Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C

Specialist Reports

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Appendix C.2:	Visual Impact Assessment
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Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.1

Agriculture Compliance Statement

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SITE SENSITIVITY VERIFICATION
AND
AGRICULTURAL COMPLIANCE STATEMENT
FOR
THE PROPOSED HOEK DOORNEN 1, 2, 3 AND 4 SOLAR PV FACILITIES
AND THEIR ASSOCIATED ELECTRICAL GRID INFRASTRUCTURE
NEAR TOUWS RIVER, WESTERN CAPE PROVINCE

Report by
Johann Lanz

29 September 2020

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EXECUTIVE SUMMARY

The key findings of this study are:

- The aridity of the area is a significant agricultural constraint that seriously limits the level of agricultural production (including grazing) which is possible across the site.
- Soils include a high proportion of shallow, rocky soils on underlying rock.
- As a result of these limitations, the study area is unsuitable for cultivation and agricultural land use is limited to low density grazing. The majority of land within the development area is classified as low agricultural sensitivity, but includes smaller patches of medium sensitivity.
- Two potential negative agricultural impacts were identified, loss of agricultural land use and land degradation, but neither is of high significance.
- The recommended mitigation measures are implementation of an effective system of storm water run-off control; maintenance of vegetation cover; and stripping, stockpiling and re-spreading of topsoil.
- The conclusion of this assessment is that the proposed development (4 x 175MW solar photovoltaic (PV) plus associated electrical grid infrastructure) will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the facts that the amount of agricultural land loss is within the allowable development limits, and that the proposed development poses a low risk in terms of causing soil degradation.
- From an agricultural impact point of view, it is recommended that the proposed development be approved.

1 INTRODUCTION

Environmental authorisation is being sought for the proposed Hoek Doornen 1, 2, 3 and 4 solar photovoltaic (PV) facilities and their associated electrical grid infrastructure, approximately 35 km north-north-west of Touws River, Western Cape Province (see Figure 1). This report provides all of the inputs required by the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*, gazetted on 20 March 2020 in Government Notice (GN) 320 (Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act (NEMA), 1998). Johann Lanz was appointed as an independent agricultural specialist to provide these inputs.

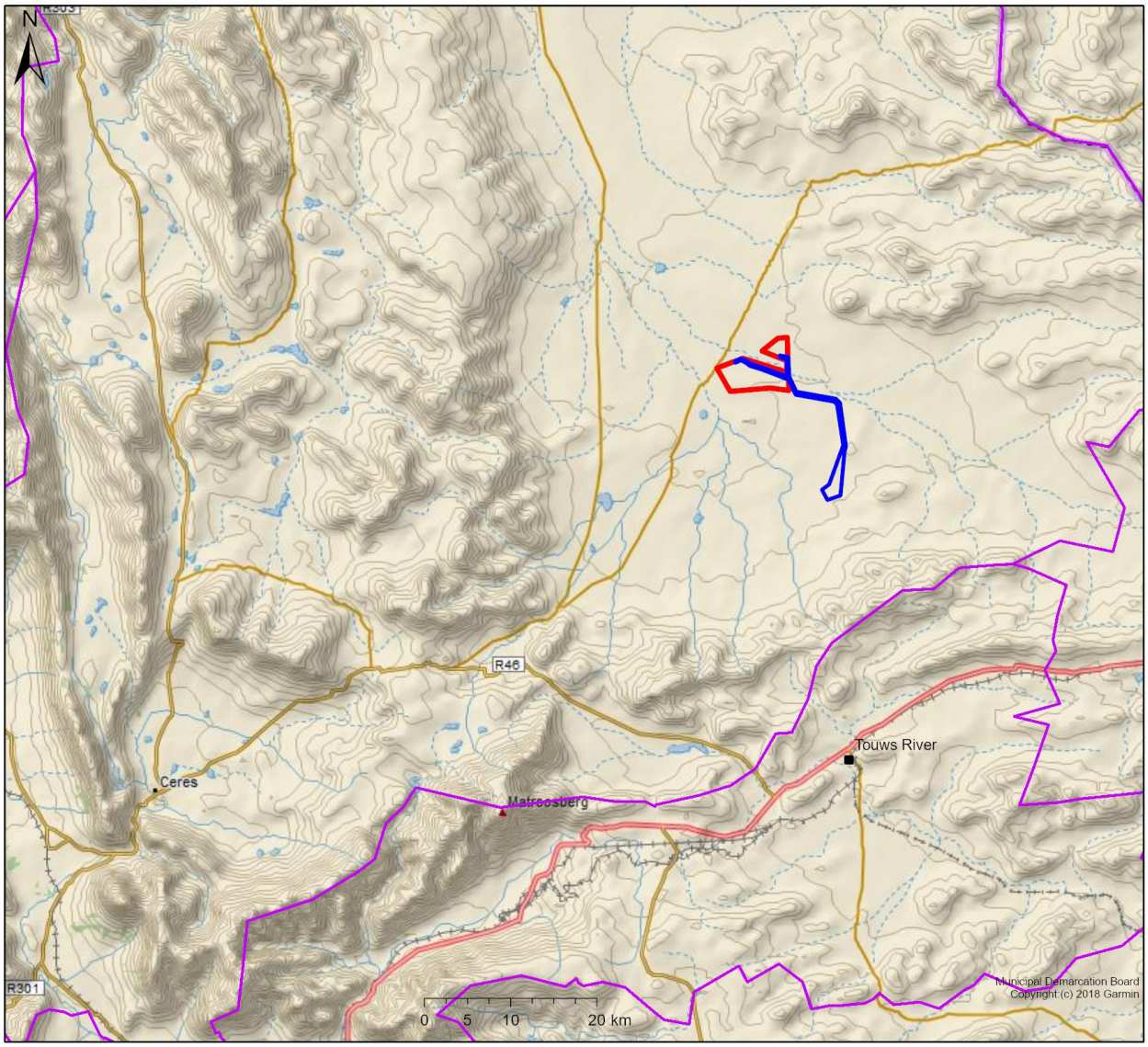

Figure 1. Locality map of the site, with the Hoek Doornen PV project study area in red and electrical grid infrastructure corridor in blue.

2 PROJECT DESCRIPTION

The proposed four PV developments will each have a capacity of 175MW. They will consist of the standard infrastructure of a PV facility including, but not limited to, PV arrays (which may require clearing of all vegetation under panels); onsite substation; 132 kV overhead power line to the Eskom Kappa substation; a battery energy storage system (BESS); offices; operation and maintenance (O&M) building; construction laydown area; access roads; panel maintenance and cleaning area, and security fencing and lighting. One of the farm access roads running through the Hoek Doornen 4 site will also be re-routed south of the PV area.

For agricultural impacts, the exact nature of the different infrastructure within a development has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land and whether it is being occupied by a solar panel, a road, a building or a substation makes no difference. What is of most relevance and addressed in this assessment, therefore, is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land.

The proposed development falls entirely within Renewable Energy Development Zone (REDZ) 2, namely the Komsberg REDZ.

3 TERMS OF REFERENCE

The terms of reference for this study is to fulfill the requirements of the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The proposed site is identified by the national web-based environmental screening tool (hereafter referred to as “Screening Tool”) as being of low and medium sensitivity for agricultural resources, and the protocol therefore requires that the level of agricultural assessment be an Agricultural Compliance Statement. The protocol also requires that a Site Sensitivity Verification be done.

The protocol states that an Agricultural Compliance Statement must be prepared by a competent soil scientist/agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP).

The compliance statement must:
(The section of this report that fulfils each requirement is given in brackets after it)

1. be applicable to the preferred site and proposed development footprint;
2. confirm that the site is of “low” or “medium” sensitivity for agriculture (Section 7); and
3. indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site (Section 9.9).

It must contain, as a minimum, the following information:

1. contact details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the statement including a curriculum vita (CV) (Appendix 2);
2. a signed statement of independence by the specialist (Appendix 3);
3. a map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool (Figure 2);
4. calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development including supporting infrastructure (Section 9.8);
5. confirmation that the development footprint is in line with the allowable development limits contained in Table 1 of the protocol (Section 9.8);
6. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimize fragmentation and disturbance of agricultural activities (Section 9.6);
7. a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development (Section 9.8);
8. any conditions to which this statement is subjected (Section 11);
9. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase (Section 9.7);
10. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr (Section 10); and
11. a description of the assumptions made and any uncertainties or gaps in knowledge or data (Section 5).

4 METHODOLOGY OF STUDY

4.1 Methodology for assessing soils and agricultural potential

This report adheres to the process and content requirements of the gazetted agricultural protocol as outlined in Section 3 above. As per the requirement, the assessment was based on a desktop analysis of existing soil and agricultural potential data for the site.

The following sources of information were used:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries (DAFF). This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
- Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the DAFF, Pretoria.
- Field crop boundaries were sourced from the national web-based environmental screening tool.
- Rainfall and evaporation data was sourced from the SA Atlas of Climatology and Agrohydrology (2009, R.E. Schulze) available on Cape Farm Mapper.
- Grazing capacity data was sourced from the 2018 DAFF long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

5 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

The study makes the assumption that water for irrigation is very limited in the study area. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist. Only very minimal irrigation water has been exploited.

There are no other specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) requires that any long term lease

associated with the renewable energy facility be approved by the Department of Agriculture, Land Reform and Rural Development (DALRRD).

Power lines require the registration of a servitude for each farm portion crossed. In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA, the registration of a power line servitude requires written consent of the Minister if the following two conditions apply:

1. if the servitude width exceeds 15 metres; and
2. if Eskom is not the applicant for the servitude.

If one or both of these conditions do not apply, then no agricultural consent is required. Eskom is currently exempt from agricultural consent for power line servitudes.

The SALA consent is separate from the application for Environmental Authorisation that is currently underway in terms of Basic Assessments (BAs), and needs to be applied for and obtained separately.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The BA process covers the required aspects of this.

7 SITE SENSITIVITY VERIFICATION

In terms of the gazetted agricultural protocol (GN 320), a site sensitivity verification must be submitted that:

1. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
2. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

Agricultural sensitivity, in terms of environmental impact, is a direct function of the capability of the land for agricultural production. This is because a negative impact, or exclusion of agriculture, on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability.

The screening tool classifies agricultural sensitivity according to two criteria - the cultivation status and the land capability. All cultivated land is classified as high sensitivity (or very high sensitivity). This is because there is a scarcity of arable production land in South Africa, in terms of how much is

required for food security.

Uncultivated land is classified by the screening tool in terms of the land capability. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017 DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. This land capability data is used by the screening tool.

The proposed site is identified by the screening tool as being of predominantly low sensitivity for agricultural resources, but it also includes patches of medium sensitivity. A map of the proposed development area overlaid on the screening tool sensitivity is given in Figure 2 and 3 below.

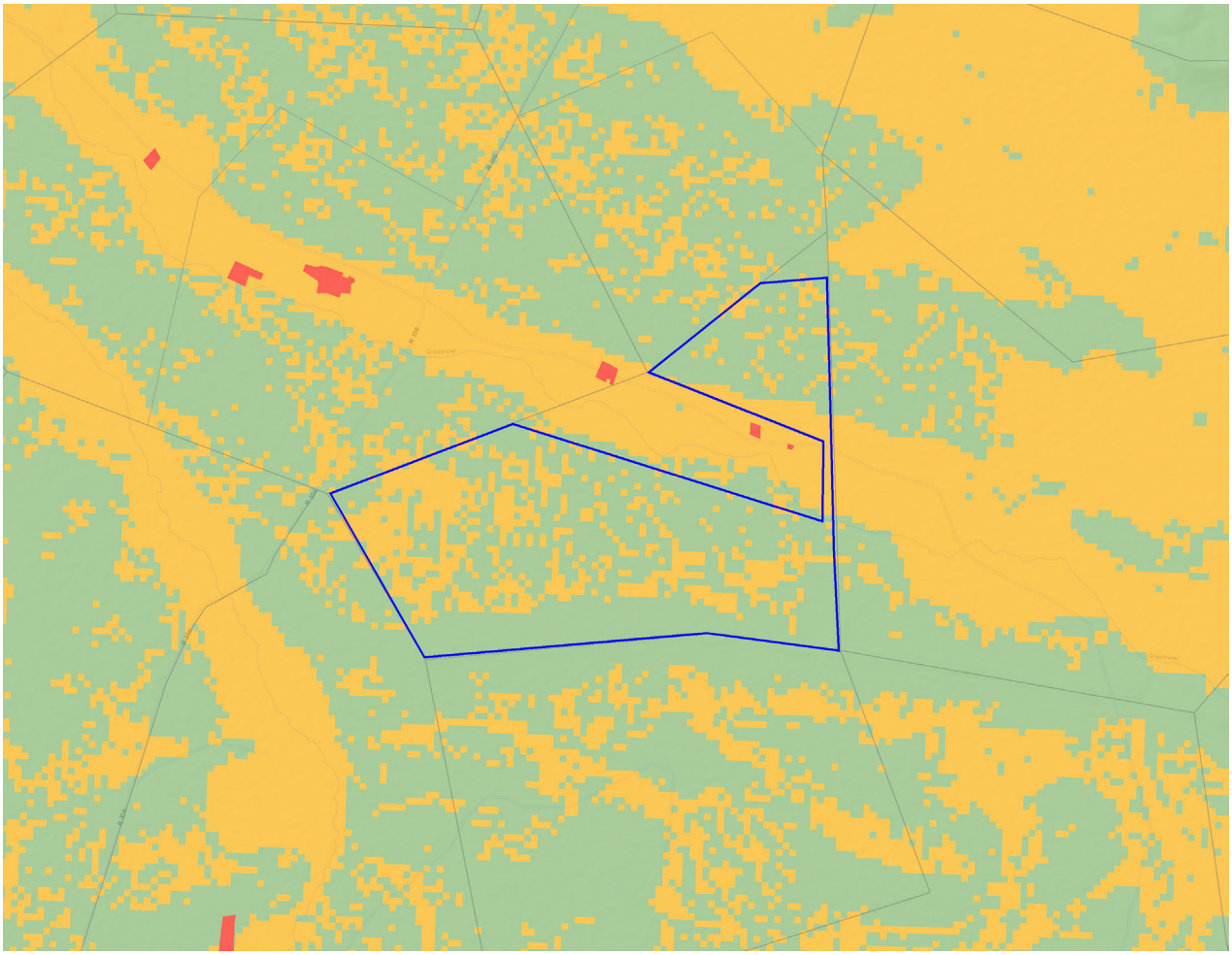

Figure 2. The PV project study area (outlined in blue) overlaid on agricultural sensitivity as identified by the screening tool (low = green; medium = yellow; red = high).

The agricultural capability of all land in the study area is severely constrained by the aridity of the climate. The further basis for the agricultural sensitivity classification of land within the site is summarised in Table 1.

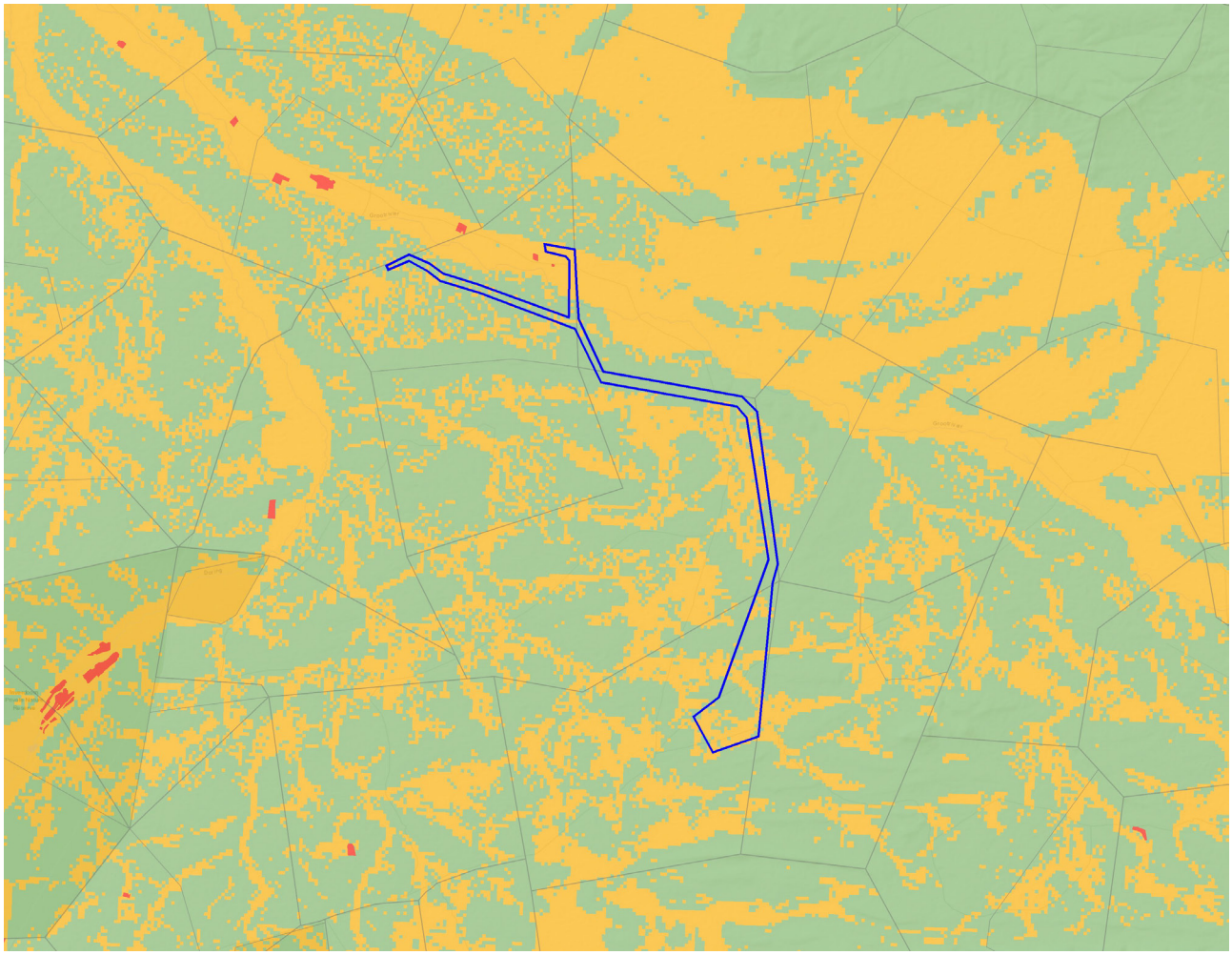

Figure 3. The electrical grid infrastructure corridor (outlined in blue) overlaid on agricultural sensitivity as identified by the screening tool (low = green; medium = yellow; red = high).

Table 1: Description of different agricultural sensitivity classes that occur in the study area.

Sensitivity category	**Cultivation status**	**Land capability evaluation values**	**General description**
Low	Uncultivated	2 to 5	Constrained by aridity. Also constrained by shallow, rocky soils on underlying hard or weathering rock.
Medium	Uncultivated	6 to 7	Constrained by aridity. Less rocky alluvial soils along drainage lines.

The agricultural sensitivity, as identified by the screening tool, is confirmed by this assessment. The motivation for confirming the sensitivity is predominantly that the climate data (low rainfall of approximately 200 mm per annum and high evaporation of approximately 1,500 mm per annum) proves the area to be arid, and therefore of limited land capability. In addition, the land type data shows the dominant soils to be shallow, rocky soils, with limited pedological development on hard or weathering underlying rock. The land of the study area, therefore, without doubt, corresponds to the definitions of the different screening tool sensitivity categories in terms of its land capability and cultivation status.

8 AGRICULTURAL LAND USE

The area is a sheep and game farming area. Low density, natural grazing is by far the predominant agricultural activity in the area. The climate does not support cultivation without irrigation. Grazing capacity of the site is very low at 90 hectares per large stock unit.

9 ASSESSMENT OF AGRICULTURAL IMPACT

9.1 General

The focus and defining question of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or potential future agricultural production. The significance of an impact is therefore a direct function of the degree to which that impact will affect current or potential future agricultural production. If there will be no impact on production, then there is no agricultural impact. Impacts that degrade the agricultural resource base pose a threat to production and therefore are within the scope of an agricultural impact assessment. Lifestyle impacts on the resident farming community, for example visual impacts, do not necessarily impact agricultural production and, if they do not, are not relevant to and within the scope of an agricultural impact assessment.

For agricultural impacts, the exact nature of the different infrastructure within a facility has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land, and whether it is being occupied by a PV panel or a substation makes no difference. What is of most relevance therefore is simply the total footprint of the facility.

The components of the project that can impact on agriculture are:

1. Occupation of the land by the total, direct, physical footprint of the proposed project including all its infrastructure.
2. Construction activities that may disturb the soil profile and vegetation, for example for

levelling, excavations, etc.

The significance of all potential agricultural impacts is kept low by the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for low density grazing.

Electrical grid infrastructure has negligible agricultural impact in this study area for two reasons:

1. Overhead transmission lines have no agricultural impact because all agricultural activities that are viable in this environment (grazing) can continue completely unhindered underneath transmission lines.
2. The direct, permanent, physical footprint of the electricity grid infrastructure that has any potential to interfere with agriculture is restricted to pylon bases and substation footprints that, in the context of the agricultural environment of extremely low density grazing on farms which are typically thousands of hectares large, is entirely insignificant.

9.2 Direct impacts for Hoek Doornen 1, 2, 3 and 4 and their associated electrical grid infrastructure

Two potential negative agricultural impacts have been identified. These impacts are described below and apply to the Hoek Doornen 1, 2, 3 and 4 PV Facilities, and all their electrical grid and other associated infrastructure:

1. **Loss of agricultural land use** - Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use. This impact is relevant only in the construction phase. No further loss of agricultural land use occurs in subsequent phases.
2. **Soil degradation** - Soil can be degraded by impacts in three different ways: erosion; topsoil loss; and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth. This impact is relevant only during the construction and decommissioning phases.

9.3 Cumulative impacts of Hoek Doornen 1, 2, 3 and 4 and their associated electrical grid infrastructure

The cumulative impact of a development is the impact that development will have when its impact

is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact. But it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of agricultural land, with a consequent decrease in agricultural production. The defining question for assessing the cumulative agricultural impact is this:

> What level of loss of agricultural land use and associated loss of agricultural production is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

DEFF requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

DEFF compliance for this project requires considering all renewable energy projects within a 30 km radius that have received an EA at the time of starting this BA (i.e. by August 2020). It is assumed that each renewable energy project consists of an EGI component. There are eleven other renewable energy project applications within 30km of the proposed site. These are listed in Appendix 1 of this report. In addition, there are nine separate PV projects (with a total of nine power lines, substations and BESS's) associated with the current development and these have also been included in the consideration of cumulative impact in this report.

In quantifying the cumulative impact, the area of land taken out of grazing as a result of the nine developments plus the other eleven renewable energy developments (total generation capacity of

4,003 MW) will amount to a total of approximately 5,097 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to 1.80% of the surface area. That is within an acceptable limit in terms of loss of low potential agricultural land, of which there is no scarcity in the country. This is particularly so when considered within the context of the following point:

In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are far higher in this region than in regions with higher agricultural potential.

Because of the negligible agricultural impacts of electrical grid infrastructure, the agricultural environment can accommodate far more electricity grid infrastructure than currently exists, or is currently proposed, before acceptable levels of change are exceeded.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

9.4 Comparative assessment of alternatives

Due to the low agricultural sensitivity of the site, and the effectively uniform agricultural conditions across the site, it is highly likely that there will be no material difference between the agricultural impact of any possible, alternative layouts on the site.

9.5 Impacts of the no-go alternative

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential such impact is that due to continued low rainfall in the area, which is likely to be exacerbated by climate change, agriculture

in the area will come under increased pressure in terms of economic viability.

Although the development offers an alternative income source to agriculture, it does exclude agriculture from the impacted land. Therefore, the agricultural impact of the no-go alternative, which does not exclude agriculture, is less significant than the agricultural impact of the development, and so, purely from an agricultural impact perspective, the no-go is the preferred alternative between the development and the no-go. But the development offers a land use with much higher income generating capacity than any viable agricultural land use on the site.

9.6 Micro-siting to minimize fragmentation and disturbance of agricultural activities

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. However, the agricultural uniformity and low agricultural potential of the environment, means that the exact positions of all infrastructure will make no material difference to agricultural impacts. It is therefore unnecessary to check whether siting of infrastructure, and any layout of infrastructure within the assessed area is acceptable in terms of agricultural impact.

9.7 Confirmation of linear activity impact

The electrical grid infrastructure is a linear activity. The protocol states that if the activity is a linear one, in which, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase, then the level of agricultural assessment required by the protocol is an Agricultural Compliance Statement. However, in this case, the agricultural sensitivity of the site is less than high, and therefore, regardless of whether the activity is linear or not, only an Agricultural Compliance Statement is required. Confirmation of the linear activity impact is therefore not required in this case.

9.8 Impact footprint

The agricultural protocol stipulates allowable development limits for renewable energy developments of > 20 MW. Allowable development limits refer to the area of a particular agricultural sensitivity category that can be directly impacted (i.e. taken up by the physical footprint) by a renewable energy development. The agricultural footprint is defined in the protocol as the area that is directly occupied by all infrastructures, including roads, hard standing areas, buildings, substations etc., that are associated with the renewable energy facility during its operational phase, and that result in the exclusion of that land from potential cultivation or grazing. It excludes all areas that were already occupied by roads and other infrastructure prior to the establishment of the energy facility but includes the surface area required for expanding existing infrastructure (e.g. widening existing roads). It excludes the corridor underneath overhead

power lines but includes the pylon footprints. It therefore represents the total land that is actually excluded from agricultural use as a result of the renewable energy facility.

It is hereby confirmed that the final layout, and associated agricultural footprint, will be well within the allowable limit of 2.5 ha per MW (175 MW x 2.5 = 437.5 ha), as per the DEFF protocols. The final agricultural footprint of each project will be in the order of 260 hectares.

9.9 Impact statement

An Agricultural Compliance Statement is not required to formally rate agricultural impacts. It is only required to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site. It must provide a substantiated statement on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development.

The conclusion of this assessment is that the proposed development (4 x 175MW Solar PV plus associated electrical grid infrastructure) will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the following points:

- The amount of agricultural land loss is within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.
- The proposed development poses a low risk in terms of causing soil degradation, which can be adequately and fairly easily managed by mitigation management actions. In addition, the degradation risk is only to land of low agricultural value, and the significance of the impact is therefore low.

Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

10 ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The environmental management programme inputs for the protection of soil resources are presented in the tables below for each phase of the development.

Table 2: Management plan for the planning and design phase

Impact	**Mitigation / management objectives and outcomes**	**Mitigation / management actions**	**Monitoring**		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Design an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	Ensure that the storm water run-off control is included in the engineering design.	Once-off during the design phase.	Holder of the EA

Table 3: Management plan for the construction phase

Impact	**Mitigation / management objectives and outcomes**	**Mitigation / management actions**	**Monitoring**		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of	Implement an effective system of storm water	Undertake a periodic site inspection to	Every 2 months during the construction	Environmental Control Officer (ECO)

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
	hard surfaces causes no erosion on or downstream of the site.	run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	phase	
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	Every 4 months during the construction phase	Environmental Control Officer (ECO)
Topsoil loss	That topsoil loss is minimised	If an activity will mechanically disturb the soil below surface in any way, then any available	Record GPS positions of all occurrences of below-surface soil disturbance (e.g.	As required, whenever areas are disturbed.	Environmental Control Officer (ECO)

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
		topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area.		

Table 4: Management plan for the operational phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That existence of hard surfaces causes no erosion on or downstream of the site.	Maintain the storm water run-off control system. Monitor erosion and remedy the storm water control system in the event of any erosion occurring.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the	Bi-annually	Facility Environmental Manager

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
			occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.		
Erosion	That denuded areas are re-vegetated to stabilise soil against erosion	Facilitate re-vegetation of denuded areas throughout the site	Undertake a periodic site inspection to record the progress of all areas that require re-vegetation.	Bi-annually	Facility Environmental Manager

Table 5: Management plan for the decommissioning phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Implement an effective system of storm water run-off control, where it is required - that is at any points where run-off water might	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control	Every 2 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final	Environmental Control Officer (ECO)

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
		accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	sign-off is achieved.	
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	Every 4 months during the decommissionin g phase, and then every 6 months after completion of decommissionin g, until final sign-off is achieved.	Environmental Control Officer (ECO)
Topsoil loss	That topsoil loss is minimised	If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for	Record GPS positions of all occurrences of below-surface soil disturbance (e.g. excavations). Record the date of topsoil stripping and replacement. Check that	As required, whenever areas are disturbed.	Environmental Control Officer (ECO)

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
		re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	topsoil covers the entire disturbed area.		

11 CONCLUSIONS

The site has very low agricultural potential because of, predominantly, aridity constraints, but also due to soil constraints. It is generally unsuitable for cultivation, and agricultural land use is limited to low density grazing. The majority of land within the development area is of low agricultural sensitivity, but it includes areas of medium sensitivity.

Two potential negative agricultural impacts were identified, loss of agricultural land use and land degradation, but neither is of high significance.

The recommended mitigation measures are implementation of an effective system of storm water run-off control; maintenance of vegetation cover; and stripping, stockpiling and re-spreading of topsoil.

The conclusion of this assessment is that the proposed development (4 x 175MW Solar PV plus associated electrical grid infrastructure) will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the facts that the amount of agricultural land loss is within the allowable development limits, and that the proposed development poses a low risk in terms of causing soil degradation.

From an agricultural impact point of view, it is recommended that the development be approved.

The conclusion of this assessment on the acceptability of the proposed development and the

recommendation for its approval is not subject to any conditions.

12 REFERENCES

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APPENDIX 1: PROJECTS INCLUDED IN CUMULATIVE ASSESSMENT

The table below shows the renewable energy facilities only, as the associated power line projects within the 30 km radius have a negligible impact from an agricultural perspective.

DEA Reference	Title	Technology	MegaWatts
14/12/16/3/3/1/1976	Kudusberg WEF	Wind	325
12/12/20/1783/1	Perdekraal 1	Wind	150
12/12/20/1783/2	Perdekraal 2	Wind	150
12/12/20/1787[1]	Konstabel	Wind	85
12/12/20/1787	Konstabel	Solar PV	85
12/12/20/1956	Touwsrivier	Solar PV	36
12/12/20/1988	Roggeveld Wind Farm	Wind	750
14/12/16/3/3/2/899	Rietkloof	Wind	36
14/12/16/3/3/2/810	Montague Road	Solar PV	75
14/12/16/3/3/2/900	Brandvalley WEF	Wind	147
14/12/16/3/3/1/1984	Tooverberg WEF	Wind	264
14/12/16/3/3/2/1115	Rondekop WEF	Wind	325
Sub-Total (Authorised Projects)			**2428**
Pending	Proposed Ceres PV Development (9 PV Facilities)	Solar PV	**1575**
Sub-Total (Current Projects)			**1575**
Total (Authorised and Current Projects)			**4003**

[1] The National REEA states that the project is 170 MW and consists of Wind and Solar technology. For purposes of this cumulative assessment for agricultural impacts, it has been assumed that 85 MW is assigned to Solar and 85 MW to Wind.

APPENDIX 2: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting **Self employed** **2002 - present**

In the past 5 years of running my soil and agricultural consulting business, I have completed more than 120 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, urban, and agricultural developments. My regular clients include: Aurecon; CSIR; SiVEST; Arcus; SRK; Environamics; Royal Haskoning DHV; Jeffares & Green; JG Afrika; Juwi; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.

In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant **Agricultural Consultors International (Tinie du Preez)** **1998 - 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
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- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

APPENDIX 3: 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

THE PROPOSED HOEK DOORNEN 1, 2, 3 AND 4 SOLAR PV FACILITIES AND THEIR ASSOCIATED ELECTRICAL GRID INFRASTRUCTURE NEAR TOUWS RIVER, WESTERN CAPE PROVINCE

Kindly note the following:

- 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.
- 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.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- 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.
- All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Private Bag X447, Pretoria, 0001
Physical address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Environment House, 473 Steve Biko Road, Arcadia

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)			
Professional affiliation/registration:	Registered Professional Natural Scientist Member of the Soil Science Society of South Africa			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax? I don't	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, 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

Johann Lanz - Soil Scientist (sole proprietor)

Name of Company:

29/09/2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, 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

Johann Lanz - Soil Scientist (sole proprietor)

Name of Company

29/09/2020

Date

Signature of the Commissioner of Oaths

2020·09·29

Date

SUID-AFRIKAANSE POLISIEDIENS
STATION COMMANDER
29 SEP 2020
SOUTH AFRICAN POLICE SERVICE

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.2

Visual Impact Assessment

VISUAL SPECIALIST ASSESSMENT: Report 3

Visual Impact Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities (Hoek Doornen PV 1, PV 2, PV 3 and PV 4), and associated Electrical Grid Infrastructure near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Quinton Lawson and Bernard Oberholzer
P O Box 320 Stellenbosch 7599 South Africa	8 Blackwood Drive, Hout Bay 7806 PO Box 471 Stanford 7210 Western Cape South Africa

Version 1: October 2020
Version 2: November 2020

Executive Summary

The proposed cluster of Hoek Doornen solar Photovoltaic (PV) facilities (PV 1, PV 2, PV 3 and PV 4) form part of a larger solar energy project, which includes the Grootfontein and Witte Wall solar PV clusters. These fall within the Komsberg Renewable Energy Development Zone (REDZ), and would form part of a larger group of proposed and existing renewable energy facilities concentrated near the existing ESKOM Kappa substation.

The generally flat terrain is visually exposed with the result that structures and pylons can be seen for several kilometres. However, there are no major scenic features of note, and the main receptors, being surrounding farmsteads, are spread fairly far apart, mostly more than 5km distance from the proposed solar facilities and connecting powerline. This means that visibility of the proposed Solar Energy Facilities (SEFs) and powerlines is low, (hardly visible to not visible from the farmsteads).

Taking into account the relatively low structures and the local scale of the proposed solar facilities and related infrastructure located in a fairly remote area, the visual impact significance was considered to be **low** before and after mitigation, as well as **low** before and after mitigation for the connecting powerlines (for the construction and operational phases). The visual landscape could be restored after potential decommissioning which means that the visual significance would be **very low** with mitigation for this phase, (see tables below).

The potential cumulative visual impact for the cluster of four solar PV facilities (Hoek Doornen PV 1, PV 2, PV 3 and PV 4), in combination with the proposed Witte Wall and Grootfontein solar PV clusters (respectively composed of two and three PV facilities), as well as the existing Perdekraal Wind Energy Facility (WEF) would increase to **moderate** significance, both before and after mitigation for the operational phase, as the landscape becomes more semi-industrialised. The fact that the ESKOM Kappa substation and power lines already occur in the area needs to be taken into account.

The potential cumulative visual impact for the electrical grid infrastructure of all the clusters (Witte Wall (PV 1 and PV 2) Grootfontein (PV 1, PV 2 and PV 3), and Hoek Doornen (PV 1, PV 2, PV 3 and PV 4), could be **moderate** if four connecting power lines to the Kappa substation are built, but would reduce to **low** if the connecting power line is shared (for the operational phase).

Therefore, given the fairly contained footprint of the proposed cluster solar PV facilities, the limited viewshed and the localised visual effects in a remote area, the overall visual impact significance for both the PV facilities and the power lines was found to be **low risk** with the implementation of mitigation measures, and **very low risk** after mitigation in the long term if the solar facilities are decommissioned.

Overall Impact Significance for Solar PV facilities and Related Buildings (post mitigation)

Phase	**Overall Impact Significance**
Construction	Low (level 4)
Operational	Low (level 4)
Decommissioning	Very low (level 5)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low (level 4)
Cumulative - Operational	Moderate (level 3)
Cumulative - Decommissioning	Very low (level 5)

Overall Impact Significance for Substations and Connecting Powerlines (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Low (level 4)
Operational	Low (level 4)
Decommissioning	Very low (level 5)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low (level 4)
Cumulative - Operational	Low (level 4)
Cumulative - Decommissioning	Very low (level 5)

Key visual management actions include locating the substations and other buildings, as well as construction camps, in unobtrusive positions in the landscape away from public roads. The Karoo landscape is particularly fragile and therefore new access roads and disturbance should be kept to a minimum for both the proposed solar facilities and connecting power lines. Connecting power lines should be shared where possible, to avoid a plethora of power lines in the exposed landscape. (It is understood that separate power lines to Kappa have to be assessed due to the bidding requirements and uncertainties).

There are no fatal flaws from a visual perspective arising from the proposed projects, and given the marginal nature of agriculture in the area, the solar energy projects are probably an inherently suitable land use that should receive authorisation from a visual perspective, provided the mitigation measures are implemented as a condition of approval.

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List of Abbreviations

BA	Basic Assessment
BAR	Basic Assessment Report
CAA	Civil Aviation Authority
DEFF	Department of Environment, Forestry and Fisheries
DEM	Digital Elevation Model
EIA	Environmental Impact Assessment
EGI	Electricity Grid Infrastructure
EMPr	Environmental Management Programme
GN	Government Notice
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NFEPA	National Freshwater Ecosystem Priority Areas
O&M	Operations and maintenance
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
REEA	Renewable Energy EIA Application Database
SACAA	South African Civil Aviation Authority
SACAD	South African Conservation Areas Database
SACAP	South African Council for the Architectural Profession
SACLAP	South African Council for the Landscape Architectural Profession
SAPAD	South African National Protected Areas Database
SEA	Strategic Environmental Assessment
SEF	Solar energy facility
SRTM	Shuttle Radar Topography Mission
VIA	Visual Impact Assessment
WEF	Wind energy facility

Glossary

Definitions	
Receptor	Individuals, groups or communities who are subject to the visual influence of a particular project
Viewpoint	A selected point in the landscape from which views of the project are ascertained
Viewshed	The outer boundary defining a view catchment area, used to determine the zone of visual influence.
View shadow	An area within the view catchment visually obscured from the project, usually by topography.
Visual absorption capacity	The ability of an area to visually absorb development by means of screening topography, vegetation or buildings.

1. Introduction

1.1. Scope, Purpose and Objectives of the Visual Specialist Report

The Visual Impact Assessment (VIA) is one of several specialist studies being carried out as part of the Basic Assessments (BAs) for the proposed development of four Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen PV 1, PV 2, PV 3 and PV 4), near Touws River, Western Cape.

The Applicant is proposing to develop nine solar PV facilities and nine power lines and associated infrastructure to link the PV facilities to the Eskom Kappa Substation. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172. This VIA deals with the Hoek Doornen projects.

The VIA includes an assessment of potential visual impacts and risks associated with the proposed solar energy facilities (SEFs) and provides recommended mitigations to minimise potential visual impacts. These are used to inform the siting and layout of the project. The VIA also includes related infrastructure, such as the powerline grid connections and substations, which form part of the BAs.

1.2. Details of the Visual Specialists

The visual specialist assessment has been undertaken by Quinton Lawson, Architect, registered with the South African Council for the Architectural Profession (SACAP), reg. no. 3686, and by Bernard Oberholzer, Landscape Architect, registered with the SA Council for the Landscape Architectural Profession (SACLAP), reg. no. 87018.

Curriculum vitae are included in Appendix A of this specialist assessment, and a signed specialist statement of independence is included in Appendix B.

1.3. Terms of Reference

- Determine Site Sensitivity Verification Requirements in terms of Government Gazette 43110, Government Notice (GN) 320, and provide a Site Sensitivity Verification Report, including a site visit in order to identify the level of sensitivity assigned to the project area on the Screening Tool, and to verify and confirm this sensitivity and land-use.
- Prepare a description and mapping baseline of the visual and scenic resources and sensitivity of the study area, including viewsheds and recommended buffers, in GIS format.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis.
- Identify and assess the potential direct, indirect and cumulative impacts of the proposed development on the receiving environment from a visual perspective, both without and with mitigation, for the construction, operational and decommissioning phases of the project.
- Prepare schematic portrayals of the potential visual impact of the proposed project infrastructure.
- Identify any protocols, legal and permit requirements that are relevant to this project and the implications thereof.
- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to reduce the effect of negative impacts and enhance the effect of positive impacts.
- Identify best practice management actions, monitoring requirements, and rehabilitation guidelines to be included in the Environmental Management Programme (EMPr).

- Incorporate and address visual issues and concerns raised by Stakeholders, Competent Authorities, Interested and Affected Parties (I&APs) and the public during the Public Participation Process.

2. Approach and Methodology

The methodology involved a number of standard procedures including those in the 'Guideline for Involving Visual and Aesthetic Specialists' (Oberholzer, B. 2005), including the following steps:

- A baseline survey of existing scenic resources and visual characteristics of the study area was made, including desktop work and field observations.
- A photographic survey included views from potentially sensitive receptor locations. A number of cameras were used to record features and determine the Global Positioning System (GPS) coordinates and compass direction of viewpoints.
- View corridors / routes and important viewpoints / receptors were mapped in relation to the proposed SEFs.
- Distance radii from the proposed SEFs were mapped to determine its potential visibility from the identified viewpoints.
- The viewsheds of the proposed SEFs and connecting powerlines were mapped to determine their zones of visual influence as well as those areas in a view shadow.
- Photomontages were constructed from selected viewpoints using panoramic photographs taken in the field, along with digital terrain modelling and superimposing a 3D model of the proposed SEFs. The montages gave a realistic impression of the proposed SEFs from the identified viewpoints at a range of distances.
- The potential visibility, zone of visual influence and photomontages of the proposed SEFs provided a quantitative measure of visual impact intensity.
- Existing vegetation cover, land uses, topographic features and general intactness of the landscape, along with the overall 'sense of place' provided a qualitative measure of visual impact intensity.
- Potential impacts identified in the visual specialist study have been assessed based on the criteria and methodology outlined in Appendix D.
- The site inspection was carried out over a full day on 27 August 2020 by two principal visual specialists. The season was not a consideration, nor had any effect on carrying out a visual assessment. Clear visibility was required for the photographic survey.

2.1. Information Sources

Base data used in the visual assessment is listed in Table 1 below. Although some of the information has not been updated for a few years, the quality of the data was considered adequate for the purpose of this assessment.

Table 1: Information Sources

Data / Information	Source	Date	Type	Description
Topo-Cadastral information	Chief Directorate: National Geospatial Information	Various dates	1:250 000 raster maps	Used for base mapping.
Topographic information	Chief Directorate: National Geospatial Information	Various dates	1:50 000 raster maps	Used for base mapping.
Elevational Data	Chief Directorate: National Geospatial Information	Various dates	Spatial Vector Dataset	RSA 5m Contour Data
Geological information	Council for Geoscience	2011	Spatial Vector Dataset	1:1 000 000 Geological Map of South Africa

Data / Information	Source	Date	Type	Description
Digital Elevation Model (DEM)	Shuttle Radar Topography Mission (SRTM)	2014	Elevational information (Raster)	1 arcSEC 30m
South African National Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial Vector Dataset	Spatial delineation of protected areas in RSA. Updated quarterly.
South African Conservation Areas Database (SACAD)	DEFF	2020, Q2	Spatial Vector Dataset	Spatial delineation of conservation areas in RSA. Updated quarterly.
Renewable Energy EIA Application Database (REEA)	DEFF	2020, Q2	Spatial Vector Dataset	Location of wind and solar renewable energy applications.
National Freshwater Ecosystem Priority Areas (NFEPA)	SANBI	2017	Spatial Vector Dataset	Spatial delineation of rivers and wetlands.
National Heritage Sites Inventory Database	SAHRA	2017	Spatial Vector Dataset	Location of classified heritage sites in SA.
Electricity Grid Infrastructure (EGI) Dataset	ESKOM	2018	Spatial Vector Dataset	Transmission line routes and Substations in RSA.
Airport, Airfields and Obstacle Datasets	Civil Aviation Authority (CAA)	2018	Spatial Vector Dataset	Location of airfields in RSA.

2.2. Assumptions, Knowledge Gaps and Limitations

Other projects in the surrounding area (within a 30km radius) that have been considered for cumulative impact assessment, are indicated on Map 1, believed to be the latest information.

No detailed layouts, heights or type of solar PV arrays were available during the preparation of the visual assessment, but a worst-case scenario of 10m height for the arrays and similarly for the battery storage systems was used in the visual modelling. The internal layout is not considered a visual concern.

No details of building finishes, or the location of construction camps, were available at this stage, and provided the mitigation measures are adhered to, this should not have any effect on the visual significance ratings.

2.3. Consultation Processes Undertaken

No consultation has taken place for this visual assessment to date and it is anticipated that any visual issues will be identified in the Socio-Economic Impact Assessment and the Public Participation Process, and that these will be addressed in the final BA Report.

3. Description of Project Aspects relevant to the Visual Assessment

The Project Applicant is proposing to design, construct and operate the Hoek Doornen solar PV cluster, consisting of four solar PV power generation facilities, north of Touws River in the Western Cape Province. Two other adjacent PV clusters, (Grootfontein with 3 facilities and Witte Wall with 2 facilities), are also being assessed. Each solar PV facility will have associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation to the south via a dedicated 132 kV power line, (see Maps 1 and 2).

Each Solar PV plant will have a footprint of about 250 hectares, along with an approximately 300 m wide corridor for the power lines. Visual sensitivity maps, prepared during the Screening Phase, were used to identify the best locations for the 250 hectare PV areas and related infrastructure. Facilities that could have visual implications are listed in Table 2 below. It must be noted that the specifications

provided in Table 2 apply to a single PV facility and are the same for Hoek Doornen PV 1, PV 2, PV 3 and PV 4, unless where specified. A general layout of the project and route taken during the field trip, are indicated on Map 2.

Table 2: Description of Proposed Hoek Doornen PV Cluster with four SEFs

Facility	Extent/Footprint	Height	Comments
SEF project area	Maximum 250 ha, including internal roads for each PV project. However, with access roads leading to the PV site, the total footprint will be approximately 260 ha.	n/a	175 MW capacity
Solar PV arrays	Single axis, fixed axis, dual axis, fixed tilt options, or bifacial panels.	Max. 10m	Galvanised steel and aluminium mounting structures.
Offices	1 000m^2	Max. 7m	
Operations and maintenance control centre	500m^2	Max. 7m	
Warehouse/workshop	500m^2	Max. 7m	
Ablution facilities	50m^2	Max. 7m	
Converter/inverter stations	2 500m^2	2,5 - 7m	
Onsite substation and/or switching station for each PV plant	20 000m^2	Max. 7m	Pylons up to 30m high
Battery energy storage systems (BESS) for each of the 4 solar projects	Up to 8 ha within the laydown area	5 – 10m	Lithium ion battery containers
Guard house	40m^2	Max. 3m	
Internal powerlines	33kV	9m	Above ground/ underground. If underground, they will have a maximum depth of about 1.6 m.
Internal service roads and service road below power line	4m wide	n/a	Gravel surface.
Access roads	4 - 8m wide	n/a	Gravel surface. A gravel road running through Hoek Doornen PV4 will also be re-routed to the south and east of the PV area.
Water storage tanks	10 000 litre tanks x20	3m	At O&M buildings during the operational phase.
Security fencing	Perimeter and internal security fencing.	2 - 3m	Either palisade, mesh or fully electrified.
Security Lighting	To be determined		Only at substation, O&M buildings and BESS.
132kV overhead powerline to Kappa Substation	33m wide servitude.	22,5 – 30m	Corridor approximately 300m wide and 20 - 23km long (power lines range from 18 – 20 km long).
Construction phase laydown area	Approximately 13 ha		Temporary construction camp and area for construction materials.

The potential visual effect of the SEFs and the associated electrical grid infrastructure could include the following:

- The visibility of the SEFs from a number of surrounding farms and routes in the area, given the relatively flat and open nature of the Karoo landscape.
- The industrial character of the SEFs, which would have an effect on the prevailing pastoral sense of place of the local region, typified by its general remoteness and wildness.
- The potential effect on tourism in the area, particularly where guest accommodation or hunting facilities are offered.
- The additional visual clutter of power lines across the landscape, adding to the existing ESKOM power lines to the south.

4. Baseline Environmental Description

4.1. General Description

The general character and landscape features of the receiving environment are described below, and in the photographic illustrations. The descriptions in this Section apply to all four solar PV facilities, being the Hoek Doornen PV 1, PV 2, PV 3 and PV 4 facilities, associated infrastructure and electrical grid infrastructure.

4.2. Project Specific Description

Location (Map 1)
The project site for all four proposed SEFs lies at the southern end of the Tanqua Karoo, also known in this section as the Ceres Karoo. Touws River and Ceres are the nearest towns, both being about 60km away by road. Access to the site is via the R356 gravel road and smaller farm gravel roads. The ESKOM Kappa Main Substation is located on the district road to the south, with existing powerlines running parallel with the road.

Geology (Map 3)
The geology of the project site consists of shale of the Tierberg Formation, which forms part of the Ecca Group of rocks within the Karoo Sequence (Council for Geoscience). The soft shales of the Tierberg Formation have been eroded by the Doring, Groot and Droëlaagte Rivers to form a broad, flat valley. More resistant sandstones give rise to the surrounding mountains, while alluvium occurs along the drainage courses. The larger study area to the south (where the proposed powerlines will run) consists of Dwyka Formation tillite, sandstone and mudstone. The geology determines the topography and therefore the scenic characteristics of the site and surroundings. (See Figures 1, 2 and 3 below).

Physical Landscape (Maps 4 and 5)
The site is surrounded to the west by the Swartruggens mountains, to the south by the Bontberg and to the north-east by the prominent Roosterberg. The relatively flat eroded plain is a semi-arid landscape, being in the rain-shadow of the surrounding mountains. The relatively even topography presents few physical constraints for development, the only major feature being the broad dry drainage course of the Groot River.

Vegetation
The vegetation type of the arid plains is classified as *Tanqua Karoo (SKv5)*, consisting of sparse low succulent shrubland on the Dwyka tillite and Ecca shales. The *Tanqua Wash Riviere* type (AZi7) is also a sparse vegetation occurring on the alluvial deposits of the sheet-wash plains, (Mucina and Rutherford, 2006). Acacia thorn trees are confined to the drainage courses, which are dry for most of the year. Copses of mainly exotic trees, provide shelter (and visual screening) around farmsteads. Succulent vygies were in flower during the site visit in late August.

Land Use

The relatively low rainfall and sparse vegetation limit the agricultural potential to mainly extensive grazing, including sheep, interspersed with game farms. Crops are confined to the minor patches of deeper soils along drainage courses or where irrigation is available.

Farms tend to be large in area in order to be viable for sheep or game farming, with farmsteads being on average 5 to 10km apart. Inverdoorn, which has tourist accommodation, and Klaserie Private Nature Reserve are about 10km from the site. Wittewal is a game farm used for hunting, while Sadawa (Doringrivier farm) offers guest accommodation. These and other receptors are indicated on Map 2.

The ESKOM Kappa substation is located about 12km to the south of the site. The substation and ESKOM 400kV power lines, together with the existing Perdekraal wind farm to the south-west have already resulted in visual intrusions in the local area.

Figure 1: Hoek Doornen landscape looking south-west

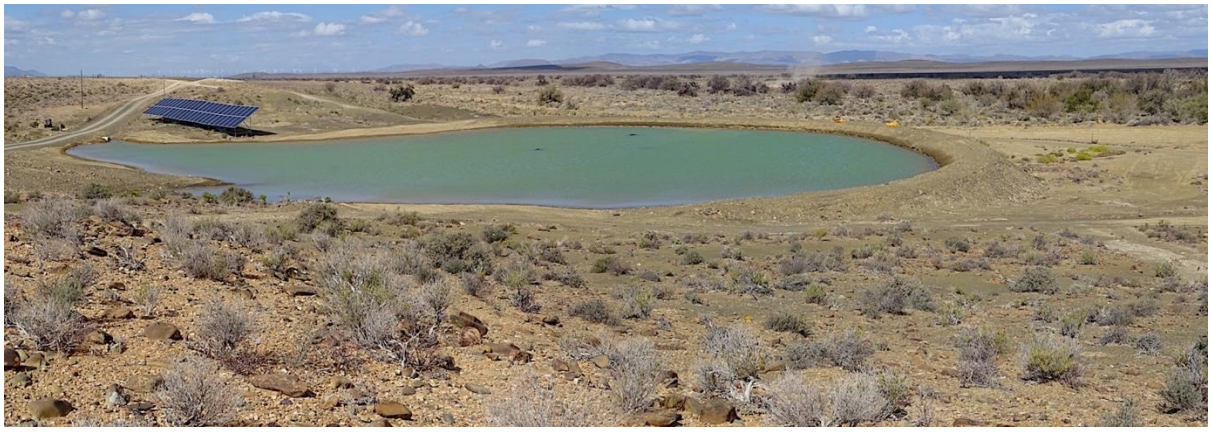


Figure 2: Farm dam in the area

Figure 3: Hoek Doornen dwelling

4.3. Identification of Environmental Sensitivities

4.3.1. Sensitivities identified by the National Web-Based Environmental Screening Tool

The visual sensitivities identified in this Section apply to the cluster of all four solar facilities proposed for Hoek Doornen, associated buildings and electrical grid infrastructure.

A screening report was compiled by the CSIR (20/8/2020) using the Department of Environment, Forestry and Fisheries (DEFF) Screening Tool based on the assessed area for all nine solar PV facilities and electrical grid infrastructure. The Screening Report includes a 'Map of Relative Landscape (Solar) Theme Sensitivity', indicated in Figure 4 below. This would have been based on mapping prepared for the Wind and Solar Strategic Environmental Assessment (SEA) by the CSIR for the DEFF in 2015 (DEA, 2015). The Screening Tool shows that the site for the proposed Hoek Doornen PV 1, PV 2, PV 3 and PV 4 facilities only has small areas of medium to very sensitivity (which the actual layout of the PV facilities largely avoid); and that the corridor for the power lines has sensitivities ranging from medium to very high. The study area falls within the Komsberg Renewable Energy Development Zone (REDZ).

The current visual sensitivity mapping undertaken in this VIA is in greater detail at the site scale for the proposed solar PV facilities and electrical grid infrastructure, and takes into account detailed viewshed mapping and local site conditions, as indicated on Figure 5.

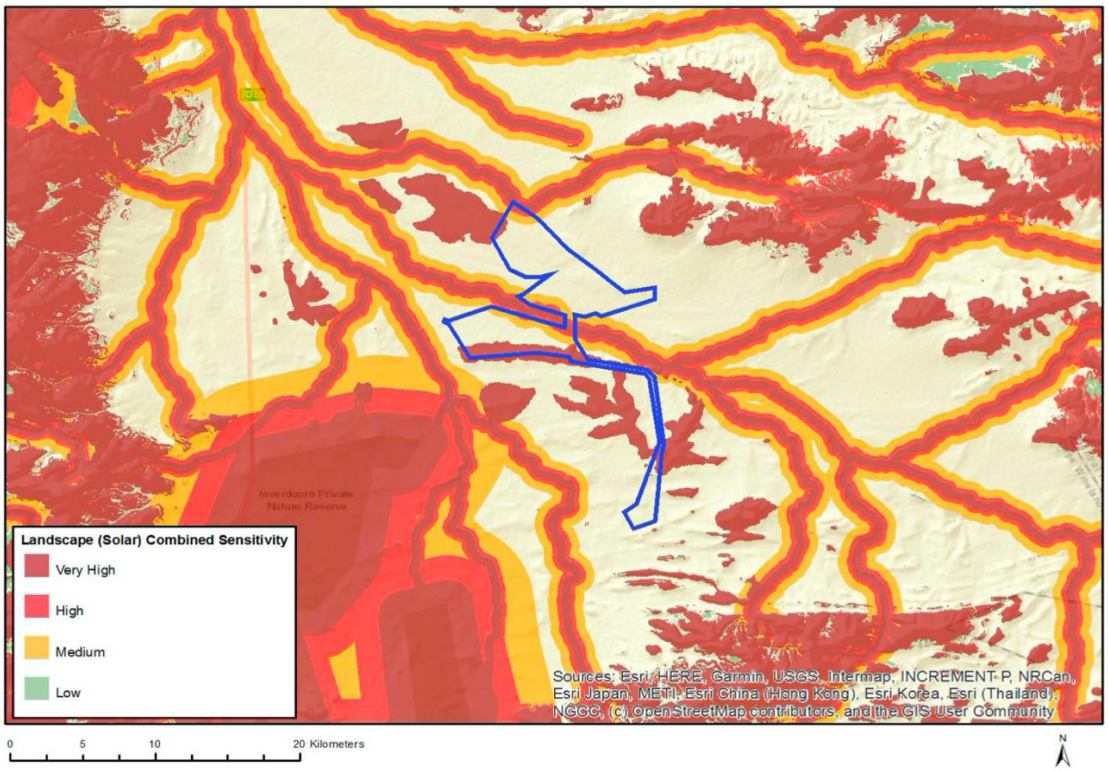


Figure 4: DEFF Screening Tool for the Landscape Theme

4.3.2. Specialist Sensitivity Analysis and Verification

The specific sensitivity of the site related to the four Hoek Doornen PV facilities, associated structures and electrical grid infrastructure are identified in this section. Areas to be avoided (including buffers) are identified, including areas not suitable for development or construction activities.

A four-tier sensitivity map of the study area (which shows very high, high, medium and low sensitivities) has been provided, with the PV facilities and associated infrastructure superimposed on the visual sensitivity map, (see Figure 5 and Maps 8 and 9).

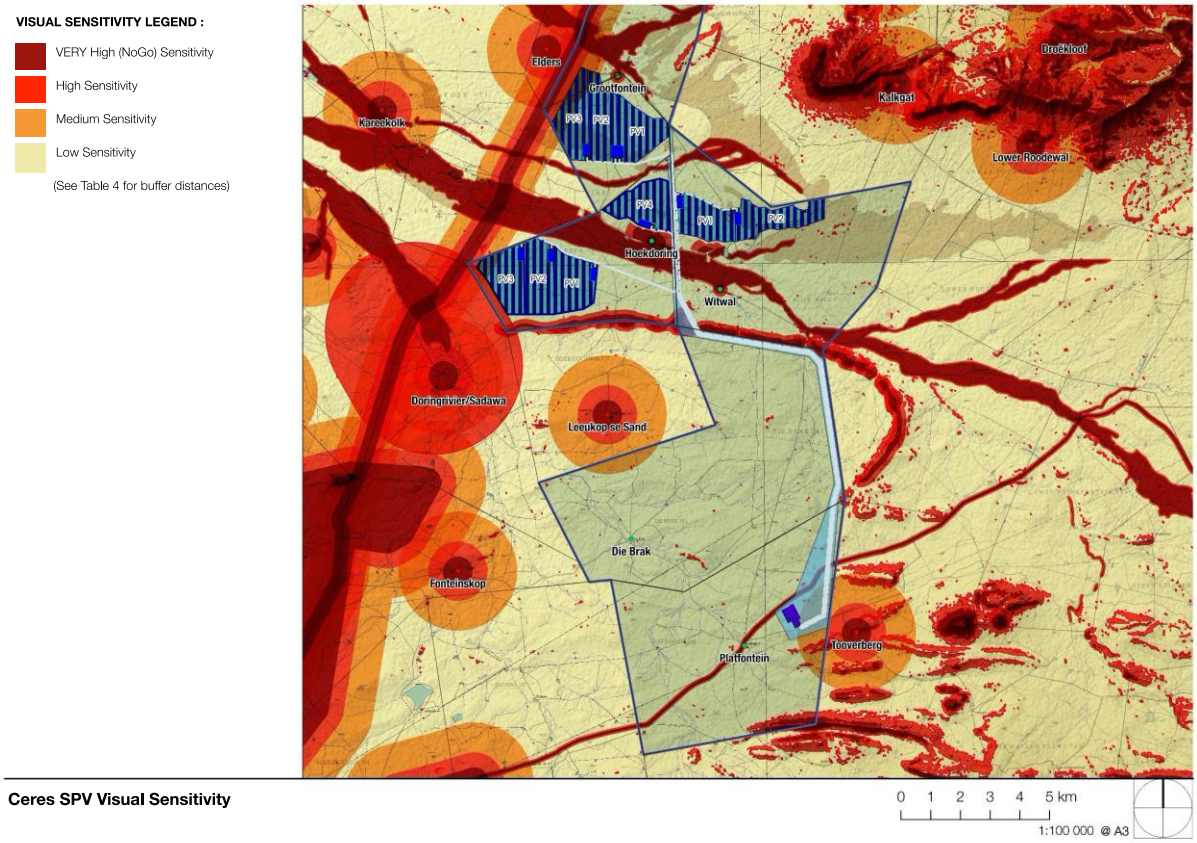


Figure 5: Detailed Visual Sensitivity Mapping for the Study Area

The Environmental Sensitivities are indicated for the four PV Facilities and Electrical Grid Infrastructure on Maps 8 and 9. A summary of visual features and sensitive receptors, and the rationale for these, is given in Table 3 below.

Table 3: Visual Features and Sensitive Receptors

Scenic Resource	**Landscape features within or adjacent to the development site.**
Topographic features	Landscape features in the area, such as hills, *koppies* and outcrops contribute to scenic and natural heritage value, providing visual interest or contrast in the landscape.
Water Features	In places, rivers have been carved into the softer Ecca shales, such as the Droëlaagte Rivier, Grootrivier and Doringrivier, which traverse the study area. In the arid landscape, drainage features with riverine thicket and dams provide scenic and amenity value.
Cultural landscapes	Intact wilderness or rural landscapes contribute to scenic value and sense of place, along with green patches of cultivated land and tree copses around farmsteads. Cultural landscapes include archaeological and historical sites identified in the Heritage Assessment.
	Receptors adjacent to the site or in the local surroundings.
Protected	The Tanqua Karoo National Park is more than 30km to the north-west of the study

Areas	area, and would not be affected by the proposed SEF projects. The Touw Local Nature Reserve is about 15km from the site, in a view shadow behind the Bontberg Mountains.
Private nature reserves, game farms	Private nature reserves and game farms in the area, some of which have guest accommodation, are important for the local tourism economy, and tend to be sensitive to loss or degradation of scenic quality. The Inverdoorn Private Nature Reserve facilities to the south-west are about 10km from the project site. The Klaserie Private Nature Reserve to the south is a similar distance from the site and both are unlikely to be visually affected by the proposed SEFs. Sadawa (Doringrivier) is a game farm, about 8.5km from the project site, with guest accommodation.
Human settlements, farmsteads	Surrounding farmsteads are widely spread and tend to be 5km or more from the project site. It is assumed that farms that form part of the leased development site are less visually sensitive.
Scenic / arterial routes	The R355, which runs north to the Tanqua Karoo and Calvinia, and which is some 12km away, would not be in the viewshed of the proposed SEF projects. The R356 runs north-east in the direction of Sutherland and abuts the study area for several kilometres. This stretch would probably not be considered a scenic route, but would require a nominal visual buffer.
Cultural and heritage sites	These form part of the heritage study, but could have visual implications.

Identification of Environmental Sensitivities

Given the relatively featureless nature of the study area, described above, the only sensitive visual features are the drainage courses, neighbouring farmsteads, and game farms, which are some distance away. Heritage features, documented by the Heritage Specialists, may have visual significance.

Other local features in the landscape, such as the existing ESKOM Kappa Substation and power lines are visual intrusions that have already altered the landscape character of the area to the south.

Visual sensitivity mapping at the broad regional scale for the Phase 1 Wind and Solar SEA (DEA, 2015) indicated a 'Low' visual sensitivity for the study area.

Visual buffers indicated in the Phase 1 Wind and Solar SEA (DEA, 2015) are listed in Table 4 below. This was for mapping at a regional scale and was used as a guide. Visual sensitivity categories and related buffers at the site scale are listed in Tables 5 and 6. Buffers for visual features and receptors are indicated on Map 8 for the proposed solar facilities, and on Map 9 for the proposed connecting powerlines.

Table 4: Visual buffers for Solar PV Facilities at the Regional Scale

Landscape features/criteria	**Wind and Solar SEA (DEA, 2015)**	**Comments relating to proposed Hoek Doornen PV facilities**
Project area boundary	-	Farm boundary setback usually 30m.
Ephemeral streams/ tributaries	-	Subject to the Biodiversity Assessment.
Steep slopes (gradient)	>1:4 (very high sensitivity) 1:4 -1:10 (high sensitivity)	None on the proposed SEF project sites.
Prominent ridgelines, peaks and rock outcrops	250m (very high sensitivity)	None on the proposed SEF project sites.
Arterial / district gravel roads	0-250m (very high sensitivity) 250m-1 km (mod. sensitivity)	The R355 is about 12km to the west of the site and the R356 adjacent to the study area.
Scenic routes, passes	0-500m (very high sensitivity)	None in the immediate area.
Protected Areas	0-1,5 km (very high sensitivity) 1,5-2 km (high sensitivity) 2-3 km (mod. sensitivity)	None in the immediate area.
Private reserves/ game farms/ guest farms.	0-1 km (very high sensitivity) 1-2 km (high sensitivity) 2-3 km (mod. sensitivity)	Two private nature reserves are about 10km from the proposed site. Sadawa guest farm is about 3km from the project site.
Farmsteads	0-250m (high sensitivity) 250-500m (mod. sensitivity)	Leeukop se Sand farmstead is about 3.5km and other farmsteads 5km or more from the SEF project sites.

Table 5: Visual Sensitivity Mapping Categories for the Proposed Solar Facilities

Scenic Resources	**Very high sensitivity (No-go)**	**High visual sensitivity**	**Medium visual sensitivity**	**Low visual sensitivity**
Topographic features	Feature	Within 150-250m	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
Drainage courses	Feature	Within 50m	-	-
Cultural landscapes/ cropland	within 250m	within 500m	-	-
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	within 500m	within 1 km	within 2 km	-
Farmsteads outside site	within 500m	within 1 km	within 2 km	-
Farmsteads inside site	within 250m	within 500m	-	-
Arterial routes	within 250m	within 500m	within 1km	-

Table 6: Visual Sensitivity Mapping Categories for Proposed 132kV Connecting Power Lines

Scenic Resources	Very high sensitivity (No-go)	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	Feature*	Within 150m	-	-
Steep slopes	-	Slopes > 1:4	Slopes > 1:10	-
Drainage courses	Feature*	Within 50m	-	-
Cultural landscapes/ cropland	within 100m	within 150m	Within 250m	-
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	Feature	within 250m	within 500m	-
Farmsteads outside site	within 50m	within 100m	-	-
Farmsteads inside site	within 50m	within 100m	-	-
Arterial / district routes	within 50m	within 100m	-	-

Note: *The power lines could cross these features at right angles.

4.3.3. Sensitivity Analysis Summary Statement

The visual sensitivities described above and in Maps 8 and 9 correspond roughly with the screening tool sensitivities, the former being more detailed and specific to the study area. These formed the basis of the Screening Phase layout. (The site sensitivity verification is included in Appendix C).

5. Issues, Risks and Impacts

5.1. Identification of Potential Impacts/Risks

The potential visual impacts resulting from the proposed Hoek Doornen PV and electrical grid infrastructure development on landscape features and receptors identified above are listed below for each of the project phases, including cumulative impacts. The potential visual impacts would be identical for each of the proposed PV facilities and electrical grid infrastructure. The impacts identified are direct and cumulative impacts. No indirect impacts have been identified.

Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Solar Facilities and Associated Buildings

Construction Phase

- Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on residents and visitors to the area, particularly users of the main arterial route (R356), to the site.
- Potential visual effect of haul roads, access roads, stockpiles and construction camps in the exposed landscape.

Operational Phase

- Potential visual intrusion of solar arrays and related infrastructure and the impact on receptors, including residents and visitors, as well as game farms in the area.
- Potential visual impact of an industrial type activity on the rural or wilderness character of the area.

Decommissioning Phase

- Potential visual effect of any remaining structures, platforms and disused roads on the landscape.

Cumulative Impacts

- Potential combined visual effect of the four solar PV facilities with the similarly proposed Grootfontein and Witte Wall solar facilities in the study area, as well as with other nearby existing and proposed renewable energy farms in the area.

Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Electrical Grid Infrastructure and Substations

Construction Phase

- Potential effect of dust and noise from construction machinery during the construction of the substation and pylons, and the effect of this on residents and visitors to the area.
- Potential visual effect of access roads, stockpiles and construction camps in the exposed landscape.

Operational Phase

- Potential visual intrusion of substations and powerlines, and the impact on receptors, particularly where powerlines cross roads.
- Potential visual impact of industrial type activities on the rural or wilderness character of the area.

Decommissioning Phase

- Potential visual effect of any remaining electrical grid structures and disused roads on the landscape.

Cumulative Impacts

- Potential combined visual effect of the four Hoek Doornen substations and four connecting powerlines with those of Witte Wall and Grootfontein solar PV facilities within the study area, as well as the nearby existing Perdekraal WEF. This would potentially result in the visual effect of nine connecting powerlines to the ESKOM Kappa substation.

5.1.1. Summary of Issues identified during the Public Consultation Phase

Comments will be received when the Draft BAR is released for public participation. This section will therefore be updated once the information is available.

6. Impact Assessment

This section provides an assessment of the potential visual impacts of the Hoek Doornen cluster of four solar PV facilities and associated buildings, as well as the electrical grid infrastructure. Comment on the no-go alternative and the overall findings are provided.

As the four solar facilities within the cluster are very similar, and because visual no-go areas have been avoided during the screening phase, only one set of assessment tables were deemed necessary.

Criteria for determining visual impact included the following:

Visibility:

Estimated degrees of visibility based on the scale of the facilities and related infrastructure, and on distance from various viewpoints are indicated in Table 7 below:

Table 7: Degrees of Visibility of Proposed SEF and Related Infrastructure

	Very high visibility	0-500m	Prominent feature within the observer's view frame
	High visibility	500m-1km	Relatively prominent within observer's view frame
	Moderate visibility	1-2km	Only prominent as part of the wider landscape
	Low visibility	2-4km	Visible as a minor element in the landscape
	Very low visibility	>4km	Hardly visible with the naked eye in the distance

The height of the solar PV arrays is relatively low (up to 10m), while the substation and power line pylons are higher. Possible degrees of visibility from a number of viewpoints are indicated in Table 8 below. (See also photomontages). Visibility of lights at night would not be significant because of the localised need for lighting and the distance of receptors. Visibility of the proposed powerline connection would also not be generally significant, except where it crosses roads.

Table 8: Hoek Doornen PV and Electrical Grid Infrastructure Viewing Distances and Visibility from Receptors

Viewpoint	Latitude	Longitude	Distance to PV arrays	Distance to powerline	Potential Visibility
S1 Elders Gate	32.937334ºS	19.929514ºE	4.93 km	-	not visible - in view shadow
S2 R356 Grootfontein Gate	32.932353ºS	19.934539ºE	5.19 km	-	not visible - in view shadow
S3 Kareekolk Gate	32.973741ºS	19.907129ºE	2.22 km	-	moderately visible
S4 Sadawa Gate	32.030539ºS	19.879571ºE	3.20 km	-	moderately visible PV 1 and 2 only
S5 Kalkgat	32.946363ºS	20.049133ºE	8.36 km	-	No Access - not visible - in view shadow
P1 District Road	33.091035ºS	20.025678ºE	-	273 m	highly visible
P2 Witwal Gate	33.025376ºS	20.015431ºE	-	193 m	highly visible
P3 Tooverberg	33.110072ºS	20.032875ºE	-	1.27 km	No Access - marginally visible
P4 Platfontein	33.115838ºS	19.992370ºE	-	1.98 km	visibility obscured by foreground of the Kappa substation
P5 Leeukop se Sand	33.045424ºS	19.943761ºE	-	3.97 km	No Access - marginally visible

Scenic Resources / Sensitive Receptors: (Map 8)

Except for river courses, there are no topographic or scenic features of note in the study area. The general area is sparsely populated, the farmsteads being far apart, and mostly a considerable distance from the proposed SEF projects. Visual sensitivity is therefore low.

Visual Exposure: (Maps 6 and 7)

The viewshed, or zone of visual influence, potentially extends for some 5km, but is partly restricted by low hills to the south, where parts of the surrounding area are in a view shadow. The viewshed (or zone of visual influence) of the proposed solar facilities and power lines tends to be fairly limited.

Landscape Integrity:

The natural landscape intactness of the area has been altered to some extent by the ESKOM Kappa Substation and power lines to the south. Further alteration of the surrounding landscape has taken place through the Perdekraal WEF to the south-east. The clustering of proposed solar facilities would help to minimise visual intrusion in the larger landscape.

Visual Absorption Capacity:

The area around the proposed site is generally flat to gently undulating, with low grass and scrub vegetation and therefore visually exposed, with low visual absorption capacity, i.e. low potential to screen any proposed structures.

The above visual criteria are summarised in Table 9 below in order to determine visual impact **consequence** for the proposed solar facilities, related infrastructure and powerline grid connections. **Significance** is determined by combining consequence with probability as indicated in Figure 6 below.

Table 9: Visual Impact Consequence

Visual Criteria	Comments	Four Solar PV facilities	Related Infrastructure	Four Connecting Powerlines
Visibility of facilities	Distance from receptors is a mitigating factor.	Low	Low	Medium
Visibility of lights at night	Distance from receptors is a mitigating factor.	Low	Low	Low
Visual exposure	Limited viewshed. Some areas in a view shadow.	Medium	Medium	Medium
Scenic resources and receptors	No scenic features of note. Receptors are isolated farmsteads.	Low	Low	Low
Landscape integrity	Rural character, with previous disturbance by powerlines and the existing Perdekraal WEF.	Low	Low	Low
Visual absorption capacity	Visually exposed landscape. Low visual absorption capacity.	Medium	Medium	Medium
Consequence	Summary	**Moderate**	**Moderate**	**Moderate**

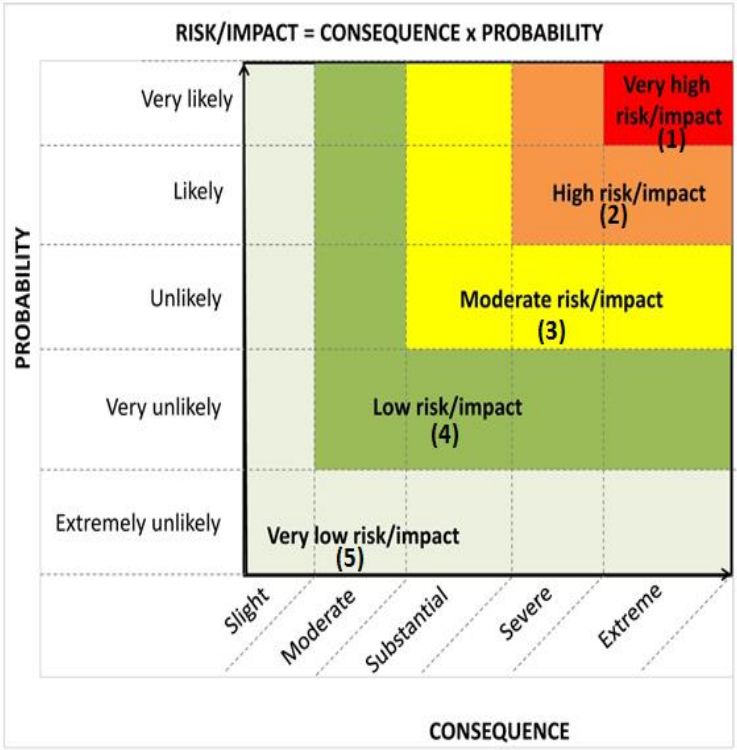


Figure 6: Visual impact Significance in relation to Consequence and Probability

6.1 Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Solar Facilities and Associated Buildings

6.1.1. Potential Impacts during the Construction Phase

This section includes an assessment of the potential direct and cumulative impacts identified for the Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Solar Facilities and Associated Buildings for the construction, operational and decommissioning phases.

6.1.1.1. Impact 1: Potential effect of dust and noise from trucks and construction machinery during the construction period

This impact relates to the potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on residents and visitors to the area, particularly users of the main arterial route (R356), to the site. This is rated as a negative, direct impact that extends locally and is of a short term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. Various mitigation measures have been allocated, such as ensuring the EMPr is implemented during the construction phase via the appointment of an Environmental Control Officer (ECO); and ensuring that construction camp and other facilities are located in visually unobtrusive areas, away from public roads. Section 6.1.1.3 provides an impact summary table.

6.1.1.2. Impact 2: Potential visual effect of haul roads, access roads, stockpiles and construction camps in the exposed landscape.

This impact relates to the potential visual effect of haul roads, access roads, stockpiles and construction camps in the exposed landscape. This is rated as a negative, direct impact with a short term duration and local spatial extent. The consequence and probability are respectively rated as moderate and very likely, rendering a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. The same mitigation measures identified for Impact 1 (Section 6.1.1.1) apply to Impact 2. Section 6.1.1.3 provides an impact summary table.

6.1.1.3. Impact Summary Table: Construction Phase

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1 and Impact 2 for the construction phase	*Status*	**Negative**	**Low risk (level 4)**	Locate construction camps, batching plants (if required) and stockpiles in visually unobtrusive areas, away from public roads. Implement the EMPr with an ECO during construction.	**Low risk (level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.1.2. Potential Impacts during the Operational Phase

6.1.2.1. Impact 1: Potential visual intrusion of solar arrays and related infrastructure and the impact on receptors, including residents and visitors, as well as game farms in the area.

This impact relates to the potential visual intrusion of solar arrays and related infrastructure and the impact on receptors, including residents and visitors, as well as game farms in the area. This is rated as a negative, direct impact that extends locally and is of a long term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. Various mitigation measures have been identified:

- Locate the O&M buildings in unobtrusive low-lying areas, away from public roads, and/or screened with earth berms where necessary.
- Use muted natural colours and non-reflective finishes for buildings and structures generally.

- Keep internal access roads as narrow as possible, and use existing roads or tracks as far as possible.
- Fit outdoor / security lighting with reflectors to minimise light spillage.
- Locate internal powerlines underground where possible.
- Use discrete outdoor signage and prohibit intrusive commercial or billboard signage.

Section 6.1.2.3 provides an impact summary table.

6.1.2.2. Impact 2: Potential visual impact of an industrial type activity on the rural or wilderness character of the area.

This impact relates to the potential visual impact of an industrial type activity on the rural or wilderness character of the area. This is rated as a negative, direct impact with a long term duration and local spatial extent. The consequence and probability are respectively rated as moderate and very likely, rendering a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. The same mitigation measures identified for Impact 1 (Section 6.1.2.1) apply to Impact 2. Section 6.1.2.3 provides an impact summary table.

6.1.2.3. Impact Summary Table: Operational Phase

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Impact 1 and Impact 2 – Operational Phase	*Status*	**negative**	**Low risk (level 4)**	Locate the O&M buildings in unobtrusive low-lying areas, away from public roads, and/or screened with earth berms where necessary. Use muted natural colours and non-reflective finishes for buildings and structures generally. Keep internal access roads as narrow as possible, and use existing roads or tracks as far as possible. Fit outdoor / security lighting with reflectors to minimise light spillage. Locate internal powerlines underground where possible. Use discrete outdoor signage and prohibit intrusive commercial or billboard signage.	**Low risk (level 4)**	**High**
	Spatial Extent	**local**				
	Duration	**long term**				
	Consequence	**moderate**				
	Probability	**very likely**				
	Reversibility	**high**				
	Irreplaceability	**low**				

6.1.3. Potential Impacts during the Decommissioning Phase

6.1.3.1. Impact 1: Potential visual effect of any remaining structures, platforms and disused roads on the landscape.

This impact relates to the potential visual effect of any remaining structures, platforms and disused roads on the landscape. This is rated as a negative, direct impact that extends locally and is of a long term duration. The consequence is rated as moderate, and the probability identified as likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance.

Various mitigation measures have been allocated, such as ensuring that the solar arrays are removed and building structures are recycled or demolished; and that hardened areas and access roads no longer required are ripped and regraded, and that disturbed areas are revegetated or returned to grazing. Section 6.1.3.2 provides an impact summary table.

6.1.3.2. Impact Summary Table: Decommissioning Phase

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
Impact 1 – Decommissioning Phase	*Status*	**Negative**	**Low risk (level 4)**	Remove solar PV arrays and demolish or recycle building structures for new uses. Rip and regrade hardened platform areas and access roads no longer required. Revegetate or return to grazing exposed or disturbed areas to blend with the surroundings.	**Very low risk (level 5)**	**Medium**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Moderate**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.1.4. Cumulative Impacts

6.1.4.1. Impact 1: Potential combined visual effect of the four Hoek Doornen solar PV facilities with those of Grootfontein (i.e. three) and Witte Wall (i.e. two) within the study area, and other nearby existing and proposed renewable energy farms in the area.

This impact relates to the potential combined visual effect of the nine proposed solar PV facilities within the study area (i.e. two for Witte Wall, three for Grootfontein and four for Hoek Doornen), and other nearby existing and proposed renewable energy farms in the area. This is rated as a negative, cumulative impact for the construction, operational and decommissioning phases. The duration for the impact is rated as short term for the construction and decommissioning phases; and long term for the operational phase. The impacts have been rated with a local spatial extent. The consequence of the impact has been rated as substantial for the operational and decommissioning phases and moderate for the construction phase; and the probability has been rated as likely for the three phases. Without the implementation of mitigation measures, the impact is rated as low significance for the construction phase, and moderate significance for the operational and decommissioning phases. With the implementation of mitigation measures, the significance of this impact is rated as low, moderate and very low significance for the construction, operational, and decommissioning phases. The mitigation measures are noted in Section 6.1.4.2 below.

6.1.4.2. Impact Summary Tables: Cumulative Impacts

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1	*Status*	**negative**	**Low risk (level 4)**	Observe EMPr requirements	**Low risk (level 4)**	**High**
	Spatial Extent	**local**				
	Duration	**short term**				
	Consequence	**Moderate**				
	Probability	**likely**				
	Reversibility	**high**				
	Irreplaceability	**low**				
OPERATIONAL PHASE						
Impact 1	*Status*	**negative**	**Moderate risk (level 3)**	Observe mitigations in 6.1.2.3 above	**Moderate risk (level 3)**	**High**
	Spatial Extent	**local**				
	Duration	**long term**				
	Consequence	**substantial**				
	Probability	**likely**				
	Reversibility	**high**				
	Irreplaceability	**low**				
DECOMMISSIONING PHASE						
Impact 1	*Status*	**negative**	**Moderate risk (level 3)**	Observe mitigations in 6.1.3.2 above	**Very low risk (level 5)**	**Medium**
	Spatial Extent	**local**				
	Duration	**short term**				
	Consequence	**substantial**				
	Probability	**Likely**				
	Reversibility	**high**				
	Irreplaceability	**low**				

6.2. Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Electrical Grid Infrastructure and Substations

This section includes an assessment of the potential direct and cumulative impacts identified for the Hoek Doornen PV 1, PV 2, PV 3 and PV 4 Electrical Grid Infrastructure and Substations for the construction, operational and decommissioning phases.

6.2.1. Potential Impacts during the Construction Phase

6.2.1.1. Impact 1: Potential effect of dust and noise from construction machinery during the construction of the substation and pylons, and the effect of this on residents and visitors to the area.

This impact relates to the potential effect of dust and noise from construction machinery during the construction of the substation and pylons, and the effect of this on residents and visitors to the area. This is rated as a negative, direct impact that extends locally and is of a short term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. Various mitigation measures have been allocated, such as ensuring the EMPr is implemented during the construction phase; and ensuring that construction camps and other facilities are located in visually unobtrusive areas, away from public roads. Section 6.2.1.3 provides an impact summary table.

6.2.1.2. Impact 2: Potential visual effect of access roads, stockpiles and construction camps in the exposed landscape.

This impact relates to the potential visual effect of access roads, stockpiles and construction camps in the exposed landscape. This is rated as a negative, direct impact with a short term duration and local spatial extent. The consequence and probability are respectively rated as moderate and very likely, rendering a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. The same mitigation measures identified for Impact 1 (Section 6.2.1.1) apply to Impact 2. Section 6.1.1.3 provides an impact summary table.

6.2.1.3. Impact Summary Tables: Construction Phase

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1 and Impact 2 for the construction phase	*Status*	**negative**	**Low risk (level 4)**	Locate construction camps and stockpiles in visually unobtrusive areas, away from public roads. Implement the EMPr requirements.	**Low risk (level 4)**	**High**
	Spatial Extent	**local**				
	Duration	**short term**				
	Consequence	**moderate**				
	Probability	**very likely**				
	Reversibility	**medium**				
	Irreplaceability	**low**				

6.2.2. Potential Impacts during the Operational Phase

6.2.2.1. Impact 1: Potential visual intrusion of substations and powerlines, and the impact on receptors, particularly where powerlines cross roads.

This impact relates to the potential visual intrusion of substations and powerlines, and the impact on receptors, particularly where powerlines cross roads. This is rated as a negative, direct impact that extends locally and is of a long term duration. The consequence is rated as moderate, and the probability identified as likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. Various mitigation measures have been identified:

- Locate substations in un-obtrusive low-lying areas, away from public roads.
- Avoid powerlines on hillcrests and ridge skylines where possible.
- Use monopoles in preference to lattice pylons.
- Keep maintenance / access roads as narrow as possible, and use existing roads or tracks as far as possible.
- Fit outdoor / security lighting at substations with reflectors to minimise light spillage.

Section 6.2.2.3 provides an impact summary table.

6.2.2.2. Impact 2: Potential visual impact of industrial type activities on the rural or wilderness character of the area.

This impact relates to the potential visual impact of industrial type activities on the rural or wilderness character of the area. This is rated as a negative, direct impact with a long term duration and local spatial extent. The consequence and probability are respectively rated as moderate and likely, rendering a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is still rated as low significance. The same mitigation measures identified for Impact 1 (Section 6.2.2.1) apply to Impact 2. Section 6.2.2.3 provides an impact summary table.

6.2.2.3. Impact Summary Tables: Operational Phase

Impact	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Impact 1 and Impact 2 – Operational Phase	*Status*	**Negative**	**Low risk (level 4)**	Locate substations in un-obtrusive low-lying areas, away from public roads. Avoid powerlines on hillcrests and ridge skylines where possible. Use monopoles in preference to lattice pylons. Keep maintenance / access roads as narrow as possible, and use existing roads or tracks as far as possible. Fit outdoor / security lighting at substations with reflectors to minimise light spillage.	**Low risk (level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Moderate**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.2.3. Potential Impacts during the Decommissioning Phase

6.2.3.1. Impact 1: Potential visual effect of any remaining electrical grid structures and disused roads on the landscape.

This impact relates to the potential visual effect of any remaining electrical grid structures and disused roads on the landscape. This is rated as a negative, direct impact that extends locally and is of a long term duration. The consequence is rated as moderate, and the probability identified as likely, resulting in an impact significance of low, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of this impact is rated as very low significance. Various mitigation measures have been allocated, such as ensuring that the pylons and substation structures are removed and recycled; and that access roads no longer required are ripped and regraded, and that disturbed areas are revegetated or returned to pasture. Section 6.2.3.2 provides an impact summary table.

6.2.3.2. Impact Summary Tables: Decommissioning Phase

Impact 1	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
Impact 1 – Decommissioning Phase	*Status*	**Negative**	**Low risk (level 4)**	Remove or recycle electrical grid substation and pylons. Rip and regrade access roads no longer required. Revegetate or return to pasture exposed or disturbed areas to blend with the surroundings.	**Very low risk (level 5)**	**Medium**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Moderate**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.2.4. Cumulative Impacts

6.2.4.1. Impact 1: Potential combined visual effect of the four Hoek Doornen substations and four connecting powerlines with those of Grootfontein and Witte Wall solar PV facilities within the study area, as well as the nearby existing Perdekraal WEF. This would potentially result in the visual effect of nine connecting powerlines to the ESKOM Kappa substation.

This impact relates to the potential combined visual effect of the nine proposed power lines and nine on-site substations within the study area (i.e. two for Witte Wall, three for Grootfontein and four for Hoek Doornen), and other nearby existing and proposed renewable energy farms in the area. It must be noted that it is unlikely that nine power lines will be constructed all the way to the Eskom Kappa Substation. If all nine proposed Ceres PV projects are developed, it is likely that a maximum of four power lines from the project sites (on the farms Witte Wall, Grootfontein and Hoek Doornen) to the Kappa substation will be constructed, realistically (i.e. along Die Brak and Platfontein Farms). However, based on the uncertainties around the future Independent Power Producers bidding process, the requirements of Eskom, and not knowing if and which project will receive preferred bidder status; it is necessary to assess nine power lines to the Kappa Substation so that future lines can be based on this.

The cumulative impact is rated as negative for the construction, operational and decommissioning phases. The duration for the impact is rated as short term for the construction phase; and long term for the operational and decommissioning phases. The impacts have been rated with a local spatial extent. The consequence of the impact has been rated as substantial for the construction, operational and decommissioning phases; and the probability has been rated as likely for all three phases. Without the implementation of mitigation measures, the impact is rated as moderate significance for the construction, operational and decommissioning phases. With the implementation of mitigation measures, the significance of this impact is rated as low for construction and operations, and very low significance for the decommissioning phase. The mitigation measures are noted in Section 6.2.4.2 below.

6.2.4.2. Impact Summary Tables: Cumulative Impact

Impact 1	*Impact Criteria*		*Significance / Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance / Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1	*Status*	**Negative**	**Moderate risk (level 3)**	Combine connecting powerlines from Witte Wall, Grootfontein and Hoek Doornen, where possible. Observe EMPr requirements.	**Low risk (level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Substantial**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				
OPERATIONAL PHASE						
Impact 1	*Status*	**Negative**	**Moderate risk (level 3)**	Combine connecting powerlines from Witte Wall, Grootfontein and Hoek Doornen, where possible. Observe mitigations in 6.2.2.3 above.	**Low risk (level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Substantial**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				
DECOMMISSIONING PHASE						
Impact 1	*Status*	**Negative**	**Moderate risk (level 3)**	Observe mitigations in 6.2.3.2 above.	**Very low risk (level 5)**	**Medium**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Substantial**				
	Probability	**Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

7. Impact Assessment Summary

The overall impact significance findings, following the implementation of the proposed mitigation measures, are shown in Table 10 and Table 11 below for the proposed Hoek Doornen solar PV facilities and for the electrical grid infrastructure.

Table 10: Overall Impact Significance for Solar PV facilities and Related Buildings (post mitigation)

Phase	**Overall Impact Significance**
Construction	Low (level 4)
Operational	Low (level 4)
Decommissioning	Very low (level 5)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low (level 4)
Cumulative - Operational	Moderate (level 3)
Cumulative - Decommissioning	Very low (level 5)

Table 11: Overall Impact Significance for Substations and Connecting Powerlines (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Low (level 4)
Operational	Low (level 4)
Decommissioning	Very low (level 5)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low (level 4)
Cumulative - Operational	Low (level 4)
Cumulative - Decommissioning	Very low (level 5)

No-go Alternative

In the no-go alternative, there would be no SEFs or additional powerlines and therefore no additional visual intrusion on the rural landscape and on surrounding farmsteads. At the same time no renewable energy would be produced at the site for export to the national grid. The visual significance would therefore be neutral, with neither impacts nor benefits occurring.

Findings

Given the fairly contained footprint of the proposed cluster solar PV facilities, the limited viewshed and the localised visual effects in a remote area, the visual impact significance was found to be **low risk**, and **very low risk** after mitigation in the long term if the solar facilities are decommissioned.

The electrical grid infrastructure would also have a **low risk** significance after mitigation, provided the proposed power lines leading to the ESKOM Kappa substation to the south of the study area are consolidated. (Although nine power lines have been assessed, in reality a maximum of four power lines from the project sites to the Kappa Substation would be constructed, depending on the bidding process).

Although the potential cumulative visual impacts, when combined with the proposed Grootfontein and Witte Wall solar PV clusters, as well as the existing Perdekraal WEF, could result in a semi-industrialised landscape, the proposed solar PV facilities tend to have less visual significance than the larger scale wind farms. It would be important however for power lines to be shared where possible, to avoid the proliferation of these in the exposed landscape.

8. Legislative and Permit Requirements

The National Environmental Management Act (Act No. 107 of 1998, as amended). (NEMA) and the (NEMA Environmental Impact Assessment (EIA) Regulations (2014, as amended) apply as the development of the proposed SEFs and associated infrastructure are a listed activity. As the site falls within a gazetted REDZ, a BA is required. The need for a visual assessment has been identified.

The National Heritage Resources Act (Act No. 25 of 1999) (NHRA), and associated provincial regulations, provide legislative protection for natural, cultural and scenic resources, as well as for archaeological and paleontological sites within the study area. This report deals with visual considerations, including scenic resources, which form part of the National Estate. The Visual Assessment would therefore form part of the Heritage Assessment in terms of obtaining the relevant comments from Heritage Western Cape.

Other than the above legislation, there are no specific policies or guidelines for visual and scenic resources for the Western Cape. The Guideline for Involving Visual and Aesthetic Specialists in EIA Processes, by the Provincial Government of the Western Cape, was used as a general guide.

The South African Civil Aviation Authority (SACAA) has an Obstacle Notice 4/2017 requiring solar project applications to be accompanied by a Glint and Glare Impact Assessment Report with relevance to aviation. There is an airstrip at Sadawa, which is about 3km away, and it is only occasionally used for small aircraft, therefore no Glint and Glare Impact Assessment is considered necessary.

9. Environmental Management Programme Inputs

Planning and Design Phase

Ensure that visual management measures are included as part of the EMPr, monitored by an ECO, including the siting of the construction camps and material stockpiles in visually unobtrusive positions in the landscape, away from public roads.

Construction Phase Monitoring:

Implement dust suppression and litter control measures, as well as rehabilitation of borrow pits (if required) and haul roads to minimise their visual effect on the surroundings. Ensure regular reporting to an environmental management team by the ECO during the construction phase.

Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the control of signage, lighting and wastes on the site by the appointed Environmental Manager.

Decommissioning Phase Monitoring:

Ensure that procedures for the removal of structures and stockpiles during the decommissioning phase are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard as prescribed in a rehabilitation plan, and signed off by the delegated authority.

10. Final Specialist Statement and Authorisation Recommendation

10.1. Statement and Reasoned Opinion

The proposed cluster of Hoek Doornen PV 1, PV 2, PV 3 and PV 4 solar facilities form part of a larger solar energy project, which includes the Grootfontein and Witte Wall clusters. These fall within the Komsberg REDZ, and would form part of a larger group of renewable energy facilities concentrated near the ESKOM Kappa substation.

The generally flat terrain is visually exposed with the result that structures and pylons can be seen for several kilometres. However, there are no major scenic features of note, and the main receptors, being surrounding farmsteads, are spread fairly far apart, and except for the Elders homestead, are mostly more than 5km distance from the proposed solar facilities and connecting powerlines. This means that visibility of the proposed solar facilities and powerlines is generally low, (hardly visible to not visible from the farmsteads).

Taking into account the relatively low structures and the local scale of the proposed solar facilities and related infrastructure located in a fairly remote area, the visual impact significance was considered to be **low** before and after mitigation, and **low** before and after mitigation for the connecting powerlines for the construction and operational phases. The visual landscape could be restored after potential decommissioning of the Solar PV facilities and the power lines which means the visual significance would be **very low** with mitigation for this phase.

The potential cumulative visual impact for the cluster of four solar facilities, in combination with the proposed Grootfontein and Witte Wall clusters, as well as the existing Perdekraal WEF would increase to **moderate** both before and after mitigation during the operational phase, as the landscape becomes more semi-industrialised. The fact that the ESKOM Kappa substation and power lines already occur in the area needs to be taken into account.

The potential cumulative visual impact for the electrical grid infrastructure of all the clusters (Witte Wall, Grootfontein and Hoek Doornen), could be high in the unlikely event that all nine connecting power lines to the Kappa substation are built, but but in reality only a maximum of four power lines would be constructed. This would reduce the significance to **moderate** before mitigation and **low** after mitigation if the connecting power lines are shared. (See Figure P4 photomontage).

10.2. EA Condition Recommendations

Key visual management actions include locating the substations and other buildings, as well as construction camps, in unobtrusive (generally low-lying) positions in the landscape away from public roads. The Karoo landscape is particularly fragile and therefore new access roads and disturbance generally should be kept to a minimum for both the proposed solar facilities and connecting power lines. Connecting power lines should be shared where possible, to avoid a plethora of power lines in the exposed landscape.

There are no fatal flaws from a visual perspective arising from the proposed project, and given the marginal nature of agriculture in the area, the solar energy project is probably an inherently suitable land use that should receive authorisation, provided the mitigation measures are implemented as a condition of approval.

References

CSIR, August 2020. Terms of Reference for Specialist Studies for the Basic Assessments for proposed development of Solar Voltaic Facilities and Associated Electrical Grid Infrastructure, near Touws River, Western Cape.

Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.

Lawson, Q. and Oberholzer, B. 2014. National Wind and Solar PV SEA Specialist Report: Landscape Assessment, with CSIR for Department of Environmental Affairs.

Mucina, L. and Rutherford, M.C. (eds) 2006.The Vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. SANBI, Pretoria.

Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes: Edition 1 CSIR Report No. ENV-S-C 2005 053 F. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning.

Appendix A - Specialist Expertise

Quinton Lawson Architect (qarc)

Qualifications:
Bachelor of Architecture (Univ. of Natal 1977)

Professional registration/membership:
Professional member of the SA Council for the Architectural Profession (SACAP), reg. no. 3686.
Member of the Cape Institute for Architects and SA Institute of Architects.
B-BBEE Status: Level 4.

Quinton has practiced as a professional architect since 1978, specialising in architectural and urban design, environmental design and computer visualisation.

He was one of the founding partners of Meirelles Lawson Architects formed in 1988, initially specialising in economic and sustainable housing. He was a senior partner at MLB Architecture and Urban Design, with specialist expertise in visual modelling and design solutions.

In the past he has been a visiting lecturer at UCT teaching a post-graduate course on Computer Techniques in Landscape Architecture, including visualisation and visual assessment techniques.

Together with BOLA, Quinton has been involved in numerous visual impact assessments over a number of years, and previously served on the Impact Assessment Review Committee of Heritage Western Cape.

Bernard Oberholzer Landscape Architect + Environmental Planner (BOLA)

Qualifications:
Bachelor of Architecture (UCT 1970), Master of Landscape Architecture (U. of Pennsylvania 1975)

Professional registration/membership:
Professional member of the SA Council for the Landscape Architectural Profession (SACLAP), reg. no. 87018.
Fellow of the Institute of Landscape Architects of South Africa.
B-BBEE Status: Level 4.

Bernard has 40 years of experience as a professional landscape architect, specialising in, environmental planning, coastal planning, urban landscape design and visual assessments.

He is currently an independent consultant, and was for 7 years the Convenor of the Master of Landscape Architecture Programme at UCT.

He has presented papers on *Visual and Aesthetic Assessment Techniques*, and provides specialist services as a reviewer of visual impact studies prepared by other firms.

He is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared with the CSIR for the Dept. of Environmental and Development Planning, Provincial Government of the Western Cape, 2005.

Bernard has been involved in numerous land use suitability studies and visual assessments for a wide range of projects, and serves as a member of the Stanford Heritage Committee.

Bernard and Quinton were joint authors of the visual specialist chapters for the National Wind and Solar SEA and National Electricity Grid Infrastructure SEA, with the CSIR, for the Department of Environmental Affairs.

Appendix B - Specialist Statement of Independence

We, Quinton Lawson and Bernard Oberholzer, declare that –

- We act as the independent specialist in this application;
- We 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;
- We declare that there are no circumstances that may compromise our objectivity in performing such work;
- We 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;
- We will comply with the Act, Regulations and all other applicable legislation;
- We have no, and will not engage in, conflicting interests in the undertaking of the activity;
- We undertake to disclose to the applicant and the competent authority all material information in our 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 us for submission to the competent authority;
- all the particulars furnished by us in this form are true and correct; and
- We 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 Specialists:

Name of Companies: qarc and bola

Date: 09 October 2020

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	BOLA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	5	Percentage Procurement recognition	
Specialist name:	Bernard Oberholzer			
Specialist Qualifications:	B. Arch M.L.Arch			
Professional affiliation/registration:	SACAP			
Physical address:	16 Caledon St. Stanford			
Postal address:	PO Box 471 Stanford			
Postal code:	7210	Cell:	083 513 5696	
Telephone:	028 341 0264	Fax:		
E-mail:	bernard.bola@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, B. Oberholzer, 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.

BO

Signature of the Specialist

BOLA

Name of Company:

26 Oct 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

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

BJO

Signature of the Specialist

BOLA

Name of Company

26 Oct 2020

Date

Signature of the Commissioner of Oaths

26 Oct 2020

Date

COMMISSIONER OF OATHS
KARIN T. SFREDDO
9/1/8/2 PRETORIA (A14)
805 STANZA BOPAPE STR. ARCADIA 0083

Karin Sfreddo

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	27 August 2020
Specialist Name	Quinton Lawson and Bernard Oberholzer
Professional Registration Number	SACAP 3686, SACLAP 87018
Specialist Affiliation / Company	qarc and bola

The site sensitivity verification was undertaken using the following means:

(a) desk top analysis, using satellite imagery;
(b) preliminary on-site inspection; and
(c) a range of other available / relevant information included in Section 2.1 of this Report.

A screening report was compiled by the CSIR (20/8/2020) using the DEFF Screening Tool. The Report includes a 'Map of Relative Landscape (Solar) Theme Sensitivity', based on mapping prepared for the Phase 1 Wind and Solar SEA by the CSIR for DEFF in 2015 (DEA, 2015). The study area falls within the Komsberg REDZ.

The current visual sensitivity mapping included in Section 4 of this Visual Impact Assessment is in greater detail (at the site scale) for the proposed solar photovoltaic (PV) and electrical grid infrastructure study area, taking into account detailed viewshed mapping and local site conditions. This mapping largely confirms the mapping contained in the DEFF Screening Tool, but provides more detail. Refer to Section 4 of the Visual Impact Assessment for a motivation and evidence of the verified use of the land and environmental sensitivity.

Appendix D: Impact Assessment Methodology

The following impact assessment methodology was used in this VIA:

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D.1).

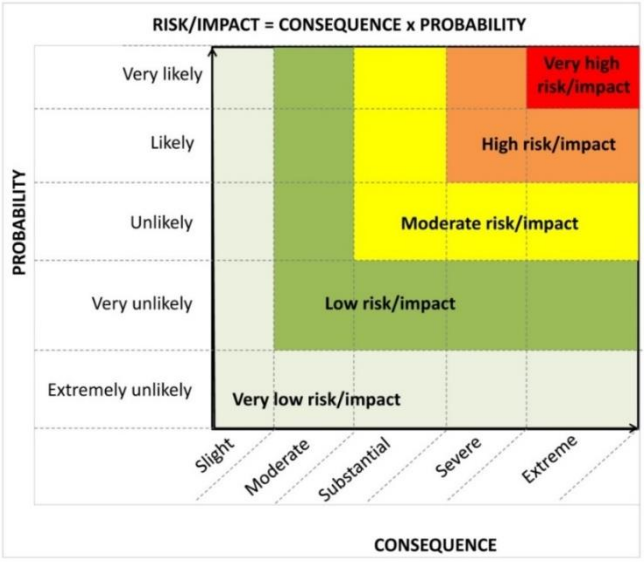


Figure D.1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
  - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*

- *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
- *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
- *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
- *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

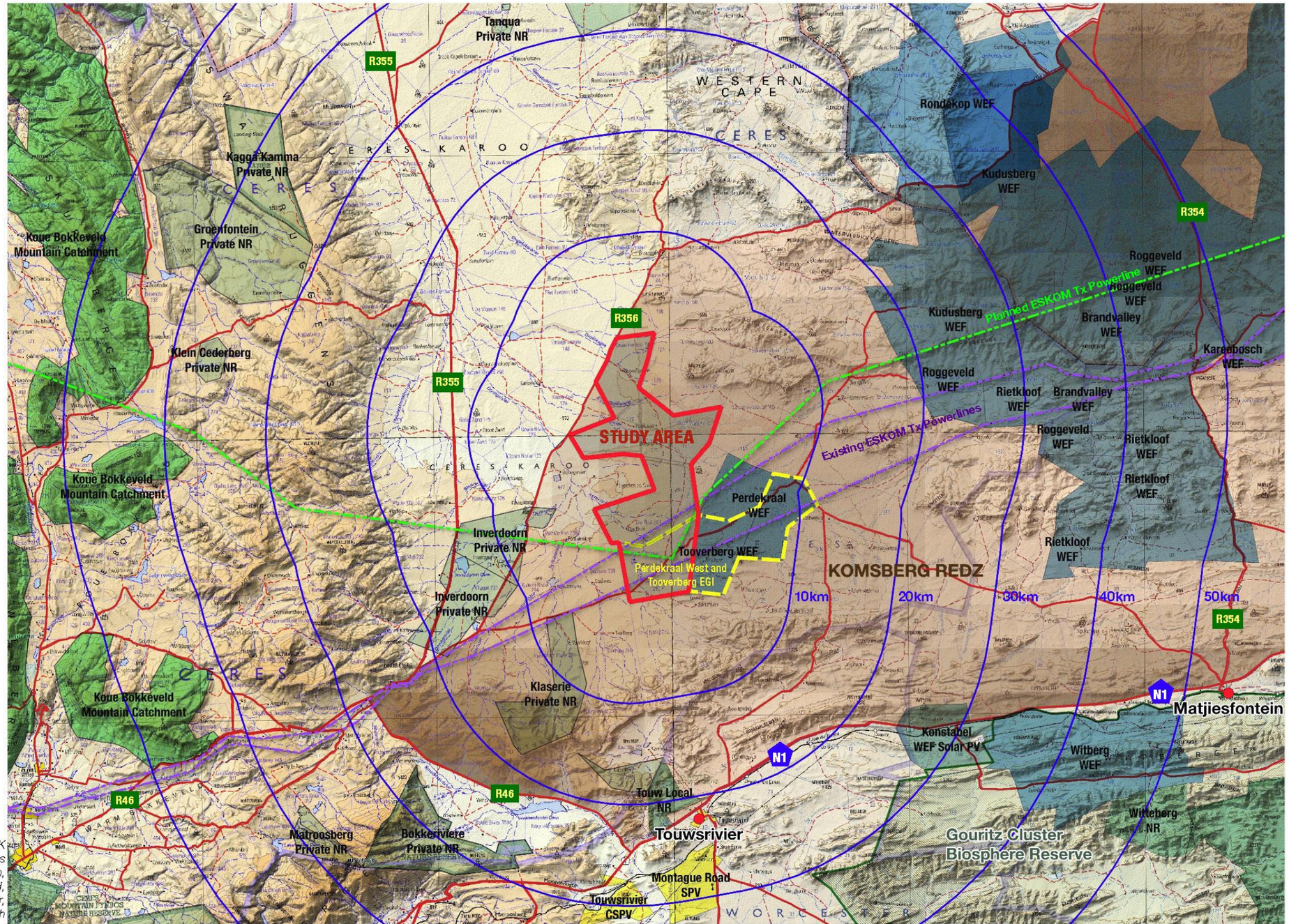
Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been 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;*	*Section 1.2 and Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B* *And Attachment*
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Section 1.1 and Section 1.3*
(cA) an indication of the quality and age of base data used for the specialist report;	*Section 2.1*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4 and Section 5*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 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 2*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Section 4.2 and Section 4.3*
g) an identification of any areas to be avoided, including buffers;	*Section 4.2 and Section 4.3*
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Maps 8 and 9*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2.2*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and Section 7*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Section 9*
l) any conditions for inclusion in the environmental authorisation;	*Section 10.2*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Section 6 and 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*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Section 2.3 and Section 5.2, and Refer to the Draft BAR*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not applicable at this stage. Report to still be released for public comment. Refer to Draft BAR*
q) any other information requested by the competent authority.	*Refer to EAP*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been addressed in the Specialist Report***
(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.	*Section 4.3.1 and Appendix C Part A of the Assessment Protocols published in GN 320 on 20 March 2020 are applicable.*

MAPS

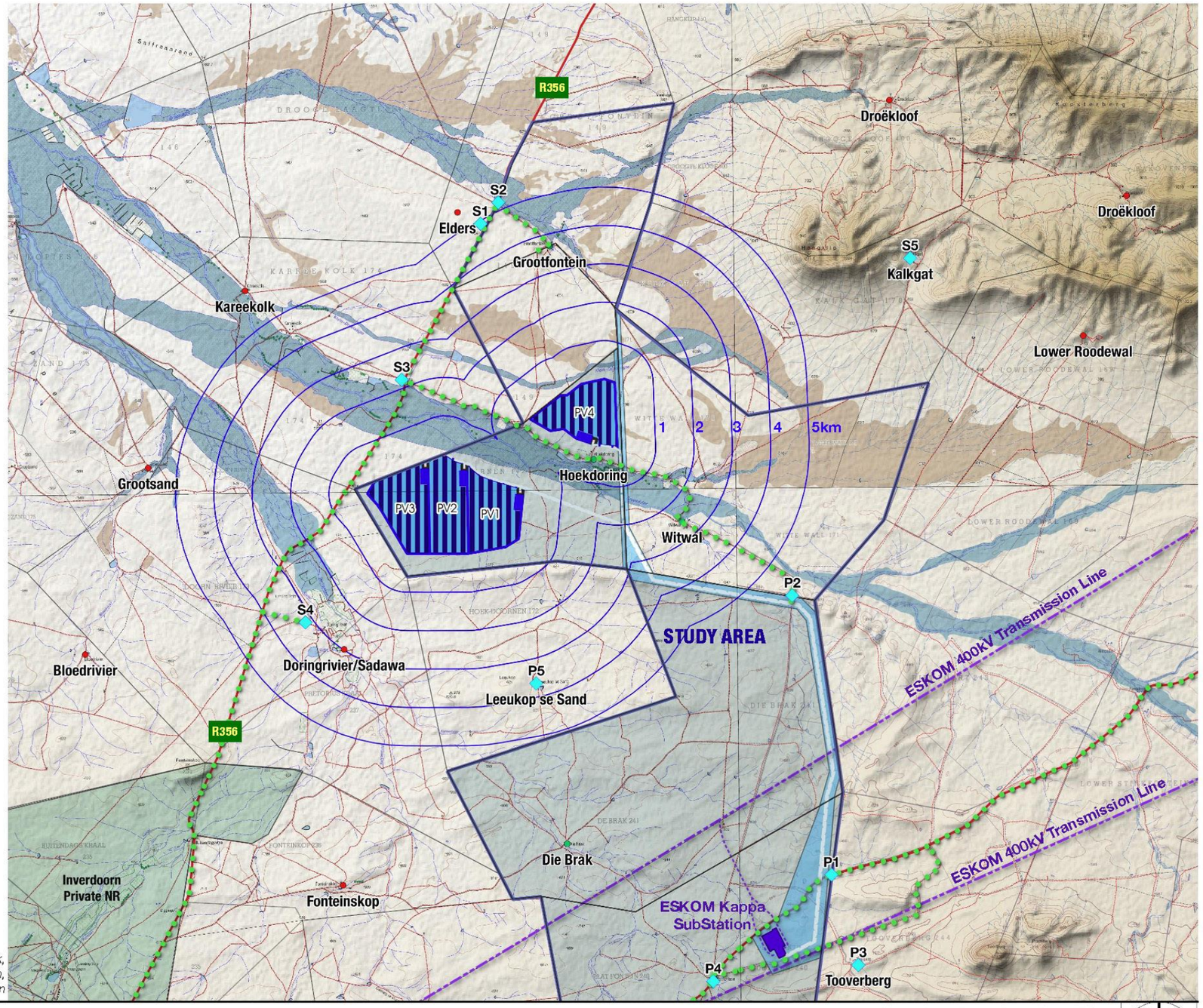


base map : NGI 1:250K Topo-Cadastral Series 3218 Clanwilliam, 3220 Sutherland, 3319 Worcester, 3320 Ladismith

map 1 : Regional Context • Cumulative Renewable Energy Facilities

LOCAL CONTEXT LEGEND :

- Solar PV Area
- 4x 132kV Powerlines within Corridor
- FieldTrack Route
- Viewpoints
- Farmsteads within Study Area
- Farmsteads outside Study Area



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 2 : Local Context • Fieldwork, Viewpoints, Existing Infrastructure, ESKOM Transmission Lines

0 1 2 3 4 5 km

1:100 000 @ A3

GEOLOGY LEGEND :

Q : Alluvium

Pa : Beaufort Group, Escourt Formation
(mudstone, sandstone)

Pko : Ecca Group, Koedoesberg Formation
(sandstone, shale)

Pk : Ecca Group, Kookfontein Formation
(shale)

Ps : Ecca Group, Skoorsteen Formation
(shale, sandstone)

Pt : Ecca Group, Tierberg Formation
(shale)

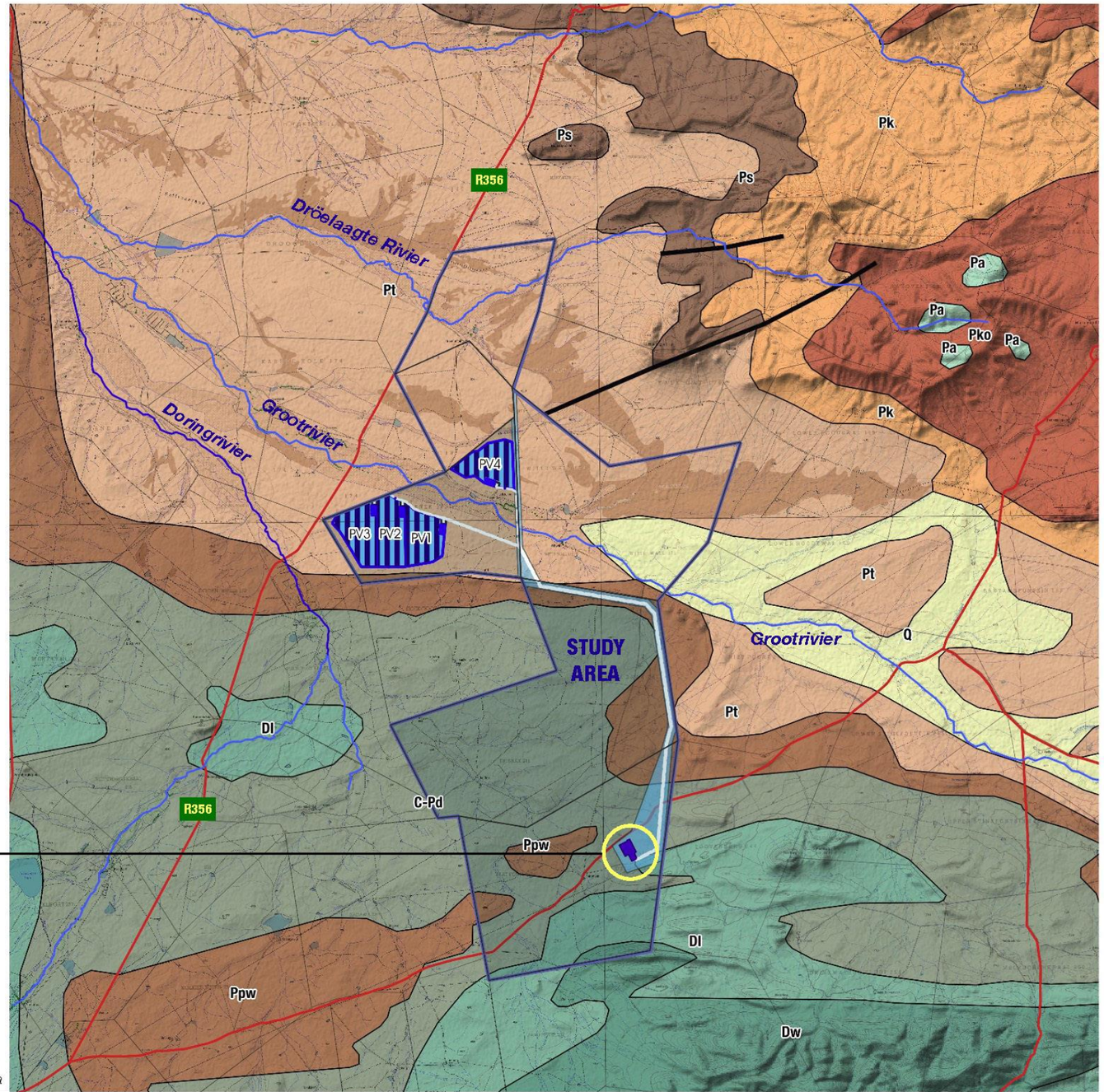
Ppw : Ecca Group, Prince Albert F./ Whitehill F.
(shale, carbonaceous shale)

C-Pd : Dwyka Formation
(tillite, sandstone, mudstone)

Dl : Witteberg Group, Kommadagga F./ Lake Mentz F.
(shale, sandstone)

Dw : Witteberg Group, Witpoort F./ Weltevrede F.
(quartzitic sandstone, shale)

ESKOM Kappa SubStation



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB, Inverdoorn, 3320AA Brewelsfontein : Council for Geoscience : RSA 1:1M Geological Spatial Data

map 3 : Geology

0 5 10 15 km

1:150 000 @ A3

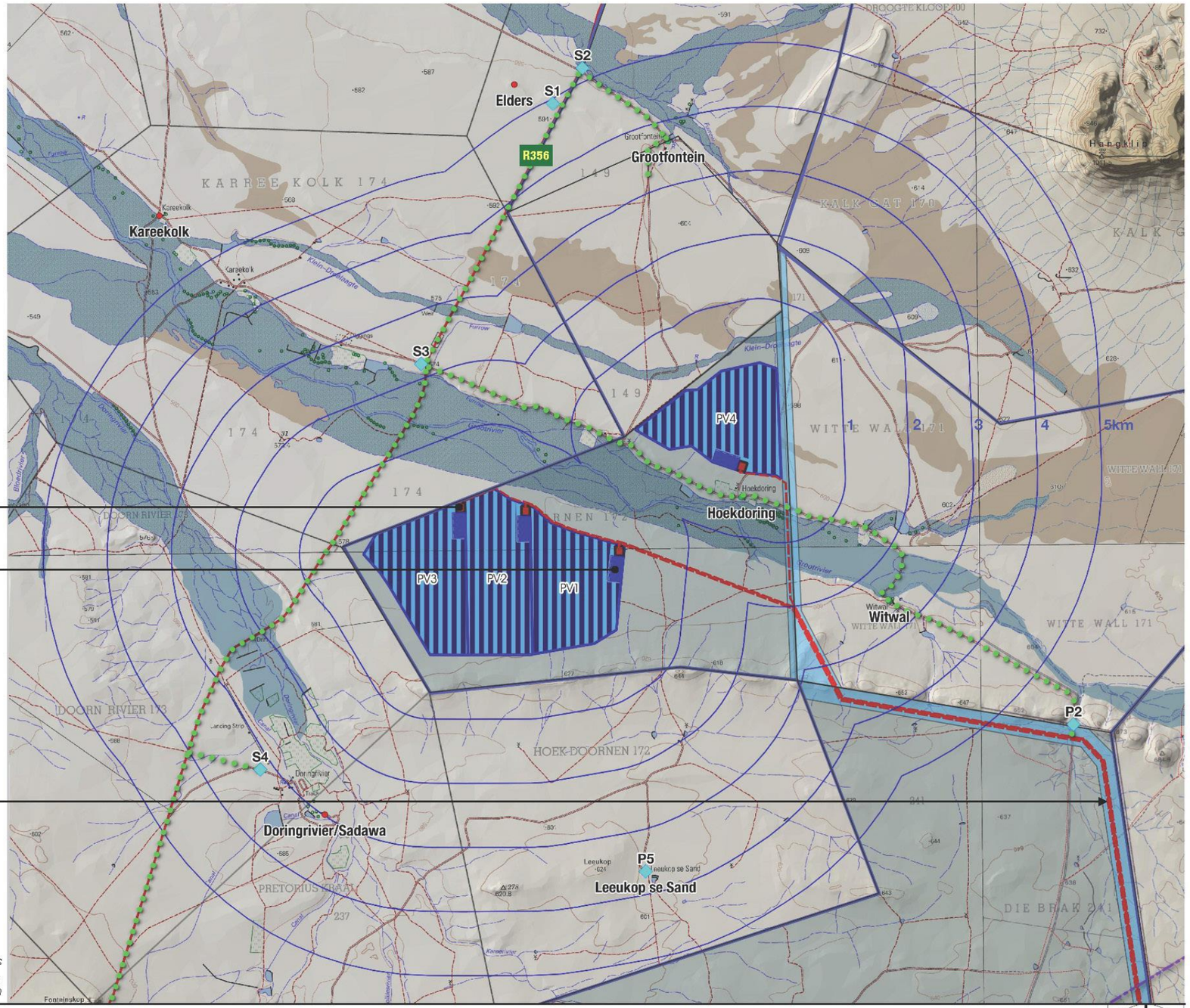
LEGEND :

- Hoekdoornen PV1, PV2, PV3 and PV4
- FieldTrack Route
- Viewpoints
- Farmsteads within Study Area
- Farmsteads outside Study Area

SubStations

Battery Energy Storage Systems

Hoekdoornen 4x 132kV Overhead Powerlines



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 4 : Project Layout • Hoekdoornen PV1, PV2, PV3 and PV4 Solar Arrays max 10m High

0 1 2 3 4 5 km

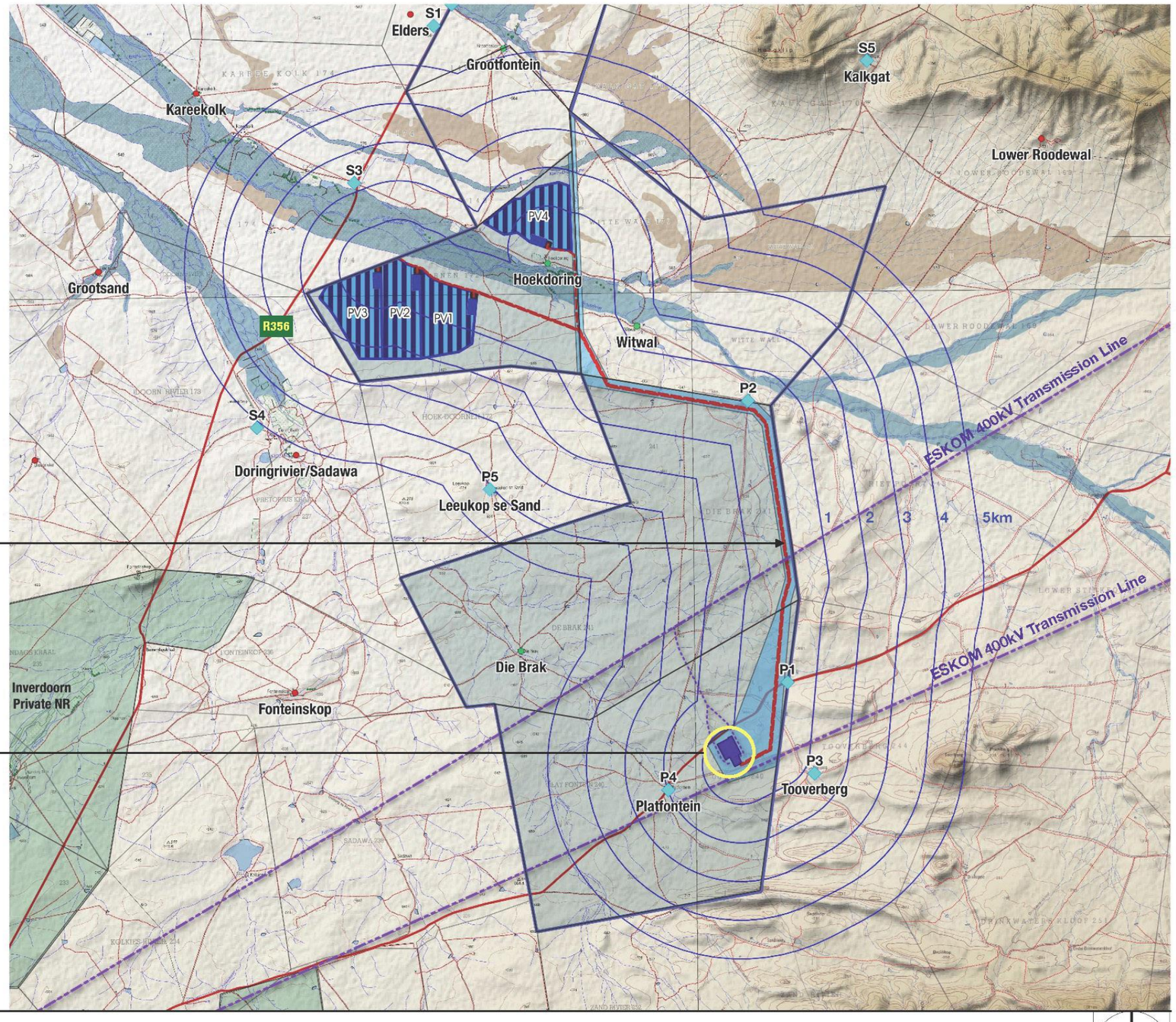
1:60 000 @ A3

LEGEND :

- Hoekdoornen PV1, PV2, PV3 and PV4
- FieldTrack Route
- Viewpoints
- Farmsteads within Study Area
- Farmsteads outside Study Area

Hoekdoornen 4x 132kV Overhead Powerlines within Servitude Corridor

ESKOM Kappa SubStation



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 5 : Project Layout • Hoekdoornen PV1, PV2, PV3 and PV4 132kV Powerlines max 30m High

0 1 2 3 4 5 km
1:100 000 @ A3

Viewshed Legend :

- High Visibility
- Medium Visibility
- Low Visibility
- No Visibility (View Shadow)

SubStations

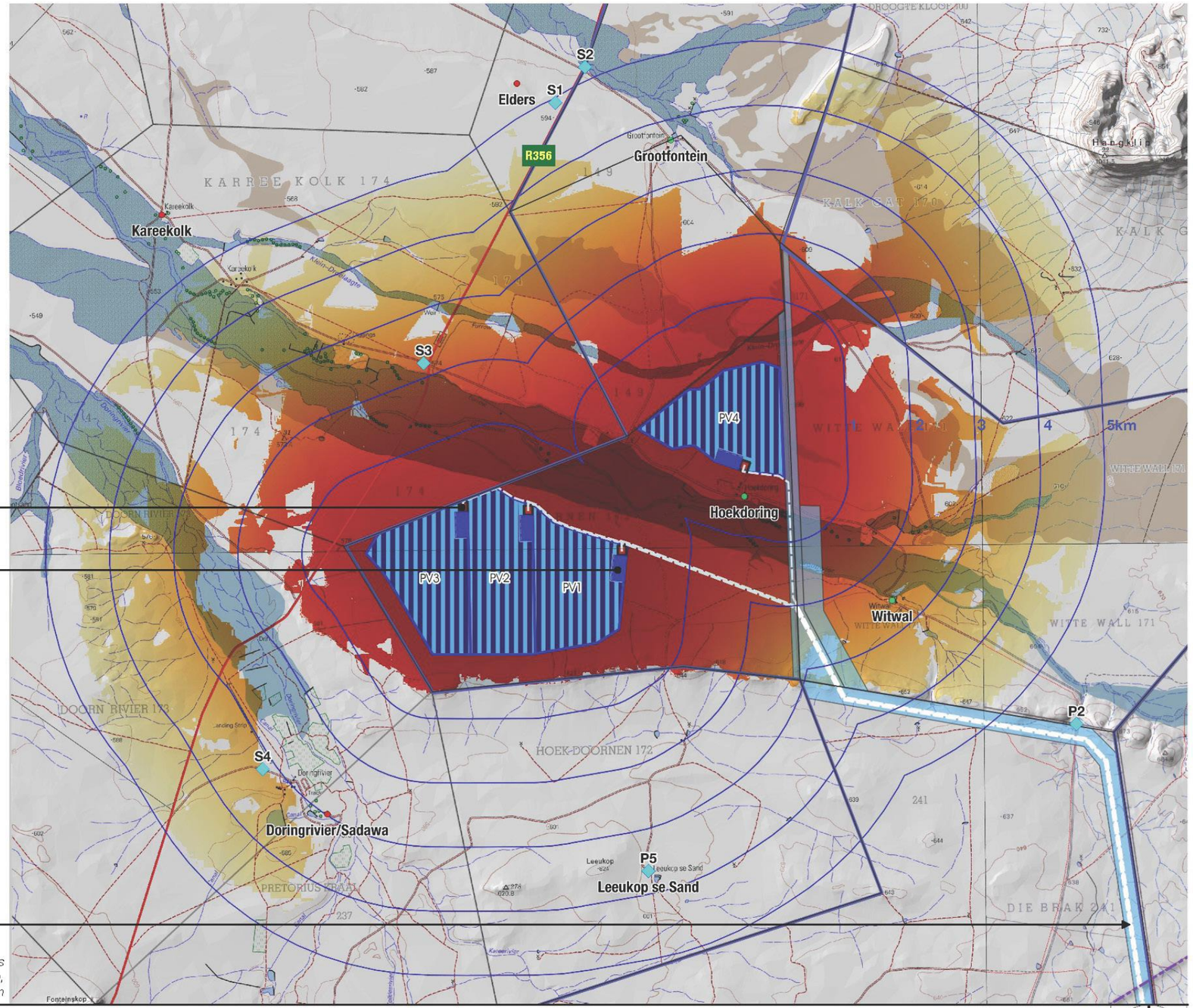
Battery Energy Storage Systems

LEGEND :

- PV1 Hoekdoornen PV1, PV2, PV3 and PV4
- S4 S Viewpoints
- Die Brak Farmsteads within Study Area
- Elders Farmsteads outside Study Area

Hoekdoornen 4x 132kV Overhead Powerlines

base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Plenaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein



map 6 : Viewshed • Hoekdoornen PV1, PV2, PV3 and PV4 Solar Arrays max 10m High

0 1 2 3 4 5 km

1:60 000 @ A3

Viewshed Legend :

High Visibility

Medium Visibility

Low Visibility

No Visibility (View Shadow)

LEGEND :

PV1 Hoekdoornen PV1, PV2, PV3 and PV4

FieldTrack Route

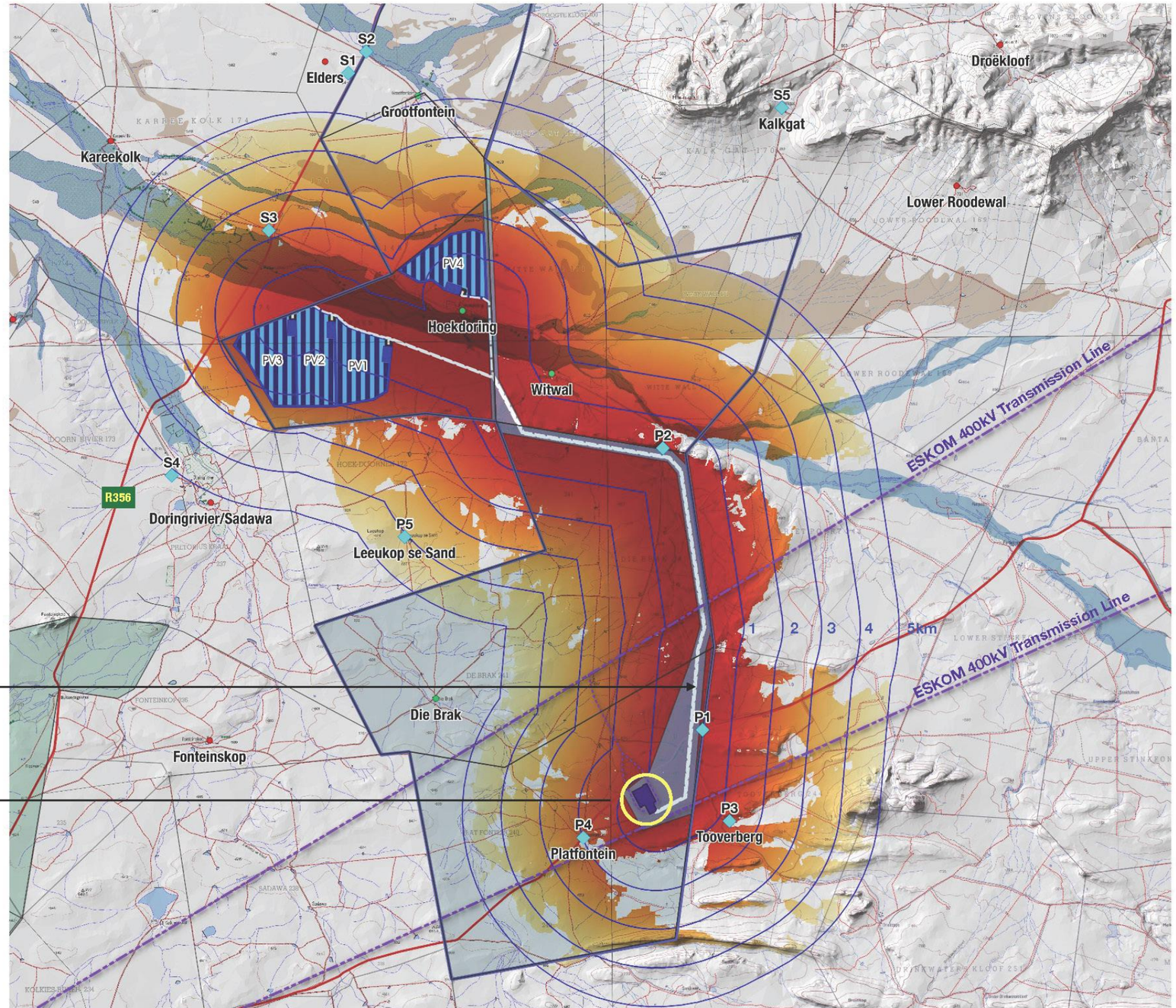
S4 S Viewpoints

Die Brak Farmsteads within Study Area

Elders Farmsteads outside Study Area

Hoekdoornen 4x 132kV Overhead Powerlines within Servitude Corridor

ESKOM Kappa SubStation



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 7 : Viewshed • Hoekdoornen PV1, PV2, PV3 and PV4 132kV Powerlines max 30m High

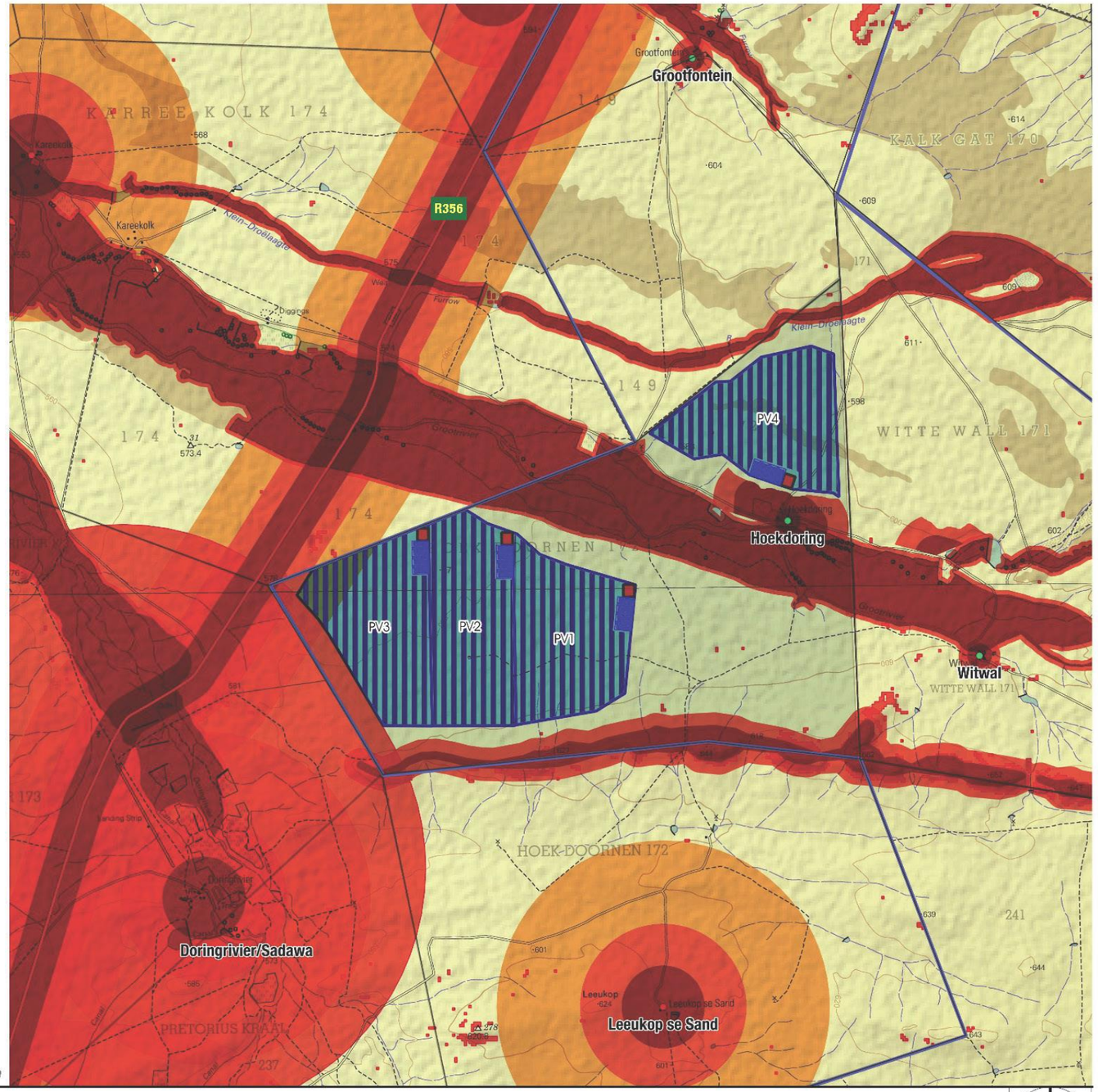
0 1 2 3 4 5 km

1:100 000 @ A3

VISUAL SENSITIVITY LEGEND :

- VERY High (NoGo) Sensitivity
- High Sensitivity
- Medium Sensitivity
- Low Sensitivity

(See Table 5 for buffer distances)



base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 8 : Visual Sensitivity • Hoekdoornen PV1, PV2, PV3 and PV4

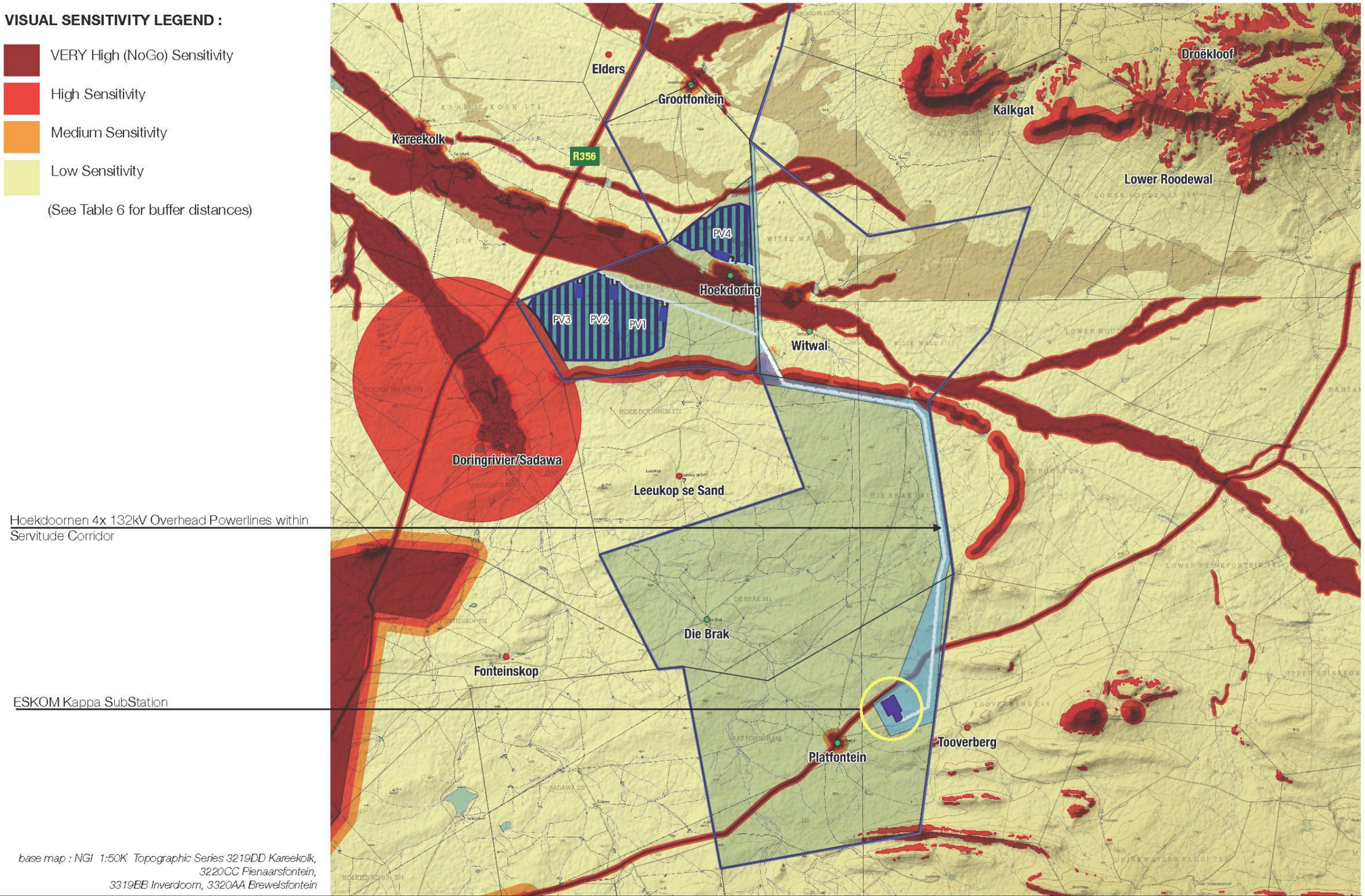
0 2.5 5 7.5 10 km

1:50 000 @ A3

VISUAL SENSITIVITY LEGEND :

- VERY High (NoGo) Sensitivity
- High Sensitivity
- Medium Sensitivity
- Low Sensitivity

(See Table 6 for buffer distances)

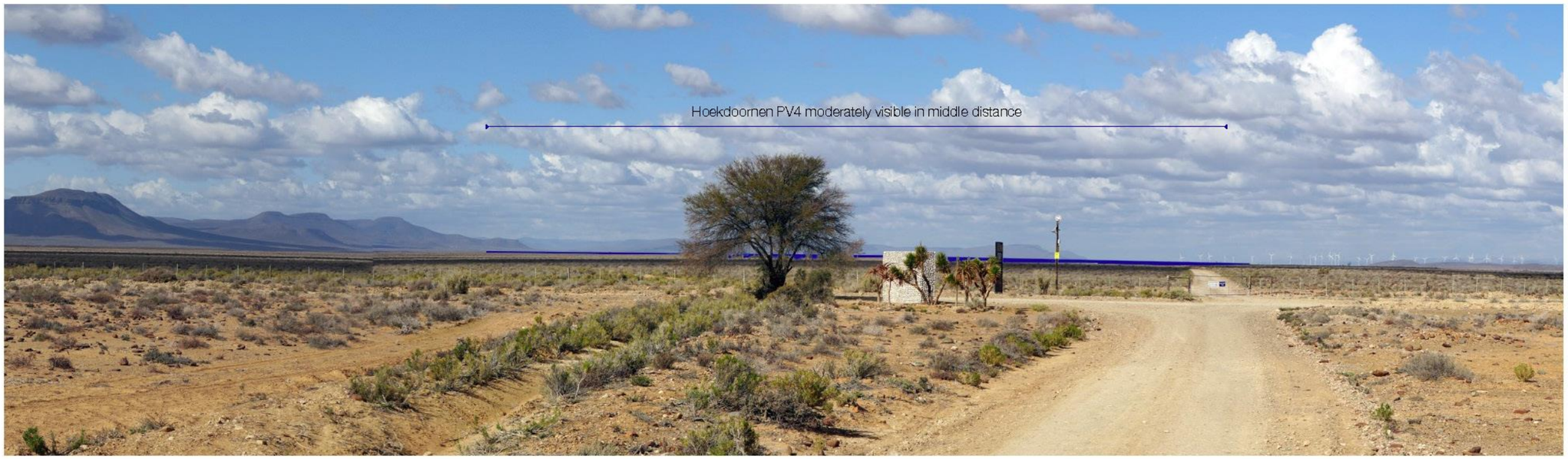


base map : NGI 1:50K Topographic Series 3219DD Kareekolk, 3220CC Pienaarsfontein, 3319BB Inverdoorn, 3320AA Brewelsfontein

map 9 : Visual Sensitivity • Hoekdoornen Connecting Power Lines 4x 132kV max 30m High

0 1 2 3 4 5 km

1:100 000 @ A3



***Viewpoint S3** : looking East from Kareekolk Gate*

Location 32.973741°S 19.907129°E Distance 3.52km

***Viewpoint S3** : looking South-East from Kareekolk Gate*

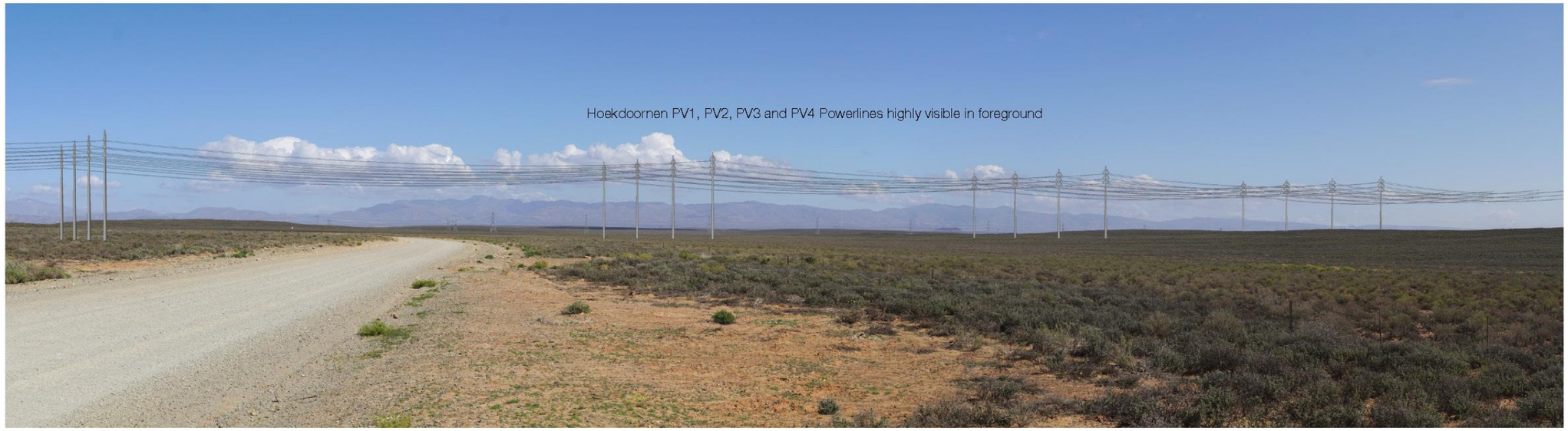
Location 32.973741°S 19.907129°E Distance 2.22km

Figure P1 : Photomontages • Hoekdoornen PV1, PV2, PV3 and PV4 : SPV Viewpoints

***Viewpoint S4** : looking North-East from Sadawa Gate*

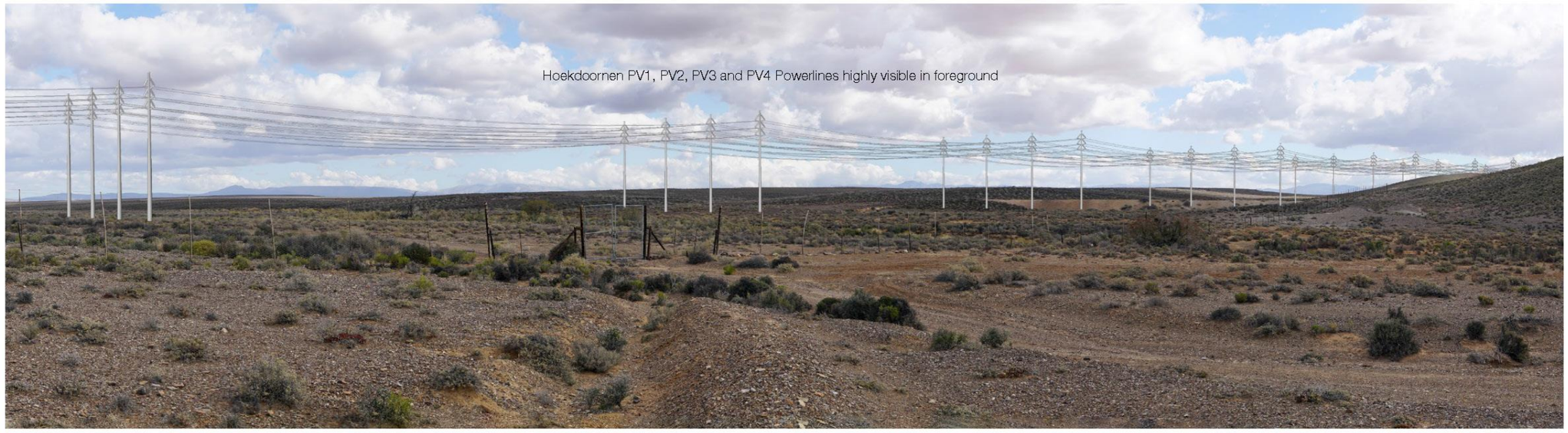
Location 32.030539ºS 19.879571ºE Distance 3.20km

Figure P2 : Photomontages • Hoekdoornen PV1, PV2, PV3 and PV4 : SPV Viewpoints



***Viewpoint P1** : looking West from District Road at Powerline Crossing*

Location 33.091035°S 20.025678°E Distance 273m



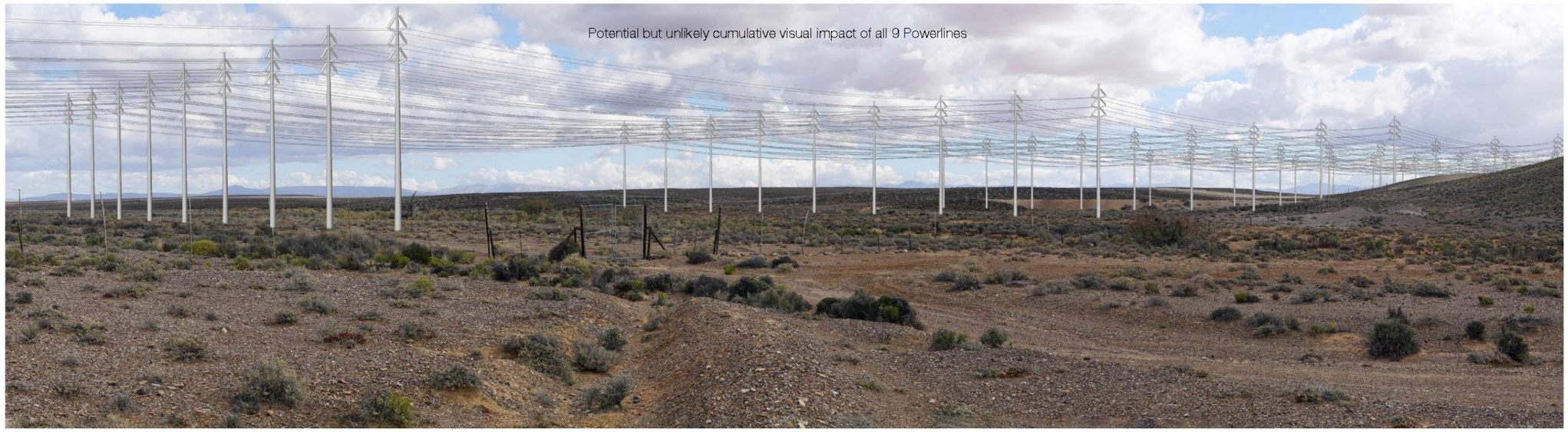
***Viewpoint P2** : looking South-West from Wittewall Gate at Powerline Crossing*

Location 33.025376°S 20.015431°E Distance 193m

Figure P3 : Photomontages • Hoekdoornen : Powerline Viewpoints P1 and P2

***Viewpoint P1** : looking West from District Road at Powerline Crossing*

Location 33.091035°S 20.025678°E Distance 195m



***Viewpoint P2** : looking South-West from Wittewall Gate at Powerline Crossing*

Location 33.025376°S 20.015431°E Distance 116m

Figure P4 : Photomontages • Powerline Viewpoints P1 and P2 showing all 9 potential 132kV powerlines

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.3

Heritage Impact Assessment (Archaeology, Cultural Landscape and Palaeontology)

HERITAGE IMPACT ASSESSMENT:

Basic Assessment for the Proposed Development of Four 175 MW Solar Photovoltaic (PV) Facilities (Hoek Doornen PV 1 - PV 4) and associated Electrical Grid Infrastructure, near Touws River, Western Cape

HWC Case No.: 20081909SB0825E

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

CSIR – Environmental Management Services
P.O. Box 320, Stellenbosch, 7599
Tel: 031 242 2318
Email: rabed@csir.co.za

On behalf of:

Veroniva (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
40 Brassie Street, Lakeside, 7945
Tel: (021) 788 1025 | 083 272 3225
Email: jayson@asha-consulting.co.za

1st draft: 12 October 2020
Draft for comment: 16 October 2020
Final report: 17 November 2020

Specialist declaration

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

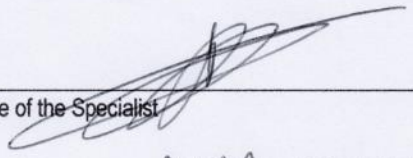
1. SPECIALIST INFORMATION

Specialist Company Name:	ASHA Consulting (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	0
Specialist name:	Dr Jayson Orton			
Specialist Qualifications:	D.Phil (Archaeology, Oxford, UK) MA (Archaeology, UCT)			
Professional affiliation/registration:	ASAPA CRM member No. 233 APHP member No. 043			
Physical address:	40 Brassie Street, Lakeside, 7945			
Postal address:	40 Brassie Street, Lakeside			
Postal code:	7945	Cell:	083 272 3225	
Telephone:	021 788 1025	Fax:	n/a	
E-mail:	jayson@asha-consulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, JAYSON ORTON, 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

ASHA CONSULTING (PTY) LTD

Name of Company:

11-10-2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, JAYSON ORTON, 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

ASHA CONSULTING (PTY) LTD

Name of Company

11-10-2020

Date

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N BACA CST

Signature of the Commissioner of Oaths

2020-10-11

Date

SOUTH AFRICAN POLICE SERVICE
KIRSTENHOF SAPS
2020 -10- 11
CSC
SUID AFRIKAANSE POLISIEDIENS

Details of Specialist, Declaration and Undertaking Under Oath

EXECUTIVE SUMMARY

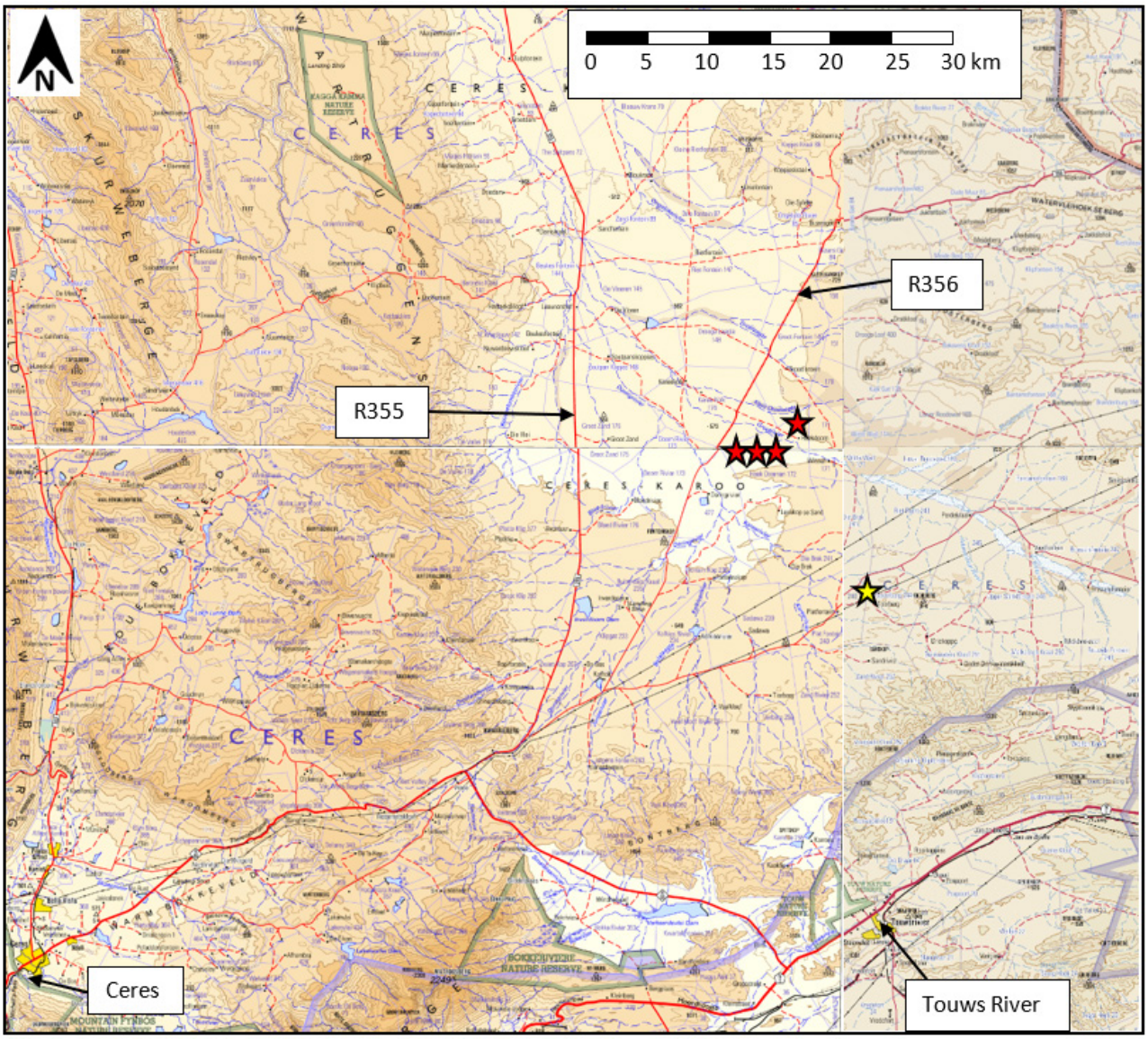
1. **Site Name**

Hoek Doornen

2. **Location**

Address: Off R356
Farms: Four photovoltaic (PV) facilities to be on Hoek Doornen 172/1 and four powerlines (within an assessed corridor) over farms Witte Wall 171, Die Brak 241 and Platfontein 240.
Centre of PV study area: S33° 00’ 00” E19° 55’ 50”
Southern end of powerline corridor: S33° 06’ 36” E20° 00’ 45”

3. **Locality Plan**



PV facilities at red stars, southern end of power line corridor at yellow star.

4. Description of Proposed Development

The proposed project includes four solar fields of 250 ha each and up to 10 m high, operation and maintenance buildings, three power lines and substations (i.e. electricity grid infrastructure (EGI)), access roads, battery energy storage facilities, fencing, and other associated and supporting infrastructure.

5. Heritage Resources Identified

Palaeontological resources were found to be very sparsely distributed across the landscape and the impacts to fossils are considered to be of generally low significance. Archaeological resources were widespread but very strongly dominated by background scatter. Dense areas of artefacts were rare with the main exception being a very dense artefact manufacturing locality on the Matjiesfontein Chert ridge along the southern boundary of the study area and which is excluded from the development footprint area. An area of sand dunes with a number of ephemeral traces of Later Stone Age (LSA) occupation was an interesting feature in the south-eastern part of the study area and one possible grave was also seen there. This area is entirely excluded from development. Historical cottage, likely originally a *brakdak*, likes on the north bank of the Groot River but has been heavily modified over the years. The cultural landscape (largely a natural landscape with aesthetic significance) was also identified as a heritage resource, but the location of the site within a Renewable Energy Development Zone (REDZ) was noted. The site is very close to the R356 but this road is not frequently used and is not considered a scenic route.

6. Anticipated Impacts on Heritage Resources

Fossils are sparse and difficult to locate. Impacts cannot be readily predicted but the chance of impacting significant fossils is low. The layout has been designed to avoid sensitive archaeological sites. Nevertheless, large numbers of background scatter artefacts would likely be lost during development. The layout has avoided the steeper slopes on site which will reduce the visibility of the PV facilities. Given (1) the findings of the Visual Impact Assessment (VIA), (2) the location of the facilities within a REDZ and (3) the existence of a wind energy facility, large substation and power lines nearby, significant new impacts to the landscape are not expected.

7. Recommendations

Hoek Doornen PV 1

It is recommended that the proposed Hoek Doornen PV 1 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Hoek Doornen PV 2

It is recommended that the proposed Hoek Doornen PV 2 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Hoek Doornen PV 3

It is recommended that the proposed Hoek Doornen PV 3 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Hoek Doornen PV 4

It is recommended that the proposed Hoek Doornen PV 4 development and rerouted private road be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

EGI

It is recommended that the proposed EGI development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) whether any areas of background scatter artefacts should be sampled;

- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

8. **Author/s and Date**

Heritage Impact Assessment: Jayson Orton, ASHA Consulting (Pty) Ltd, 17 November 2020
Archaeological specialist study: Jayson Orton, ASHA Consulting (Pty) Ltd, 09 October 2020
Palaeontological specialist study: John Almond, Natura Viva cc, October 2020
Visual Impact Assessment: Quinton Lawson and Bernard Oberholzer, QARC and BOLA, 16 October 2020

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency

Brakdak: A roof building technique in which large beams are covered by smaller poles, bamboo or reeds and finally a layer of mud.

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Handaxe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: A group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BA: Basic Assessment

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

DMR: Department of Mineral Resources

ECO: Environmental Control Officer

EGI: Electricity Grid Infrastructure

EIA: Environmental Impact Assessment

EMPR: Environmental Management Programme

ESA: Early Stone Age

GPS: Global Positioning System

GP: General Protection

HIA: Heritage Impact Assessment

HWC: Heritage Western Cape

LSA: Later Stone Age

MSA: Middle Stone Age

NCW: Not Conservation Worthy

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

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

NID: Notification of Intent to Develop

PHS: Provincial Heritage Site

PPP: Public Participation Process

REDZ: Renewable Energy Development Zone

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 (7 April 2017)	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;	Section 1.4 Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii (Preliminary Section of this report)
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 7.4, 7.1.4, 7.5
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
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 alternatives;	Section 1.1.3, Section 5, Appendix 3
g) an identification of any areas to be avoided, including buffers;	Section 13
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;	Section 13
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.5
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 10
l) any conditions for inclusion in the environmental authorisation;	Section 14
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and 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 13.1
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 12
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 12
q) any other information requested by the competent authority.	Not Applicable
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	Part A of the Assessment Protocols published in Government Notice No. 320 on 20 March 2020 is applicable (i.e. Site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed). See Appendix 3.

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1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Veroniva (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of four 175 MW photovoltaic (PV) solar energy facilities on the farm Hoek Doornen 172/rem and four power lines (within an assessed corridor) stretching over farms Witte Wall 171, Die Brak 241 and Platfontein 240 to end at the existing Eskom Kappa Substation located on the latter farm. The centre of the PV study area is at S33° 00' 00" E19° 55' 50", while the Kappa Substation at the southern end of the powerline corridor is at S33° 06' 36" E20° 00' 45". The study area lies off the R356 in the Ceres Karoo with the proposed PV area being some 37 km north of Touws River and 30 km northeast of Karoo Poort (Figures 1 & 2).

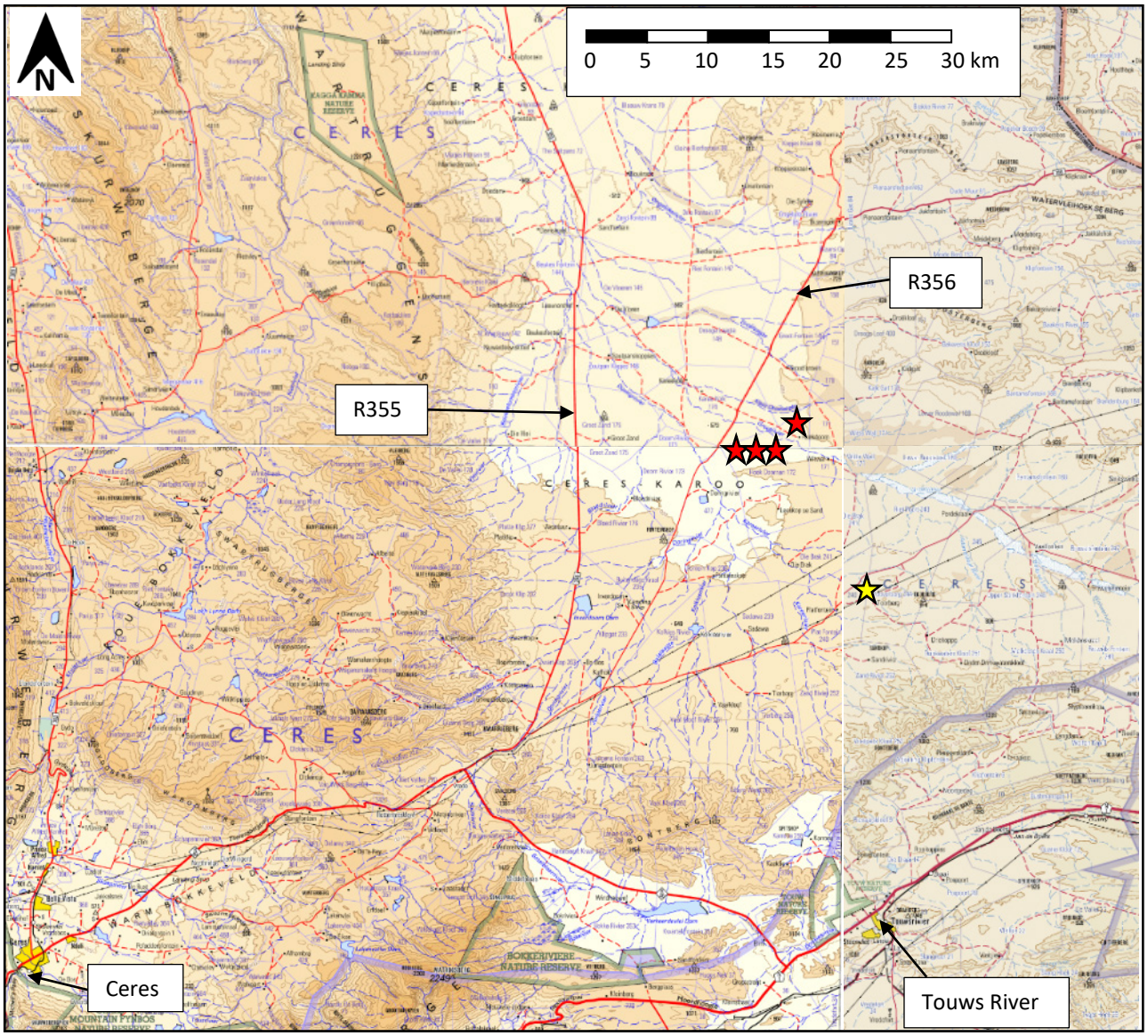

Figure 1: *Composite of the 3218, 3220, 3319, and 3320 1:250 000 topographic maps showing the approximate location of the PV sites (red stars) and the existing Eskom Kappa Substation (yellow star). Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

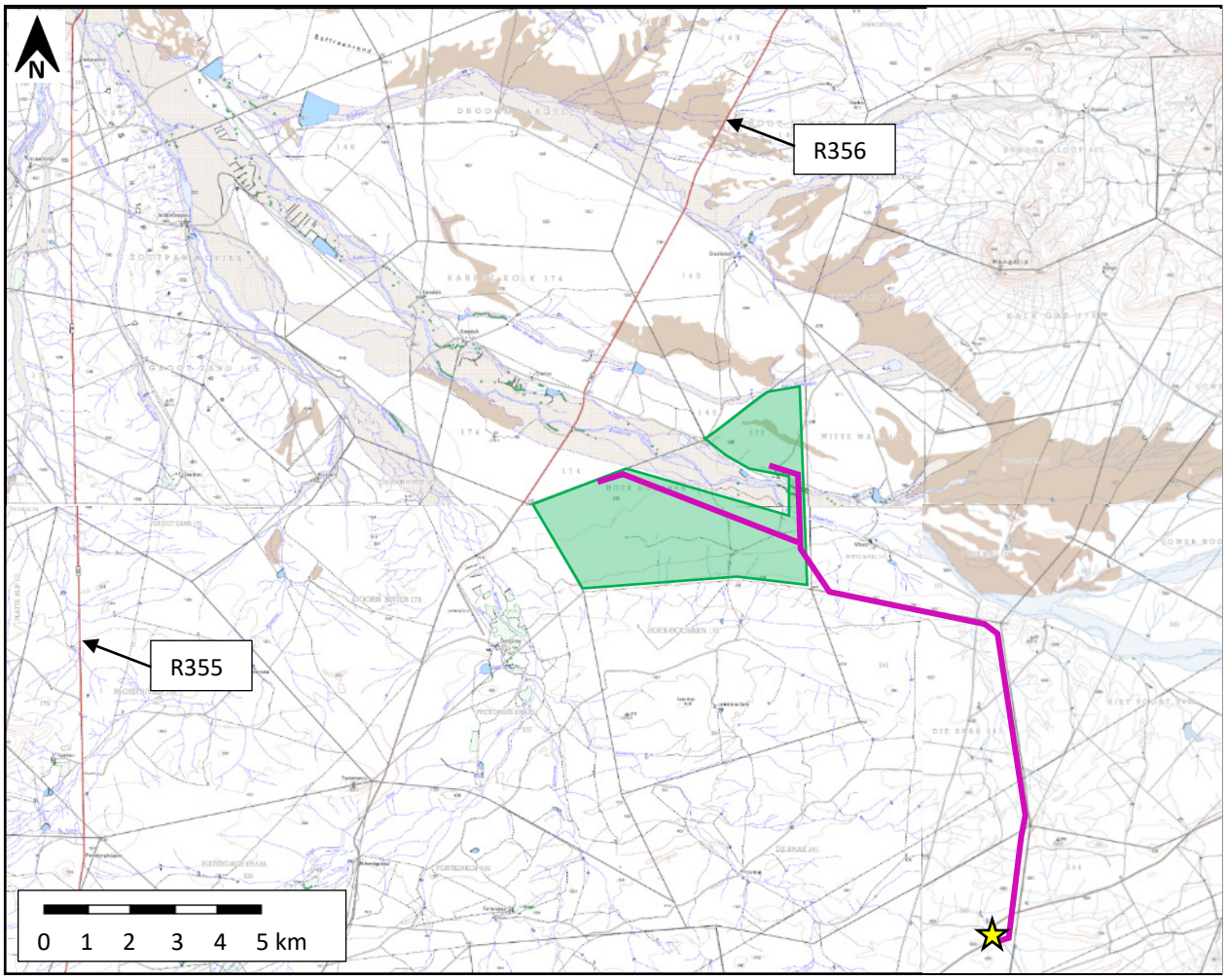

Figure 2: *Extract from 1:50 000 mapsheets 3219DD, 3319BB, 3220CC & 3220AA showing the approximate location of the PV study area (green shaded polygon), power line corridor (purple line) and Eskom Kappa Substation (yellow star).*

The Applicant is proposing to develop nine solar PV facilities and nine power lines and associated infrastructure to link the PV facilities to the Eskom Kappa Substation. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172. This Heritage Impact Assessment (HIA) deals with the Hoek Doornen projects to be known as Hoek Doornen PV 1, Hoek Doornen PV 2; Hoek Doornen PV 3 and Hoek Doornen PV 4.

1.1. The proposed project

1.1.1. Project description

Each PV project would comprise of the following components (Figure 3 shows the PV layout area and powerline corridor):

- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 250 hectares per project, including the following:
    - PV Modules;

- Single Axis Tracking structures (aligned north-south), Fixed Axis Tracking (aligned east-west), Dual Axis Tracking (aligned east-west and north-south), Fixed Tilt Mounting Structure or Bifacial Solar Modules;
- Solar module mounting structures comprised of galvanised steel and aluminium; and
- Foundations which will likely be drilled and concreted into the ground.

- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 500 m^2);
  - Ablution facilities (maximum height 7 m and footprint 50 m^2);
  - Converter/inverter stations (height from 2.5 m to 7 m (maximum) and footprint 2500 m^2);
  - On-site substation and/or a switching substation (footprint 20 000 m^2); and
  - Guard Houses (height 3 m, footprint 40 m^2).
- Associated Infrastructure
  - 132 kV overhead power line to connect to the existing Eskom Kappa Substation to be located within a corridor of approximately 300 m wide that has been assessed as part the Basic Assessment (BA) Process. The specific power line will have the following specifications:
    - Height = 22.5 m to 30 m.
    - The servitude for the 132 kV power line will be 33 m wide.
    - Length from the PV site to the Eskom Substation:
      - Hoek Doornen PV 1 Power Line: Approximately 18 km
      - Hoek Doornen PV 2 Power Line: Approximately 20 km
      - Hoek Doornen PV 3 Power Line: Approximately 21 km
      - Hoek Doornen PV 4 Power Line: Approximately 18 km
  - Associated electrical infrastructure at the Eskom Kappa Substation (including but not limited to feeders, Busbars, new transformer bay (up to 500 MVA) and extension to the platform at the Eskom Kappa Substation);
  - On-site substation and/or a switching substation;
  - Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m);
  - A Lithium Ion battery storage facility for each Solar PV project, which may cover an area of up to 8 hectares and a height of up to 5 – 10 m (to be constructed within the proposed laydown area);
  - Underground low voltage cables or cable trays (underground to maximum depth of 1.4 m);
  - Access roads:
    - Width ranging between 4 - 8 m.
    - Total Length: Approximately 1 km for the Hoek Doornen PV1 to PV3 Projects and 6 km for Hoek Doornen PV4.

        - Internal gravel roads and service road below the power line (width of 4 m);
        - A section of private road through the Hoek Doornen PV 4 site will need to be rerouted to the southern and eastern boundary of the site;
    - Fencing (between 2 – 3 m high) around the PV Facilities - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
    - Fencing for the power corridors: game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm;
    - Panel maintenance and cleaning area;
    - Stormwater channels;
    - Construction work area (i.e. laydown area of maximum 13 ha);

It is proposed that panel cleaning will take place quarterly; however, this may be revised should the site conditions warrant more frequent cleaning. It is estimated that the panel washing process will require approximately 5 million to 8 million litres of water per year during operations; this is to be sourced from the Municipality. At this stage, no water is planned to be abstracted from or discharged to any surface water systems.

The construction phase for each proposed project is expected to extend 12 to 14 months.

The total maximum project footprint of each PV facility will be approximately 250 hectares including the PV facility and infrastructure such as internal roads for each PV facility. Some of the main access roads will fall outside of the 250 hectares. Therefore, overall the PV facility and associated infrastructure including access roads will cover an estimated area of 260 hectares.

1.1.2. Identification of alternatives

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some micrositing of the alignment to reduce impacts.

1.1.3. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for foundations may impact on archaeological and/or palaeontological remains, while the above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

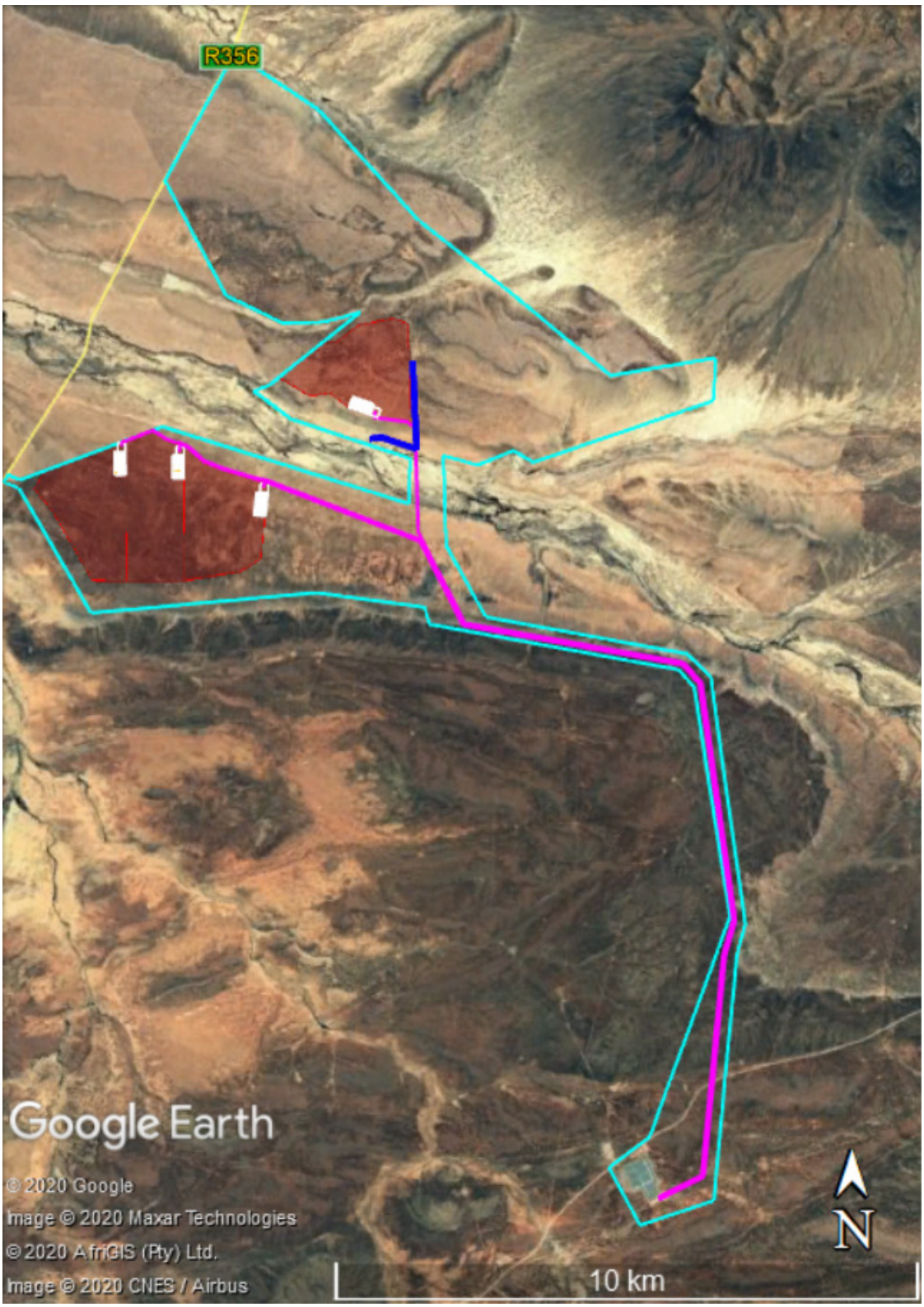

Figure 3: *Aerial view of the greater project area for all nine PV facilities and the associated Electrical Grid Infrastructure (EGI) corridor (turquoise) showing the location of the proposed Hoek Doornen PV 1, PV 2, PV 3 & PV 4 facilities (red shading) and their associated powerlines (pink lines). The dark blue line is the section of private road to be rerouted.*

1.2. Terms of reference

ASHA Consulting was asked to compile a Heritage Impact Assessment (HIA) that would meet the requirements of Heritage Western Cape (HWC) and that included assessments for each of the three proposed PV facilities, power lines and their associated infrastructure. The study also needed to include the following aspects:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, Government Notice (GN) 320. This specifically includes Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed.
- Provide a Site Sensitivity Verification Report based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.
- Comply with Appendix 6 of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations (as amended), as well as any additional relevant legislation and guidelines that may be deemed necessary.
- The specialist must undertake a site visit in order to identify the level of sensitivity assigned to the project area on the National Web-Based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use.
- Determination, description and mapping of the baseline environmental condition and sensitivity of the study area. Specify set-backs or buffers, and provide clear reasons for these recommendations.
- Provide sensitivities in KMZ or similar GIS format.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.
- Describe and map the heritage and features of the site and surrounding area based on desktop reviews, fieldwork, available databases, findings of the Renewable Energy Development Zones (REDZs) Phase 1 Strategic Environmental Assessment (SEA) (DEA 2015), and findings from other heritage studies in the area, where relevant. Include reference to the grade of heritage feature and any heritage status the feature may have been awarded. The assessment must also consider the maps generated by the Screening Tool.
- Map heritage sensitivity for the site. Clearly show any “no-go” areas in terms of heritage and provide recommended buffers or set-back distances. Indicate which very high sensitivity areas are regarded as complete no-go areas.
- Identify and assess the potential direct, indirect and cumulative impacts of the proposed development on the full scope of heritage features, including archaeology, palaeontology and the cultural-historical landscape, as required by heritage legislation. Impact significance must be rated both without and with mitigation, and must cover the construction, operational and decommissioning phases of the project.
- Liaise with the relevant authorities (i.e. HWC) in order to obtain a letter of approval, comments or a Permit in terms of National Heritage Resources Act, 1999 (Act No. 25 of 1999), including Regulations issued thereunder, as necessary. This also includes submitting a Notice of Intent to Develop to HWC and meeting the requirements of HWC.

- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts. Also identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts. This must be included in the Environmental Management Programme (EMPr).
- Incorporate and address all issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that are not included in the pre-approved generic EMPr (Part B – Section 1). If so, provide a list of these specific impact management outcomes and actions.

As part of the process a Notification of Intent to Develop (NID) form was submitted to HWC. Please note that at the time three PV facilities were proposed on Hoek Doornen but due to constraints on the Witte Wall site which led to a reduction in number there, a fourth facility has been added to Hoek Doornen to keep the overall number of facilities at nine. HWC responded on 14th September 2020 with the following requirements for the HIA:

> Heritage Western Cape is in receipt of your application for the above matter received. This matter was discussed at the Heritage Officers meeting held on 7 September 2020.
>
> You are hereby notified that, since there is reason to believe that the proposed three 115 MW Solar Photovoltaic (PV) power generation facilities to be constructed on Witte Wall 171, farm Die Brak 241, farm Platfontein 240. Witzenbergwill impact on heritage resources, HWC requires that a Heritage Impact Assessment (HIA) that satisfies the provisions of section 38(3) of the NHRA be submitted. This HIA must have specific reference to the following:
>
> - A Visual Impact Assessment;
> - An Archaeological Impact Assessment; and
> - A Palaeontological Impact Assessment.
>
> The required HIA must have an integrated set of recommendations.
> Please note, should you require the HIA to be submitted as a Phased HIA, a written request must be submitted to HWC prior to submission. HWC reserves the right to determine whether a phased HIA is acceptable on a case by case Basis.
>
> The comments of relevant registered Conservation Bodies; all Interested and Affected parties; and the relevant Municipality must be requested and included in the HIA where provided. Proof of these requests must be supplied.

It should also be noted, however, that following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.3. Scope, purpose and objectives of the report

An HIA is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the

requirements of the heritage authorities such that a comment can be issued by them for consideration by the Department of Environment, Forestry and Fisheries (DEFF) who will review the BA and grant or refuse authorisation. The HIA report outlines any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. Details of specialist

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting HIAs and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) Cultural Resources Management (CRM) section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old as well as military remains more than 75 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;
- Palaeontological material: “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith,

which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";

- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

Section 3(3) describes the types of cultural significance that a place or object might have in order to be considered part of the national estate. These are as follows:

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

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the 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. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the NEMA (No. 107 of 1998), as amended, the project is subject to a BA. The present report provides the heritage component. HWC is required to provide comment on the proposed project in order to facilitate decision making by the DEFF.

3. APPROACH AND METHODOLOGY

3.1. Literature survey and information sources

Table 1 lists the sources of information used in this report.

Table 1: *Sources of information.*

Data / Information	Source	Date	Type	Description
1:50 000 map 3219DD	Chief Directorate: National Geo-Spatial Information	1960, 1987, 2003	Topographic maps	1:50 000 maps
1:50 000 map 3319BB	Chief Directorate: National Geo-Spatial Information	1969, 1987, 1997	Topographic maps	1:50 000 maps
3220CC	Chief Directorate: National Geo-Spatial Information	1968, 1986, 2005	Topographic maps	1:50 000 maps
3220AA	Chief Directorate: National Geo-Spatial Information	1967, 1986, 2005	Topographic maps	1:50 000 maps
1:250 000 map 3218	Chief Directorate: National Geo-Spatial Information	2003	Topographic map	1:250 000 maps
1:250 000 map 3220	Chief Directorate: National Geo-Spatial Information	2005	Topographic map	1:250 000 maps
1:250 000 map 3319	Chief Directorate: National Geo-Spatial Information	1997	Topographic map	1:250 000 maps
1:250 000 map 3320	Chief Directorate: National Geo-Spatial Information	2006	Topographic map	1:250 000 maps
Cadastral details	CapeFarmMapper	current	Cadastral map	Cadastral map
Descriptions of heritage resources	South African Heritage Resources Information System	Various	Unpublished reports	Commercial impact assessment reports listing heritage resources recorded during their compilation
Descriptions of heritage resources	Books	Various	Published books	Books on various aspects of local history

3.2. Field survey

The PV site was subjected to a foot survey on 7th, 9th and 11th September 2020. Sections of the EGI corridor in the north were surveyed on 8th and 9th September 2020, while other parts further to the south were also visited briefly on 28 January 2020 (Figure 4). These surveys were in spring and summer but, in this very dry area, the season makes no meaningful difference to vegetation covering and hence the ground visibility for the archaeological survey. Other heritage resources are not affected by seasonality. During the survey the positions of finds and survey tracks were recorded on a hand-held Global Positioning System (GPS) receiver set to the WGS84 datum.

Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

It should be noted that amount of time between the dates of the field inspection and final report do not materially affect the outcome of the report.

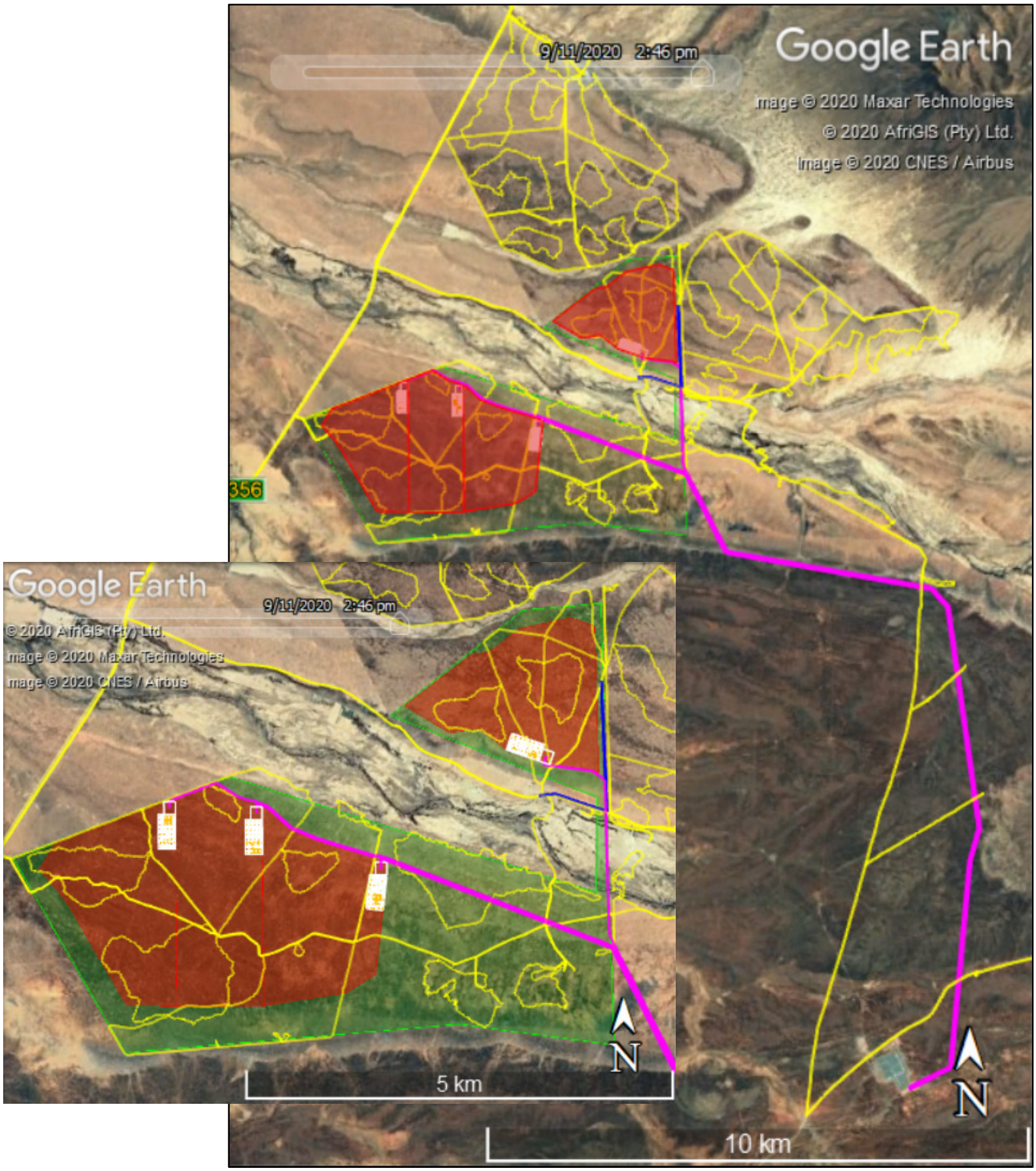

Figure 4: *Aerial view showing the survey tracks (yellow lines). The red shading shows the PV footprints and the green shading the broader study area considered for development. The approximate alignment of the power lines is shown in purple.*

3.3. Impact assessment

For consistency among specialist studies, the impact assessment was conducted through application of a scale supplied by the CSIR. The methodology is presented in full in the BA report.

3.4. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. Heritage Western Cape (2016), however, uses a system in which resources of local significance are divided into Grade 3A, 3B and 3C. These approximately equate to high, medium and low local significance respectively, while sites of very low or no significance (and generally not requiring mitigation or other interventions) are referred to as Not Conservation Worthy (NCW).

3.5. Assumptions, knowledge gaps and limitations

The study is carried out at the surface only and hence any completely buried archaeological sites will not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface. Due to the size of the site it was not possible to examine every part of it in detail. The focus was on understanding the distribution and types of heritage resources present and it was assumed that this distribution would be broadly true throughout the study area.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 30 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are shown in Figure 5[1]. Note that the cumulative impact assessment also takes into consideration the proposed Ceres PV development, i.e. nine solar PV and nine power lines.

[1] Please note that the map shows affected farms Witte Wall and Karrekolk, however it must be noted that there are no approved Renewable Energy projects on these farm portions. An updated map will be included in the BA Report.

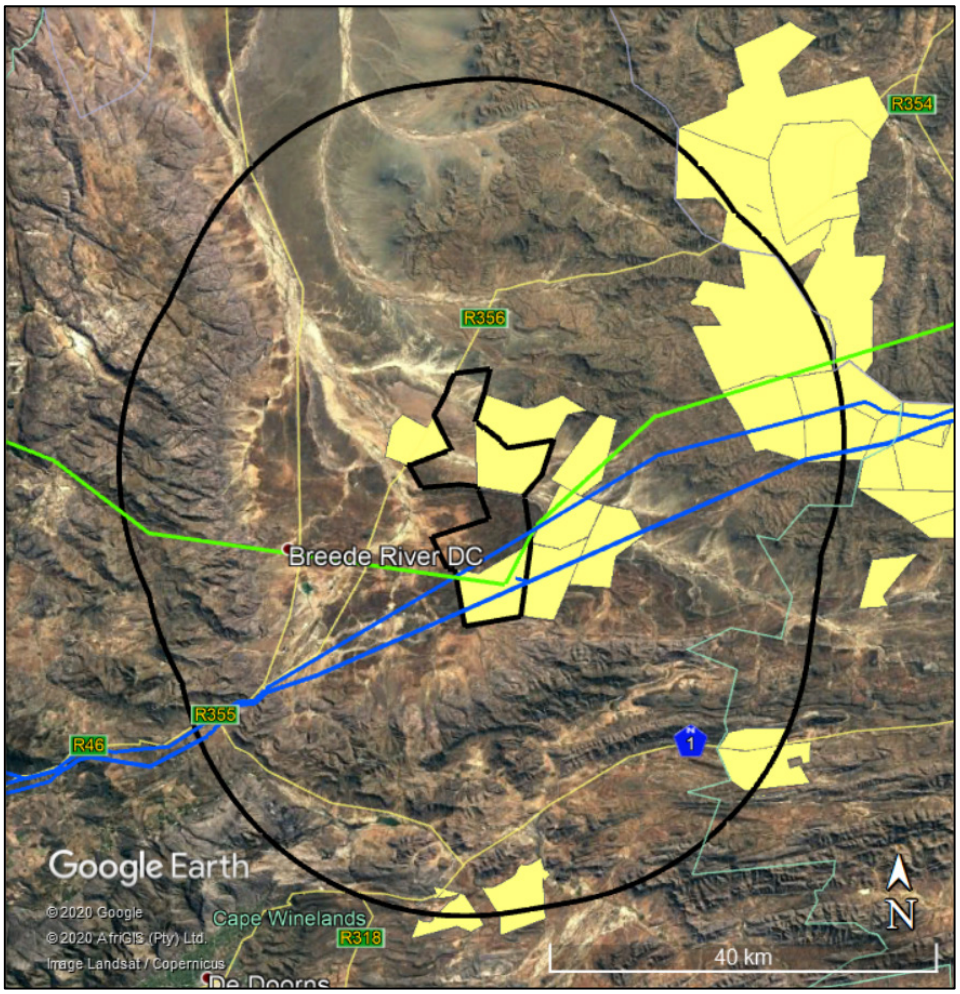

Figure 5: *Aerial view of the broader study area (black polygon) showing other existing and proposed renewable energy and electrical developments within a 30 km radius (black oval). Yellow shading denotes renewable energy facilities (but please see footnote 1), while the green and blue lines are large power lines (either existing or proposed).*

3.6. Consultation processes undertaken

The draft HIA was submitted to relevant interested and affected parties as required by HWC in their response to the NID application (Section 1.2). The report was also included in the main public participation process (PPP) required under NEMA as part of the EIA.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site is in a remote location in the Ceres Karoo. It lies off the R356 gravel road. Although the area is currently only used for the grazing of livestock and game, it does lie within the Komsberg REDZ and one wind energy facility has already been developed between 10 km and 18 km to the southeast. The large Eskom Kappa Substation and several power lines occur in the south. Other infrastructure, aside from farm buildings and wind pumps, is largely absent from the local landscape.

4.2. Site description

The broader study area is a wide, flat plain bisected by the Groot River and its tributaries. The Hoek Doornen PV 4 study area lies north of the Groot River, while the other three sites are to the south. The majority of the study area is flat and coated in sand and gravel with only very low vegetation, but denser low bushes do occur in places (Figures 6 to 8). The exception is close to the rivers where trees occur. The southern margin of the site is formed by the Matjiesfontein Chert ridge (Figure 9) and in the southeast sand that has blown over this ridge has formed a small dune field which differs in character from the rest of the study area due to its sandy substrate. It tends to have lower density but far larger bushes (Figure 10).

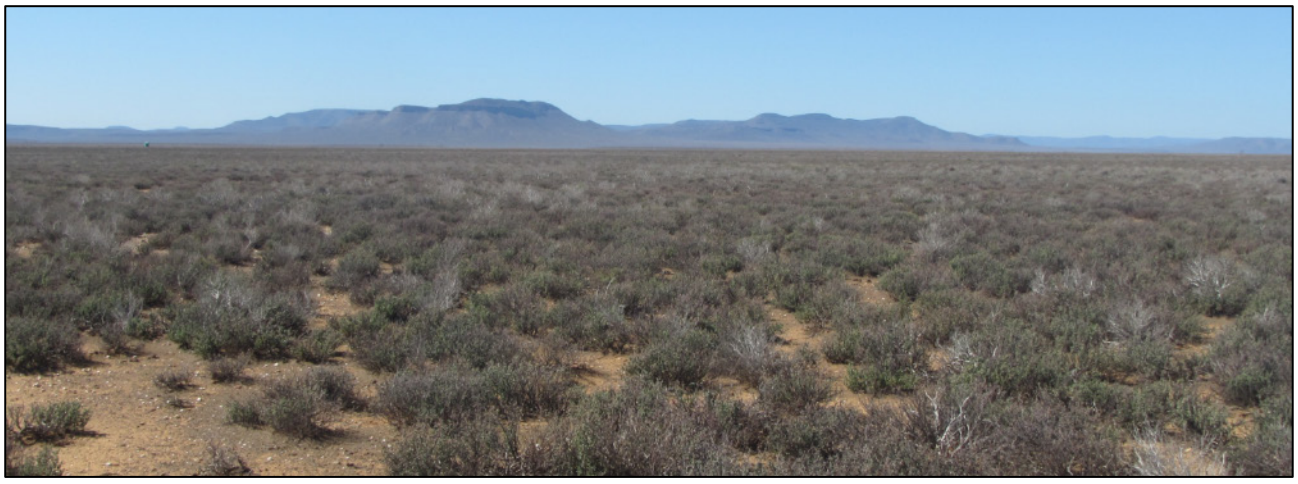

Figure 6: *View towards the northeast across the Hoek Doornen PV 3 & PV 2 sites showing the low vegetation.*

Figure 7: *View towards the southwest within the Hoek Doornen PV 3 site showing sparse vegetation.*

Figure 8: *View towards the northeast across the Hoek Doornen PV 4 site showing sparse vegetation.*

Figure 9: *View towards the west along the southern margin of the broader Hoek Doornen study area (fence line at left) from the Matjiesfontein Chert ridge. The high point in mid-view is also part of the ridge.*

Figure 10: *View towards the north from the high-lying sand dunes in the south-eastern part of the larger Hoek Doornen study area. The different vegetation when compared to the low-lying flat land is obvious.*

The powerline corridor was mostly visited in the north where it passed through the various PV study areas. However, during an earlier survey, parts of the corridor were visited and can be briefly described. Figure 11 shows a view towards the west along the west-east section of the power line corridor. It shows the ridge containing the Matjiesfontein Chert band. And the plains to its south. Figure 12 shows an example of one of the patches of fractured chert debris that occur along the ridge in places. The southernmost part of the corridor is very flat and ends at the large Eskom Kappa Substation (Figure 13).

Figure 11: *View towards the west from the eastern end of the west-east section of the power line corridor. The dashed line shows the approximate centre of the corridor until it passes over the ridge in the distance. The yellow arrow marks the location of Figure 12. Photographed 28 January 2020.*

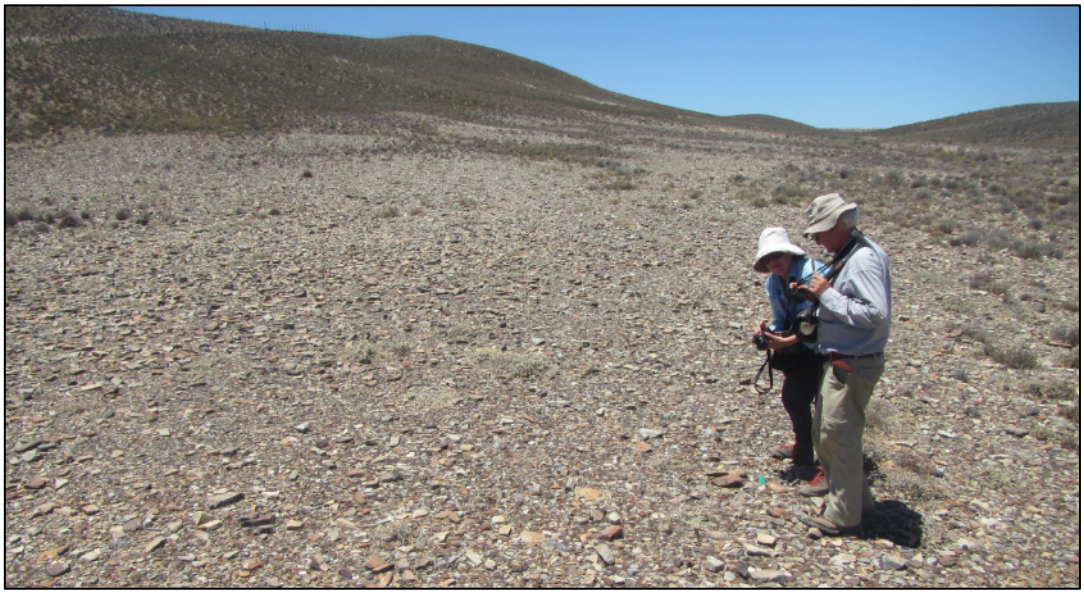

Figure 12: *View of the southern base of the Matjiesfontein Chert ridge showing the fractured debris that has accumulated from weathering of the ridge. Figure 11 was photographed from the skyline in mid-picture. Photographed 28 January 2020.*

Figure 13: *View towards the south of the Kappa Substation from within the southern end of the power line corridor. Photographed 28 January 2020.*

5. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. Note that mapping has been included in Appendix 3.

5.1. Palaeontology

The South African Heritage Resources Information System (SAHRIS) Palaeosensitivity map shows the study area to be of medium to high sensitivity with a very narrow band of very high sensitivity along the west-east section of the power line corridor.

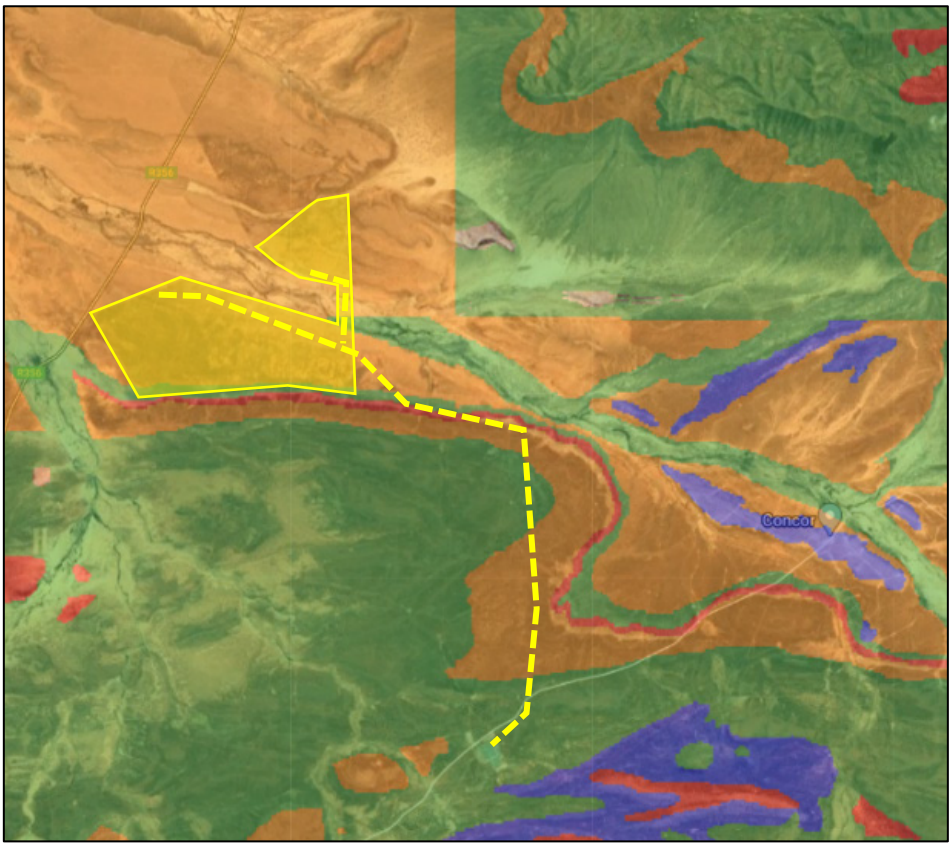

Figure 14: *Extract from the SAHRIS Palaeosensitivity map showing the study area to be of largely medium and high palaeontological sensitivity (green and orange shading respectively). A strip along the power line route is of very high sensitivity (red).*

Almond (2020) notes that the project area is situated on a pediment surface of Neogene to Pleistocene age that has been planed off by river erosion. Beneath a thin capping of alluvial gravels, calcrete hardpans, sandy soils and downwasted surface gravels are Tierberg Formation (Ecca Group) sediments of Middle Permian age. They are weathered, folded and often tectonically-cleaved. Almond (2020:1) comments that "the only fossil remains recorded from such pediment settings in the Ceres Karoo comprise (1) sparse, generally small blocks of reworked silicified fossil wood within alluvial and surface gravels of uncertain provenance (probably Ecca Group) and (2) occasional calcretised fossil termite nests of probable Pleistocene age that are found embedded within calcretised superficial sediments as well as weathered, calcrete-veined bedrocks. … These fossils are of widespread occurrence within the Ceres Karoo region and are not of high scientific interest or conservation value." He notes that most fossil occurrences found in the field were outside of the PV footprint areas.

The power line corridor overlies rocks of the Permo-Carboniferous, glacial-related Dwyka Group and the lower Ecca Group (Prince Albert, Whitehill and Collingham Formations). The potentially-fossiliferous Prince Albert, Whitehill and Collingham Formations were found to be highly weathered and cleaved in the study area and no sensitive fossil sites have been found along the corridor (Almond 2020).

The full palaeontological specialist study is included in Appendix 4.

5.2. Archaeology

5.2.1. Desktop study

Some other studies have been done in the area but few are available on SAHRIS. Halkett and Webley (2011) located many light scatters of artefacts in an area to the southeast of the present study area and focused along the margins of streams. The vast majority were considered to be Middle Stone Age (MSA) with far fewer relating to either the Early (ESA) or Late (LSA) Stone Ages. A few bifacial pieces seemed likely to be ESA handaxes though. Orton (2008) worked at the southern end of the present power line corridor and located a number of light scatters of artefacts. Most were MSA artefacts (e.g. Figure 15) but one small scatter was strongly dominated by LSA artefacts (Figure 16). A single willow pattern ceramic (plate) fragment was also found.

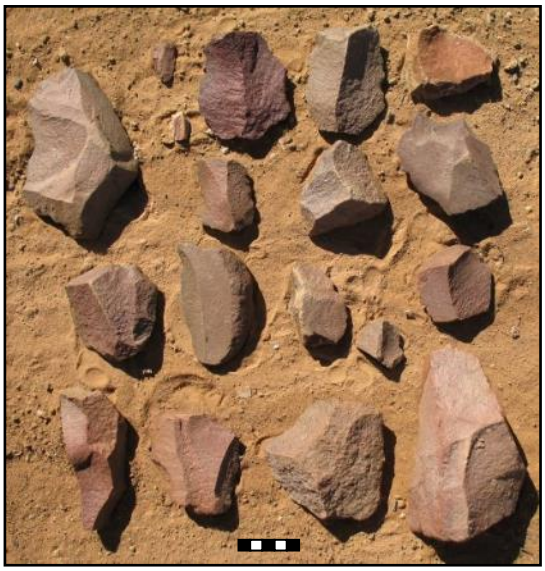

Figure 15: *Artefacts from PFN2008/007. Scale in cm. Source: Orton 2008: fig. 63.*

Figure 16: *A selection of artefacts from PFN2008/004. Note the inclusion of quartz and absence of quartzite. The dark rock is unweathered hornfels. Scale in cm. Source: Orton 2008: fig. 65.*

Towards the east and into the foothills of the escarpment, Smuts (2018) found stone artefacts to be far rarer than out on the plains but also noted that what was present was focused along rivers. Smuts (2018) also recorded a rock shelter with finger paintings and a single pot sherd. A subsequent visit to this site by the present author showed it to contain a good deposit with many stone artefacts, some grindstones, a grooved stone, many finger-painted images on the rear wall and a string of five *Nassarius kraussianus* shell beads. These are estuarine shells that had to have been brought to the site from the coast. Two other rock art sites – one a fine line painting and another a set of geometric paintings – have been seen by the present author some 19 km north of the PV study area.

5.2.2. Site visit

Table 1 provides a list and description of all heritage resources recorded during the ground survey. Not recorded are the very large number of isolated Stone Age artefacts seen throughout the study area (except for ESA bifaces and LSA lower grindstones which were recorded). These isolated artefacts are what are commonly referred to as background scatter, their distribution having been conditioned more by natural forces than anthropogenic ones (Orton 2016). They are dominated by

MSA artefacts but ESA and LSA artefacts were also frequently seen. Figure 17 shows a selection of such isolated finds from the Hoek Doornen farm, while Figure 18 shows the three ESA bifacial artefacts (handaxes) seen. Figures 19 and 20 show artefacts from two patches of denser background scatter in the western part of the study area. These were close to a small scraped dam in a very flat area and it is possible that the dam was once a natural pan. Figure 21 shows artefacts from a small scatter of silcrete artefacts in the Hoek Doornen PV 4 study area, just north of the Groot River. This scatter, while still part of the background scatter because of the small number of artefacts, must relate to activity that happened on that spot. Background scatter artefacts were seen in all of the few locations visited along the power line corridor, while some denser scatters of artefacts were recorded by Orton (2008) in the very southern end of the corridor alongside the Kappa Substation. The artefacts along the power line corridor seem to be largely MSA, as occurs elsewhere, but a number of ESA items have been seen by both the archaeologist and palaeontologist in close proximity to the Matjiesfontein Chert ridge.

Table 1: *List of heritage resources recorded during the survey.*

Waypoint	Location	Description	Significance	Grade
132	S32 59.962 E19 53.616	Large stone beacon at the intersection point of three farms.	Medium	IIIB
133	S33 00.076 E19 53.977	A scraped area revealing MSA background scatter (BGS). Plenty of retouched artefacts, some points present. Materials include hornfels, cryptocrystalline silica (CCS) and 'other'.	Very low	NCW
134	S33 00.057 E19 53.919	An area with elevated density BGS. Some retouched pieces present. The material is MSA in age. Materials include quartzite hornfels, CCS, silcrete and 'other'. Potential sample location.	Very low	NCW
135	S33 00.034 E19 53.802	An area of BGS with a semi-*in situ* scatter of light grey artifacts that were obviously flaked at this spot. The artefacts are of Matjiesfontein Chert. Potential sample location.	Low	IIIC
136	S32 59.902 E19 54.333	An area of elevated density BGS.	Very low	NCW
137	S33 00.961 E19 54.646	An area of elevated density BGS but seemingly with a low density, possibly in situ scatter of grey Matjiesfontein Chert artefacts.	Very low	NCW
138	S33 01.193 E19 54.487	A large and extremely dense CCS (Matjiesfontein Chert, but darker grey than usual) factory site located on the crest of a hill. It extends at least 200m towards the east from this waypoint. The hill is part of the ridge in which the Matjiesfontein Chert lies.	Medium	IIIB
139	S33 01.102 E19 55.157	An area of dense BGS in a sandy area further along the same ridge.	Very low	NCW
140	S33 01.089 E19 55.637	A small scatter of LSA artefacts on a sand dune area on the northwest side of the Matjiesfontein Chert ridge. There are maybe fifteen artefacts visible and several pieces of ochre. There may be more buried in the sand. Included in the flaked assemblage is half a segment on Matjiesfontein Chert. There is also hornfels and one quartz flake.	Low	IIIC
141	S33 01.075 E19 55.669	A small scatter of LSA artefacts on a sand dune area on the northwest side of the Matjiesfontein Chert ridge. There are maybe fifteen artefacts visible. Materials include hornfels and CCS (Matjiesfontein Chert).	Low	IIIC

Waypoint	Location	Description	Significance	Grade
171	S32 59.560 E19 57.640	A cottage that has been renovated and added to in an organic manner over the years. The original was undoubtedly a brakdak structure.	Low	IIIC
172	S32 59.209 E19 57.310	An undiagnostic scatter of silcrete flakes and a single core, about 20 artefacts. Occurs amongst the general background scatter.	Very low	NCW
221	S33 00.867 E19 56.948	A stone cluster/feature on a sand dune. One ostrich eggshell fragment nearby. Possible grave.	High	IIIA
222	S33 00.863 E19 56.945	A very loose cluster of rocks on a sand dune (seems unlikely to be a grave) with 1 quartz, 1 CCS and about 10 chert artefacts associated. Also 1 ostrich eggshell fragment, a lower grindstone and an upper grindstone/hammerstone.	Very low	IIIC
223	S33 00.816 E19 56.875	A scatter of ostrich eggshell fragments and 4 rocks on a sand dune.	Very low	NCW
224	S33 00.764 E19 56.854	A cluster of rocks on a sand dune. Seems unlikely to be a grave.	Very low	NCW
225	S33 00.804 E19 56.752	A deflation hollow with an ephemeral scatter of quartz, chert and CCS flaked artefacts. There is a cluster of rocks in the southern end of the hollow and another in the west. The latter includes an anvil stone. There are also 2 lumps of yellow ochre in the southern part of the hollow.	Low	IIIC
226	S33 00.891 E19 57.772	A scatter of rocks on a sand dune with three cores, a few flakes and a hammerstone. There is recent sand deposition so undoubtedly there are more buried flaked artefacts. There is also a light scatter of flakes and ostrich eggshell fragments about 8 m to the south of the rock cluster.	Low	IIIC
227	S33 00.048 E19 57.585	Two stone features along the edge of the raised terrace overlooking the river floodplain. Very unlikely to be graves because of hard, rocky substrate.	Very low	NCW
228	S33 00.012 E19 57.485	A large mound of stones at the edge of the raised terrace overlooking the river floodplain. Seems very unlikely to be a grave.	Very low	NCW
229	S33 00.026 E19 57.438	A mound of stones at the edge of the raised terrace overlooking the river floodplain. Not a grave because bedrock is visible adjacent to the lowest stones.	Very low	NCW
230	S32 59.964 E19 57.322	An ephemeral scatter of hornfels and chert flaked artefacts, ostrich eggshell fragments and rocks as well as a lower grindstone and an upper grindstone/hammerstone.	Low	IIIC
231	S32 59.942 E19 57.257	A small cluster of rocks including one possible lower grindstone eroding off the edge of a silt stack on the river floodplain. Seems very unlikely to be a grave (silt does not look disturbed).	Very low	NCW
232	S33 00.156 E19 57.474	A handaxe of 110 (broken) x 68 x 38 mm. The tip break is fresh.	Very low	NCW
670	S33 05.494 E20 01.541	Low density background scatter on Dwyka Tillite gravel.	Very low	NCW
671	S33 02.423 E20 01.424	Low density background scatter on Dwyka Tillite gravel.	Very low	NCW
672	S33 01.542 E20 00.936	Background scatter along the edge of the Collingwood Formation which has several chert bands, including the well-known Matjiesfontein Chert. The scatter was low density but it was interesting to note the variety of	Low	IIIC

Waypoint	Location	Description	Significance	Grade
		items present. These includes material likely to be of all three Stone Ages. Notably, many artefacts were simply natural pieces of stone, often diamond-shaped in cross-section), that had been modified slightly for further use. This included many small slabs of rock with abundant edge-damage as well as well-weathered handaxes that were made with around 3 to 5 removals. Although outside the powerline route, it likely serves as a representative sample of what would be present in those places where the route crosses this geology elsewhere.		
003	33° 06 41.9 S 20° 00 59.6 E	Deflated area with LSA and MSA artefacts on hornfels and quartzite. Recorded by Orton (2008).	Very low	NCW
004	33° 06 43.4 S 20° 00 50.7 E	Good scatter of LSA artefacts over an area about 5 m across, no evidence of organics, just two MSA. Recorded by Orton (2008).	Low	IIIC **Sample**
005	33° 06 37.4 S 20° 00 59.0 E	MSA background scatter artefacts in quartzite and hornfels. Recorded by Orton (2008).	Very low	NCW
006	33° 06 38.2 S 20° 01 03.1 E	MSA background scatter artefacts in quartzite and hornfels. Recorded by Orton (2008).	Very low	NCW
007	33° 06 35.6 S 20° 00 53.8 E	Widespread MSA background scatter artefacts in quartzite and hornfels. One LSA artefact. Recorded by Orton (2008).	Very low	NCW
kraal 1	33° 06 51.5 S 20° 01 27.6 E	Historical stone-built kraal built on a north-facing hill slope. Also many LSA stone artefacts noted in the vicinity. Recorded by Orton (2008).	Medium	IIIB
kraal 2	33° 06 54.0 S 20° 01 31.0 E	Historical stone-built kraal built on a south-facing hill slope (same hill as kraal 1). Visible on aerial photography.	Medium	IIIB

Figure 17: *Selection of background scatter artefacts from the Hoek Doornen farm. They include mostly ESA and MSA artefacts with only rare LSA materials. Notable inclusions are a natural slab with a worked edge (bottom centre, edge and plan view shown) and an MSA point with notched margins (bottom right, ventral and dorsal surfaces shown).*

Figure 18: *ESA bifaces (handaxes) from Hoek Doornen. Middle artefact is from waypoint 232.*

.

Figure 19: *Background scatter artefacts from waypoint 134.*

Figure 20: *Background scatter artefacts from waypoint 135.*

Figure 21: *A selection of silcrete artefacts from waypoint 172.*

The south-western corner of the wider study area (and indeed its southern boundary) lies along the ridge that hosts the Matjiesfontein Chert band. At the corner there is a prominent hill (Figure 9) which hosts a massive number of stone artefacts. It is quite clear that this prominent landmark location has been extensively quarried for chert to manufacture stone artefacts amongst the chert gravel (Figure 22 & 23).

Figure 22: *View east from the hilltop site at waypoint 138.*

Figure 23: *Stone artefacts in Matjiesfontein Chert at waypoint 138.*

The south-eastern part of the Hoek Doornen study area is quite different from the rest thanks to the red sand dunes it hosts. This dune area was frequented by LSA people who left many ephemeral sites. The sites have flaked and ground stone artefacts, clusters of rocks and some ostrich eggshell fragments. Figure 24 shows artefacts from waypoint 140. Aside from a fragment of ochre, a notable inclusion is a segment (Figure 25). This is an artefact type usually – but not exclusively – made during the mid-Holocene, 6000 to 3000 years ago. Figures 26 and 27 show another example of one of these LSA sites, while Figure 28 and 29 show a third. The latter includes a lower grindstone. An ephemeral LSA artefact scatter was also seen along the southern bank of the Groot River.

Figure 24: *Chert artefacts and an ochre fragment from waypoint 140. Upper right artefact is a broken segment.*

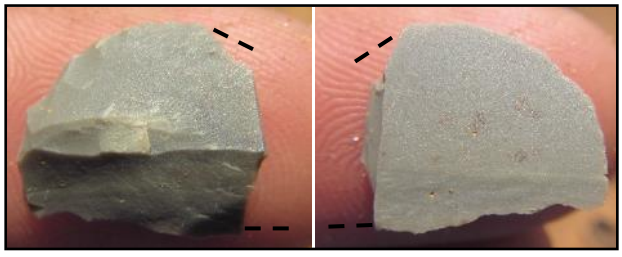

Figure 25: *Dorsal and ventral views of a chert segment from waypoint 140. The dashed lines indicate the break.*

Figure 26: *View across a site on the dunes at waypoint 187.*

Figure 27: *Chert artefacts from waypoint 187.*

Figure 28: *A stone cluster on the sand dunes at waypoint 222.* It seems unlikely to be a grave.

Figure 29: *A lower grindstone at waypoint 222.*

Historical archaeological materials were surprisingly not seen in the Hoek Doornen study area.

5.3. Graves

A number of piles of stones were seen in one area close to the southern bank of the Groot River (e.g. Figures 30 & 31). These were largely on the rocky terrace and none looked like graves. Their function is unknown. Figures 30 and 31 show examples.

Figure 30: *Two stone piles at waypoint 227.*

Figure 31: *A stone pile at waypoint 229.*

5.4. Historical aspects and the Built environment

5.4.1. Desktop study

In addition to standing structures, Halkett and Webley (2011) found many small stone ruins. They were from a variety of features including houses, kraals, ovens, a possible threshing floor and a well. Smuts (2018) also noted many stone structures and ruins. To the south of the Kappa Substation and some 450 m outside the proposed power line corridor, a large stone-built kraal was recorded on a north-facing slope by Orton (2008; Figures 32 & 33). A second one lies over the hill about 100 m further to the southeast.

Figure 32: *View across the Platfontein site towards the kraal. The study area extends approximately as far as the power lines visible in the photograph and the kraal is some 350 m beyond its edge. Source: Orton (2008: fig. 66).*

Figure 33: *Close up view of the kraal looking southwards. Source: Orton (2008: fig. 67).*

Karoo Poort is an important historical passage that hosts a Provincial Heritage Site (PHS), the Karoopoort Outspan. The poort is located some 35 km southwest of the PV study area. The PHS buildings and grounds are sadly run down and the "mile-long row of ancient fig trees" mentioned by Mossop (1927:182) is now largely dead. The old road, or 'Forgotten Highway', to the diamond fields used to pass through Karoo Poort (also once known as Bokkeveld's Poort) on its way to Sutherland. Figure 34 shows Mossop's (1927: facing page 168) map of the area. The historical road approximately equates to the R356 of today with the latter simply being a straightened and modernised version. After passing the study area, the road makes its way below a prominent landmark hill known as Hanglip, for the slightly overhanging cliff visible in profile from the southwest and northeast. The original road lay closer to the foot of Hanglip (as shown by a photograph in Mossop (1927)). There was also an outspan at the foot of the hill.

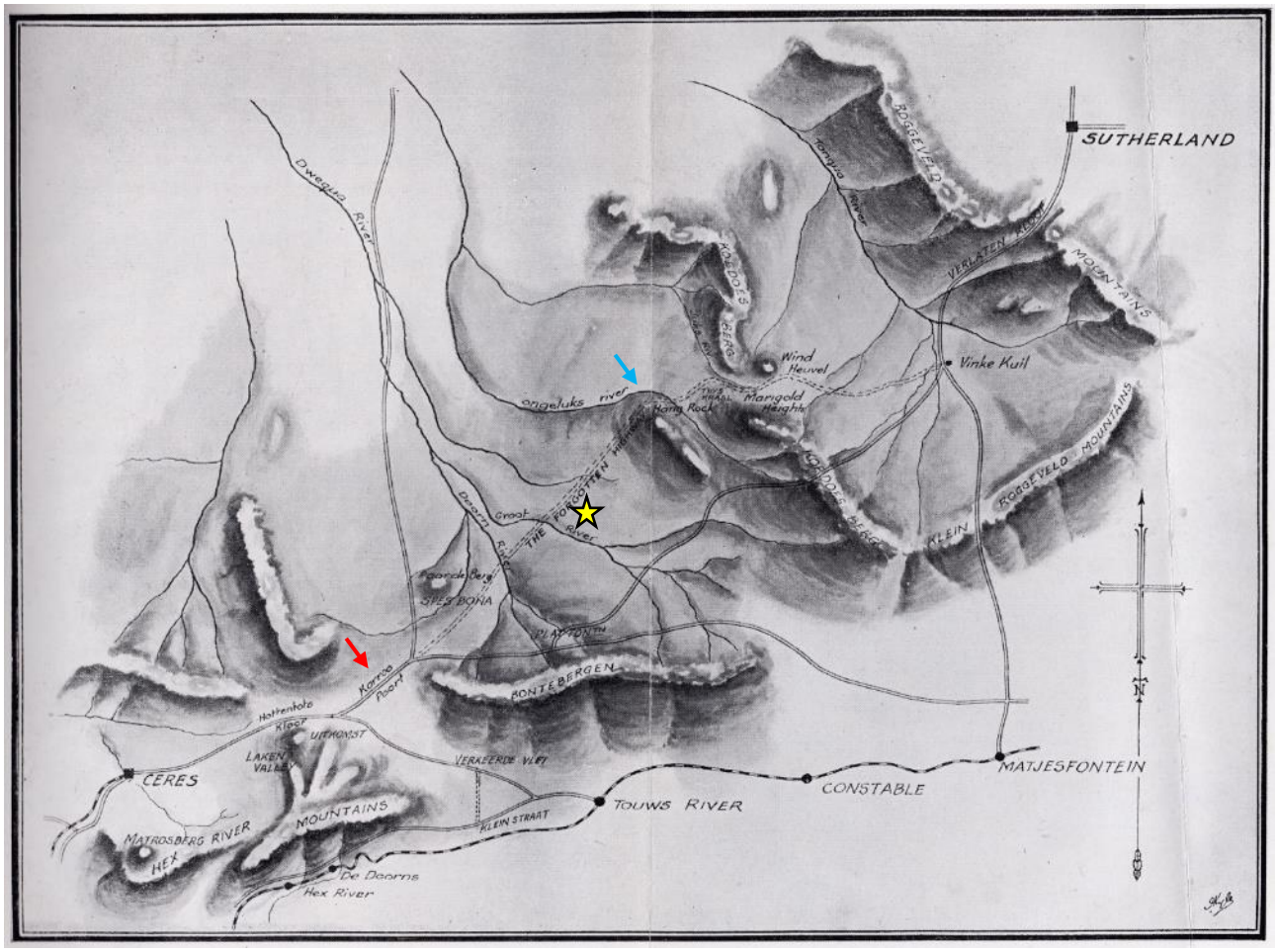

Figure 34: *Map of the Ceres Karoo showing the 'Forgotten Highway' leading past the study area (yellow star). The important landmarks of Karoo Poort (red arrow) and Hanglip (blue arrow) are indicated.*

5.4.2. Site visit

Two historical features were noted on site. One was a large stone boundary beacon (Figure 35) and the other was a cottage that had clearly been altered, added to and maintained many times over the years. It very likely started out as a brakdak house but now has a flat corrugated iron roof.

Figure 35: *The stone cairn at the western corner of Hoek Doornen at waypoint 132. This point is the intersection of three farms.*

Figure 36: *The cottage at waypoint 171 on the north bank of the Groot River.*

5.5. Cultural landscapes and scenic routes

The landscape is very strongly a natural one which has a distinctive aesthetic appeal to lovers of South Africa's dry landscapes. Figures 6 to 12 provide an impression of the landscape, showing its expansiveness and, within the Ceres Karoo basin, lack of steep topography. The triangular basin is ringed by mountains: the Swatruggens lie in the west, the Bontberg and other small unnamed mountains form the southern edge, and the Roggeveld Mountains lead up to the escarpment in the northeast. Although the area is very remote and has no paved roads, it has been included in the Komsberg REDZ which means that wind and solar farms can be expected to be developed in the area (Figure 37). The REDZ already hosts several wind farms, including one located to the southeast of the present study area. The Kappa Substation occurs at the southern end of the proposed power line corridor and several large power lines already traverse the Ceres Karoo going in and out of the substation (Figures 5 & 13).

Although Winter and Oberholzer (2013) list Karoo Poort as a Grade II scenic resource for its historical and architectural value and the uplands (Koedoesberge) to the north of the project area as a Grade III scenic resource rising from the flat plain, they ascribe no scenic value to the plain itself and the R356 that traverses it. The road is nevertheless considered by the present specialist to have at least some value as a local scenic route, especially given its historical role.

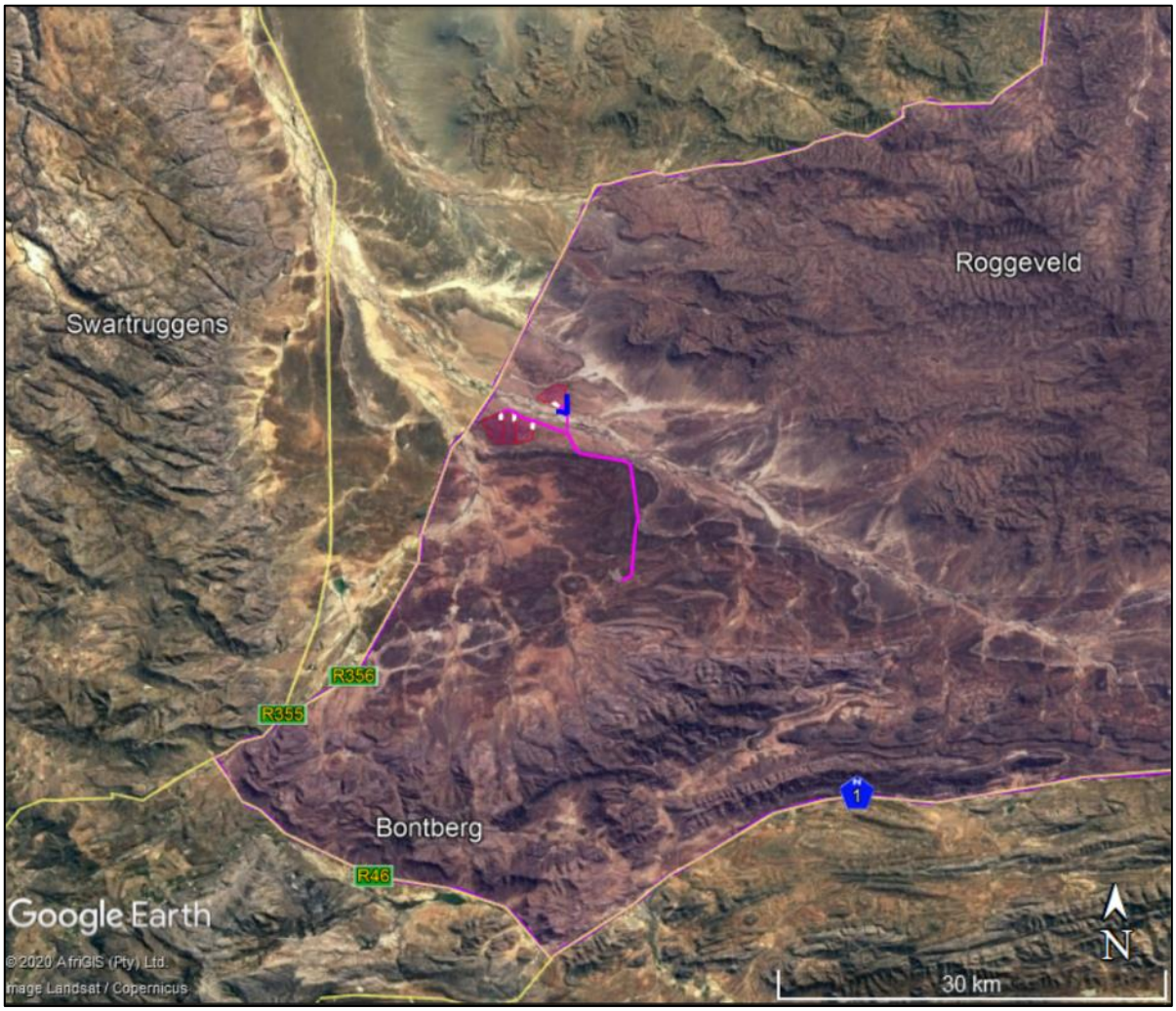

Figure 37: *Aerial view of the Ceres Karoo showing project site (PV Areas for Hoek Doornen PV 1 to PV 4 and power lines to the Eskom Kappa Substation) relative to the western part of the Komsberg REDZ (purple shading) and surrounding mountains (labelled).*

As already noted in Section 5.4.1, the Ceres Karoo hosted an important historical travel route. The small mountain known as Hanglip was a crucial landmark in the landscape as it signalled the end of the Ceres Karoo crossing and also arrival at an outspan. Hanglip is very prominent and forms a key component of the cultural landscape (Figure 38). For the rest, the natural landscape is marked only by rare houses, often accompanied by gum or other trees, farm fences and tracks and water infrastructure (earthen dams, round cement reservoirs and wind pumps). The anthropogenic imprint on the landscape is thus very light. Karoo Poort is also an important component of the wider cultural landscape but, owing to its distance from the project area, is not of concern here.

Figure 38: *View along the R356 northwards towards Hanglip, the small peak at the left end of the middle ground mountain.*

5.6. Visual impact assessment

A specialist visual assessment has been carried out by Oberholzer and Lawson (2020; see Appendix 5). They note that the viewshed extends up to 5 km but that the visual exposure is medium because some areas fall within a view shadow. They note that scenic resources are absent from the immediate area with only farmsteads serving as visual receptors. The landscape integrity is considered to be low with powerlines and the Perdekraal wind energy facility having disturbed the landscape. Figures 39 shows that the R356 could be significantly affected by the PV projects, while Figure 40 shows that the EGI would not visually impact this road. Figure 41 shows that, despite a 500 m buffer, the PV panels would be moderately visible from the R356. The power lines would be visible from the road passing the Kappa Substation but much other electrical infrastructure already occurs in that area.

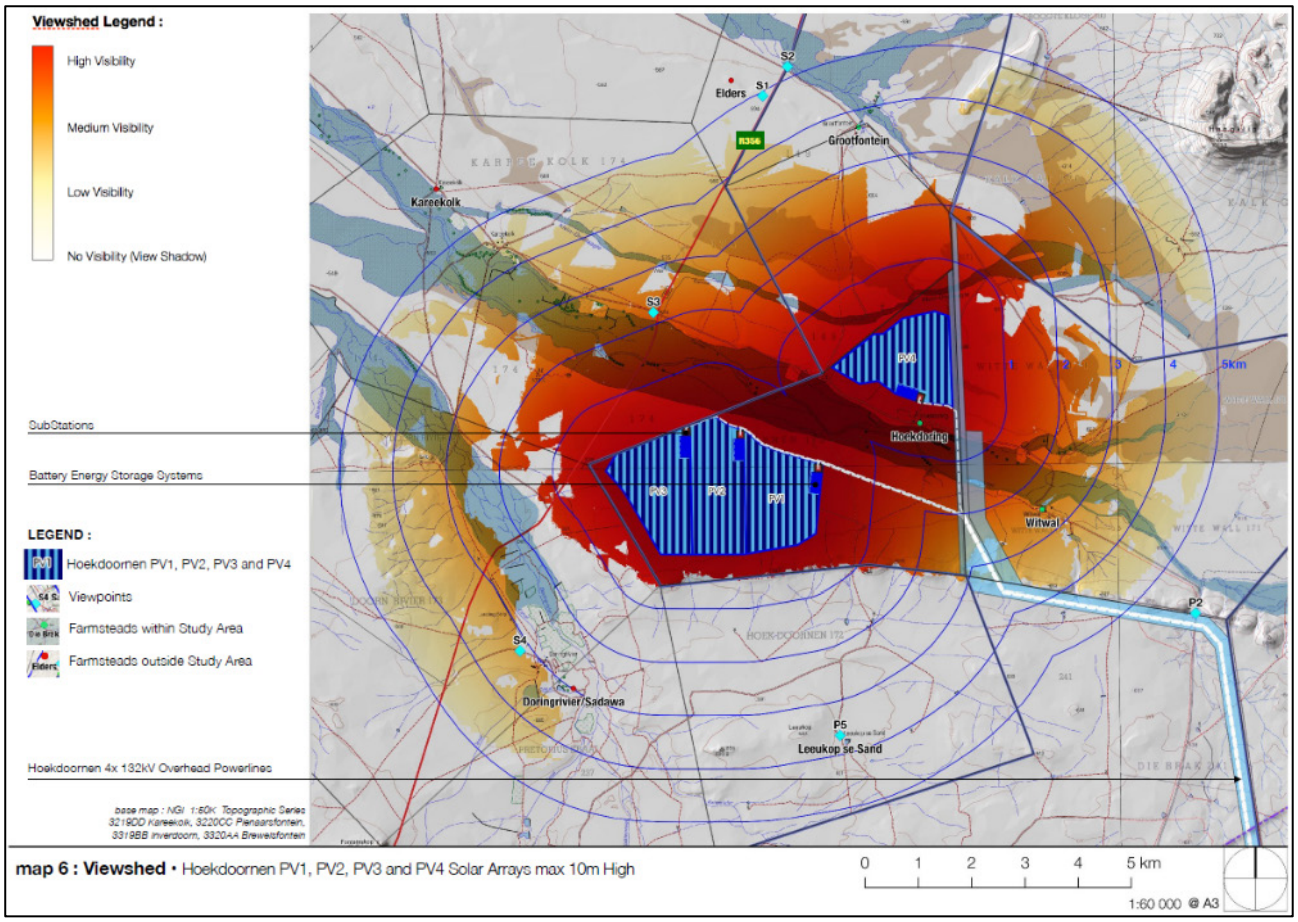

Figure 39: *Viewshed map for the four Hoek Doornen PV projects.*

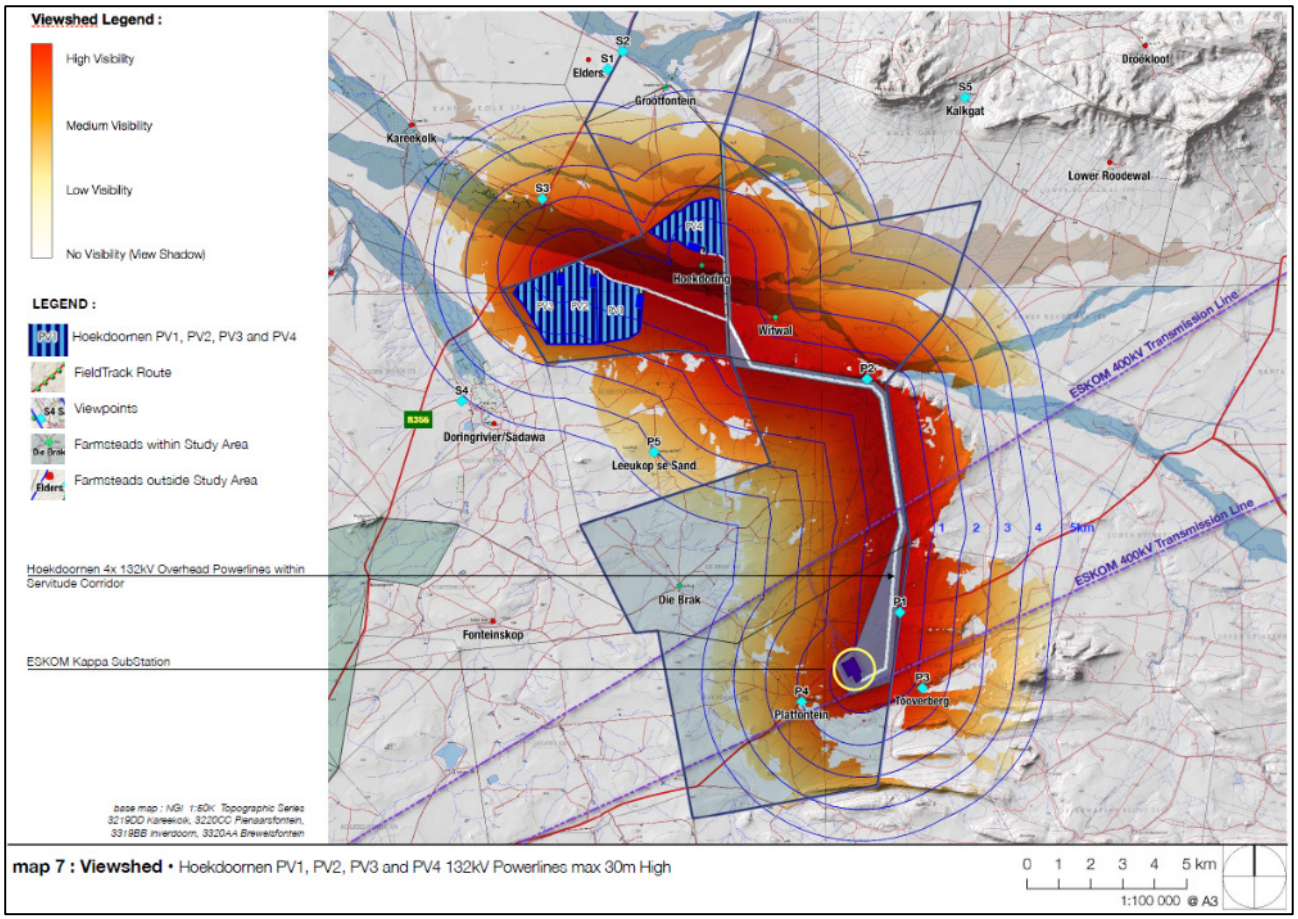

Figure 40: *Viewshed map for the Hoek Doornen EGI.*

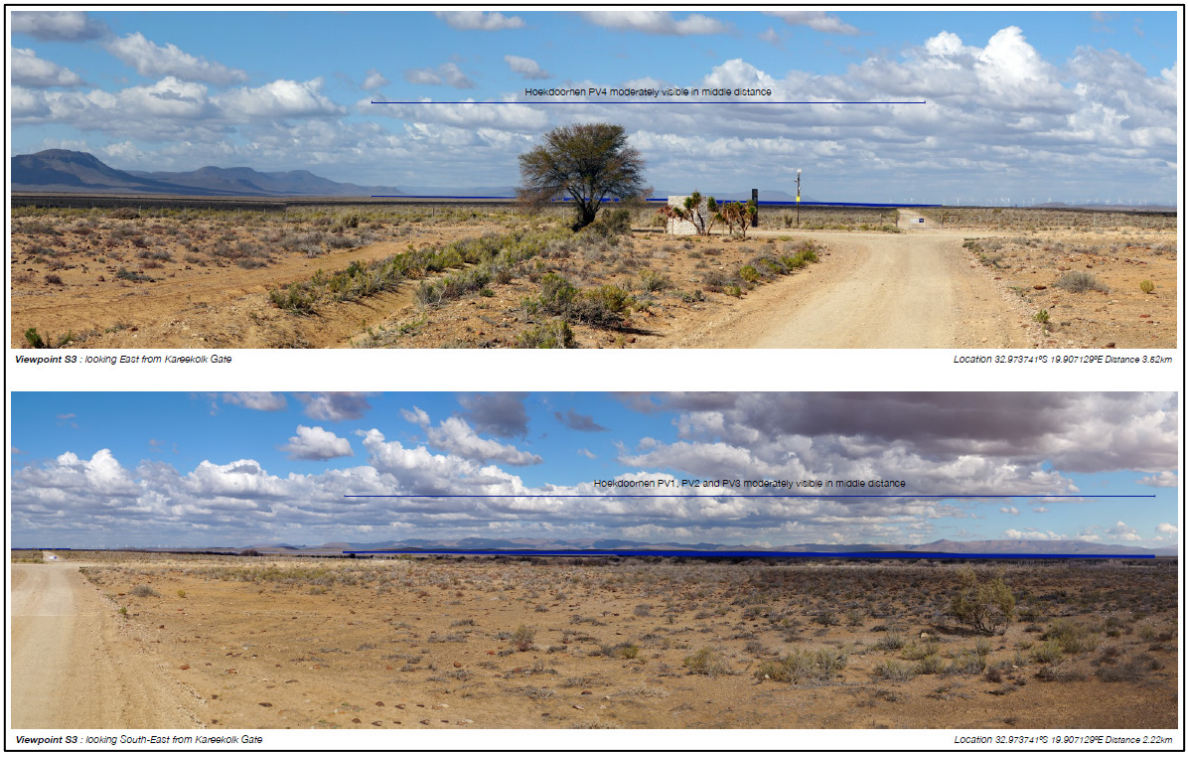

Figure 41: *Photomontages looking eastwards and south-eastwards from the R356 (immediately north of the Groot River). Source: Lawson & Oberholzer 2020: fig. P1).*

5.7. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. The reasons that a place may have cultural significance are outlined in Section 3(3) of the NHRA (see Section 2 above).

The palaeontological resources are deemed to have low cultural significance for their scientific value. Any fossils found are likely to be in the Grade IIIB to NCW range.

The archaeological resources within the Hoek Doornen PV 1 to PV 4 and power line study areas are deemed to have generally low cultural significance for their scientific value. They are rated as NCW. Other sites of greater significance have been excluded from the development footprints and are graded up to IIIA (Figure 42). There are no historical archaeological resources within the study area. The two stone kraals just outside the power line corridor are also given Grade IIIB.

Graves are deemed to have high cultural significance for their social value and are considered Grade IIIA resources. None are known within the development areas.

There are no buildings within the PV sites. Elsewhere on the farm, the single built heritage structure to the north of the Groot River and the stone boundary beacon to the south are considered low and medium cultural significance respectively for their architectural and social values and are graded IIIC and IIIB.

The cultural landscape, despite already hosting significant electrical infrastructure, is considered to be of at least medium significance worthy of a IIIB grading. Certain iconic views, for example within Karoo Poort or of Hanglip can be considered as of high significance and worthy of grade IIIA.

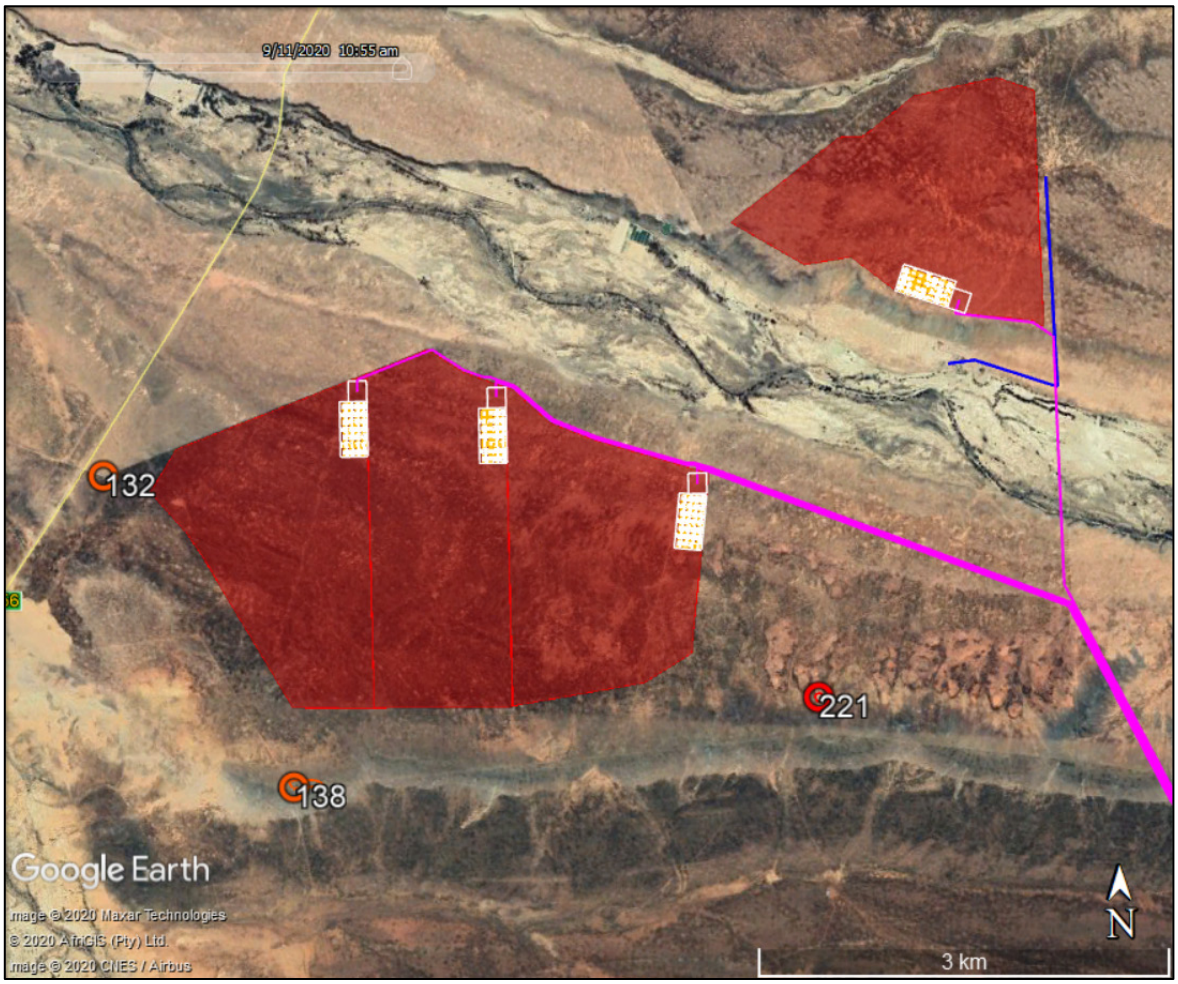

Figure 42: *Aerial view of the PV study area (red shading) and northern part of the power line corridor (pink lines) showing heritage resources of Grade IIIA (red circles – waypoint 221) and IIIB (orange circles – waypoints 132 and 138).*

5.8. Summary of heritage indicators

Fossils can be present in the landscape and are easily damaged or destroyed during development.

- Indicator: Significant fossils should not be damaged or destroyed.

Archaeological resources and graves are generally very fragile and vulnerable to damage or disturbance.

- Indicator: Significant archaeological resources and graves should not be damaged or destroyed.

The cultural landscape can be very easily spoiled by insensitive developments that dominate from many viewpoints.

- Indicator: The cultural landscape should not be visually dominated by the proposed development.
- Indicator: Steep slopes should be avoided for the PV layouts and BESS.
- Indicators: The southern ridge and sand dune area should be avoided as much as possible for the PV layouts (Figure 43).

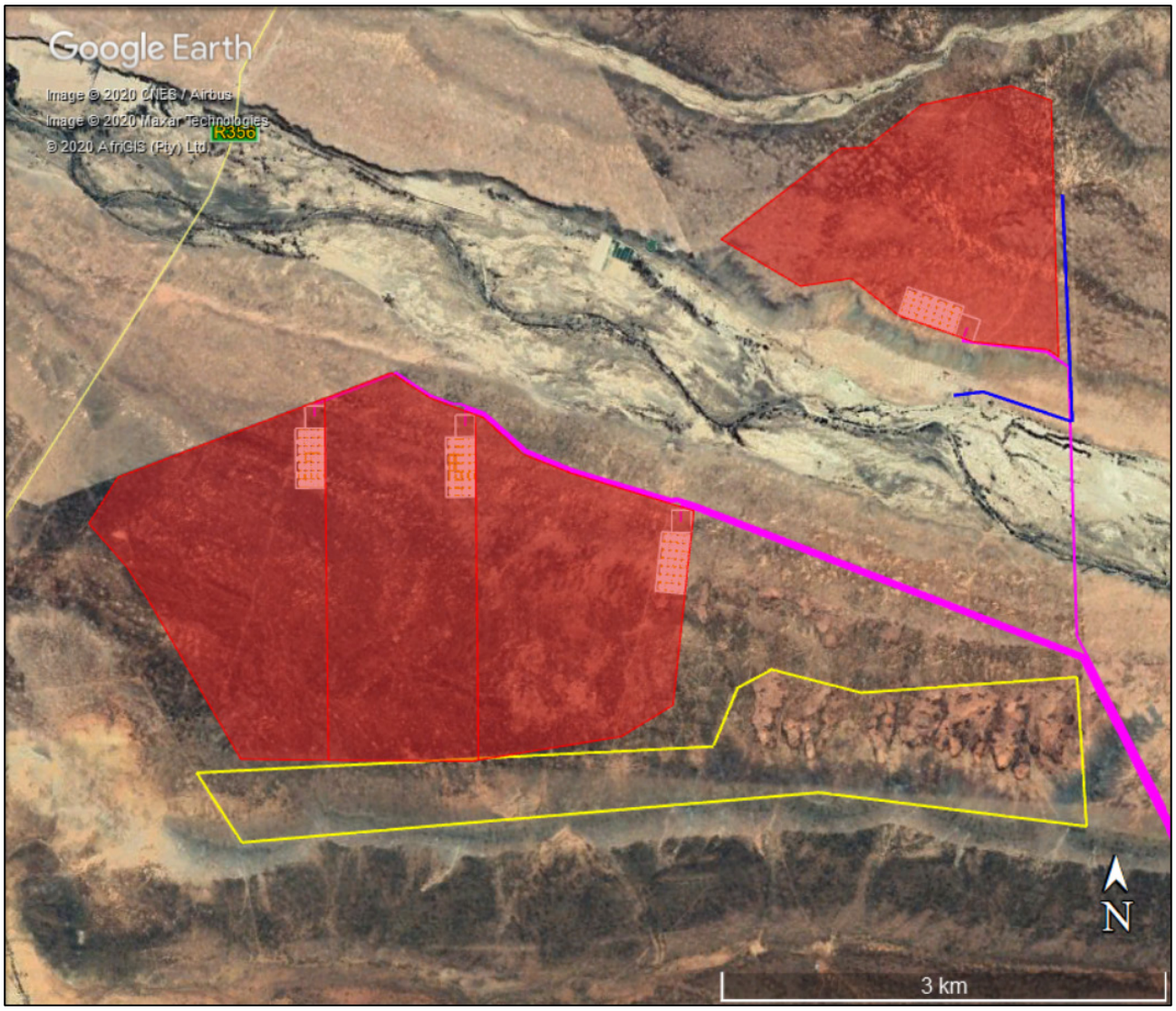

Figure 43: *Aerial view of the Hoek Doornen PV sites showing the area (outlined in yellow) to be avoided for visual and cultural landscape reasons.*

6. ISSUES, RISKS AND IMPACTS

6.1. Issues, risks and impacts

The potential impacts identified during the assessment are the **same** for **the Hoek Doornen PV 1 to PV 4 projects (i.e. including the PV Facilities, Power Lines and Associated Infrastructure)**. They are:

Construction Phase

- Potential impacts to palaeontological resources
- Potential impacts to archaeological resources and graves
- Potential visual impacts to the cultural landscape

Operational Phase

- Potential visual impacts to the cultural landscape

Decommissioning Phase

- Potential visual impacts to the cultural landscape

Cumulative impacts

- Potential impacts to palaeontological resources
- Potential impacts to archaeological resources
- Potential impacts to the cultural landscape

7. IMPACT ASSESSMENT: HOEK DOORNEN PV 1 TO PV 4

The impact assessments for all four projects are expected to be the same. Please note that the assessments for palaeontology have been provided in the attached palaeontological specialist study (Appendix 4) and are not repeated here, save to note that the impacts would occur during the construction phase and their significance would be **very low negative** both before and after mitigation.

The impacts below apply to the **PV Facilities, Power Lines and Associated Infrastructure**.

7.1. Direct Impacts

7.1.1. Construction Phase

Potential Impacts to archaeology and graves

Impacts to archaeology and graves would be direct impacts that might occur during construction when these resources are damaged or destroyed during excavation work. Although the impacts would be permanent and are very likely to happen, the moderate consequence means that significance before mitigation is **low negative** (Table 2). A detailed pre-construction survey of the final layouts (PVs and power lines) should be undertaken in order to determine appropriate sample areas from which to collect artefacts. There is a small possibility that more significant sites or even graves may be found. While background scatter artefacts occur widely and in variable densities across the landscape, it is suggested that one area per PV project footprint could be collected from in order to record some of the variability across the wider project area. Collection along the power line route can also be contemplated if necessary but, because of the limited footprint associated with the power lines, this is likely to not be needed, especially since micrositing of pylons and the service track should be fairly straightforward. The ECO should also ensure that all staff are alerted to the possibility of finding archaeological resources and instructed to report any unusual finds. With mitigation the impact significance is expected to be **very low negative**, although it is noted that new data from an otherwise poorly understood area could contribute some scientific benefit.

Table 2: *Impacts to archaeology & graves – construction phase.*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE						
Impacts to archaeology & graves	Status	*Negative*	*Low (4)*	*Pre-construction survey.* *Sample artefacts.* *Educate staff on possible finds.*	*Very low (5)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate*				
	Probability	*Very likely*				
	Reversibility	*Non-reversible*				
	Irreplaceability	*High*				

Potential Impacts to the cultural landscape

Impacts to the cultural landscape would be direct impacts that might occur during construction when much machinery and equipment is on site and there is plenty of activity in what is an otherwise very quiet and tranquil landscape with minimal traffic. The impacts would be medium term (as long as construction takes) and are very likely to happen. The substantial consequence means that the significance before mitigation is **moderate negative** (Table 3). Mitigation would entail minimising the disturbance footprint, utilising dust suppression measures, ensuring effective rehabilitation of areas not needed during operation, locating the laydown area and batching plant (if needed) as far from public roads as possible and using natural colours and finishes on buildings. With mitigation the impact significance is expected to be **low negative**. It is noted that Lawson and Oberholzer (2020) have rated the significance of visual impacts as **low negative** both before and after mitigation.

Table 3: *Impacts to the cultural landscape – construction phase.*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE						
Impacts to cultural landscape	Status	*Negative*	*Moderate (3)*	*Minimise disturbance footprint.* *Employ dust suppression measures.* *Ensure effective rehabilitation.* *Locate laydown, batching plant and buildings far from public road.* *Natural colours and finishes on buildings.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*Non-reversible*				
	Irreplaceability	*High*				

7.1.2. Operation Phase

Potential Impacts to the cultural landscape

Impacts to the cultural landscape would be direct impacts that might occur during operation through the visual intrusion of an industrial-type facility on the otherwise rural cultural landscape. Because the facility layout has responded to the landscape character and will sit quite low in the landscape, the

extent of impacts is expected to be local. The impacts would be long term and are very likely to happen. The moderate consequence means that significance before mitigation is **low negative** (Table 4). Once construction is over, there are only minor mitigation measures that can be applied. Security lighting should be directed to minimise light pollution and signage should be as small and unobtrusive as possible. These will not change the overall visual intrusion much and the post-mitigation significance thus remains **low negative**. It is noted that Lawson and Oberholzer (2020) have rated the significance of visual impacts as **low negative** both before and after mitigation.

Table 4: *Impacts to the cultural landscape – operation phase.*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATION PHASE						
Impacts to cultural landscape	Status	*Negative*	*Low (4)*	*Minimise light pollution. Signage to be small and unobtrusive.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Very likely*				
	Reversibility	*Non-reversible*				
	Irreplaceability	*High*				

7.1.3. Decommissioning Phase

Potential Impacts to the cultural landscape

Impacts to the cultural landscape would be direct impacts that might occur during decommissioning when much machinery and equipment is on site and there is plenty of activity. The impacts would be long term because rehabilitation is likely to take decades to be completed. Impacts are very likely to happen. The substantial consequence means that significance before mitigation is **moderate** (Table 5). Mitigation would largely entail employing best practice i.e. minimising the disturbance footprint, utilising dust suppression measures, and ensuring effective rehabilitation of all areas. With mitigation the impact significance is expected to be **low**. It is noted that Lawson and Oberholzer (2020) have rated the significance of visual impacts before mitigation as **low negative** and after mitigation as **very low negative**.

Table 5: *Impacts to the cultural landscape – decommissioning phase.*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
DECOMMISSIONING PHASE						
Impacts to archaeology & graves	Status	*Negative*	*Moderate (3)*	*Minimise disturbance footprint. Employ dust suppression measures. Ensure effective rehabilitation.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*Non-reversible*				
	Irreplaceability	*High*				

7.1.4. Cumulative Impacts

Cumulative impacts relate to the loss of archaeological resources over wide areas and the presence of multiple electrical facilities in the landscape. Because significant archaeological sites are generally located and protected from development – and so few significant sites exist in developable areas – the cumulative impacts are driven mainly by the visual impacts to the cultural landscape. In this regard, wind turbines have the greatest impact, followed perhaps by power lines, although the latter reduce in visibility more quickly than turbines do. It is expected that the cumulative impacts to heritage will be **moderate negative**. Mitigation measures would be the same as proposed for the present projects but, because visual mitigation measures can never screen these large developments, the post-mitigation impacts are expected to remain **moderate negative**. Note that because the various facilities in the landscape will be built, operated and decommissioned at different times, there is no distinction made between the project phases for cumulative impacts.

Table 6: *Cumulative impacts to heritage resources.*

Impact	**Impact Criteria**		**Significance and Ranking (Pre-Mitigation)**	**Potential mitigation measures**	**Significance and Ranking (Post-Mitigation)**	**Confidence Level**
ALL PHASES						
Impacts to all heritage resources	Status	*Negative*	*Moderate (3)*	*Pre-construction archaeological surveys with sampling as needed. Minimise areas disturbed. Minimise light pollution and signage. Effective rehabilitation.*	*Moderate (3)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*Reversible*				
	Irreplaceability	*High*				

7.2. Indirect Impacts

No indirect impacts are anticipated.

7.3. The No-Go alternative

The No-Go alternative would entail not developing the projects and the landscape would remain in its present undeveloped state. Not developing the projects would not result in any new impacts to heritage resources. Existing natural erosion and weathering of artefacts, ruins and buildings would continue but at a very slow rate. Impact significance from the No-Go alternative is thus expected to be **very low negative** for all aspects of heritage.

7.4. Existing impacts to heritage resources

There are currently no obvious threats to heritage resources on the site aside from the natural degradation, weathering and erosion that will affect archaeological materials, ruins and structures. Trampling from grazing animals and/or farm/other vehicles may also affect artefacts.

7.5. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many vantage points is undesirable.

8. IMPACT ASSESSMENT SUMMARY

Table 7 provides a summary of the expected impacts after mitigation.

Table 7: *Overall Impact Significance (Post Mitigation)*

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Moderate
Cumulative - Operational	Moderate
Cumulative - Decommissioning	Moderate

9. LEGISLATIVE AND PERMIT REQUIREMENTS

This report and the proposed recommendations will need to be approved by HWC. There are no further legislative requirements for the approval process but if archaeological mitigation is needed then the appointed archaeologist will need to submit a Workplan to HWC to do the work. This must be carried out well in advance of construction to ensure that there is enough time for HWC to approve the mitigation work before construction commences.

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

EMPr inputs for palaeontology and visual concerns are provided in the separate palaeontological and visual specialist reports. This section deals only with archaeology as this was the specialist aspect conducted by the present author.

There are three main recommendations to be included in the EMPrs for all project components. The first is to commission a pre-construction survey of the approved PV layouts and power line routes. Further recommendations will stem from the results of that survey. The survey should be done well in advance of construction (preferably at least 6 months) in order to allow time for:

- The field survey;
- Reporting to HWC and application for Workplan approval;
- Conducting the mitigation fieldwork;
- Analysis and reporting; and

- Final approval by HWC

The project developer should ensure that this appointment is made or, if an Environmental Control Officer (ECO) is already appointed, they can see that the requirements are met.

The second measure is for the ECO to ensure that all project staff are aware of the possibility of finding buried heritage materials and that they know the procedure to protect and report such finds. Workers must keep a watch for such items during work.

The third is that the ECO must conduct formal monitoring site visits to (1) verify that all work is remaining within the authorised area and (2) check for any fossils or artefact concentrations that might be revealed.

One specific measure that is required is to ensure the protection of the stone cairn at waypoint 132 if this access point is used. If road widening is required, then this must happen towards the north (i.e. away from the beacon).

The generic EMPrs for substations and power lines (GN 435) make provision for general monitoring by project staff and protection and reporting of any chance finds.

11. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

The projects will result in an improved electricity supply for South Africa which can have extensive benefits in terms of improving the economic outlook and investment potential in the country. At the local scale, it is likely that between about 90 and 150 skilled and between 400 and 460 unskilled employment opportunities will be created during the construction phase per project, while approximately 20 skilled and 40 unskilled employment opportunities would be created over the 20-year operational lifespan of the proposed facility. These unskilled jobs will be linked to services such as panel cleaning, maintenance and security. The heritage resources are not of such a significance that they outweigh the socio-economic benefits of the proposed developments.

12. CONSULTATION WITH HERITAGE CONSERVATION BODIES

This report[2] was submitted to the Witzenberg Municipality for comment as required by the HWC NID response. In addition, and because there are no conservation bodies registered in the area, the report was also sent to Hex Valley Tourism Association and the Touws River Heritage and Conservation Society as the next closest registered organisations. This was on 16 October 2020. By the time of finalising this report on 17 November 2020, only the Hex Valley Tourism Association had responded as shown below. They were in support of the project, the assessment and the

[2] Please note that since submission to the I&APs, the laydown areas for each project have been increased from 5 ha to 13 ha.

recommendations of the HIA. The BA with all specialist studies is due to undergo full public participation shortly.

Re: Re[6]: Ceres Karoo heritage consultation

GA From Graham Abrahams Mon 2020/11/16 12:20
to Jayson and copy to Hex Valley Tourism, christiaan@netandmail.com, david@witzenberg.gov.za, RAbed@csir.co.za

⚠ Download pictures or always download pictures from this sender. To preserve privacy, external content was not downloaded.

Hi Jayson

I trust that you, your family and colleagues are all well?

Thank you for making the effort to connect with our society through your email, and for meeting with me. Thank you for sharing your work and findings and the supporting documents, in terms HWC Case No: 20081910SB0825E, in regard to the three heritage impact assessments for solar projects in the Tankwa Karoo region, that I received from you and which I have now read through.

I have definitely benefited (and am enlightened) from reading through your Impact Assessment papers. They certainly provided me with a fresh perspective on the content and quality of the detail that goes into a report such as this. Well done on providing such detailed and comprehensive content.
I respect your professional opinion in this regard in relation to all of the planned PV and associated EGI projects, and therefore support your findings and recommendations, since I am satisfied that they cover all of the issues that are contained in Appendix 6.

I have made copies of the general compliance requirements (Appendix 6) to distribute among my own committee members so that they too can have a better understanding of everything that is considered, such as the "Chance Find Procedure" you mention, and appropriate steps to take in terms of Impact Assessments from the Conservation standpoint.

Then, I have also spoken to my colleague, Melanie Esterhuyse (CEO of Hex River Valley Tourism), regarding your and my discussions on inviting you to address local Stakeholders and Media on Conservation issues in our valley. I think they will find this very interesting. Melanie suggested that one of the evenings of the Media Educational Tour, which at this stage is scheduled for the week 15th to 19th Feb 2021, would be most suitable. She is busy with logistics arrangements (due to limited accommodation in the valley) so I await to hear from her as to which date would be best, and I will let you know asap.

Once again thank you for making contact with us, and we look forward to seeing you next year!

Kind regards,

Graham
G.N.Abrahams: Chairman - Hex River Valley Heritage & Conservation Society
Cell: +27(0)61-583-4269

13. CONCLUSIONS

Table 8 lists the heritage indicators identified for these projects and shows the responses. Some are design responses but others will only be met later through the application of mitigation measures. There are no remaining concerns and it is considered that the proposed developments will not result in significant impacts to heritage resources. There are currently no areas within the PV layouts or power line corridors that require avoidance, but it should be noted that a stone

boundary beacon occurs alongside the current access to the southern part of the farm at waypoint 132. It is acceptable that this road may be used by the project so long as any widening happens northwards, away from the beacon.

Table 8: *Heritage indicators and design responses.*

Indicator	Project Response
Significant fossils should not be damaged or destroyed.	No design response possible but a Chance Finds Procedure will be implemented under the EMPr to ensure that any chance finds are recorded and/or collected as required.
Significant archaeological resources and graves should not be damaged or destroyed.	Known significant sites have been avoided by the PV layout and a pre-construction survey is recommended to (1) ascertain whether any further sites are present within the footprint and (2) choose the densest areas of background scatter for formal sampling.
The cultural landscape should not be visually dominated by the proposed development.	Because the PV developments are relatively low to the ground and the power lines lack significant mass, they should only be visible from relatively close to the sites.
Steep slopes should be avoided for the PV layouts and BESS.	The PV project has avoided the visually significant ridge along the southern margin of the study area as well as the area of sand dunes in the southeast. The R356 has been given a 500 m buffer which will reduce the visibility of the project to road users.

13.1. Statement and reasoned opinion of the specialist

Because no significant impacts to culturally significant heritage resources are anticipated and impacts of low significance can be easily managed or mitigated, all four of the proposed Hoek Doornen PV developments and their associated electrical grid infrastructure (EGI) should be authorised in full. This includes the rerouting of the public road at Hoek Doornen PV 4.

14. RECOMMENDATIONS

14.1. Hoek Doornen PV 1

It is recommended that the proposed Hoek Doornen PV 1 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

14.2. Hoek Doornen PV 2

It is recommended that the proposed Hoek Doornen PV 2 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

14.3. Hoek Doornen PV 3

It is recommended that the proposed Hoek Doornen PV 3 development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

14.4. Hoek Doornen PV 4

It is recommended that the proposed Hoek Doornen PV 4 development and rerouted public road be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) the best area for sampling of background scatter artefacts;
- The stone boundary beacon at waypoint 132 must be protected from harm. Any road widening needed here must be undertaken towards the north; and
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

14.5. EGI

It is recommended that the proposed EGI development be authorised but subject to the following recommendations:

- A pre-construction archaeological survey must be carried out to determine (1) whether any further sites are present and (2) whether any areas of background scatter artefacts should be sampled;
- If any fossils, archaeological material or human burials are uncovered during the course of the development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist.

Such heritage is the property of the state and may require excavation and curation in an approved institution.

15. REFERENCES

Almond, J.E. 2020. Palaeontological input to Heritage Impact Assessment: proposed development of nine 175 Mw Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure near Touwsriver, Witzenberg Local Municipality, Western Cape. Unpublished report prepared for Veroniva (Pty) Ltd, Cape Town: Natura Viva.

Department of Environmental Affairs. 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.

Halkett, D. & Webley, L. 2011. Heritage Impact Assessment: proposed Perdekraal Wind and Solar Energy Facility, Western Cape Province. Unpublished report prepared for ERM Southern Africa. St James: ACO Associates cc.

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Winter, S. & Oberholzer, B. 2013. Heritage and Scenic Resources: Inventory and Policy Framework for the Western Cape. Report prepared for the Provincial Government of the Western Cape Department of Environmental Affairs and Development Planning. Sarah Winter Heritage Planner, and Bernard Oberholzer Landscape Architect / Environmental Planner, in association with Setplan.

APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 40 Brassie Street, Lakeside, 7945
Telephone: (021) 789 0327
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:

- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 archaeological test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 – Site Sensitivity Verification

As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area. The details of the site sensitivity verification are noted below:

Date of Site Visit	7, 9 and 11 September 2020
Specialist Name	Dr Jayson Orton
Professional Registration Number	Association of Southern African Professional Archaeologists (ASAPA): 233 Association of Professional Heritage Practitioners (APHP): 043
Specialist Affiliation / Company	ASHA Consulting (Pty) Ltd

Method of the Site Sensitivity Verification

- Provide a description on how the site sensitivity verification was undertaken using the following means:
(a) desk top analysis, using satellite imagery;
(b) preliminary on -site inspection; and
(c) any other available and relevant information.

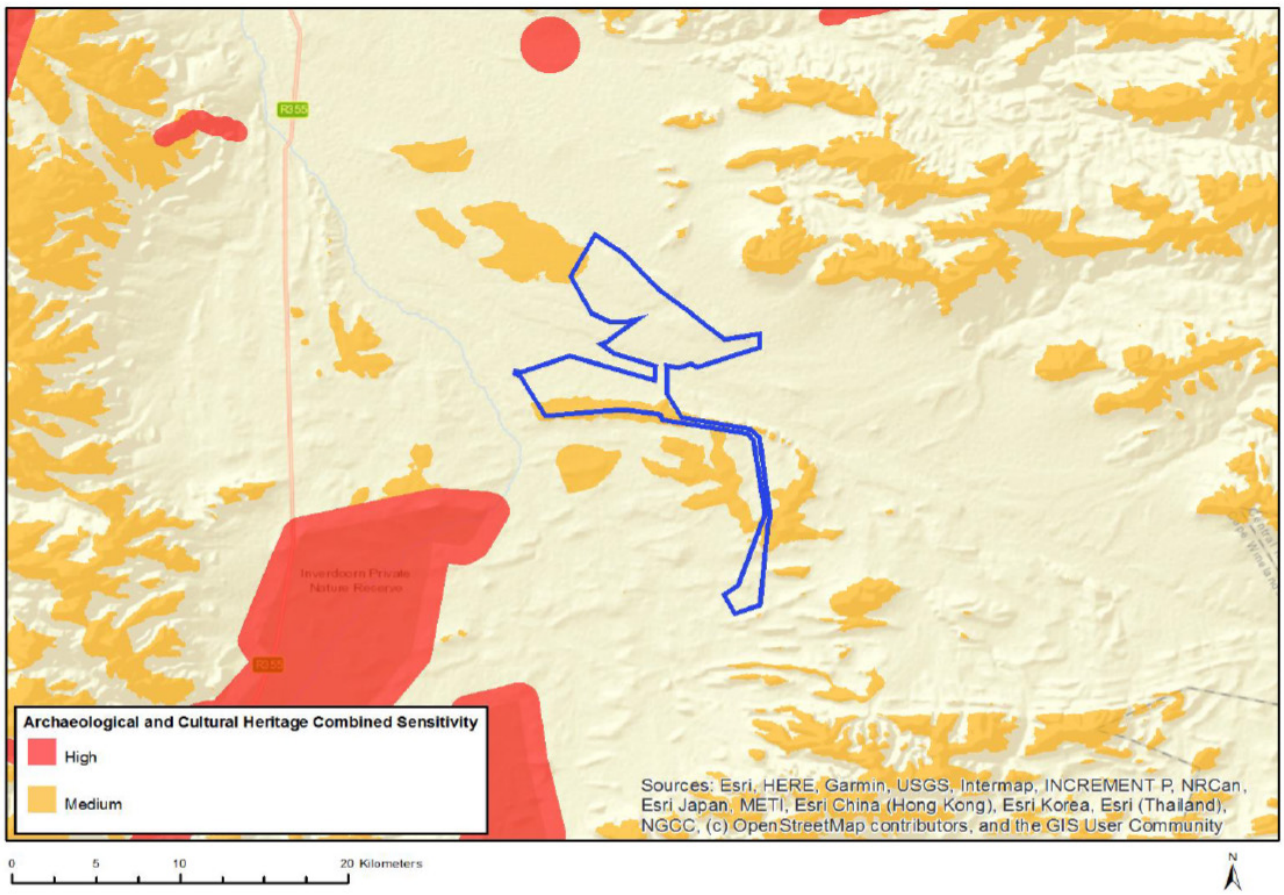
Initial work was carried out using satellite aerial photography in combination with the author's accumulated knowledge of the broader landscape. This was used to determine areas that should be targeted for fieldwork. Subsequent fieldwork then served to ground truth the site, including areas identified as potentially sensitive. Desktop research was also used to inform on the heritage context of the area. This information is all presented in the report (Section 5).

Outcome

- Provide a description of the outcome of the site sensitivity verification in order to:
(a) confirm or dispute the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.; and
(b) include a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

The map below is extracted from the screening tool report and shows the archaeological and heritage sensitivity to be low throughout most the Hoek Doornen PV 1 to PV 4 study areas but with a strip of medium sensitivity along the southern margin. The site visit confirms the sensitivity ratings, although in practice the medium sensitivity area is not continuous but limited to small areas where archaeological sites occur. Figure 42 in the report shows the areas considered to be archaeologically sensitive. They have medium to high heritage significance. A photographic record and description of the relevant heritage resources is contained within the impact assessment report with further photographs on record with the specialist. The screening tool map shows parts of the power line corridor to be of medium sensitivity. This is disputed, however, since only sites

of low cultural significance were found in the areas examined and there is little reason to believe that this would change with further survey. The nature of the archaeological resources along the area shown in the screening tool map as of medium sensitivity is such that it is an extensive resource with low cultural significance.



The screening tool map for palaeontology has been included and discussed in the palaeontological specialist report (Appendix 4 of the present HIA).

APPENDIX 3 – Mapping

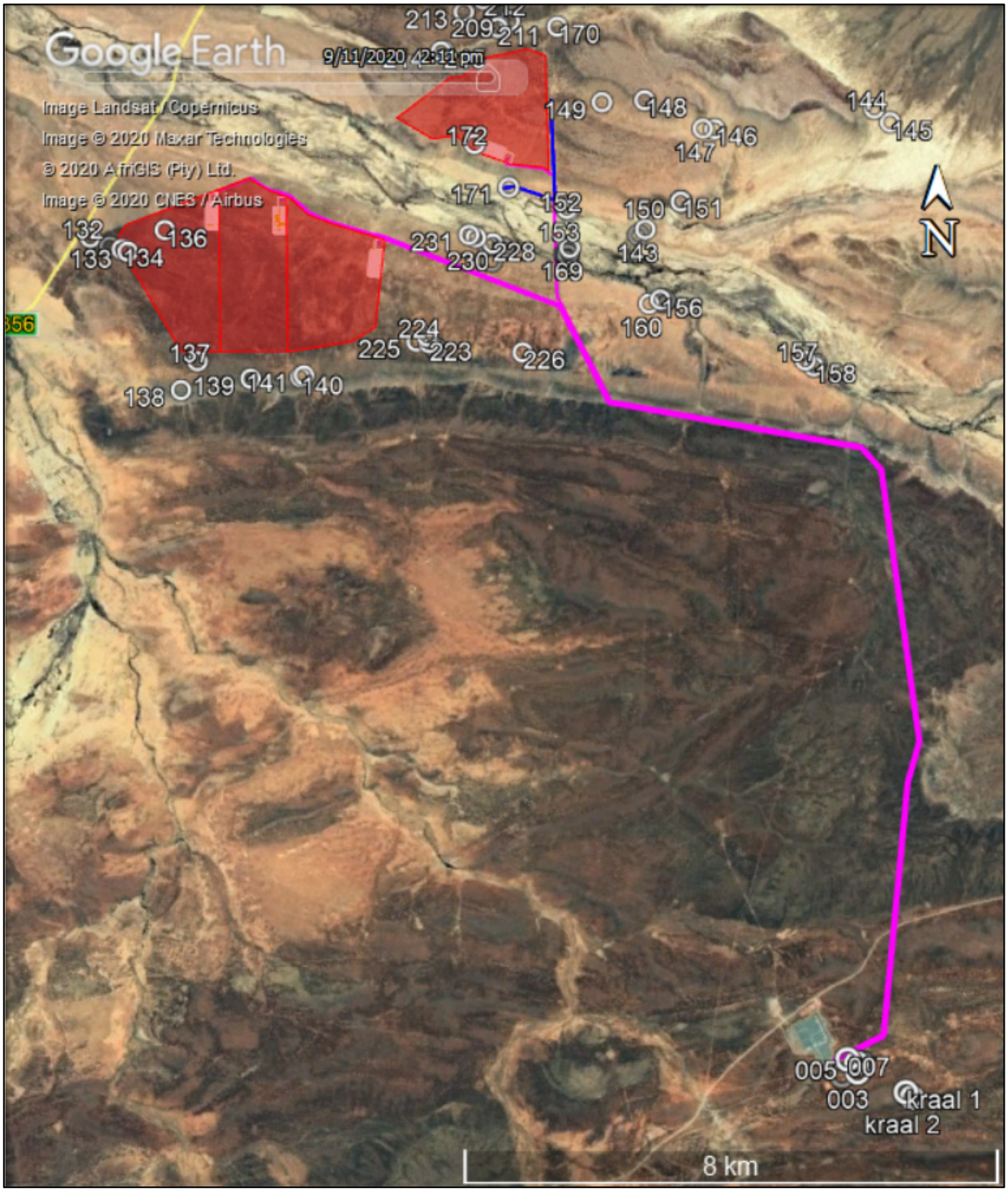


Figure A3.1: *Aerial view of entire study area showing all heritage resources recorded.*

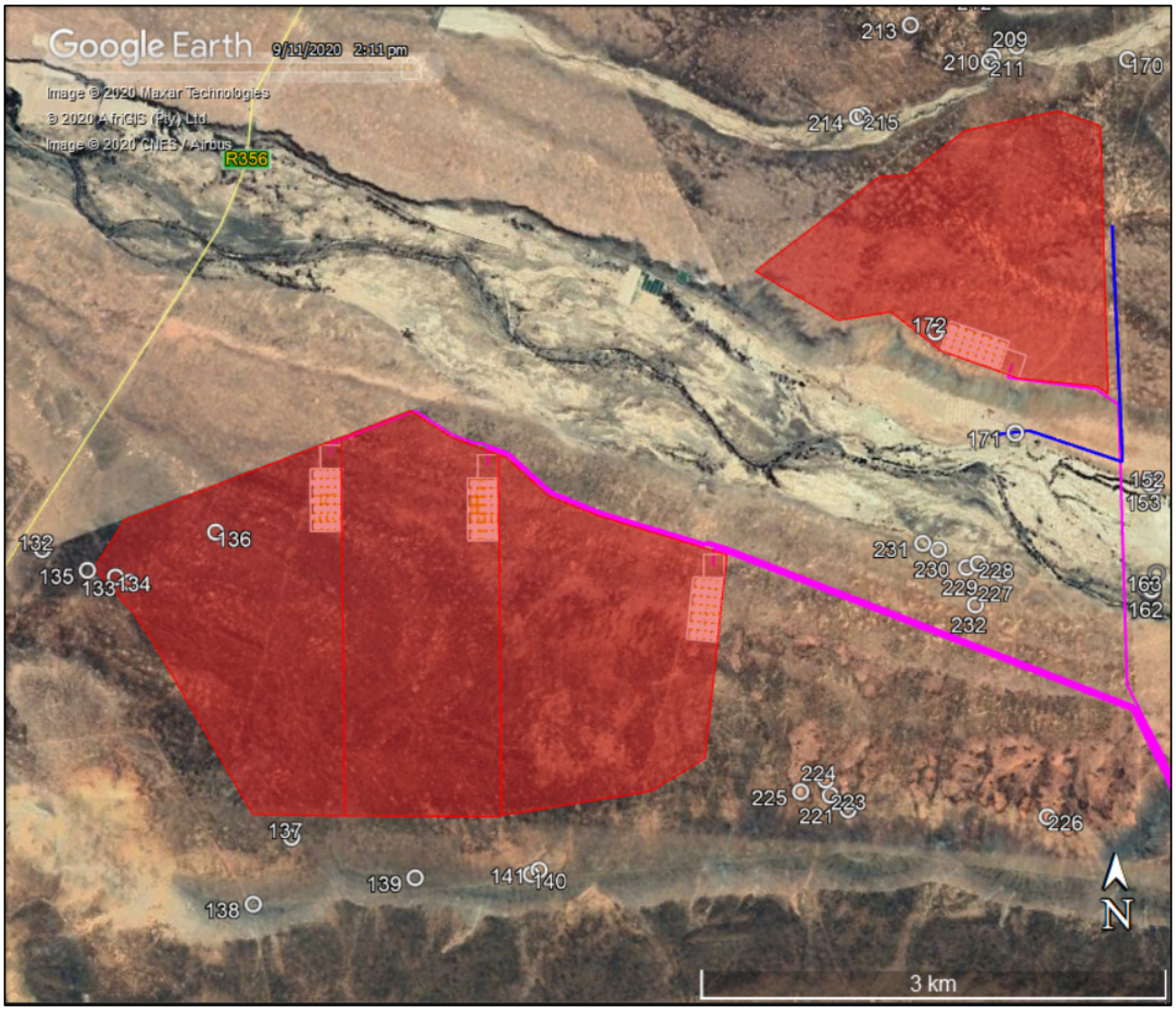


Figure A3.2: *Aerial view of the PV sites (red shading) showing all heritage resources recorded.*

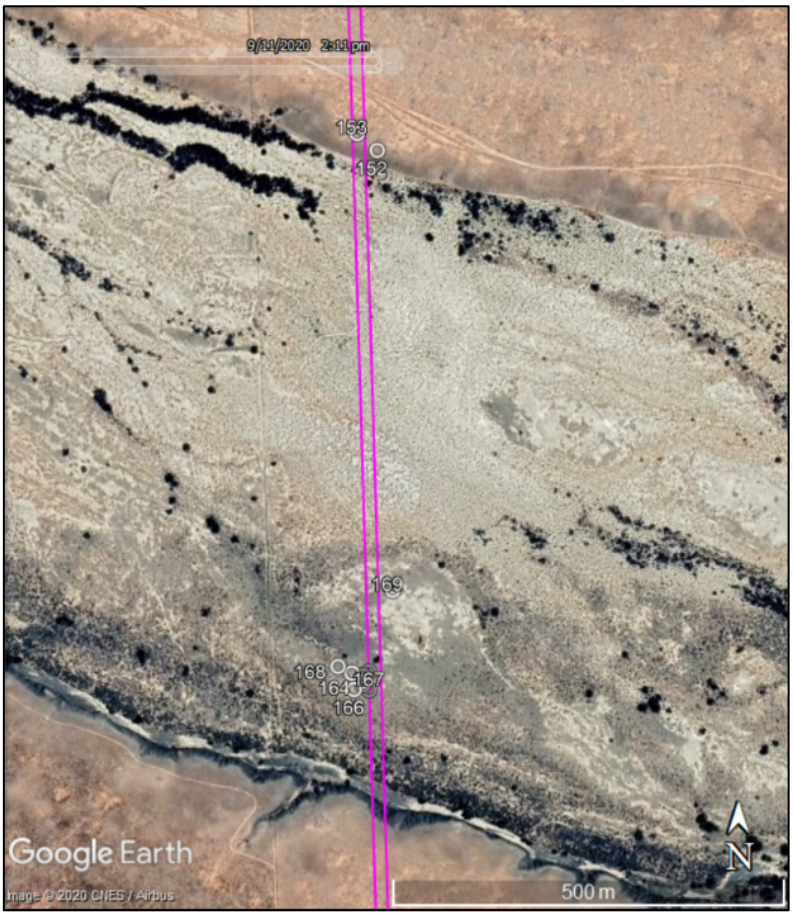


Figure A3.3: *Aerial view of the area where the power lines cross the river showing all heritage resources recorded.*

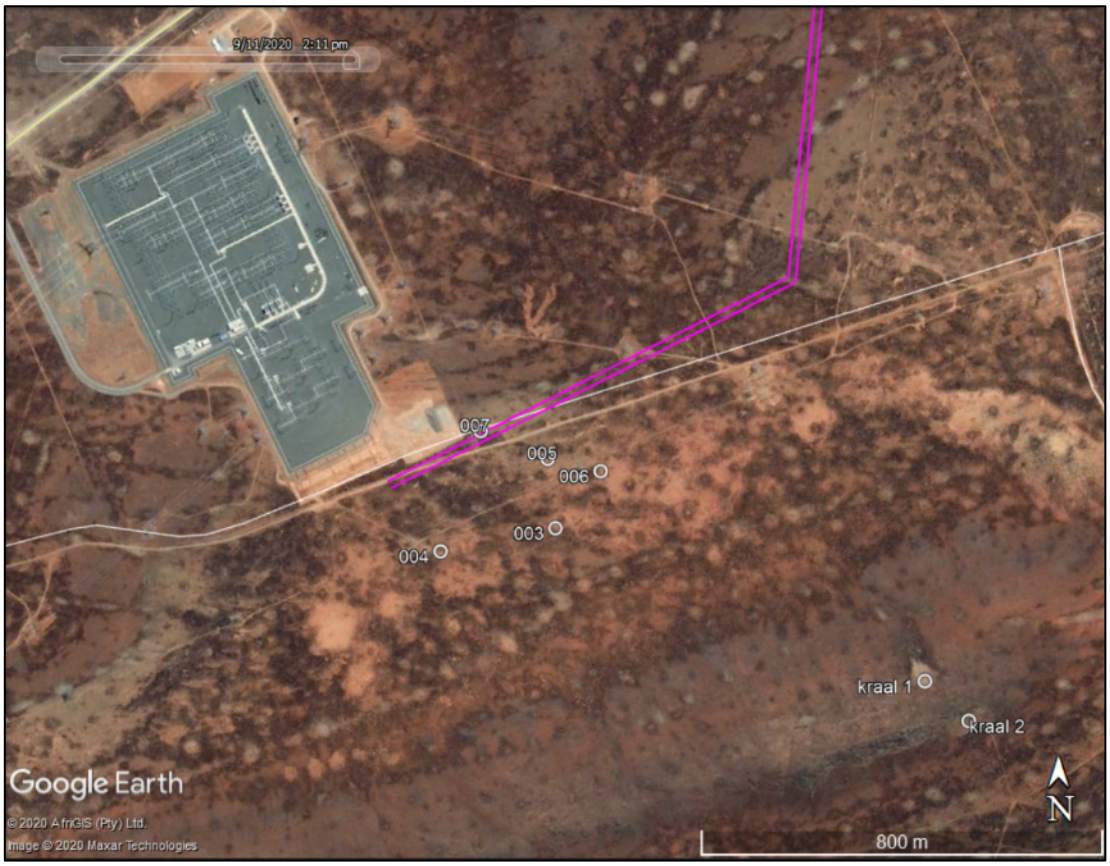


Figure A3.4: *Aerial view of the southern end of the power line corridor showing all heritage resources recorded.*

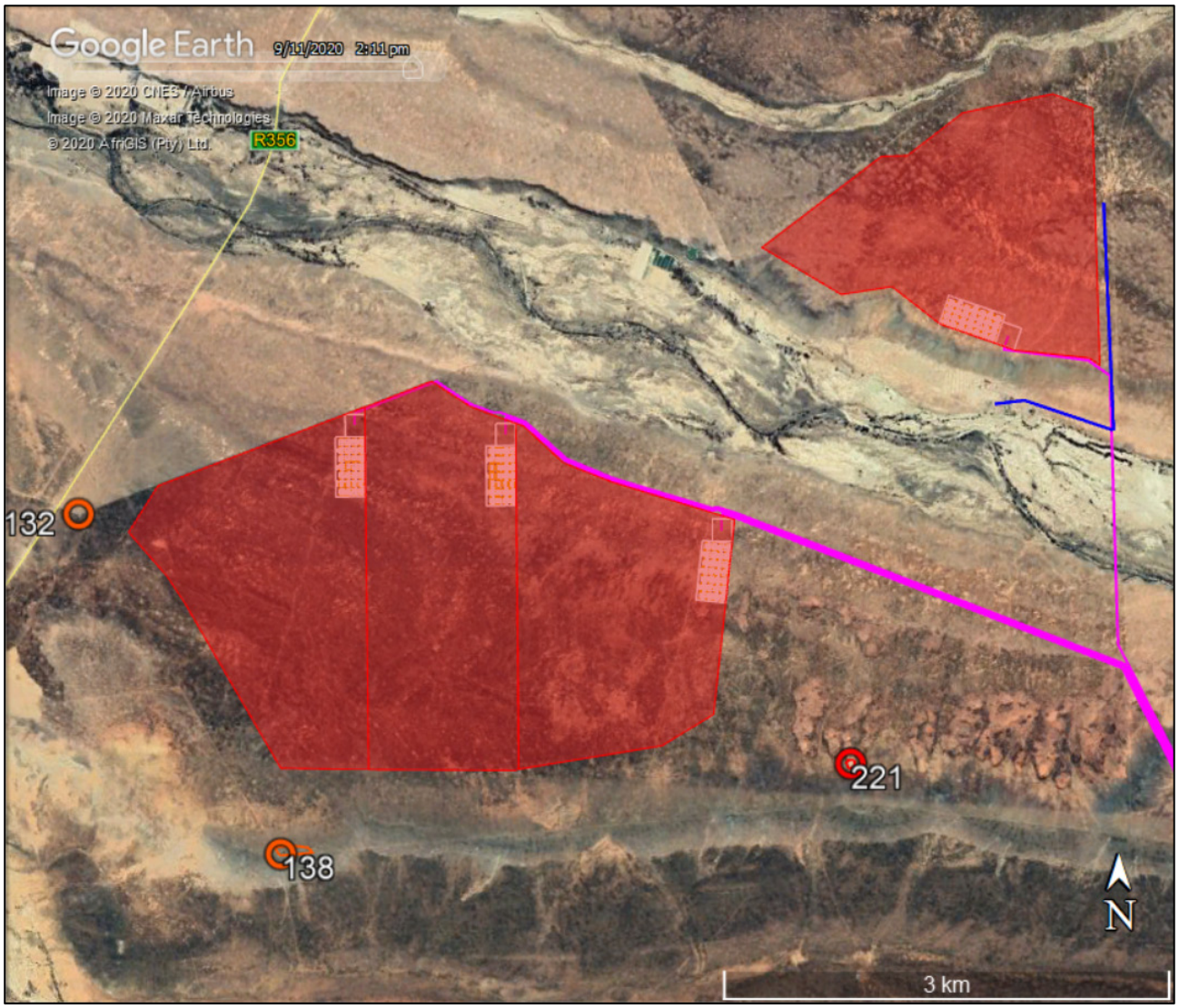


Figure A3.5: *Aerial view of the PV site and surrounds showing the one Grade IIIA (waypoint 221) and two Grade IIIB heritage resources (waypoints 132 & 138).*

Figure A3.6: *Aerial view of the southern end of the power line corridor showing the Grade IIIC heritage resource requiring mitigation.*

APPENDIX 4 – Palaeontological study

Refer to separately attached document.

APPENDIX 5 – Visual Impact Assessment

Refer to Appendix C.2 of the BA Report for the Visual Impact Assessment.

APPENDIX 4 OF THE HERITAGE IMPACT ASSESSMENT: PALAEONTOLOGICAL INPUT TO HERITAGE IMPACT ASSESSMENT

PROPOSED DEVELOPMENT OF NINE 175 MW SOLAR PHOTOVOLTAIC FACILITIES AND ASSOCIATED ELECTRICAL GRID INFRASTRUCTURE NEAR TOUWSRIVER, WITZENBERG LOCAL MUNICIPALITY, WESTERN CAPE

Dr John E. Almond
***Natura Viva* cc**
PO Box 12410 Mill Street
CAPE TOWN 8010, RSA

October 2020

EXECUTIVE SUMMARY

The Project Applicant is proposing to develop nine 175 MW Solar Photovoltaic (PV) power generation facilities in the Ceres Karoo region near Touwsrivier, situated in the Witzenberg Local Municipality of the Western Cape Province. Each solar PV facility will have a range of associated infrastructure, including an on-site substation with Battery Energy Storage System (BESS), and will connect to the existing Eskom Kappa Substation *via* a dedicated 132 kV power line. The proposed PV facilities will be constructed on the following farm portions: Remainder of Grootfontein Farm 149; Portion 5 of Grootfontein Farm 149; Remainder of Witte Wall Farm 171; and Portion 1 of Hoek Doornen Farm 172. The power lines will traverse these farm portions, as well as the farms Die Brak 241 and Platfontein 240. Given the very similar geological and palaeontological context and scale of each of the nine proposed solar PV facilities and its associated power lines, the impact assessments and mitigation recommendations for each project are identical and can be summarized as follows:

The solar PV facility project area is situated on a flat to gently-sloping pediment surface of Late Caenozoic (Neogene – Pleistocene) age on the flanks of the Grootrivier Valley which drains this sector of the Ceres Karoo. The pediment surface has been planed-off by river erosion into underlying fine-grained, non-marine, basinal to distal submarine fan sediments of the Tierberg Formation (Ecca Group) that are Middle Permian in age. Field surveys show that the Tierberg bedrocks beneath the thin (few dm to few meters maximum) capping of alluvial gravels, calcrete hardpans, sandy soils and downwasted surface gravels capping the pediment surface are weathered, folded and often tectonically-cleaved. The only fossil remains recorded from such pediment settings in the Ceres Karoo comprise (1) sparse, generally small blocks of reworked silicified fossil wood within alluvial and surface gravels of uncertain provenance (probably Ecca Group) and (2) occasional calcretised fossil termite nests of probable Pleistocene age that are found embedded within calcretised superficial sediments as well as weathered, calcrete-veined bedrocks. The majority of fossil sites recorded fall within designated No-Go areas lying *outside* the project footprint. These fossils are of widespread occurrence within the Ceres Karoo region and are not of high scientific interest or conservation value. No fossil sites of high sensitivity or No-Go areas were identified within the solar PV project areas during the palaeontological field survey and the palaeontological sensitivity of the project area is assessed as generally LOW.

The power line corridor between the solar PV sites and the existing Kappa Substation on Platfontein 240 traverses the outcrop areas of the Permo-Carboniferous, glacial-related Dwyka Group as well as the lower Ecca Group (Prince Albert, Whitehill and Collingham Formations). The potentially-fossiliferous Prince Albert, Whitehill and Collingham Formations are highly weathered and cleaved in this region. No sensitive fossil sites have been recorded within or close to the proposed corridor on Die Brak 241 and Platfontein 240 during the present field survey or several previous field studies in the vicinity by Almond (2010a-c, 2016a) and the palaeontological sensitivity of the corridor is assessed as LOW.

As a consequence of (1) the paucity of irreplaceable, unique or rare fossil remains within the development footprint, as well as (2) the extensive superficial sediment cover overlying most potentially-fossiliferous bedrocks within the solar PV facility and power line project area, the overall impact significance of the construction phase of the proposed solar PV facility regarding legally-protected palaeontological heritage resources is assessed as *VERY LOW* (*negative status*), with and without mitigation. This assessment applies to all the associated solar PV facility and power line infrastructure within the project area. No significant further impacts on fossil heritage are anticipated during the operational and decommissioning phases of the solar PV energy facility and associated infrastructure. The No-Go alternative (*i.e.* no solar PV facility and power line development) will probably have a neutral impact on palaeontological heritage. Confidence levels for this assessment are MEDIUM, given the generally low exposure levels of potentially-fossiliferous bedrocks.

Anticipated cumulative impacts in the context of other renewable energy projects in the Ceres Karoo region – *including* the nine solar PV facilities - are assessed as *LOW (negative)* without mitigation but *VERY LOW (negative)* with mitigation. It is concluded that as far as fossil heritage resources are concerned, the proposed solar facility and power line projects, whether considered individually or together, will *not* result in an unacceptable loss or unacceptable additional impacts, considering all the renewable energy projects proposed in the area. This analysis only applies *provided that* all the proposed monitoring and mitigation recommendations made for all these various projects are consistently and fully implemented.

No specialist palaeontological monitoring or mitigation is recommended for this development, pending the potential discovery of significant new fossil material here during the construction phase. The ECO should be made aware of the possibility of important fossil remains (bones, teeth, petrified wood, plant-rich horizons, fossil termitaria *etc.*) being found or unearthed during the construction phase of the development. Monitoring for fossil material of all major surface clearance and deeper (>1m) excavations by the Environmental Control Officer on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape for recording and sampling by a professional palaeontologist. The palaeontologist concerned will need a Fossil Collection Permit from Heritage Western Cape and all fossil material collected must be properly curated in an approved repository (museum / university collection). These recommendations must be included within the Environmental Management Programme (EMPr) for the solar PV facility and power line developments. A protocol for Chance Fossil Finds is appended to this report (Appendix C).

There are no identified fatal flaws and no objections on palaeontological heritage grounds to authorisation of the proposed solar PV facilities with its associated power line connections to the Kappa Substation.

1. INTRODUCTION & BRIEF

1.1. Project outline

The Project Applicant is proposing to design, construct and operate nine 175 MW solar photovoltaic (PV) power generation facilities in the Ceres Karoo region near Touwsrivier, situated in the Witzenberg Local Municipality of the Western Cape Province. Each solar PV facility will have a range of associated infrastructure, including an on-site substation with a Battery Energy Storage System (BESS), and will connect to the Eskom Kappa Substation *via* a dedicated 132 kV power line. The proposed PV facilities will be constructed on the following farm portions (Fig. 1):

- Remainder of Grootfontein Farm 149;
- Portion 5 of Grootfontein Farm 149;
- Remainder of Witte Wall Farm 171; and
- Portion 1 of Hoek Doornen Farm 172.

The power lines will traverse these farm portions, as well as the farms Die Brak 241 and Platfontein 240 (Fig. 1).

A total of four separate Basic Assessment processes are being conducted for the following projects (Fig. 1):

- Witte Wall Farm 171: 2 PV Facilities (*i.e.* **Witte Wall PV 1 and PV 2**) and Associated Infrastructure;

- Grootfontein Farm 149: 3 PV Facilities (*i.e.* **Grootfontein PV 1, PV 2 and PV 3**) and Associated Infrastructure;

- Hoek Doornen Farm 172: 4 PV Facilities (*i.e.* **Hoek Doornen PV 1, PV 2, PV 3 and PV 4**) and Associated Infrastructure; and

- Electrical Grid Infrastructure for each PV Plant (*i.e.* 9 Power Lines and 9 onsite substations) and Associated Infrastructure.

A detailed description of each PV project is supplied in the Heritage Impact Assessment reports.

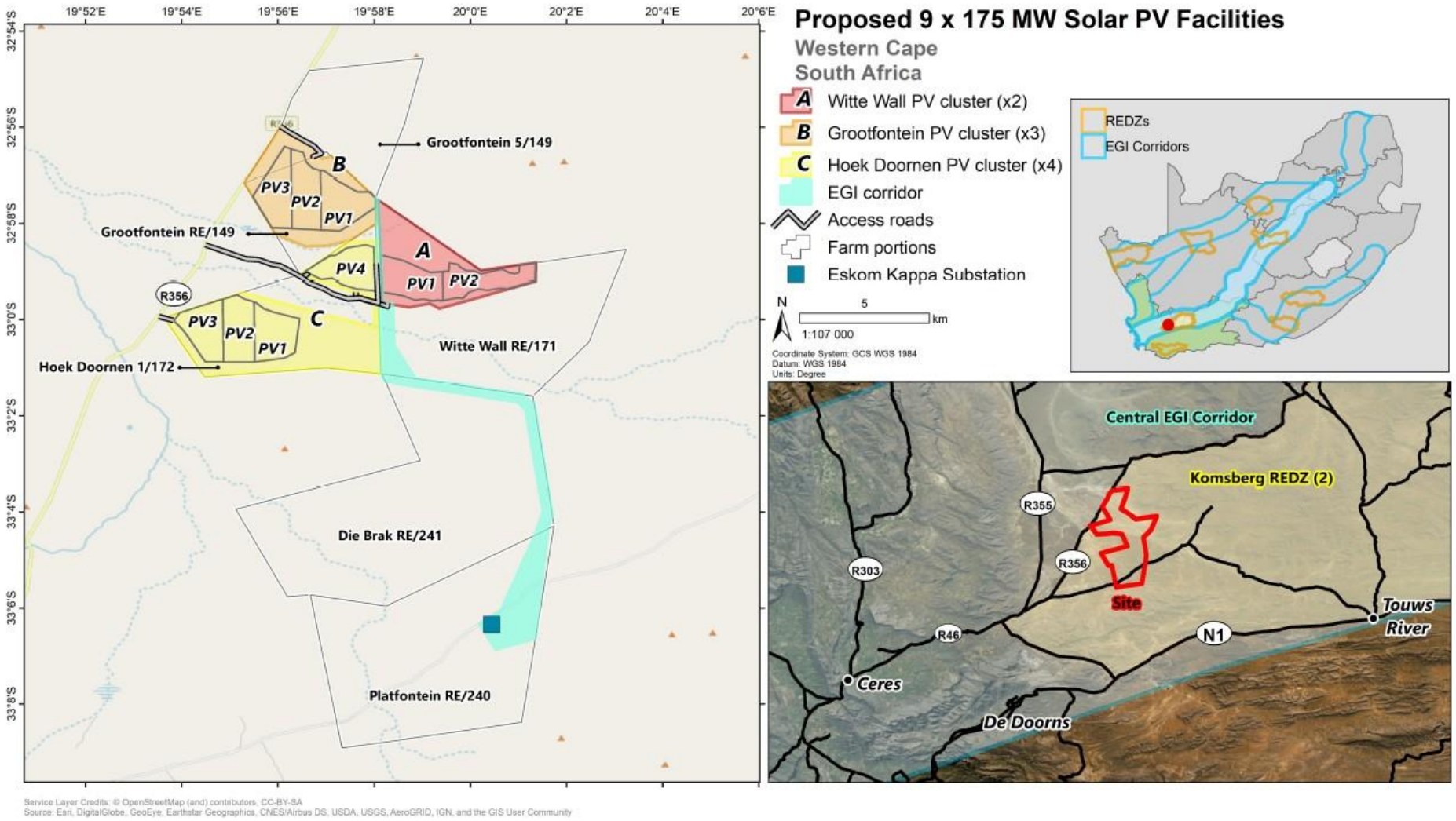


Figure 1: Maps showing the location of the solar PV facility project area in the Ceres Karoo region, *c*. 40 km north of Touwsrivier, Witzenberg Local Municipality, Western Cape Province (Image supplied by CSIR - Environmental Management Services). The project area lies within the Komsberg Renewable Energy Development Zone 2 (REDZ 2).

1.2. Purpose of report

The project area for the proposed solar PV facilities and associated power lines is underlain by potentially-fossiliferous sedimentary bedrocks of the Karoo Supergroup (Dwyka and Ecca Groups) as well as Late Caenozoic superficial deposits (Sections 4 & 5). The construction phase of the developments may entail the disturbance, damage, destruction or sealing-in of scientifically valuable and legally protected palaeontological heritage resources preserved at or beneath the ground surface within the project footprint. No further significant impacts on palaeontological heritage are anticipated during the operational and decommissioning phases of the developments.

Because the project areas lie within the gazetted Komsberg Renewable Energy Development Zone (REDZ 2) gazetted by the Minister of Environmental Affairs in Government Gazette 41445, Government Notice (GN) 114 on 16 February 2018 (*cf* Fourie *et al.* 2015), the proposed renewable energy projects will be subject to a Basic Assessment (BA) Process. The present combined Palaeontological Heritage Assessment Report will contribute to the three separate consolidated Basic Heritage Impact Assessments (HIAs) for the proposed solar PV facilities and their associated power lines, as listed above, in accordance with the latest requirements of the 2014 National Environmental Management Act (Act 107 of 1998, as amended in 2017) (NEMA) Environmental Impact Assessment (EIA) Regulations. The consolidated HIAs are being compiled by Dr Jayson Orton of ASHA Consulting (Pty) Ltd (Contact details: 40 Brassie Street, Lakeside, 7945, South Africa. Telephone: 021 783 0557. E-mail: jayson@asha-consulting.co.za).

Four separate BA Processes as listed in Section 1.1 are being conducted for the solar PV facility and power line developments on behalf of the proponent by the CSIR - Environmental Management Services, Durban (Contact details: Ms Rohaida Abed. CSIR - Environmental Management Services. P.O. Box 59081, Umbilo, Durban, 4075. Tel: 031 242 2318. Fax: 031 261 8172. E-mail: rabed@csir.co.za).

1.3. Terms of reference

The Terms of Reference for this palaeontological study, as specified by the CSIR, are as follows:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. This specifically includes Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed.
- Provide a Site Sensitivity Verification Report based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.
- Compile a Palaeontological Impact Assessment (PIA) in compliance with Appendix 6 of the 2014 NEMA EIA Regulations (as amended) and any additional relevant legislation and guidelines that may be deemed necessary.
- The specialist must undertake a site visit in order to identify the level of sensitivity assigned to the project area on the Screening Tool, and to verify and confirm this sensitivity and land-use.
- Determination, description and mapping of the baseline environmental condition and sensitivity of the study area. Specify set-backs or buffers, and provide clear reasons for these recommendations.

- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.
- Prepare and undertake a study on the palaeontology and fossil heritage within the proposed project area, based on:
    - Site visit (as required);
    - a review of all relevant palaeontological and geological literature, including
        - geological maps and previous reports,
        - location and examination of fossil collections from the study area (e.g. museums), and
        - data on the proposed development (e.g. location of footprint, depth and volume of bedrock excavation envisaged).
- Describe the type and location of known palaeontology and fossil heritage sites in the study area, and characterize all items that may be affected by the proposed project.
- Note fossils and associated sedimentological features of palaeontological relevance (photos, maps, aerial or satellite images, and stratigraphic columns).
- Evaluate the potential for occurrence of palaeontology and fossil heritage features within the study area.
- Identify and rate potential direct, indirect and cumulative impacts of the proposed project on the palaeontology and fossil heritage during the construction, operational and decommissioning phases of the project. Study the cumulative impacts of the project by considering the impacts of existing renewable energy plants within the area (as well as those proposed), together with the impact of the proposed project.
- Identify any protocols, legal and permit requirements that relevant to this project and the implications thereof.
- Provide recommendations and suggestions regarding fossil heritage management on site, including conservation measures, as well as promotion of local fossil heritage to ensure that the impacts are limited.
- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts. Also identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts.
- Incorporate and address all review comments made by the Project Team (CSIR and Project Applicant) during the various revisions of the specialist report.
- Incorporate and address relevant issues and concerns raised by Stakeholders (i.e. Heritage Western Cape and South African Heritage Resources Agency (SAHRA)), Competent Authority, Interested and Affected Parties (I&APs) and the public during the Public Participation Process (where relevant and applicable).
- Review the Generic Environmental Management Programme (EMPr) for 1) Power Lines and 2) Substations (GN 435).

2. STUDY APPROACH

The approach to this palaeontological heritage study can be briefly summarized as follows. Fossil bearing rock units occurring within the broader study area (including all relevant land parcels) are determined from geological maps and relevant geological sheet explanations as well as satellite images. Known fossil heritage associated with each rock unit is inventoried from published and unpublished scientific literature, previous PIAs of the broader study region, and the author's field

experience and palaeontological database (*cf* Almond & Pether 2008). Based on this data as well as field examination of representative exposures of all major sedimentary rock units present, both within and in the vicinity of the project footprint, the impact significance, including cumulative impacts, of the proposed developments is assessed using the methodology specified by the CSIR. Recommendations for any further studies or mitigation are outlined for inclusion within the EMPr for the development.

In the case of the present solar PV facility assessments, several transects across the stratigraphy underlying the three affected land parcels were made over the course of four days in order to gauge the levels of exposure, weathering, tectonic deformation and palaeontological sensitivity of each of the sedimentary rock units represented here. The power line corridors between the PV facility project areas and the Kappa Substation were mainly assessed on the basis of data from several relevant PIA reports by the author (notably Almond 2010a-c, 2016b) as well as additional field observations made for an adjoining renewable energy development in 2020.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013) and by Heritage Western Cape (2016).

2.1. Information sources

The present combined desktop and field-based palaeontological heritage assessment for the solar PV facilities and associated power lines is based on:

- A brief project outline, kmz files and maps provided by CSIR - Environmental Management Services;
- A desktop review of (a) the relevant 1: 50 000 and 1: 250 000 scale topographic maps, (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including 1: 250 000 geological maps and accompanying sheet explanations (Theron 1983, Theron et al. 1991, Gresse & Theron 1992, Almond 2008b) as well as (d) several previous and on-going fossil heritage assessments in the Ceres Karoo region by the author and colleagues (e.g. Almond 2010a, 2010b, 2010c, 2010d, 2015a, 2016a, 2016b, 2018, 2020, Almond in prep. and Butler 2018);
- The author's field experience with the formations concerned and their palaeontological heritage (cf Almond & Pether 2008, Almond 2008b and PIA reports listed in the References); and
- A four-day field assessment of the study area, including all land parcels involved, by the author and an experienced field assistant, Madelon Tusenius, during the period 7 to 10 September, 2020. The season in which the site visit took place has no bearing on the study.

2.2. Assumptions and limitations

The accuracy and reliability of palaeontological specialist studies as components of HIAs are generally limited by the following constraints:

- 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.

- 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 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.
- Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;
- 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;
- 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 PIA may be significantly enhanced through field assessment by a professional palaeontologist. In the present case, site visits to the study areas in some cases considerably modified our understanding of the rock units (and hence potential fossil heritage) represented there.

In the case of the present study area in the Ceres Karoo region near Touwsrivier (Western Cape) exposure of potentially fossiliferous bedrocks is very limited, due to extensive cover by superficial sediments and karroid *bossieveld* vegetation. However, sufficient exposures were examined to allow a realistic assessment of the palaeontological sensitivity of the key rock units (See Section 4), while a substantial amount of relevant geological and palaeontological data is available from previous PIAs in the region (See, for example, References under Almond). Confidence levels for this assessment are accordingly rated as Medium. Comparatively few academic palaeontological studies have been carried out in the region, so any new data from impact studies here are of scientific interest.

3. LEGISLATIVE CONTEXT AND PERMIT REQUIREMENTS

All South African fossil heritage, including palaeontological sites and specimens, is protected by law (South African National Heritage Resources Act, 1999). South African fossils cannot be collected, damaged, destroyed or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency.

Where palaeontological mitigation of a development project in the Western Cape is required, the palaeontologist concerned with mitigation work would need a valid fossil collection permit from Heritage Western Cape (HWC). Any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for palaeontological studies developed by SAHRA (2013) and Heritage Western Cape (2016).

The present palaeontological heritage assessment 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 EMPr 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 authority.
(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 authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
(4) No person may, without a permit issued by the responsible heritage resources authority—
(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 authority 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 authority 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.

- **Legislative and Permit Requirements for potential specialist mitigation**

(1) Should professional palaeontological mitigation be necessary during the construction phase, the palaeontologist concerned will need to apply for a Fossil Collection Permit from Heritage Western Cape. (2) Palaeontological collection should comply with international best practice. (3) All fossil material collected must be deposited, together with key collection data, in an approved depository (museum / university). (4) Palaeontological mitigation work including the ensuing Fossil Collection reports should comply with the minimum standards specified by Heritage Western Cape (2016) and SAHRA (2013).

4. GEOLOGICAL SETTING

The combined proposed PV facility and power line project area is located in a low-lying, semi-arid extension of the Great Karoo region known as the Ceres Karoo or southern Tanqua Karoo. It is situated between the rugged Bontberg mountain range to the south – a west-east trending subunit of the Cape Fold Mountains - and the foothills of the Klein-Roggeveld Escarpment to the north. Topographic relief here is generally low (Figs. 5 to 7), with elevations between 600 and 700 m amsl (above mean sea level), since the area is largely underlain by readily-weathered, clay-rich sedimentary rocks and has experienced extensive, protracted weathering and denudation by post-Gondwana river systems during the Caenozoic Era. The area is drained by the non-perennial Grootrivier and its various tributaries (notably the Klein-Droëlaagte); the Grootrivier is itself a tributary of the extensive Doringrivier – Tanquarivier drainage system of the Ceres – Tanqua Karoo. Levels of bedrock exposure in the flatter-lying portions of the Ceres Karoo region are generally poor, except along larger water courses (Figs. 4, 14), because in most areas there is extensive cover by alluvial and colluvial deposits (*e.g.* river conglomerates, grits and sands as well as surface gravels, soils) and by karroid vegetation - Tanqua Karoo and Koedoesberg-Moordenaarskaroo bossieveld *plus* Tanqua Wash Riviere along drainage channels.

In geological terms the PV facility and transmission line project area lies along the south-western margin of the Main Karoo Basin of South Africa (Johnson *et al.* 2006). The bedrocks have been deformed during the Permo-Triassic Cape Orogeny (mountain building event) and thus lie within, and towards the northern margin of, the Cape Fold Belt (CFB), within or just to the east of the Cape syntaxis (*i.e.* junction of the N-S and E-W branches of the CFB). The geology of the study area is outlined on the four adjoining 1: 250 000 geology sheets Clanwilliam 3218, Sutherland 3220, Worcester 3319 and Ladismith 3320 (Council for Geoscience, Pretoria) (Fig. 2). A total of

seven mappable sedimentary rock units (formations) are represented within the study area, most of which are assigned to the **Karoo Supergroup** and are of Gondwanan (Permo-Carboniferous) age (See stratigraphic column in Fig. 3). Within the PV facility project area, the Karoo bedrock succession generally youngs to the north and northeast towards the Klein-Roggeveld Escarpment. The power line connection southwards to Kappa Substation traverses a broad anticline-syncline pair of Dwyka and Ecca Group bedrocks with WSW-ESE fold axes which is clearly picked out by the sinuous ridge of the more resistant-weathering Collingham Formation (marked by a pale band on satellite images) as well as cyclical banding within the dark Dwyka outcrop area. Nevertheless, given the gentle nature of the broad-scale folding, levels of tectonic deformation are generally low, with gentle bedding dips of 5º to 20° (occasionally higher dips are seen along the banks of the Grootrivier; Figs. 4, 14). A tectonic cleavage may be well-developed within finer-grained mudrocks, especially towards the Bontberg range in the south, while soe brittle rock units such as the cherty beds within the Collingham Formation show pronounced, closely spaced jointing (Fig. 13). Only very minor intrusions of the Karoo Dolerite suite - a single narrow but regionally persistent dolerite dyke (Fig. 19) - are mapped within the study area.

The geology and sedimentology of the various sedimentary rock units represented in the solar facility and power line project area has been covered in some detail, with extensive references, in previous PIAs for the Ceres Karoo region and southern margins of the Great Karoo by the author (*e.g.* Almond 2016a-b, 2018, 2020) and will not be repeated here.

4.1. Dwyka Group

Portions of the power line route on Die Brak 241 as well as in the vicinity of Kappa Substation on Platfontein 240 are underlain by Late Carboniferous to Early Permian glacial sediments of the **Dwyka Group** (**C-Pd**), namely the **Elandsvlei Formation** (Fig. 8). The Dwyka rocks here, with a brownish hue on satellite images, build the cores of WSW-ENE trending CFB mega-anticlines. They are generally poorly exposed, with the exception of several good sections of grey, clast-rich Dwyka tillite seen along larger water courses such as the Kareerivier to the east and north of Die Brak homestead (Almond 2016a). The tillites display well-developed tombstone weathering which clearly developed before deposition of the overlying pervasive mantle of gravelly to sandy alluvial sediments. Low hills and ridges of Dwyka rocks within the region probably represent the coarser basal portion of several deglaciation cycles which impart a colour-banded pattern to the Dwyka outcrop area. A series of several low, rocky outcrops of greyish, gritty to pebbly, locally cross-bedded or deformed quartzites and sandstones in the central portion of Die Brak probably represent glacial outwash fans or eskers within the Elandsvlei Formation. The quartzose bodies are only a few meters across and irregular in geometry (Almond 2016a).

4.2. Ecca Group

The remainder of the power line corridor as well as all the proposed PV project areas are underlain at depth by basinal “marine” to submarine fan sediments of the **Ecca Group** that were deposited within an extensive brackish to freshwater inland lake or Ecca Sea in Early to Middle Permian times (Cole & Basson 1991, Cole 2005, Viljoen 2005). Several lower Ecca Group formations, predominantly recessive-weathering mudrocks with subordinate fine-grained wackes (impure sandstones), crop out here around the flanks of the WSW-ENE trending mega-anticline. In order of decreasing age these are: the Prince Albert Formation (Pp/ Ppr), the Whitehill Formation (Pw), the Collingham Formation (Pc) and the Tierberg Formation (Pt / K2S1).

The **Prince Albert Formation** forms low-lying terrain of little relief that is largely blanketed in alluvial soils and fine surface gravels downwasted from the nearby Collingham outcrop area. Limited exposures on the northern edge of Die Brak 241 (Fig. 9) favour zones of thin, resistant-weathering but highly-jointed, grey-green to yellowish-weathering cherty bands or lenticles. Some of these beds are strongly mineralised with rusty iron and metallic-grey manganese ores associated with snuffbox weathering.

The **Whitehill Formation** is exposed in numerous small erosion gullies on the south- and west-facing flanks of the low range of hills that defines the border between Die Brak 241 and Witte Wall 171, curving southwards through Rietpoort RE/243 just to the east of the power line corridor. The originally thinly-laminated, dark, carbonaceous Whitehill mudrocks here are invariably highly altered through near-surface weathering to friable, white or cream saprolitic material traversed by veins of multi-hued secondary minerals. Large, boulder-sized, sphaeroidal concretions of greyish dolomite weather out in the lower part of the succession (Fig. 11).

The overlying **Collingham Formation** builds the crests and dip slopes of the sinuous range of low hills described earlier which runs to the south of the PV project areas but is followed or traversed by the power line corridor at several points (*e.g.* southern margins of Hoek Doornen 172 – Witte Wall 171 project areas; see satellite image Fig. 53). The Collingham exposures are dominated by several prominent-weathering, highly-jointed, tabular cherty beds between 20 and 50 cm in thickness that show local thrusting and small-scale folding (Figs. 12 & 13). These cherty layers are broadly equivalent to the **Matjiesfontein Member** identified within the Collingham Formation elsewhere along the southern Karoo margin; the presence of several chert bands is a special feature of the Collingham Formation in the Ceres Karoo region (*cf* Almond 2015a). Where they are not too intensely jointed, the Collingham cherts have been extensively exploited by Stone Age peoples as raw material for stone artefacts. These last often abound in the vicinity of the chert bands. For example, an unusually dark grey, hornfels-like chert bed along the Hoek Doornen fence line is associated with a carpet of anthropogenically flaked rubble while the *in situ* chert itself as well as large float blocks in the area show abundant evidence of flaking. The intervening grey hackly-weathering siltstone horizons are occasionally exposed in erosion gullies (*e.g.* on Witte Wall 171). The majority of the narrow Collingham outcrop area is typically mantled by angular, blocky colluvial gravels of grey, silicified mudrock that show up clearly as a pale brownish zone on satellite images. The cherty Collingham gravels also cover most of the lower-lying Whitehill Formation outcrop and the lower beds of the adjoining Tierberg Formation (Fig. 37).

The **Tierberg Formation** that underlies all the PV facility project areas on Witte Wall 171, Hoek Doornen 172 and Grootfontein 149 where it is almost entirely covered by a blanket of alluvial sediments and soils (Figs. 4, 14-18). There are occasional good exposures along the steep southern banks of the Grootrivier and much more limited ones in the beds of its shallow tributaries. Near-surface, as well seen along the northern bank of the Grootrivier on Karee Kolk 174 as well as in low pediment escarpment exposures north of the Grootrivier, the Tierberg mudrocks are usually weathered and crumbly with no bedding plane exposure and are in addition extensively veined by Late Caenozoic calcrete (Fig. 5). The Tierberg succession is dominated by laminated to thin-bedded, highly-tabular, dark grey to khaki mudrocks with zones of large, oblate sphaeroidal to flattened lenticular concretions and lenticular beds of rusty-brown, ferruginous carbonate or mudrock. The concretions are late diagenetic and often display superficially fossil-like cone-in-cone structures (Fig. 41). Pale, grey-green bands of friable, fine-grained clay-like material may be altered tuff bands (volcanic ashes).

4.3. Karoo Dolerite Suite

A straight SE-NW trending dyke of the Early Jurassic **Karoo dolerite suite** traversing the NE part of Die Brak 241 from Riet Poort 243 is mapped on 1: 250 000 sheet 3320 (Fig. 2). The same intrusion probably extends further to the NW into the PV project area since it re-appears along strike close to the intersection of farms Grootfontein 149, Hoekdoornen 172 and Karee Kolk 174. This subvertical dyke of rusty-brown dolerite reaches a thickness of 2.5 m to 6 m (but is often thinner) with narrower veins or apophyses extending into the Tierberg country rocks. It features impressive radiating fans of pale bladed sparry calcite (Fig. 19).

4.4. Late Caenozoic superficial deposits

As is apparent in satellite images, and especially in the field, the Palaeozoic sedimentary bedrocks in the Ceres Karoo region are extensively blanketed by a range of – mostly unconsolidated - superficial deposits. These include pedocretes (*e.g.* calcrete), colluvium (slope deposits such as scree and hillwash), sheetwash and alluvial (river) sediments, surface gravels as well as silty, sandy and gravelly / rocky soils of mainly Quaternary to Recent age. Of these younger sedimentary units, most are too thin to be mapped separately at 1: 250 000 scale.

A wide range of **Late Caenozoic alluvial deposits** are represented within PV facility and power line project area, especially along the Grootrivier and other larger drainage systems, as well as in the *vlaktes* to the north and south of the Grootrivier on Witte Wall 171, Hoek Doornen 172 and Grootfontein 149 (Figs. 20 to 37). The dominant geomorphological feature here, clearly seen on satellite images, are series of dissected, flat to very gently sloping **pediment surfaces** planed across the Tierberg Formation bedrocks by earlier phases of the Grootrivier (Fig. 53). There is a flight of at least three or more pediment surfaces which increase in elevation and age with distance from the modern rivier. Based on (*N.B.* very inaccurate) Google Earth spot heights, these surfaces lie at approximately 580 m amsl., 600 m amsl and 620-640 m amsl (the last outside and NE of the project area). The surfaces slope gently down in a downstream direction and even the lowest lies some 10-15 m or more above present day river level. The ages of these surfaces is uncertain but is likely to span at least the Late Neogene Period and Pleistocene Epoch. The key infrastructure for all the PV facilities will be situated on these almost level to stepped pediment surfaces (Fig. 53).

In contrast to their marginal scarps, where weathered and calcretised Tierberg Formation bedrocks are locally exposed, the pediment surfaces are widely mantled by alluvial gravels) of guesstimated Late Neogene to Pleistocene age (Figs. 6 & 29). The relict gravelly patches are mapped along the banks of the Grootrivier as so-called **High Level Gravels** and are provisionally assigned to the **Grahamstown Formation** (Tg), doubtless a misnomer since no *in situ* evidence of the extensive silcretisation typical of this latter rock unit is observed. The coarse, poorly-sorted alluvial to downwasted pediment gravels are generally dominated by angular to subrounded reddish-brown weathering Ecca wackes with subordinate ferruginised mudrock (often desert-varnished), pale grey Matjiesfontein Member chert, white Witteberg quartzite, rare pale yellowish-green, orange-patinated tuff or tuffite, vein quartz, polymict Dwyka erratics (*e.g.* Precambrian vesicular lavas, silicified breccias), occasional dolerite and small clasts of petrified wood. Larger, boulder-sized clasts may retain surface impact crescents. An interesting, locally abundant component to the pediment gravels are pale grey to buff or yellowish-green sandy to gritty silcretes whose provenance is currently unclear; they may have been derived from Neogene silcrete outcrops (the "real" Grahamstown Formation) further to the east within the Grootrivier catchement area that have since been completely denuded. A high proportion of the silcrete clasts are anthropogenically

flaked (Fig. 30). On satellite images the pediment surfaces are densely pock-marked by small round *heuweltjies* of possible termite and / or bush-clump origin. Away from the edges of the pediments, flat areas are often mantled with pale orange sandy to silty soils (possibly with aeolian reworking in places) with sparse gravels or unvegetated patches with fine sheetwash gravels (Figs. 31 to 33).

A well-developed, solid to rubbly or nodular **calcrete hardpan** up to a few meters thick typically crops out along the crests of the marginal scarp defining the relict pediment surfaces patches (Figs. 4, 5 & 20 to 22). This is well seen, for example, on Karee Kolk 174 on the northern bank of the Groootrivier. The underlying Tierberg mudrocks are weathered and calcrete veined. Excellent exposures of calcretised fluvial conglomerates up to several (3-10) meters-thick are seen along the south bank of the Grootrivier on Witte Wall 171 where they show a sharp basal angular unconformity overlying inclined Tierberg Formation bedrocks that may be elevated up to 10 m or more above the present river bed. The conglomerates are oligomict (dominated by Ecca wackes), poorly-sorted with local development of current-generated clast imbrication as well as interbedded lenticular to tabular packages of pale brownish to greyish, gritty, horizontally-bedded to cross-bedded, calcretised sands. These last sometimes cap or pass horizontally into coarse channel lag conglomerates incised into the bedrock representing perched tributaries of the ancient Grootrivier. The ruditic High Level Gravel alluvial deposits are in turn overlain by unconsolidated younger alluvial silts and sands as well as aeolian reworked sands. Dispersed angular clasts of pale greyish Matjiesfontein chert within the High Level Gravels are often marginal flaked but this might be natural damage rather than anthropogenic (Fig. 20).

Blocky **colluvial gravels** are well seen on the steep to gentle slopes of low hills capped by the Collingham Formation, as described earlier (Fig. 37). Extensive flat-lying portions of the study area, including parts of the pediment surfaces, feature sheetwashed **surface gravels** of various sorts that are best seen in unvegetated patches. The sheetwash gravels are fine, angular to subrounded and dominated by reistent-weathering lithologies such as cherts, silicified and ferruginised mudrocks with occasional small blocks of petrified wood (Figs. 31 & 32).

Coarse cobbly to bouldery modern gravels strongly dominated by Ecca wackes as well as finer alluvial sands occur along the present course of the Grootrivier. Distinctive coarse, multi-hued, oligomict gravels rich in silcrete clasts are seen along bed of Klein-Droëlaagte where they are exposed as low gravel bars and in stream banks beneath sandy alluvium (Figs. 24 to 26). As well as lots of silcrete, these gravels include clasts of Matjiesfontein cherts, highly patinated wacke, occasional quartzite, Dwyka erratics (vesicular lavas, silicified breccias) and weathered-out Tierberg ferruginous carbonate concretions (Fig. 41). The clasts are variously angular to well-rounded. They are of interest in that they are often (but not invariably) associated with abundant Early Stone Age (ESA) bifaces (Pleistocene) as well as occasional small blocks of petrified wood and rare small fossil logs (Section 5 and Fig. 44). The contrast between these polymict gravels and the local modern river gravels in terms of clast lithology, archaeology and palaeontology suggests that they may have a different provenance, perhaps reflecting different drainage patterns in Plio-Pleistocene times. They are largely buried beneath younger superficial sediments and only exposed where the modern and fossil drainage networks intersect.

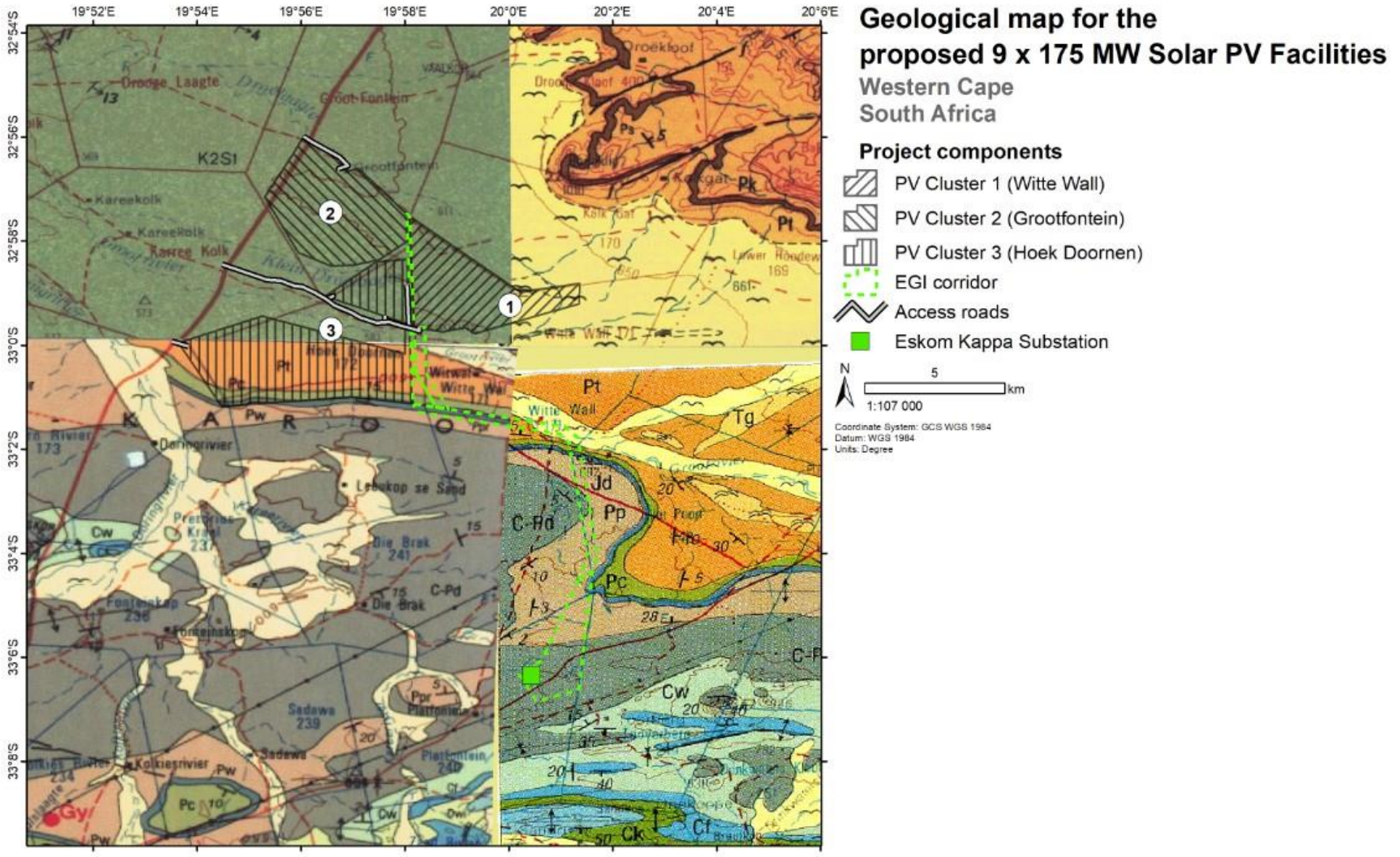
Thick deposits of alluvial sands along the course of the Grootrivier locally contain nodular calcrete hardpans. Locally they have been reworked into small **aeolian dunefields** characterised by well-sorted, orange-brown unconsolidated fine sands, locally displaying large scale dune cross-sets

(Fig. 35). Deflation of fine river sands up onto adjacent hillslopes is well seen in the southern portion of Hoek Doornen 172 where the dunes support a distinctive shrubby vegetation (Fig. 34).

Surface gravels overlying the Dwyka Group are typically highly polymict, *i.e.* composed of a wide range of rock types (cherts, carbonates, quartzites, lavas, granites *etc*), reflecting the range of glacial erratics enclosed by the underlying tillites. Fine pebbly gravels overlying the Prince Albert Formation are dominated by angular to subrounded cherty and siliceous mudrock clasts, many of which are ferruginised or with a well-developed patina of desert varnish (Fig. 10). **Calcrete hardpans** have developed within older sandy to silty alluvial deposits and soils, especially overlying the Dwyka Group, and are well exposed along the banks of drainage courses (*e.g.* near Die Brak homestead and along the banks of the Grootrivier) (Almond 2016a).

Figure 2 (following page): Extracts from four adjoining 1: 250 000 scale geology sheets Clanwilliam 3218, Sutherland 3220, Worcester 3319 and Ladismith 3320 (Council for Geoscience, Pretoria) showing the main stratigraphic units represented within the proposed solar PV facility and power line project area located *c*. 30 km north of Touwsrivier, Western Cape (black polygon). The dashed green polygon indicates the corridor for the power line connections to the existing Eskom Kappa Main Transmission Substation. The main geological units mapped within the study area include:

- **DWYKA GROUP: C-Pd (grey) = Elandsvlei Formation**
- **ECCA GROUP: Ppr, Pp (pale brown or buff) = Prince Albert Formation; Pw (dark blue) = Whitehill Formation; Pc (green, grey-green) = Collingham Formation; Pt, K2S1 (dark yellow, pale orange or grey) = Tierberg Formation**
- **KAROO DOLERITE SUITE: Jd (red line)**
- **SUPERFICIAL DEPOSITS: medium yellow (Tg with double flying bird symbol) = Tertiary or Quaternary High Level Gravels; pale yellow or white with single flying bird symbol = Quaternary to Recent alluvium**



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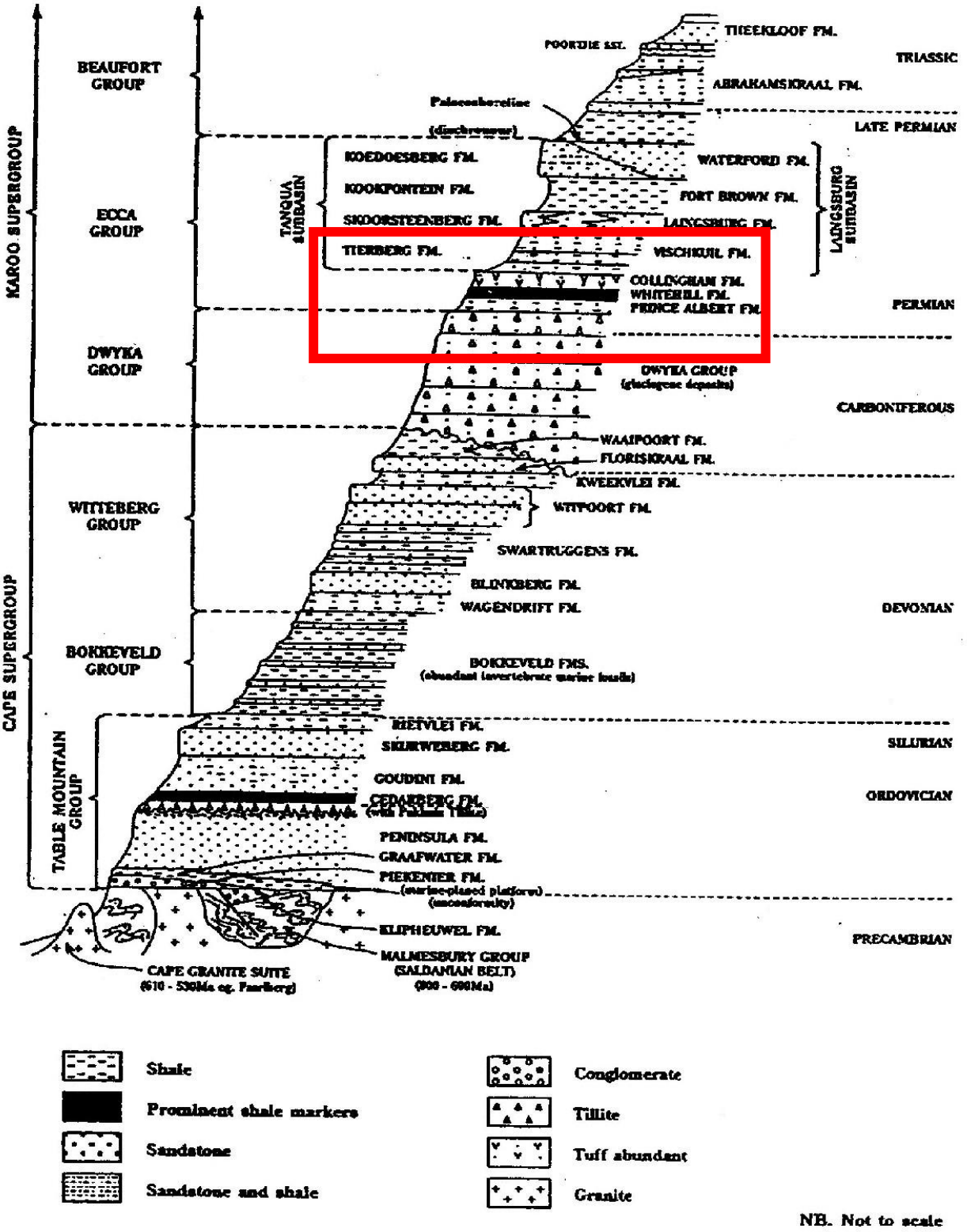

Figure 3: Schematic stratigraphic column for the Western Cape, the red box outlining the Late Palaeozoic formations of Karoo Supergroup sedimentary rocks that crop out in the solar PV facility and power line project area (Modified from original figure by H. de V. Wickens).

Figure 4: Riverine cliff exposure of eastward-dipping Tierberg Formation mudrocks unconformably capped by calcretised High Level Gravels with aeolian dune sands banked up against the cliff base, southern bank of the Grootrivier, Wittewall 171.

Figure 5: View eastwards along the low scarp marking the riverine edge of the lowest pediment surface on the northern side of the Grootrivier, Karee Kolk 174. The extensive flat-topped pediment is incised into weathered, khaki-hued Tierberg Formation mudrocks and its edge is heavily calcretised.

Figure 6: View southwards across the flat to gently sloping pediment surface on Grootfontein 149 with the Bontberg range in the background. The pediment surface here is mantled by poorly-sorted, downwasted alluvial gravels.

Figure 7: View of the low ridge of Ecca Group rocks running along the southern boundary of Witte Wall 171. The power line corridor runs along the ridge crest. Note thick sandy alluvial soils and dense *bossieveld* vegetation clothing the north-eastern sector of De Brak 241 in the foreground.

Figure 8: Typical appearance of the Elandsfontein Formation (Dwyka Group) outcrop area showing tombstone weathering of massive, grey-green tillites and polymict downwasted surface gravels derived from weathered-out glacial erratics, Die Brak 241 (From Almond 2016a).

Figure 9: Tabular-bedded, grey-green basinal mudrocks and fine-grained wackes of the Prince Albert Formation near the boundary between Die Brak 241 and Witte Wall 171 (From Almond 2016a). Good bedding plane exposures of this unit are rare.

Figure 10: Surface gravels overlying the Prince Albert Formation outcrop area, typically dominated by silicified mudrocks, cherts, vein quartz and other resistant-weathering rock types, with rare clasts of petrified wood of uncertain provenance, Die Brak 241 (Hammer = 30 cm).

Figure 11: Gullied exposure of highly-weathered, friable and mineralised mudrocks of the Whitehill Formation with boulder-sized dolomite concretions in the foreground, low hills along boundary between Witte Wall 171 and Die Brak 241 (From Almond 2016a).

Figure 12: Multiple tabular beds of prominent-weathering chert or silicified mudrocks assigned to the Matjiesfontein Member within the Collingham Formation, Witte Wall 171 (Hammer = 30 cm) (From Almond 2016a). The intervening mudrocks are mantled by downwasted cherty rubble.

Figure 13: Closely-spaced fracture set transecting brittle, silicified mudrock beds of the Collingham Formation, Witte Wall 171 (Hammer = 30 cm).

Figure 14: Eastward-dipping, laminated to thin-bedded, dark grey to khaki-weathering mudrocks with thin lenses and concretions of ferruginous carbonate as well as packages of brownish fine-grained wackes of the Tierberg Formation exposed along the southern banks of the Grootrivier, Witte Wall 171.

Figure 15: Stream gulley exposure of crumbly, weathered Tierberg Formation mudrocks with zone of prominent-weathering, rusty-brown, sphaeroidal diagenetic concretions of ferruginous carbonate, Witte Wall 171 (Hammer = 30 cm).

Figure 16: Stream bed exposure of gently-dipping, dark grey-green Tierberg Formation mudrocks along the Klein-Droëlaagte drainage line, northern margins of Hoek Doornen 172. The Ecca bedrocks here are mantled by oligomict alluvial gravels and younger sandy alluvium.

Figure 17: Friable weathered mudrocks with thin ferruginous carbonate lenses of the Tierberg Formation intermittently exposed along a low scarp between adjoining pediment surfaces, Hoek Doornen 172.

Figure 18: Limited exposure of weathered Tierberg Formation bedrocks along an erosion gulley through alluvial gravels and overlying sandy soils, southern margins of pediment surface on Hoek Doornen 172.

Figure 19: Narrow, rusty-brown, weathered dolerite dyke with pale veins of bladed sparry calcite extending across the boundary between Witte Wall 171 and Karee Kolk 174 (Hammer = 30 cm).

Figure 20: Thick, heavily-calcretised fluvial gravels with subordinate lenticular beds of gritty sandstone exposed along the southern bank of the Grootrivier on Witte Wall 171 (Hammer = 30 cm). The gravels contain sparse clasts of pale grey Matjiesfontein chert, some of which might be flaked artefacts, but this is equivocal.

Figure 21: Calcretised rubbly alluvial gravels along the edge of the lowermost pediment surface north of the Grootrivier on Karee Kolk 174 (Hammer = 30 cm). Many of the cobble-sized wacke clasts are moderately well-rounded.

Figure 22: Block-weathering, sparely-gravelly, pale brown calcretised alluvial sands locally capping the southern bank of the Grootrivier on Witte Wall 171 (Hammer = 30 cm). These sandy deposits pass downwards and laterally into coarse alluvial High Level Gravels.

Figure 23: Rubbly to nodular calcrete hardpan exposed along the crest of a low scarp between successive flat-topped pediment surfaces on Witte Wall 171.

Figure 24: Distinctive oligomict, coarse, unconsolidated gravels rich in chert clasts as well as ESA bifaces and occasional petrified wood blocks, Klein-Droëlaagte on Grootfontein 149. The gravels directly overlie Tierberg mudrocks and are mantled by unconsolidated sandy alluvium.

Figure 25: Close-up of oligomict gravels exposed along the Klein-Droëlaagte similar to those seen in previous figure (but here on Hoek Doornen 172) showing abundance of flaked ESA artefacts of brownish silcrete and grey Matjiesfontein chert (Scale is *c.* 15 cm long).

Figure 26: Calcretised, possibly cross-bedded lens of fine gravelly to gritty alluvium overlying Tierberg Formation bedrocks on the banks of the Klein-Droëlaagte, Grootfontein 149 (Hammer = 30 cm). These beds may be similar in age to the unconsolidated coarse oligomict gravels found along the same drainage line (*cf* Figure 24).

Figure 27: Pale, gullied, unconsolidated Recent sandy alluvium along the southern banks of the Klein-Droëlaagte on Hoek Doornen 172.

Figure 28: Section through the younger sandy alluvium with sparse dispersed gravel clasts overlying Tierberg Formation bedrocks, banks of the Klein-Droëlaagte on Hoek Doornen 172 (Hammer = 30 cm).

Figure 29: Poorly-sorted, oligomict downwasted surface gravels dominated by brownish-patinated Ecca wacke clasts and pale sandy soils that typically blanket the flat to gently-sloping pediment surfaces long the Grootrivier, seen here on Hoek Doornen 172.

Figure 30: Close-up of pediment gravels on Witte Wall 171 in an area showing a preponderance of pale grey to brownish silcrete clasts, many of which are anthropogenically flaked (Scale in cm). Small water-worn blocks or pebbles of silicified wood may occur in such areas (*cf* Figure 48).

Figure 31: Open, unvegetated area of pediment surface on Witte Wall 171 showing mantle of sandy alluvial soils and thin veneer of fine sheetwash gravels.

Figure 32: Close-up of angular to subrounded sheetwash gravels seen in the previous figure (Scale in cm and mm), Witte Wall 171. The clasts are largely of resistant-weathering lithologies including silicified mudrocks, cherts, occasional Dwyka erratics with sparse small blocks of petrified wood.

Figure 33: Patch of pale sandy soils on a pediment surface on Witte Wall 172 showing development of nodular calcrete and animal burrowing typical of these *heuweltjie* areas – possibly associated with ancient termite activity and / or bush clumps.

Figure 34: Patches of thick, fine sandy soils with distinctive shrubby vegetation and no gravels, such as seen here mantling gentle north-facing pediment slopes on Hoek Doornen 172, represent alluvial sands deflated from the bed of the Grootrivier by winds.

Figure 35: Large-scale sand dunes with typical low-angle aeolian cross-bedding exposed on the bed of the Grootrivier on Witte Wall 171.

Figure 36: Younger alluvial deposits exposed along the northern bank of the Grootrivier on Hoek Doornen 172, including well-rounded, cobbly to pebbly basal gravels and well-bedded overlying sandy deposits (Hammer = 30 cm).

Figure 37: Thin carpet of angular cherty colluvial gravels downwasted from the Collingham Formation and mantling a gently-sloping pediment surface on the southern sector of Hoek Doornen 172. The gravels include a sparse background scatter of flaked stone artefacts.

5. PALAEONTOLOGICAL HERITAGE

Fossil assemblages that have been recorded elsewhere from the various Karoo Supergroup and Late Caenozoic rock units represented within the proposed solar PV facility and power line project areas are outlined in Table 1 below. They have been treated, with extensive references, in several previous combined desktop and field-based palaeontological assessment studies for the Ceres Karoo region by the present author dealing with electrical infrastructure projects (*e.g.* Kappa Substation, Gamma – Omega transmission line) as well as renewable energy projects in the Ceres Karoo such as the Perdekraal Wind Energy Facility (WEF), Rietkloof WEF, Kolkies WEF and Karee WEF projects (See References under Almond). New fossil sites recorded during the recent palaeontological field survey of the proposed solar PV and power line facility project areas are listed together with GPS data and comments as well as proposed field ratings in Appendix A while numbered fossil localities are shown on the satellite maps in Figures 53 and 54. For sectors of the associated power line corridor between Witte Wall 171 and the Kappa Substation, field observations from several previous PIA studies by Almond (2010a-d, 2016a) have been taken into consideration as well as a recent site visit to Die Brak 241 for another renewable energy project (Almond in prep., 2020).

All of the sedimentary formations enumerated in Table 1 are potentially fossiliferous, although only three are considered to be generally or potentially of moderate to high palaeontological sensitivity (Theron *et al.,* 1991, Almond 2008a, 2008b, Almond & Pether 2008). Fossils within the glacially-influenced **Dwyka Group** succession are rare and mainly confined to thin interglacial or post-glacial facies, with the notable exception of occasional ice-rafted limestone or dolomite erratics, examples of which containing Cambrian archaeocyathids (fossil sponges) and trilobites have been recorded from the southern margins of the Great Karoo and Namibia. A small boulder of stromatolitic limestone or dolomite of probable Precambrian or Cambrian age from the Dwyka tillite is recorded from Sadawa 238, adjoining Platfontein 240 on the west, by Almond (2016a). No further fossiliferous carbonate erratics were encountered during recent fieldwork.

An important fossiliferous interval occurs within the lowermost **Prince Albert Formation**; fossil fish, molluscs and petrified wood have been recorded here in the Tanqua Karoo and the Northern Cape. A few small blocks of silicified wood displaying fine seasonal growth rings were recorded from surface gravels overlying the Prince Albert Formation in the Kolkies WEF study area by Almond (2016a) but their stratigraphic provenance is ambiguous; they have probably been reworked from younger Ecca Group formations. A fragment of a sizeable petrified trunk with fine growth rings from the SW Tanqua Karoo is displayed at the Doringrivier homestead (Pretorius Kraal 237) to the NW of Die Brak 241. The provenance is uncertain, but it probably also comes from the lower Ecca Group.

The **Whitehill Formation** is famous for its well-preserved skeletons of intact mesosaurid reptiles and palaeoniscoid bony fish, as well as prolific small crustaceans. However, these carbonaceous mudrocks are highly weathered and secondarily mineralised near-surface within the study area (Fig. 11), with little exposure of fresh bedding planes. No fossils were recorded from the Whitehill bedrocks, including the prominent-weathering, large dolomitic concretions and lenses, during the present field survey.

The overlying **Collingham Formation** along the southern Great Karoo margins is well-known for rare well-preserved petrified logs and trackways of giant eurypterids (water scorpions). Occasional small blocks of petrified wood occur among downwasted cherty Collingham gravels on Hoek

Doornen 172 (Fig. 47), close to exposures of the Matjiesfontein chert, although the Collingham Formation is not mapped here. Small cylindrical burrows infilled with pale ash that contrasts with the dark mudrock matrix are found along the contacts of thin tuff horizons on Witte Wall 171 (Fig. 43). The only other fossils seen this formation within the Ceres Karoo are dense but low-diversity assemblages of horizontal burrows that are widely recorded elsewhere along the southern Karoo margins (Fig. 42) (Almond 2016a).

The basinal and distal submarine fan mudrocks of the **Tierberg Formation** are characterised by a range of interesting trace fossils and drifted plant material of the *Glossopteris* Flora (*e.g.* stems, leaves and segmented roots of *Glossopteris* trees); animal body fossils (*e.g.* palaeoniscoid fish) are very rare, however. Apart from occasional fragmentary rusty-brown compressions of wood remains within siltstone exposed close to the Grootrivier (J. Orton., pers. comm. 2020), fossil plant material was not observed *in situ* in the PV facility project area. Low diversity assemblages of simple horizontal burrows can be seen within dark Tierberg mudrocks along the banks of the Grootrivier on Witte Wall 171 (Fig. 39) as well as along the Klein-Droëlaagte on Hoek Doornen 172 (Fig. 40). These trace fossils are widely-occurring forms of no special conservation significance, however. Complex cone-in-cone structures developed within diagenetic concretions of ferruginous carbonate in the Tierberg Formation have frequently been mistaken for fossil stromatolites but are actually pseudofossils (Fig. 41). The same applies to dendrites - moss- or fern-like growths of the manganese psilomelane commonly seen on bedding planes and fracture surfaces of Tierberg wackes.

Older **alluvial gravels,** such as the calcretised, downwasted and sheet-washed pediment gravels along the margins of the Grootrivier, contain a sparse background scatter of small blocks of resistant-weathering silicified wood reworked from the Ecca Group bedrocks (Figs. 46 & 48). The blocks are various angular to water-worn and are generally only a few cm in maximum diameter. The wood shows well-developed seasonal growth lines, as typically seen in the high-palaeolatitude Karoo Basin. Some, and perhaps the majority, of the silicified wood specimens encountered within surface gravels within the project area come from the Tierberg Formation. Given the extensive catchment area of the Grootrivier and its tributaries, it is possible that some of the petrified wood comes from the Mid-Permian Waterford Formation (Ecca Group) which is known to contain well-preserved fossil logs in the Klein-Roggeveldberge region (*cf* Almond 2018) or from the Collingham Formation as previously discussed. It is noted that a high proportion of the fossil wood blocks recorded during the recent field survey – including one small log - come from the distinctive coarse, oligomict alluvial gravels found along the Klein-Droëlaagle drainage line where they are associated with abundant silcrete clasts (including common ESA bifaces) (Figs. 44 & 45). Where concentrations of silcrete clasts are found on the pediment surfaces away from modern water courses, float blocks of petrified wood (and stone artefacts) often occur here as well, suggesting the possible presence of buried ancient channel conglomerates at these sites. Given its uncertain provenance and widespread occurrence within surface gravels in the region, the scientific and conservation value of the petrified wood material encountered is rated as low and no special mitigation measures are proposed for the known fossil sites. The sites along the Klein-Droëlaagle drainage line will be protected within the riverine buffer zone (Fig. 54).

Large (several dm diameter), sphaeroidal, calcretised subterranean termitaria (termite nests) with finely-spaced ribbing on the inner surface (marginal supports for the delicate fungus-garden combs) and porous outer walls have been reported from a number of localities in the semi-arid Western and Northern Cape where they may be embedded within saprolite (weathered bedrock) of

a wide range of ages. The complex wavy-laminated internal structure of the thick nest wall is well seen on fractured surfaces. Several partial specimens and broken fragments of fossil nests were recorded within or near the proposed project area in the Ceres Karoo where they are found weathering-out from weathered, calcrete-veined Tierberg Formation mudrocks and overlying calcretised pediment sediments close to the scarp edges (Figs. 49 to 52). Some of these nests may have originally been built several meters below the ground surface while the ill-defined calcrete "veins" in the vicinity might in part be fossilised termite tunnels. The age of the fossil nests is unclear; they may well reflect termite activity during cool, dry episodes within the Pleistocene Epoch which may have supported a more grassy vegetation than found locally today. The dense pattern of *heuweltjies* seen in satellite images of the Ceres Karoo pediment surfaces may be related to the activities the same termites. The preferential development of calcretised soils within the *heuweltjies* could be an indirect consequence of their biological activity.

Finer-grained **alluvium** may host Pleistocene to recent mammal bones, teeth and horn cores as well as distinctive calcretised fossil termite nests and other burrows. Fossils previously recorded within the superficial deposits in the Ceres Karoo region comprise (1) isolated small blocks of reworked petrified wood within surface gravels (see above), and (2) bioturbated horizons within calcretised sandy alluvium along the banks of the Grootrivier (Almond 2016a). The trace fossils concerned in the second case might be rhizoliths (calcretised root casts) and / or invertebrates; they are probably of Pleistocene age.

Given (1) the scarcity of unique or scientifically-valuable fossils recorded during the field-based scoping assessment of the proposed solar PV facility and power line project areas, as well as (2) the paucity of fossil remains recorded during previous PIA studies in the Ceres Karoo region (See References under Almond) it is concluded that these areas are of low palaeontological sensitivity. The fossil material recorded – principally (1) low-diversity trace fossil assemblages within the Ecca Group, (2) sparse, widely-dispersed and mostly small, reworked blocks of petrified wood of uncertain stratigraphic provenance within surface and alluvial gravels, and (3) calcretised termite nests of probable Pleistocene age – is of widespread occurrence along the SW Karoo margins and not of any special scientific or conservation value. No fossil sites of high palaeosensitivity of No-Go areas were identified during the field survey. No special mitigation measures are recommended for the recorded fossil sites, all of which are assigned a low provisional field rating (See table in Appendix A).

- **Palaeontological heritage site sensitivity verification**

The palaeosensitivity map generated by the Department of Environment, Forestry and Fisheries (DEFF) screening tool for the combined proposed solar PV facility and associated power line project area is provided in Figure 38. According to this map, the project area includes regions of (1) medium sensitivity towards the north, corresponding largely to the Tierberg Formation outcrop area, (2) high sensitivity towards the south, corresponding to the Dwyka Group outcrop area, and (3) a central band with unspecified sensitivity which corresponds to the folded Lower Ecca Group outcrop area.

On the basis of (1) the recent palaeontological field survey for the proposed solar and power line projects as well as (2) several desktop- and field-based previous PIA studies in the Ceres Karoo (notably Almond 2010a-c, 2016a, 2018, 2020), the screening tool map is disputed and *rejected* here as an accurate reflection of palaeosensitivity within the present study area. The main reasons for this are:

- The inaccurate overlay of the project area on the palaeosensitivity map (which is based primarily on the relevant 1: 250 000 geological maps);
- The Dwyka Group (indicated in red) is generally regarded as of LOW palaeosensitivity whereas the Tierberg Formation is of MEDIUM sensitivity, at most. Field data for the proposed project suggest a LOW palaeosensitivity for the Tierberg Formation outcrop area here due to weathering and extensive cover by low-sensitivity calcrete, gravels and soils.
- Potentially-sensitive rock units such as the basal Prince Albert Formation and Whitehill Formation are not rated on the map (Field data suggests these are generally of LOW palaeonsensivity in this region, mainly due to weathering and cleavage development).
- The map does not address the Late Caenozoic sediments that mantle the bedrocks in the project area, and in particular the pediment gravels (ancient alluvium) underlying almost the entire solar PV study areas as well as younger alluvium along the Grootrivier and its tributaries. Almost all the new fossil occurrences noted during the recent field survey were found in such settings. However, these fossils are generally of low conservation value and the palaeosensitivity of the Late Caenozoic sediments is according rated as LOW.

It is concluded that the entire combined project area for the proposed solar PV facilities and associated power line to Kappa Substation is in practice of LOW palaeosensivity. Potentially fossiliferous rock units such as the Prince Albert and Whitehill Formations are too weathered and tectonically deformed (cleaved) to contain scientifically valuable fossils in the project area. No significant, conservation-worthy fossil sites or palaeontological No-Go areas were recorded during the field survey.

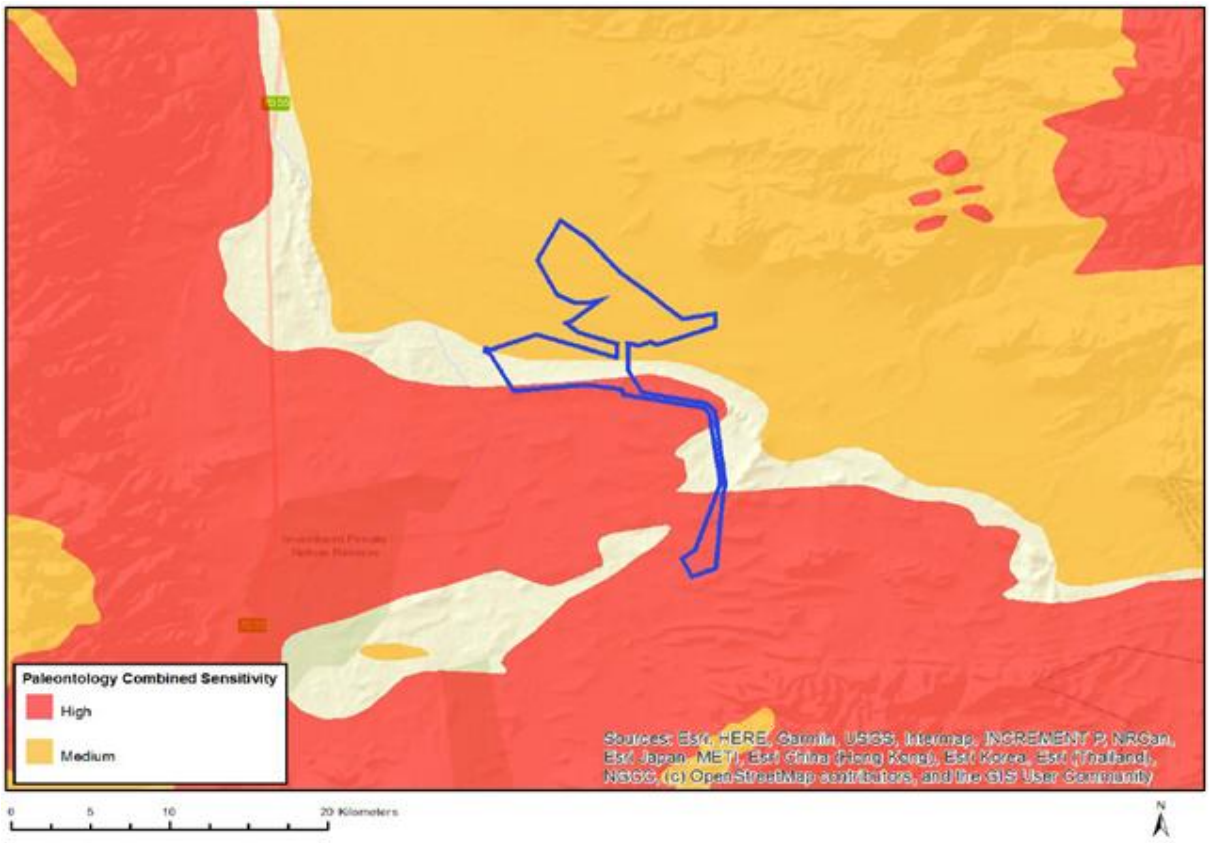

Figure 38: Palaeosensitivity map for the combined solar PV facility and associated power line project area (blue polygon) produced from the DEFF screening tool. Data from several recent field surveys as well as desktop studies indicate that in practice the project area is of LOW palaeosensitivity.

Figure 39: Low diversity assemblages of simple, straight to sinuous horizontal endichnial burrows (*c.* 4 mm wide) on rare bedding plane exposures of the Tierberg Formation, south bank of the Grootrivier, Witte Wall 171 (Loc. 149).

Figure 40: Cylindrical to flattened horizontal, straight to gently-curved burrows (1-2 cm wide, arrowed) with distinctive longitudinal surface ridges or wrinkles (*cf Palaeophycus*), Tierberg Formation exposures in bed of Klein-Droëlaagte, Hoek Doornen 172 (Loc. 122).

Figure 41: Weathered-out, oblate diagenetic concretions of ferruginous carbonate from the Tierberg Formation showing stromatolite-like cone-in-cone structures (pseudofossils), bed of the Klein-Droëlaagte on Hoek Doornen 172 (Scale *c*. 15 mm long).

Figure 42: Typical dense, low-diversity assemblage of horizontal burrows (*c*. 2-3 mm across) preserved within silicified mudrocks of the Collingham Formation (Witte Wall 171) (From Almond 2016a).

Figure 43: Small (1-2 mm diameter) ash-infilled invertebrate burrows (arrowed) close to the interface with a pale cream tuff horizon, Collingham Formation (Witte Wall 171) (From Almond 2016a).

Figure 44: Coarse silcrete gravels and associated reworked petrified wood block from the bed of the Klein-Droëlaagte on Grootfontein 149 (Loc. 165) (Scale in cm).

Figure 45: Portion of a small petrified log showing well-developed seasonal growth lines recorded among oligomict, silcrete gravels in the bed of the Klein-Droëlaagte on Grootfontein 149 (Loc. 169) (Scale in cm).

Figure 46: Collection of small angular to slightly rounded blocks of petrified wood from sheetwash surface gravels on Hoek Doornen 172 (Loc. 128) (Scale in cm and mm).

Figure 47: Small block of petrified wood showing prominent seasonal growth rings recorded close to an exposure of Matjiesfontein chert and so possibly from the Collingham Formation (not mapped here), Hoek Doornen 172 (Loc. 150) (Scale in cm and mm).

Figure 48: Small, well-rounded (water-worn) clasts of silicified wood from pediment surface gravels on Witte Wall 171 (Loc. 132) where they occur in possible association with silcrete-rich older alluvial gravels (Scale in cm and mm).

Figure 49: *In situ* large sphaeroidal calcretised termitarium (yellow dashed area) still largely buried within calcretised pediment gravels with detached blocks extending downslope in float, Grootfontein 149 (Loc. 158) (Scale is *c*. 15 cm long).

Figure 50: Close-up of fragment of calcretised termitarium wall showing the distinctive wavy or zigzag pattern of the fine internal lamination. Block is c. 10 cm across. Same locality as previous figure.

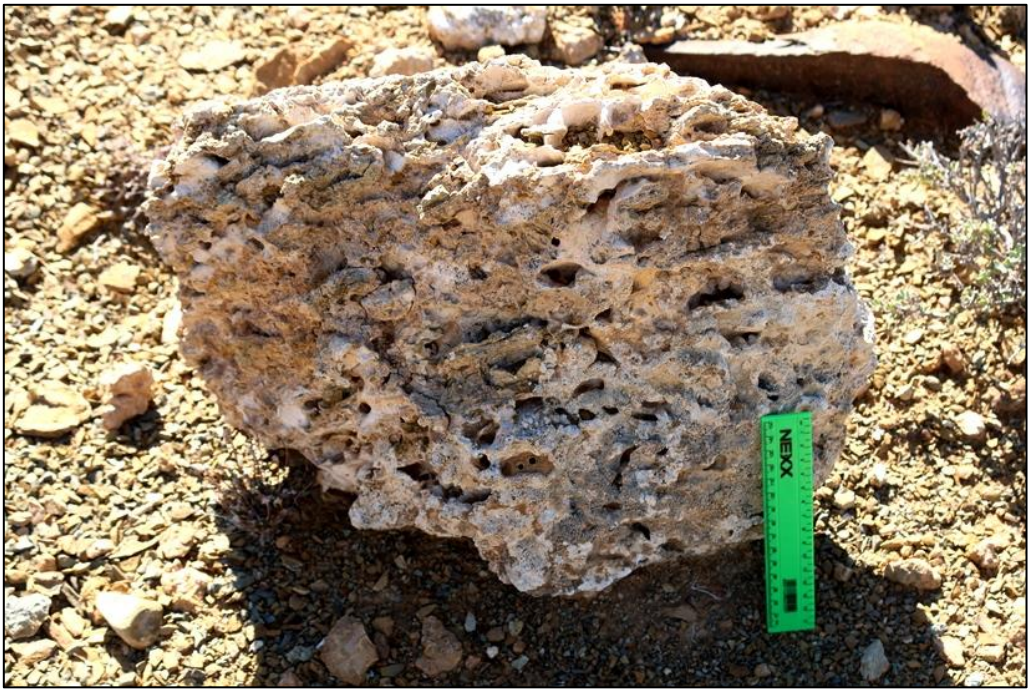

Figure 51: Porous outer surface of a partially weathered-out sphaeroidal termitarium originally embedded within weathered Tierberg Fromation mudrocks on the northern banks of the Grootrivier, Karee Kolk 174 (Scale is *c*. 15 cm long).

Figure 52: Finely-ribbed inner surface of the calcretised termitarium illustrated above (Scale is *c*. 15 cm long). The ribs would have originally supported closely-spaced shelves of the termite colony's fungus garden.

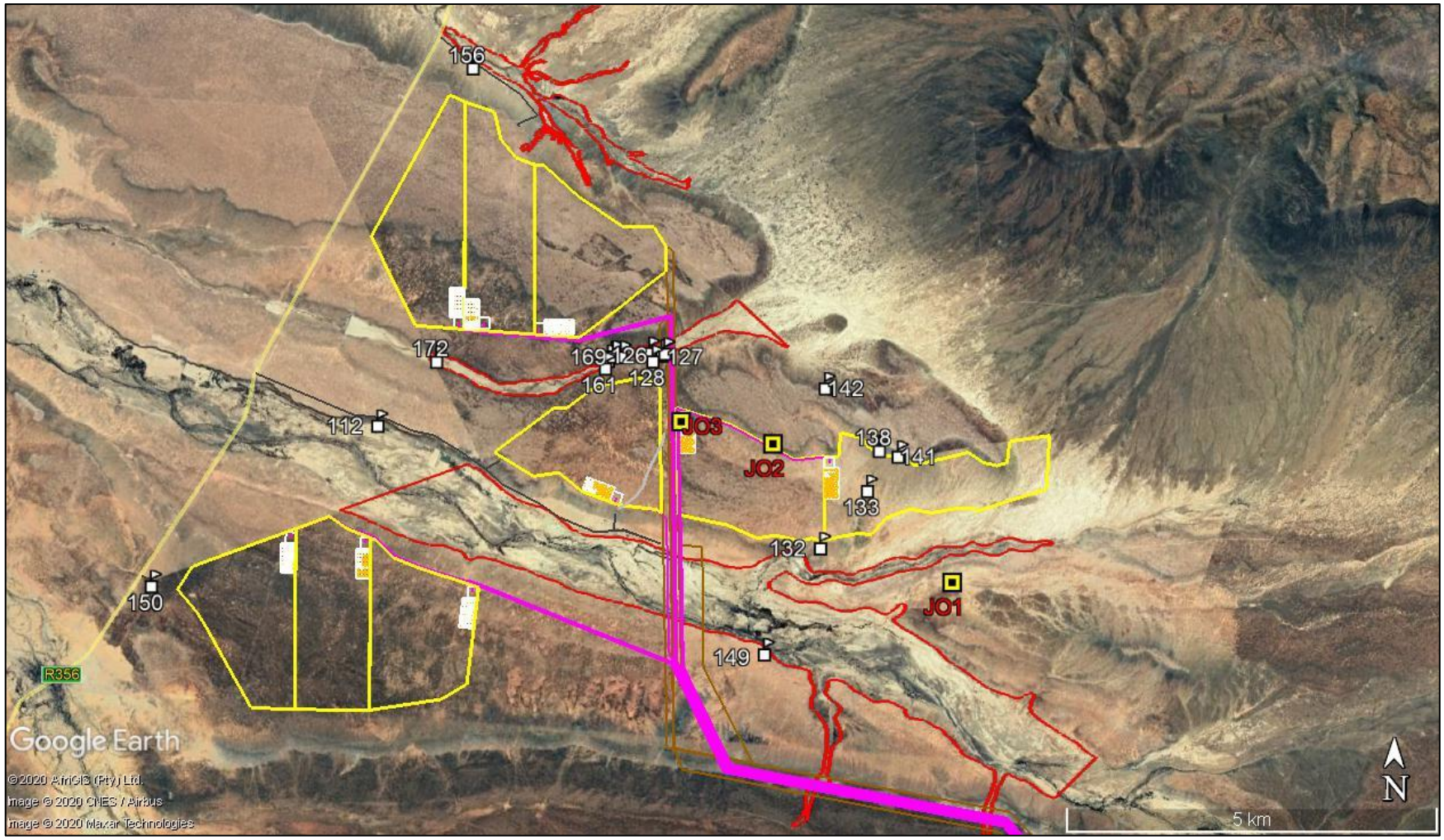

Figure 53: Google Earth© satellite image of the solar PV facility project areas (yellow polygons) with associated power lines (pink) in the corridor linking to the existing Eskom Kappa Substation. The numbered squares show new fossil sites, most of which are associated with drainage line exposures falling in No-Go areas *outside* the project footprint (See Appendix A for details of fossil sites). None of these sites (which represent only a small fraction of potential fossil sites in the area) are considered to be of high scientific or conservation value and no recommendations for their mitigation are proposed here.

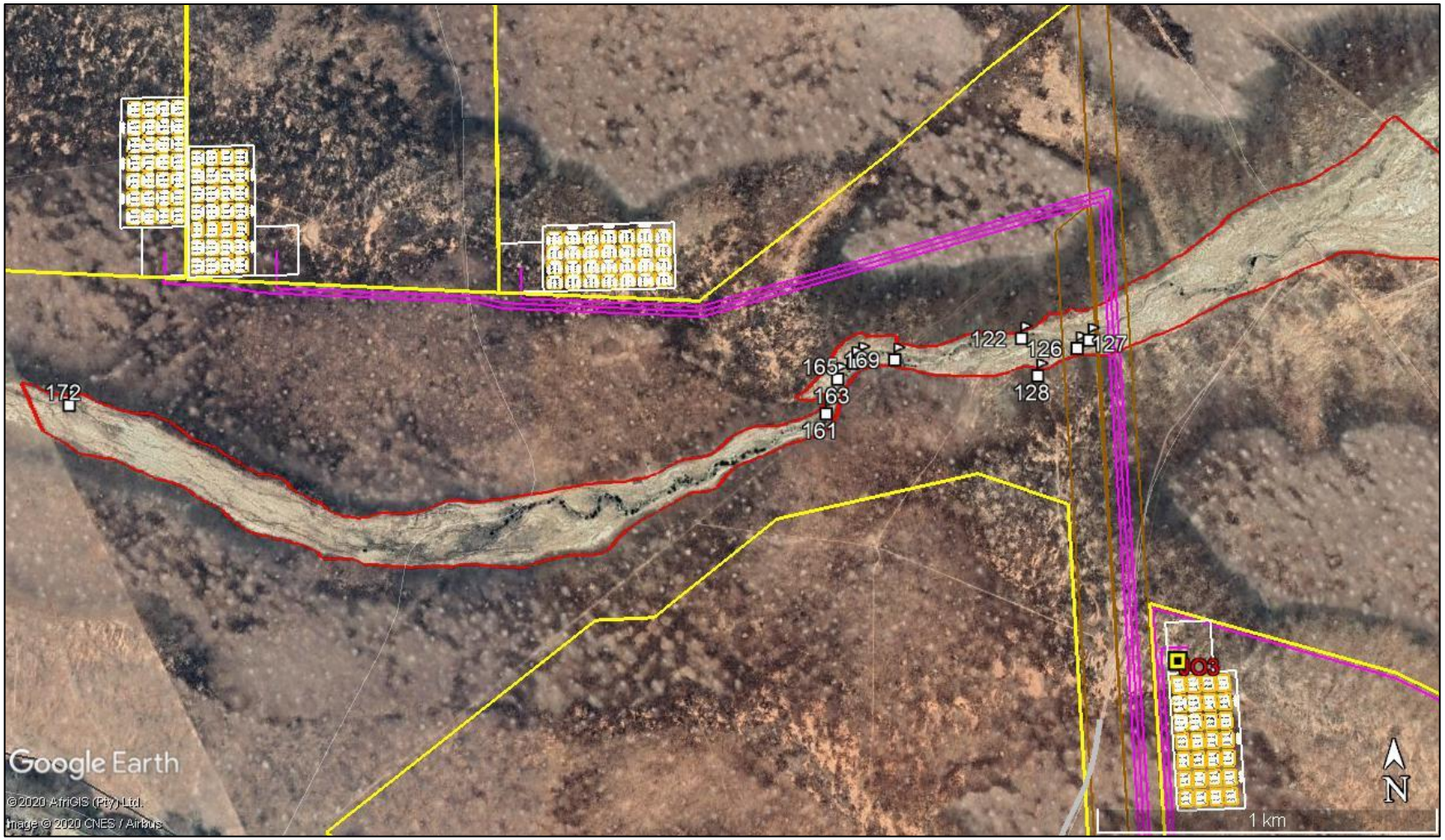

Figure 54: Google Earth© satellite image showing in more detail numbered fossil sites (reworked petrified wood, generally associated with gravels rich in ESA stone artefacts) along the Klein-Droëlaagte drainage line on Witte Wall 171 and Grootfontein 149. These sites lie within a designated No-Go area (identified by the Biodiversity Specialists) and should be protected within the anticipated buffer zone along drainage lines. No recommendations for their mitigation are therefore proposed here.

Table 1: Summary of known fossil record of the main sedimentary rock units represented in the proposed solar PV facility and power line study area. Note that palaeontological sensitivity is strongly dependent on local levels of bedrock weathering and tectonic deformation (*e.g.* cleavage).

GROUP	FORMATION & AGE	FOSSIL BIOTAS	PALAEONTOLOGICAL SENSITIVITY
SUPERFICIAL DEPOSITS	**High Level Gravels, alluvium, colluvium, pedocretes (*e.g.* calcrete)** **LATE TERTIARY TO RECENT**	Bones and teeth of wide range of mammals, including mammals (*e.g.* teeth & bones of mastodont proboscideans, rhinos, bovids, horses, micromammals), reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* termitaria, horizontal invertebrate burrows, stone artefacts), reworked petrified wood, leaves, rhizoliths, diatom floras, peats and palynomorphs.	**LOW (but may be locally HIGH)**
ECCA GROUP	**Tierberg Formation** **E-M PERMIAN**	Rare palaeoniscoid fish, disarticulated microvertebrate remains (*e.g.* fish teeth, scales), sponge spicules, sparse vascular plants (esp. leaves, roots of glossopterids), silicified wood, low to moderate diversity trace fossil assemblages (*e.g.* large ribbed pellet burrows, arthropod scratch burrows, *Siphonichnus etc*).	**LOW-MODERATE**
	Collingham Formation **EARLY PERMIAN**	Low diversity but locally abundant ichnofaunas (horizontal "worm" burrows, arthropod trackways, including those of giant eurypterids), vascular plant remains (petrified and compressed wood, twigs, leaves *etc*).	**MODERATE**
	Whitehill Formation **EARLY PERMIAN**	Mesosaurid reptiles, rare cephalochordates, variety of palaeoniscoid fish, small eocarid crustaceans, insects, low diversity of trace fossils (*e.g.* king crab trackways, possible shark coprolites), palynomorphs, petrified wood and other sparse vascular plant remains (*Glossopteris* leaves, lycopods *etc*).	**HIGH**
	Prince Albert Formation **EARLY PERMIAN**	Low diversity marine invertebrates (bivalves, nautiloids, brachiopods), palaeoniscoid fish, sharks, fish coprolites, protozoans (foraminiferans, radiolarians), petrified wood, palynomorphs (spores, acritarchs), non-marine trace fossils (especially arthropods, fish, also various "worm" burrows), possible stromatolites, oolites.	**MODERATE**
DWYKA GROUP	**Elandsfontein Formation** **LATE CARBONIFEROUS TO EARLY PERMIAN**	Interglacial mudrocks occasionally with low diversity marine fauna of invertebrates (molluscs, starfish, brachiopods, coprolites *etc*), palaeoniscoid fish, petrified wood, leaves (rare) and palynomorphs of *Glossopteris* Flora. Well-preserved non-marine ichnofauna (traces of fish, arthropods) in laminated mudrocks. Possible stromatolites, oolites at top of succession. Limestone erratics with Cambrian archaeocyathid sponges, trilobites, small stromatolites.	**LOW**

6. PALAEONTOLOGICAL HERITAGE IMPACT ASSESSMENT

The anticipated impact significance of the proposed solar PV facilities and associated power lines on local fossil heritage resources is evaluated in Table 3 below. The assessment applies equally to all nine of the 175 MW Solar Photovoltaic (PV) power generation facilities as well as to the associated power lines.

The *key impacts* on local palaeontological heritage resources considered here are *direct* and concern:

- the potential disturbance, damage, destruction or sealing-in of scientifically-important and legally-protected fossils preserved at or beneath the surface of the ground due to construction phase excavations (*e.g.* PV module footings, building foundations, power line pylon footings, underground cables, stormwater channels), and ground clearance (*e.g.* access roads, solar arrays).

This assessment applies only to the *construction phase* of the developments since further significant impacts on fossil heritage during the planning, operational and decommissioning phases of the facilities are not anticipated.

In general, the destruction, damage or disturbance out of context of fossils preserved at the ground surface or below ground that may occur during construction represents a *direct*, *negative* impact that is limited to the development footprint (*site specific*). Such impacts can usually be mitigated but cannot be fully rectified or reversed (*i.e. permanent, irreversible*). Most of the sedimentary formations represented within the study area contain fossils of some sort, so impacts *at some level* on fossil heritage are *very likely*. However, most fossil occurrences encountered within the project footprint occur widely within the study region (*i.e. not unique / irreplaceable*) and are not considered to be of great scientific significance. Exceptional fossils such as well-preserved, well-articulated vertebrate skeletons, vertebrate trackways or substantial petrified logs that are scientifically valuable and conservation-worthy appear to be very rare in the study area. The probability of loss of such conservation-worthy fossil heritage due to the proposed development is considered to be *low*. This is because of (a) the very sparsely-scattered distribution of exceptional, well-preserved fossils within the bedrocks as well as within the overlying superficial sediments (*e.g.* older alluvium, surface gravels), (b) the mantling of the bedrocks with thick superficial sediments in most areas, so that major impacts on potentially-fossiliferous fresh (*i.e.* unweathered) bedrock are limited. The consequence of the anticipated impacts on palaeontological heritage is therefore assessed as *slight* without mitigation. The significance of slight but high (i.e. very likely) probability impacts on fossil heritage resources that are restricted to the development footprint and of permanent duration is rated as *very low (negative)* without mitigation.

Levels of confidence for this impact assessment are *medium* given (1) the unpredictable occurrence of well-preserved, scientifically-valuable fossils, (2) the limited scope and number of field-based palaeontological studies carried out in the broader region and (3) the low levels of bedrock exposure within the development footprint.

It should be noted that, should the recommended mitigation measures for the construction phase of the solar PV and power line developments (Section 7) be fully and consistently

implemented, the impact significance would remain *very low* but would entail both positive and negative impacts (Table 3). Residual negative impacts from inevitable loss of some fossil heritage would be partially offset by an improved palaeontological database for the study region as a direct result of appropriate mitigation. This is a *positive* outcome because any new, well-recorded and suitably-curated fossil material from this palaeontologically little-known region would constitute a useful addition to our scientific understanding of South African fossil heritage.

6.1. Assessment of cumulative impacts

A number of renewable energy and electrical infrastructure projects have been proposed for the Ceres Karoo region within a radius of 30 km of the project areas for the proposed solar PV facility and power line projects. Field-based palaeontological heritage assessments for these projects have been conducted by the author and palaeontological colleagues (*cf* PIAS for the Perdekraal East, Kolkies, Karee, Rietkloof / Indyebo, Tooverberg WEFs by Almond 2015, 2016a, 2016b, 2018 and Butler 2018). In addition, several further new solar energy facility and WEF project proposals (*e.g.* Pienaarspoort 1 WEF and Pienaarspoort 2 WEF) are currently being assessed in the Ceres Karoo area (Almond 2020 and two additional solar facility studies in progress). A tentative assessment of the potential cumulative impacts of the proposed projects in the context of these other developments (not all of which may be granted environmental authorisation) is provided in Table 4. This assessment provided here applies equally to all of the Veronica project components (PV solar facilities, power lines) considered individually and in conjunction.

It is noted that cumulative impact assessments only have real meaning if comparable resources are considered (*e.g.* fossil assemblages in the same geological formations), while developments other than renewable energy projects (*e.g.* borrow pits, roads, power lines) are also relevant (*cf* Almond 2010a-c for the Eskom Gamma-Omega 765kV transmission line and Kappa Substation). Several renewable energy developments in the Klein Roggeveldberge and Cape Fold Mountains which respectively affect Permian continental fossils within the Lower Beaufort Group and Devonian marine fossils within the Cape Supergroup are *not* considered to be relevant here. Furthermore, the cumulative impact assessment assumes – rather optimistically - that all the relevant palaeontological mitigation measures recommended for the authorised renewable energy projects considered are fully implemented.

Given the generally Low, but not negligible, impact significance assigned to the various *relevant* renewable energy developments in the Ceres Karoo listed above, as well as the Very Low impact significance assessed here for each of the nine proposed PV and power line developments themselves, a LOW (negative) cumulative impact significance for the latter projects is suggested in the absence of mitigation. Should the various mitigation measures proposed for these projects be fully implemented, the cumulative impact significance may fall to VERY LOW (negative). It is concluded that as far as fossil heritage resources are concerned, the proposed solar facility and power line projects, whether considered individually or together, will *not* result in an unacceptable loss or unacceptable additional impacts, considering all the authorised renewable energy projects proposed in the area.

6.2. Impact Assessment Summary

A summary of the overall impact significance findings (following mitigation) for the proposed solar facility and power line projects is provided in Table 2 below.

Table 2: Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Very Low
Operational	Not applicable
Decommissioning	Not applicable
Loss of palaeontological heritage	**Overall Impact Significance**
Cumulative - Construction	Very Low
Cumulative - Operational	Not applicable
Cumulative - Decommissioning	Not applicable

Table 3: Impact assessment summary table for the Construction Phase of each solar PV facility and associated power line [No further impacts anticipated during operational and decommissioning phases]

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Disturbance, damage or destruction of fossils within the development footprint due to excavations and surface clearance	***Status***	**Negative**	**Very low impact (5)**	**Monitoring for fossil remains on on-going basis by the Environmental Control Officer (ECO) during the construction phase. See Chance Fossil Finds Procedure (Appendix C and EMPr)**	**Very low impact (5)**	**Medium**
	Spatial Extent	**Site specific**				
	Duration	**Permanent**				
	Consequence	**Slight**				
	Probability	**Very likely**				
	Reversibility	**Non-reversible**				
	Irreplaceability	**Low**				

Table 4: Cumulative impact assessment summary table for each solar PV facility and associated power line in the context of the other proposed solar projects as well as other renewable energy developments in the area (≤ 30 km radius)

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Disturbance, damage or destruction of fossils within the development footprint due to excavations and surface clearance	***Status***	**Negative**	**Low impact (4)**	**Monitoring for fossil remains on on-going basis by the ECO during the construction phase. See Chance Fossil Finds Procedure (Appendix C and EMPr)**	**Very low impact (5)**	**Medium**
	Spatial Extent	**Site specific**				
	Duration	**Permanent**				
	Consequence	**Moderate**				
	Probability	**Very likely**				
	Reversibility	**Non-reversible**				
	Irreplaceability	**Low**				

7. MONITORING AND MITIGATION MEASURES FOR INCLUSION IN THE EMPr

Since unique, scientifically-valuable, conservation-worthy fossils are rare within the proposed solar facility and power line project areas, no further specialist palaeontological studies, monitoring or mitigation is recommended for this development, pending the potential discovery of significant new fossil material during the construction phase.

The following monitoring and mitigation measures are recommended for the construction phase of the developments, for inclusion in the EMPrs:

- Monitoring for fossil material of all major surface clearance and deeper (>1m) excavations by the Environmental Control Officer (ECO) on an on-going basis during the construction phase.

- Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape for recording and sampling by a professional palaeontologist (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za).

- Professional mitigation, involving the recording and judicious sampling of fossil material together with pertinent field data (stratigraphy, taphonomy), should conform to best practice. Fossil material collected must be curated within an approved repository (university or museum collection).

A tabulated summary of recommendations regarding palaeontological heritage for the construction phase of the proposed solar facility and power line developments is provided in Table 5 below. This table applies equally to all proposed solar PV facilities and associated power lines, as well as the grid connection at the Kappa Substation.

A general protocol for Chance Fossil Finds for this project is appended to this report (Appendix C).

There are no palaeontological monitoring or mitigation requirements for the operational and decommissioning phases of the developments.

7.1. Generic EMPr for Power Lines and Substations

Section 5.12 (Protection of Heritage Resources) in the Generic EMPr for Power Lines and Substations (GN 435), gazetted in 2019, adequately covers the generic palaeontological heritage monitoring and mitigation measures appropriate for the proposed solar PV facility power line and substation projects. There are no specific palaeontological heritage management actions that are important and not included in GN 435.

Table 5: Management Plan for the Construction Phase (Including pre- and post-construction activities) [This table applies equally to all solar PV facilities, power lines and substation grid connection]

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Palaeontological heritage					
Disturbance, damage, destruction or sealing-in of scientifically valuable fossil material embedded within bedrock or exposed at ground surface within development footprint.	Safeguarding, recording and sampling of scientifically-important fossil material encountered or exposed during development (Chance Fossil Finds)	a. Monitoring of all bedrock excavations and cleared sites for fossil remains during construction phase. Safeguarding of chance fossil finds.	Regular visual inspection of substantial excavations and cleared areas for fossil remains. Chance fossil finds to be safeguarded (site taped-off or fossils set aside) and reported to Heritage Western Cape (HWC) for possible mitigation.	Ongoing during Construction Phase	ECO
		b. Recording and judicious sampling of exceptional new fossil material and relevant geological data from the development footprint.	Standard palaeontological recording and collection methods (GPS / photos / field notes / careful wrapping of specimens for transport)	Following report of significant new fossil finds by ECO	Professional palaeontologist assisted by ECO
		c. Curation of fossil specimens at an approved repository (e.g. museum).	Cataloging and safe storage of fossils *plus* key field data in an approved repository (museum / university)	Following mitigation	Professional palaeontologist
		d. Final technical report on palaeontological heritage within study area submitted to HWC.	Minimum reporting requirements specified by heritage resources agency (*e.g.* SAHRA / HWC)	Following mitigation and preliminary analysis of fossil finds	Professional palaeontologist

8. CONCLUSIONS AND RECOMMENDATIONS

Given the very similar geological and palaeontological context and scale of each of the nine proposed solar PV facilities and the associated power lines, the impact assessments and mitigation recommendations for each project are identical.

The solar PV facility project area is situated on a flat to gently-sloping pediment surface of Late Caenozoic (Neogene – Pleistocene) age on the flanks of the Grootrivier Valley which drains this sector of the Ceres Karoo. The pediment surface has been planed-off by river erosion into the underlying fine-grained, non-marine, basinal to distal submarine fan sediments of the Tierberg Formation (Ecca Group) that are Middle Permian in age. Field surveys show that the Tierberg bedrocks beneath the thin (few dm to few meters maximum) capping of alluvial gravels, calcrete hardpans, sandy soils and downwasted surface gravels capping the pediment surface are weathered, folded and often tectonically-cleaved. The only fossil remains recorded from such pediment settings in the Ceres Karoo comprise (1) sparse, generally small blocks of reworked silicified fossil wood within alluvial and surface gravels of uncertain provenance (probably Ecca Group) and (2) occasional calcretised fossil termite nests of probable Pleistocene age that are found embedded within calcretised superficial sediments as well as weathered, calcrete-veined bedrocks. The majority of fossil sites recorded fall within designated No-Go areas lying *outside* the project footprint. These fossils are of widespread occurrence within the Ceres Karoo region and are not of high scientific interest or conservation value. No fossil sites of high sensitivity or No-Go areas were identified within the solar PV project areas during the palaeontological field survey and the palaeontological sensitivity of the project area is assessed as generally LOW.

The power line corridor between the solar PV sites and the existing Kappa Substation on Platfontein 240 traverses the outcrop areas of the Permo-Carboniferous, glacial-related Dwyka Group as well as the lower Ecca Group (Prince Albert, Whitehill and Collingham Formations). The potentially-fossiliferous Prince Albert, Whitehill Formations and Collingham Formations are highly weathered and cleaved in this region. No sensitive fossil sites have been recorded within or close to the proposed corridor on Die Brak 241 and Platfontein 240 during the present field survey or several previous field studies in the vicinity by Almond (2010a-c, 2016a) and the palaeontological sensitivity of the corridor is assessed as LOW.

As a consequence of (1) the paucity of irreplaceable, unique or rare fossil remains within the development footprint, as well as (2) the extensive superficial sediment cover overlying most potentially-fossiliferous bedrocks within the solar PV facility and power line project area, the overall impact significance of the construction phase of the proposed solar PV facility regarding legally-protected palaeontological heritage resources is assessed as *VERY LOW* (*negative status*), with and without mitigation. This assessment applies to all the associated solar PV facility and power line infrastructure within the project area. No significant further impacts on fossil heritage are anticipated during the operational and decommissioning phases of the solar PV energy facility and associated infrastructure. The No-Go alternative (*i.e.* no solar PV facility and power line development) will probably have a neutral impact on palaeontological heritage. Confidence levels for this assessment are MEDIUM, given the generally low exposure levels of potentially-fossiliferous bedrocks.

Anticipated cumulative impacts in the context of other renewable energy projects in the Ceres Karoo region – *including* the nine proposed solar PV facilities and power lines - are assessed as *LOW (negative)* without mitigation but *VERY LOW (negative)* with mitigation. It is concluded that as far as fossil heritage resources are concerned, the proposed solar facility and power line projects, whether considered individually or together, will *not* result in an unacceptable loss or unacceptable additional impacts, considering all the renewable energy projects proposed in the area. This analysis only applies *provided that* all the proposed monitoring and mitigation recommendations made for all these various projects are consistently and fully implemented.

No specialist palaeontological monitoring or mitigation is recommended for this development, pending the potential discovery of significant new fossil material here during the construction phase. The ECO should be made aware of the possibility of important fossil remains (bones, teeth, petrified wood, plant-rich horizons, fossil termitaria *etc.*) being found or unearthed during the construction phase of the development. Monitoring for fossil material of all major surface clearance and deeper (>1m) excavations by the ECO on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape for recording and sampling by a professional palaeontologist. The palaeontologist concerned will need a Fossil Collection Permit from Heritage Western Cape and all fossil material collected must be properly curated in an approved repository (museum / university collection). These recommendations must be included within the EMPr for the proposed solar PV facility and power line developments. A protocol for Chance Fossil Finds is appended to this report (Appendix C).

There are no identified fatal flaws and no objections on palaeontological heritage grounds to authorisation of the proposed solar PV facilities with its associated power line connections to the Kappa Substation.

9. ACKNOWLEDGEMENTS

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11. 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 Province, Mupumalanga 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).

APPENDIX A: GPS FOSSIL LOCALITY DATA

All GPS readings were taken in the field using a hand-held Garmin GPSmap 64s instrument. The datum used is WGS 84. Please note that:

- The fossil sites recorded here represent only a small sample of potential sites present at or beneath the ground surface within the project area.
- This palaeontological site data is *not* for public release, due to conservation concerns.

LOC.	GPS DATA	COMMENTS
112	[redacted]	Karee Kolk 174. Partially *in situ*, sphaeroidal calcretised termitarium (fossil termite nest) embedded within weathered and calcrete-veined Tierberg Fm mudrocks exposed along steep pediment edge on N. banks of Grootrivier. Fragments downwasted further down slope. Proposed Field Rating IIIB Local Resource.
122		Hoek Doornen 172 (northern area). Locally common cylindrical to flattened horizontal, straight to gently-curved burrows (1-2 cm wide) with distinctive longitudinal surface ridges or wrinkles (*cf Palaeophycus*). Tierberg Formation exposures in bed of Klein-Droëlaagte. Proposed Field Rating IIIC Local Resource.
126		Hoek Doornen 172 (northern area). Oligomict coarse, silcrete-rich alluvial gravels along the bed of the Klein-Droëlaagte with sparse small blocks of silicified wood (probably reworked from the Tierberg Fm). Proposed Field Rating IIIC Local Resource.
127		Hoek Doornen 172 (northern area). Oligomict coarse, silcrete-rich alluvial gravels along the bed of the Klein-Droëlaagte with sparse small blocks of silicified wood (probably reworked from the Tierberg Fm). Proposed Field Rating IIIC Local Resource.
128		Hoek Doornen 172 (northern area). Sandy alluvium, possible heuweljie sands with sheetwash surface gravels on floodplain of Klein-Droëlaagte. Sparse scatter of small angular to slightly water-worn blocks of silicified wood. Proposed Field Rating IIIC Local Resource.
132		Witte Wall 171. Pediment surface gravels including abundant buff to yellowish-grey sandy to gritty silcrete, often flaked (ESA, MSA). Occasional small rolled clasts of petrified wood in same area. Possible trace of ancient coarse alluvial deposits. Proposed Field Rating IIIC Local Resource.
133		Witte Wall 171. Open patch with fine sheetwash gravels dominated by resistant cherty lithologies, occasional exotic Dwyka erratics, sparse small blocks of petrified wood. Proposed Field Rating IIIC Local Resource.
138		Witte Wall 171. Calcretised crest of upper pediment surface. Occasional small float blocks of petrified wood. Proposed Field Rating IIIC Local Resource.
141		Witte Wall 171. Detached angular blocks of large calcretised termitarium blocks reworked from calcretised crest of pediment surface nearby and extending downslope in float. Proposed Field Rating IIIC Local Resource.
142		Witte Wall 171. Fine surface gravels below elevation of upper pediment surface forming desert pavement (serir), with sparse small blocks of petrified wood. Proposed Field Rating IIIC Local Resource.
149		Witte Wall 171. Well-exposed Tierberg Formation siltstones with bedding plane assemblages of simple, sinuous, cross-cutting horizontal burrows with softer ferruginous mineral infill. Proposed Field Rating IIIC Local Resource.

LOC.	GPS DATA	COMMENTS
150	[redacted]	Hoek Doornen 172. Isolated small float block of petrified wood with well-developed seasonal growth lines. Mapped as Tierberg Fm but Collingham Fm outcrop with Matjiesfontein chert v. close by. Proposed Field Rating IIIC Local Resource.
156		Grootfontein 149. Sandy alluvial soils with fine surface gravels, including sparse small angular to subrounded blocks of petrified wood. Proposed Field Rating IIIC Local Resource.
158		Grootfontein 149. Calcretised soils near pediment escarpment edge. Largely embedded sphaeroidal calcretised termitarium with detached blocks extending downslope in float. Proposed Field Rating IIIC Local Resource.
161		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood and ESA stone artefacts. Proposed Field Rating IIIC Local Resource.
163		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood and ESA stone artefacts. Proposed Field Rating IIIC Local Resource.
165		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood and ESA stone artefacts. Proposed Field Rating IIIC Local Resource.
166		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood and ESA stone artefacts. Proposed Field Rating IIIC Local Resource.
169		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood, rare small petrified logs and ESA stone artefacts. Proposed Field Rating IIIB Local Resource.
172		Grootfontein 149. Coarse silcrete-rich oligomict alluvial gravel lenses in bed and banks of Klein-Drooelaagte drainage line. Sparse small blocks of petrified wood, ESA stone artefacts. Proposed Field Rating IIIC Local Resource.
JO1		Small block of petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource.
JO2		Small block of petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource.
JO3		Small block of petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource.
JO4		Small block of petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource.

APPENDIX B: SPECIALIST STATEMENT OF INDEPENDENCE

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of two 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Witte Wall 1 and Witte Wall 2), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

1. **SPECIALIST INFORMATION**

Specialist Company Name:	NATURA VIVA CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr John Edward Almond			
Specialist Qualifications:	PhD (palaeontology)			
Professional affiliation/registration:	Palaeontolgical Society of Southern Africa, Association of Professional Heritage Practitioners (W Cape)			
Physical address:	76 Breda Park, Breda Street, Oranjezicht, CAPE TOWN			
Postal address:	PO Box 12410 Mill Street, Cape Town			
Postal code:	8010	Cell:	n/a	
Telephone:	021 462 3622	Fax:	n/a	
E-mail:	naturaviva@universe.co.za			

2. **DECLARATION BY THE SPECIALIST**

I, **Dr John Edward Almond**, 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

Natura Viva cc

Name of Company:

24 Nov 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, **Dr John Edward Almond**, 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

NATURA VIVA CC

Name of Company

24 October 2020

Date

Signature of the Commissioner of Oaths

2020-10-24

Date

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
CAPE TOWN
2020 -10- 24
CAPE TOWN
STATION COMMANDER
SOUTH AFRICAN POLICE SERVICE

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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PROJECT TITLE

Basic Assessments for the Proposed Development of three 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Grootfontein 1; Grootfontein 2; and Grootfontein 3), near Touws River, Western Cape

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Email: EIAAdmin@environment.gov.za

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Postal address:	PO Box 12410 Mill Street, Cape Town			
Postal code:	8010	Cell:	n/a	
Telephone:	021 462 3622	Fax:	n/a	
E-mail:	naturaviva@universe.co.za			

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- 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;
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- 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.

John E. Almond

Signature of the Specialist

Natura Viva cc

Name of Company:

24th October 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, **Dr John Edward Almond**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company

24th October 2020

Date

Signature of the Commissioner of Oath

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
CAPE TOWN
2020 -10- 24
CAPE TOWN
STATION COMMANDER
SOUTH AFRICAN POLICE SERVICE

2020-10-24

Date

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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- 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;
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- 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.

J E Almond

Signature of the Specialist

Natura Viva cc

Name of Company:

24 August 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Dr John Edward Almond**, 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

NATURA VIVA CC

Name of Company

24th October 2020

Date

Signature of the Commissioner of Oaths

2020-10-24

Date

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
CAPE TOWN
2020 -10- 24
CAPE TOWN
STATION COMMANDER
SOUTH AFRICAN POLICE SERVICE

<table>
<tr><td colspan="3">APPENDIX C: CHANCE FOSSIL FINDS PROCEDURE: Proposed solar PV facilities and associated power lines to Kappa Substation, Ceres Karoo</td></tr>
<tr><td>Province & region:</td><td colspan="2">Western Cape: Cape Winelands District Municipality / Witzenberg Local Municipality</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">HERITAGE WESTERN CAPE (Contact details: Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za)</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Dwyka Group, Ecca Group (Prince Albert, Whitehill, Collingham & Tierberg Formations), Late Caenozoic colluvium and alluvium.</td></tr>
<tr><td>Potential fossils</td><td colspan="2">In bedrocks: fossil fish, mesosaurid reptiles, shelly invertebrates, vascular plants (incl. petrified wood), trace fossil assemblages. In colluvium and alluvium: teeth, bones and horn cores of mammals, non-marine molluscs, calcretised trace fossils (e.g. termitaria), reworked fossil wood.</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 D: SITE SENSITIVITY VERIFICATION

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification for the proposed solar PV facility and associated power line projects was undertaken in order to confirm the current palaeontological heritage sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool) (Figure D1).

The details of the site sensitivity verification are noted below:

Date of Site Visit	7-10 September 2020
Specialist Name	Dr John E. Almond
Professional Registration Number	Not registered
Specialist Affiliation / Company	*Natura Viva* cc

- **Information sources**

The palaeontological heritage site sensitivity verification is based on the following information sources:

1. Site paleosensitivity map produced by the DEFF screening tool (Figure D1);

2. A brief project outline, kmz files and maps provided by CSIR - Environmental Management Services;

3. A desktop review of (a) the relevant 1: 50 000 and 1: 250 000 scale topographic maps, (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including 1: 250 000 geological maps and accompanying sheet explanations as well as (d) several previous and on-going fossil heritage assessments in the Ceres Karoo region by the author and colleagues;

4. The author's field experience with the formations concerned and their palaeontological heritage;

5. A four-day field assessment of the study area, including all land parcels involved, by the author and an experienced field assistant.

- **Outcome of the site sensitivity verification**

On the basis of information sources listed previously the screening tool palaeosensitivity map in Figure D1 is disputed and *rejected* here as an accurate reflection of palaeosensitivity within the present study area. The main reasons for this are:

1. The inaccurate overlay of the project area on the palaeosensitivity map (which is based primarily on the relevant geological maps);

2. The Dwyka Group (indicated in red) is generally regarded as of LOW palaeosensitivity whereas the Tierberg Formation is of MEDIUM sensitivity, at most. Field data for the proposed project suggest a LOW palaeosensitivity for the Tierberg Formation outcrop area here due to weathering and extensive cover by low-sensitivity calcrete, gravels and soils.

3. Potentially-sensitive rock units such as the basal Prince Albert Formation and Whitehill Formation are not rated as high sensitivity on the map (Field data suggests these are generally of LOW palaeosensivity in this region, mainly due to weathering and cleavage development).

4. The map does not address the Late Caenozoic sediments that mantle the bedrocks in the project area, and in particular the pediment gravels (ancient alluvium) underlying almost the entire solar PV study areas as well as younger alluvium along the Grootrivier and its tributaries. Almost all the new fossil occurrences noted during the recent field survey were found in such settings. However, these fossils are of low conservation value and the palaeosensitivity of the Late Caenozoic sediments is according rated as LOW.

As motivated in the relevant palaeontological heritage Basic Assessment report, it is concluded that the entire combined project area for the proposed solar PV facilities and associated power line to Kappa Substation is in practice of LOW palaeosensivity. Potentially fossiliferous rock units underlying the project footprint such as the Prince Albert and Whitehill Formations are too weathered and tectonically deformed (cleaved) to contain scientifically valuable fossils in the project area. No significant, conservation-worthy fossil sites or palaeontological No-Go areas were recorded during the field survey.

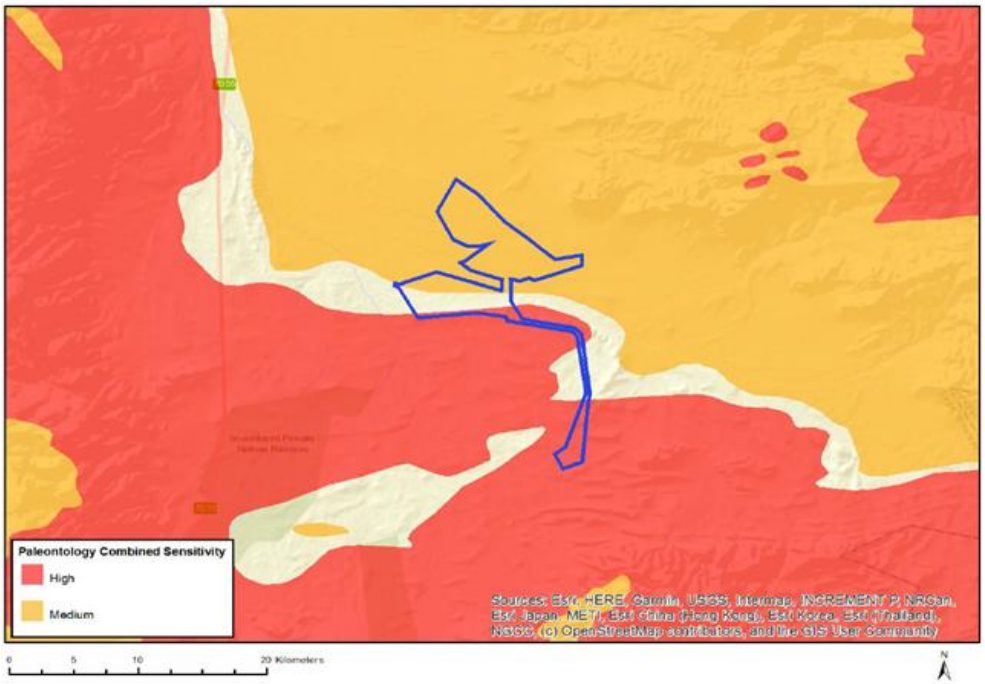

Figure D1: Palaeosensitivity map for the combined proposed solar PV facility and associated power line project area (blue polygon) produced from the DEFF screening tool. Data from several recent field surveys in the Ceres Karoo as well as desktop studies indicate that in practice the entire project area is of LOW palaeosensitivity.

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

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been 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;*	*Section 11*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
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 2.1*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Sections 4 to 6*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 2.1*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 2*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Sections 4 & 5*
g) an identification of any areas to be avoided, including buffers;	*N/A*
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;	*Figs. 53 & 54*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2.2*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Sections 4, 5 & 6*
k) any mitigation measures for inclusion in the EMPr;	*Sections 7 & 8*
l) any conditions for inclusion in the environmental authorisation;	*Section 8*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Sections 7 & 8*
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*	*Section 8*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been addressed in the Specialist Report*
avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*N/A*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*N/A (Refer to BA Report)*
q) any other information requested by the competent authority.	*N/A (Refer to BA Report)*
(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.	*Part A of the Assessment Protocols published in GN 320 on 20 March 2020 are applicable (i.e. Site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed). See Appendix D*

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.4

Terrestrial Biodiversity and Species

TERRESTRIAL BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT:

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure on the Farm Hoek Dooren (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4), near Touws River, Western Cape

---

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	SDP Ecological & Environmental Services
P O Box 320	P O Box 1016
Stellenbosch	Ballito
7599	4420
South Africa	South Africa

October 2020

Executive Summary

Four 175 MW photovoltaic (PV) power generation plants (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4) have been proposed for establishment on the Farm Hoek Doornen 172. In addition, a 132kV overhead powerline, is proposed that would connect the proposed PV facilities with the Kappa Substation, some 12km to the south of the site.

An evaluation of the biophysical aspects of the Farm Hoek Doornen was undertaken during September 2020 in order to consider the nature of the area in question and to evaluate the impacts of the proposed development.

The Farm Hoek Doornen lies within the Tanqua Succulent Karoo Biome and comprises of two veld types, namely Tanqua Karoo and Tanqua Wash Riviere. The former is associated with elevated terrestrial environments while the latter is associated with sandy, riparian habitats. Both veld types are considered "least threatened".

In evaluating the ecological significance of the subject site, it was determined that while floral diversity and significance were not considered to be high, the importance of the Tanqua Wash Riviere habitat or lower riparian environments were important in terms of faunal diversity. These areas are considered important faunal habitat and are evidently also associated with extreme flood states, providing them with a high ecological sensitivity. These findings align with those of the Department of Environment, Forestry and Fisheries (DEFF) screening tool and the various data sets associated with the region.

Given the above, the proposed development within Hoek Doornen is expected to elicit a moderate ecological impact that may be reduced to "low" if suitable mitigation measures are employed. The overhead powerline is expected to elicit only a low impact, primarily associated with change that may arise in the riparian environments.

The proposed developments, if authorised should be approved with a number of conditions, in particular the placement of the development within the footprint identified and that a suitable game permeable fence should be instituted. A number of related mitigation and management measures are proposed.

From the above, it is evident that subject to the conditions outlined in this report, the development of four 175 MW PV facilities at Hoek Doornen cannot be precluded on ecological grounds.

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List of Abbreviations

AIP	Alien Invasive Plant
AMSL	Above Mean Sea Level
BA	Basic Assessment
CBA	Critical Biodiversity Areas
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental importance and sensitivity
EGI	Electricity Grid Infrastructure
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PV	Photovoltaic

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Aquifer	Underground layer of water-bearing permeable rock
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Dune	Landscape feature arising from the deposition of sediment, transported primarily by winds and resulting in a sandy feature that may or may not be stabilised by vegetation
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating non linear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Scarp	Physical feature determined by geology and comprises of a steep slope that differs from the slope of the prevailing landscape
Sheetwash	A mobile sheet of sediment deposited by water flow over a hill-slope or plain
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

TERRESTRIAL BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This report serves as the Terrestrial Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (EGI) on the Farm Hoek Doornen 172, near Touws River in the Western Cape. These projects are referred to as Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4.

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Project Applicant is undertaking an Application for Environmental Authorisation to be submitted to the National Department of Environment Forestry and Fisheries (DEFF), which entails significant planning as well as the undertaking of BA processes. The Project Applicant is proposing to develop nine solar PV facilities, nine powerlines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172. This Terrestrial Biodiversity and Species Specialist Assessment specifically deals with the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, as well as the associated EGI (Figure 1). This specialist study, is being undertaken as part of the BA process in order to evaluate the terrestrial habitats and biodiversity of the receiving environment in relation to the proposed development.

The biophysical reconnaissance and evaluation of the farm Hoek Doornen was undertaken during September 2020 and entailed both a literature review of the region, as well as on site evaluations, during which specific primary data was collected and evaluated. In addition, the identification of key terrestrial, ecological features on site and an interpretation of the prevailing habitat form were undertaken.

All data collected in the field and during the literature review was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. The evaluation also sought to identify any anomalies within the prevailing environment. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.2 Details of Specialist

This specialist assessment has been undertaken by Messrs S C Bundy, L P Maingard and AM Whitehead of SDP Ecological and Environmental Services. The following information is provided in respect of the above:

S C Bundy	Ecologist	SACNASP No.400093/06
Supported by		
LP Maingard	Ecologist	SACNASP No.116639/16
AM Whitehead	Ecologist	SACNASP No 400176/10

Curriculae vitae are included in Appendix A of this specialist assessment, as well as specialist statements of independence.

1.3 Terms of Reference

The overall objectives of the Terrestrial Biodiversity and Species Specialist Study are:

- To identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to important terrestrial habitats, as they may be identified.

- To provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.

- To assess the actual and potential impacts arising from the proposed development on both the terrestrial habitat and fauna within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary; or may be of a cumulative nature, in terms of impacts arising from similar developments or activities within the region.

- To provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site, as a consequence of the proposed development.

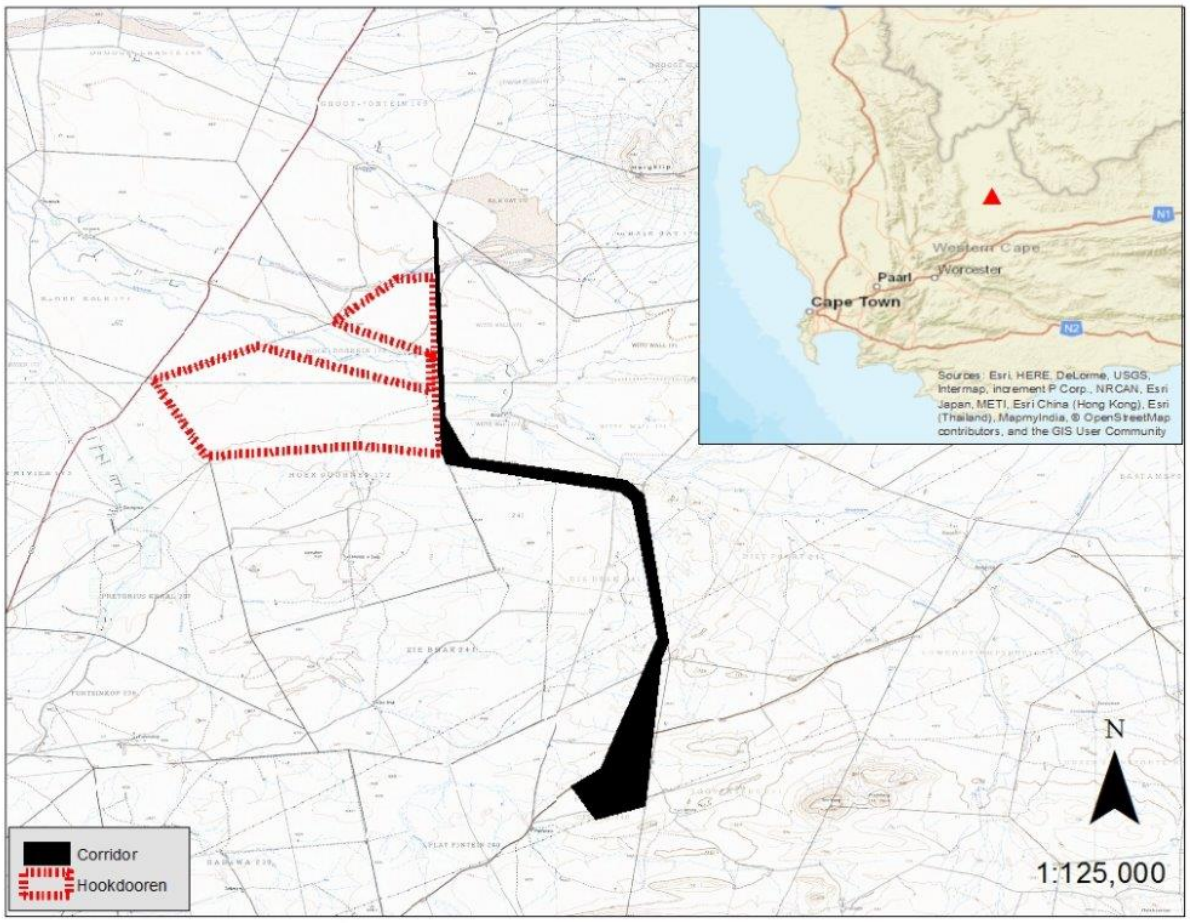

Figure 1. Topographic map indicating the study areas (outlined in red for the PV Facilities and black for the EGI Corridor) within the Farm Hoek Doornen.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320; as well as all relevant legislation. Identify any additional protocols, legal and permit requirements that are relevant to this project and the implications thereof.
- Review detailed information relating to the project description and precisely define the environmental risks to the terrestrial environment and consequences for prevailing ecology.
- Compile a baseline description of the terrestrial ecology of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity.
- Provide specific ecological data in respect of the terrestrial floral and faunal components of the site using ground-truthing methods, with an emphasis on those areas considered to be of "high" and possibly, "moderate" sensitivity.
- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review. The site visit must also identify the level of sensitivity assigned to the project area on the National Web-based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use. A Site Sensitivity Verification Report must also be compiled based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.
- Collate all data collected during the field work and undertake a statistical review using methodologies that allows for comparison of biological data.
- Undertake a faunal investigation on site based on relevant data and related information.
- Provide a detailed terrestrial sensitivity map of the site, including mapping of disturbance and transformation on site, as well as set-backs or buffers.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.
- Identify any species of special concern or protected species on site.
- Identify and delineate wetlands that may occur on the site, using the relevant protocols established.
- Determine if a Water Use License (WUL) is required and if so, determine the requirements thereof.
- Identify and rate potential direct, indirect and cumulative impacts on the terrestrial ecology, communities and ecological processes within the site during the construction, operation and decommissioning phases of the project.
- Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the terrestrial ecology are limited.
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site-specific impact management outcomes and actions that need to be included.
- Compile an assessment report qualifying the risks and potential impacts on terrestrial ecology in the study area and impact evaluations.
- Incorporate and address issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).

2 Approach and Methodology

A literature review and desktop analysis were undertaken prior to the field investigation, utilizing various sources including the South African National Biodiversity Institute (SANBI) data and other relevant sources. Recent and historical aerial imagery of the site was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken from the 12 to 18 September 2020 whereby the key approach to evaluating the subject site is through the following actions:

- Identification of the key ecological drivers within the region and determination of their relevance within the site. e.g. wind may be a key ecological driver that determines the distribution and nature of habitats.

- Following the determination of these drivers the identification of habitat forms and structures within the subject site and identification of their ecological significance e.g. sand or lithic associated habitats and their relevance within the broader landscape.

- With the evaluation of the significance and relevance of identified habitats, consideration is given to the applicability of establishing the proposed development, namely a solar PV facility within the site, as well as associated infrastructure, and associated powerlines. Specific consideration is given to:

    a) The identification of areas where habitat forms will not be directly affected by the proposed development.
    b) The identification of areas of the site where the proposed development will not adversely affect the key drivers of terrestrial habitat.
    c) Consideration of the presence / absence of specific fauna within the subject site.
    d) The identification of areas of the site where biophysical factors will not adversely affect the proposed development.
    e) Other specific issues that may be of relevance e.g. specific high faunal populations within specific areas.

In order to evaluate faunal presence and composition the following actions were undertaken:

- A review of the site was undertaken to identify specific features, in particular habitat conducive to the presence of *Bunolagus monticularis* (riverine rabbit).

- Mr S Todd of 3 Foxes Biodiversity Solutions established cameras at selected sites on the Farms Witte Wall, Grootfontein, and Hoek Doornen in compliance with the requirements of the Endangered Wildlife Trust. A separate report has been compiled regarding the Riverine Rabbit, and provided in Appendix A of this assessment report.

- Additional cameras were placed at points within the subject site by the author.

- Specific habitat was traversed on foot (river bed and across scarp) identifying *inter alia* evidence of fauna (through spoor, scat or other features) or actual siting of specimens. The presence of such species was noted in relation to the habitat under investigation.

- Nocturnal assessments were undertaken on two nights.

Further evaluation of specific literature was undertaken to confirm or corroborate findings, as well as to consider the likelihood of specific fauna that may be of conservation value.

2.1 Information Sources

The following data sources were consulted during this investigation.

Table 1. Data sources utilised during assessment

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	CapeNature. 2017. Western Cape Biodiversity Spatial Plan 2017. http://bgis.sanbi.org/	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Western Cape province
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
http://posa.sanbi.org/sanbi South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]	SANBI Plants of Southern Africa	2016	Data	Plant list for Tankwa region.
www.vmus.adu.org.za. Animal Demography Unit (ADU).	ADU: University of Cape Town	2020	Data	Specific data on geographic occurrence and record for various taxa.
Tankwa Weather http://tankwaweather.co.za	Private weather station	2020	Data	A private Davis Vantage Pro 2 mounted 1.6m above the ground. And anemometer at 10m angle. Operational since: Jan 2015

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations are presented in respect of this evaluation:

- Site reconnaissance was undertaken over a consecutive 5 day period during the early summer. Such field reconnaissance will not account for seasonal variations that may arise and reliance on collated and historical data from the region is required.

- During the period of reconnaissance, weather conditions may have affected findings, in particular, colder temperatures. From a botanical perspective, the early winter period is considered most ideal for the evaluation of plants in this region. Some fauna (particularly invertebrates) may also be in torpor or generally absent from the area on account of season and / or weather. This is however not considered a fatal flaw as prevailing habitat dominates.

- The area in general has been subject to an extended and significant drought, which is likely to have influenced habitat form at a limited level as well as faunal populations.

- Cumulative impacts have been considered on a regional basis over a 30km radius.

2.3 Consultation Processes Undertaken

Interaction was undertaken with local residents and interested parties who were considered to have specific knowledge of the area, these included:

- Mr Philip van Heerden
- Mr Andre Vermeulen.

The above persons provided anecdotal information which was verified and considered during the site evaluation as well as by further interrogation of the literature and data.

3 Description of Project Aspects relevant to Terrestrial Biodiversity

The development of a PV facility, associated infrastructure and EGI on the subject properties will by necessity, be undertaken on land that meets a number of criteria including, *inter-alia*, level or gradual falls, generally suitable founding conditions and avoidance of areas that may be inundated by flooding. As a consequence, the proposed PV facilities will avoid all riverine and wetland environments.

The proposed Hoek Doornen PV projects will see a land use change that differs significantly from the prevailing land use. The implementation of the proposed development will result in notable change to the prevailing catchment associated with the river systems in the area, primarily on account of the construction stage of the project, as well as the long-term operational stage. The development of the site for the PV facilities, associated infrastructure and EGI will see the following activities arise:

- Cordoning and fencing of the sites during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence (or palisade or mesh type) of about 2 – 3 m high which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing. Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm.

- Clearance or partial clearance of minor topographic features and vegetation, where applicable, during the construction phase.

- Establishment of roadways (i.e. access roads leading to the site and internal gravel access roads) and hard panning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays. The footing of the module framework is founded into the ground using an earth screw or similar methods. Internal 33 kV power lines/underground cables are to be installed underground to maximum depth of 1.6 m or above ground with height of 9 m.

- Establishment of step up transformers and four on-site substations (one for each PV Facility). This facility is expected to occupy an area of approximately 2 ha each. It will be fenced and isolated from the balance of the site.

- A Lithium Ion Battery Energy Storage System (BESS) will be established at each PV Facility. The proposed BESS will cover an area of up to 8 hectares within the laydown area, and a height of up to 5 – 10 m.

- A laydown area of approximately 13 hectares in extent.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

- An overhead powerline (132kV) will be established per PV Facility from the on-site substation to the Kappa substation. The powerlines will traverse the Groot River and adjacent lands to the south, aligning with existing powerlines associated with adjacent renewable energy projects.

The commencement of construction on site will entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facilities. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short temporal extent, as the construction project rolls out and a stability, albeit within a differing environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts.

4 Baseline Environmental Description

The Farm Hoek Doornen lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome. The Succulent Karoo Biome is distinct from the neighbouring Nama-Karoo Biome. The Tankwa Karoo is associated with a low altitude and generally flat to undulating landscape, not exceeding 1500m amsl (Low and Rebelo, 1996). According to the Koppen-Geiger climate classification method the area is classified “BSh”, which is indicative of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective. Some consideration of the broader terrestrial ecological features of the site are presented below.

4.1.1 Terrestrial Ecosystems

The subject site can be described as an elevated plateau that acts as a watershed between drainage to the north and drainage to the south. The lower elevations of the site, particularly to the north are dominated by sheet wash plains and a larger ephemeral river system, the Groot River.

Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo, a form of the Succulent Karoo Biome and Tanqua Wash Riviere (AZi 7) a riparian habitat form (Mucina and Rutherford 2006) (Figure 2). Both these veld types are considered “least threatened” from a conservation perspective (Figure 3). The same applies to the EGI corridor running along Die Brak and Platfontein Farms. The sheet wash (AZi7) is however considered to show some botanical significance, primarily in respect of the occurrence of geophytes. However, it should be noted such specimens may only be evident from a seasonal perspective.

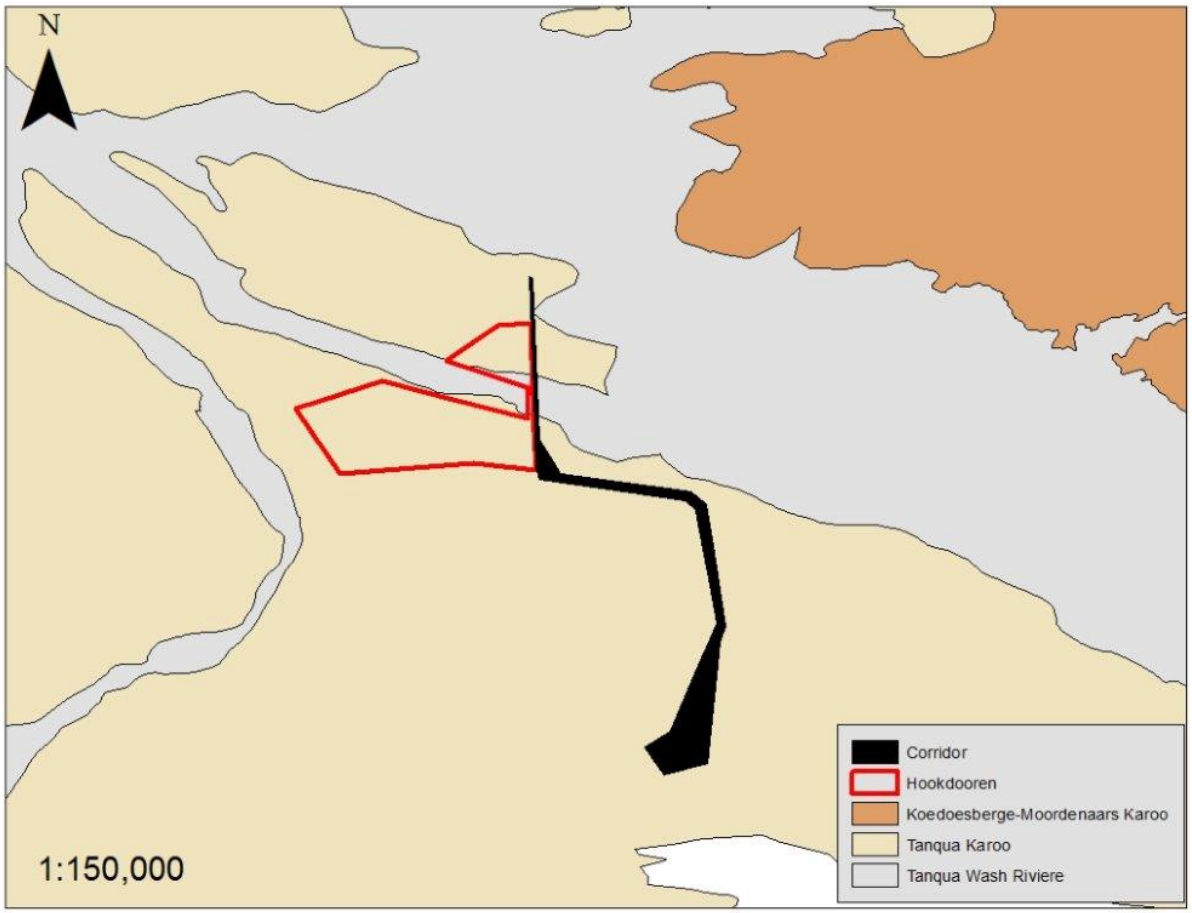

Figure 2. Map indicating veld types in relation to study area

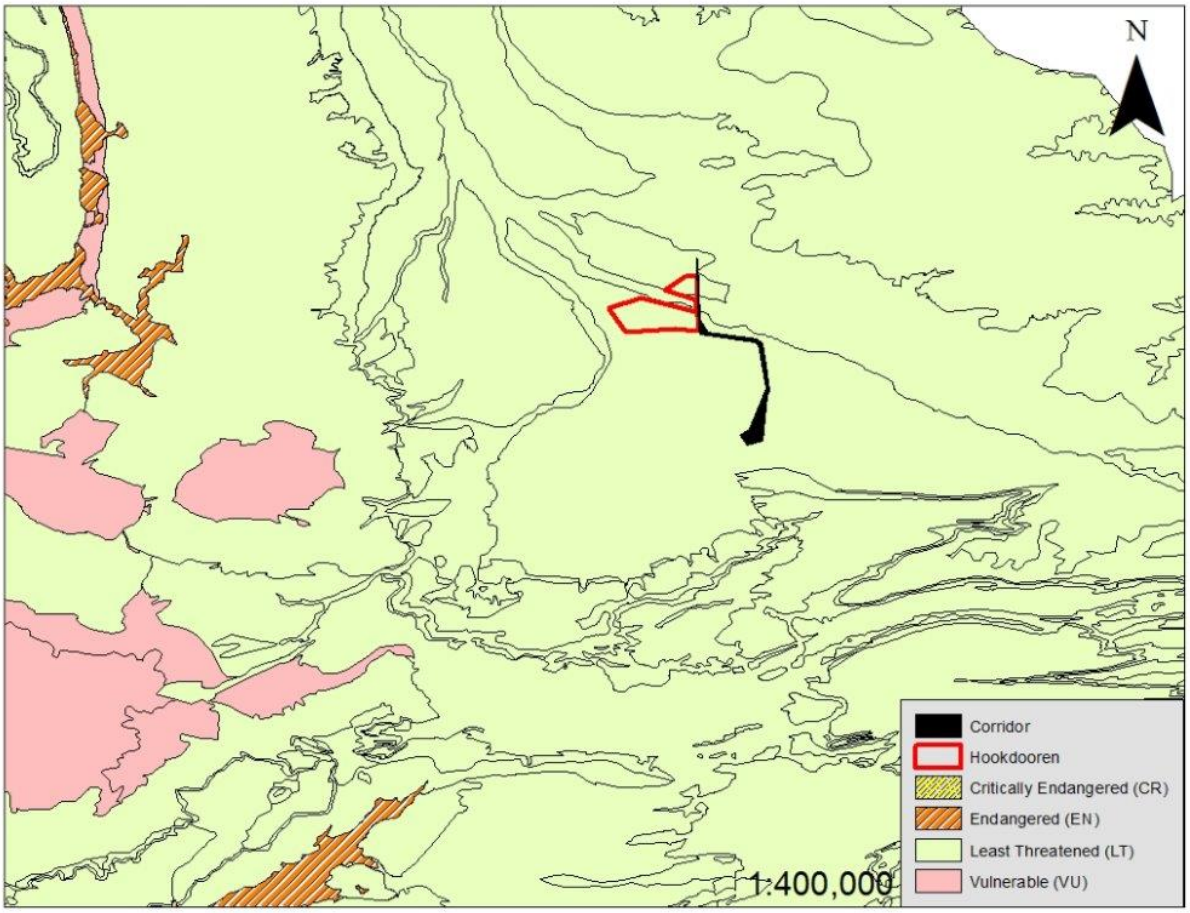

Figure 3. Map indicating site in relation to areas of conservation significance

4.1.2 Ecological Processes, Functioning and Drivers

Two principle factors are considered to be the master elements driving the localised ecology. These can be considered to be broadly, meteorological factors, namely wind, rainfall and temperature, while edaphics, particularly giving rise to lithic or sandy environments may be considered a geophysical driver. Notably, anthropogenic factors have over the previous century proven to be a key driver in contemporary habitat form and structure.

From a meteorological perspective the study area is a “xeric habitat”, with an average annual rainfall recorded over the last 5 years of between just over 40mm and 66mm in 2017. (2020 may exceed this record). There is evidently, high spatial and inter-annual variability in rainfall patterns across the region (Figure 4). According to Mucina and Rutherford (2006), the region may be considered to be a “rain shadow desert”, where topography influences rainfall patterns.

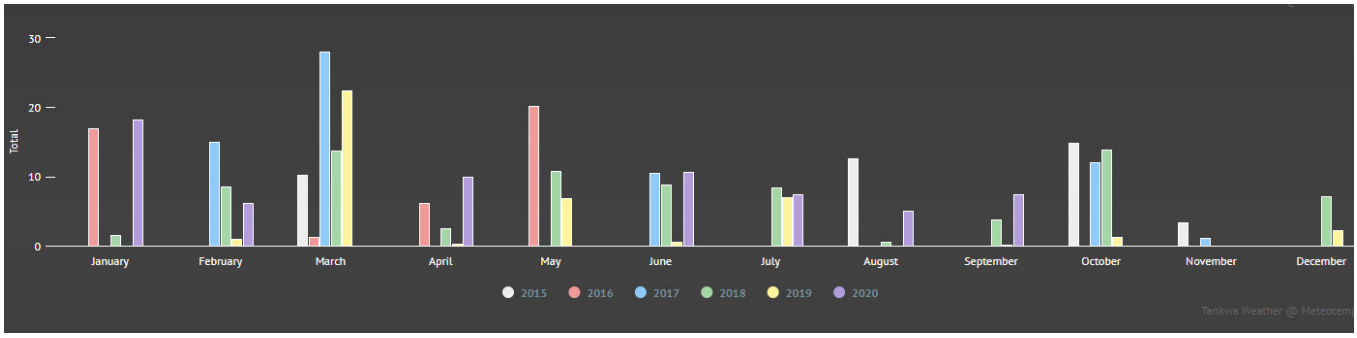

Figure 4. Graph showing monthly rainfall in Tankwa 2015 – date.

Figure 5 presents an aerial image of the Farm Hoek Doornen from 1982. This image was taken the year following the Laingsburg floods of 1981, which are considered one of the most significant flood events, with a flood return expectation of once a century. The image, particularly when compared with a similar image taken nearly 40 years later, shows that little change has arisen in the overall state of the farm and surrounding landscape. Notable is the primary channel within the Groot River which effectively follows a similar traverse today as that evident in 1982. Evidently, physical change in this environment is limited and is probably subtle, relating to factors such as wind and faunal presence.

As indicated, wind is a key issue within the region, driving sediment movement and promoting aeolian, sediment transport in areas exposed to high winds and with little vegetative cover. Where vegetation cover has been compromised, aeolian transport generally prevents the natural re-establishment of plants. The dominant winds within the subject site are the north westerly and southerly wind, which are seasonally prevalent (Figure 6). Sheetwash is also conspicuous to the east of the site, where sediments transported from up-slope have been deposited, proximal to the riverine areas.

Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3 °C and the highest maxima being 50.2°C (http://tankwaweather.co.za/pages/station/climate.php). A mean maximum temperature of 35°C is recorded by the SA Weather Service. Such extremes are indicative of the requirement for floral and faunal species to be tolerant of the effects of frosting, as well as high insolation and transpiration states. As a consequence, plant communities and faunal populations in the region generally show high levels of adaptation, occurring in specific areas or zones and with the utilisation of specific, niche environments, e.g. scarp slopes and riverine environments by both floral and faunal communities, or behaviour concomitant with specific environments.

Given the above, anthropogenic factors have been a key determinant in the contemporary nature of the terrestrial habitat within the site. The current land use on the site is livestock, focussing on sheep and goat farming, which has been undertaken since the 1700s (http://media.withtank.coma). The demand for wool in the mid part of the 20th Century and the subsidisation of farming, saw unsustainable stocking levels of sheep in much of the Tanqua region (Simbi 1998). In addition, other crops have been utilised within the broader area including wheat and dates (A Vermeulen *pers comm*). It was also common practice to utilise the flood plains of proximal rivers on sites for the cultivation of crops and pasture and indeed this practice prevails today. Overgrazing has arisen across much of the region and is evident in Hoek Doornen.

The above natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat. It follows that further land use change in the region, where livestock are excluded, may allow for the seral succession processes of habitats previously affected by farming activities to emerge. However, the prudent implementation of such development is required in order to achieve such goal.

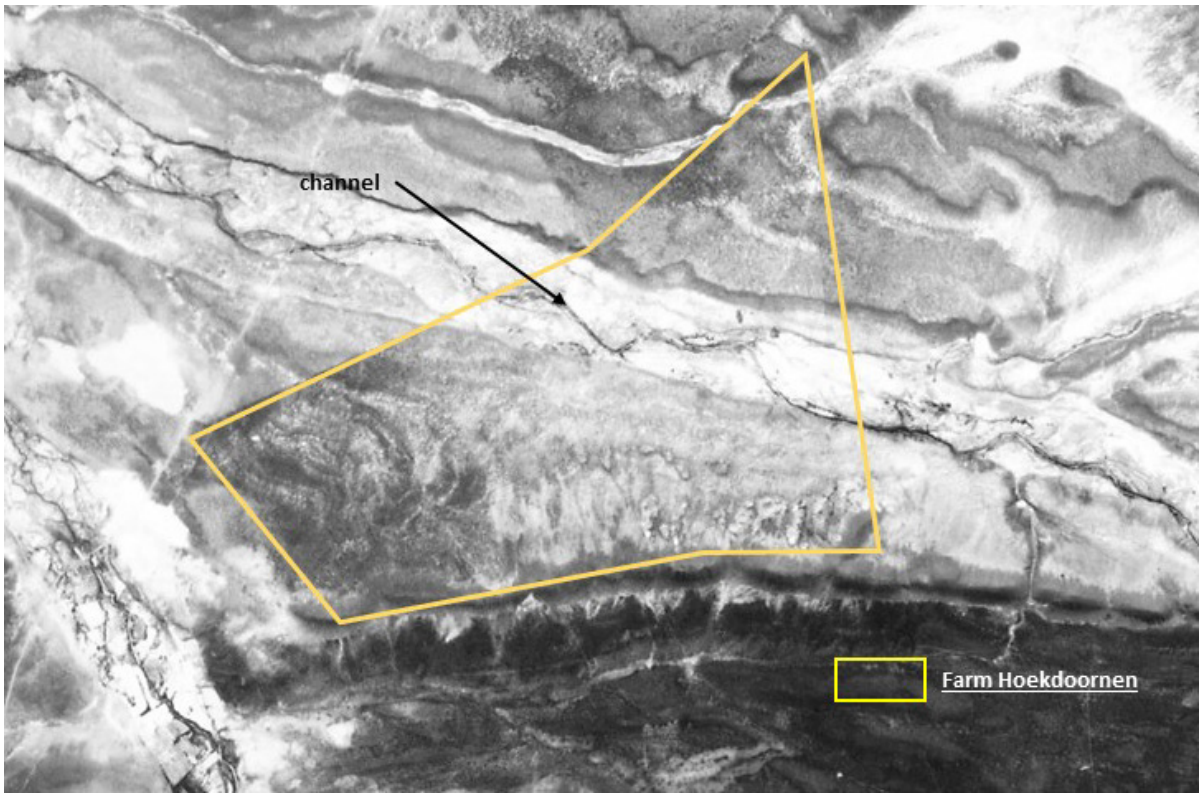

Figure 5. A 1982 aerial image of the site showing the Hoek Doornen Farm and surrounding environments. Note the position of the primary channel within the river (indicated) and compare to Figure 6 below, a more recent image (2016).

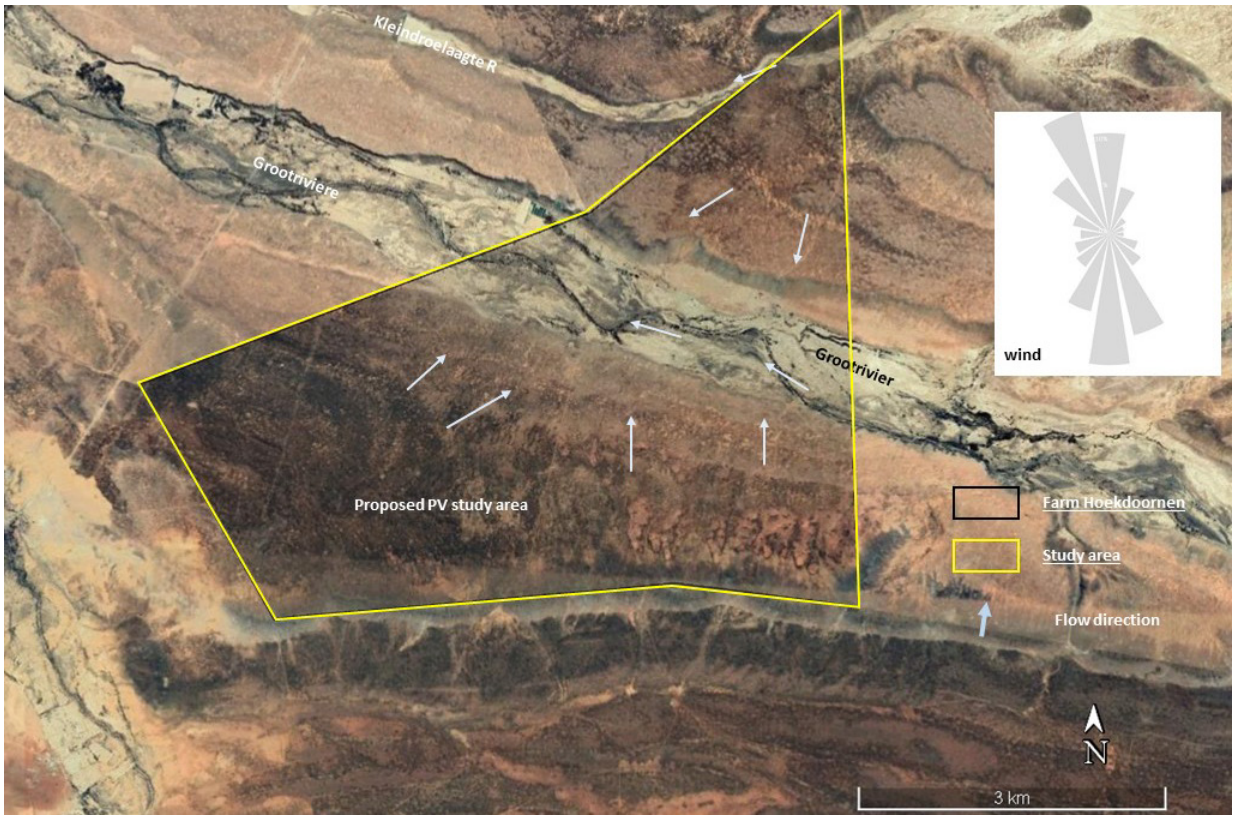

Figure 6. Aerial image showing the Hoek Doornen site, specific features, primarily associated with drainage and prevailing wind directions

4.1.3 Flora and Fauna

Although much of the land within and proximal to the site has been subject to significant change on account of previous land use practices (Acocks 1988), faunal populations and diversity can generally be described as moderate to high on account of limited anthropogenic presence. Botanical diversity is generally associated with niche environments, in particular rock ridges and sandy or stone wash plains (sheetwash), and in these areas geophytes may be evident. Tables 2 and 3 indicate the recorded botanical and faunal species common to the study area and surrounds.

The majority of the listed flora are aizoons of the Family Aizoaceae ("succulents") as well as *Salsola* spp. Of interest is *Haemanthus tristis* which is a rare species identified in the southern Tanqua Karoo, on the nearby farm of Grootfontein. Other important endemic species identified include *Tanquana prismatica*. Graminoids are limited to primarily the genus *Stipagrostis* (e.g. *S obtusa*), and are most frequently encountered in the more sandy regions.

Fauna recorded from the region are evidently weighted in favour of mammal species, with Muridae (rodents), being the dominant species on record. Only *Miniopterus schreibersii*, (long fingered hairy bat) is to be considered of conservation significance, being classified as "near threatened". Notable by its absence from Table 3 is *Bunolagus monticularis,* the riverine rabbit.

Table 2. List of specimens of plants recorded from the broader locale of the site by SANBI and others (SANBI Plants of Southern Africa (POSA))

Family	Genus	Species	Author	Ecology
Aizoaceae	*Conophytum*	*piluliforme*	(N.E.Br.) N.E.Br.	Indigenous; Endemic
Scrophulariaceae	*Selago*	*centralis*	Hilliard	Indigenous
Asteraceae	*Eriocephalus*	*aromaticus*	C.A.Sm.	Indigenous; Endemic
Aizoaceae	*Leipoldtia*	*sp.*		
Amaryllidaceae	*Haemanthus*	*coccineus*	L.	Indigenous
Amaryllidaceae	*Haemanthus*	*tristis*	Snijman	Indigenous; Endemic
Crassulaceae	*Tylecodon*	*striatus*	(Hutchison) Toelken	Indigenous; Endemic
Aizoaceae	*Hereroa*	*crassa*	L.Bolus	Indigenous; Endemic
Aizoaceae	*Lithops*	*sp.*		
Malvaceae	*Hermannia*	*sp.*		
Meliaceae	*Nymania*	*capensis*	(Thunb.) Lindb.	Indigenous
Aizoaceae	*Ruschia*	*centrocapsula*	H.E.K.Hartmann & Stuber	Indigenous; Endemic
Aizoaceae	*Ruschia*	*sp.*		
Apocynaceae	*Quaqua*	*mammillaris*	(L.) Bruyns	Indigenous
Hyacinthaceae	*Albuca*	*namaquensis*	Baker	Indigenous
Aizoaceae	*Hammeria*	*meleagris*	(L.Bolus) Klak	Indigenous; Endemic
Asteraceae	*Pteronia*	*fasciculata*	L.f.	Indigenous; Endemic
Aizoaceae	*Lampranthus*	*haworthii*	(Haw.) N.E.Br.	Indigenous; Endemic
Colchicaceae	*Ornithoglossum*	*undulatum*	Sweet	Indigenous
Aizoaceae	*Mesembryanthemum*	*junceum*	Haw.	Indigenous; Endemic
Aizoaceae	*Lampranthus*	*uniflorus*	(L.Bolus) L.Bolus	Indigenous; Endemic
Aizoaceae	*Peersia*	*macradenia*	(L.Bolus) L.Bolus	Indigenous; Endemic
Aizoaceae	*Ruschia*	*uncinata*	(L.) Schwantes	Indigenous; Endemic
Aizoaceae	*Mesembryanthemum*	*nitidum*	Haw.	Indigenous; Endemic
Aizoaceae	*Mesembryanthemum*	*tetragonum*	Thunb.	Indigenous
Aizoaceae	*Braunsia*	*apiculata*	(Kensit) L.Bolus	Indigenous; Endemic

Family	Genus	Species	Author	Ecology
Iridaceae	*Lapeirousia*	*pyramidalis*	(Lam.) Goldblatt	Indigenous; Endemic
Aizoaceae	*Tanquana*	*prismatica*	(Schwantes) H.E.K.Hartmann & Liede	Indigenous; Endemic
Aizoaceae	*Malephora*	*crassa*	(L.Bolus) H.Jacobsen & Schwantes	Indigenous; Endemic
Aizoaceae	*Braunsia*	*stayneri*	(L.Bolus) L.Bolus	Indigenous; Endemic
Iridaceae	*Watsonia*	*laccata*	(Jacq.) Ker Gawl.	Indigenous; Endemic
Aizoaceae	*Ruschiella*	*lunulata*	(A.Berger) Klak	Indigenous; Endemic
Malvaceae	*Anisodontea*	*procumbens*	(Harv.) Bates	Indigenous; Endemic

Table 3 Species list for mammals, reptiles, amphibians and some invertebrates recorded from the Tankwa region (source www.vmus.adu.org.za)

Family	Scientific name	Common name	Red list category
Mammalia			
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern (2008)
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern (2016)
Bovidae	*Oryx gazella*	Gemsbok	Least Concern (2016)
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)
Canidae	*Otocyon megalotis*	Bat-eared Fox	Least Concern (2016)
Canidae	*Vulpes chama*	Cape Fox	Least Concern (2016)
Felidae	*Felis silvestris*	Wildcat	Least Concern (2016)
Herpestidae	*Herpestes pulverulentus*	Cape Gray Mongoose	Least Concern (2016)
Leporidae	*Lepus capensis*	Cape Hare	Least Concern
Macroscelididae	*Macroscelides proboscideus*	Short-eared Elephant Shrew	Least Concern (2016)
Muridae	*Aethomys granti*	Grant's Rock Mouse	Least Concern
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern
Muridae	*Desmodillus auricularis*	Cape Short-tailed Gerbil	Least Concern (2016)
Muridae	*Gerbilliscus paeba*	Paeba Hairy-footed Gerbil	Least Concern (2016)

Family	Scientific name	Common name	Red list category
Muridae	*Micaelamys granti*	Grant's Micaelamys	Least Concern (2016)
Muridae	*Otomys irroratus*	Southern African Vlei Rat	Least Concern (2016)
Muridae	*Otomys unisulcatus*	Karoo Bush Rat	Least Concern (2016)
Muridae	*Parotomys brantsii*	Brants's Whistling Rat	Least Concern (2016)
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern (2016)
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	Near Threatened (2016)
Nesomyidae	*Malacothrix typica*	Large-eared African Desert Mouse	Least Concern (2016)
Nesomyidae	*Petromyscus barbouri*	Barbour's Pygmy Rock Mouse	Least Concern (2016)
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	Least Concern (2016)
Soricidae	*Myosorex varius*	Forest Shrew	Least Concern (2016)
Vespertilionidae	*Miniopterus schreibersii*	Schreibers's Long-fingered Bat	Near Threatened
Viverridae	*Genetta genetta*	Common Genet	Least Concern (2016)
Viverridae	*Genetta tigrina*	Cape Genet	Least Concern (2016)
Reptilia			
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)
Agamidae	*Agama hispida*	Spiny Ground Agama	Least Concern (SARCA 2014)
Chamaeleonidae	*Bradypodion gutturale*	Little Karoo Dwarf Chameleon	Least Concern (SARCA 2014)
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	Least Concern (SARCA 2014)
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Chondrodactylus angulifer angulifer*	Common Giant Ground Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Goggia hexapora*	Cederberg Pygmy Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus weberi*	Weber's Gecko	Least Concern (SARCA 2014)
Lacertidae	*Pedioplanis laticeps*	Karoo Sand Lizard	Least Concern (SARCA 2014)
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	Least Concern (SARCA 2014)

Family	Scientific name	Common name	Red list category
Scincidae	*Trachylepis variegata*	Variegated Skink	Least Concern (SARCA 2014)
Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern (SARCA 2014)
Testudinidae	*Psammobates tentorius tentorius*	Karoo Tent Tortoise	
Amphibia			
Bufonidae	*Vandijkophrynus gariepensis gariepensis*	Karoo Toad (subsp. gariepensis)	
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)
Invertebrates			
BUTHIDAE	*Parabuthus capensis*		
BUTHIDAE	*Parabuthus granulatus*		
BUTHIDAE	*Uroplectes carinatus*		
EREBIDAE	*Automolis meteus*		Not listed
EREBIDAE	*Utetheisa pulchella*		Not listed
GEOMETRIDAE	*Isturgia deerraria*		Not Threatened (NT)
GEOMETRIDAE	*Pseudomaenas intricata*		Not Threatened (NT)
LYCAENIDAE	*Aloeides apicalis*	Pointed russet	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides depicta*	Depicta russet	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides vansoni*	Roggeveld russet	Least Concern (SABCA 2013)
LYCAENIDAE	*Azanus ubaldus*	Velvet-spotted babul blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Chilades trochylus*	Grass jewel blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis beaufortia charlesi*	Charles's opal	Least Concern (SABCA 2013)
LYCAENIDAE	*Leptotes pirithous pirithous*	Common zebra blue	Least Concern (SABCA 2013)
NYMPHALIDAE	*Melampias huebneri huebneri*	Boland brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Stygionympha robertsoni*	Koppie hillside brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Tarsocera sp.*		
NYMPHALIDAE	*Tarsocera fulvina*	Karoo spring widow	Least Concern (SABCA 2013)
NYMPHALIDAE	*Torynesis mintha mintha*	Mintha veined widow	Least Concern (SABCA 2013)
NYMPHALIDAE	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)
PIERIDAE	*Pontia helice helice*	Southern meadow white	Least Concern (SABCA 2013)
PTEROPHORIDAE	*FAMILY PTEROPHORIDAE*	Unidentified PTEROPHORIDAE	
Coenagrionidae	*Africallagma glaucum*	Swamp Bluet	LC

Family	Scientific name	Common name	Red list category
Gomphidae	*Paragomphus genei*	Common Hooktail	LC
Libellulidae	*Crocothemis erythraea*	Broad Scarlet	LC
Libellulidae	*Orthetrum trinacria*	Long Skimmer	LC
Libellulidae	*Sympetrum fonscolombii*	Red-veined Darter or Nomad	LC
Libellulidae	*Trithemis furva*	Navy Dropwing	LC
Libellulidae	*Trithemis kirbyi*	Orange-winged Dropwing	LC
Scarabaeidae	*Aphengoecus multiserratus*		
Scarabaeidae	*Epirinus rugosus*		
Scarabaeidae	*Euoniticellus intermedius*		

4.1.4 Conservation Planning

Critical Biodiversity Areas and Ecological Support Areas

Figure 7 below provides an illustration of the assessed area for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects, and EGI corridor in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) in terms of the Western Cape Biodiversity Spatial Plan (2017).

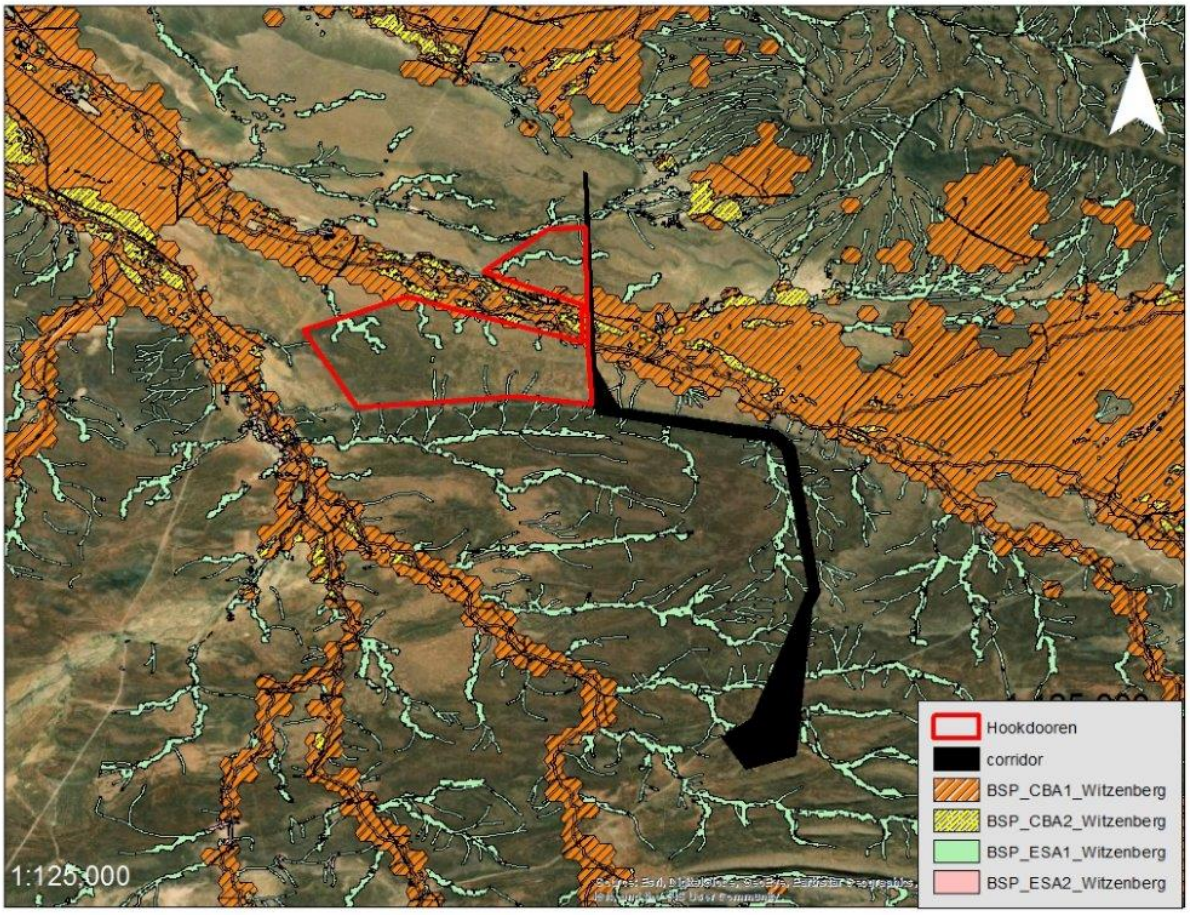

Figure 7. Map image detailing the Hoek Doornen PV site and associated infrastructure in relation to CBA and ESA portion of lands identified through the Western Cape Biodiversity Spatial Plan framework (Cape Nature, 2017).

The assessed area for the PV arrays and associated infrastructure, specifically the power lines, traverse a number of Terrestrial and Aquatic CBA and ESA delineated areas as indicated by Figure 7 above. However, the actual footprint of the Hoek Doornen PV 1 and Hoek Doornen PV 3 facilities do not traverse any CBAs; however covers a few minor areas of Aquatic ESA 1, mostly associated with drainage line watercourses. The actual footprint of the Hoek Doornen PV 2 and Hoek Doornen PV 4 facilities covers a few extremely minor areas of CBA 1 (Terrestrial) and Aquatic ESA 1, mostly associated with drainage line watercourses. This preliminary data provided by the Western Cape Biodiversity Spatial Plan (WCBSP) is the product of a systematic biodiversity planning assessment which identifies portions of land that require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and aquatic realms (CapeNature 2017). These spatial priorities are used to inform sustainable development in the Western Cape Province.

In addition to the above, CBAs and ESAs are separated further into CBA 1 and 2 as well as ESA 1 and 2 respectively. It is important to note that CBA 1 show areas in a natural condition and those that are potentially degraded or represent secondary vegetation are considered to be CBA 2. Similarly, a distinction is made between ESAs that are likely to be functional (i.e., in a natural, near-natural or moderately degraded condition; ESA 1), and ESAs that are likely severely degraded or have no natural cover remaining and therefore require restoration where feasible (ESA 2). The ESAs are not considered essential from a conservation perspective for meeting biodiversity targets; however, they may offer some ecological services.

As much of the floral and faunal diversity within the subject region is related to riparian environments, it is clear that by excluding the proposed development from these areas, impacts on areas or corridors that have significant ecological support functions are unlikely to be affected by the proposed development.

Critically Endangered and Threatened Ecosystems

According to the Biodiversity Geographic Information System (BGIS) developed by SANBI, there are no Critically Endangered and Threatened Ecosystems on the subject sites. The 'endangered' and 'threatened' eco-systems identified within the Cape Winelands District Municipal region are not located within the study areas. Figure 3 above indicates that such areas are located some 40 kilometres to the east and the west of the site, but do not extend into the subject area.

Protected Areas (PAs)

The project area does not fall within or adjacent to a Protected Area.

4.1.5 Key Landscape Features

The subject site, as indicated above, straddles the Groot River with the Kleindroelaagte River forming the northern extent of the farm. The southern extent lies to the north of a significant shale ridge associated with the valley of the Karee Rivier.

Broadly, the study area can be shown to comprise, from a landscape perspective of three habitat forms, namely, a stony environment underlain by shales, to the north and west of the site, a sandy environment with significant aeolian deposition and dune structures to the east, and the riparian environments associated with the Groot River, which bisects the study area. In some instances, there are distinct junctures between the terrestrial and riparian edge on account of steep, shale or sand cliffs.

The riparian systems of the Groot River which bisects the site, are associated with the southern extent of the catchment of the Tankwa River, where the confluence of the two systems is located, downstream of the Oudebaaskraal Dam. Refer to the separate Aquatic Biodiversity and Species Assessment for details on the aquatic features.

4.1.5.1 Indigenous Forests

The Farm Hoek Doornen encompasses two habitat forms, namely Tanqua Karoo and Tanqua Wash Riviere. The former is a definitive arid succulent vegetation form of low, forb-dominated vegetation and no natural forest habitat is present. Within the Tanqua Wash Riviere habitat form, woody habitat is evident, dominated by *Vachellia karoo*. From a legal perspective, such areas may be considered forest (National Forest Act (Act 84 of 1998)), however these small, isolated communities do not align with the ecological definition using Raunkiaer Classification (1934). In addition, given the proposed "footprints" of

the development on Hoek Doornen, these “wooded” environments would be avoided by the PV facilities. Some clearance or pruning may be required in respect of the proposed powerline for Hoek Doornen PV 4, where it crosses the Groot River (the power lines for Hoek Doornen PV 1, PV 2 and PV 3 will not cross the Groot River).

V karoo or canopied environment would not be affected by the proposed PV facilities *in toto*. Howsoever, the establishment of the powerline servitude across the Groot River (for Hoek Doornen PV 4) may see the need to remove some specimens, subject to the placement of towers and the manner in which the line is strung. Final survey of the powerline would determine the need for an application in terms of the National Forest Act. It should be noted that under the National Forest Act, that three trees or more that form a contiguous canopy would require a permit in order to disturb, prune or remove such woody specimens.

Where felling of woody species is required, it is anticipated that this would relate to individual specimens or the pruning of individual trees.

1. Riparian zone showing alluvial deposit

2. Sheetwash

3. Shale cliff associated with riverine channel

4. Moderately steep ridge

Figure 8. Typical landscape features associated with site

4.1.5.2 Strategic Water Source Areas

Figure 9 below indicates the site in relation to designated strategic water source areas (SWSAs). As indicated, the site does not fall within an SWSA. As such, impacts on the terrestrial habitat of SWSAs; and the impacts of the proposed development on the SWSA water quality and quantity are not evident.

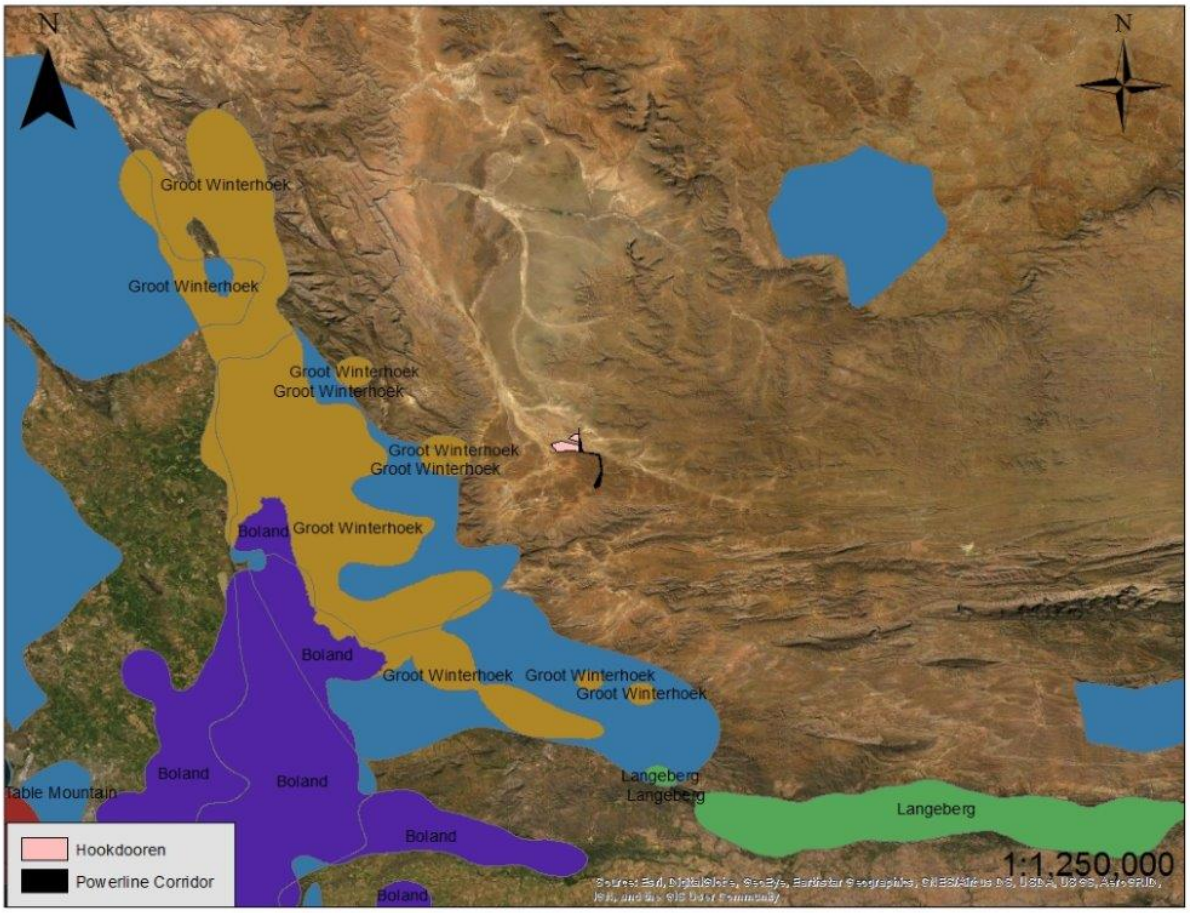

Figure 9. Map indicating site in relation to SWSAs within the Western Cape.

4.1.5.3 Freshwater Ecosystem Priority Area Sub Catchments

The subject site does not lie within any National Freshwater Ecosystem Priority Areas (NFEPA) sub catchments. As such there are no impacts of the proposed development on habitat condition and species in FEPA sub catchments.

4.2 Project Specific Description

The Hoek Doornen farm lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome associated with a low altitude and generally flat to undulating landscape. This area is of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective. The lower elevations of the site are associated with sheet wash plains and larger ephemeral rivers that are dominated by alluvial sands. Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo, a form of the Succulent Karoo Biome, and Tanqua Wash Riviere (AZi 7) a riparian habitat form. Both these veld types

are considered “least threatened” from a conservation perspective (Figure 3). The same applies to the EGI corridor running along Die Brak and Platfontein Farms.

From a meteorological perspective the study area is a “xeric habitat” with inter-annual variability in rainfall patterns across the region. Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3 °C (minus) and the highest maxima being 50.2°C. Natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat.

The project includes the establishment of four PV Facilities, connected by powerlines to the Kappa Substation, located to the south of the site. The siting of these facilities is determined by engineering requirements, such as insolation and the grade of slope, but are also to be positioned within areas that are not considered to be of ecological significance or high sensitivity, nor where habitat is considered to adversely affect operations.

4.3 Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figures 10 – 15 below indicates the results of the Screening Tool when interrogated in respect of floral and faunal “sensitivity”. It includes the Hoek Doornen Farm for the proposed PV Facilities, as well as for Die Brak and Platfontein Farms for the EGI Corridor.

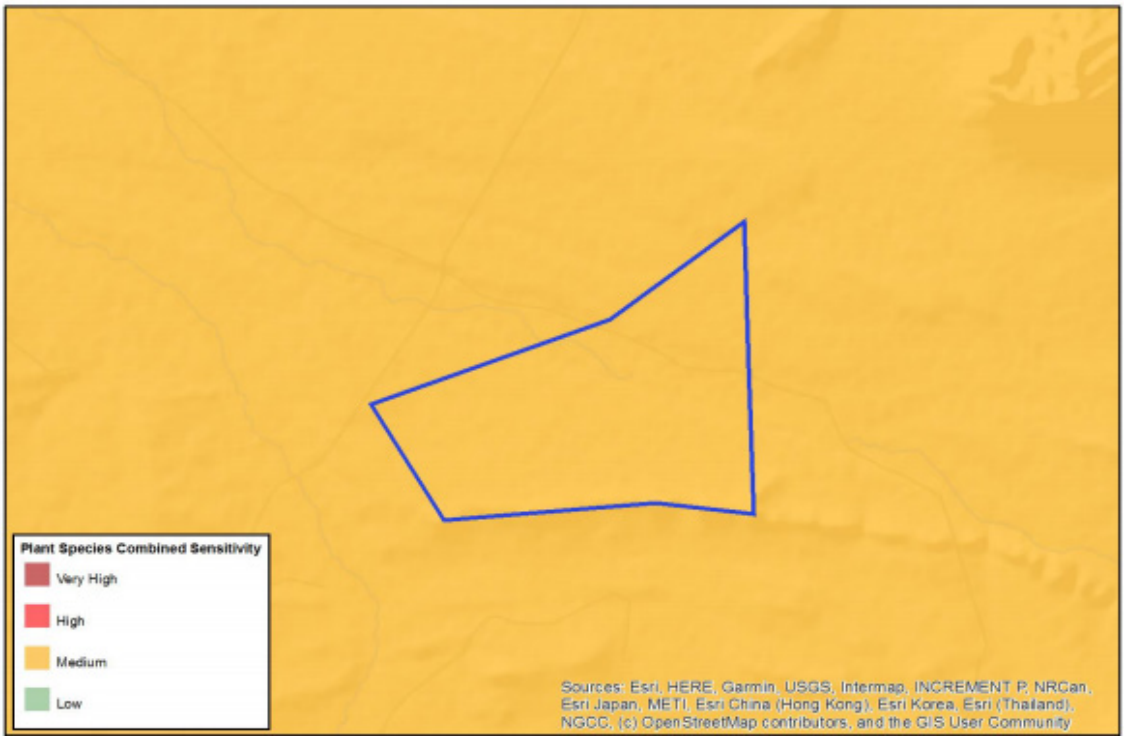

Figure 10. Map image indicating Plant Species sensitivity in relation to the farm Hoek Doornen for the Solar PV Facilities (Source: DEFF Screening Tool, 2020).

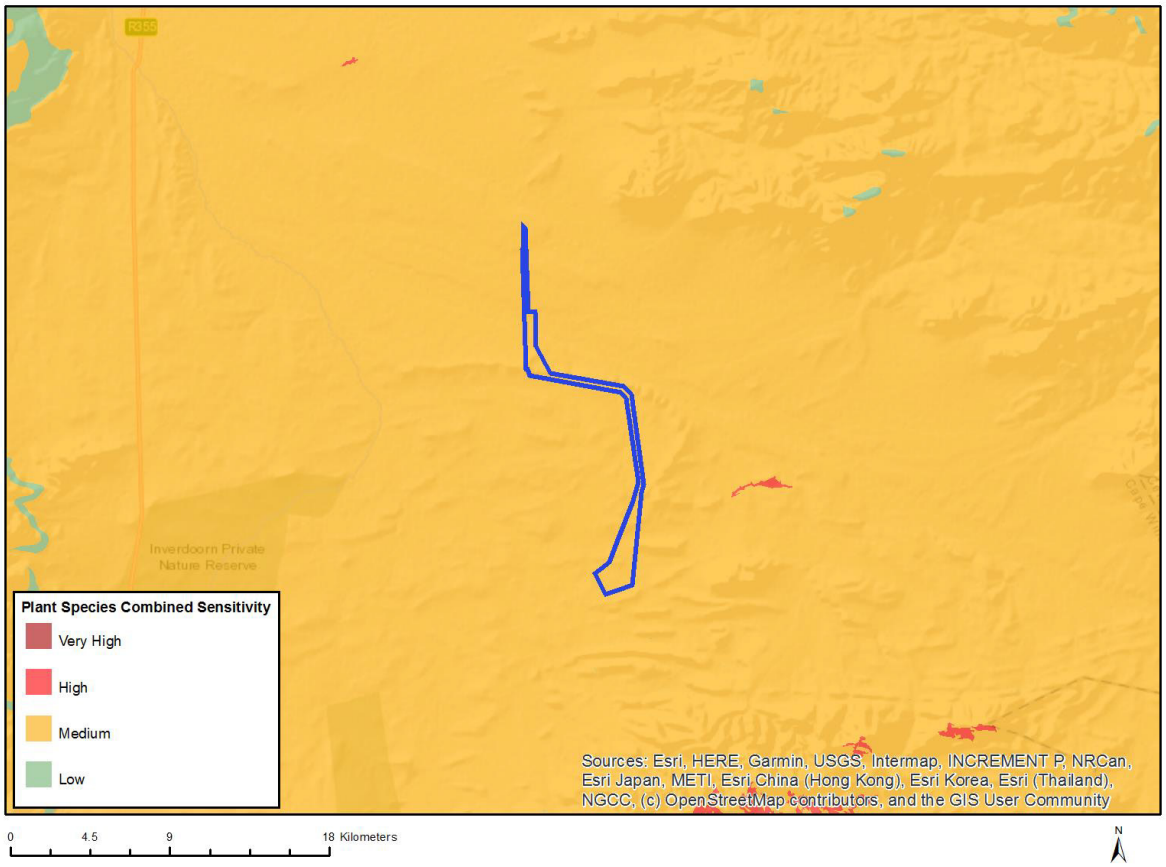

Figure 11. Map image indicating Plant Species sensitivity in relation to the farms Witte Wall, Die Brak and Platfontein for the EGI Corridor (Source: DEFF Screening Tool, 2020).

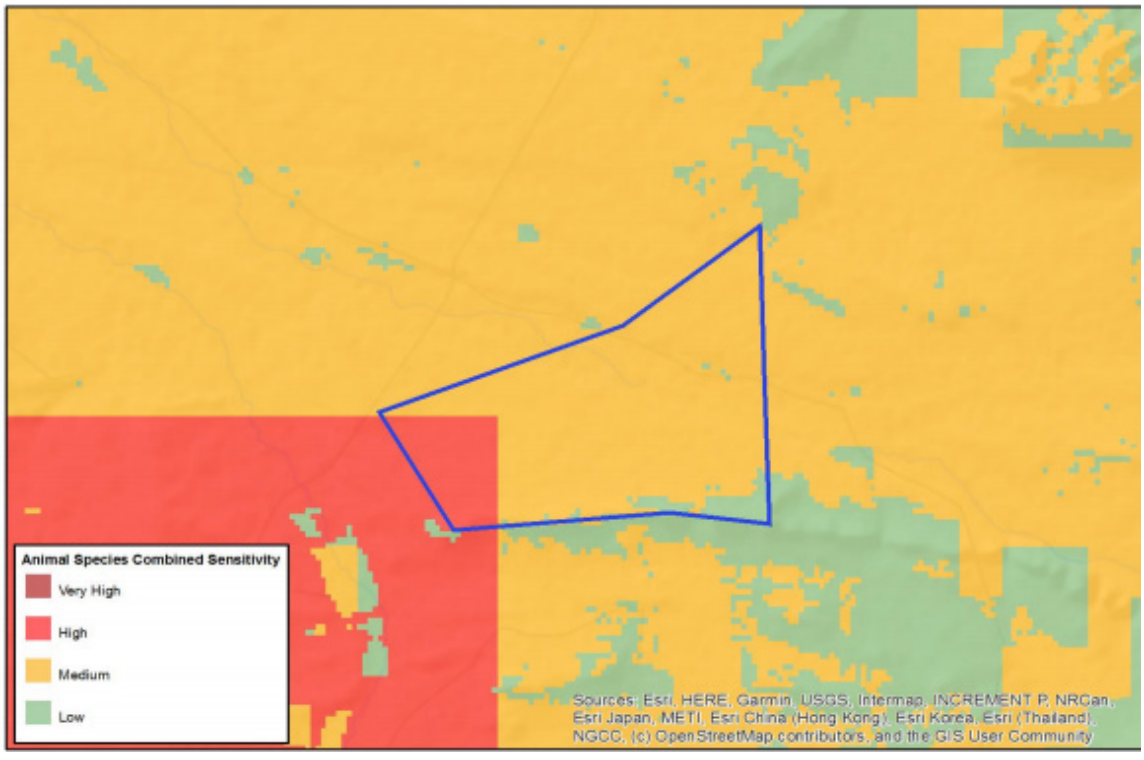

Figure 12. Map image indicating Animal Species sensitivity in relation to the farm Hoek Doornen for the Solar PV Facilities (Source: DEFF Screening Tool, 2020).

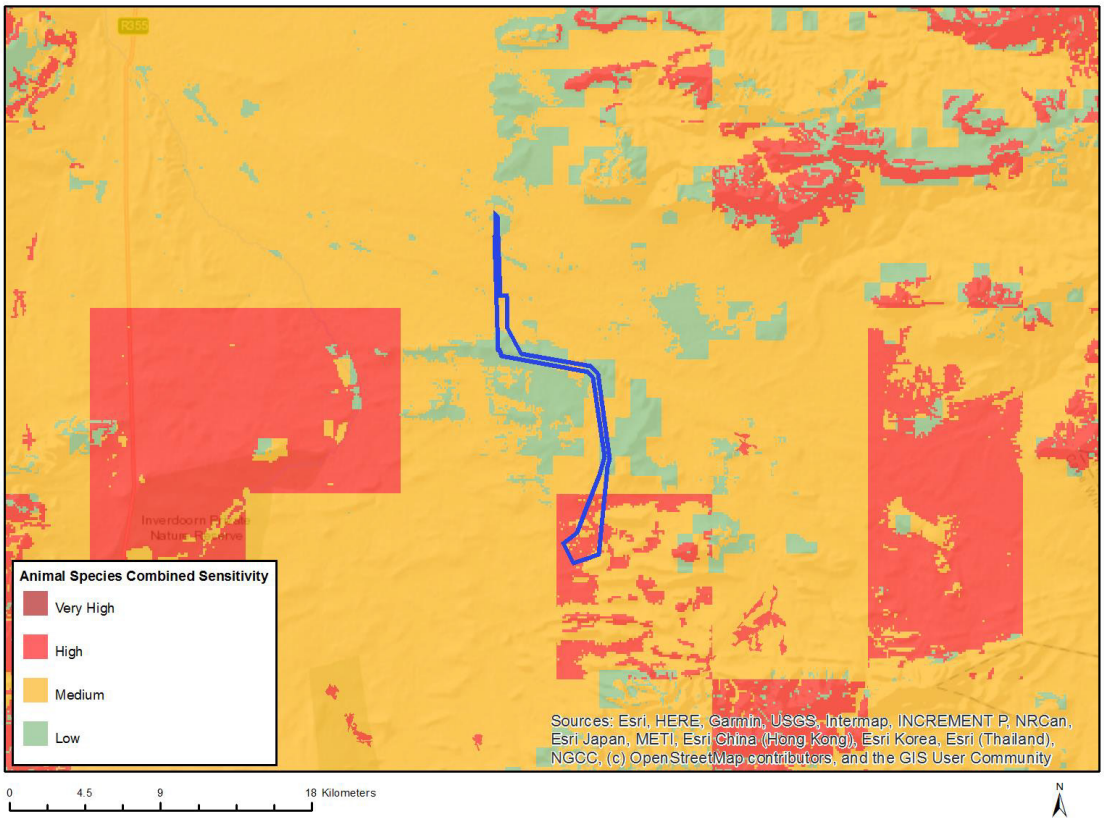

Figure 13. Map image indicating Animal Species sensitivity in relation to the farms Witte Wall, Die Brak and Platfontein for the EGI Corridor (Source: DEFF Screening Tool, 2020).

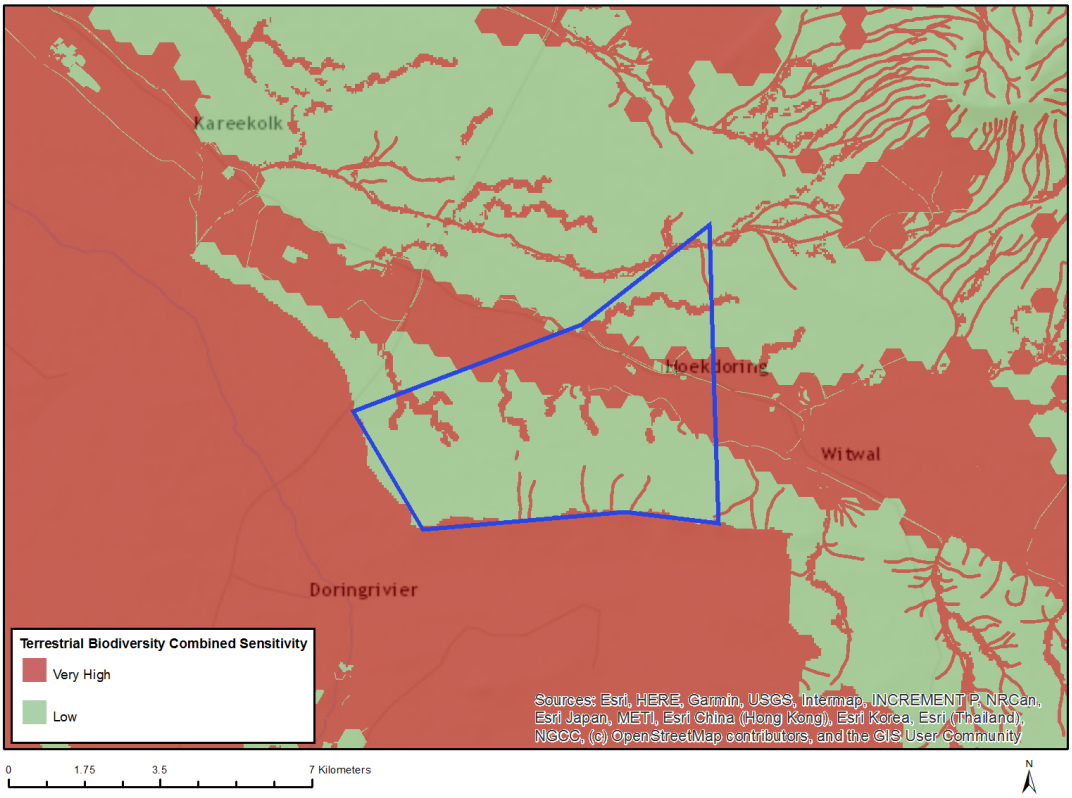

Figure 14. Map image indicating terrestrial faunal combined biodiversity sensitivity for the farm Hoek Doornen for the Solar PV Facilities (Source: DEFF Screening Tool, 2020).

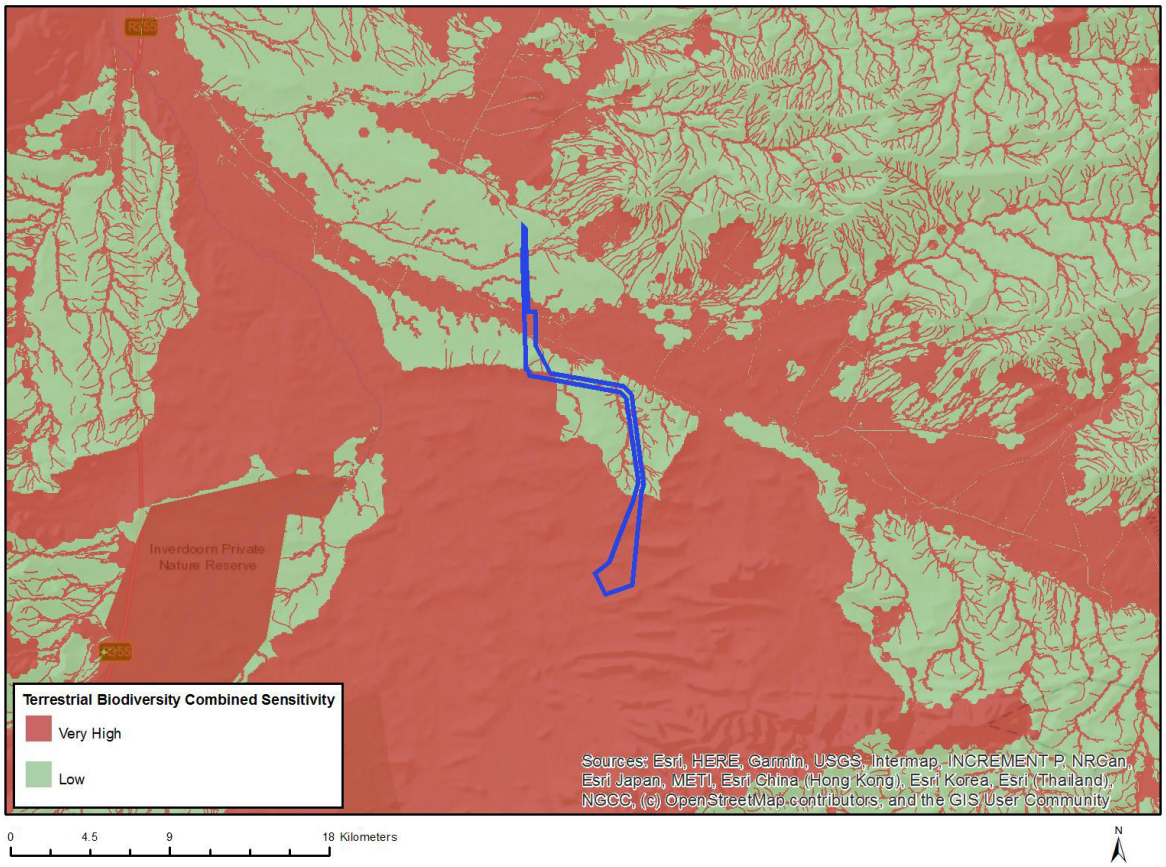

Figure 15. Map image indicating terrestrial faunal combined biodiversity sensitivity for the farms Hoek Doornen, Die Brak and Platfontein for the EGI Corridor (Source: DEFF Screening Tool, 2020).

From the above, it is clear that the DEFF Screening Tool States:

- Floral significance or sensitivity is deemed to be of medium significance (Figure 10), suggesting that there may be some occurrence of important botanical communities. This is supported by the information presented in Table 2 above.

- Faunal populations in the region are considered to range from “very high to low” ecological significance or “sensitivity”, with the riverine or riparian environments being designated “very high”, while elevated areas to the north of the site, being designated “low”. as depicted by the terrestrial biodiversity combined sensitivity layer on the Screening Tool (Figure 14). In terms of the terrestrial biodiversity combined sensitivity layer on the Screening Tool, the central portion of the Hoek Doornen farm has very high sensitivity areas owing to CBA 1 and 2, ESA 1 and 2 and freshwater ecosystem priority area quinary catchments. However, the actual footprint of the Hoek Doornen PV 1, 2, 3 and 4 facilities contain a low to very high sensitivity in terms of the terrestrial biodiversity combined sensitivity layer due to small areas of ESA 1 and CBA 1. The Animal Species sensitivity (Figure 12) indicates that the Hoek Doornen farm is mainly of medium sensitivity, with some areas of high and low sensitivity. The actual footprint of the PV Facilities is mainly medium with some high sensitivity areas in Hoek Doornen PV 3 in terms of the Animal Species sensitivity.

For the farms Witte Wall, Die Brak and Platfontein encompassing the EGI Corridor:

- Floral significance or sensitivity is deemed to be of medium significance (Figure 11), suggesting that there may be some occurrence of important botanical communities, but this is not of a high probability. This result is supported by the evidence in Table 2 above.

- Faunal populations in the region are considered to range from "very high to low" ecological significance or "sensitivity", with the riverine or riparian environments being designated "very high", while elevated areas to the north of the site, being designated "low" (as depicted by the terrestrial biodiversity combined sensitivity layer on the Screening Tool (Figure 15). In terms of the terrestrial biodiversity combined sensitivity layer on the Screening Tool, the central portions of the Witte Wall farm have very high sensitivity areas owing to CBA 1 and 2 and ESA 1 and 2; and the southern portion of the EGI corridor has a very high sensitivity (i.e. CBA 1 and 2 and ESA 1 and 2; and freshwater ecosystem priority area quinary catchments) in terms of the terrestrial biodiversity combined sensitivity layer (Figure 15). The Animal Species sensitivity (Figure 13 indicates that the farms affected by the EGI corridor is mainly of medium to low sensitivity, with small areas of high sensitivity close to the Kappa Substation.

The above information was interrogated through literature review and site reconnaissance.

4.3.2 Sensitivity Analysis and Verification

4.3.2.1 Hoek Doornen PV 1, PV 2, PV 3 and PV 4 – PV Facilities and Associated Infrastructure

The Farm Hoek Doornen, which is envisaged to encompass the proposed PV facilities Hoek Doornen PV 1, PV 2, PV 3 and PV 4 can be considered to fall within an area approximating 2400ha, that straddles the Groot River. The area comprises of a generally level shale dominated plateau to the west and north and a similar, slightly elevated plateau to the east which is overlain by aeolian sands, derived from both riparian and terrestrial environments. The highest elevation of the site lies at approximately 615m amsl, located to the east. The riparian environments can be found primarily around the Groot River and the Kleindroelaagte, which traverse the farm boundaries. Three ecomorphological habitats can be found within the terrestrial components of the site, these being:

1. A level rocky terrain (Figure 16)
2. A sandy aeolian habitat located to the east (Figure 17)
   and
3. Alluvial and related riparian environments, located in and around the Groot River and the Kleindroelaagte.

The riparian habitat is evaluated under the separate "Aquatic Biodiversity and Species Assessment" component of the BA.

The higher lying grounds show a generally *level, undulating* environment with a sparse vegetation cover. The dominant habitat is typical of commonly occurring species within the Tanqua Karoo (SKv 5), these being *Antimima hantamensis, Augea capensis*, *Ruschia spinosa* and *Lycium cymosum (*Figure 16). Vegetation cover is generally sparse (<40%), which may have been exacerbated by the prevailing drought in the region. Although showing a similar level of floral composition and cover, the alluvial sandy environment to the east is subject to significant wind transport. These areas show a more dynamic environment with, *Salsola sp* being the dominant vegetation form in this area and playing a significant role in maintaining stability.

Although subject to high levels of grazing by livestock over an extended period of time, the areas around the riverine environments may be considered to offer some level of botanical significance, particularly in the form of occasional geophytes that may be seasonally present.

Figure 16 Typical Tanqua Karoo veld found to the west of the site

Figure 17. Image of aeolian deposits and dune formation on eastern portion of Hoek Doornen.

Given the moderate or medium botanical sensitivity applied to Hoek Doornen and surrounds, consideration was given to faunal populations present within the area. Some of the larger mammals presented in Table 3 are evidently associated with game farming operations on adjacent properties, (e.g. Oryx, *O gazella*) while others are endemic and present on account of habitat requirements; or are relic and have adapted to the contemporary habitat. The latter populations are of particular importance from an ecological perspective. As noted above, 3Foxes Biodiversity Solutions (Mr S Todd) undertook to evaluate the presence of mammals within the subject site and beyond, with particular emphasis on the presence or absence of the riverine rabbit (*B monticularis*). A camera trapping exercise was undertaken on the affected farm portions (i.e. Farms Witte Wall, Grootfontein and Hoek Doornen), with an emphasis on recording the presence of larger mammalian species common to the area. Appendix F of this report indicates the findings of this report. Evidently, no specimens of *B monticularis* were identified on site, however a number of other mammals were recorded.

Site reconnaissance undertaken over a 5-day period revealed a number of smaller mammal and reptile species, of particular interest being common mole rat (*Cryptomys hottentotus*) (Figure 18), a generally fossorial species and the angulate tortoise (*Chersina angulata*) (Figure 19). In addition, evidence of scorpions, most likely a Parabuthid, was identified on the steeper rocky slopes located just off the site.

With the exception of *C angulata* and the *Parabuthid*, all fauna identified on site were recorded from the lower, riverine environments, including *C hottentotus, Lepus capensis*, the Cape hare and a number of smaller antelope, in particular *Raphicerus campestris* (steenbok) and *Sylvicapra grimmia* (bushbuck). The only reptile recorded from the region, this being an agamid (probably *A hispida*), was also identified within the alluvial deposits of the Groot River.

It follows that the screening tool sensitivity maps presented above conforms with the findings of the site assessment with low levels of faunal diversity being evident on higher ground within the Hoek Doornen area and most faunal populations being associated with the riverine environments. This concentration of faunal assemblages can be anticipated on account of the increased vegetative cover evident within the river channels, offering improved refugia and browse for many herbivores and the sandy soils that favour fossorial species. In addition, the availability of water at these points would be a significant factor.

Given the above, areas that should be avoided in respect of the proposed development should include all riparian areas and the more extensive areas of sheetwash within the site, while steep, rocky ridges, which may favour small invertebrates and some floral species should also be excluded. Figure 20below indicates these areas as they pertain to the site.

Figure 18. Common mole rat (*Cryptomys hottentotus*)

Figure 19. Angulate tortoise (*Chersina angulata*), common to site

Figures 20 and 21, presents the proposed extent of the four solar PV facilities (Hoek Doornen PV 1, PV 2, PV 3, PV 4) in relation to the identified areas of sensitivity and ecological significance. Of note are:

- The proposed areas of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV4 are associated with the level terrain within the site.

- Much of the land in question has been subject to extensive grazing and shows limited diversity and cover.

- Areas of potential improved botanical diversity or “niche” environments, in particular, the riparian environments and the eastern dune forms, have been excluded from the proposed PV array area.

- A significant terrestrial buffer has been established around the Groot River and Klein Droelaagte River, with a minimum distance of 100m being anticipated and most setbacks from the riparian zone approximating 180m. It is anticipated that 100m would be an acceptable distance from the riparian edge.

- The powerlines will traverse portions of land on the Farms Hoek Doornen, Witte Wall, Die Brak, and Platfontein. The powerline from Hoek Doornen PV 4 will cross the Groot River downstream of the crossing of the rest of the powerlines for the Grootfontein and Witte Wall PV facilities.

4.3.2.2 EGI and Associated Infrastructure

In addition, Figure 23 presents the nature of the land associated with the proposed powerline on Die Brak farm. Evidently, the establishment of towers will result in minor clearance of the land for the establishment of footings. The habitat along this servitude is similar to that found to the north on Witte Wall (as described in the separate Terrestrial Biodiversity and Species Assessment for the Witte Wall PV Facilities), and the servitude aligns with an existing roadway. Figure 22 presents the entire route and associated areas of ecological sensitivity. Notably, the Groot River is considered to be the only area showing ecological sensitivity. Refer to Annexure F of this study for the separate report that has been compiled regarding the Riverine Rabbit and other fauna found on site.

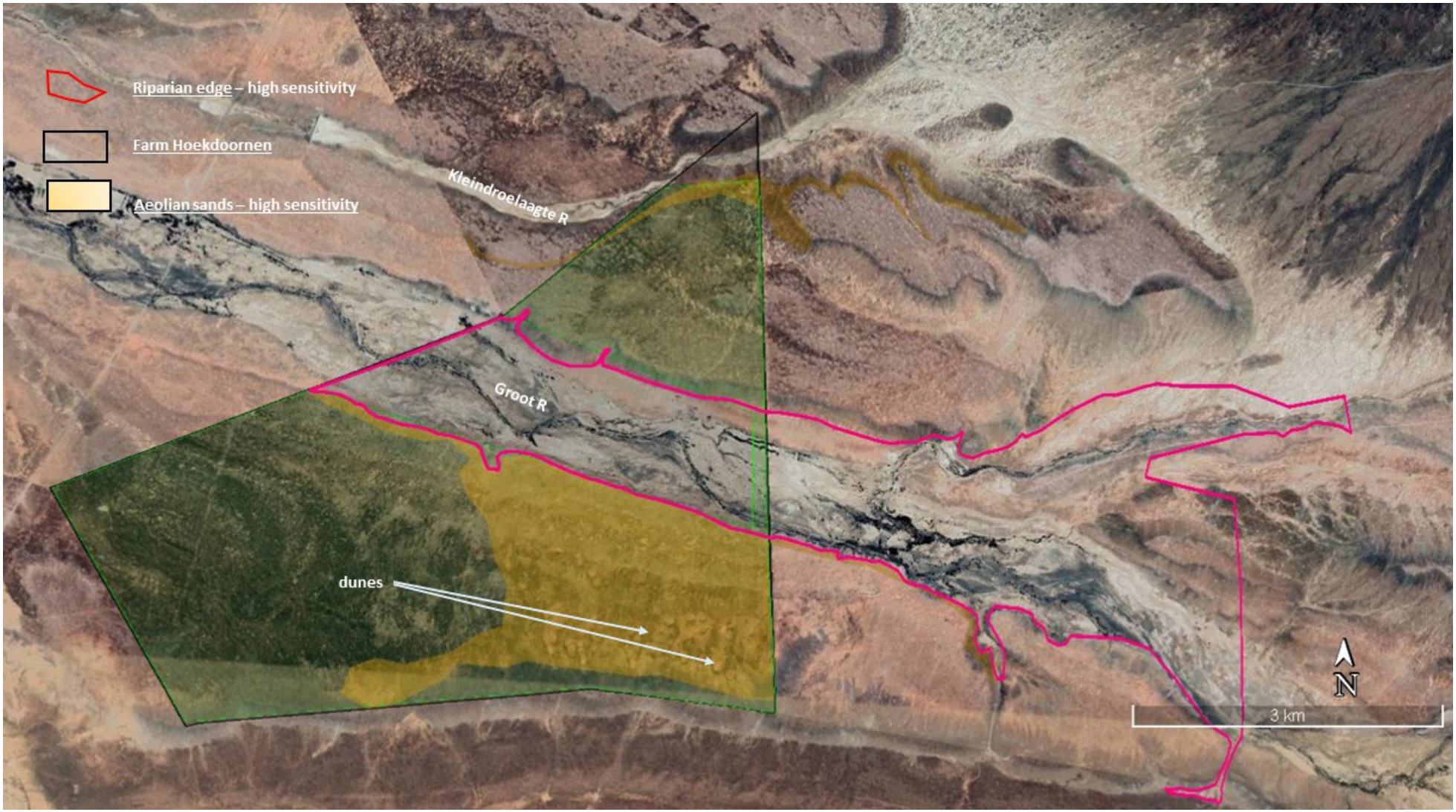

Figure 20. Aerial image of the site showing areas of high ecological sensitivity.

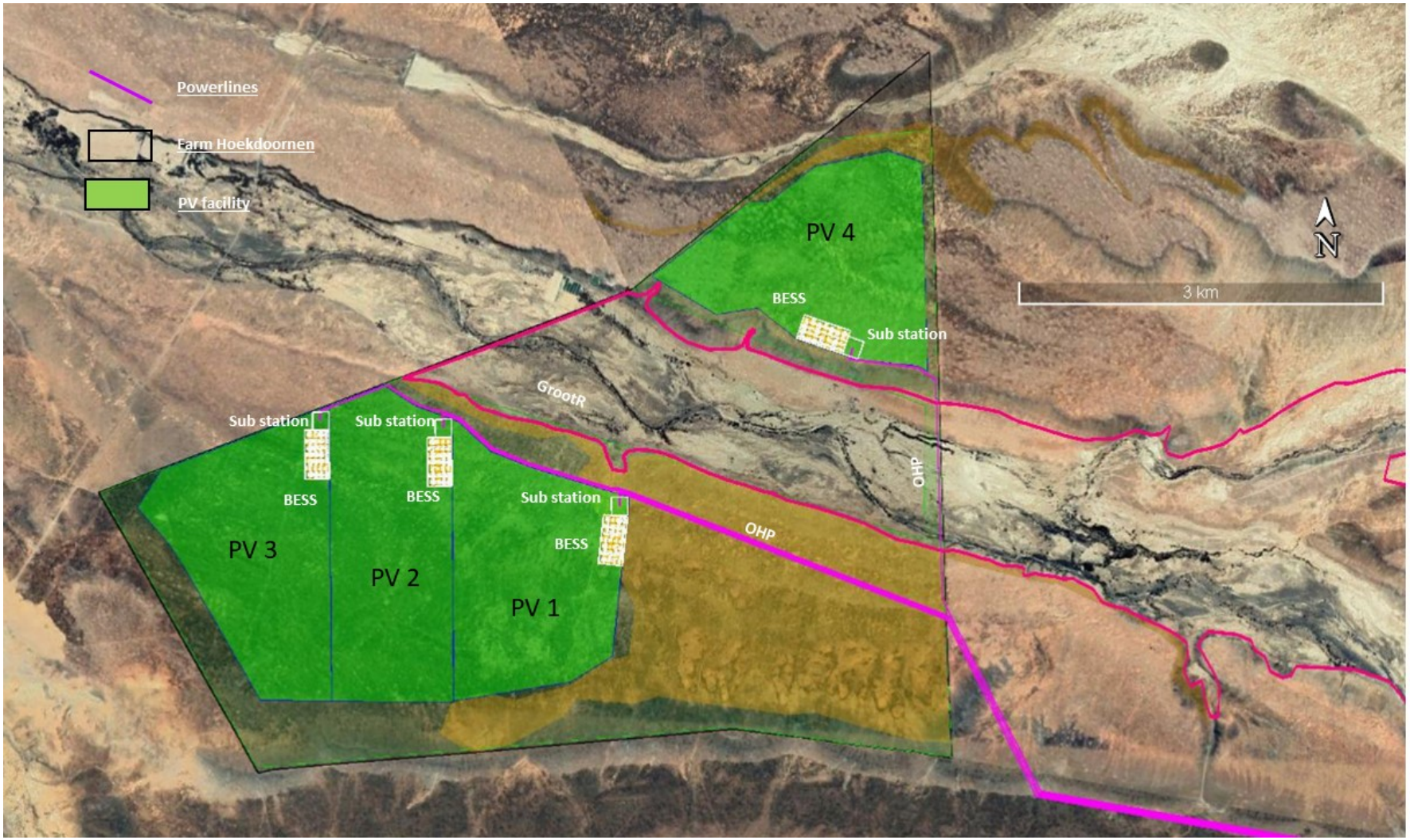

Figure 21. Aerial image showing PV layouts, with BESS and alignment of overhead lines to the Kappa substation.

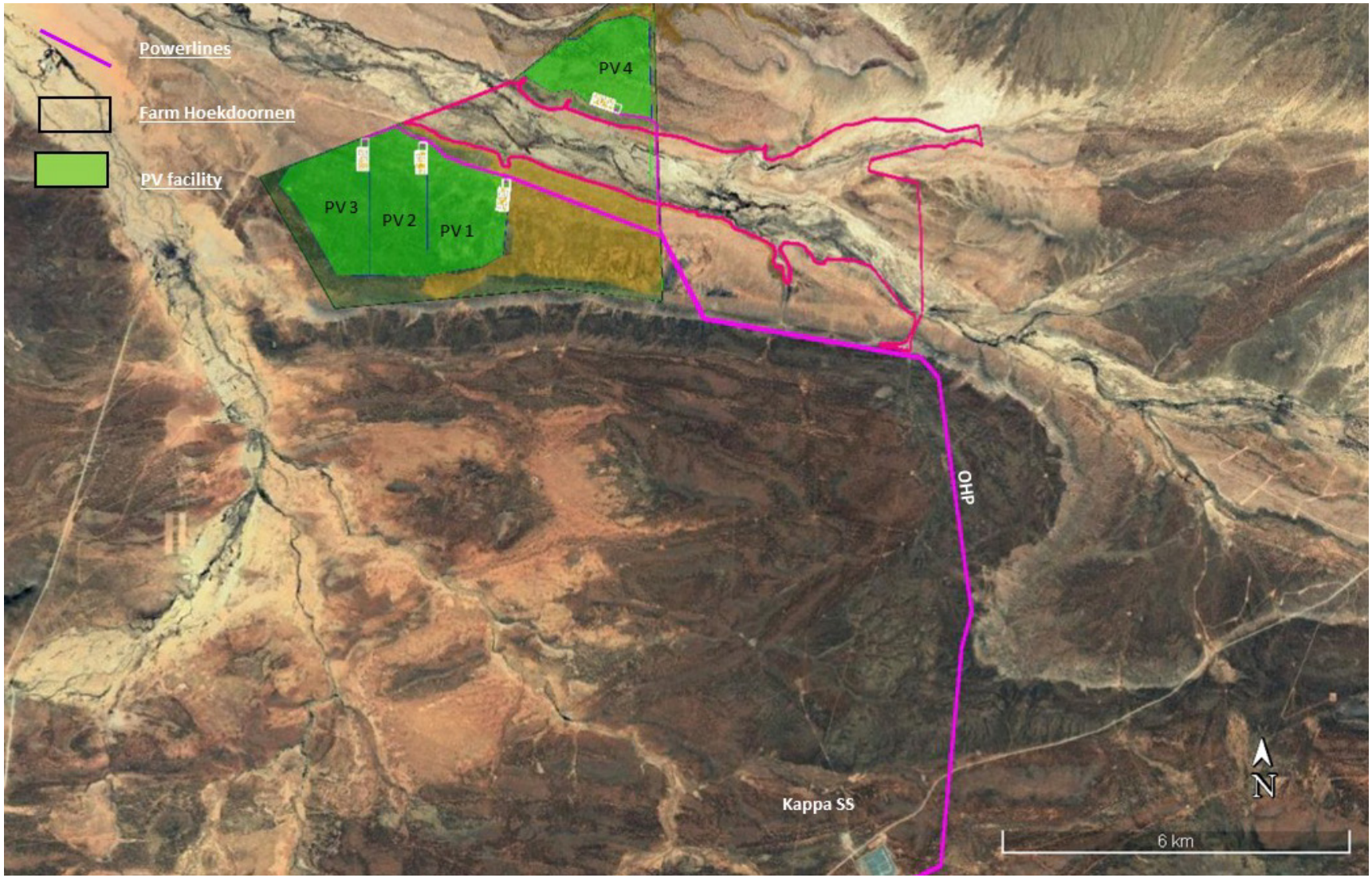

Figure 22. Aerial image showing extent of the proposed Hoek Doornen PV Facilities and proposed overhead powerline routes that will connect the facilities with the Kappa substation.

Figure 23. Image showing nature of the corridor to be traversed by the electrical powerlines serving the Kappa substation and existing powerlines proximal to the servitude on the Farm Die Brak.

Given the above, the following Environmental Sensitivities can be attributed to the four PV sites and the EGI. Refer to Appendix C of this report for the Site Sensitivity Verification Report.

4.3.3 Sensitivity Analysis Summary Statement

The terrestrial environment within Hoek Doornen, encompassing the four PV sites show primarily low levels of ecological significance. Improved areas of moderate and high ecological sensitivity are related to the scarp slopes and sheetwash environments associated with the riparian edge, which have the potential to provide suitable habitat for lithic and geophytic plants of conservation significance.

Notably, the overhead powerline servitude shows only low ecological sensitivity or significance, being associated with primarily farmland and in proximity to existing powerline servitudes. With suitable mitigation measures employed, the powerlines may traverse these sensitive areas (namely the Groot River) at the points indicated by Figure 24 above.

Evidence indicates that faunal populations are concentrated in and around riparian areas or sandy environments, in association with improved foraging and the availability of water. Some invertebrates, such as scorpions may utilize the elevated scarp slopes as refugia, however larger mammals and most reptiles are generally only transitory in these areas. The riparian environments are allocated a “high level” of ecological sensitivity on account of the increased faunal populations identified within these areas and the evident intermittent flooding that may affect these areas. Figure 24 demonstrates a typical cross section through the site, showing areas for exclusion and inclusion in the development.

The above sensitivity analysis largely corroborates the findings of the Screening Tool, the sensitivities of which have been verified and utilized in the planning of the PV facilities at Hoek Doornen and for the EGI Corridor along the farms Platfontein and Die Brak, in order to develop the “preferred” alternative.

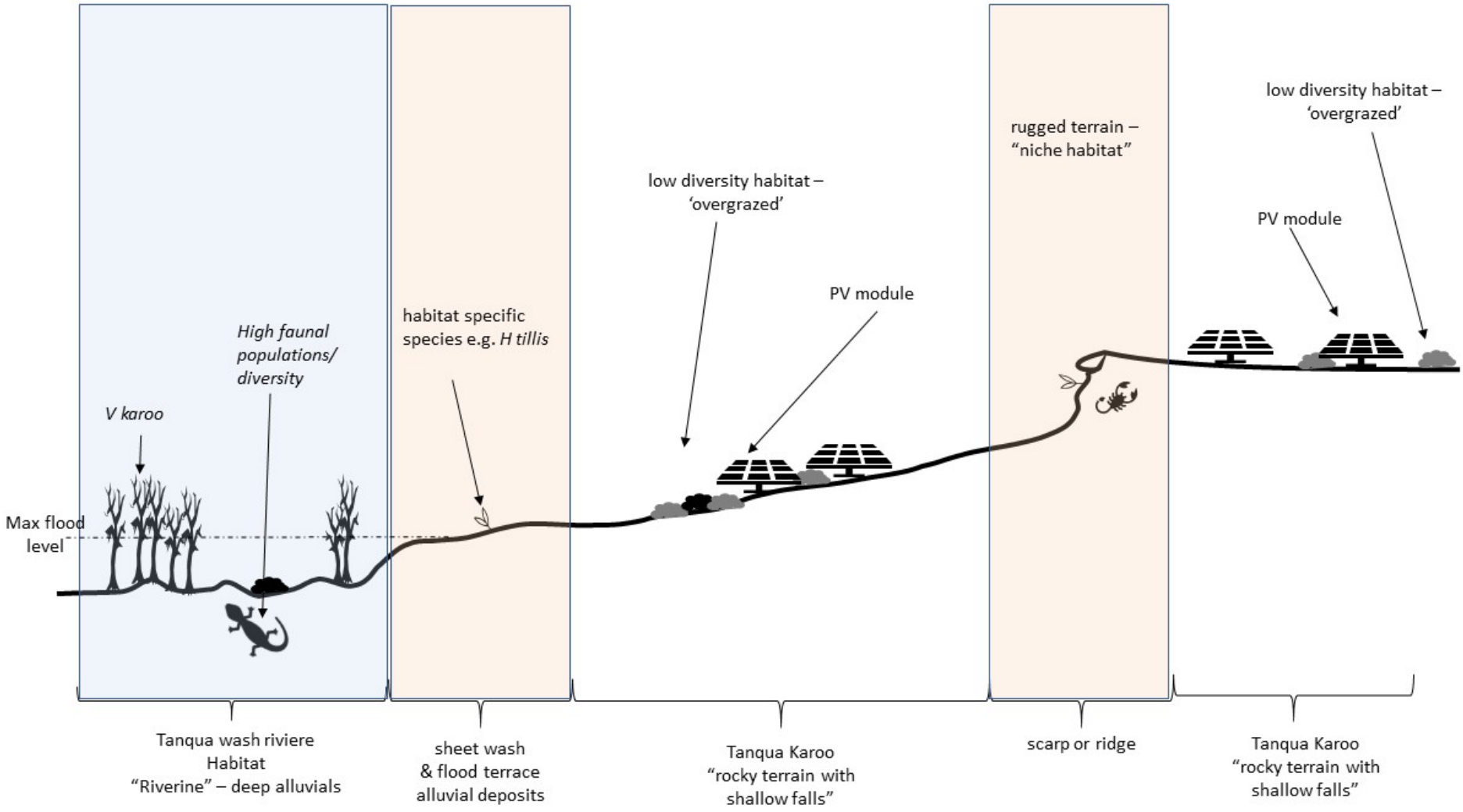

Figure 24. Schematic diagram indicating areas of high sensitivity and areas suitable for establishment of solar modules

5 Alternative Development Footprints

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some specific siting of the alignment to reduce impacts.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localised and broader ecology of the region can be identified as a consequence of the proposed PV and EGI developments being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the proposed project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the proposed development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the "decommissioning phase".

6.1.1 Construction Phase

Construction phase impacts through the establishment of the PV Facilities, EGI and associated infrastructure are listed below:

- Change in localised topography on account of excavation and site establishment. Areas of elevation and depression are likely to be altered to establish infrastructure.
- Change, both short and long term in localised hydrology – percolation rates, points of groundwater recharge, surface water flow will arise.
- Clearance of vegetation to establish roadways and other infrastructure.
- Isolation and cordoning off the site through fencing, affecting the movement of fauna.
- Dust – according to movement of traffic and other construction related factors will affect factors such as palatability of vegetation.
- Electrical light pollution – primarily associated with work at night, will alter faunal ethos of some species.
- Incidental pollution events, including the loss of solid waste, spillage of liquids such as hydrocarbons and other fuels as well as possible sewerage and other waste is likely to alter select points within the subject site, possibly affecting habitat form and other factors.
- General disturbance on account of pedestrian movement and activities on site.

The following potential impacts during the construction phase are therefore presented and assessed in this report:

- **Potential Impact 1**: Alteration of habitat structure and composition;
- **Potential Impact 2**: Ousting (and recruitment) of various fauna;

- **Potential Impact 3**: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it;
- **Potential Impact 4**: Increased electrical light pollution, leading to changes in nocturnal behavioural patterns of fauna;
- **Potential Impact 5**: Exclusion or entrapment of (in particular) large fauna, on account of the fencing of the site;
- **Potential Impact 6**: Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points;
- **Potential Impact 7**: Changes in subsurface water resources arising from alteration of percolation and recharge at points;
- **Potential Impact 8**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities; and
- **Potential Impact 9**: Exotic weed invasion;
- **Potential Impact 10**: Clearance of vegetation to establish roadways and other infrastructure;
- **Potential Impact 11**: Increased dust levels due movement of traffic and other construction related factors will affect factors such as palatability of vegetation;
- **Potential Impact 12**: Incidental pollution events, including the loss of solid waste, spillage of liquids such as hydrocarbons and other fuels as well as possible sewerage and other waste is likely to alter selected points within the subject site, possibly affecting habitat form and other factors; and
- **Potential Impact 13**: General disturbance on account of pedestrian movement and activities on site.

6.1.2 Operational Phase:

Operational phase impacts through the utilization of the PV Facilities, EGI and associated infrastructure are listed below:

- Altered topography within and adjacent to site will give rise to differing habitat regimen with variation in floral and faunal forms and ecology on site.

- Change in the localised hydrology will see variation in topography as surface run off establishes new primary drainage channels and areas of sheet wash and other depositional features. Structures alter flow and percolation rates across site

- Secondary vegetation will arise following a possibly different seral process that will be driven by features including variation in solar irradiance (increased shade from modules), ongoing disturbance (clearance of larger vegetation affecting modules) and plant communities will alter on account of changing hydrology and topography

- The isolation of the site by a fence (perhaps electrified), will alter faunal ethos, while a changed habitat within the site may act to encourage faunal passage into the site. The fence may also alter predator – prey relationships both within and adjacent to the site, where prey is cordoned on account of the presence of fencing (e.g. jackals may use fencing to direct and run down prey).

- Electrical light pollution. Some points within the PV may be flood lit for security and other reasons. Such lighting or “ELP” may alter the ethos of fauna that are either attracted to lights or use light for predation. This may be a minor and generally latent impact, but is a likely state in the operational phase.

- Incidental pollution events are likely to continue throughout the operational stage. If tracking modules are utilised spills of hydraulic fluid may arise or other spillages may be evident.

Small volumes of sewerage may be introduced into the localised environment from operational offices, while solid waste may arise within the site from time to time.
- General disturbance on account of pedestrian movement and activities on site

The following potential impacts during the Operational Phase can be summarized:

- **Potential Impact 14**: Continued alteration of habitat structure and composition on account of continuing low level anthropogenic impacts, such as "shading of vegetation" from arrays;
- **Potential Impact 15**: Ousting (and recruitment) of various fauna on account of long term changes in the surrounding habitat/environment;
- **Potential Impact 16**: Changes in the geomorphological state of drainage lines on account of long term climatic changes and the concomitant change in the nature of the catchment arising from the land use change;
- **Potential Impact 17**: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long term activities on site, but are likely to be negligible; and
- **Potential Impact 18**: Exotic weed invasion as a consequence of regular and continued disturbance of site.

6.1.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use and operation cease of the PV Facilities, EGI and associated infrastructure. However, abandonment of the site would probably result in:

- **Potential Impact 19**: A reversion to an early seral stage;
- **Potential Impact 20**: A reversion of present faunal population states within the study area, with some variation to these populations being possible;
- **Potential Impact 21**: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment; and
- **Potential Impact 22**: Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures.

6.1.4 Indirect Impacts

The following indirect impacts apply to the PV Facilities, EGI and associated infrastructure:

- **Potential Impact 23**: Changes in broader landscape ecology through alteration of eco-morphological drivers.
- **Potential Impact 24:** Changes in faunal ethos as a result of the establishment of the PV facilities on Hoek Doornen.

6.1.5 Cumulative Impacts

The following cumulative impacts below apply to the PV Facilities, EGI and associated infrastructure:

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) and 11 other renewable energy projects that have received EA on some 50 000 ha of farm land within 30 km of the subject site. The

cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- **Potential Impact 25**: Alteration of habitat structure and composition, albeit primarily sporadic in nature, over an extensive and wide area.
- **Potential Impact 26**: Changes in faunal populations through exclusion of certain species and beneficiation of others over an extensive and wide area – primarily on account of change in habitat as well as the implementation of security fencing;
- **Potential Impact 27**: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment;
- **Potential Impact 28**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment; and
- **Potential Impact 29**: Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of site.

It must also be noted that in terms of the no-go option, this will result in no additional impacts on biodiversity and will result in the ecological status quo being maintained, which will be to the advantage of the biodiversity. However, that being said, no fatal flaws were discovered in the course of the investigations for the proposed development.

6.2 Summary of Issues identified during the Public Consultation Phase

Interaction with local residents in the region indicated that:

- Historically, farming activities over the preceding 150 years was seen to have altered the prevailing habitat;

- Fauna were confined to the riverine areas in general; and

- Flood events could be severe, with a rapid rise in the water levels within rivers being noted following rain in the upper catchments.

Additional points raised by the local residents are captured in Table 4 below.

Table 4: Comments Received from Stakeholders / Local Residents during the Field Work component of this Terrestrial Biodiversity and Species Assessment

Comment	Commenter	Response
The removal of natural vegetation containing threatened, protected and endemic species as a result of the proposed project	Mr Andre Vermeulen	The general approach to construction of the proposed facilities, associated infrastructure and EGI is to maintain vegetation on site. No "blading" of areas, other than along roads, within substations and in the laydown area is to be undertaken.
An increased exotic infestation due to disturbance caused by the proposed project	Mr Andre Vermeulen	An Alien Invasive Plant (AIP) management system is to be introduced at an early stage of implementation and undertaken on an ongoing basis.
Increased dust deposition during construction activities	Mr Andre Vermeulen	This is a likely scenario. Mitigation measures will have to be employed including "damping", traffic speed limitations and other management measures

7 Impact Assessment

The nature of impact / risk of PV Facilities, EGI and associated infrastructure is discussed below. The impacts described below apply to Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects (i.e. they are the same and have not been repeated).

7.1 Construction Phase

Potential Impact 1: Alteration of habitat structure and composition

Change in localised topography on account of excavation and site establishment will occur. Areas of elevation and depression are likely to be altered to establish infrastructure. This impact will arise as an ecological response to disturbances and will be reflected in the composition of habitat. Given the generally depauperate habitat within the proposed development areas, such impacts may be generally of a "moderate" negative sensitivity at the construction phase. Improved management of the site during construction should minimize this impact to "low" significance.

Potential Impact 2: Ousting (and recruitment) of various fauna

Fauna are likely to emigrate from the region as behavioral ethos and refugia will be affected by construction and the high level of disturbance. This is rated as a direct, negative impact. Exclusion areas should be maintained, cordoning off site to prevent inward migration of fauna and other general management principles will reduce such impacts from "high" to "moderate" significance, during the construction phase.

Potential Impact 3: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it

As construction proceeds the natural drainage patterns, sediment transport mechanisms and other related factors will alter, with concomitant change in the ecology associated with these factors. This is rated as a direct, negative impact. Implementation of management principles will reduce these impacts from “high” to “moderate” significance and possibly “low”, during the closing of the construction phase.

Potential Impact 4: Increased electrical light pollution (ELP), leading to changes in nocturnal behavioural patterns of fauna

ELP will alter faunal ethos of some species, particularly during construction, primarily associated with work at night. ELP can be addressed through initially, interventions in respect of lighting during the construction phase such as reduced security lighting, downward lighting and restriction on lumens employed. This is generally a low significance impact before and after implementation of mitigation measures.

Potential Impact 5: Exclusion or entrapment of (in particular) large fauna, on account of the fencing of the site

Entrapment of larger mammals within the PV facilities is common. Regular flushing of the area is required, throughout the construction phase. This is rated as a low significance impact.

Potential Impact 6: Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points

As per the eco-morphological change, soil structure and form will alter on account of construction activities, where excavation and compaction, for example arise. Ruderal vegetation may replace more resilient species with minor alteration of faunal ethos. This is rated as a low significance impact on account of the existing habitat forms.

Potential Impact 7: Changes in subsurface water resources arising from alteration of percolation and recharge at points:

This impact relates to the change, both short and long term, in localised hydrology, which will influence percolation rates, points of groundwater recharge, and surface water flow. This impact would be most prevalent in and around the sandy environments of the site. However, the impact is likely to be less significant on the upper elevations of the site where the development is to be positioned. This impact is rated with a low significance. Adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces is achieved.

Potential Impact 8: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities

During the construction phase, increased mobilization of sediments, minor spills of materials and other factors may alter surface water chemistry. This impact would however be low significance, with the employment of suitable management measures during the construction stage. Such measures include to 1) ensure all hazardous materials are adequately stock piled in a leak proof receptacle and 2) Ensure a spill kit is placed on site in order to contain any hydrocarbon leaks if necessary.

Potential Impact 9: Exotic weed invasion

Exotic weed invasion may arise through disturbance (e.g. *Atriplex lindleyi*). However, weed invasion is limited in this habitat and selective redress of exotic weeds during and after construction would render this impact of low significance.

Potential impact 10: Clearance of vegetation to establish roadways and other infrastructure

Clearance of vegetation results in the exposure of bare soil, leaving the affected area susceptible to erosion as well as the invasion and proliferation of exotic species. In order to lessen this impact from moderate (3) to Low (4) significance the following mitigation measures are to be carried out, 1) Specimens to be relocated if possible, through plant rescue, 2) Clearance activities are to be strictly

confined to the development foot print, and 3) Clearance is to be carried out where needed to accommodate infrastructure.

Potential impact 11: Increased dust – according to movement of traffic and other construction related factors will affect factors such as palatability of vegetation

In order to reduce the significance of this impact from moderate the most effective mitigation would be to Impose a speed limit on construction vehicles operating within the construction site. Such an action would reduce the impact to low (4) significance. Furthermore, the use of a water bowser has been discounted based on the lack of water availability in the area.

Potential impact 12: Incidental pollution events, including the loss of solid waste, spillage of liquids such as hydrocarbons and other fuels as well as possible sewerage and other waste is likely to alter selected points within the subject site, possibly affecting habitat form and other factors.

In order to limit the effect of incidental pollution events, the following mitigation measures are recommended to be carried out; 1) A waste management plan is to be compiled and implemented onsite 2) A spill kit is to be placed on site in order to curtail and contain any hydrocarbon spill; and 3) A designated waste area is to be placed within a suitable place onsite, which is to be identified by the appointed Environmental Control Officer (ECO). The implementation of management actions will render the significance of this impact as low.

Potential impact 13: General disturbance on account of pedestrian movement and activities on site

General pedestrian movement from labour on foot extends the overall impact extent of the development, albeit marginally, restrictions on movement within the subject site is likely to reduce general litter and other undesirable pollution. In order to limit this impact to Low significance, environmental inductions as well as the necessary signage are to convey acceptable areas in which to traverse within the subject site.

7.1.1 Impact Summary Table: Construction Phase

The impact ratings are described in this section for the construction phase.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE – Direct Impacts						
Impact 1: Alteration of habitat structure and composition	Status	Negative	Moderate (3)	• Implement general management principles as per the EMPr to ensure that the site is managed appropriately.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 2: Ousting (and recruitment) of various fauna	Status	Negative	High (2)	• Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. • Avoid extensive alteration of sheet wash areas. • Cordon off the sites to prevent inward migration of fauna. • Implement other general management principles as per the EMPr.	Moderate (3)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 3: Changes in the geomorphological state of drainage patterns	Status	Negative	High (2)	• Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas. • Cordon off the sites to prevent inward migration of fauna • Implement other general management principles as per the EMPr.	Moderate (3) to Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 4: Increased ELP	Status	Negative	Low (4)	• Ensure reduced security lighting, downward lighting and restriction on lumens employed	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
	Irreplaceability	Low				
Impact 5: Exclusion or entrapment of (in particular) large fauna	Status	Negative	Low (4)	• Ensure regular flushing of the area throughout the construction phase	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 6: Changes in edaphics (soils) due to excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points	Status	Negative	Low (4)	• Ensure construction activities are limited to the development foot print in order to minimise the extent of impact	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 7: Changes in subsurface water resources arising from alteration of percolation and recharge at points	Status	Negative	Low (4)	• Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces is achieved.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 8: Changes in water resources and surface water in terms of water quality	Status	Negative	Moderate (3)	• Ensure all hazardous materials are adequately stock piled in a leak proof receptacle. • Ensure a spill kit is placed on site in order to contain any hydrocarbon leaks if necessary.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 9: Exotic weed invasion	Status	Negative	Moderate (3)	• Limit construction activities to the development foot print to lessen disturbance within the area • The removal through mechanical or application of a herbicide is likely to be required in order to curtail proliferation. Note that the appointed Environmental	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
	Reversibility	Low		Control Officer (ECO) of the project is to be consulted prior to application of the herbicide.		
	Irreplaceability	Low				
Impact 10: Clearance of vegetation to establish roadways and other infrastructure	Status	Negative	Moderate (3)	• Specimens to be relocated if possible, through plant rescue. • Clearance activities are to be strictly confined to the development foot print. • Clearance is to be carried out where needed to accommodate infrastructure.	Low (4)	High
	Spatial extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 11: Dust – according to movement of traffic and other construction related factors will affect factors such as palatability of vegetation	Status	Negative	Moderate (3)	• Impose a speed limit on construction vehicles operating within the construction site.	Low (4)	High
	Spatial extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 12: Incidental pollution events, including the loss of solid waste, spillage of liquids such as hydrocarbons and other fuels as well as possible sewerage and other waste is likely to alter select points within the subject site, possibly affecting habitat form and other factors.	Status	Negative	Moderate (3)	• A waste management plan is to be compiled and implemented onsite • A spill kit is to be placed on site in order to curtail and contain any hydrocarbon spill. • A designated waste area is to be placed within a suitable place onsite, which is to be identified by the appointed ECO.	Low (4)	High
	Spatial extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 13: General disturbance on account of pedestrian movement and activities on site	Status	Negative	Moderate (3)	• Limit pedestrian/labour movement to within the confines of the site. • Appropriate signage and environmental induction are to be carried out in order to convey this point to onsite labourers (i.e. convey acceptable areas in which to traverse within the subject site).	Low (4)	High
	Spatial extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				

7.2 Operations Phase

The following potential impacts during the Operational Phase can be summarised:

Potential Impact 14: Continued alteration of habitat structure and composition on account of continuing low-level anthropogenic impacts, such as "shading of vegetation" from arrays.
This impact will be of moderate significance as drivers will alter within the PV facilities on account of the exclusion of the animal element of the system as well as other management interventions (e.g. washing of PV modules). The impact may however not necessarily be "negative" if some faunal components are retained and management of the facility is ecologically driven". These mitigation measures would reduce the impact from Moderate (3) to Low (4).

Potential Impact 15: Ousting (and recruitment) of various fauna on account of long-term changes in the surrounding habitat/environment
As some drivers have changed on site, this will favour certain fauna and alter faunal ethos. It follows that small ecological shifts may transpire within the region and particularly within the PV facilities and powerline corridors. Such impacts may not necessarily be negative, however there is likely to be some short-term changes in populations of specific species or possible introduction of undesirable species (e.g. Rattus rattus – house rat). Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. Mitigation of this impact would result in a low rating.

Potential Impact 16: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change
As climatic factors change within the region, natural bio-physical responses, including changes in habitat or faunal population shifts may be affected on account of the presence of the PV facilities and power line corridors. This impact is considered "low" significance on account of the generally limited extent of the site in relation to surrounding habitats. Mitigation measures include the cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.

Potential Impact 17: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities
Such changes to water resources and quality will be related to the long-term activities on site, but are likely to be negligible. Alteration in water quality are surmised to stem primarily from unintended hydrocarbon leaks from operating vehicles and other machinery on site. However, impacts of this nature during the operational phase are considered to be of "low" significance with mitigation measures including to retain spill kits on site.

Potential Impact 18: Exotic weed invasion as a consequence of regular and continued disturbance of site.
As per the construction phase, exotic weed invasion is likely to arise on account of ongoing disturbance. If managed correctly through the implementation of a weed eradication plan, this impact can be classified as "low" significance.

7.2.1 Impact Summary Table: Operational Phase

The impact ratings are described in this section for the operational phase.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE – Direct Impacts						
Impact 14: Continued alteration of habitat structure and composition on account of continuing lowlevel anthropogenic impacts, such as "shading of vegetation" from arrays	Status	Neutral	Moderate (3)	• Ensure that the faunal components are retained and management of the facilities are ecologically driven. • Implement other general management principles as per the EMPr.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 15: Ousting (and recruitment) of various fauna on account of long-term changes in the surrounding habitat/environment	Status	Negative	Moderate (3)	• Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. • Avoid extensive alteration of sheet wash areas. • Implement other general management principles as per the EMPr.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 16: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change	Status	Negative	Low (4)	• Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas. • Cordon off the sites to prevent inward migration of fauna • Implement other general management principles as per the EMPr	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 17: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities	Status	Negative	Low (4)	• All stagnant/parked vehicles operating within the site are to have a drip tray placed underneath the engine. • A spill kit is to be placed onsite in order to limit any impact • Limit access to the riverine areas.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
	Irreplaceability	Low				
Impact 18: Exotic weed invasion as a consequence of regular and continued disturbance of site	Status	Negative	Low (4)	• Implementation of a weed eradication plan	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				

7.3 Decommissioning of Site

The following potential impacts during the Decommissioning Phase can be summarised:

Potential Impact 19: A reversion to an early seral stage
Once decommissioning has taken place, much of the affected area may revert to an early seral stage, although it is anticipated that some vegetation may have entered higher seres on account of the limitation of grazing. Mitigation measures include the specific rehabilitation of the site throughout the overall development and operation foot print. This impact is not considered to be significant and may be classed as “low” significance.

Potential Impact 20: A reversion to present faunal population states within the study area, with some variation to these populations being possible.
On account of both the abovementioned seral state of the land as well as other factors, decommissioning and reversion to a land use, akin to the present, should see some alteration of faunal populations and a reversion to present populations with some ousting and recruitment of species. This impact is rated as “low” significance before and after the implementation of management actions such as 1) ensure that there is appropriate disposal of materials and waste during decommissioning activities as well as 2) manage stabilisation and reinstatement of the land.

Potential Impact 21: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment
The decommissioning of the site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is rated as “low” significance.

Potential Impact 22: Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures.
Disturbance to the site through cessation and decommission of activities may result in further proliferation of any existing exotic species on site. Thus, weed eradication should continue post decommissioning of the project to ensure limited spread of exotic species. This mitigation would maintain the impact as low.

7.3.1 Impact Summary Table: Decommissioning Phase

The impact ratings are described in this section for the decommissioning phase.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
DECOMMISSIONING PHASE – Direct Impacts						
Impact 19: A reversion to an early seral stage	Status	Neutral	Low (4)	• Ensure that there is appropriate disposal of materials and waste during decommissioning activities • Manage stabilisation and reinstatement of the land	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 20: A reversion to present faunal population states within the study area, with some variation to these populations being possible	Status	Neutral	Low (4)	• Ensure that there is appropriate disposal of materials and waste during decommissioning activities • Manage stabilisation and reinstatement of the land	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 21: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	Status	Neutral	Low (4)	• Cordon off access to dendritic drainage lines.	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 22: Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures	Status	Neutral	Low (4)	• Post bi-yearly monitoring of the site to hinder proliferation of exotic species as a result of the development	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				

7.4 Indirect Impacts

The following indirect impacts are anticipated to be associated with the establishment of the PV Facilities, EGI and associated infrastructure on the farm Hoek Doornen. Indirect impacts arising from the establishment of the site are likely to be of low significance, and generally latent in nature.

Potential Impact 23: Changes in the broader landscape ecology through alteration of eco-morphological drivers
The development of the proposed PV facilities on Hoek Doornen may alter habitat form and structure beyond the boundaries of the PV facilities as support infrastructure (e.g. roads) are established, or as physical or biological factors change (e.g. drainage patterns change or grazing pressures increase at other points). The impacts may however prove to be of low impact significance.

The decommissioning of the site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is considered to be "low" significance.

Potential Impact 24: Changes in faunal ethos due to the establishment of the PV Facilities
Changes in faunal ethos on account of the establishment of the PV facilities on Hoek Doornen, some faunal populations may emigrate from the area, while others may favour other factors around the site. Behavioural change in faunal populations will drive ecological change beyond the boundaries of the PV Facilities. This impact is rated as "low" significance without and with the implementation of mitigation measures.

7.4.1 Impact Summary Table: Indirect Impacts

The impact ratings for indirect impacts are described in this section.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE – Indirect Impacts						
Impact 23: Changes in the broader landscape ecology through alteration of eco-morphological drivers	Status	Neutral	Low (4)	• Appropriate management of the site must be undertaken along ecological integration approaches. • Cordon off access to dendritic drainage lines	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				
Impact 24: Changes in faunal ethos due to the establishment of the PV Facilities	Status	Neutral	Low (4)	• Implementation of security fencing is likely to arise	Low (4)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Low				

7.5 Cumulative Impacts stemming from both the construction and operational phases of the development

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) (i.e. two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172). As noted above, notably there are approximately 11 authorised renewable energy projects on some 50 000 ha of land within 30 km of the subject site (Figure 25). The majority of these projects employ wind turbines, which present fundamentally different impacts and externalities that may affect the broader ecology of the region, although three smaller sites located some 30 km south of Hoek Doornen will employ PV technology for power generation. The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius. Given the above, cumulative impacts arising from the implementation of the proposed projects and other land use changes in the region are likely to exhibit the following:

Potential Impact 25: Alteration of habitat structure and composition, albeit primarily sporadic in nature, over an extensive and wide area

This impact would be extensive, being associated with the exclusion of fauna from extensive ranges within the area and the apparent change in some ecological drivers within the PV facilities. The impact is however to be considered only of low negative significance as some beneficiation may arise from this state. However, construction should be limited to the approved development footprint and clearance of vegetation should take place only where necessary to ensure this impact is low.

Potential Impact 26: Changes in fauna, faunal ethos and related factors

Faunal populations through exclusion of certain species and beneficiation of others over an extensive and wide area – primarily on account of change in habitat as well as the implementation of security fencing is likely to arise. In addition, as the range of larger vertebrate populations may change across the broader area, this too will affect faunal ethos and impact on localized ecology at points. This impact could be considered of “moderate” significance but may also offer some beneficiation, particularly where habitat improvement arises within the region whereas post mitigation this impact is considered to be ‘low’.

Potential Impact 27: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment

This impact will be a long-term impact which may be considered “negative” but of low significance. Additional hard panning as a result of the establishment of the PV facilities and associated infrastructure contributes to the change in the geomorphological state of the drainage lines. Stormwater controls are to be incorporated into the development to ensure attenuation of flow.

Potential Impact 28: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment

Excessive run off and potential hydrocarbon spills from vehicles and plant may enter into the water sources and alter such water quality. The consequence of this impact is rated as moderate, and the probability is rated as likely, resulting in a low significance before and after mitigation. The mitigation measures provided below are to be carried out.

Potential Impact 29: Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of site

This impact is likely to be driven by levels of disturbance across the site. Sound site management at each project should avert extensive AIP establishment on site, but is likely to be common place across the region. This impact is considered to be of a low significance; however, the implementation of an eradication plan is recommended to be carried out to ensure this impact is low.

7.5.1 Impact Summary Table: Cumulative Impacts

The impact ratings are described in this section for the cumulative impacts during the construction and operation phase.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
Construction and Operational phase – Cumulative Impacts						
Impact 25: Alteration of habitat structure and composition, albeit primarily sporadic in nature, over an extensive and wide area	Status	Negative	Low (4)	• Ensure construction is limited to the approved development footprint • Clear vegetation only where necessary.	Low (4)	High
	Spatial Extent	Regional				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				
Impact 26: Changes in fauna, faunal ethos and related factors	Status	Negative	Moderate (3)	• Allow for permeability in fence line for greater ease of migration for fauna.	Low (4)	High
	Spatial Extent	Regional				
	Duration	Long term				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				
Impact 27: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment	Status	Negative	Low (4)	• Ensure storm water controls are adequately attenuate storm water runoff. • Limit scour and erosion	Low (4)	High
	Spatial Extent	Regional				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				
Impact 28: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment	Status	Negative	Low (4)	• All stagnant/parked vehicles operating within the site are to have a drip tray placed underneath the engine. • A spill kit is to be placed onsite in order to limit any impact • Limit access to the riverine areas.	Low (4)	High
	Spatial Extent	Regional				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
	Irreplaceability	Low				
Impact 29: Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of site	Status	Negative	Low (4)	• Co-ordinated and sustained management of all nine PV and EGI Projects associated with this BA	Low (4)	High
	Spatial Extent	Regional				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				

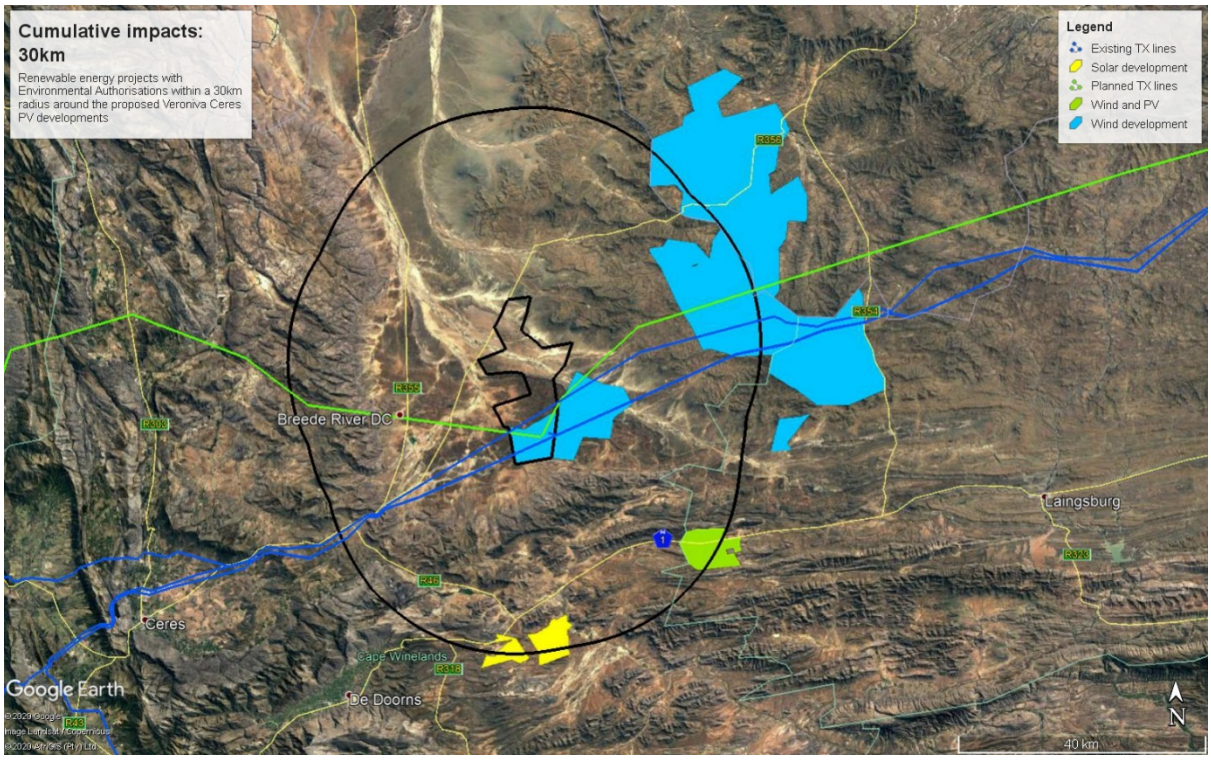

Figure 25. Map indicating renewable energy projects within 30 kilometres of the project site (van Rooyen, 2020)

8 Impact Assessment Summary

The overall impact significance (with the implementation of mitigation measures) associated with the PV facilities and the electrical powerlines is presented below (Table 5 and Table 6, respectively). The overhead power line for Hoek Doornen PV 4 will also traverse the Groot River and in this regard, reference should be made to the separate Aquatic Biodiversity and Species Assessment.

Table 5: Overall Impact Significance (Post Mitigation) of the proposed PV facilities and associated infrastructure

Phase	**Overall Impact Significance**
Construction	Moderate
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

Table 6: Overall Impact Significance (Post Mitigation) of the proposed EGI to support the PV Facilities

Phase	**Overall Impact Significance**
Construction	Moderate
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

9 Legislative and Permit Requirements

The proposed establishment of the PV facilities on the subject site are considered to elicit a requirement for compliance with the following legislation.

1. The National Environmental Management: Biodiversity Act (10 of 2004)

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) may be applicable to site, particularly in respect of matters pertaining to threatened or protected species encountered on or around the sites or the matter of redress of AIPs. This may apply in respect of the establishment of the powerlines across riverine habitats.

2. The National Water Act (Act 36 of 1998)

The proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such, maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The sensitivity map in Figure 12 indicates that for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, areas of terrestrial importance and a "buffer" at the interface of the terrestrial and riparian areas have been demarcated, which approximates 100 m and includes areas of sheet wash and flood extremes. In addition, no wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines).

The powerline for Hoek Doornen PV 4 will, however, cross the Groot River and would require the establishment of one or two towers within the riparian environment of the Groot River. The powerlines for the Hoek Doornen PV 1, PV 2 and PV 3 facilities will not cross the Groot River, as these facilities lie to the south of the Groot River. In addition, the access road leading to the Hoek Doornen PV 4 site would need to be upgraded as part of the proposed projects. Sections of the access road upgrade will take place within 100 m of the Groot River.

The requirement for a General Authorisation or Water Use License in terms of Section 21 (c) and 21 (i) of the National Water Act may be required where activities arise within the bed of the river in respect of the establishment of towers for the overhead powerlines and the road upgrading. Therefore, the following project likely requires a Water Use License or similarly a General Authorisation:

- Hoek Doornen PV 4 – for the access road upgrade and power line specifically.

However, if the towers are needed to be placed within 100 m of the bank of the Groot River, for the Hoek Doornen PV 1, PV 2 and PV 3 facilities, then a Water Use License or similarly a General Authorisation may be required.

The Department of Human Settlements, Water and Sanitation are to confirm such prerequisite legal requirements.

3. The National Forest Act (Act 84 of 1998)

The clearance of "natural forest" may be applicable, where, particularly in the establishment of the power line that traverses the Groot River, there may be the requirement to remove associations of V karoo. Although not strictly "forest" in ecological terms, the *contiguous canopy* definition of forest would apply under Section 7 of the National Forest Act (Act 84 of 1998).

4. The Cape Nature and Environmental Conservation Ordinance 19 of 1974 (also the Western Cape Nature Conservation Laws Amendment Act (2000).

This act should be given consideration following EA with particular respect to Chapters IV, (The protection of wild animals other than fish) and Chapter VI, (The protection of flora). The requirement for permits when removing and relocating specific flora that may be encountered or alternatively addressing fauna that may be encountered around the sites would require due consideration. A review of site prior to the commencement of construction will confirm the need for application in terms of the Ordinance.

5. Draft Western Cape Biodiversity Bill, 2019.

This law has not been promulgated however some aspects of Chapter 7, in particular may apply to the sites, once promulgated.

6. The National Environmental Management Act 107 of 1998

The establishment of PV facilities and associated infrastructure within 32 meters of a water course as well as within areas designated CBAs require EA as such activity's 'trigger' listed activities in the 2014 NEMA EIA Regulations.

In consideration of the applicable legislation listed above, it is important to note that the requirement for approval is to be confirmed by the competent authority on the matter.

10 Environmental Management Programme Inputs

Reference is made to the EMPr in respect of the terrestrial environment at Hoek Doornen. The following key management interventions are proposed for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, should they be approved. Further detail on these actions is proposed in the EMPr.

- Avoidance of major drainage lines identified in the report, in particular, the Groot River. The development footprint should align with the recommended / approved layout in Figure 20, 21 and 22.

- Avoidance of excessive clearance of vegetation within the site, with restriction to roads, substations and laydown areas and related built structures;

- Management of exotic weed invasion that may arise at points.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife porosity” into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife See Figure 26 below.

- Suitable stormwater management measures to redress excessive surface flows from site towards drainage lines

- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

Figure 26. Image showing “critter path” within electrified fence. Similar measures should be implemented on the site.

10.1 Powerline/electrical grid infrastructure

General management measures associated with the powerline are akin to those associated with this Terrestrial Biodiversity and Species Assessment as much of the powerlines lie within this environment. Howsoever, the management principles associated with the traversing of the river systems are of some significance and reference to the Aquatic Biodiversity and Species Assessment and EMPr is required. Nonetheless, the primary issues that should be incorporated into the management of the powerlines are:

- Tower footings should be subject to review by the ECO or an ecologist prior to the commencement of construction.
- Plant rescue operations should be implemented where species of ecological significance are encountered or identified
- Service roads associated with the powerline routes should be suitably designated to ensure that vehicles remain within these routes; and
- Minimum driving speeds should be implemented for all vehicles utilising these roads, (<30km/h)

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

Given the information presented above it is evident that should the Applicants establish the proposed development within the identified footprint on Hoek Doornen, that Hoek Doornen PV 1 – PV 4 may proceed with limited impact on the broader ecological processes and those areas deemed to be of ecological significance (namely the lower riparian environments and sand wash environments). It therefore follows that the PV sites show a low-level ecological impact within the sites identified and subject to the implementation of the prescribed management recommendations and conditions should not be precluded from development on ecological grounds.

11.2 EA Condition Recommendations

Should the mandated authorities approve the proposed development, the following broad management recommendations are recommended for incorporation into the EA:

- Maintenance and establishment of an ambulatory set back of >100m from the identified riparian areas and points of sheet wash as per the layout plan presented

- That construction and establishment of modules be undertaken without the clearance of vegetation. Where vegetation proves excessively tall and effects either construction or operation, pruning may be affected.

- A detailed stormwater management and drainage plan be developed that considers inter alia, surface flows arising from elevated areas above the PV facility and its discharge from the facility. This philosophy must include attenuation and energy dissipation mechanisms and redress of erosion and sheet flow across site.

- The laydown area for the PV facilities should be subject to compaction and the use of dust suppressants when in operation, to prevent excessive particulate matter becoming airborne.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife” porosity into fencelines and the implementation of measures on the energised fenceline to avoid mortalities to wildlife

- Management of exotic weed invasion that may arise.
- A detailed plan relating to the limiting of ELP on site must be compiled.
- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

It is our opinion that with the implementation of the above, the project proposal, subject to final design and adherence to the above recommendations, should be authorised.

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APPENDICES

Appendix A - Specialist Expertise

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MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist
EDUCATION
BSc Biological Science (1990) University of Natal
Diploma Project Management (1997) Executive Education
MSc (2004) University of KwaZulu Natal
PhD. Candidate: Department of Engineering, University of Kwa Zulu Natal
1998: Guest of Konrad Adenhauer Foundation to Berlin to consider "sustainable development initiatives" in Europe
2000: Training course: "Environmental Economics and Development". University of Colorado (Boulder) USA.
2008: Certificate in Coastal Engineering: Stellenbosch University

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. With a core competency in coastal ecological systems and coastal management, Bundy has worked on coastal projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as South Africa, providing ecological and general environmental advice and support. In addition, Bundy has worked in Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large-scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical supports, as well as the undertaking of rehabilitation programmes.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. In 2015, Bundy formulated the coastal set back line method for the iSimangaliso Wetland Park, funded by the Global Environment Fund of the United Nations. Bundy acts as botanical and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the Council for Scientific and Industrial Research, Stellenbosch.

SELECTED RELEVANT PROJECT EXPERIENCE

Aquatic and Ecological evaluation of the impacts of Scatec Kenhardt Solar Facilities 1 – 6 in Northern Cape – CSIR (2016 to 2019)
Investigations and review of the aquatic and terrestrial ecology associated with 6 solar facilities at Kenhardt in Northern Cape
Aquatic and Ecological evaluation of the impacts of Maintstream wind Projects in Sutherland Northern Cape & Western Cape – CSIR (2015 to 2016)

Investigations and review of the terrestrial ecology associated with wind power facilities near Sutherland in Northern Cape

Environmental Assessment Practitioner Project Ecologist: eThekweni Municipality – evaluation of impacts and rehabilitation recommendations 2007.

Evaluate the impact of the 2007 storm event on coastal infrastructure along the eThekweni coastline with recommendations on rehabilitation. Undertake application to Provincial and National Departments for rehabilitation in terms of NEMA

Ecological investigations Tongaat and Illovo Desalination Plants: CSIR – (2013 - 2016)

Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning: Sodwana Bay: iSimanagaliso Wetland Park Authority – (2014 - 2015)

Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Review of Project Leader and Coastal Specialist: Addington Farm Strategic Environmental Assessment (2016)

Evaluation of coastal habitat and beach-dune interface for the generation of setback lines for the proposed Addington Farm residential development.

Aquatic and Ecological evaluation of the impacts of in-water hull cleaning, Port Louis, Mauritius and Port of Durban – Aquatech / Divetech Solutions(2014 to date)

Investigations and review of the chemo-physical impact of in-water hull cleaning in the Durban and Port Louis Ports for accreditation with the International Maritime Organisation.

Coastal ecological evaluation of the Van Riebeeckstrand coastline, Cape Town for the establishment of inter-continental telecommunication cables. Acer Africa (2016)

Specialist investigation into the impact of establishing marine cables at Van Riebeeckstrand Cape Town for MTN. Client: Acer Africa.

Review and report on impact of the Fairbreeze Mine at Mtunzini on aquaculture operations at Mtunzini Aquaculture – Supporting document for legal argument presented on behalf of Mtunzini Aquaculture. (2017)

Specialist review and investigation of groundwater discharge and dune mobility at Siyaya, Mtunzini and its effect on the marine intake supplying the Mtunzini Fish Farm. Client: Mtunzini Fish Farm / Eversheds

Coastal ecological evaluation of the Margate – Lucien Beach sewer reticulation and outfall, Hibiscus Coast KZN. Client: Enaq (2018)

Specialist investigation into the impact of waste water discharge at Lucien Beach, Margate and recommendations on discharge points for additional works.

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event: West of England Insurance, United Kingdom (2018 - 2019)

Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assoc's and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

Rehabilitation Projects: (2010 - 2015)

- Dune rehabilitation of Durban Harbour southern breakwater 2009 – 2010 for Group 5. Sculpt, establish and maintain.
- Mangrove forest rehabilitation of Hugh Dent pump station 2015 for Sembcorp Siza Water.
- Dune rehabilitation of Ballito beachfront 2009 for KwaDukuza Municipality, following 2007 storm surge event
- Ulundi TSC rehabilitation for Eskom Eastern Region, 2016
- Mangethe substation rehabilitation of area for Eskom Eastern region, 2016.

PUBLICATIONS

Bundy S C. 2018 "The great coastal conservation conundrum". EKZNWildlife Conservation Symposium
Smith AM, Bundy SC, Cooper (2016) "Apparent dynamic stability of the south east African coastline, despite sea level rise" Earth Surface Processes and Landforms DOI 10. 1002
Bundy, S. C. and Forbes, N. T., 2015. *"Coastal dune mobility and their use in establishing a setback line*" 9th West Indian Ocean Marine Science Conference 2015
Smith AM, SC Bundy 2012 "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper
Bundy, S. C., Smith, A. M., Mather, A. A. 2010. "Dune retreat and stability on the Northern Amanzimtoti Dune Cordon", EKZN Wildlife Conservation Symposium 2010
Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A; 2010 "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press
Bundy SC AM Smith, (2009) "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred
Bundy, S. C. and Smith, A. M. 2009 *"Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.
Smith A and Bundy S 2009 "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi-Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa
Smith A, Mather A, Theron A, S Bundy 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the South African Environmental Observation Network publication "Climate Change in Southern Africa"

Name:	Alexander Michael Whitehead
Profession:	Environmental Consultant/Ecologist
Date of Birth:	30/08/1983
Current Employment:	Sustainable Development Projects cc
Position:	Ecologist/Environmental Consultant
Years of experience:	14
Nationality:	South African
Email address:	alex@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Ichthyology and Fisheries Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – Reg. No. 400176/10 (Ecological Science)

Key Skills and experience:

- Computer skills – (MS Word, STATISTICA, Excel, MS Access, PRIMER 5 (multivariate statistical program), CAP 4 (multivariate statistical program));
- Bioassessment - Experience in sampling aquatic invertebrates (SASS 5) and ichthyofauna (Electrofishing and estuarine sampling techniques);
- Water quality - Experience in carrying out water samples and interpreting results in both freshwater and estuarine environments;
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Wetland functionality assessments – Assessment of wetland functionality using ecological indicators and standard methods such as Wet-Ecoservices and Wet-Health.
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Rehabilitation – Compilation of wetland and terrestrial rehabilitation plans as well as practical experience in planning and conducting weed eradication and re-vegetation programs.
- Environmental monitoring and auditing –
- Open space and conservation planning – Identification of areas of open space or conservation importance.
- Botanical/protected species permits and Risk Assessments – Permit applications under the National Forest Act (84 of 1998), Natal Nature Conservation Ordinance (15 of 1973) and National Environmental Management: Biodiversity Act (10 of 2004).

Name:	Luke Patrick Maingard
Profession:	Environmental Consultant/Ecologist
Date of Birth:	15/09/1993
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	5
Nationality:	South African
Email address:	Luke@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Environmental Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – (Ecological Science)

Key Skills and experience:

- Geographic Information Systems
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);

- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental legislation
- Storm water control and management design and implementation
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Environmental Control Officer to numerous construction sites
- Data management and analysis
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.

Appendix B - Specialist Statement of Independence

I, Simon C Bundy, 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:

Name of Company: SDP Ecological and Environmental Services

Date: 15/10/2020

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

Specialist Company Name:	SDP Ecological & Environmental Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	ex	Percentage Procurement recognition	
Specialist name:	Simon C Bundy			
Specialist Qualifications:	BSc MSC Dip Proj Man			
Professional affiliation/registration:	SACNASP			
Physical address:	6 Salisbury Road, Ballito			
Postal address:	P O Box 1016, Ballito			
Postal code:	4420	Cell:	082 446 4847	
Telephone:	032-586 1218	Fax:		
E-mail:	simon@ecocoast.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Simon C Bundy_____, 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

S. D. P CC
P.O. BOX 1016, BALLITO 4
TEL: 032 946 1685
FAX
WEB

Name of Company:

17/11/20

Date

Appendix C: Site Sensitivity Verification

Prior to commencing with the Terrestrial Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	12 – 18 September 2020
Specialist Name	S C Bundy
Professional Registration Number	
Specialist Affiliation / Company	SDP Ecological & Environmental
Date of Site Visit	12 – 18 September 2020
Specialist Name	L P Maingard
Professional Registration Number	
Specialist Affiliation / Company	SDP Ecological & Environmental

Site sensitivity verification was undertaken using the following means:

1. Preliminary desktop analysis achieved by reviewing and overlaying a variety of geospatial data. Review of literature and general review of planning information
2. On site traverse of site by vehicle and by foot
3. Establishment of camera traps
4. Interaction with local residents with specific knowledge of site.
5. Determination and consideration of ecological drivers including soils, slope, hydrology etc.

Review of the above led to the confirmation that the site shows general conformation with the screening tool,

Appendix D: Impact Assessment Methodology

The following impact assessment methodology was adopted:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D.1).

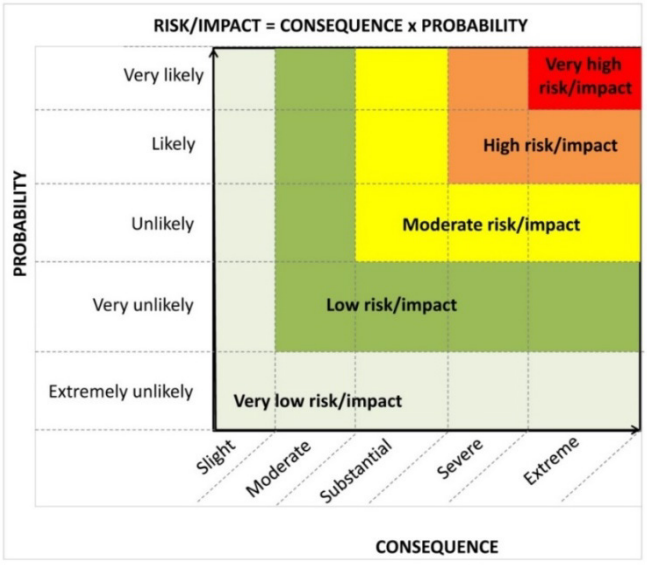

Figure D.1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Terrestrial Biodiversity Protocol (GN 320, 20 March 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity	***Section where this has been addressed in the Specialist Report***
The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;*	*Section 4*
2.3.2. ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;	*Section 4.2*
2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	*Section 4. The perceived corridors relate to riparian environments, which are excluded from the development footprint*
2.3.4. the description of any significant terrestrial landscape features (including rare or important flora- faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;	*Section 4*
2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including: *a) main vegetation types;* *b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;* *c) ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and* *d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;*	*Sections 4.1.1, 4.1.2 and 4.1.3* *a. Tanqua Karoo and Tanqua Wash River* *b. These systems are not threatened* *c. Connectivity relates to the riparian environments* *d. no significant species were identified or associated with the development footprints*
2.3.6. the assessment must identify any alternative development footprints within the preferred site which would be of a low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	*Section 5 (Not Applicable)*
2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify: *2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:* *a) the reasons why an area has been identified as a CBA;* *b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the*	*Section 4.1.4* *1. The Hoek Doornen Farm assessed area contains CBAs and ESAs, but only a few minor areas infringe for the actual development footprint. The power line corridor towards the middle and south contain ESAs and CBAs.* *2. The site is not critical to the maintenance of a CBA* *3. The development is not*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity	***Section where this has been addressed in the Specialist Report***
ecosystem type(s); *d) the impact on ecosystem threat status;* *e) the impact on explicit subtypes in the vegetation;* *f) the impact on overall species and ecosystem diversity of the site; and* *g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;*	*foreseen to impact on the remaining eco system type due to high levels of habitat transformation* *4. No change to ecosystem threat change is envisaged* *5. No "sub types" of vegetation were identified due to high levels of transformation* *6. Ecosystem diversity may improve in some respects, while change on account of exclusion from areas may alter faunal movement* *7. No change to populations in general are expected from the proposed development*
2.3.7.2. terrestrial ecological support areas (ESAs), including: *a) the impact on the ecological processes that operate within or across the site;* *b) the extent the proposed development will impact on the functionality of the ESA; and* *c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;*	*Section 4.1.4*
2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including- *a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;*	*The area is not within or adjacent to a protected area (Section 4.4)*
2.3.7.4. priority areas for protected area expansion, including- *a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;*	*The site does not lie within an area identified for protected area expansion*
2.3.7.5. SWSAs including: *a) the impact(s) on the terrestrial habitat of a SWSA; and* *b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);*	*Section 4.1.5*
2.3.7.6. FEPA sub catchments, including- *a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;*	*Section 4.1.5*
2.3.7.7. indigenous forests, including: *a) impact on the ecological integrity of the forest; and* *b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation*	*Section 4.1.5*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity	***Section where this has been addressed in the Specialist Report***
to the remaining areas.	
3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A*
3.1.2. a signed statement of independence by the specialist;	*Appendix B*
3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 2 and Appendix C*
3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	*Section 2*
3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	*Section 2.2*
3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	*Sections 4 and 11.2*
3.1.7. additional environmental impacts expected from the proposed development;	*Sections 4, 6 and 7*
3.1.8. any direct, indirect and cumulative impacts of the proposed development;	*Sections 6 and 7*
3.1.9. the degree to which impacts and risks can be mitigated;	*Section7*
3.1.10. the degree to which the impacts and risks can be reversed;	*Section 7*
3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 7*
3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	*Sections 7, 10 and 10.1*
3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	*Section 4.7* *The PV facilities were positioned to exclude areas of high sensitivity and lie upon areas of low sensitivity*
3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	*Section 11.1*
3.1.15. any conditions to which this statement is subjected.	*Section 11.2*
3.2. The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr, where relevant.	*Sections 7 and 10 of this report include mitigation and monitoring measures. These are to be included and incorporated into the BA Report.*
3.2.1. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Appendix B of this report. This report is included as an appendix to the BA Report.*

Appendix F: Riverine Rabbit Camera Trapping Exercise Report

Refer to the separately attached document.

KAPPA PV FACILTIES:

Riverine Rabbit Habitat Assessment and Camera trapping Survey

PRODUCED FOR CSIR/VERONIVA

October 2020

3Foxes Biodiversity Solutions

Simon.Todd@3foxes.co.za

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SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

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Kommetjie
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Ecological Solutions for People & the Environment

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.
- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town

- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Environmental Impact Assessment for the Proposed Komsberg East and Komsberg West Wind Farms and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment. Arcus Consulting 2014.
- Proposed Rietkloof & Brandvallei Wind Farms and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment Report. EOH 2016.
- Proposed Gunstfontein Wind Farm and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment Report. Savannah Environmental 2016.
- Tooverberg Wind Energy Facility and Grid Connection. Sivest 2018.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, 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 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:

Name of Specialist: ____Simon Todd_____

Date: ____24 October2020_____

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	3Foxes Biodiversity Solutions			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Simon Todd			
Specialist Qualifications:	BSc. (Zool. & Bot.), BSc Hons (Zool.), MSc (Cons. Biol.)			
Professional affiliation/registration:	SACNASP 400425/11			
Physical address:	23 De Villiers Road, Kommetjie 7975			
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Postal code:	7975	Cell:	082 3326502	
Telephone:		Fax:		
E-mail:	Simon.Todd@3foxes.co.za			

2. DECLARATION BY THE SPECIALIST

I, _____Simon Todd_____, 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

3Foxes Biodiversity Solutions

Name of Company:

17 November 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ____Simon Todd_____, swear under oath / affirm that all the information submitted o to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

3Foxes Biodiversity Solutions

Name of Company

17 November 2020

Date

Signature of the Commissioner of Oaths

SUID-AFRIKAANSE POLISIEDIENS
COMMUNITY SERVICE CENTRE
17 NOV 2020
OCEAN VIEW W.C.
SOUTH AFRICAN POLICE SERVICE

2020-11-17

Date

1 INTRODUCTION

Veroniva (Pty) Ltd, the Project Developer, is proposing to develop a series of 9 solar PV projects, associated infrastructure and electricity grid infrastructure on a ca. 10 000ha site situated in the Tanqua Karoo about ~40km north of Touwsrivier in the Western Cape. In this report, the proposed development is referred to as the Ceres/Kappa PV development. CSIR are conducting the required Basic Assessment (BA) processes and 3Foxes Biodiversity Solutions has been appointed to provide specialist faunal input for the proposed development, with particular reference on the Riverine Rabbit *Bunolagus monticularis*, which is listed as Critically Endangered and considered one of the most threatened mammals in South Africa. This species is known from the area and has been recorded on some of the adjacent properties to the proposed project site. The potential presence of this species at the proposed project site is a concern and represents a potential fatal flaw associated with the proposed development. As a result, Veroniva (Pty) Ltd have commissioned this study to address the above concerns with the following Terms of Reference:

- Conduct a field assessment to evaluate the Riverine Rabbit habitat suitability of the site.
- Conduct a camera trapping campaign at the site to evaluate the presence of the Riverine Rabbit at the site.
- Provide a Riverine Rabbit sensitivity map for the affected area with any associated buffers and development constraints.
- Provide an assessment of the impact of the development on the Riverine Rabbit with associated mitigation and avoidance measures.

1.1 RELEVANT ASPECTS OF THE DEVELOPMENT

The Kappa PV site is illustrated below in Figure 1 and includes the location and of the 9 different PV facilities and the electricity grid corridor to the Eskom Kappa Substation. The assessed layout of the PV development sites is illustrated below and it is important to note that this layout has been informed by the current study and the mapping of Riverine Rabbit sensitivity as well as the other environmental constraints present at the site.

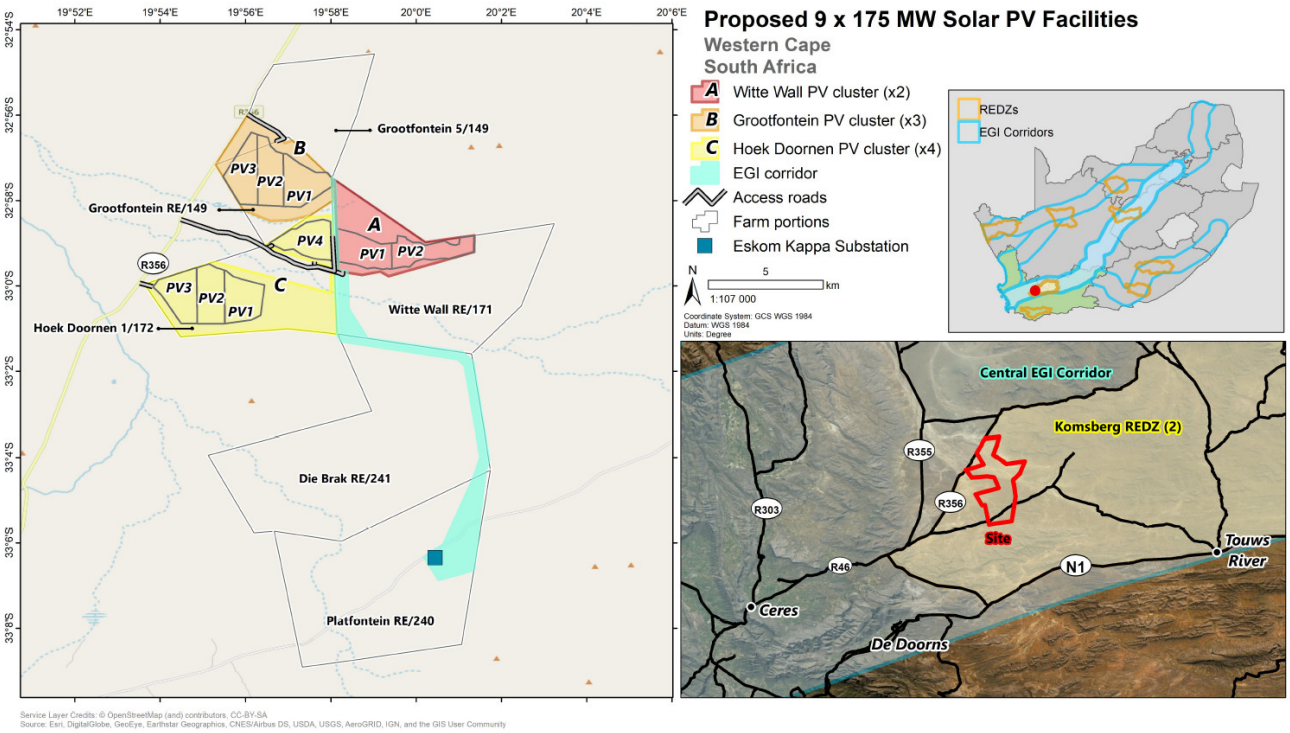

Figure 1. Image showing the location and layout of the Kappa PV cluster and grid corridor to the Kappa Substation.

2 METHODOLOGY

2.1 CAMERA TRAPPING & FIELD ASSESSMENT

As the Riverine Rabbit is the vertebrate species of particular concern at the site, camera trapping was used across the whole Kappa PV site to establish the presence or absence of the Riverine Rabbit and also to characterise the fauna of the site more generally. A total of 30 camera traps were distributed across the site (Co-ordinates in Annex 1), on the 8th and 9th of September 2020 and retrieved on the 21st and 22nd of October 2020, giving rise to 6 weeks of continuous camera trapping. Due to the association of Riverine Rabbits with riparian floodplain habitats, camera traps were concentrated within riparian areas identified as potential habitat for this species. This amounted to approximately two-thirds of the cameras in riparian areas and the remainder were located in other habitats. In order to increase the number of fauna captured, the cameras were placed along paths, fences etc. where fauna are likely to pass and be captured by the cameras.

Before going to the field, the different habitats present at the site were mapped from satellite imagery of the site. This allowed the identification of the riparian areas and other areas where Riverine Rabbits are more likely to be present and also aid in camera trap placement. In the field, these different areas were assessed based on plant species composition and substrate conditions for habitat suitability in order to inform the sensitivity classification of these different areas.

2.2 SENSITIVITY MAPPING & ASSESSMENT

A Riverine Rabbit sensitivity map of the site was produced by integrating the results of the field assessment and camera trapping results. The sensitivity of the mapped units was rated according to the scale as indicated below.

- **Low** – Areas outside of riparian habitats where it is considered highly unlikely that the Riverine Rabbit is present or uses these areas on a regular basis. Development can proceed within these areas with little impact on the Riverine Rabbit.
- **Medium**- Areas where it is considered unlikely but possible that the Riverine Rabbit is present. These are areas of sub-optimal habitat where it is considered unlikely that there are any resident Riverine Rabbits present, although it is possible that rabbits move through this area occasionally. Some development in these areas is considered acceptable.
- **High** – Riparian areas where it is considered potentially likely that Riverine Rabbits are present. These are not areas of optimal habitat, but rather smaller drainage lines where the extent of suitable habitat and presence of food plants is limited. These areas are likely important for connectivity and it is likely that Riverine Rabbit utilise these areas when traversing the landscape.
- **Very High** – Riparian areas considered to represent optimal or near-optimal areas of habitat where the probability of Riverine Rabbit presence is high. However, even if no rabbits are located in these areas through camera trapping, they are considered essential for connectivity and as potential habitat. These areas are usually no-go areas from a developmental perspective and should be avoided as much as possible. It is however acceptable for access roads and power lines to traverse these areas where necessary.

2.3 LIMITATIONS & ASSUMPTIONS

The current study is based on two site visits with six weeks of camera trapping as well as an associated desktop study. This significantly reduces the assumptions required for the current study and in particular the Riverine Rabbit sensitivity mapping. It is however important to note that the camera traps were in the field for 6 weeks which is a relatively short period of time and a failure to capture any images of Riverine Rabbits does not confirm that they are not present on the site. It does however suggest that the abundance of Riverine Rabbits is low, especially when considered against the high numbers of the ecologically similar Cape Hare that were observed. Based on results from other nearby sites with Riverine Rabbits, this species tends to be restricted to areas of favourable habitat where it can be picked up by camera traps relatively easily. As such, the failure to capture any Riverine Rabbits in the current study suggests that the site is at the very least not an important area for Riverine Rabbits and is unlikely to support an extensive population. The aridity of the site may be an important factor in this regard as the other places in the Tanqua Karoo where Riverine Rabbits have been observed have generally all been near to the surrounding fold mountains in areas that receive greater rainfall than the current site. Overall, the camera trapping information is considered to represent an important activity which lends significant weight to the findings of this report. In addition, given the high conservation status of the Riverine Rabbit, a

conservative approach is required with the result that the failure to confirm the presence of Riverine Rabbits on the site is an important finding, but does not change the sensitivity of the areas assessed as having suitable habitat. The lack of observations of Riverine Rabbits at the site, is however used to confirm the low sensitivity of the surrounding plains where this species is considered highly unlikely to be present. Given the extent of the site and the number of cameras deployed, the camera trapping density was relatively high and the six week trapping period is considered adequate to provide a reliable representation of the faunal community of the site.

3 RIVERINE RABBIT HABITAT EVAUATION

This section provides an illustration and description of the habitats present at the site and their sensitivity based on their habitat suitability for Riverine Rabbits and the likelihood that Rabbits are present in these areas. Each habitat observed is illustrated and described briefly below. All images are taken from actual camera trap locations.

Tanqua Karoo Plains

The majority of the site is classified as the Tanqua Karoo vegetation type. Within the site at least, this is a generally homogenous vegetation type which occupies the extensive plains of the site. There are however several different communities associated with this vegetation type, determined by the substrate conditions. On calcrete soils, the vegetation tends to be dominated by *Pteronia paniculata*, while on most other soil types, the vegetation is dominated by *Ruschia intricata*. This is not considered to represent an important habitat type for Riverine Rabbits and it is highly unlikely that they occur in this habitat type. As a result, this habitat type is considered low sensitivity and development can proceed within this habitat with minimal potential consequence for Riverine Rabbits. Under the layout of the proposed development as assessed, the majority of the development footprint is located within this habitat type.

Figure 2. Typical view of the Tanqua Karoo plains of the site, showing the homogenous nature of this habitat, here dominated by *Ruschia intricata*.

Figure 3. Where the Tanqua Karoo plains are on shallow caclrete soils, the vegetation tends to be dominated by *Pteronia paniculata*, but has similar low sensitivity to those areas dominated by *Ruschia intricata*.

Tanqua Karoo Dunes

There is a relatively small extent of habitat within the farm Hoek Doornen that consists of aeolian sands, dominated by leaf-succulent shrubs such as *Leipoldtia* spp. and scattered *Stipagrostis* tussocks. This habitat has a moderate probability of being used by Riverine Rabbits as they have been observed in similar habitat south of the Kappa substation. As a result, this habitat type is not considered suitable for PV development and should be avoided by the PV fields. Although there were initially some PV areas planned within these areas, the layout has been adapted to accommodate these areas which are now completely avoided.

Figure 4. There Tanqua Dune habitat consists of loose sands accumulated against hillsides and other places protected from the wind. This is considered to represent a relatively sensitive vegetation type and should be avoided by the PV fields.

Minor Drainage Lines

There are several minor drainage lines and washes across the site. These are not considered to represent optimal habitat for Riverine Rabbits as the extent of associated floodplains and riparian vegetation is limited and there is probably insufficient habitat along these minor drainage features to support a population of Riverine Rabbits. These areas are however important for landscape connectivity as it is likely that these features are used for movement and migration of Riverine Rabbits when moving about the landscape. In addition, such sub-optimal areas can be important during times of stress as they can provide a resource that can be used when the primary habitat has become degraded or over-utilised. The core drainage features are mapped as Very High sensitivity while the adjacent floodplains and riparian vegetation are mapped as High sensitivity. No PV areas should be located in these areas or the buffers, but it would be acceptable for roads to traverse these features if there no existing roads that can be upgraded or alternative suitable access possibilities.

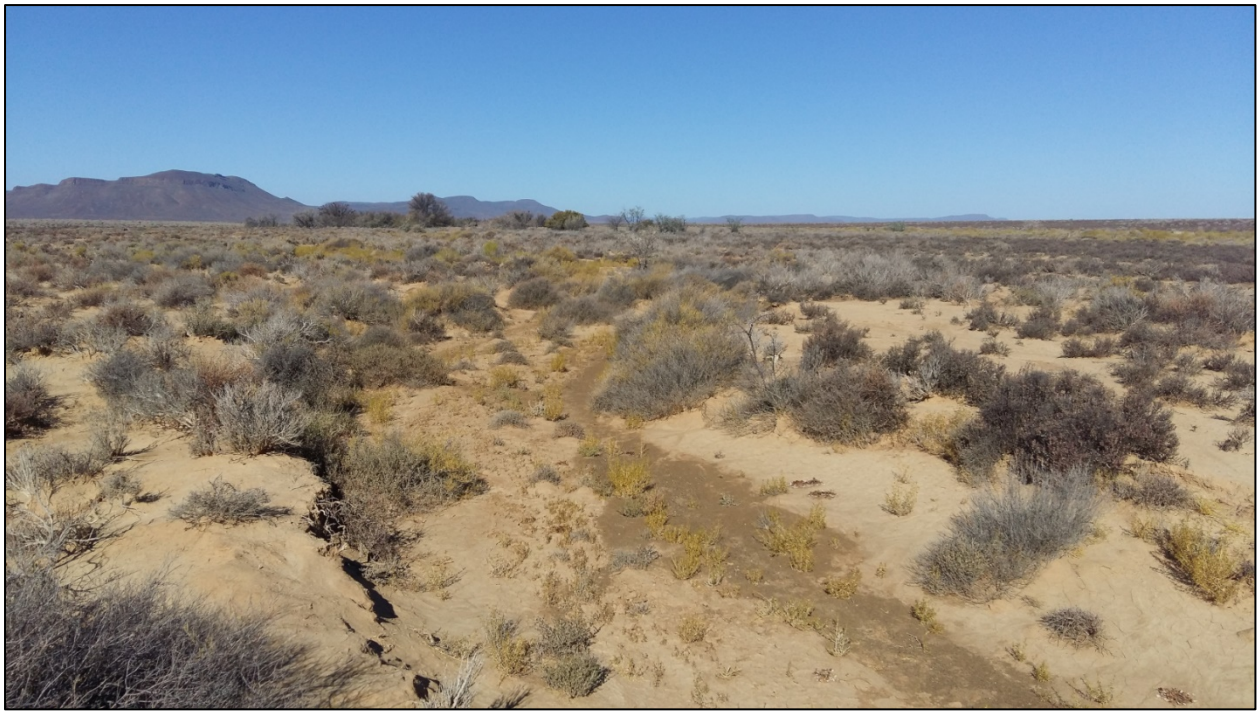

Figure 5. Typical minor drainage line within the site with Galenia Africana in the river bed and species such as Salsola spp. and Pteronia spp. on the adjacent floodplains. The riparian vegetation is not considered to represent optimal habitat for Riverine Rabbits as the cover is too low and the abundance of known food plants is also low.

Figure 6. Another example of a minor drainage feature from the site, with localised areas of floodplain vegetation that appear suitable as habitat for Riverine Rabbits but are limited in extent and are probably not sufficient to support a local population of Riverine Rabbits.

Major Drainage Lines

The major drainage line which traverses the site is the Groot River. The floodplain of the river is usually at least 500m wide and consists of a confined or braided channel flanked by silty floodplains dominated by halophytic shrubs such as *Salsola aphylla* with occasional stands of *Acacia karroo*. Although there are some parts of the floodplain that are degraded, possibly as a result of historical overgrazing, there are also extensive areas with dense riparian vegetation that is considered to represent excellent Riverine Rabbit habitat. Although no rabbits were captured on the camera traps, they are confirmed present in the greater Groot/Doring system and most likely move through the area at least on occasion. The river and adjacent floodplain have been classified as Very High sensitivity and disturbance and transformation in these areas should be kept to the minimum. Buffers around the floodplain have also been included in the sensitivity mapping to ensure that noise and other disturbances are kept away from the core of the habitat. As such no additional buffers around any of the mapped features is required.

Figure 7. View of the Groot Rivier, which the main drainage feature which traverses the site. In the section pictured, the right-hand bank consists of steep slopes of weathered shale, while there are extensive floodplains on the other side dominated by *Salsola aphylla* and *Acacia karroo*.

Figure 8. Typical riparian vegetation along the Groot Rivier, dominated by *Salsola* species with *Acacia karroo* in the background along a channel. This habitat is considered highly favourable for Riverine Rabbits and it is likely that Rabbits are at least on occasion present in these areas.

3.1 CAMERA TRAPPING RESULTS

A total of 12 different mammal species were captured by the cameras (Figure 9, Figure 10). This represents a relatively low total and does not compare favourably to other areas near the Kappa substation where camera trapping captured more than 20 different species. This low diversity and capture rate can be explained by the relative homogeneity of the site and aridity of the area compared to the wetter and more diverse landscapes near Kappa substation where several sites have been camera trapped. No Riverine Rabbits of other species of conservation concern were captured or observed at the site. In terms of the faunal community as observed by the camera traps, this is somewhat different from the other sites in the area that have been sampled, in that the Common Duiker was the most common species observed at the current site. At the majority of sites sampled nearby and in the wider karoo more generally, the Steenbok is usually the most common species observed. Although Caracal are not very common in the area, they are conspicuously absent from the current site, which may reflect the lack of sufficient cover for this species.

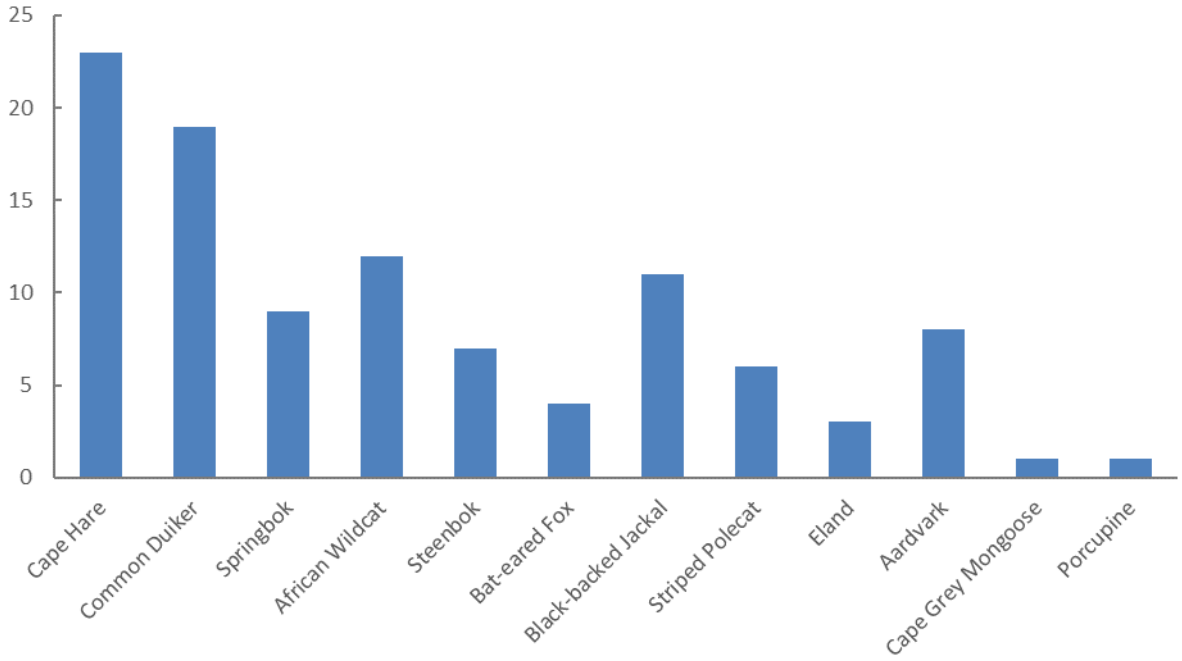

Figure 9. Frequency of different mammals captured by the camera traps. The y-axis represents the number of cameras each species was represented at (i.e. the "count" values in Annexure 1) (out of a total of 30 cameras).

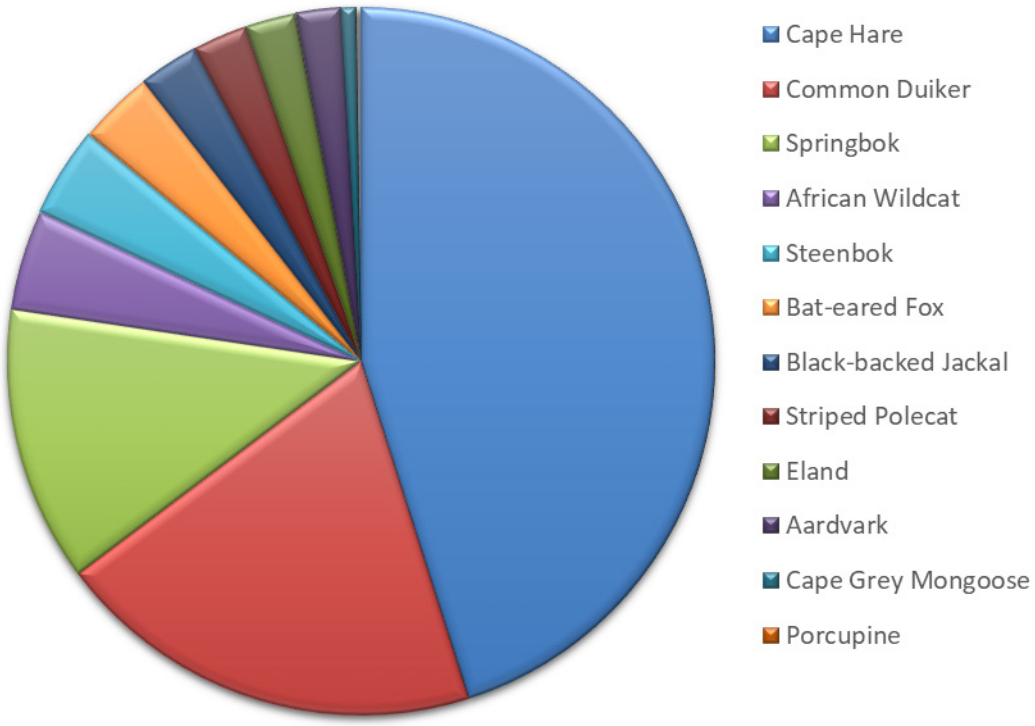

Figure 10. Pie chart showing the relative abundance of each species recorded. The species are sorted as per the legend from most abundant to least common.

Although no Riverine Rabbits were recorded on the site (Figure 12), the high conservation status of this species requires that a cautious and considered approach is required for this species. Furthermore, while it may not be present on the site itself, it does not directly follow that there would be no potential impacts on Riverine Rabbits. If present, impact on the Riverine Rabbit would predominantly be from habitat loss, disturbance during construction and the potential for deaths from vehicle collisions during construction. A breakdown and discussion of the potential impacts of the development on Riverine Rabbits is provided below in Table 1 and discussed in Sections 5 and 6. Although numerous camera traps were located in the areas considered to represent the best habitat for Riverine Rabbits, no Riverine Rabbits were recorded in these areas, but many Cape Hares were observed. There appears to be some competition between these species and Riverine Rabbits are usually absent in areas with high Cape Hare density. Consequently, the high abundance of Cape Hare in these areas is further support of the likely absence of the Riverine Rabbit from these areas. Despite, the absence of Riverine Rabbits from these areas, a cautious approach has been implemented with regards to buffering these areas from development. Given the fine-scale habitat mapping and buffering that has been conducted within the site and maintained in the layout, potential impacts on Riverine Rabbit habitat loss and disturbance will be reduced to acceptable levels. During operation, impacts are likely to be low and the main avenues of possible impact would be from vehicle collisions and human disturbance.

Table 1. Breakdown of potential impacts on Riverine Rabbits and the potential significance and mitigation and avoidance options that can be implemented to reduce potential impacts.

Potential Impact	**Impact Source/Project Components**	**Potential Significance and Mitigation Options**
Habitat Loss	The construction of access roads, PV fields etc. will result in the destruction of currently intact vegetation, possibly leading to habitat loss and fragmentation.	The primary area of potential conflict in terms of habitat loss would be the areas of potential Riverine Rabbit habitat along the drainage lines of the site. As the drainage lines and floodplains have been mapped as Very High sensitivity, no PV fields would be located in these areas and the total development footprint in these areas would be low. As a result, the total potential extent of habitat loss is likely to be very low and the resulting impact from habitat loss would also be low.
Collisions with vehicles	The large amount of traffic during construction will increase the probability of vehicle-related mortality. This would potentially be within the site as well as on the larger public roads to the site such as the R356. During operation, this potential impact would be significantly reduced.	Roadkill is a significant source of mortality for Riverine Rabbits. As the public roads to the site go through several areas of potential habitat, the increase in traffic associated with construction could increase the probability of roadkill. As Riverine Rabbit activity is highest between dusk and dawn, traffic during these hours can be curtailed. In addition, speed limits in areas of potential conflict can be implemented as this reduces collision risk.
Disturbance	Construction activity will result in noise and disturbance which may deter Riverine Rabbits from the affected areas.	Construction activity will generate much noise and disturbance which could impact Riverine Rabbits when this occurs in or near Riverine Rabbit habitat. As there are limited areas of potentially suitable Riverine Rabbit within the site, this would be a localised impact. If there are no Riverine Rabbits in the affected areas, then this impact would be of minimal intensity.

Figure 11. Examples of camera trap images obtained from the site. Clockwise from bottom-left, African Wildcat, Aardvark, Eland, Common Duiker, Steenbok, Springbok, Bat-eared Fox and Black-backed Jackal.

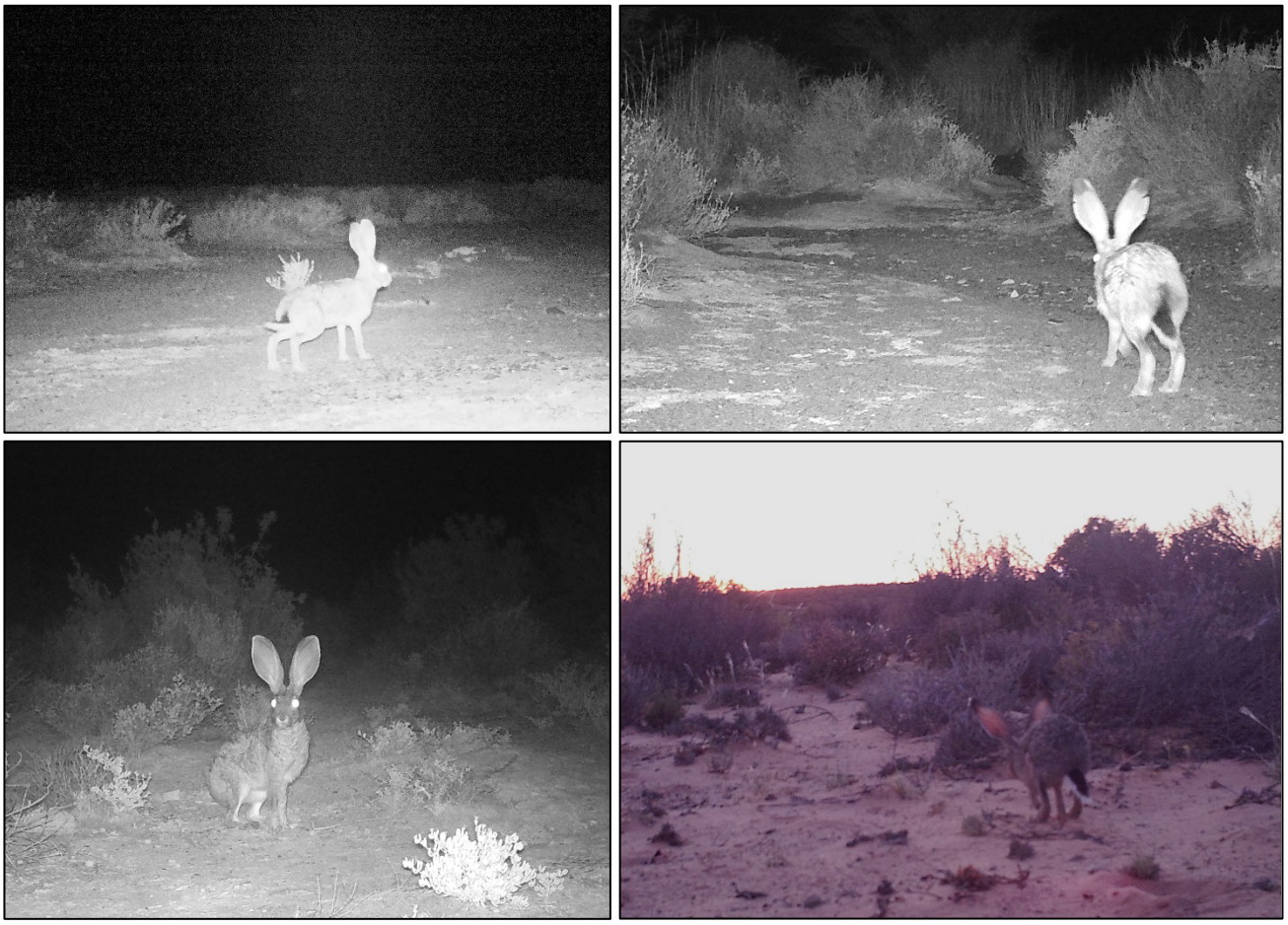

Figure 12. The only lagomorph observed at the site is the Cape Hare, here pictured from various camera locations and habitats across the site. No Riverine Rabbits were recorded by the camera traps. Characteristic and distinguishing features of the Cape Hare are the black and white tail, longer legs and different shaped head and ears of the Cape Hare compared to the Riverine Rabbit.

4 KAPPA PV RIVERINE RABBIT HABITAT SENSITIVITY ASSESSMENT

The Riverine Rabbit Habitat sensitivity map for the study area is depicted below in Figure 13. The major drainage features of the site classified as Very High sensitivity while the buffers around these features as well as areas of sub-optimal habitat are classified as High sensitivity. Under the assessed layout provided for this assessment, the PV footprint areas do not impinge into the High or Very High sensitivity areas and as such, the layout is considered acceptable and would likely generate low impact on the Riverine Rabbit and its associated habitats. Although Riverine Rabbits can be found outside of riparian habitats in the southern Cape, this does not appear to be case for the current population and as such, its presence outside of these areas is seen as extremely unlikely.

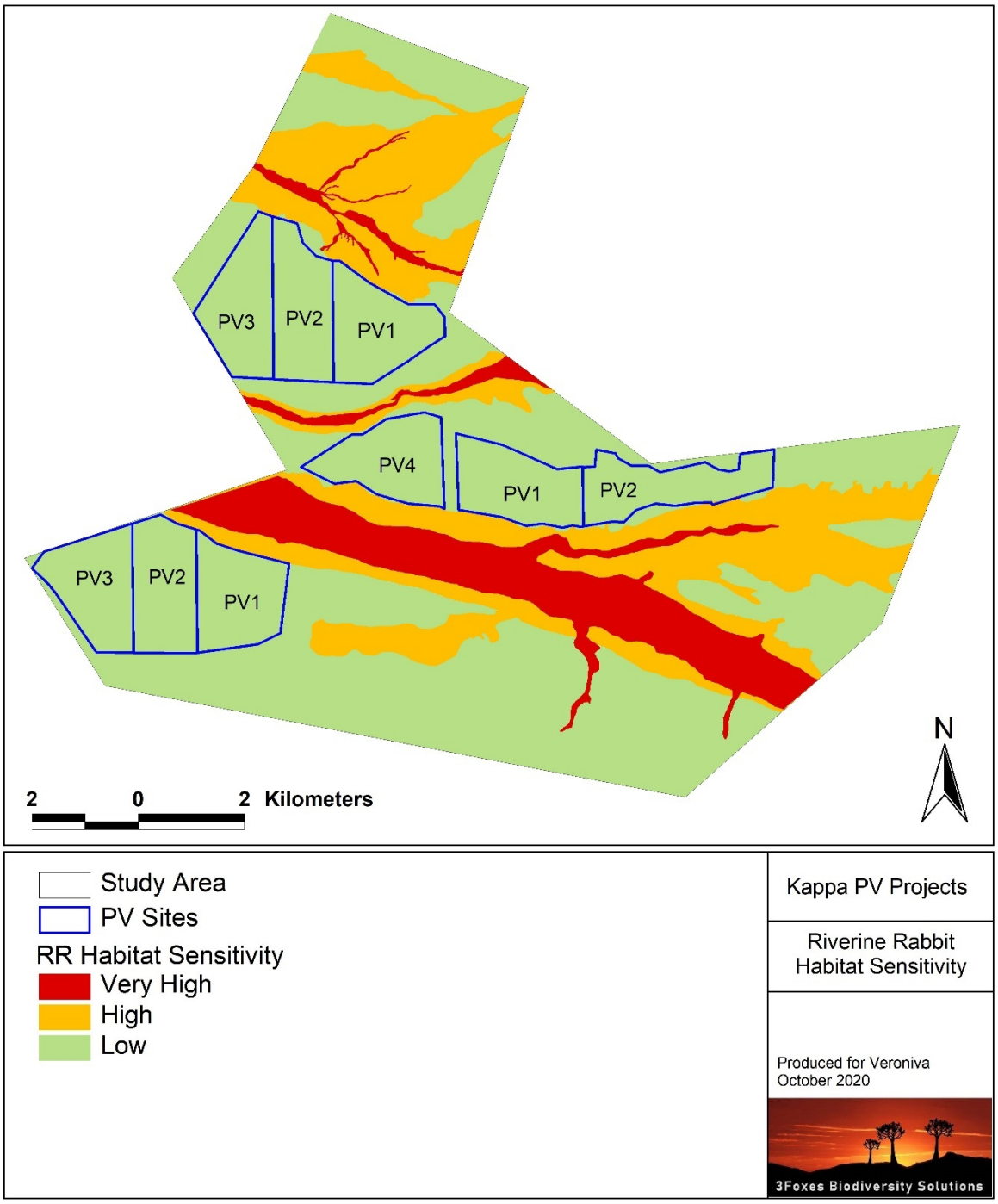

Figure 13. Riverine Rabbit habitat sensitivity map for the study area, showing the proposed footprint areas of the PV areas.

5 IMPACTS AND ISSUES IDENTIFICATION

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The development of the Kappa PV projects would potentially result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat during construction. During operation, the impacts would be reduced and restricted largely to potential noise impacts and occasional disturbance from operational activities. These potential impacts are outlined below as they relate to the Riverine Rabbit.

Impact 1. Direct Impact on the Riverine Rabbit

Although the Riverine Rabbit is not expected to occur within the development area, it is known to occur in the area. During construction, the increased levels of traffic at the site would potentially increase collision risk with rabbits, which is a known major cause of mortality for this species. Furthermore, the noise and disturbance associated with construction may deter rabbits from the affected areas where these are in close proximity to areas where Rabbits are present. During operation, impacts would be reduced, but noise from operational activities would potentially impact this species, resulting in local habitat degradation within and adjacent to the PV sites.

Impact 2. Cumulative Impacts

The development of the Kappa PV projects would result in habitat loss and an increase in overall cumulative impacts on fauna and flora in the area. Current levels of transformation in the area resulting from solar PV and wind farm development is moderate and the current proposed development would add approximately 2270ha to the existing level of potential impact associated with approved projects. This is a locally significant contribution and rivals the entire footprint of all approved projects within 30km of the site. However, it is important to note that especially with regards to Riverine Rabbit habitat, the loss associated with the current proposed project would be very low and the proposed project would be unlikely to generate significant habitat fragmentation for the Riverine Rabbit given the avoidance of the preferred habitat areas.

6 ASSESSMENT OF IMPACTS – KAPPA PV FACILITIES

An assessment of the impact of the proposed Kappa PV project on the Riverine Rabbit is provided below. There are no significant differences between any of the individual PV projects in terms of their potential impacts and as such, the assessment is considered to apply to all of the associated projects.

6.1 CONSTRUCTION PHASE IMPACT 1. DIRECT AND INDIRECT IMPACTS ON RIVERINE RABBITS

The construction of access roads, PV fields etc. will result in the destruction of currently intact vegetation, possibly leading to habitat loss and fragmentation. The large amount of traffic during construction will increase the probability of vehicle-related mortality. This would potentially be within the site as well as on the larger public roads to the site such as the R356. Roadkill is a significant source of mortality for Riverine Rabbits. As the public roads to the site go through several areas of potential habitat, the increase in traffic associated with construction could increase the probability of roadkill. As Riverine Rabbit activity is highest between dusk and dawn, traffic during these hours can be curtailed. In addition, speed limits in areas of potential conflict can be implemented as this reduces collision risk. In addition, construction activity will result in noise and disturbance which may deter Riverine Rabbits from the affected areas. These impacts would however be transient and restricted to the construction phase, with significantly lower levels of traffic and disturbance during the operational phase. The primary area of potential conflict in terms of habitat loss would be the areas of potential Riverine Rabbit habitat along the drainage lines of the site. As the drainage lines and floodplains have been mapped as Very High sensitivity, no PV fields would be located in these areas and the total development footprint in these areas would be low. As a result, the total potential extent of habitat loss is likely to be very low and the resulting impact from habitat loss would also be low.

Without mitigation this impact is likely to be of **Moderate** significance.

Essential mitigation measures would include:

- Adhere to the development restrictions placed on areas of High and Very High sensitivity. No PV fields to be placed in these areas and any roads and power lines through these areas should use existing footprint areas where possible.
- All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h.
- Limiting access to the site and ensuring that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site must be undertaken.
- The design should ensure that there is no electrical fencing around the PV fields or substations (and associated battery facility) or other infrastructure that are within 20cm of the ground as some fauna can become stuck against such fences and are electrocuted to death.

With the implementation of the suggested mitigation the construction phase impact on Riverine Rabbits can likely be reduced to a **Low Significance**.

6.2 OPERATIONAL PHASE IMPACT 1. IMPACTS ON RIVERINE RABBITS DURING OPERATION

The operational phase would entail significantly lower levels of disturbance than the construction phase. However, there would still be increased traffic to and from the site each day leading to increased collision risk as well as some noise and disturbance associated with the operation and maintenance of the PV facilities which would have a negative influence on any resident Riverine Rabbits. The noise and disturbance would however be of a relatively low intensity and would have a largely local impact only.

Without mitigation this impact is likely to be of **Low** significance.

Essential mitigation measures would include:

- Human activity and disturbance outside of the fenced PV areas should be kept to a minimum and restricted to required maintenance activities only.
- All vehicles should adhere to a low speed limit on-site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h.

With the implementation of the suggested mitigation the operational phase impact on Riverine Rabbits would remain at a **Low Significance**.

6.3 CUMULATIVE IMPACT 1. CUMULATIVE IMPACTS ON BROAD-SCALE ECOLOGICAL PROCESSES AS RELATED TO THE RIVERINE RABBIT.

The development would result in cumulative impacts on broad-scale ecological processes such as movement and migration of Riverine Rabbits. The current proposed development would add approximately 2270ha to the existing level of potential impact associated with approved PV and wind energy projects. This is a locally significant contribution and rivals the entire footprint of all approved projects within 30km of the site. However, it is important to note that with regards to Riverine Rabbit habitat, the loss associated with the current proposed project would be very low and the proposed project would be unlikely to generate significant habitat fragmentation for the Riverine Rabbit given the avoidance of the preferred habitat areas.

Without mitigation this impact is likely to be of **Moderate** significance.

Essential mitigation measures would include:

- Adhere to the sensitivity maps provided within this assessment when determining the final layout of the PV facilities and associated infrastructure.
- Ensure that all the operational phase management plans are fully implemented and that the associated monitoring and feedback mechanisms to management are in place.

With the implementation of the suggested mitigation the cumulative impact on Riverine Rabbits can likely be reduced to a **Low Significance**.

6.4 IMPACT ASSESSMENT SUMMARY

CONSTRUCTION PHASE													
Direct impacts													
Impact on Riverine Rabbits due to construction phase activities													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Habitat Loss & Disturbance	**-**	**Local**	**Long-term**	**Substantial**	**Very Likely**	**Low**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low Risk (4)**	**4**	**High**

Suggested Mitigation:

- Adhere to the development restrictions placed on areas of High and Very High sensitivity. No PV fields to be placed in these areas and any roads and power lines through these areas should use existing footprint areas where possible.
- All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h.
- Limiting access to the site and ensuring that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site must be undertaken.
- The design should ensure that there is no electrical fencing around the PV fields or substations (and associated battery facility) or other infrastructure that are within 20cm of the ground as some fauna can become stuck against such fences and are electrocuted to death.

OPERATIONAL PHASE													
Direct impacts													
Impact on Riverine Rabbits due to operational phase activities													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Disturbance & vehicle collisions	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Low**	**Moderate**	**Low Risk (4)**	**Partly**	**Partly**	**Low Risk (4)**	**4**	**High**

Suggested Mitigation:

- Human activity and disturbance outside of the fenced PV areas should be kept to a minimum and restricted to required maintenance activities only.
- All vehicles should adhere to a low speed limit on-site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h.

CUMULATIVE IMPACT													
Cumulative impact on Riverine Rabbits													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Disturbance & vehicle collisions	**-**	**Local**	**Long-term**	**Substantial**	**Very Likely**	**Low**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low Risk (4)**	**4**	**High**

Suggested Mitigation:

- Adhere to the sensitivity maps provided within this assessment when determining the final layout of the PV facilities and associated infrastructure.
- Ensure that all the operational phase management plans are fully implemented and that the associated monitoring and feedback mechanisms to management are in place.

7 CONCLUSION & RECOMMENDATIONS

The Kappa PV facilities are located in an area where Riverine Rabbits are known to occur and would potentially impact on this Critically Endangered species. The field assessment reveals that there is suitable habitat present on the site, especially along the Groot Rivier. The areas of habitat along this as well as the other smaller drainage features of the site have been mapped as Very High sensitivity and should be avoided as much as possible. In addition, the transitional areas between the drainage lines and the adjacent veld have been demarcated as buffer areas firstly to buffer the core areas of Riverine Rabbit habitat from impact and then secondly to provide additional space for Riverine Rabbits for foraging opportunity outside of the drainage lines and to ensure that landscape connectivity along the major water courses of the site is maintained. The buffer areas have been classified as High sensitivity and no PV fields should be located within these areas, as has been achieved under the assessed layout. The power line would not generate a significant extent of habitat loss within the riparian areas and a significant impact from the power line would not occur.

The camera trapping did not capture any images of Riverine Rabbits, suggesting at the very least that this species is not common in the area. The cameras did however pick up almost 600 images of Cape Hare, indicating that this is the dominant lagomorph of the area. Since these two species rarely co-occur at any individual camera trapping station, this suggests that Riverine Rabbits are not present at least within the areas sampled by the camera traps. It is possible that Riverine Rabbits are present along the major drainage lines of the site and were simply not picked by the camera traps. However, even if this is the case, there has been sufficient avoidance of this habitat that even if all 9 PV facilities were to be built that impact on Riverine Rabbit would likely remain low.

Based on the field assessment and assessed layout of the Kappa PV facilities, the development would not generate significant impact on the Riverine Rabbit and with the provided buffers around the important habitat features, the loss of habitat and impacts on landscape connectivity for Rabbits would be low.

<u>Riverine Rabbit Impact Statement</u>

The footprint of the Kappa PV facilities does not impinge on any areas that are considered to represent important habitat for the Riverine Rabbit. The areas assessed as being suitable habitat have been buffered to reduce potential impact on these features and to ensure that landscape connectivity is maintained. Under the layout of the Kappa PV facilities as assessed, there are no impacts on Riverine Rabbits that are moderate or high after mitigation and as a result, the development of the Kappa PV facilities is considered acceptable. The grid connection route to the Kappa substation wold generate a low impact on Riverine Rabbit habitat and no significant impacts on Riverine Rabbits are expected to occur as a result of the grid connection. Overall, there are no fatal flaws associated with any of the Kappa PV facilities or grid connection and it can be supported in terms of generating acceptably low Riverine Rabbit impacts.

8 ANNEX 1. LIST OF CAMERA TRAPPING OBSERVATIONS

List of cameras, their locations and counts of species observations.

Camera	Latitude	Longitude	Aardvark	African Wildcat	Bat-eared Fox	Black-backed Jackal	Cape Grey Mongoose	Cape Hare	Common Duiker	Eland	Porcupine	Springbok	Steenbok	Striped Polecat
C1	-32.94612400	19.95804900	0	0	0	0	0	9	3	0	0	0	0	0
C2	-32.93669200	19.94515600	0	0	0	0	0	39	6	0	0	0	0	0
C3	-32.96660500	19.94266200	0	0	0	0	0	0	0	0	0	3	0	3
C4	-32.96591900	19.92985000	3	0	3	0	0	45	12	0	0	0	3	0
C5	-32.97554200	19.94612900	0	3	0	0	0	3	15	0	0	0	0	0
C6	-32.97159600	19.95909100	0	12	0	0	0	3	42	0	0	3	0	0
C7	-32.96464700	19.96656200	0	0	0	0	0	75	24	0	0	0	9	0
C8	-32.95751200	19.95794300	0	3	0	3	0	3	0	0	0	3	0	0
C9	-33.00163100	19.90001300	3	0	0	0	0	24	9	0	0	0	0	6
C10	-32.99745800	19.91094400	0	3	0	0	0	54	18	0	3	0	0	15
C11	-33.00945600	19.92504000	0	0	0	3	0	78	0	0	0	0	6	0
C12	-33.00083000	19.96632400	0	0	9	3	0	3	0	0	0	0	0	0
C13	-32.99958100	19.96108400	0	0	0	0	0	0	9	0	0	0	0	0
C14	-32.99214100	19.93934200	3	3	30	3	0	3	15	0	0	0	0	0
C16	-33.01818600	19.92729400	3	3	0	3	0	12	36	3	0	0	9	3
C17	-33.01224800	19.94616800	0	3	0	3	0	75	3	0	0	0	0	0
C18	-33.01256600	19.96487400	0	0	0	0	0	42	15	0	0	0	0	0

Camera	Latitude	Longitude	Aardvark	African Wildcat	Bat-eared Fox	Black-backed Jackal	Cape Grey Mongoose	Cape Hare	Common Duiker	Eland	Porcupine	Springbok	Steenbok	Striped Polecat
C19	-33.00524700	19.98679200	0	3	3	3	0	0	12	0	0	0	0	0
C20	-32.99813900	19.99379600	0	0	0	0	0	0	0	0	0	0	0	0
C21	-32.99365500	20.01076200	3	0	0	3	0	6	6	24	0	45	0	0
C22	-32.96802200	19.97899700	0	12	0	3	0	0	0	0	0	0	0	0
C23	-32.96850200	19.97248600	0	3	0	0	0	0	9	3	0	0	0	0
C26	-33.00512400	19.98184500	3	0	0	0	9	6	12	0	0	0	0	0
C27	-32.94810500	19.94532500	0	9	0	0	0	27	0	0	0	63	21	0
C28	-32.97674800	19.98357000	3	0	0	3	0	18	0	0	0	24	0	0
C29	-32.98623900	19.99613100	0	0	0	0	0	3	0	0	0	9	0	0
C30	-32.98224300	20.00947200	0	0	0	0	0	18	9	0	0	12	0	0
C32	-32.98493700	19.96814500	0	3	0	6	0	39	3	0	0	3	3	3
C34	-32.95327700	19.92655100	0	0	0	0	0	0	0	0	0	0	3	3
C35	-32.97305400	19.93599600	6	0	0	0	0	6	0	0	0	0	0	0
Sum			27	60	45	36	9	591	258	30	3	165	54	33
Count			8	12	4	11	1	23	19	3	1	9	7	6

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.5

Aquatic Biodiversity and Species

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT:

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure on the Farm Hoek Doornen (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

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October 2020

Executive Summary

Four 175 MW photovoltaic (PV) power generation plants (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4) have been proposed for establishment on the Farm Hoek Doornen 172. In addition, these plants, would provide power through 132kV overhead powerlines that would connect with the Kappa Sub-station, some 12km to the south of the site.

An evaluation of the aquatic aspects of the Farm Hoek Doornen was undertaken during September 2020 in order to consider the nature of the area in question and to evaluate the impacts of the proposed development.

The Farm Hoek Doornen lies within the Tanqua Succulent Karoo Biome and comprises of two veld types, namely Tanqua Karoo and Tanqua Wash Riviere. The former is associated with elevated terrestrial environments while the latter is associated with sandy, riparian habitats. Both veld types are considered "least threatened".

In evaluating the ecological significance of the subject site, it was determined that the importance of the Tanqua Wash Riviere habitat or lower riparian environments were high in terms of faunal diversity. These areas are considered important faunal habitat and are evidently also associated with extreme flood states, providing them with a high ecological sensitivity. These findings align with those of the Department of Environment, Forestry and Fisheries (DEFF) screening tool and the various data sets associated with the region.

Given the above, the proposed development of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 is expected to elicit an overall moderate ecological impact that may be reduced to "low" significance if suitable mitigation measures are employed. The overhead powerlines are expected to elicit only a low significance impact, primarily associated with change that may arise in the riparian environments.

The proposed developments, if authorised should be approved with a number of conditions, in particular the placement of the development within the footprint identified and that a suitable game-permeable fence should be instituted. A number of related mitigation and management measures are proposed.

From the above, it is evident that subject to the conditions outlined in this report, the development of four 175 MW PV facilities at Hoek Doornen cannot be precluded on ecological grounds.

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List of Abbreviations

AIP	Alien Invasive Plant
AMSL	above mean sea level
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental importance and sensitivity
BA	Basic Assessment
CBA	Critical Biodiversity Areas
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
EGI	Electricity Grid Infrastructure
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PV	Photovoltaic

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Aquifer	Underground layer of water-bearing permeable rock
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Dune	Landscape feature arising from the deposition of sediment, transported primarily by winds and resulting in a sandy feature that may or may not be stabilised by vegetation
EI	Environmental Importance
ES	Environmental Sensitivity
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also, monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating nonlinear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Scarp	Physical feature determined by geology and comprises of a steep slope that differs from the slope of the prevailing landscape
Sheetwash	A mobile sheet of sediment deposited by water flow over a hill-slope or plain
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This report serves as the Aquatic Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (EGI) on the Farm Hoek Doornen 172, near Touws River in the Western Cape. These projects are referred to as Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4.

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Project Applicants are undertaking an Application for Environmental Authorisation (EA) to be submitted to the National Department of Environment, Forestry and Fisheries (DEFF), which entails significant planning, as well as the undertaking of BA processes. The Project Applicants are proposing to develop nine solar PV facilities, nine powerlines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Four PV facilities are being proposed on the Farm Hoek Doornen 172; three PV Facilities are being proposed on the farm Grootfontein 149; and two PV Facilities will be constructed on the Farm Hoek Witte Wall 171. This Aquatic Biodiversity and Species Specialist Assessment specifically deals with the Hoek Doornen PV 1 – 4 projects, as well as the associated EGI (Figure 1). This specialist study, is being undertaken as part of said BA process, in order to evaluate the aquatic habitats of the receiving environment in relation to the proposed development.

The bio physical reconnaissance and evaluation of a portion of the farm Hoek Doornen was undertaken during the period September 2020 and entailed both a literature review of the region, as well as on site evaluations, during which specific primary data was collected and evaluated. In addition, the identification of key hydrological features on site and an interpretation of the prevailing flora and fauna as well as other features were undertaken.

All data collected in the field and during the literature review was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. The evaluation also sought to identify any anomalies within the prevailing environment. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.2 Details of Specialist

This specialist assessment has been undertaken by Messrs S C Bundy, L P Maingard and AM Whitehead of SDP Ecological and Environmental Services. The following information is provided in respect of the above:

S C Bundy	Ecologist	SACNASP No. 400093/06
LP Maingard	Ecologist	SACNASP No. 116639/16
AM Whitehead	Ecologist	SACNASP No. 400176/10

Curriculae vitae of the individuals above are included in Appendix A of this specialist assessment, as well as specialist statements of independence in Appendix B.

1.3 Terms of Reference

The overall objectives of the Aquatic Biodiversity and Species Specialist Assessment are:

- To identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to important aquatic or riverine habitats, as they may be identified.

- To provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.

- To assess the actual and potential impacts arising from the proposed development on the hydrological features within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary; or may be of a cumulative nature, in terms of impacts arising from similar developments or activities within the region.

- To provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site, as a consequence of the proposed development.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320; as well as all relevant legislation. Identify any additional protocols, legal and permit requirements that are relevant to this project and the implications thereof.

- Review detailed information relating to the project description and precisely define the environmental risks to the aquatic environment and consequences for prevailing ecology.

- Compile a baseline description of the aquatic ecology of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity.

- Provide specific ecological data in respect of the aquatic components of the site using ground-truthing methods, with an emphasis on those areas considered to be of “high” and possibly, “moderate” sensitivity.

- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review. The site visit must also identify the level of sensitivity assigned to the project area on the National Web-based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use. A Site Sensitivity Verification Report must also be compiled based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.

- Collate all data collected during the field work and undertake a review using methodologies that allows for comparison or consideration of biological data.

- Provide a detailed hydrological and aquatic biodiversity sensitivity map of the site, including mapping of disturbance and transformation on site, as well as set-backs or buffers.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.

- Identify any species of special concern or protected species on site.

- Identify and delineate wetlands that may occur on the site, using the relevant protocols established.

- Determine if a Water Use License (WUL) is required and if so, determine the requirements thereof.

- Identify and rate potential direct, indirect and cumulative impacts on the aquatic ecology, species and ecological processes within the site during the construction, operation and decommissioning phases of the project.

- Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the aquatic ecology are limited.

- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.

- Compile an assessment report qualifying the risks and potential impacts on aquatic ecology in the study area and impact evaluations.

- Incorporate and address issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).

2 Approach and Methodology

A literature review and desktop analysis were undertaken prior to the field investigation, utilizing various sources including the National Fresh Water Priority Areas (NFEPA) data and other relevant sources. Recent and historical aerial imagery of the site was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken from the 12th to 18th September 2020, whereby:

- Key features, such as rivers and scarps were evaluated in order to determine the key, geophysical features on the site;

- Sites of geomorphological or topographic variance were identified and subjected to an evaluation of species present within a 40 m linear extent across the selected site. Species were identified and collated according to a “presence – absence” method of evaluation;

- Additional random sample points were selected from across the site for comparative purposes; and

- Any additional species of significance not identified within the sample sites were also noted.

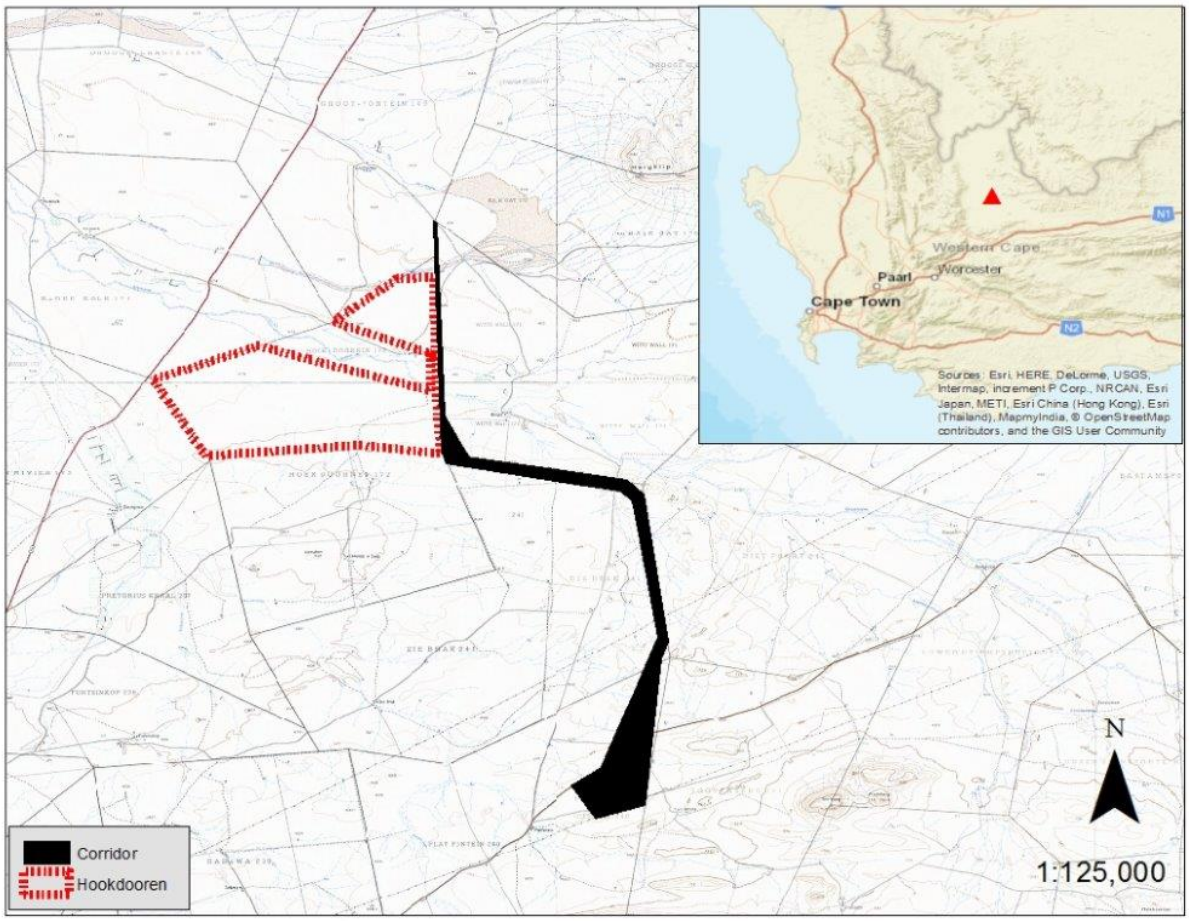

Figure 1. Topographic map indicating the study area (outlined in red) on the Farm Hoek Doornen and the adjoining powerline corridor.

All data was collated and subject to evaluation in order to:

- Place the data into a hierarchy of similarities according to species composition and sample sites.
- Give consideration to the overall structure of habitat within the subject site.
- Identify any habitat anomalies that may be identified in such analysis.
- Allow for the interpretation of such data in order to prioritise and evaluate habitat form and structure within the study area.

In addition, using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), such features were identified and defined. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. Where riparian and wetland systems were identified these areas were subject to specific evaluation within this assessment report.

Riparian delineation methods

As noted above, the delineation of riparian edge and ephemeral wetland environments was undertaken utilizing accepted delineation techniques contained within "*A Practical Field Procedure for Identification of Wetlands and Riparian Areas"* (DWAF 2005) and the updated guidelines (DWAF 2008). A description of the rationale is provided below.

Riparian indicators - Indicators of a riparian system include the following (as per DWAF 2005):

1. An "obvious" floodplain and active channel.
2. Evidence of active erosion indicating a high energy system.
3. The absence of "classic" hydromorphic vegetation, with species associated with riparian areas dominating, or simply a change in vegetation density and structure.

As such, the approach to defining the riparian zone is not strictly defined (DWAF 2005) and a number of methods can be used. Accepted riparian indicators include:

1) **Topography**: identification of flood terraces and macro-channels.

2) **Vegetation**: identification of a distinct area of vegetation change, often in close association with the macro-channel. Changes can be in relation to species diversity or physical nature (density or health).

3) **Alluvial soils** and deposited material: identification of recent deposits of sand or mud, serves as a confirmatory indicator.

A number of methods exist for identifying riparian indicators. Acceptable methods include (DWAF 2005):

1) The use of topographical maps.

2) Aerial photographs and aerial videos.

3) Ecoregions (e.g. using climatic, geological or vegetative community indicators can be useful as a predictive method).

4) Field work (i.e. confirming desktop observations by locating indicators on site).

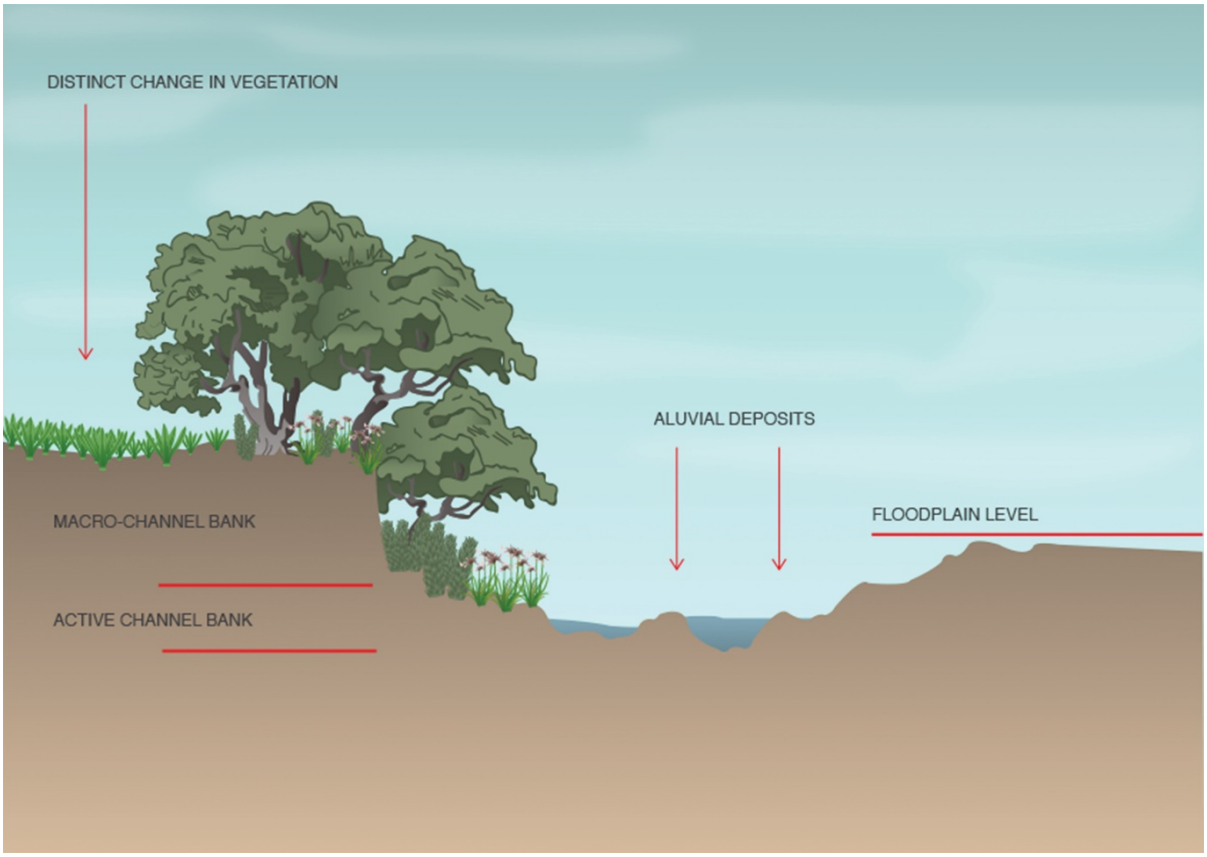

Figure 2. Illustration of a typical riparian cross section (Adapted from DWAF 2005), indicating riparian edge (arrow (distinct change in vegetation)).

Wetland Habitat

Due to the continuous or regular saturation experienced within wetland environments, soil chemistry differs from mesic or dry environments, giving rise to specific plant associations or groupings (hydrophytes) within wetland environments (Figure 2). The dependence of hydrophytes on wetland conditions varies from species to species and as a result, these species can be classified according to their occurrence within wetland areas. Such groups include obligate wetland species and facultative wetland species (as set out in DWAF 2005 and 2008).

A dominance of obligate species, indicates wetland conditions. In addition, the species present can be used to determine the three wetland zones, permanent, seasonal and temporary, however the difference between seasonal and temporary wetland areas is often ambiguous, resulting in the two categories being combined occasionally.

Soil characteristics are also utilized in the delineation process. Under fluctuating periods of water inundation, as well as the permanent presence of water within the upper soil horizons, minerals in the soil are either leeched from the horizon or are subject to chemical reactions, leading to changes in soil colouration and the presence of "mottling". The frequency of mottling indicates the degree of saturation and hence the wetland zone.

During the delineation exercise, the riparian and wetland areas associated with the site were delineated using aerial photography and field observations, which focus primarily on changes in vegetation, topography and the presence of alluvial deposits. Specific points were marked using a Garmin VI Montana Global Positioning System (GPS) device, where necessary.

Wetland functionality and health (PES)

Utilization was made of the Wet-Eco services tool (Kotze et. al. 2007) to determine the significance of the three identified wetland environments. Being an arid environment, with little or intermittent flow arising only on occasion, a "desktop" environmental importance and sensitivity (EIS) and Present Ecological State (PES) was undertaken (i.e. it was not possible to evaluate aquatic biota or undertake water chemistry analysis). This exercise involved the identification of the appropriate riverine section. The results of the PES or ecological status of the system provide an indication of the level of importance of the river, according to a ranking. The various classes or ratings are presented in Table 1.

Table 1. PES/Ecological status ratings for riverine system (Kleynhans et al 2005)

Rating	Description
A	Unmodified, natural.
B	Largely natural. A slight change in ecological processes is discernible but the system remains largely intact.
C	Moderately modified. A moderate change in ecological processes has taken place but the system remains predominantly intact.
D	Largely modified. A large change in ecological processes has occurred and the system is appreciably altered.
E	Greatly modified. The change in ecological processes is great but some features are still recognizable.

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category as listed in Table 2 below:

Table 2. EIS category, score and interpretation.

EIS Category	Range of Mean	Recommended Ecological Management Class[3]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

2.1 Information Sources

The following data sources were consulted during this investigation.

Table 3. Data sources utilised during assessment

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environmental Affairs	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	CapeNature. 2017. Western Cape Biodiversity Spatial Plan 2017. http://bgis.sanbi.org/	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Western Cape province
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
http://posa.sanbi.org/sanbi South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]	SANBI Plants of Southern Africa	2016	Data	Plant list for Tankwa region.
www.vmus.adu.org.za Animal Demography Unit	ADU: University of Cape town	2020	Data	Specific data on geographic occurrence

Data / Information	Source	Date	Type	Description
(ADU).				and record for various taxa.
Tankwa Weather http://tankwaweather.co.za	Private weather station	2020	Data	A private Davis Vantage Pro 2 mounted 1.6m above the ground. And anemometer at 10m angle Operation since: Jan 2015

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations are presented in respect of this evaluation:

- Site reconnaissance was undertaken over a consecutive 5 day period during the early summer. Such field reconnaissance does not account for seasonal variations that may arise and reliance on collated and historical data from the region is required.
- During the period of reconnaissance, seasonality and weather conditions may have affected findings, in particular, colder temperatures.
- The area in general has been subject to an extended and significant drought, which is likely to have influenced habitat form at a limited level, as well as faunal populations.
- Cumulative impacts have been considered on a regional basis over a 30km radius.

2.3 Consultation Processes Undertaken

Interaction was undertaken with local residents and interested parties who were considered to have specific knowledge of the area, these included:

- Mr Philip van Heerden
- Mr Andre Vermeulen.

The above persons provided anecdotal information which was verified and considered during the site evaluation, as well as by further interrogation of the literature and data.

3 Description of Project Aspects relevant to Aquatic Biodiversity

The development of a PV facility, associated infrastructure and EGI on the subject properties will by necessity, be undertaken on land that meets a number of criteria including, *inter-alia*, level or gradual falls, generally suitable founding conditions and avoidance of areas that may be inundated by flooding. As a consequence, the proposed PV facilities will avoid all riverine and wetland environments.

Howsoever, the proposed development will alter the nature of the immediate catchment associated with such riverine environments through both the construction of the facility as well as its operations. Such change will arise primarily from changes in the rate of flow of surface water and possible alteration of the edaphics or soils within the facility, as well as, to a minor extent, water chemistry and perhaps, more indirectly, the biotic components of the riverine system.

The proposed Hoek Doornen PV projects will see a land use change that differs significantly from the prevailing land use. The implementation of the proposed development will result in notable change to the prevailing catchment associated with the river systems in the area, primarily on account of the construction stage of the project, as well as the long-term operational stage. Indirect impacts may therefore arise on riverine systems as a consequence of changes in the catchment. The development of the site for the PV facilities, associated infrastructure and EGI will see the following activities arise:

- Cordoning and fencing of the sites during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence (or palisade or mesh type) of about 2 – 3 m high which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing. Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm.

- Clearance or partial clearance of minor topographic features and vegetation, where applicable, during the construction phase.

- Establishment of roadways (i.e. access roads leading to the site and internal gravel access roads) and hard panning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays. The footing of the module framework is founded into the ground using an earth screw or similar methods. Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m

- Establishment of step up transformers and 4 substations (one for each PV facility). This facility is expected to occupy an area of approximately 2 ha each. It will be fenced and isolated from the balance of the site.

A Lithium Ion Battery Energy Storage System (BESS) will be established at each PV Facility. The proposed BESS will cover an area of up to 8 hectares within the laydown area and a height of up to 5 – 10 m.

A laydown area of approximately 13 ha in extent.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

- An overhead powerline (132kV) will be established per PV Facility from the on-site substation to the Kappa substation. The powerline for Hoek Doornen PV 4 will traverse the Groot River and adjacent lands to the south, aligning with existing powerlines associated with adjacent renewable energy projects.

The commencement of construction on site will entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facilities. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short temporal extent, as the construction project rolls out and a stability, albeit within a differing environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts.

4 Baseline Environmental Description

The Hoek Doornen farm lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome. The Tankwa Karoo is associated with a comparatively low altitude and generally flat to undulating landscape, not exceeding 1500m amsl. According to the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified "BSh", which is indicative of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective.

In an arid region such as the Tankwa, riverine environments are primarily seasonal systems, flowing intermittently during high precipitation events. These episodes of flow can be significant flood events as deep frontal rains, as well as orographic rainfall arises within the catchment and on the Hangklip mountain to the north east. Rainfall events are also seasonal (mainly a winter period phenomenon) and during the periods between such precipitation events, little or no flow arises in these systems. Given the alluvial nature of these systems, little in the way of wetland environment is encountered in the river channels.

Some consideration of the broader ecological features of the site are presented below.

4.1 General Description

Hoek Doornen can be described as a series of undulating plains and plateaux, interspersed with occasional dolerite ridges. The lower elevations of the site are associated with sheet wash plains and larger ephemeral rivers that are dominated by alluvial sands.

Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo (Mucina and Rutherford 2006), a form of the Succulent Karoo Biome, and Tanqua Wash Riviere (AZi 7) a riparian habitat form (Figure 3). Both these veld types are considered "least threatened" from a conservation perspective (Figure 3). The same applies to the EGI corridor running along Die Brak and Platfontein Farms.

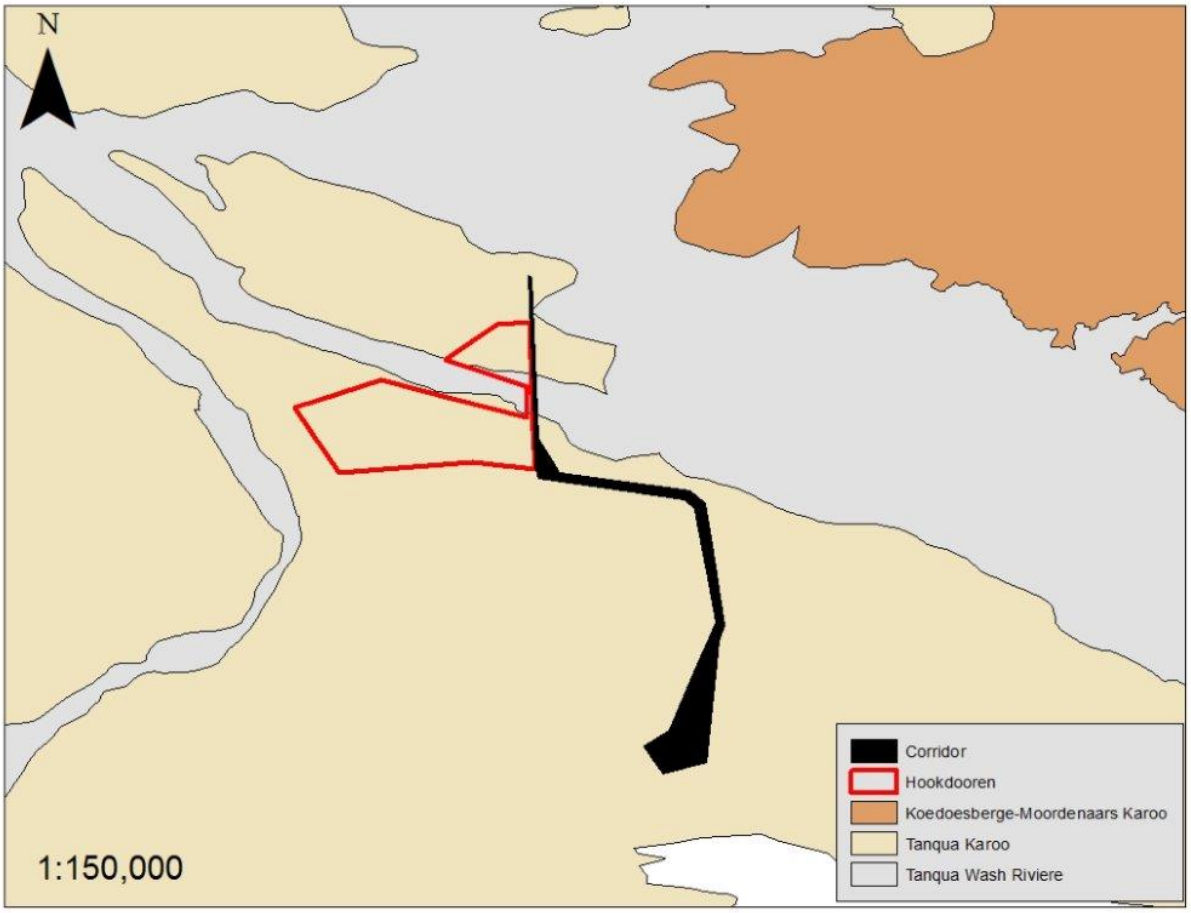

Figure 3. Map indicating veld types in relation to study area

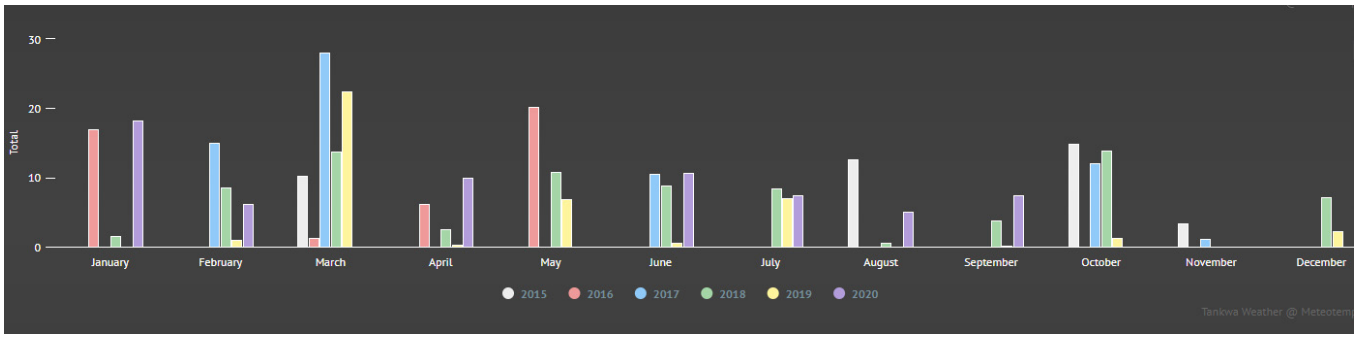

Figure 4. Graph showing monthly rainfall in Tankwa 2015 – date.

4.1.1 Ecological Processes, Functioning and Drivers

Two principle factors are considered to be the master elements driving the localised ecology. These can be considered to be broadly meteorological factors, namely wind, rainfall and temperature, while edaphics, particularly giving rise to lithic or sandy environments may be considered a geophysical driver. Notably, anthropogenic factors have over the previous century proven to be a key driver in contemporary habitat form and structure.

From a meteorological perspective the study area is a “xeric habitat”, with an average annual rainfall recorded over the last 5 years of between just over 40mm to 66mm in 2017 (2020 may exceed this record). There is however, high spatial and inter annual variability in rainfall patterns across the

region (Figure 4). According to Mucina and Rutherford (2006), the region may be considered to be a "rain shadow desert", where topography influences rainfall patterns.

In addition to the above, wind is a key issue within the region, driving sediment movement and promoting aeolian, sediment transport in areas exposed to high winds and with little vegetative cover. Where vegetation cover has been compromised, aeolian transport generally prevents the natural re-establishment of vegetation, or at least retards such emergence. The dominant winds within the subject site are the north westerly and southerly wind, which are seasonally prevalent (Figure 5). Sheetwash is also conspicuous to the east of the site, where sediments transported from up-slope have been deposited, proximal to the riverine areas.

Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3. °C and the highest maxima being 50.2°C (http://tankwaweather.co.za/pages/station/climate.php). A mean maximum temperature of 35°C is recorded by the SA Weather Service. Such extremes are indicative of the requirement for floral and faunal species to be tolerant of the effects of frosting, as well as high insolation and transpiration states. As a consequence, plant communities and faunal populations in the region generally show high levels of adaptation, occurring in specific areas or zones and the utilisation of specific, niche environments, e.g. scarp slopes and riverine environments by both floral and faunal communities.

4.1.2 Aquatic Biodiversity and Ecosystems

4.1.2.1 Aquatic Ecosystems

At a landscape level, riverine and riparian areas in the southern Tankwa region generally show improved vegetation cover and faunal presence on account of access to water and increased availability. The vegetation cover is however, primarily not hygrophilous in nature and is generally a *Vachellia* karoo dominated environment with *Lyceum cinereum* and *Salsola ceresica* being the dominant species within vegetation associes in these areas. Such species align with the Tankwa Wash Riviere habitat and as such, do not conform with the strict definition of "riparian vegetation". Mucina and Rutherford (2006) refer to this habitat as either "alluvial shrublands and herb lands", and "sheetwashes".

These areas are however subject to intermittent but significant flooding and as such there can be significant transport of material within these riverine environments. As such these areas show a natural disturbance regime that results in scour and erosion, as well as significant deposition. Lighter falls may result in generally low-level inundation of pools and ponds within the riverine environments, and these may support small associes and consocies of *Spiloxene aquatica* and *Scirpoides dioecus.* Given the generally dry and erratic flows experienced within aquatic environments within the southern Tankwa region, aquatic biota is generally limited and cannot be utilised in the determination of the ecological state of these systems. Howsoever, terrestrial fauna is notably more prevalent in the Tankwa Wash Riviere habitat, primarily because of improved cover and access to water.

Given the above, anthropogenic factors have been a key determinant in the contemporary nature of the aquatic or riverine environments within the site. While the current land use on the site is game ranching on adjacent sites (the current site does not have any current agricultural practices), previous agricultural land uses have specifically focussed on sheep and goat farming, which has been undertaken since the 1700s. The overgrazing of the land has given rise to poor vegetation cover and has contributed significantly to sediment deposition and alluvial conditions that presently prevail in the riparian environments. In addition, owing to the poor soils found in the terrestrial environments of the

Tankwa, almost all cultivation practices, including the laying down of pasture, has been and continues to be undertaken in the riverine environments. There is thus regular and sustained disturbance in these areas. In addition, the scarcity of water in the region has resulted in the establishment of dams and other features to attenuate and capture water in the rivers. Some dams are successful, while others are less so, having been breached by the torrential flooding that arises from time to time.

In addition to the above, a point of some interest is the significant use of subterranean water through abstraction for the tending of livestock and other activities. Notably this water has a high salinity and as the subterranean water enters the riparian environment, such salts may have a small but pervasive effected on this habitat (*pers obs*).

The above natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat within and adjacent to the river systems of the locale. It follows that further land use change in the region, where livestock are excluded, may allow for the seral succession processes of habitats previously affected by farming activities to emerge. Such change may alter the nature of the catchment and indirectly affect the evident aquatic and riverine systems. Such change may not necessarily be adverse and improvements in the local aquatic ecology may arise. A prudent approach to the implementation of such development is however required in order to ensure beneficiation.

4.1.2.2 Aquatic Species

No aquatic biota was identified within either the Klein Droelaagte River or the Groot River (Figure 5).

Given the ostensibly dry state of the river bed, as well as the intermittently extreme flow experienced in these systems, there is little likelihood of fish species being present within either of the two river systems at any given time. The nearest data relating to ichthyofauna within the catchment of these two rivers arises from the confluence of the Doering River and Groot River, some 60 kilometres downstream. This data indicates the presence *Barbus capensis*, (Clanwilliam yellowfish), *B serra* (Clanwilliam sawfin) endangered, *Galaxias zebratus* and the endangered Clanwilliam sandfish, *Labeo seeberi*. *Micropterus salmoides*, the exotic largemouth bass, has also been recorded from these areas (Department of Water and Sanitation[1] (DWS), 2014). Recent attempts to locate *L seeberi* in the lower Tankwa River have not been successful.

The Animal Demography Unit (ADU) data base identifies only two anurans (frogs) from the Tankwa region, these being *Vandijkophrynus gariepensis gardenias* (Karoo toad) and the common *Amietia fuscigula* (the Cape river frog). *A fuscigula* is rapidly expanding its range, utilising farm dams and open water, while *V gariepinus* is an abundant species in the region. Both species are considered to be of least concern from a conservation perspective.

Data derived from the ADU identified three families of Odonata (dragonflies) within the region, these being the Libellulidae, Gomphidae and Coenagrionidae (FitzPatrick Institute of African Ornithology, 2020). All species are of least concern from a conservation perspective. Notably Libellulids are commonly associated with stagnant or still waters, rather than streams and regular flow which would account for their representation in this region.

In general, much of the riparian areas within the region are subject to regular disturbance primarily on account of farming activities, where cultivation and pastural activities are compelled to be undertaken within these areas. More terrestrial environments are not easy to till and are generally water deficient and thus production is poor.

[1] DWS is now operating as the Department of Water, Sanitation and Human Settlements

4.1.2.3 Conservation Planning

Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are categorised in terms of the Western Cape Biodiversity Spatial Plan (WCBSP) (2017). The assessed area for the PV arrays and associated infrastructure, specifically the power lines, traverse a number of Terrestrial and Aquatic CBA and ESA delineated areas. However, the actual footprint of the Hoek Doornen PV 1 and Hoek Doornen PV 3 facilities do not traverse any CBAs; however covers a few minor areas of Aquatic ESA 1, mostly associated with drainage line watercourses. The actual footprint of the Hoek Doornen PV 2 and Hoek Doornen PV 4 facilities covers a few extremely minor areas of CBA 1 (Terrestrial) and Aquatic ESA 1, mostly associated with drainage line watercourses. This preliminary data provided by the WCBSP is the product of a systematic biodiversity planning assessment which identifies portions of land that require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and aquatic realms (CapeNature 2017) These spatial priorities are used to inform sustainable development in the Western Cape Province.

In addition to the above, CBAs and ESAs are separated further into CBA 1 and 2 as well as ESA 1 and 2 respectively. It is important to note that CBA 1 show areas in a natural condition and those that are potentially degraded or represent secondary vegetation are considered to be CBA 2. Similarly, a distinction is made between ESAs that are likely to be functional (i.e., in a natural, near-natural or moderately degraded condition; ESA 1), and ESAs that are likely severely degraded or have no natural cover remaining and therefore require restoration where feasible (ESA 2). The ESAs are not considered essential from a conservation perspective for meeting biodiversity targets; however, they may offer some ecological services.

As much of the floral and faunal diversity within the subject region is related to riparian environments, it is clear that by excluding the proposed development from these areas, impacts on areas or corridors that have significant ecological support functions are unlikely to be affected by the proposed development.

Critically Endangered and Threatened Ecosystems

According to the Biodiversity Geographic Information System (BGIS) developed by SANBI, there are no Critically Endangered and Threatened Ecosystems on the subject sites. The ‘endangered’ and ‘threatened’ eco-systems identified within the Cape Winelands District Municipal region are not located within the study areas. Such areas are located some 40 kilometres to the east and the west of the site, but do not extend into the subject area.

Protected Areas (PAs)

The project area does not fall within or adjacent to a Protected Area.

4.2 Project-specific Environmental Description

As indicated above, the riverine and riparian habitat of such an arid region does not display the classic characteristics of hygrophilous habitats. As such, the PES of these environments cannot be determined using the recommended methods of the DWS from primary data collection. Consideration is therefore given to the general nature of the site and the use of a desktop PES.

The Farm Hoek Doornen incorporates portions of two river systems, namely the Klein Droelaagte, in the north and the Groot River in the south (Figure 5).

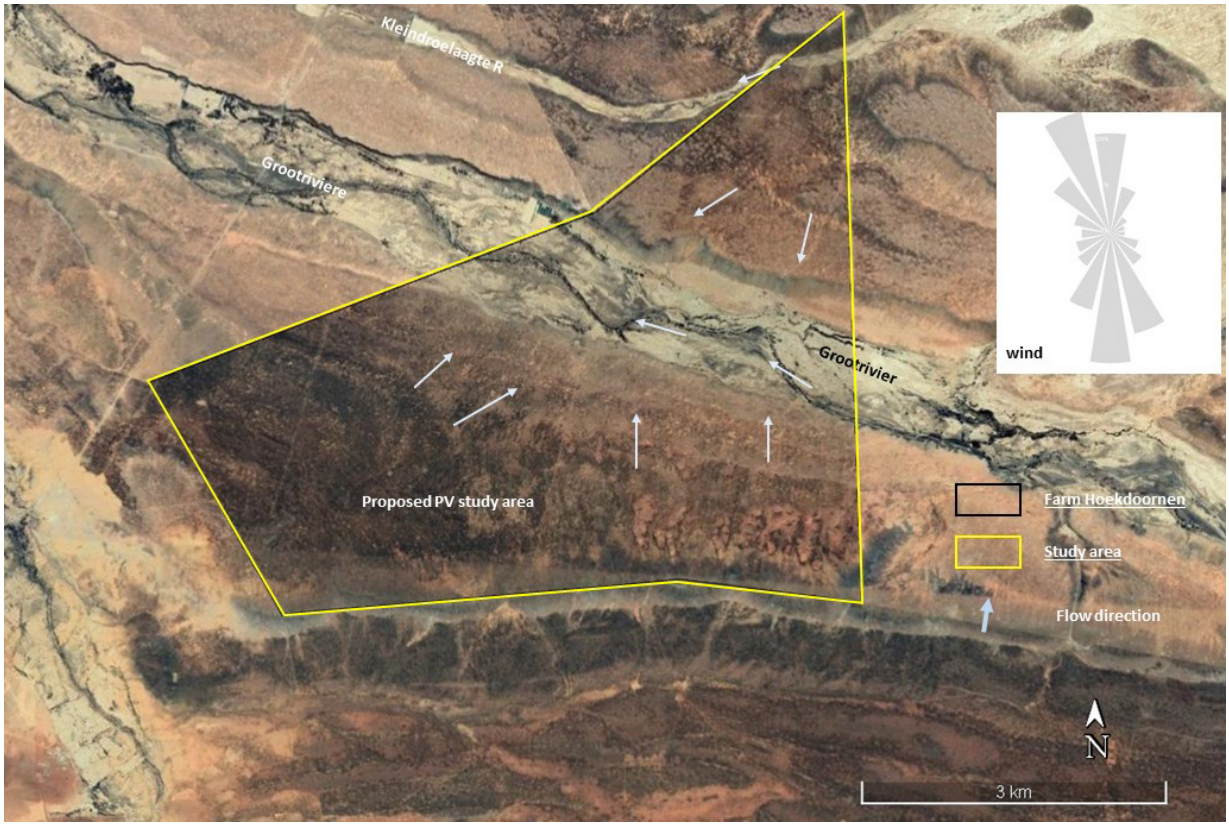

Figure 5. Map image showing two major river systems associated with the farm Hoek Doornen and drainage patterns (Google Earth, 2020).

These rivers all ultimately flow into the Doring River and this in turn, serves the Olifants River, with its confluence some 60 kilometres north of the site. Most surface drainage from the farm Hoek Doornen flows into the Groot River on account of the prevailing topography.

According to the DWS (2014) data for reach 8160 of the Groot River, this system has been classed using a desktop PES as "D" with an environmental importance (EI) of "*moderate*" and a "*very high*", environmental sensitivity (ES). The Klein Droelaagte has not been assessed, however the Droelaagte, from the same data set and located downstream of the site is considered to have a PES of "D", an EI ranked as "*moderate*" and an environmental sensitivity of "*very high*".

The Groot River is, as stated above, part of a network of ephemeral river systems with intermittent flows primarily associated with the winter rainfall period. The wider riparian environment comprises of a network of minor channels that are active under low flow conditions, while under high flow conditions and flooding events, the entire riparian area can be subject to inundation (Figure 6).

Figure 6. Image of the dam wall within the Hoek Doornen farm area – note breach within the centre of the wall.

On account of the general lack of flow within the channel, a number of dam and attenuation initiatives have been employed along the Groot River within Hoek Doornen and neighbouring farms in order to arrest flow and contain water for farming purposes. Larger dams on site are noted to have failed during the Laingsburg floods (Figure 6), having been breached by the flood waters. Smaller initiatives are also evident within the riparian environment, however most water used for stock and game farming is subterranean. The morphology of the river system varies either from a shale scarp, with vertically incised embankments with stony bed to alluvial deposits which can be several metres in depth (Figures 7 and 8). As a consequence, differing eco-morphologies can be identified within the river channel. The more lithic embankments favour refugia for a number of reptile and invertebrate species, while the talus associated with ablation and scour that is found at points within the river bed may favour some geophytes. The alluvial deposits offer a differing form of refugia, in particular nesting areas for a number of bird species such as the kingfishers (Alcedinidae) (Figure 8).

Vegetation comprises primarily of xeric shrubs associated with the Tanqua Wash Riviere habitat form, with *Lyceum cinereum* and *V karoo* forming the dominant species in these areas. In isolated portions of the riparian environment, small outliers of *Scirpoides dioecus* may be evident within the primary channels, particularly where soils show an improved clay content and are able to retain moisture. As discussed above, the riverine environments show improved faunal populations on account of the increased availability of water near the surface, improved vegetation cover and related factors. It is clear that within Hoek Doornen, this state prevails within the Groot River. Species identified within the riverine areas include *Pedioplanis laticeps*, the Karoo sand lizard, small mammals including the Cape hare (*Lepus capensis*) and the common mole rat (*Cryptomys hottentotus*). The latter, a fossorial species is evidently prevalent in these areas.

Figure 7. Image of channel of Groot River at Hoek Doornen showing shallow river bed environment.

Figure 8. Image of deep, sandy alluvial deposit with nesting holes.

Using the above information, a desktop PES can be compiled for the subject section of the Groot River. This PES is presented in Table 4. The ecological importance of the system is presented in Table 5.

Table 4. PES rating of the section of the Groot River at Hoek Doornen.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	2	3
Water Quality	3	2
Stream Bed Condition	2	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	2	3
PES	2.5 (C)	

Table 5. EIS rating of the Groot River

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The above PES and EIS differ somewhat from the DWS classification with a slightly higher PES and somewhat lower EIS. This differentiation is attributed primarily to the more recent drought conditions that prevail across the site and the very low level of instream biota evident within the system at this point. All drainage from the sites proposed for the development of the PV facilities will be into the Groot River. The Klein Droelaagte within Hoek Doornen is similar in nature to that of the Groot River whereas the dominant vegetation forms being *V karoo*, with a primarily alluvium dominated bed form (Figure 9). A PES and EIS for this system are presented in Tables 6 and 7.

Figure 9. Image of typical section of the Klein Droelaagte.

Table 6. PES rating of the section of the Klein Droelaagte River at Hoek Doornen.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	3	3
Water Quality	3	2
Stream Bed Condition	1	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	1	3
PES	2.3 (C)	

Table 7. EIS rating of the Klein Droelaagte section at Hoek Doornen

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The EIS records a moderate level of ecological importance, whilst PES shows a score of C - "Moderately *modified. A moderate change in ecological processes has taken place but the system remains predominantly intact*". In respect of the subject system, however change to the system arising from the proposed Hoek Doornen PV 1 - 4 projects, including all associated infrastructure and EGI, is unlikely to be evident as most, if not all of the development footprint lies outside of the catchment of this system.

4.3 Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 10 below presents the information relating to the Screening Tool for the Aquatic Biodiversity Combined Sensitivity as it relates to the Farm Hoek Doornen for the proposed PV Facilities, and Figure 11 shows the extent of the EGI Corridor. Evident from this data is that much of the area under consideration is considered to be of *low sensitivity* in terms of the aquatic biodiversity prevalent in the region. The data does however indicate "very high" sensitivity in respect of the Groot River which bisects the site, as shown in Figure 10 (for the PV Facilities) and Figure 11 (for the EGI corridor) below. The Klein Droelaagte river is not represented in this data set. The ecological sensitivity is however believed to approximate that of the Groot River. The Screening Tool identifies the very high sensitivity areas as aquatic CBAs, Rivers, and Freshwater ecosystem priority area quinary catchments. However, it must be noted that the actual footprint of the PV Facilities is only earmarked as low sensitivity on the Screening Tool from an aquatic biodiversity sensitivity perspective.

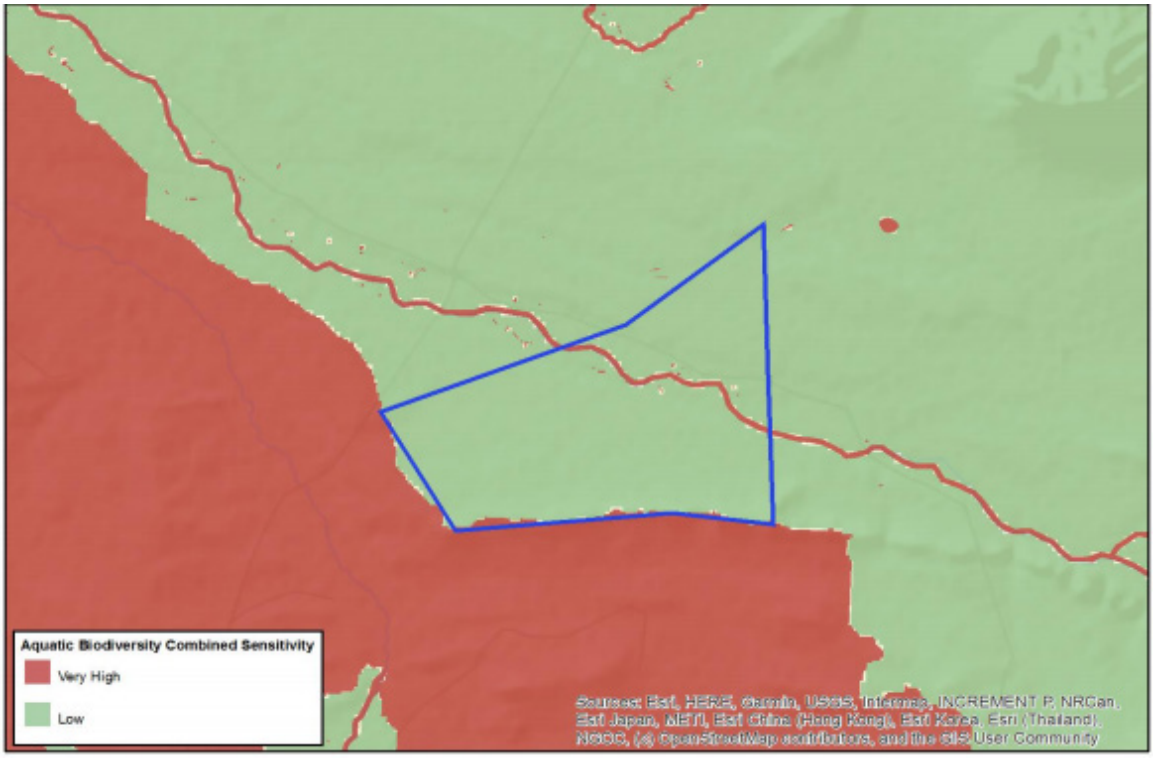

Figure 10. Map depicting aquatic biodiversity combined sensitivity in and around the Hoek Doornen farm (Source DEFF Screening Tool, 2020).

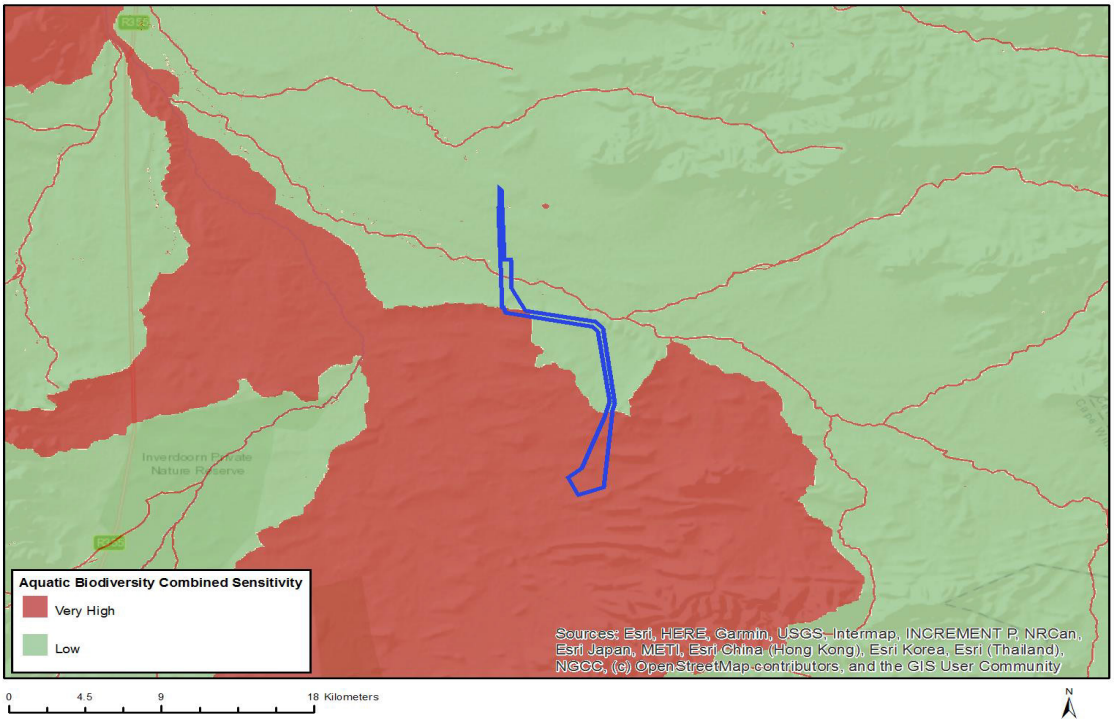

Figure 11. Map depicting aquatic biodiversity combined sensitivity in and around the EGI corridor (Source DEFF Screening Tool, 2020).

In terms of the EGI Corridor, the Screening Tool shows Very High sensitivity due to Aquatic CBAs, Rivers and freshwater ecosystem priority area quinary catchments. The river showing Very High sensitivity is the Groot River which bisects the Witte Wall farm.

The very high sensitivity attributed to the Groot River is perhaps related to the presence of certain critically endangered species, such as Clanwilliam sandfish (*L seeberi*). While the riverine rabbit (*Bunolagus monticularis*), the subject of a particular investigation may also be present in the riparian environments, it must be considered a terrestrial species in respect of the aquatic assessment and its presence or absence would not alter the findings of Tables 4, 5, 6 and 7 above. Howsoever, *B monticularis'* preferred habitat range being within these areas, as well as the general use of the systems by terrestrial fauna does render the drainage features with a high ecological sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

Using the above information, as well as the findings of the aquatic assessment a sensitivity map of the site can be compiled. This is presented in Figure 12 below. This map indicates the following for the Hoek Doornen PV 1 – PV 4 sites:

- The terrestrial environments which are deemed to have "low sensitivity" from an ecological perspective.
- The riparian environments, which are deemed to have "high sensitivity".
- Areas of terrestrial importance and a "buffer" at the interface of the terrestrial and riparian areas, which approximates 100m and includes areas of sheet wash and flood extremes.

Figures 12 and 13 presents the proposed Hoek Doornen PV 1 – PV 4 development footprints in relation to the low, moderate and high sensitivity mapping information. Notably, the four project areas fall outside of areas of moderate and high sensitivity.

Figure 14 shows the position of the Hoek Doornen PV facilities in relation to the Kappa Substation. Overhead powerlines will connect Hoek Doornen PV Facilities to the Kappa Substation. Figure 14 shows that the overhead powerline for Hoek Doornen PV 4 will traverse the Groot River, however the servitude will not affect any other wetland or riparian environments, and is acceptable to cross.

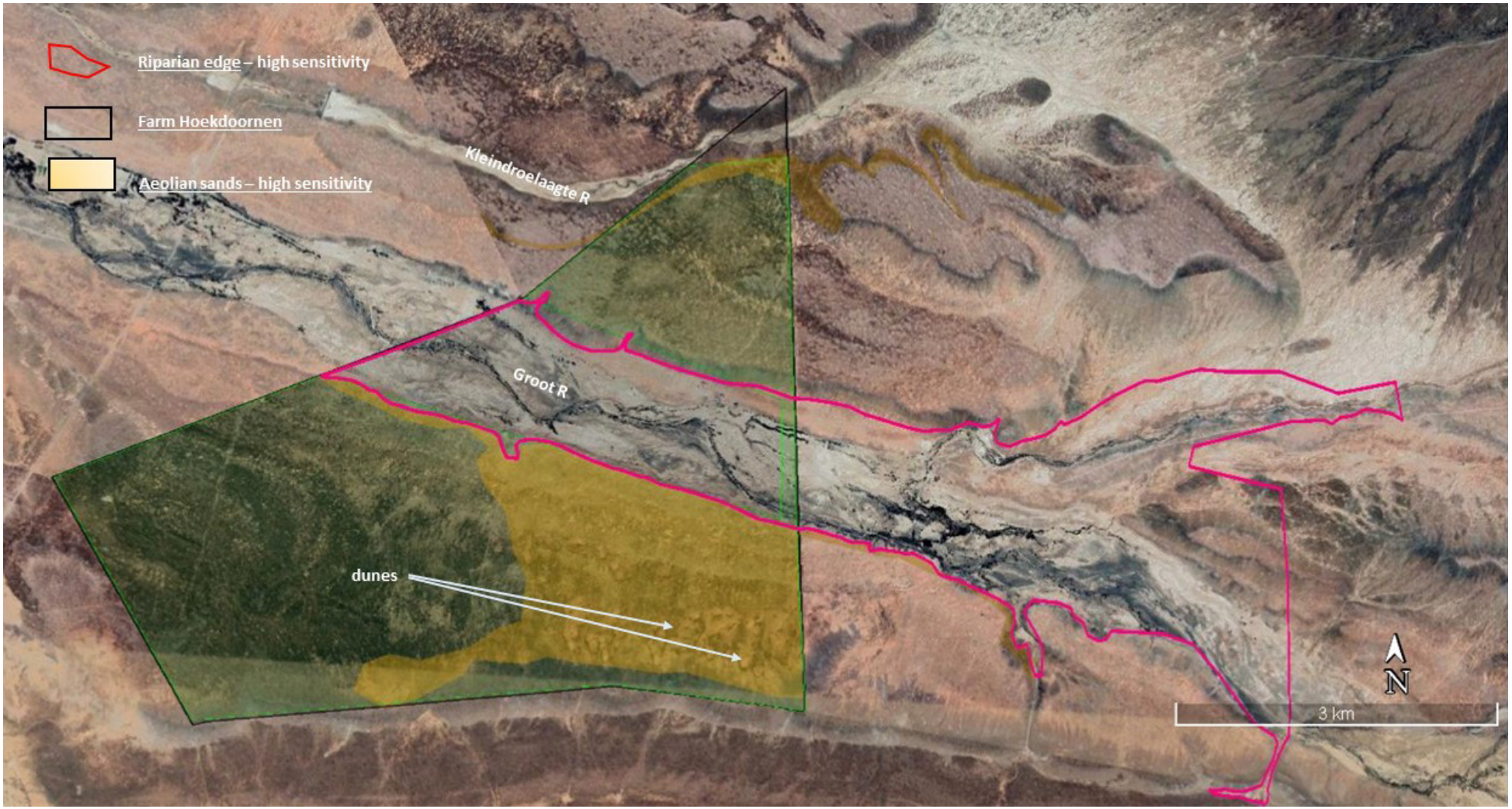

Figure 12. Map showing areas of ecological sensitivity in subject site.

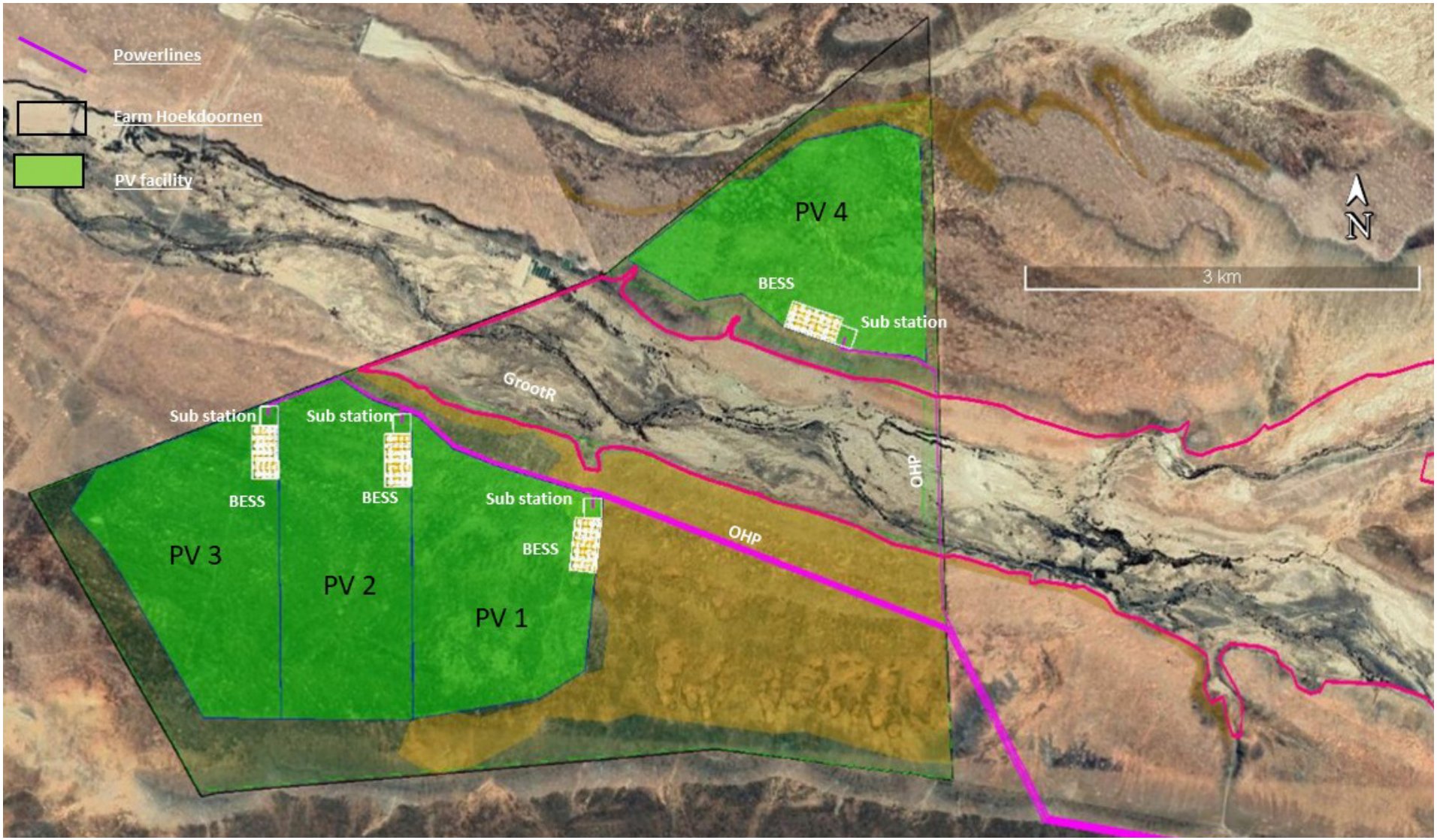

Figure 13. Map showing detail of Hoek Doornen PV 1 – PV 4 layout and development footprint at Hoek Doornen.

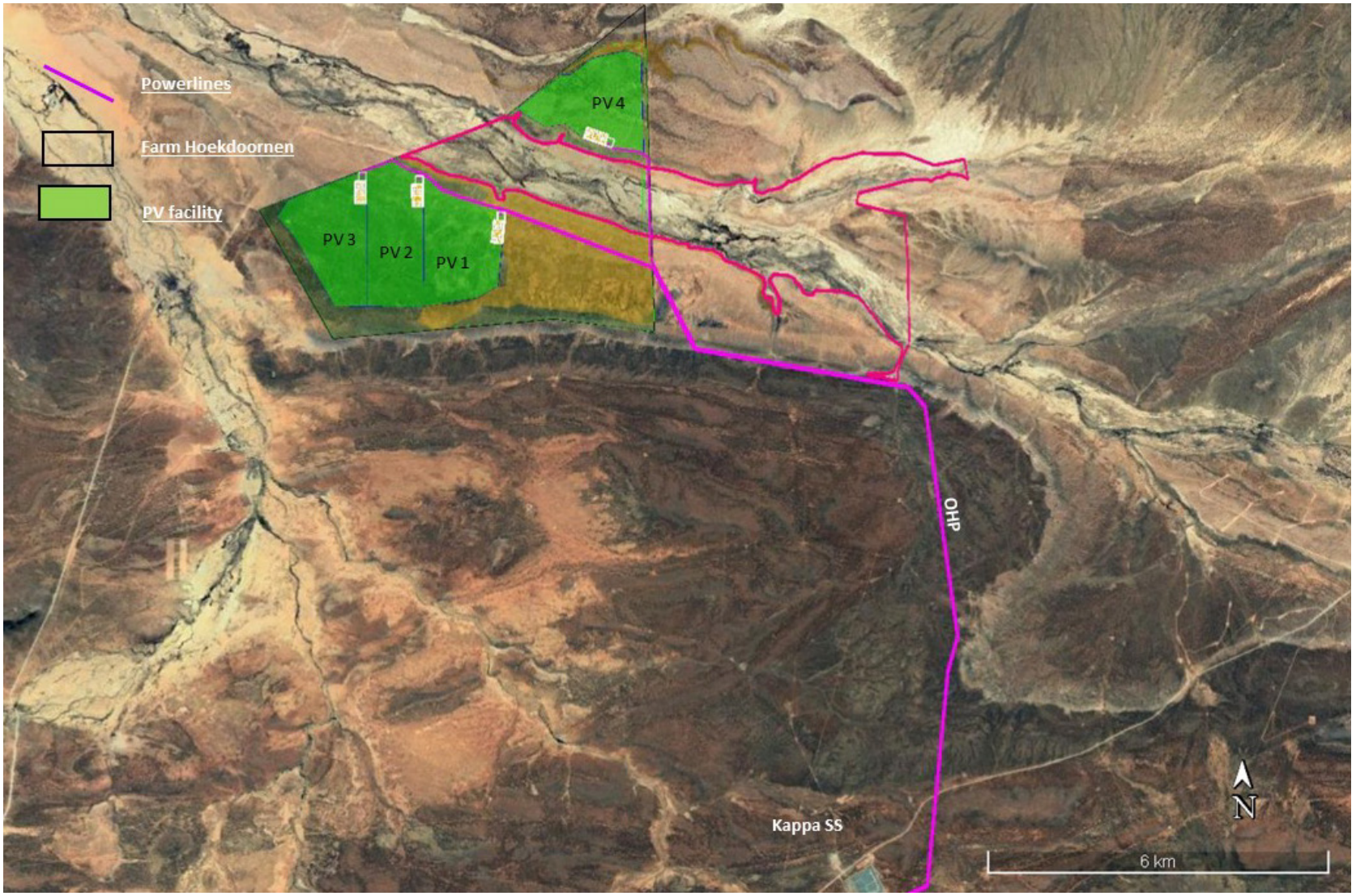

Figure 14. Map showing Hoek Doornen PV 1 - PV 4 and overhead powerline route to Kappa Substation, highlighting riparian areas of ecological sensitivity

Given the above, the following Environmental Sensitivities can be attributed to the four PV sites and the EGI. Refer to Appendix C of this report for the Site Sensitivity Verification Report.

4.3.2.1 Hoek Doornen – PV Facility 1 – PV 4 and Associated Infrastructure

The proposed extent of Hoek Doornen PV facilities encompasses areas within the terrestrial environment, generally classified as being of “low” ecological sensitivity. An extensive buffer (100 m) has been applied between the “high ecological sensitivity areas” of the Groot River and the development footprint of the PV facility. It follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Groot River and Klein Droelaagte will have to be implemented.

4.3.2.2 EGI and Associated Infrastructure

The PV facilities would serve the Kappa substation to the south of the farm. One 132kV powerline for the Hoek Doornen PV 4 facility with associated towers would cross the Groot River to the south of the PV facilities in the vicinity of a point located to the west of the Witte Wall Farm (Figure 15). This crossing will be downstream of an existing fenced boundary on the Witte Wall Farm and would require the establishment of one or two towers within the riparian environment.

The position of the footings of the towers should evidently avoid the main channels within the riparian edge and be built to accommodate significant flooding and high-level flows. However once established, the towers should not be considered a significant impact of ecological significance. The powerlines for the Hoek Doornen PV 1, PV 2 and PV 3 facilities will not cross the Groot River, as these facilities lie to the south of the Groot River.

Figure 15. Image showing fence line across Groot River, where the overhead power line servitude has been proposed for the proposed power lines. The powerline for Hoek Doornen PV 4 would cross the Groot River downstream of this fence line.

Other portions of the powerline effectively avoid any significant watercourse or drainage feature and align with a wholly terrestrial environment.

4.3.3 Sensitivity Analysis Summary Statement

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Hoek Doornen and these systems are considered to be of moderate aquatic ecological importance and overall high sensitivity that which have been catagorised as ESA and CBA respectively as shown by Figure 16 below. The Klein Droelaagte system is not depticed on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figure 17). The proposed Hoek Doornen PV facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. No wetland environments are associated with the PV and associated development footprints (including the power lines).

The balance of the area on Hoek Doornen PV facilities are assigned low sensitivity, which corroborates with the Screening Tool. The electrical overhead powerline that traverses the Groot River for Hoek Doornen PV 4, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system. The above sensitivity analysis largely corroborates the findings of the Screening Tool, the sensitivities of which have been verified and utilized in the planning of the PV facilities at Hoek Doornen and for the EGI corridor along the farms Platfontein and Die Brak. Where the powerlines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

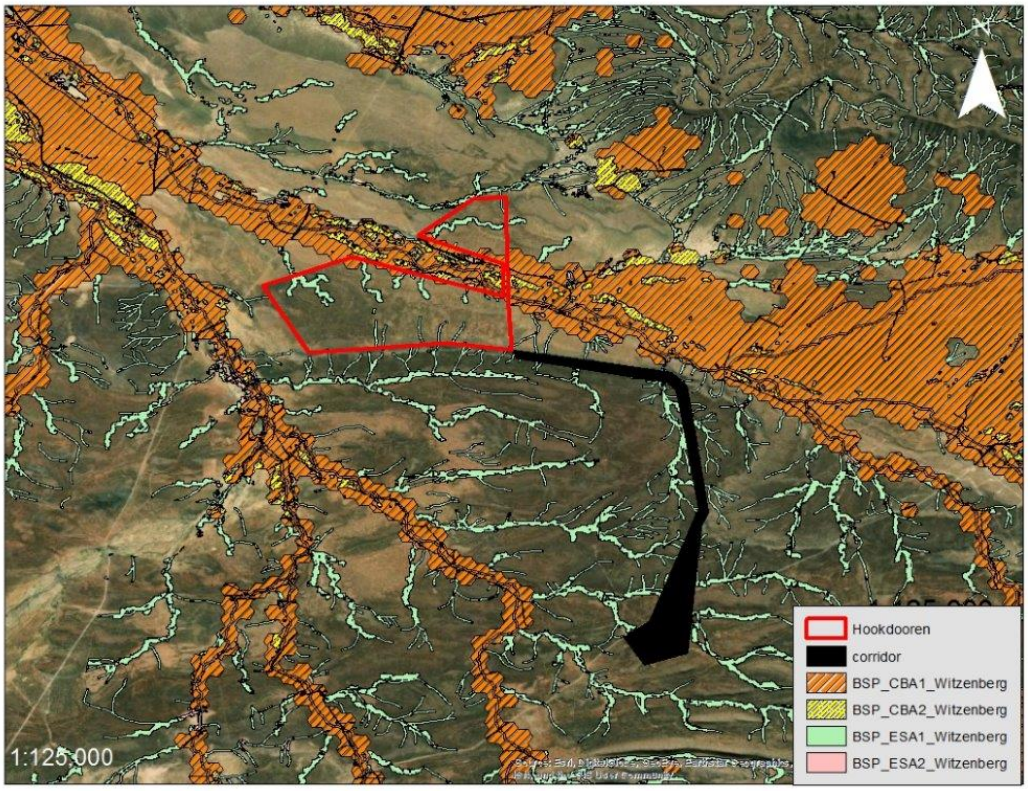

Figure 16. Map image detailing the Hoek Doornen PV site and associated infrastructure in relation to CBA and ESA portion of lands identified through the Western Cape Biodiversity Spatial Plan framework (Cape Nature, 2017).

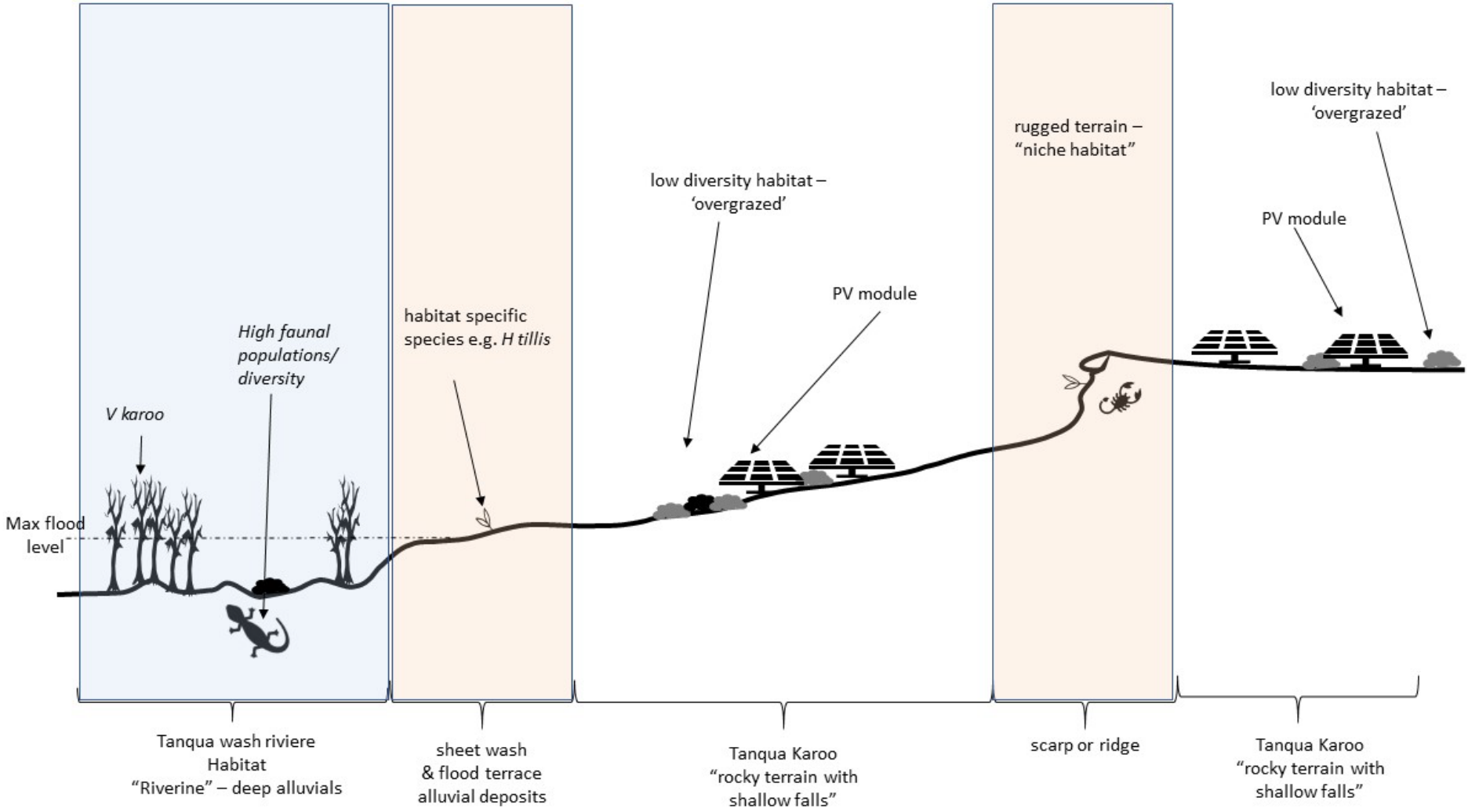

Figure 17. Schematic diagram indicating areas of high sensitivity (blue), moderate sensitivity (beige), and areas suitable for establishment of solar modules.

5 Alternative Development Footprints

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some micrositing of the alignment to reduce impacts.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localized and broader ecology of the region can be identified as a consequence of the proposed PV and EGI developments being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the proposed project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the proposed development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the 'decommissioning phase".

6.1.1 Construction Phase

The following potential impacts during the Construction Phase of the PV Facilities, EGI and associated infrastructure.

- **Potential Impact 1**: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it.
- **Potential Impact 2**: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna.
- **Potential Impact 3**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities.

6.1.2 Operational Phase:

The following potential impacts during the Operational Phase of the PV Facilities, EGI and associated infrastructure can be summarized:

- **Potential Impact 4**: Changes in the geomorphological state of drainage lines on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change.
- **Potential Impact 5**: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long-term activities on site, but are likely to be negligible.

6.1.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use.However, abandonment of the site and cessation of the PV Facilities, EGI and associated infrastructure
would probably result in:

- **Potential Impact 6**: A reversion of present faunal population states within the study area, with some variation to these populations being possible.
- **Potential Impact 7**: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment.

6.1.4 Indirect Impacts of the PV Facilities, EGI and associated infrastructure.

The following indirect impacts on the PV Facilities, EGI and associated infrastructure have also been identified:

- **Potential Impact 8**: Changes in the broader landscape ecology through alteration of eco-morphological drivers.
- **Potential Impact 9**: Changes in faunal ethos as a result of the establishment of the PV facilities on Hoek Doornen.

6.1.5 Cumulative Impacts of the PV Facilities, EGI and associated infrastructure.

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) (i.e. two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172). Notably there are 11 other renewable energy projects that have received EA within 30 km of the subject site. The majority of these projects employ wind turbines, which present fundamentally different impacts and externalities that may affect the broader ecology of the region, although three smaller sites located some 30 km south of Hoek Doornen will employ PV technology for power generation. The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- **Potential Impact 10:** Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.
- **Potential Impact 11**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

6.2 Summary of Issues identified during the Public Consultation Phase

Interaction with local residents in the region indicated that:

- Historically, farming activities over the preceding 150 years was seen to have altered the prevailing habitat.

- Fauna were confined to the riverine areas in general.
- Flood events could be severe, with a rapid rise in the water levels within rivers being noted following rain in the upper catchments.

Additional points raised by the local residents are captured in Table 8 below.

Table 8: Comments Received from Stakeholders / Local Residents during the Field Work component of this Aquatic Biodiversity and Species Assessment

Comment	Commenter	Response from the Specialist
The removal of natural vegetation containing threatened, protected and endemic species as a result of the proposed project	Mr Andre Vermeulen	The general approach to construction of the proposed facilities, associated infrastructure and EGI is to maintain vegetation on site. No "blading" of areas, other than within the laydown area, the site of the substation and along roads is to be undertaken.
Increased dust deposition during construction activities	Mr Andre Vermeulen	This is a likely scenario. Mitigation measures will have to be employed including "damping", traffic speed limitations and other management measures.

Additional comments will be received from stakeholders and Interested and Affected Parties during the 30-day comment period on the Draft BA Report.

7 Impact Assessment of the PV Facilities, EGI and associated infrastructure.

The nature of impact / risk is discussed below. The impacts described below apply to both the Hoek Doornen PV 1, PV 2, PV 3 and PV 4 projects, including the EGI and associated infrastructure (i.e. they are the same and have not been repeated).

7.1 Potential Impacts during the Construction Phase

Potential Impact 1: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it

As construction proceeds the natural drainage patterns, sediment transport mechanisms and other related factors will alter, with concomitant change in the ecology associated with these factors. This is rated as a direct, negative impact. Implementation of management principles will reduce these impacts from "high" to "moderate" significance and possibly "low", during the closing of the construction phase.

Potential Impact 2: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna

ELP will alter faunal ethos of some species, particularly during construction, primarily associated with work at night. ELP can be addressed through initially, interventions in respect of lighting during the construction phase such as reduced security lighting, downward lighting and restriction on lumens employed. This is generally a low significance impact before and after implementation of mitigation measures.

Potential Impact 3: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities

During the construction phase, increased mobilization of sediments, minor spills of materials and other factors may alter surface water chemistry. This impact would however be low significance, with the employment of suitable management measures during the construction stage. Mitigation measures include providing adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.

7.1.1 Impact Summary Table: Construction Phase

The impact ratings are described in this section for the construction phase.

Table 9: Impact Summary Table for the Construction Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE – Direct Impacts						
Impact 1: Changes in the geomorphological state of drainage patterns	*Status*	*Negative*	*High (2)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Moderate (3)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 2: Increased ELP	*Status*	*Negative*	*Low (4)*	• *Ensure reduced security lighting, downward lighting and restriction on lumens employed*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 3: Changes in water resources and surface water in terms of water quality	*Status*	*Negative*	*Moderate (3)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operations Phase

Potential Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change

As climatic factors change within the region, natural bio-physical responses, including changes in habitat or faunal population shifts may be affected on account of the presence of the PV facilities, EGI and associated infrastructure. This impact is considered "low" significance on account of the generally limited extent of the site in relation to surrounding habitats.

Potential Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities

Such changes will be related to the long-term activities on site, but are likely to be negligible. Alteration in water quality are surmised to stem primarily from unintended hydrocarbon leaks from operating vehicles and other machinery on site. However, impacts of this nature during the operational phase are considered to be of "low" significance with mitigation measures including to retain spill kits on site.

7.2.1 Impact Summary Table: Operational Phase

The impact ratings are described in this section for the operational phase.

Table 10: Impact Summary Table for the Operational Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE – Direct Impacts						
Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change	*Status*	*Negative*	*Low (4)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities	*Status*	*Negative*	*Low (4)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces* • *Implement proper spill control and management, such as the retention of emergency spill kits on site*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.3 Decommissioning of Site

Potential Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible

On account of both the abovementioned seral state of the land as well as other factors, decommissioning and reversion to a land use, akin to the present, should see some alteration of faunal populations and a reversion to present populations with some ousting and recruitment of species. This impact is rated as "low" significance before and after the implementation of management actions.

Potential Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment

This impact is rated with a low significance and possibly, "positive". This impact will be a long-term impact which may be considered "negative" but of low significance. Additional hard panning as a result of the establishment of the PV facilities and associated infrastructure contributes to the change in the geomorphological state of the drainage lines. Stormwater controls are to be incorporated into the development to ensure attenuation of flow.

7.3.1 Impact Summary Table: Decommissioning Phase

The impact ratings are described in this section for the decommissioning phase.

Table 11: Impact Summary Table for the Decommissioning Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE – Direct Impacts						
Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible	*Status*	*Neutral*	*Low (4)*	• *Ensure that there is appropriate disposal of materials and waste during decommissioning activities* • *Manage stabilisation and reinstatement of the land*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	*Status*	*Neutral*	*Low (4)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.4 Indirect Impacts

The following indirect impacts are anticipated to be associated with the establishment of the PV facilities, EGI and associated infrastructure on the farm Hoek Doornen. Indirect impacts arising from the establishment of the site are likely to be of low significance, and generally latent in nature.

Potential Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers

The development of the four proposed PV facilities on Hoek Doornen may alter habitat form and structure beyond the boundaries of the PV facilities as support infrastructure (e.g. roads) are established, or as physical or biological factors change (e.g. drainage patterns change or grazing pressures increase at other points). The impacts may however prove to be of low impact significance.

The decommissioning of the site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is considered to be "low" significance.

Potential Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities.

Changes in faunal ethos on account of the establishment of the PV facilities on Hoek Doornen, some faunal populations may emigrate from the area, while others may favour other factors around the site. Behavioral change in faunal populations will drive ecological change beyond the boundaries of the PV Facilities. This impact is rated as "low" significance without and with the implementation of mitigation measures.

7.4.1 Impact Summary Table: Indirect Impacts

The impact ratings are described in this section for the indirect impacts during both the construction and operation phase.

Table 12: Impact Summary Table for Indirect Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Indirect Impacts						
Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers	*Status*	*Negative*	*Low (4)*	• *Appropriate management of the site must be undertaken along ecological integration approaches*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities	*Status*	*Negative*	*Low (4)*	Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. Mitigation of this impact would result in a low rating.	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7.5 Cumulative Impacts

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) and there are 11 authorised renewable energy projects on some 50 000 ha of land within 30 km of the subject site (Figure 18). The

cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of the proposed projects and other land use changes in the region are likely to exhibit the following:

Potential Impact 10: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

This impact deals with increased an increased change in the geomorphological state of drainage lines and water courses due to long term and extensive change in the nature of the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are rated as moderate and likely, respectively, rendering the significance as low without the implementation of management measures. Mitigation measures include cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.

Potential Impact 11: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

This impact deals with changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are respectively rated as moderate and likely, rendering the significance as low without the implementation of management measures. Mitigation measures include coordinated and sustained management of all nine PV and EGI Projects associated with this BA.

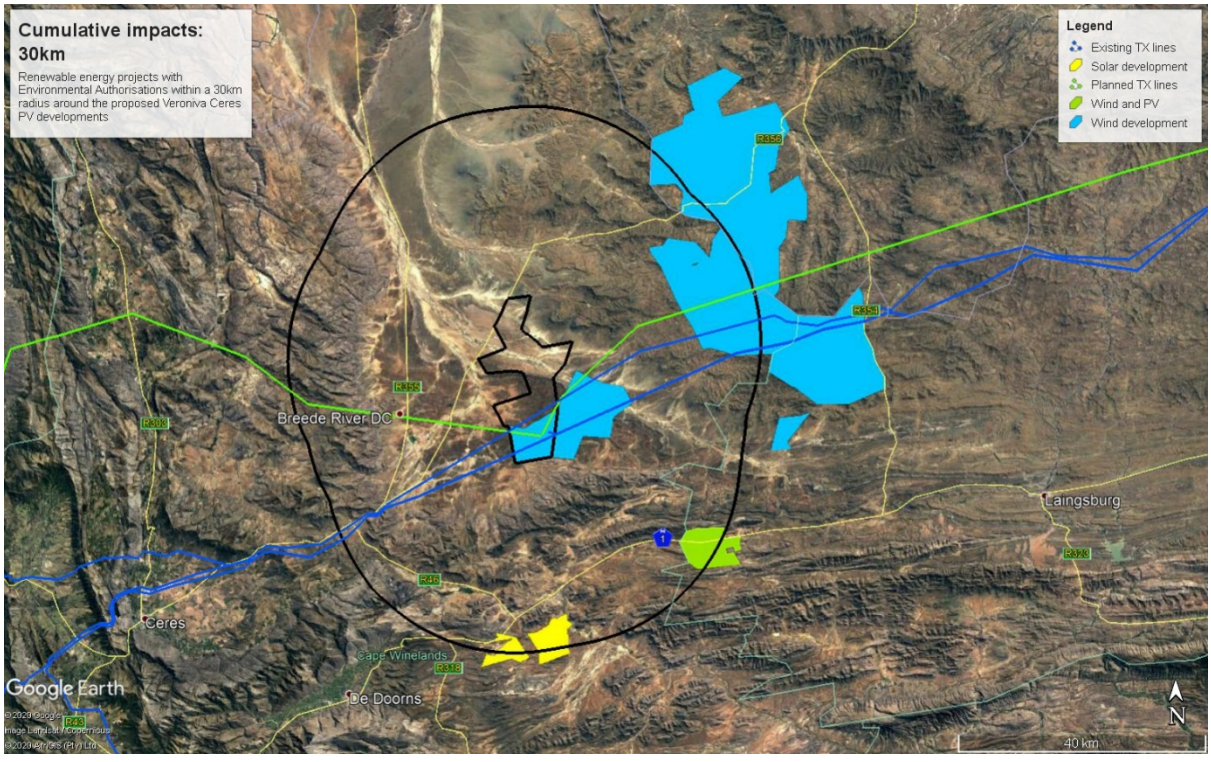

Figure 18. Map indicating renewable energy and EGI projects within 30 km of project site (van Rooyen, 2020).

7.5.1 Impact Summary Table: Cumulative Impacts

The impact ratings are described in this section for the cumulative impacts during the construction and operational phase.

Table 13: Impact Summary Table for the Cumulative Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Cumulative Impacts						
Impact 10: *Increased change in the geomorphological state of drainage lines and watercourses, on account of long term and extensive change in the nature of the catchment*	*Status*	*Negative*	*Low (4)*	Cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
Impact 11: *Changes in water resources and surface water in terms of water quality on account of extensive changes in the catchment.*	*Status*	*Negative*	*Low (4)*	*Co-ordinated and sustained management of all nine PV and EGI Projects associated with this BA.*	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

8 Impact Assessment Summary

Table 14 and Table 15 provides a summary of the expected impacts after mitigation for the PV Facilities and EGI, respectively.

Table 14: Overall Impact Significance (Post Mitigation) of the proposed PV facilities and associated infrastructure

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

Table 15: Overall Impact Significance (Post Mitigation) of the proposed EGI to support the PV facilities

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

9 Legislative and Permit Requirements

The proposed establishment of the Hoek Doornen PV facilities, associated infrastructure and EGI on the subject sites are considered to elicit a requirement for compliance with the following legislation as this may apply to the riverine and aquatic environments.

- **The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended)**

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) may be applicable to the site, particularly in respect of matters pertaining to threatened or protected species encountered on or around the sites or the matter of redress of AIPs. This may apply in respect of the establishment of the powerline across the Groot River.

- **The National Water Act (Act 36 of 1998, as amended)**

As noted above, the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such, maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The sensitivity map in Figure 12 indicates that for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, areas of terrestrial importance and a “buffer” at the interface of the terrestrial and riparian areas have been demarcated, which approximates 100 m and includes areas of sheet wash and flood extremes. In addition, no wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines).

The powerline for Hoek Doornen PV 4 will, however, cross the Groot River and would require the establishment of one or two towers within the riparian environment of the Groot River. The powerlines for the Hoek Doornen PV 1, PV 2 and PV 3 facilities will not cross the Groot River, as these facilities lie to the south of the Groot River. In addition, the access road leading to the Hoek Doornen PV 4 site would need to be upgraded as part of the proposed projects. Sections of the access road upgrade will take place within 100 m of the Groot River.

The requirement for a General Authorisation or Water Use License in terms of Section 21 (c) and 21 (i) of the National Water Act may be required where activities arise within the bed of the river in respect of the establishment of towers for the overhead powerlines and the road upgrading. Therefore, the following project likely requires a Water Use License or similarly a General Authorisation:

- Hoek Doornen PV 4 – for the access road upgrade and power line specifically.

However, if the towers are needed to be placed within 100 m of the bank of the Groot River, for the Hoek Doornen PV 1, PV 2 and PV 3 facilities, then a Water Use License or similarly a General Authorisation may be required. The Department of Human Settlements, Water and Sanitation are to confirm such prerequisite legal requirements.

- **The National Forest Act (Act 84 of 1998)**

The clearance of "natural forest" may be applicable, where, particularly in the establishment of the power line that traverses the Groot River for Hoek Doornen PV 4, there may be the requirement to remove associations of *V karoo*. Although not strictly "forest" in ecological terms, the *contiguous canopy* definition of forest would apply under Section 7 of the National Forest Act (Act 84 of 1998).

- **The Cape Nature and Environmental Conservation Ordinance 19 of 1974 (also the Western Cape Nature Conservation Laws Amendment Act (2000))**

This act should be given consideration following EA with particular respect to Chapters IV, (The protection of wild animals other than fish) and Chapter VI, (The protection of flora). The requirement for permits when removing and relocating specific flora that may be encountered or alternatively addressing fauna that may be encountered around the sites would require due consideration.

- **Draft Western Cape Biodiversity Bill, 2019.**

This law has not been promulgated however some aspects of Chapter 7, in particular may apply to the sites, once promulgated.

In consideration of the applicable legislation listed above, it is important to note that the requirement for approval is to be confirmed by the competent authority on the matter.

10 Environmental Management Programme Inputs

The proposed PV facilities on Hoek Doornen and the associated infrastructure and EGI, will not effectively enter into the riparian environments located on the affected farms. However, the BA process has identified a number impacts that are expected to arise during the planning and construction components of this project. The prevailing impacts to the aquatic biodiversity are:

- Increased surface run off of storm water under high precipitation events with concentration at specific points; and
- Minor changes in water quality through suspended and dissolved materials arising from activities on site (e.g. fats, soaps and oils).

The riverine environments are effectively ephemeral rivers and not subject to regular flow. It is anticipated that impacts from the PV facilities and their associated infrastructure and EGI will be primarily indirect in nature. The EMPr focuses on the mitigation and management of the prevailing (direct, indirect, cumulative) impacts, the subsequent mitigation actions as well as the methodology, frequency and responsibility of the monitoring regime. From the above the EMPr has been compiled in alignment with Appendix 4 of the 2014 NEMA EIA Regulations which aims to detail measures that are to be carried out in order to:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;

- Comply with any applicable provisions regarding closure; and
- Comply with any provisions regarding financial provision for rehabilitation.

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

Given the information presented above it is evident that should the Applicants establish the proposed development within the identified footprint on Hoek Doornen that the Hoek Doornen PV facilities may proceed with limited impact on the broader ecological processes and those areas deemed to be of ecological significance (namely the lower riparian environments and sand wash environments).

It therefore follows that: Hoek Doornen PV facilities and associated infrastructure show a low-level aquatic ecological impact on adjacent riparian environments identified and subject to the implementation of the prescribed management recommendations and conditions, should not be precluded from development on ecological grounds.

11.2 EA Condition Recommendations

Should the mandated authorities approve the proposed development, the following broad management recommendations are proposed for incorporation into the EA:

- Maintenance and establishment of an ambulatory set back of >100m from the identified riparian areas and points of sheet wash as per the layout plan presented.

- That construction and establishment of modules and arrays be undertaken without the clearance of vegetation. Where vegetation proves excessively tall and affects either construction or operation, pruning may be effected.

- A detailed stormwater management and drainage plan be developed that considers *inter alia*, surface flows arising from elevated areas above the PV facilities and its discharge from the facilities. This philosophy must include attenuation and energy dissipation mechanisms and redress of erosion and sheet flow across site.

- The laydown area for the PV facilities should be subject to compaction and the use of dust suppressants when in operation, to prevent excessive particulate matter becoming airborne.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife” porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.

- Maintain the riparian areas as general “exclusion areas” for all operations, with the exception of the establishment of the overhead powerlines.

- Management of exotic weed invasion that may arise within riparian areas as a consequence of disturbance.

- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

It is our opinion that with the implementation of the above, the project proposal, subject to final design and adherence to the above recommendations, should be authorised.

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APPENDICES

Appendix A - Specialist Expertise

NAME Simon Colin Bundy

PROFESSION Ecologist / Environmental Assessment Practitioner

DATE OF BIRTH 7 September 1966

MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist

EDUCATION

BSc Biological Science (1990) University of Natal

Diploma Project Management (1997) Executive Education

MSc (2004) University of KwaZulu Natal

PhD. Candidate: Department of Engineering, University of Kwa Zulu Natal

1998: Guest of Konrad Adenhauer Foundation to Berlin to consider "sustainable development initiatives" in Europe

2000: Training course: "Environmental Economics and Development". University of Colorado (Boulder) USA.

2008: Certificate in Coastal Engineering: Stellenbosch University

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. With a core competency in coastal ecological systems and coastal management, Bundy has worked on coastal projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as South Africa, providing ecological and general environmental advice and support. In addition, Bundy has worked in Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large-scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. In 2015, Bundy formulated the coastal set back line method for the iSimangaliso Wetland Park, funded by the Global Environment Fund of the United Nations. Bundy acts as botanical

and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the Council for Scientific and Industrial Research, Stellenbosch.

SELECTED RELEVANT PROJECT EXPERIENCE

Aquatic and Ecological evaluation of the impacts of Scatec Kenhardt Solar Facilities 1 – 6 in Northern Cape – CSIR (2016 to 2019)

Investigations and review of the aquatic and terrestrial ecology associated with 6 solar facilities at Kenhardt in Northern Cape

Aquatic and Ecological evaluation of the impacts of Maintstream wind Projects in Sutherland Northern Cape & Western Cape – CSIR (2015 to 2016)

Investigations and review of the terrestrial ecology associated with wind power facilities near Sutherland in Northern Cape

Ecological investigations Tongaat and Illovo Desalination Plants: CSIR – (2013 - 2016)

Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning: Sodwana Bay: iSimangaliso Wetland Park Authority – (2014 - 2015)

Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Review of Project Leader and Coastal Specialist: Addington Farm Strategic Environmental Assessment (2016)

Evaluation of coastal habitat and beach-dune interface for the generation of setback lines for the proposed Addington Farm residential development.

Aquatic and Ecological evaluation of the impacts of in-water hull cleaning, Port Louis, Mauritius and Port of Durban – Aquatech / Divetech Solutions (2014 to date)

Investigations and review of the chemo-physical impact of in-water hull cleaning in the Durban and Port Louis Ports for accreditation with the International Maritime Organisation.

Coastal ecological evaluation of the Van Riebeeckstrand coastline, Cape Town for the establishment of inter-continental telecommunication cables. Acer Africa (2016)

Specialist investigation into the impact of establishing marine cables at Van Riebeeckstrand Cape Town for MTN. Client: Acer Africa.

Review and report on impact of the Fairbreeze Mine at Mtunzini on aquaculture operations at Mtunzini Aquaculture – Supporting document for legal argument presented on behalf of Mtunzini Aquaculture. (2017)

Specialist review and investigation of groundwater discharge and dune mobility at Siyaya, Mtunzini and its effect on the marine intake supplying the Mtunzini Fish Farm. Client: Mtunzini Fish Farm / Eversheds

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event: West of England Insurance, United Kingdom (2018 - 2019)

Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assoc's and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

Rehabilitation Projects: (2010 - 2015)

- Dune rehabilitation of Durban Harbour southern breakwater 2009 – 2010 for Group 5. Sculpt, establish and maintain.
- Mangrove forest rehabilitation of Hugh Dent pump station 2015 for Sembcorp Siza Water.
- Dune rehabilitation of Ballito beachfront 2009 for KwaDukuza Municipality, following 2007 storm surge event
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Smith A, Mather A, Theron A, S Bundy 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the South African Environmental Observation Network publication "Climate Change in Southern Africa"

Name:	Alexander Michael Whitehead
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Current Employment:	SDP Ecological and Environmental Services cc
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Tertiary Qualifications:	BSc (Hons.) Ichthyology and Fisheries Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – Reg. No. 400176/10 (Ecological Science)

Key Skills and experience:

- Computer skills – (MS Word, STATISTICA, Excel, MS Access, PRIMER 5 (multivariate statistical program), CAP 4 (multivariate statistical program));
- Bioassessment - Experience in sampling aquatic invertebrates (SASS 5) and ichthyofauna (Electrofishing and estuarine sampling techniques);
- Water quality - Experience in carrying out water samples and interpreting results in both freshwater and estuarine environments;
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Wetland functionality assessments – Assessment of wetland functionality using ecological indicators and standard methods such as Wet-Ecoservices and Wet-Health.
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Rehabilitation – Compilation of wetland and terrestrial rehabilitation plans as well as practical experience in planning and conducting weed eradication and re-vegetation programs.
- Environmental monitoring and auditing –
- Open space and conservation planning – Identification of areas of open space or conservation importance.
- Botanical/protected species permits and Risk Assessments – Permit applications under the National Forest Act (84 of 1998), Natal Nature Conservation Ordinance (15 of 1973) and National Environmental Management: Biodiversity Act (10 of 2004).

Name:	Luke Patrick Maingard
Profession:	Environmental Consultant/Ecologist
Date of Birth:	15/09/1993
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	5
Nationality:	South African
Email address:	Luke@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Environmental Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – (Ecological Science)

Key Skills and experience:

- Geographic Information Systems
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental legislation
- Storm water control and management design and implementation
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Environmental Control Officer to numerous construction sites
- Data management and analysis
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.

Appendix B - Specialist Statement of Independence

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

Specialist Company Name:	SDP Ecological & Environmental Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	ex	Percentage Procurement recognition	
Specialist name:	Simon C Bundy			
Specialist Qualifications:	BSc MSC Dip Proj Man			
Professional affiliation/registration:	SACNASP			
Physical address:	6 Salisbury Road, Ballito			
Postal address:	P O Box 1016, Ballito			
Postal code:	4420	Cell:	082 446 4847	
Telephone:	032-586 1218	Fax:		
E-mail:	simon@ecocoast.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Simon C Bundy_____, 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

S. D. P CC
P.O. BOX 1016, BALLITO 4420
TEL: 032 946 1685
FAX: 086 [illegible] ZA
WWW.SDPECOLOGY.CO.ZA

Name of Company:

17/11/20

Date

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity and Species Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	14/09/2020 – 18/09/2020
Specialist Name	Simon Bundy and Luke Maingard
Professional Registration Number	S C Bundy SACNASP No.400093/06 L P Maingard SACNASP No. 116639/16
Specialist Affiliation / Company	SDP Ecological and Environmental Services

The Site sensitivity verification was undertaken using the following means:

1. Preliminary desktop analysis achieved by overlaying a variety of geospatial data features – namely NFEPA data and other sensitivity data obtained from the SANBI BGIS as well as the DEFF Screening Tool. Further to this, the Present Ecological State (PES) and Environmental importance and sensitivity (EIS) data had been derived from the DWS Present Ecological State and Ecological Importance model.
2. Literary review of the site, obtaining baseline knowledge of the ecological history of the site as well as the PES of the site. To this end a review of historical images of the site had also been undertaken.
3. Onsite investigation of the subject area from the 14/09/2020 to the 18/09/2020.

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Hoek Doornen and these systems are considered to be of moderate aquatic ecological importance. The Klein Droelaagte system is not depicted on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figures 11, 12 and 13 in the main report). The proposed Hoek Doornen PV 1 and Hoek Doornen PV 2 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The rest of the area on Hoek Doornen PV 1 and Hoek Doornen PV 2 are assigned low sensitivity, which corroborates with the Screening Tool.

The electrical overhead powerline that traverses the Groot River for Hoek Doornen PV 4, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system.

The above sensitivity analysis corroborates the findings of the screening tool and has been utilized in the planning of the PV facilities at Hoek Doornen and for the EGI corridor along the farms Platfontein and Die Brak. Where the powerlines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

Appendix D: Impact Assessment Methodology

The following impact assessment was adopted, which includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

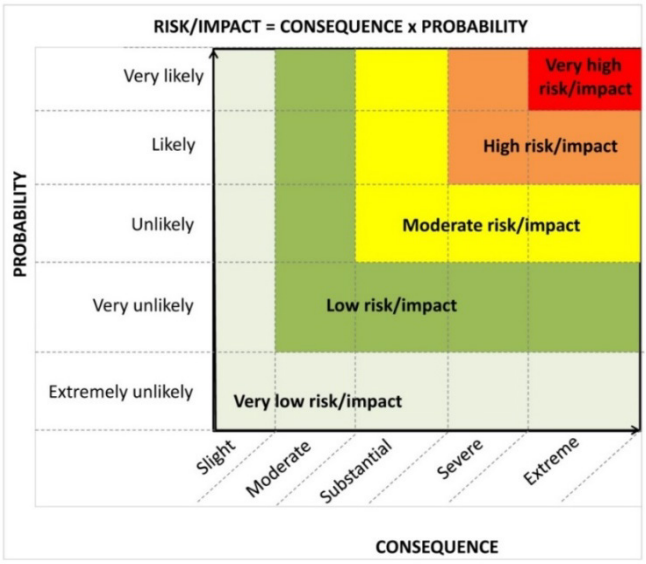

Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;*	*Section 4*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Figure 11, Figure 12 and Figure 13*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 4*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 4 and Tables 4, 5, 6 and 7*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Not Applicable – see Section 5*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?* *2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?* *2.5.3. How will the proposed development impact on fixed and*	*Sections 6 and 7* *In particular planning, operation and decommissioning impacts* *1. No change in state anticipated* *2. No change in resource quality anticipated* *3. Riparian areas are excluded – no change in ecological processes of significance*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity		Section where this has been addressed in the Specialist Report
	dynamic ecological processes that operate within or across the site? This must include: *a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);* *b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub - catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);* *c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and* *d) to what extent will the risks associated with water uses and related activities change;*	*anticipated.* *a. As significant buffering of riparian areas, limited hardpanning is anticipated – impacts of a hydrological importance are not anticipated* *b. Sediment transport change will be negligible* *c. Minor change in lower catchment with minimal change that is negligible, to the watercourse* *d. No changes to water use or any related activities are anticipated.*
2.5.4.	*how will the proposed development impact on the functioning of the aquatic feature? This must include:* *a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);* *b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);* *c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley -bottom wetland);* *d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);* *e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and* *f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);*	*Section 7* *In summary* *a. Baseflow does not arise as the systems are ephemeral* *b. Flow is intermittent. No change is expected in volumes* *c. Hydrogeomorphic state will remain intact and no change is anticipated* *d. Water quality is unlikely to have any significant alteration particularly during operations and decommissioning* *e. No fragmentation is anticipated as riparian environments have been avoided* *f. No change in important features anticipated.*
2.5.5.	*how will the proposed development impact on key ecosystems regulating and supporting services especially:* *a) flood attenuation;* *b) streamflow regulation;* *c) sediment trapping;* *d) phosphate assimilation;*	*As the systems are ephemeral, set back and out of maximum flood extents and there is a distinct lack of aquatic habitat and eco-morphology, no variation in ecological drivers*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
e) nitrate assimilation; *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*of aquatic systems is anticipated.*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Sections 4 and 7* *Aquatic biota are transitory in the affected systems and no change is anticipated with the proposed development.*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: *a) size of the estuary;* *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	*Not Applicable – the site does not include any estuaries.*
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A*
2.7.2. a signed statement of independence by the specialist;	*Appendix B*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 2 and Appendix C*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 2*
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	*Section 2.2*
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Sections 4 and 11.2*
2.7.7. additional environmental impacts expected from the proposed development;	*Sections 4, 6 and 7*
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	*Sections 6 and 7*
2.7.9. the degree to which impacts and risks can be mitigated;	*Section 7*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 7*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 7*
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	*Sections 4.3.2 and 11.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Sections 7 and 10*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*Not Applicable – the PV sites fall outside of the sensitive areas.*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 11.1*
2.7.16. any conditions to which this statement is subjected.	*Section 11.2*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	*Sections 7 and 10 of this report include mitigation and monitoring measures. These are to be included and incorporated into the BA Report.*
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Appendix B of this report. This report is included as an appendix to the BA Report.*

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.6

Avifauna Assessment

AVIFAUNAL SPECIALIST ASSESSMENT

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure known as Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	Chris van Rooyen Consulting P.O. Box 2676 Fourways 2055

October 2020

Executive Summary

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, as the associated infrastructure and Electrical Grid Infrastructure.

It is estimated that a total of 100 bird species could potentially occur in the broader area. Of these, 41 species are classified as priority species, of which 17 is expected to occur regularly at the study area. The overall abundance of priority species at the study area was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment. Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects.

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Phase	**Overall Impact Significance (Pre Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

ENVIRONMENTAL SENSITIVITIES

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities and associated infrastructure:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- Access to the rest of the property must be restricted.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.

Operational phase

- The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.
- A 300m infrastructure-free buffer must be maintained around the water reservoirs (refer to the sensitivity map in Figure 12).
- No solar PV arrays must be constructed in drainage lines (refer to the sensitivity map).
- A single perimeter fence should be used.
- Use underground cabling for the internal reticulation network.
- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

De-commissioning phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.

STATEMENT AND REASONED OPINION

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV facilities, associated infrastructure and the electrical grid infrastructure were rated to be Moderately negative pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (refer to the table above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the Environmental Management Programme EMPr (see Section 9) are strictly implemented.

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List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DEFF	Department of Environment, Forestry and Fisheries
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NPAES	National Protected Areas Expansion Strategy
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa National Protected Areas Database

Glossary

Definitions	
Study area	The area covered by the proposed application sites and the powerline corridor.
Broader area	A consolidated data set for a total of 12 pentads where the study area is located.
PV footprint	The actual development footprint containing the PV solar arrays and associated infrastructure.
Priority species	• South African Red Data species. • South African endemics and near-endemics. • Raptors • Waterbirds
Cumulative impact	Impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts.

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

The proposed PV facilities will be constructed on the following farm portions:

- Remainder of Grootfontein Farm 149;
- Portion 5 of Grootfontein Farm 149;
- Remainder of Witte Wall Farm 171; and
- Portion 1 of Hoek Doornen Farm 172.
- The power lines will traverse these aforementioned farm portions, as well as the Die Brak 241 and Platfontein 240.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, as well as all associated infrastructure, including Electrical Grid Infrastructure.

1. Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The purpose of the report is to assess the potential impacts of the Hoek Doornen 1, 2, 3 and 4 PV facilities, as well as all associated infrastructure, including Electrical Grid Infrastructure, on avifauna, to provide a reasoned opinion on whether the projects should proceed or not from an avifaunal impact perspective, and to recommend measures for the mitigation of identified impacts, should the project proceed.

1.2 Details of Specialist

This specialist assessment has been undertaken by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting. Chris van Rooyen works under the supervision of Albert Froneman who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400177/09 in the field of Zoology. Curriculum vitae are included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.3 Terms of Reference

The terms of reference for the specialist study are as follows:

- Describe the affected environment from an avifaunal perspective.
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting / breeding.
- Discuss gaps in baseline data and other limitations.
- Adhere to the content requirements for specialist reports in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations 2014, as amended.
- Provide an overview of all applicable legislation.
- Provide an overview of assessment methodology used.

- Confirm the impact status, use of the land, and sensitivity of the site in comparison to the National Department of Environment, Forestry and Fisheries (DEFF) National Environmental Web-based Screening Tool (National Screening Tool) and associated protocols.
- Identify and assess the potential impacts of the proposed development on avifauna including cumulative impacts.
- Provide sufficient mitigation measures to include in the
- Environmental Management Programme (EMPr), as well as review of the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.
- Conclude with an impact statement whether the PV facility is fatally flawed or may be authorised.

2. Approach and Methodology

The following approach was followed to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000 (see Figure 1).
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System (BGIS) map viewer (SANBI 2020).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al*. 2015).
- The global threatened status of all priority species was determined by consulting the latest (2020.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The SANBI BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- A desktop investigation was conducted to source information on the impacts of solar facilities and Electrical Grid Infrastructure on avifauna.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies for solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017). Monitoring was conducted in the following manner:
    - Eighteen walk transects were identified totalling 1km each in the study area and counted once per survey. One observer walking slowly recorded all birds on both sides of the transect. The observer stopped at regular intervals to listen to bird calls and to scan the environment with binoculars.
    - The following variables were recorded:
        - Species;
        - Number of birds;
        - Date;
        - Start time and end time;
        - Estimated distance from transect (m);

- Wind direction;
- Wind strength (estimated Beaufort scale 1 - 7);
- Weather (sunny; cloudy; partly cloudy; rain; mist);
- Temperature (cold; mild; warm; hot);
- Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying- foraging; flying-commute; foraging on the ground.

- All incidental sightings of priority species were recorded.
- Three potential avifaunal focal points were also identified namely two water reservoirs and a small dam.

See Figure 1 below for the extent of the broader area.

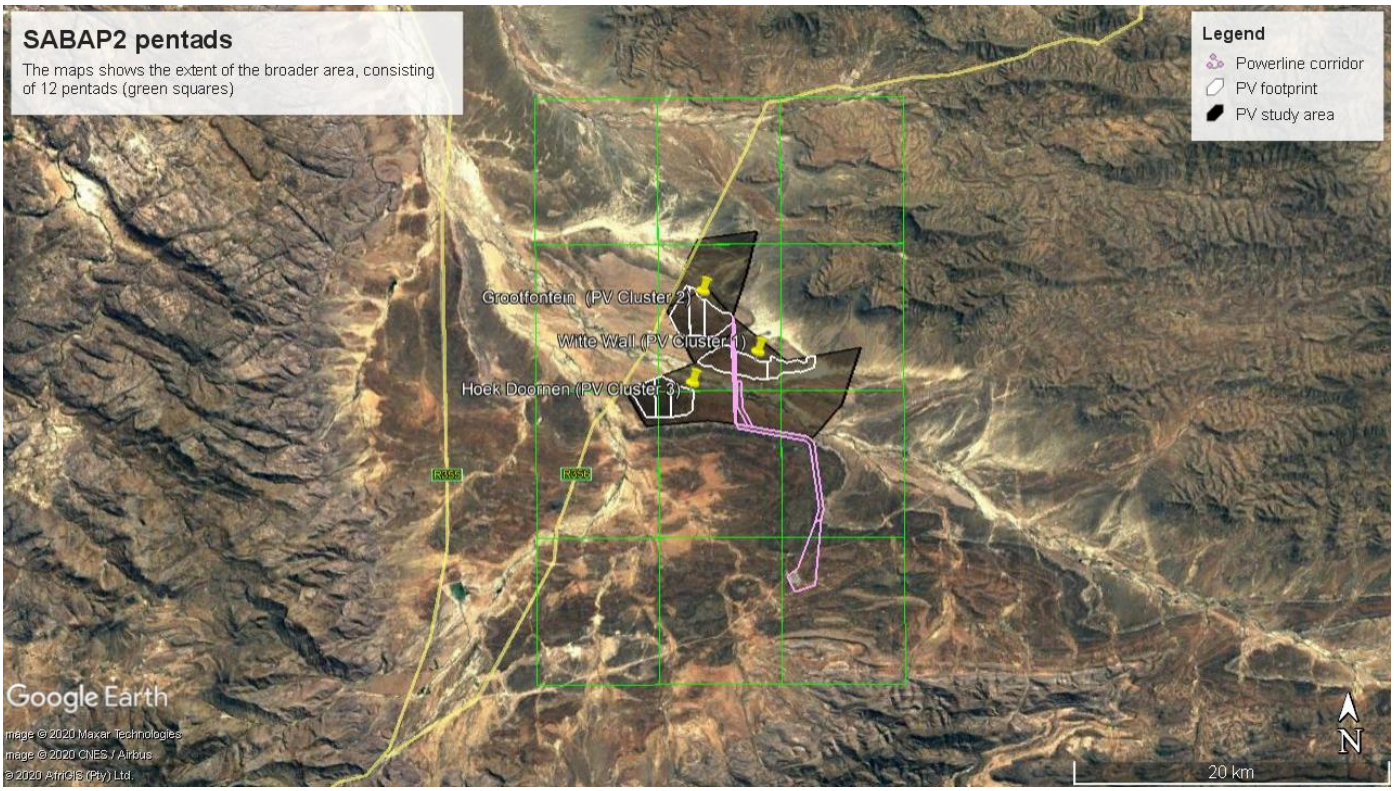

Figure 1: Area covered by the twelve SABAP 2 pentads (broader area = green squares).

See Figure 2 for the location of walk transects and focal points.

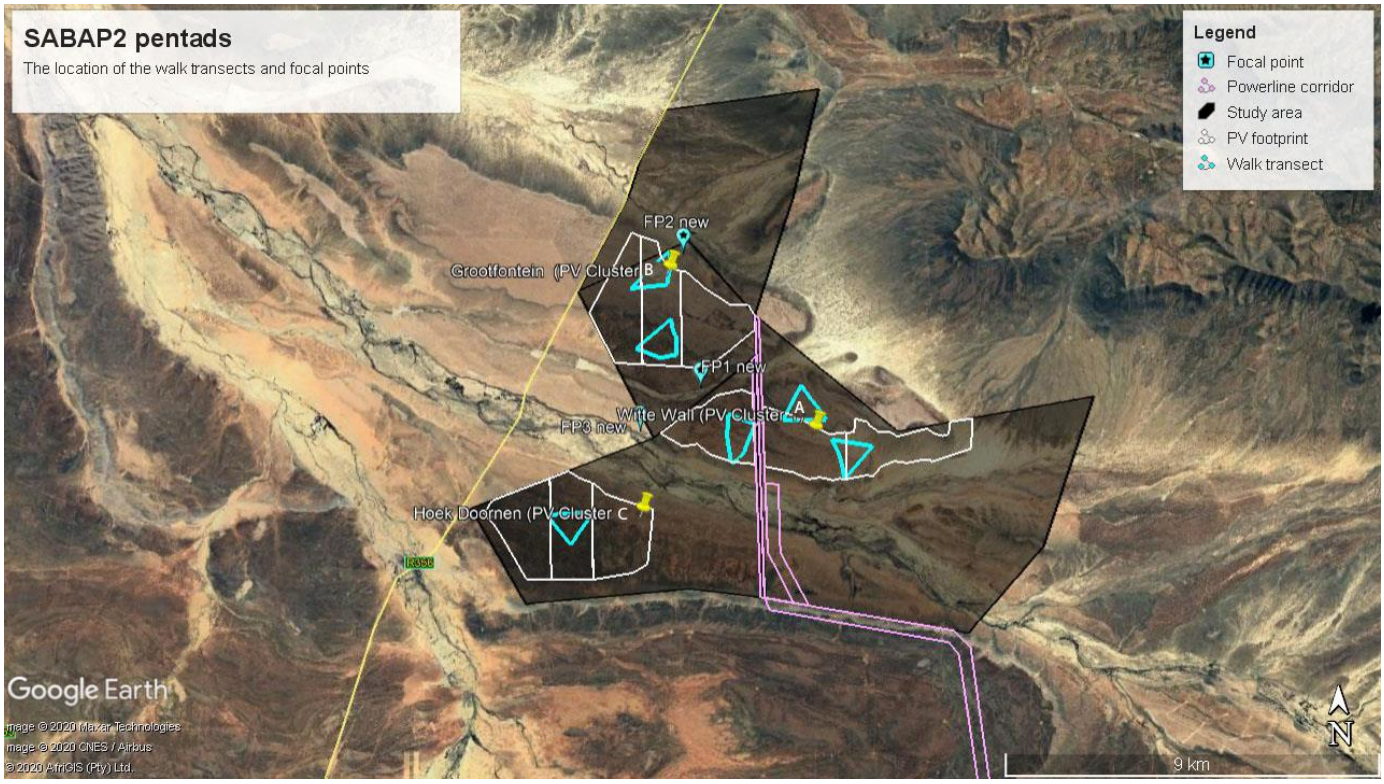

Figure 2: The location of the walk transects and focal points

2.1 Information Sources

The following data sources were used to compile this report:

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	October 2020	Spatial, database	SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
IUCN Red List of Threatened Species (2020.2)	IUCN	2020. 2	Online reference source	Established in 1964, the International Union for Conservation of Nature's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria.
National Protected Areas and	DEFF	2009	Spatial	The goal of the NPAES is to achieve cost effective protected area expansion for ecological sustainability

Data / Information	Source	Date	Type	Description
National Protected Areas Expansion Strategy (NPAES)				and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.	2015	SEA	The SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).
DEFF National Screening Tool	Department of Environment and Forestry (DEFF)	2020	Online assessment tool	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

2.2 Assumptions, Knowledge Gaps and Limitations

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- A total of 70 SABAP2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 48 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) were also recorded. The SABAP2 data was therefore regarded as an adequate indicator of the avifauna which could occur at the study area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study was primarily on the potential impacts of the proposed solar PV facility and associated grid connection on priority species.
- Priority species were defined as follows:
  - South African Red Data species.
  - South African endemics and near-endemics.
  - Raptors
  - Waterbirds
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018) currently exists. Some reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
- The assessment of impacts is based on the baseline environment as it currently exists at the study area.
- Cumulative impacts include all renewable energy projects within a 30 km radius that have received an EA at the time of starting this BA (i.e. by August 2020). Cumulative impacts also included the consideration of approved (i.e. received EA at the start of this BA), existing and two proposed power line projects within the 30 km radius. The list of projects was provided by the CSIR, and it is assumed that the list is complete.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The broader area is defined as the area encompassed by the 12 pentads where the project is located (see Figure 1 above). The study area is defined as the area covered by the application sites and the powerline corridor. The PV footprint is the where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

2.3 Consultation Processes Undertaken

No specific consultative processes were undertaken during the compilation of this assessment.

3. Description of Project Aspects relevant to Avifauna

The following project components are relevant as far as avifauna is concerned:

- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 250 hectares.
- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 500 m^2);
  - Ablution facilities (maximum height 7 m and footprint 50 m^2);
  - Converter/inverter stations (height from 2.5 m to 7 m (maximum) and footprint 2500 m^2);
  - On-site substation and/or a switching substation (footprint 20 000 m^2); and
  - Guard Houses (height 3 m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead power line to connect to the existing Eskom Kappa Substation with a length of 18 – 21km;
  - Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m);
  - Battery storage for each Solar PV project. The proposed battery technology is a Lithium Ion Battery, that will cover an area of up to 8 hectares (within the laydown area) and a height of up to 5 – 10 m;
  - Access roads with width ranging between 4 - 8 m. Approximately 10 - 12 km for the Hoek Doornen PV Project; as well as re-routing of an existing road;
  - Internal gravel roads and service road below the power line (width of 4 m);
  - Fencing (between 2 – 3 m high) around the PV Facilities - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
  - Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm, Hoekdoornen and Grootfontein; and
  - Construction work area (i.e. laydown area of maximum 13 ha).

It must be noted that the specifications provided above apply to a single PV facility and are the same for Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4, unless where specified.

4. Baseline Environmental Description

4.1 General Description

4.1.1 Important Bird Areas (IBAs)

The Cedarberg - Koue Bokkeveld Complex IBA SA101 is the closest IBA and is located approximately 16km west of the study area. The proposed development is not expected to have any impact on the avifauna in this IBA.

4.1.2 Protected Areas

The study area does not form part of a formally protected area. The closest protected area is the Inverdoorn Private Nature Reserve which is located approximately 6 - 10km away at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve.

4.1.3 National Protected Areas Expansion Strategy

The study area is not included in the NPAES except for a small section of the powerline corridor which falls within the Tankwa-Cederberg-Roggeveld focus area, which should not result in a significant impact for the focus area.

4.1.4 The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa

The study area falls within the Komsberg Renewable Energy Zone (REDZ) and is classified as Low Sensitivity for avifauna from a solar PV perspective.

4.1.5 Climate, topography and habitat classes

The study area is located in the Succulent Karoo biome, in the Rainshadow Valley Karoo Bioregion (Mucina & Rutherford 2006). The topography is very flat. The Tankwa Karoo is one of the most arid sections of the

Karoo. Isohyets of mean annual rainfall (mm) for the Karoo indicate that the Tankwa-Karoo National Park, which is situated approximately 50km north of the study area in the same bioregion, falls into the 0-100mm range, with 75% of the mean annual precipitation in winter (https://www.sanparks.org/).

The mean July minimum temperature is 6°C (lowest measured -1°C), and the mean January maximum temperature is 38°C (highest measured 50°C). The highest average maximum temperatures occur from November to March with the hottest months being January and February. The highest wind speeds occur from October to March (https://www.sanparks.org/). The land use in the study area is primarily game farming.

The most important anthropogenic avifaunal-relevant habitat modifications currently present in the study area which could potentially influence the avifaunal community that were recorded in or close to the study area are earth dams, boreholes with water reservoirs and troughs, fences and transmission lines.

The habitat in the study area is discussed in more detail below. The priority species associated with each habitat class are listed in Table 1.

- **Succulent Karoo**

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The dominant vegetation type in the study area is Tankwa Karoo (Mucina & Rutherford 2006), which occurs on the plains where study area is located. The plains are very sparsely vegetated with low succulent shrubland, and in extreme precipitation-poor years could appear almost barren (Mucina & Rutherford 2006). The study area is intersected by several drainage lines, supporting a mosaic of succulent shrublands and clumps of *Vachellia karroo* thickets (drainage line woodland). The stunted *Vachellia karoo* trees are used by a number of species for nesting including priority species such as Pale Chanting Goshawk and various smaller shrubland/woodland species.

Images of the typical vegetation structure on the study area is shown below in Figure 3 and Figure 4.

Figure 3: An example of the dominant Succulent Karoo habitat in the study area, consisting mostly of dwarf shrubs with open ground in between.

Figure 4: An example of a drainage line with shrubs and stunted trees.

See Table 1 for a list of priority species that could utilise the Succulent Karoo habitat associated with the study area.

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid environment. The study area contains a few earth dams located in ephemeral drainage lines, but these are generally dry for most of the year. The dams and drainage lines hold water after good rains, when it is attractive to various bird species, including large raptors, to drink and bath. It also serves as an attraction to waterbirds when it contains water during the winter season, although it must be noted that the study site is generally dry for most of the year. Pools of standing water form in the drainage lines after good rains, which can last for several weeks, depending on the level of precipitation. The study area also contains boreholes with water reservoirs, where surface water becomes available in the form of water troughs, which is an important source of permanent surface water. These water troughs are a big attractant for birds, as they often are the only source of permanent surface water in the area. The wind pumps at the boreholes are also used by a number of species for nesting, including priority species such as Greater Kestrel.

See Figures 5 and 6 for examples of surface water in the study area.

Figure 5: An earth dam in the study area where water is pumped. The dams are dry for most of the year. Note that this dam is located on the Farm Kareekolk (outside of the footprint for the proposed PV plants and power lines).

Figure 6: A borehole and water trough in the study area

See Table 1 for a list of priority species that could utilise the surface water in the study area.

- **Transmission lines**

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2006, 2013). There are no transmission lines in the PV study area itself, but the powerline corridor is crossed by the 2 Droërivier Muldersvlei – Kappa 400kV transmission line. There is a nest originally built by Martial Eagles situated approximately 3.7km from the powerline corridor at its closest point on Tower 26 of the Kappa Muldersvlei 400kV transmission line. The pair of eagles have not bred there in the 2019 and 2020 breeding season, and the nest was used in both years by a pair of Lanner Falcons (see Figure 7).

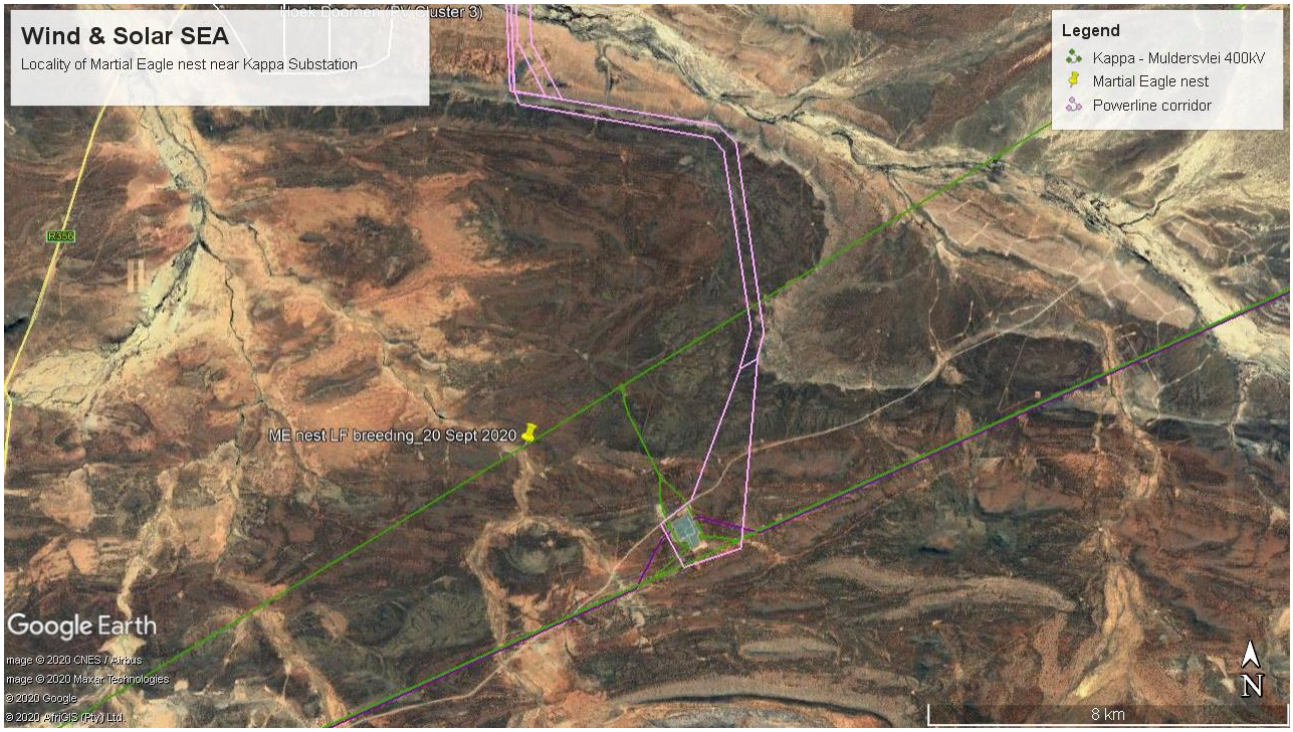

Figure 7: A pair of Lanner Falcons breeding on the Tower 26 of Kappa – Droërivier Muldersvlei 400kV transmission line. High voltage lines are represented by the green and dark purple lines.

See Table 1 for a list of priority species that could utilise the transmission lines near the study area.

- **Fences**

The study area contains a number of fences (see Figure 8 below). Farm fences provide important perching substrate for a wide range of birds in this virtually treeless environment where natural perches are scarce, as a staging post for territorial displays by small birds and also for perch hunting by raptors such as Greater Kestrel, Rock Kestrel, Jackal Buzzard and Pale Chanting Goshawk.

Table 1 lists the priority species which are associated with fences in the study area.

Figure 8: The study area contains many fences.

- **Agriculture**

The principal land-use in the study area is game farming, with the game subsisting on the natural vegetation. Crops are cultivated on a very limited scale and consist mostly of supplementary fodder, especially lucerne, which is usually located near drainage lines and irrigated through a system of boreholes. The agricultural lands attract certain priority species, e.g. Ludwig's Bustard, Spur-winged Goose, Black-headed Heron, Hadeda Ibis and Egyptian Goose.

Table 1 lists the priority species which are associated with cultivation in the study area.

4.1.6 Avifauna

- **Southern African Bird Atlas 2**

It is estimated that a total of 100 bird species could potentially occur in the broader area. Please refer to Appendix F which provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring so far. Of these, 41 species are classified as priority species, and 17 could occur regularly in the study area. The probability of a priority species occurring regularly in the study area is indicated in Table 1.

Table 1 below lists all the priority species and the possible impact on the respective species by the proposed PV facilities, power lines, and associated infrastructure.

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened
- LC = least concern
- L= Low
- M = Medium
- H = High

Table 1: Priority species occurring in the broader area. The likelihood of regular occurrence in the study area is also indicated

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
African Spoonbill	*Platalea alba*	0.00	4.17	x					x	L				x									x
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic	x		L		x					x	x	x	x		x	
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic			H		x			x		x	x	x	x			
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x					x	L				x	x							x	
Booted Eagle	*Aquila pennatus*	8.57	4.17	x				x		M		x		x			x		x	x		x	
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic			H			x	x			x	x	x				
Cape Clapper Lark	*Mirafra apiata*	0.00	0.00	x			Endemic			L	x	x					x	x	x	x			
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic			L			x					x	x		x		
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic			H			x				x		x				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x					x	H	x			x	x	x		x				x	x
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic			H			x					x	x				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x					x	L				x				x					
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x				x		H	x	x				x	x	x	x	x		x	
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic			H	x	x	x					x	x	x			
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic			L		x						x	x	x	x		
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x					x	H			x	x	x								
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic	x		M	x	x		x		x	x		x	x		x	
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic			H	x	x	x					x	x	x			

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT				H	x	x							x	x	x		x
Karoo Lark	*Calendulauda albescens*	0.00	0.00	x			Endemic			L	x	x						x	x	x			
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic			H	x		x					x	x	x			
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU		x		M		x	x	x	x	x	x	x	x	x		x	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic			H	x	x					x	x	x	x			
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic			H			x					x	x	x			
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN				H	x	x			x				x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN		x		M	x	x	x	x	x	x			x	x		x	
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic			H			x					x	x	x			
Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x				x		H	x	x	x	x	x	x	x	x	x	x		x	
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x					x	L	x			x				x					
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic			L	x	x	x	x			x	x	x	x			
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x					x	L				x				x					x
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x				x		H		x					x		x	x		x	
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic			L	x	x	x				x	x	x	x			
South African Shelduck	*Tadorna cana*	14.29	0.00	x					x	M	x			x				x					x
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic			L		x							x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	0.00	0.00	x			Endemic			L	x		x					x	x				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x				x		M	x	x	x		x		x	x	x			x	
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x					x	L				x	x			x					x
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x				x		L	x			x				x	x				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU		x		L		x		x		x			x	x		x	

- **Pre-construction surveys**

As noted above, on-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2). Surveys were conducted according to a Regime 2 site (medium sensitivity) as defined in the best practice guidelines for avifaunal impact studies at solar developments, compiled by BLSA in 2017 (Jenkins *et al.* 2017).

The abundance of priority species (birds/km) recorded during the walk transects is displayed in Figure 9 below.

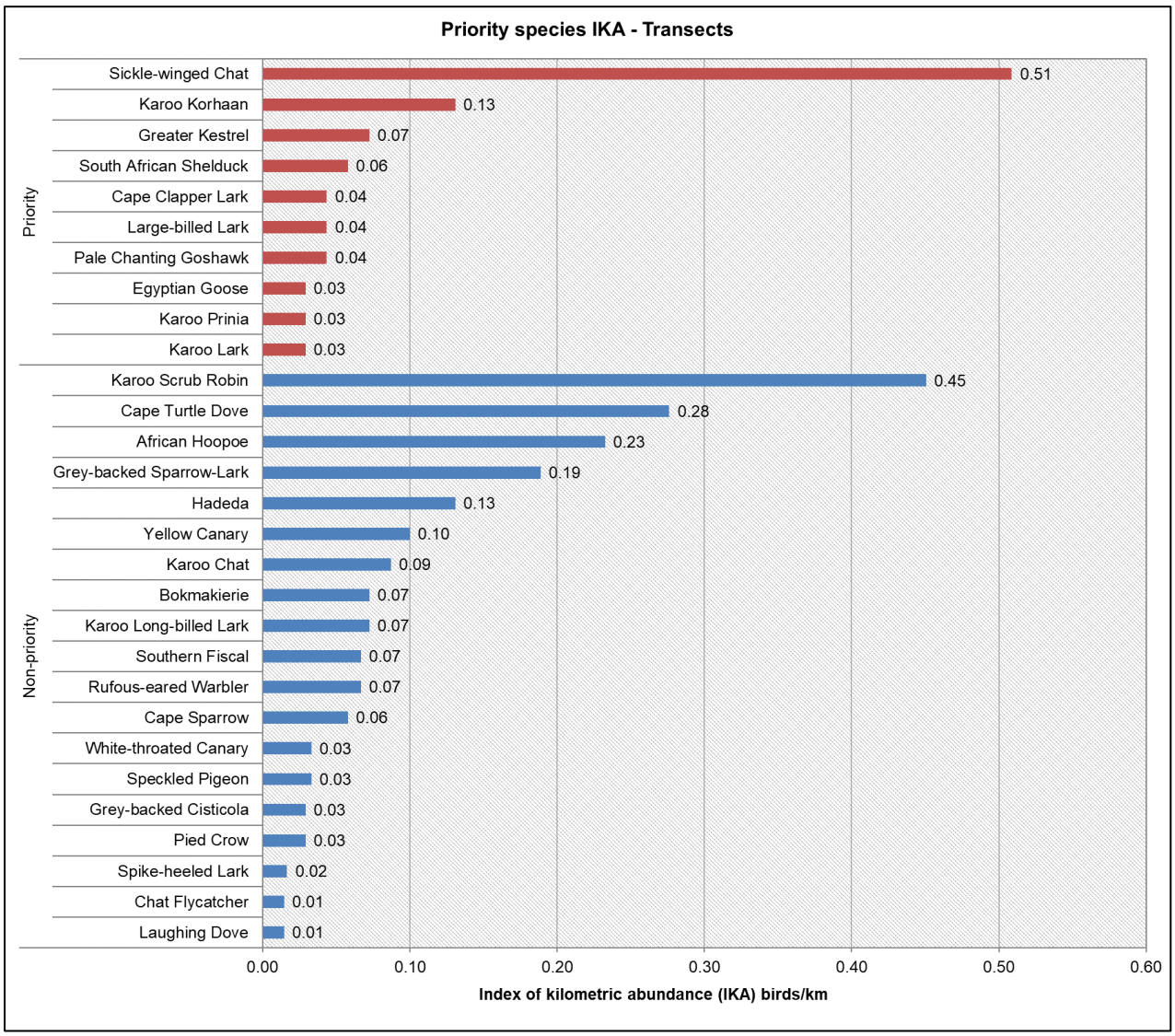

Figure 9: The abundance of priority species recorded during transect counts.

The species which were recorded at focal points are listed in Table 2 below

Table 2: Species recorded at focal points. Priority species are shaded in red.

FP1	FP2	FP3
Karoo Chat	Karoo Korhaan	Brown-throated Martin
Speckled Pigeon	Karoo Chat	Pearl-breasted Swallow
Cape Sparrow	Cape Wagtail	Pied Avocet
Southern Fiscal	Egyptian Goose	South African Shelduck
Yellow Canary	Malachite Sunbird	Three-banded Plover
Karoo Lark	Yellow Canary	Yellow Canary
Bokmakierie	Pied Crow	
Cape Bunting	Cape Turtle Dove	
Malachite Sunbird		
Grey Tit		
Southern Double-collared Sunbird		
Lark-like Bunting		
White-throated Canary		

Table 3 lists the priority species which were recorded as incidental records.

Table 3: Priority species which were recorded as incidental records.

Species	Number
Karoo Korhaan	5
Karoo Lark	3
Ludwig's Bustard	3
Pale Chanting Goshawk	3
Pied Starling	3
Grey Heron	2
Karoo Prinia	2
South African Shelduck	2
Greater Kestrel	1
Jackal Buzzard	1
Karoo Eremomela	1
Large-billed Lark	1
Martial Eagle	1
Spotted Eagle-Owl	1

The overall abundance of priority species at the site was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

4.2 Project Specific Description

4.2.1. Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.2. Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). There is one small earth dam located in the south of the PV footprint. The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.3. Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small earth dam located in the extreme west of the PV footprint. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.4. Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.3. Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the Screening Tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF Screening Tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high

sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

See Appendix C for the Site Sensitivity Verification report and Figures 10 and 11 for maps of the sensitivities identified by the screening tool for PV solar (Avifauna) and powerlines (Animal Species Theme).

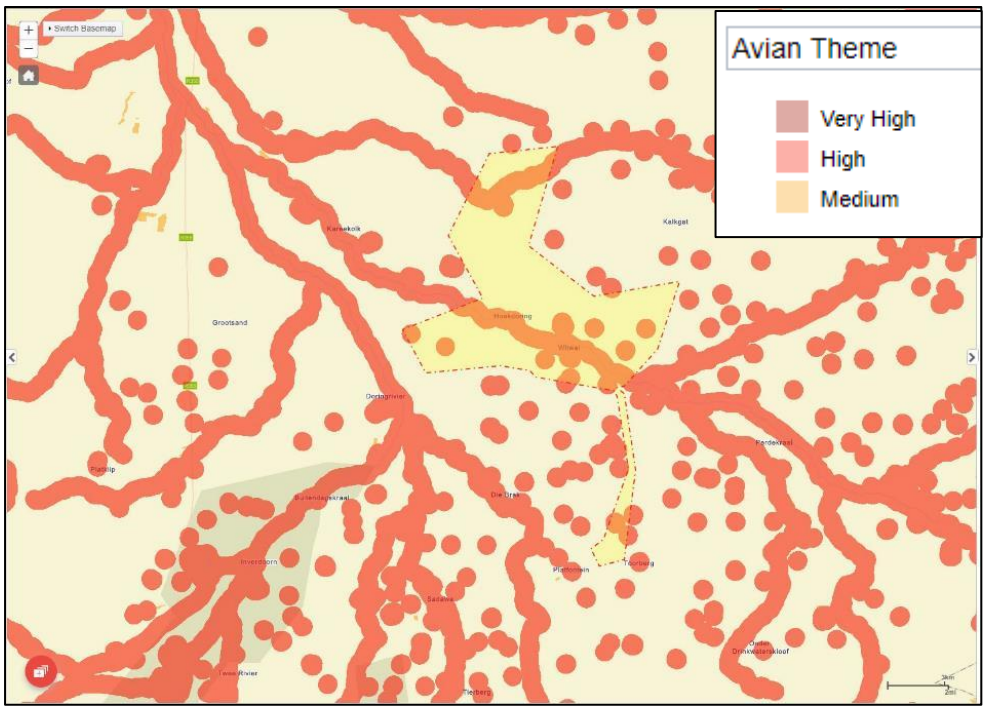

Figure 10: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the solar PV avifaunal theme.

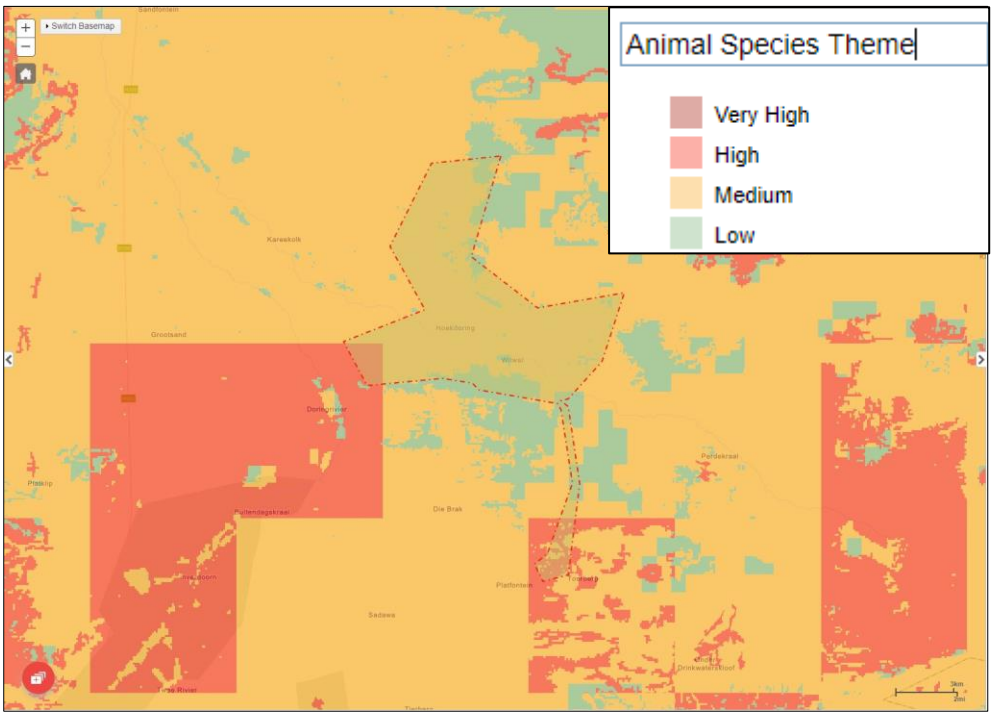

Figure 11: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the powerline general animal species theme.

4.3.1.1 Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated **Infrastructure**

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.2 Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity with one area of high sensitivity, a small earth dam. The dam is very small and basically dry for the majority of the year. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.3 Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity with one area of high sensitivity, a small earth dam. The dam is very small and basically dry for the majority of the year. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.4 Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

See Figures 12 and 13 for the avifaunal sensitivities identified from a PV solar and powerline perspective at the four Hoek Doornen PV facilities, electrical grid infrastructure and associated infrastructure.

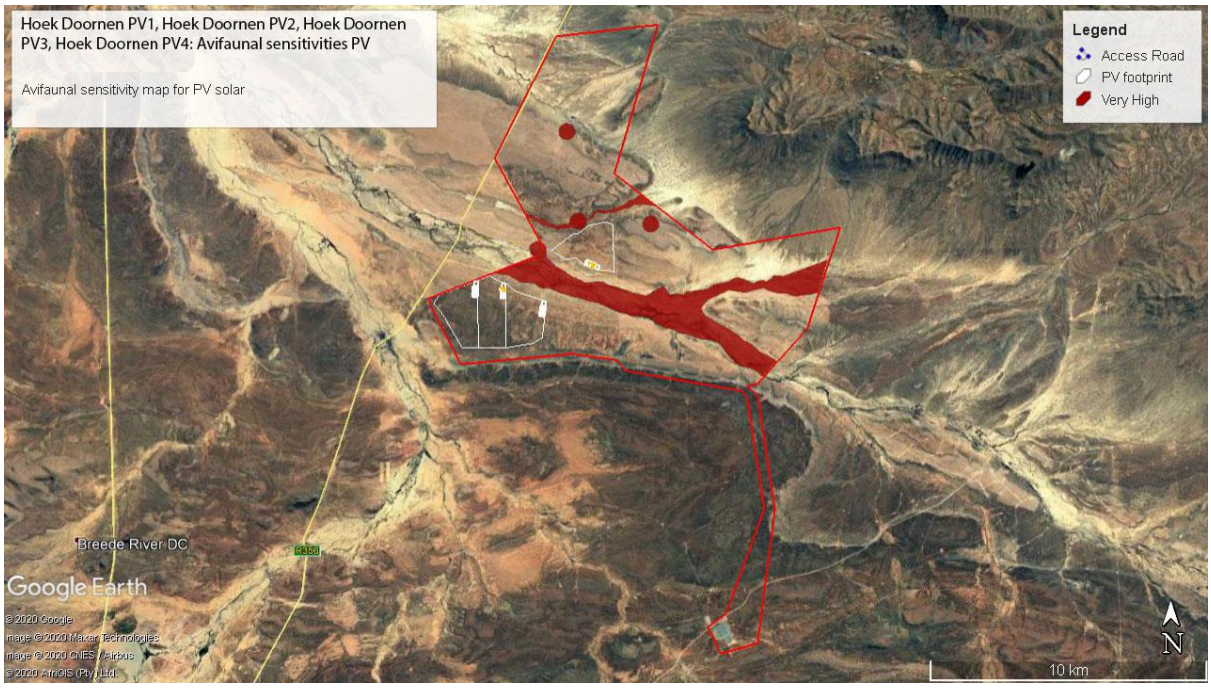

Figure 12: Avifaunal sensitivities (for the PV solar) at the four Hoek Doornen PV facilities and associated infrastructure. These are only for the PV panels, not for associated infrastructure e.g. powerlines.

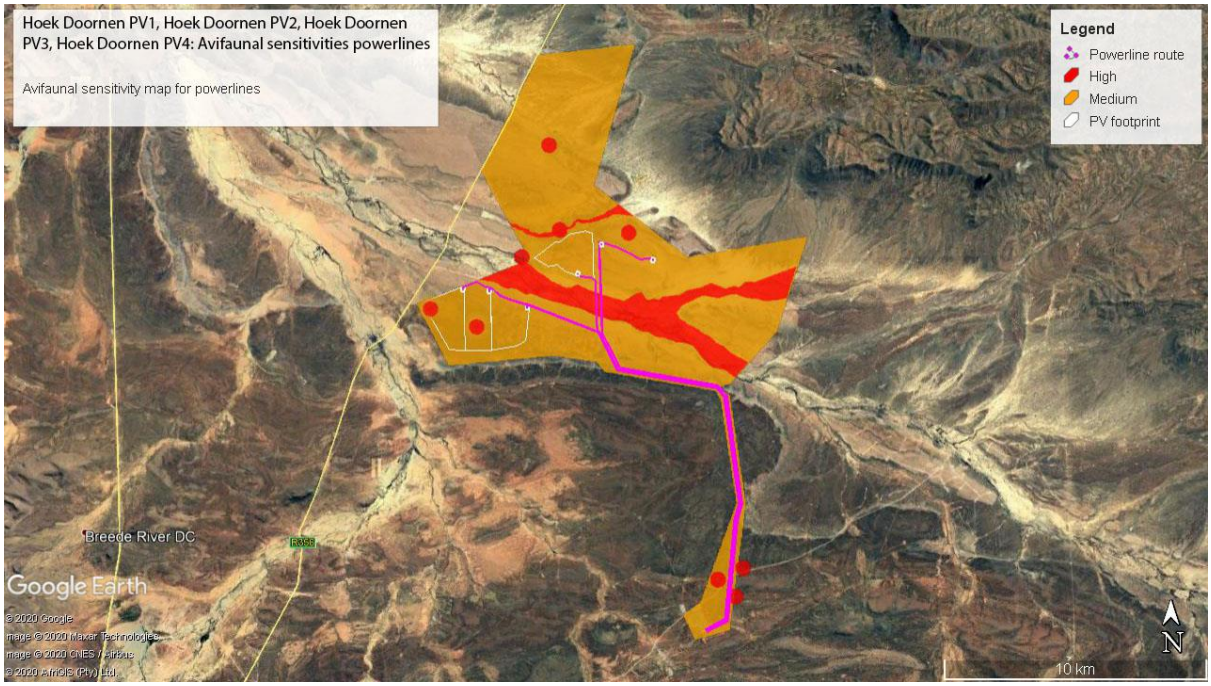

Figure 13: Avifaunal sensitivities (for the powerlines) at the four Hoek Doornen PV facilities and associated electrical grid infrastructure.

4.3.2.1 Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.2 Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.3 Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.4 Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the

power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.3 Sensitivity Analysis Summary Statement

- PV solar: Avifaunal theme

The site investigation revealed that the site is generally low sensitivity with a few **very highly (No-Go)** sensitive areas namely water reservoirs, drainage lines and priority species nests. The sensitivity ratings in the DEFF screening tool are therefore partially confirmed as far as the low sensitivity areas are concerned. However, a few very highly sensitive areas were identified which do not appear in the screening tool.

- Powerline: Animal Species theme

The site investigation revealed that the sensitivity rating of medium sensitivity is accurate for avifauna as far as powerlines are concerned, but there are also areas of **high sensitivity**, namely water reservoirs, drainage lines and earth dams. There are no No-Go areas as far as powerlines are concerned.

See Appendix C for the site verification reports.

5 Issues, Risks and Impacts

5.1 Identification of Potential Impacts/Risks

The potential impacts identified in the course of the study are:

5.1.1 Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

5.1.2 Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

5.1.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

5.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

6 Impact Assessment

6.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006, the World Wide Fund for Nature (WWF) Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth & Mallon 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change; and
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, loss occurs without accompanying range expansion.
- For 188 species, loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi & Sebitosi 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

6.2 Impacts associated with PV plants and associated infrastructure

6.2.1 Impact trauma (collisions)

This impact refers to collision-related fatality i.e. fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called “lake effect” i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[1]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility in California (44%) may support the “lake effect” hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). However, until such time that enough scientific evidence has been collected to discount the “lake effect” hypothesis, it must be considered as a potential source of impacts.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of

[1] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550MW, 1 600ha Desert Sunlight PV plant in California. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/yr (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2019).

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially

affected by this impact are mostly small birds which forage between the solar panels, and possibly raptors which prey on them.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.2 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence.

It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.3 Displacement due to disturbance and habitat transformation associated with the construction and operation of the solar PV facilities

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the semi-desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are *typically* associated with the construction and operation of solar facilities and could have direct impacts on avifauna (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Increased vehicle traffic;
- Short-term construction-related noise (from equipment) and visual disturbance;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;

- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging and roosting in or in close proximity through disturbance and transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2019) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. The most significant finding of Visser *et al*. (2019) was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialist species appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser *et al.* 2019).

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area of the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities.

As far as displacement, either completely or partially (reduced densities) due to habitat loss and transformation is concerned, it is highly likely that the same pattern of reduced avifaunal densities for shrubland species, as explained above, will manifest itself at the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 facility. In addition, raptors and large terrestrial species could also be impacted.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.4 Electrocutions

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 (van Rooyen 2004). The electrocution risk is largely determined by the design of the electrical hardware. There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, on the internal 33kV powerlines within the footprint of the PV facilities, should the decision be to not go underground with the reticulation network. This is

especially a major problem for the larger Red Listed species, e.g. Martial Eagle, as it is envisaged that they will frequently perch on the power poles.

See Table 1 for list of species which could potentially be affected by this impact.

6.3 Impacts associated with electricity grid infrastructure

Negative impacts on birds by electricity infrastructure generally take two principal forms, namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). In this instance, the major potential impact with the 132kV grid connections is powerline collisions.

6.3.1 Collisions with the 132kV grid connections

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Shaw 2013).

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini *et al*. 2005, Jenkins *et al*. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin *et al*. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown *et al.* 1987, Henderson *et al.* 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power

lines that they can see but do not have enough flight control to avoid (Brown *et al*. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins *et al.* 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al.* 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin *&* Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks*.* In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite evidence that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the Bird Flight Diverters were critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

Quantifying the collision impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the EWT, it is possible to give a measure of what species are susceptible to powerline collisions (see Figure 14). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

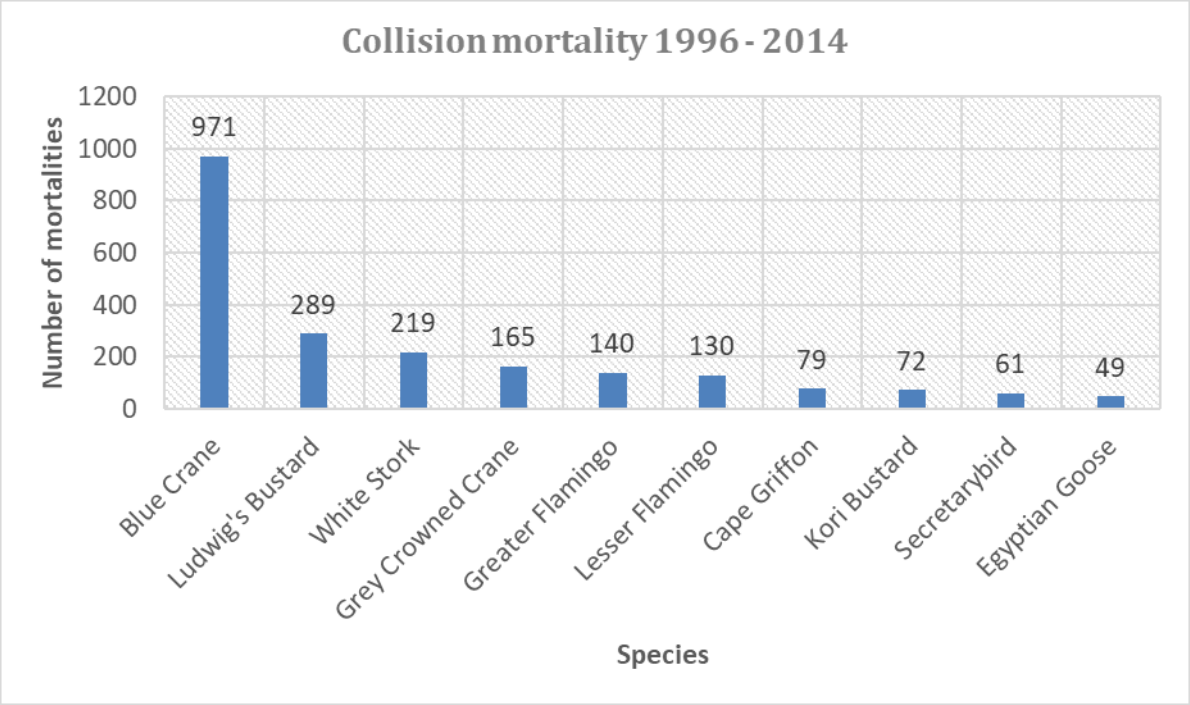

Figure 14: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data 2014).

Species potentially at risk of collisions with the 132kV grid connection are listed in Table 1.

6.4 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments that have received an Environmental Authorisation within at least a 30km radius of the proposed site, as well as the nine proposed Veroniva Ceres PV developments and associated grid connections (i.e. total of nine power lines). There are currently 11 renewable energy projects authorised within a 30km radius around the proposed nine Veroniva Ceres PV projects. Of these, only two are solar PV projects, and one is a hybrid wind and solar PV project. The locality of renewable projects (land parcels) which are authorised are displayed in Figure 15 and listed in Appendix G.

The total affected land parcel area taken up by authorised renewable energy projects and their grid connections within the 30km radius is approximately 44 578 ha. The total affected land parcel area of the nine Veroniva Ceres PV projects and grid connections comprises approximately 18 232ha. If one assumes that all nine Veroniva projects will be authorised, the combined land parcel area affected by renewable energy developments within the 30km radius around the Veroniva projects will equal 62 810 ha. The total area within the 30km radius around the proposed projects equates to about 502 776ha of similar habitat. The total combined size of the land parcels affected by renewable energy projects and their grid connections will thus equate to 12.4% of the available habitat in the 30km radius. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves, for example in the case of wind energy, the physical footprint comprises less than 5% of the project area. Furthermore, each of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction. The cumulative impact of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV projects is thus anticipated to be **low** after mitigation.

The proposed grid connections of the 9 Veroniva Ceres PV projects equates to about 184km. However, approximately 135km of line will be routed parallel in one “highway”, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 64km. There are approximately 221km of existing and 83km (total = 304km) of planned transmission lines within the 30km radius around the Veroniva Ceres PV projects. These projects will thus increase the total number of planned and existing high voltage lines by 21%. The cumulative impact of the planned grid connections is therefore considered to be **moderate** from a potential bird collision perspective after mitigation.

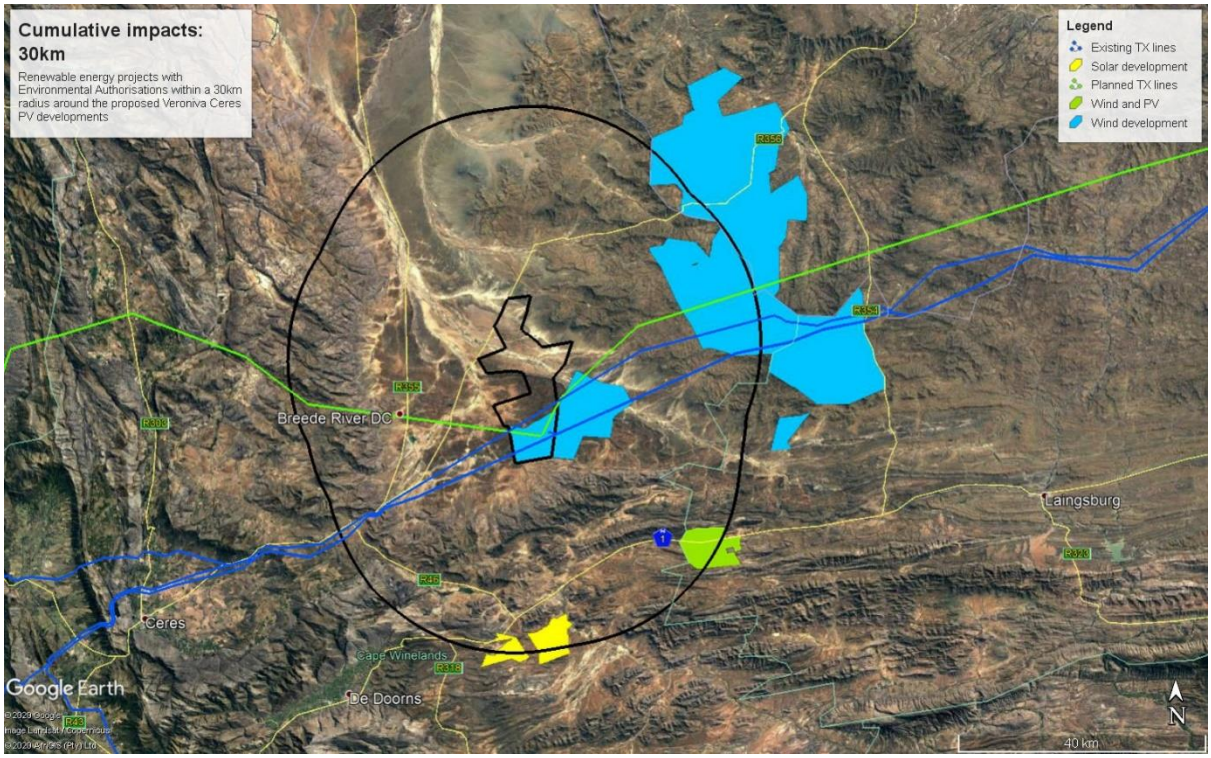

Figure 15: Map showing location of land parcels with authorised renewable energy projects within a 30km radius around the study area. This map also shows proposed and existing power lines within the 30km radius.

6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. No fatal flaws were discovered in the course of the investigations.

6.6 Hoek Doornen PV 1, PV 2, PV 3 and PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure[2]

This section includes a description of the assessment of the potential impacts identified for avifauna for the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, Hoek Doornen PV 4 and all associated infrastructure, including the power lines. No indirect impacts have been identified for the proposed project from an avifaunal perspective.

[2] Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects

6.6.1. Potential Impacts during the Construction Phase

The following impacts have been identified for the construction phase.

6.6.1.1. **Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure**

The noise and movement associated with the construction activities at the proposed PV footprints for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, and associated infrastructure (including roads and substation) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.1.2 below.

6.6.1.2. **Impact Summary Tables: Construction Phase**

The rating of the impacts identified for the construction phase is discussed in this section.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
CONSTRUCTION PHASE						
Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.2. Potential Impacts during the Operational Phase

The following impacts have been identified for the operational phase.

6.6.2.1. **Impact 1**: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.2. **Impact 2:** Bird mortality through collisions with the solar panels.

This impact relates to the bird kills and injury as a result of potential collisions with the solar panels. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a slight consequence and unlikely probability, which will render the impact significance as very low. As detailed in Section 6.6.2.6 below, no mitigation is required due to the very low impact significance.

6.6.2.3. **Impact 3:** Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.

This impact pertains to the entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the long timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is rated with a moderate consequence and likely probability, which will result in a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to very low. The recommended mitigation measure includes using a single perimeter fence around the PV Facility.

6.6.2.4. **Impact 4:** Electrocution of priority species on the internal 33kV powerlines.

This impact deals with the potential electrocution of priority species on the internal 33kV powerlines at the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 facilities. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will result in an impact significance of high, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. use underground cabling), the significance of the impact is reduced to very low.

6.6.2.5. **Impact 5:** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.6. **Impact Summary Tables: Operational Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
OPERATIONAL PHASE						
Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.	*Status*	*Negative*	*High (2)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *A 300m infrastructure-free buffer must be maintained around the water reservoirs (see sensitivity map Figure 12).* ▪ *No solar PV arrays must be constructed in drainage lines (see sensitivity map Figure 12).*	*Moderate (3)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
OPERATIONAL PHASE						
Mortality through collisions with the solar panels	*Status*	*Negative*	*Very low (5)*	*No mitigation is required due to the very low significance*	*Very low (5)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Slight*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	*Status*	*Negative*	*Low (4)*	*A single perimeter fence should be used.*	*Very low (5)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Electrocution of priority species on the internal 33kV powerlines.	*Status*	*Negative*	*High (2)*	*Use underground cabling*	*Very Low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Collision mortality of priority species due to the 132kV grid connections.	*Status*	*Negative*	*High (2)*	*The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be*	*Moderate (3)*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
	Probability	*Likely*		*marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.*		
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.3. Potential Impacts during the Decommissioning Phase

The following impacts have been identified for the decommissioning phase.

6.6.3.1. **Impact 1:** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.3.2 below.

6.6.3.2. **Impact Summary Tables: Decommissioning Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the displacement of avifauna from the area.	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.4. Cumulative Impacts

The following cumulative impacts have been identified.

6.6.4.1. **Impact 1: Construction Phase -** Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities of similar projects within the 30 km radius will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.7 below.

6.6.4.2. **Impact 2**: **Operational Phase** - Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines

This impact deals with the following during the operational phase with regards to other similar projects in the 30 km radius:

- Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure;
- Bird mortality and injury as a result of collisions with the solar panels;
- Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality;
- Electrocution of priority species on the internal 33kV powerlines; and
- Collisions with the 132kV grid connections.

This impact is rated as negative, with a regional spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.3. **Impact 3: Operational Phase -** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections during the operational phase with regards to other similar projects in the 30 km radius. This impact is rated as negative, with a local spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.4. **Impact 4: Decommissioning Phase -** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities (in terms of other similar projects in the 30 km radius) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.5. **Impact Summary Tables: Cumulative Impacts**

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Site specific* *Short term* *Substantial* *Very likely* *High* *Low*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
OPERATIONAL PHASE						
Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Regional* *Long term* *Substantial* *Likely* *High* *Low*	*Moderate (3)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *Infrastructure-free buffers must be maintained around the water reservoirs*	*Low (4)*	*Medium*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
				▪ No solar PV arrays must be constructed in drainage lines ▪ A single perimeter fence should be used. ▪ Use underground cabling		
Collisions with the 132kV grid connection	Status	Negative	High (2)	▪ The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.	Moderate (3)	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Low				
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the	Probability	Negative	Moderate (3)	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry.	Low (4)	Medium
	Reversibility	Site specific				
	Irreplaceability	Short term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	High				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
displacement of avifauna from the area	*Irreplaceability*	*Low*		▪ *Maximum use should be made of existing access roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*		

7 Impact Assessment Summary

The overall impact significance is provided in this section, in terms of pre- and post-mitigation.

Table 4: Overall Impact Significance (Pre- and Post Mitigation)

Phase	Overall Impact Significance (Pre Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

8 Legislative and Permit Requirements

8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical grid infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of BLSA i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. *Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa*. This guideline has been considered in this assessment.

8.1.1 Agreements and conventions

International agreements and conventions are described in this section.

Table 5: International agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of AEWA is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has three main objectives: • The conservation of biological diversity; • The sustainable use of the components of biological diversity; and	Global

Convention name	Description	Geographic scope
	• The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the UNEP, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

8.1.2 National legislation

8.1.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
    (i) prevent pollution and ecological degradation;
    (ii) promote conservation; and
    (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

8.1.2.2 The National Environmental Management Act (Act 107 of 1998, as amended)

The NEMA creates the legislative framework for environmental protection in South Africa, and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be

performed only after an EIA or BA has been undertaken and environmental authorisation has been obtained from the relevant competent authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 and the Threatened or Protected Species Regulations, February 2007

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 5 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

8.1.2.4 Provincial legislation

8.1.2.4.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wild animals, including avifauna.

9 Environmental Management Programme Inputs

Please see a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

9.1 Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[3].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement					
Displacement of avifauna due to habitat loss in the development footprint.	Prevent displacement of avifauna	1. A 300m infrastructure-free buffer must be maintained at waterpoints in terms of the sensitivities determined for the power lines. 2. No solar panels to be constructed in drainage lines	Design the facility with 300m buffers around boreholes and with no solar panels in drainage lines.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution					
Electrocution of raptors on the internal 33kV poles	Prevent electrocutions	1. Use underground cabling	Design the facility with underground cabling	Once-off during the planning phase.	Project Developer

[3] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

9.2 Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connection.	Prevention of collision mortality on the powerline.	Pro-active marking of identified high risk spans with Bird Flight Diverters (BFDs), based on walk-through by the avifaunal specialist.	1. Walk-through by avifaunal specialist prior to implementation to identify high risk spans. 2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.	1. Once-off during the construction phase. 2. Once-off during the construction phase.	1. Facility Environmental Manager 2. Facility operational manager

9.3 Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Project Developer 2. Facility Environmental Manager 3. Project Developer and Facility Operational Manager
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connections.	Prevention of collision mortality on the powerlines.	Reactive marking of identified high risk spans with Bird Flight Diverters (BFDs), based on regular powerline inspections by the avifaunal specialist.	1. Powerline inspections by avifaunal specialist to look for carcasses. 2. Implementation of	1. Monthly 2. Monthly	1. Facility Environmental Manager 2. Facility Operational Manager

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.		

10 Final Specialist Statement and Authorisation Recommendation

10.1 Statement and Reasoned Opinion

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in Section 9 above.

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Appendices

Appendix A: Specialist Expertise

Appendix B: Specialist statement of independence

Appendix C: Site sensitivity verification

Appendix D: Impact Assessment methodology

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Appendix F: Species List

Appendix G: List of renewable energy projects within 30km radius

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Appendix A - Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring

29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape

4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. Scatec Solar Kenhardt PV 4, PV 5 and PV6 Projects, Kenhardt, Northern Cape
15. NamPower CSP Facility near Arandis, Namibia
16. Dayson Klip PV Facility near Upington, Northern Cape
17. Geelkop PV Facility near Upington, Northern Cape
18. Oya PV Facility, Ceres, Western Cape
19. Vrede and Rondawel PV Facilities, Free State
20. Kolkies & Sadawa PV Facilities, Western Cape
21. Leeudoringstad PV Facility, North-West

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation

37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV

94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra – “Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works,

Gauteng.

11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Albert Froneman **(**Pr.Sci.Nat) has more than 18 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

Renewable Energy Facilities – avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project
17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring
19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring
20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Utrecht Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Facility (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)

27. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
28. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
29. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
30. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
31. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
32. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
33. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
34. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
35. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
36. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
37. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
38. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
39. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
40. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
41. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
42. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
43. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
44. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
45. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
46. Pofadder Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
47. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
48. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
49. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.
2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study
4. Bird Impact Assesment Study - Bird Helicopter Interaction – The Bitou River, Western Cape Province South Africa
5. Proposed La Mercy Airport – Bird Aircraft interaction specialists study using bird detection radar to assess swallow flocking behaviour
6. KwaZulu Natal Power Line Vulture Mitigation Project – GIS analysis
7. Perseus-Zeus Powerline EIA – GIS Analysis
8. Southern Region Pro-active GIS Blue Crane Collision Project.
9. Specialist advisor ~ Implementation of a bird detection radar system and development of an airport wildlife hazard management and operational environmental management plan for the King Shaka International Airport
10. Matsapha International Airport – bird hazard assessment study with management recommendations
11. Evaluation of aviation bird strike risk at candidate solid waste disposal sites in the Ekurhuleni Metropolitan Municipality
12. Gateway Airport Authority Limited – Gateway International Airport, Polokwane: Bird hazard assessment; Compile a bird hazard management plan for the airport
13. Bird Specialist Study - Evaluation of aviation bird strike risk at the Mwakirunge Landfill site near Mombasa Kenya
14. Bird Impact Assessment Study - Proposed Weltevreden Open Cast Coal Mine Belfast, Mpumalanga
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Mpumalanga

16. Avifaunal Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
17. Avifaunal Impact Assessment Study (with specific reference to African Grass Owls and other Red List species) Stone Rivers Arch
18. Airport bird and wildlife hazard management plan and training to Swaziland Civil Aviation Authority (SWACAA) for Matsapha and Sikhupe International Airports
19. Avifaunal Impact Scoping & EIA Study - Renosterberg Wind Farm and Solar PV site
20. Bird Impact Assessment Study - Proposed 60 year Ash Disposal Facility near to the Kusile Power Station
21. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
22. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
23. Habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
24. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
25. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
26. Avifaunal Specialist Study – Rooikat Hydro Electric Dam – Hope Town, Northern Cape
27. The Stewards Pan Reclamation Project – Bird Impact Assessment study
28. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production
3. ESKOM Power line Riversong EIA – GIS specialist & map production
4. ESKOM Power line Waterberg NDP EIA – GIS specialist & map production
5. ESKOM Power line Bulge Toulon EIA – GIS specialist & map production
6. ESKOM Power line Bulge DORSET EIA – GIS specialist & map production
7. ESKOM Power lines Marblehall EIA – GIS specialist & map production
8. ESKOM Power line Grootpan Lesedi EIA – GIS specialist & map production
9. ESKOM Power line Tanga EIA – GIS specialist & map production
10. ESKOM Power line Bokmakierie EIA – GIS specialist & map production
11. ESKOM Power line Rietfontein EIA – GIS specialist & map production
12. Power line Anglo Coal EIA – GIS specialist & map production
13. ESKOM Power line Camcoll Jericho EIA – GIS specialist & map production
14. Hartbeespoort Residential Development – GIS specialist & map production
15. ESKOM Power line Mantsole EIA – GIS specialist & map production
16. ESKOM Power line Nokeng Flourspar EIA – GIS specialist & map production
17. ESKOM Power line Greenview EIA – GIS specialist & map production
18. Derdepoort Residential Development – GIS specialist & map production
19. ESKOM Power line Boynton EIA – GIS specialist & map production
20. ESKOM Power line United EIA – GIS specialist & map production
21. ESKOM Power line Gutshwa & Malelane EIA – GIS specialist & map production
22. ESKOM Power line Origstad EIA – GIS specialist & map production
23. Zilkaatsnek Development Public Participation –map production
24. Belfast – Paarde Power line - GIS specialist & map production
25. Solar Park Solar Park Integration Project Bird Impact Assessment Study – avifaunal GIS analysis.
26. Kappa-Omega-Aurora 765kV Bird Impact Assessment Report – Avifaunal GIS analysis.
27. Gamma – Kappa 2nd 765kV – Bird Impact Assessment Report – Avifaunal GIS analysis.
28. ESKOM Power line Kudu-Dorstfontein Amendment EIA – GIS specialist & map production.
29. Proposed Heilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA – GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map production

37. City of Tswane – New bulkfeeder pipeline projects x3 Map production
38. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
39. ESKOM Geluk Rural Powerline GIS & Mapping
40. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
41. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
42. ESKOM Lephalale CNC – GIS Specialist & Mapping
43. ESKOM Marken CNC – GIS Specialist & Mapping
44. ESKOM Lethabong substation and powerlines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional affiliations

South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.

Appendix B - Specialist Statement of Independence

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive Plettenberg Bay			
Postal address:	P.O Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen 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

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company:

1 November 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Chris van Rooyen, 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

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company

1 November 2020

Date

Signature of the Commissioner of Oaths

2020-11-01

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2020 -11- 01
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	25-27 August 2020 and 16 – 19 September 2020
Specialist Name	Chris van Rooyen
Professional Registration Number	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.
Specialist Affiliation / Company	Chris van Rooyen Consulting

1 Methodology

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the study area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity BGIS map viewer (SANBI 2020).
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017).

2 Results

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the screening tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of very high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF screening tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

3 Concluding statement

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

Appendix D: Impact Assessment Methodology

The following impact assessment was used in this study.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

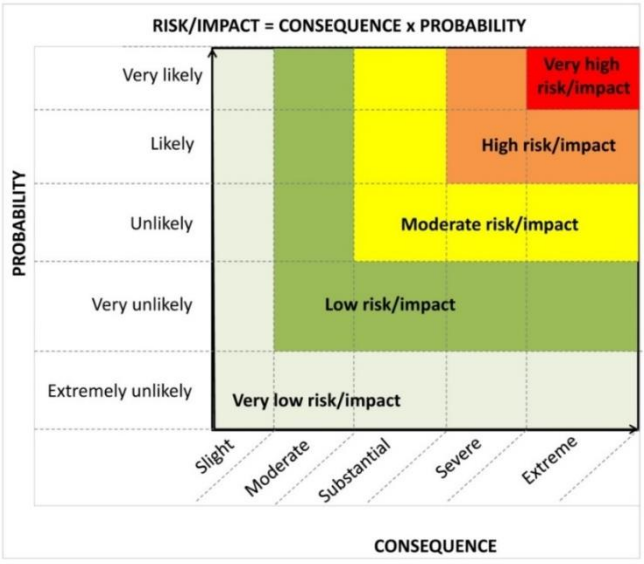

Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been 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;*	*Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
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 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4 and Section 6*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 4*
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;	*Section 5*
g) an identification of any areas to be avoided, including buffers;	*Section 4*
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;	*Section 4*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2 (i.e. Section 2.2)*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and Section 10*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Appendix H*
l) any conditions for inclusion in the environmental authorisation;	*Appendix H*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Appendix H*
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*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Not Applicable*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable. Refer to the BA Report for additional information.*
q) any other information requested by the competent authority.	*Not Applicable. Refer to the BA Report for additional information.*
(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.	*Appendix C (i.e. Part A of the Assessment Protocols published in GN 320 on 20 March 2020 (i.e. Site sensitivity verification*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been addressed in the Specialist Report*
	requirements where a specialist assessment is required but no specific assessment protocol has been prescribed)).

Appendix F: Species Lists

Species recorded by SABAP2 in the broader area

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Acacia Pied Barbet	*Tricholaema leucomelas*	14.29	0.00				
African Black Swift	*Apus barbatus*	2.86	0.00				
African Pipit	*Anthus cinnamomeus*	0.00	4.17				
African Reed-warbler	*Acrocephalus baeticatus*	2.86	0.00				
African Spoonbill	*Platalea alba*	0.00	4.17	x			
Alpine Swift	*Tachymarptis melba*	11.43	4.17				
Anteating Chat	*Myrmecocichla formicivora*	5.71	0.00				
Barn Swallow	*Hirundo rustica*	11.43	4.17				
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x			
Bokmakierie	*Telophorus zeylonus*	54.29	4.17				
Booted Eagle	*Aquila pennatus*	8.57	4.17	x			
Brown-throated Martin	*Riparia paludicola*	20.00	0.00				
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic
Cape Bunting	*Emberiza capensis*	57.14	29.17				
Cape Penduline-tit	*Anthoscopus minutus*	8.57	0.00				
Cape Robin-chat	*Cossypha caffra*	5.71	0.00				
Cape Sparrow	*Passer melanurus*	77.14	20.83				
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic
Cape Turtle-dove	*Streptopelia capicola*	28.57	0.00				
Cape Wagtail	*Motacilla capensis*	40.00	12.50				
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic
Capped Wheatear	*Oenanthe pileata*	0.00	4.17				
Cardinal Woodpecker	*Dendropicos fuscescens*	2.86	0.00				
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	28.57	8.33				
Common Fiscal	*Lanius collaris*	57.14	16.67				
Common Ostrich	*Struthio camelus*	11.43	0.00				
Common Quail	*Coturnix coturnix*	2.86	0.00				
Common Waxbill	*Estrilda astrild*	17.14	4.17				
Dusky Sunbird	*Cinnyris fuscus*	5.71	4.17				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x			
European Bee-eater	*Merops apiaster*	14.29	4.17				
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic
Familiar Chat	*Cercomela familiaris*	45.71	0.00				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x			
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x			
Greater Striped Swallow	*Hirundo cucullata*	8.57	8.33				
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic
Grey-backed Cisticola	*Cisticola subruficapilla*	62.86	12.50				
Grey-backed Sparrowlark	*Eremopterix verticalis*	5.71	0.00				
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic (SA, Lesotho, Swaziland)
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x			
Helmeted Guineafowl	*Numida meleagris*	0.00	4.17				
House Sparrow	*Passer domesticus*	14.29	0.00				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic
Karoo Chat	*Cercomela schlegelii*	100.00	41.67				
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT	
Karoo Lark	*Calendulauda albescens*	74.29	33.33				Near endemic
Karoo Long-billed Lark	*Certhilauda subcoronata*	25.71	4.17				
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic
Karoo Scrub-robin	*Cercotrichas coryphoeus*	62.86	12.50				
Kittlitz's Plover	*Charadrius pecuarius*	2.86	0.00				
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic
Lark-like Bunting	*Emberiza impetuani*	14.29	0.00				
Laughing Dove	*Streptopelia senegalensis*	2.86	0.00				
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic
Little Swift	*Apus affinis*	17.14	0.00				
Long-billed Crombec	*Sylvietta rufescens*	17.14	0.00				
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN	
Malachite Sunbird	*Nectarinia famosa*	31.43	12.50				
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN	
Mountain Wheatear	*Oenanthe monticola*	2.86	16.67				
Namaqua Dove	*Oena capensis*	14.29	12.50				
Namaqua Sandgrouse	*Pterocles namaqua*	17.14	0.00				
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic
Neddicky	*Cisticola fulvicapilla*	2.86	0.00				
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x			
Pied Crow	*Corvus albus*	51.43	16.67				
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic (SA, Lesotho, Swaziland)
Pin-tailed Whydah	*Vidua macroura*	0.00	4.17				
Pririt Batis	*Batis pririt*	20.00	0.00				
Red-capped Lark	*Calandrella cinerea*	2.86	4.17				
Red-faced Mousebird	*Urocolius indicus*	8.57	0.00				
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x			
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x			
Rock Martin	*Hirundo fuligula*	62.86	25.00				
Rufous-eared Warbler	*Malcorus pectoralis*	68.57	25.00				
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic
South African Shelduck	*Tadorna cana*	14.29	0.00	x			
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic
Southern Double-collared Sunbird	*Cinnyris chalybeus*	42.86	4.17				Near endemic
Southern Masked-weaver	*Ploceus velatus*	22.86	0.00				
Southern Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x			
Speckled Pigeon	*Columba guinea*	34.29	16.67				
Spike-heeled Lark	*Chersomanes albofasciata*	45.71	4.17				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x			
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x			
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x			
Tractrac Chat	*Cercomela tractrac*	22.86	0.00				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU	
White-backed Mousebird	*Colius colius*	34.29	4.17				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
White-breasted Cormorant	*Phalacrocorax carbo*	0.00	4.17	x			
White-necked Raven	*Corvus albicollis*	20.00	4.17				
White-rumped Swift	*Apus caffer*	14.29	0.00				
White-throated Canary	*Crithagra albogularis*	57.14	12.50				
Willow Warbler	*Phylloscopus trochilus*	2.86	0.00				
Yellow Canary	*Crithagra flaviventris*	85.71	37.50				
Yellow-bellied Eremomela	*Eremomela icteropygialis*	8.57	8.33				

Species recorded during the pre-construction monitoring

Priority Species		**Transects**	**Focal point**	**Incidental**
Cape Clapper Lark	*Mirafra apiata*	*		
Egyptian Goose	*Alopochen aegyptiaca*	*	*	
Greater Kestrel	*Falco rupicoloides*	*		*
Grey Heron	*Ardea cinerea*			*
Grey Tit	*Melaniparus afer*		*	
Jackal Buzzard	*Buteo rufofuscus*			*
Karoo Eremomela	*Eremomela gregalis*			*
Karoo Korhaan	*Eupodotis vigorsii*	*	*	*
Karoo Lark	*Calendulauda albescens*	*	*	*
Karoo Prinia	*Prinia maculosa*	*		*
Large-billed Lark	*Galerida magnirostris*	*		*
Ludwig's Bustard	*Neotis ludwigii*			*
Martial Eagle	*Polemaetus bellicosus*			*
Pale Chanting Goshawk	*Melierax canorus*	*		*
Pied Avocet	*Recurvirostra avosetta*		*	
Pied Starling	*Lamprotornis bicolor*			*
Sickle-winged Chat	*Emarginata sinuata*	*		
South African Shelduck	*Tadorna cana*	*	*	*
Southern Double-collared Sunbird	*Cinnyris chalybeus*		*	
Spotted Eagle-Owl	*Bubo africanus*			*
Three-banded Plover	*Charadrius tricollaris*		*	
Yellow-billed Kite	*Milvus aegyptius*			*
22	*Priority Species sub-total:*	10	8	15
Non-Priority Species		**Transects**	**Focal point**	
African Hoopoe	*Upupa africana*	*		
Bokmakierie	*Telophorus zeylonus*	*	*	
Brown-throated Martin	*Riparia paludicola*		*	
Cape Bunting	*Emberiza capensis*		*	
Cape Sparrow	*Passer melanurus*	*	*	

Cape Turtle Dove	*Streptopelia capicola*	*	*	
Non-Priority Species		**Transects**	**Focal point**	
Cape Wagtail	*Motacilla capensis*		*	
Chat Flycatcher	*Melaenornis infuscatus*	*		
Grey-backed Cisticola	*Cisticola subruficapilla*	*		
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	*		
Hadeda	*Bostrychia hagedash*	*		
Karoo Chat	*Emarginata schlegelii*	*	*	
Karoo Long-billed Lark	*Certhilauda subcoronata*	*		
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*		
Lark-like Bunting	*Emberiza impetuani*		*	
Laughing Dove	*Spilopelia senegalensis*	*		
Malachite Sunbird	*Nectarinia famosa*		*	
Pearl-breasted Swallow	*Hirundo dimidiata*		*	
Pied Crow	*Corvus albus*	*	*	
Rufous-eared Warbler	*Malcorus pectoralis*	*		
Southern Fiscal	*Lanius collaris*	*	*	
Speckled Pigeon	*Columba guinea*	*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*		
White-throated Canary	*Crithagra albogularis*	*	*	
Yellow Canary	*Crithagra flaviventris*	*	*	
25	*Non-priority Species sub-total:*	19	15	
	Grand total:	**29**	**23**	

Appendix G: List of renewable energy projects within 30km radius

Renewable Energy Projects - Source: DEA REEA, 2020 Q2 (2020-08-31)

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1976	DEA/EIA/0001017/2018	2014	BAR	Proposed development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure in Western and Northern Cape Provinces	2018-11-13	Kudusberg Wind Farm (Pty) Ltd	CSIR	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved
								Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape			
12/12/20/1783/1	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 2	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2/AM1	DEA/EIA/AMEND/000468/2014	2010	Amendment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2014-10-03	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technology	0	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
12/12/20/1783/2/AM3	To Review	2014	Amend ment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2017-09-20	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	150	Approved
12/12/20/1783/2/AM5	To Review	2014	Amend ment	Proposed development of a Wind Energy Facility at Perdekraal, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1787	DEAT/EIA/12346/ 2011	2010	Scoping and EIA	Proposed Renewable Energy Facility at Konstabel	2010-01-29	South Africa Mainstream Renewable Power Developmen ts (Pty) Ltd	Environmental Resource Management (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind and Solar PV	170	Approved
12/12/20/1956	DEAT/EIA/12205/ 2011	2010	Scoping and EIA	Proposed Touwsrivier Solar Energy Facility	2010-06-07	CPV Power Plant No.1 Pty Ltd	University of Cape Town Environmental Evaluation	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	36	Approved
12/12/20/1988	DEAT/EIA/12460/ 2011	2010	Scoping and EIA	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of	2012-11-16	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	750	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
				the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province									
12/12/20/1988/1/AM1	DEA/EIA/AMEND/0000529/2015	2010	Amendment	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province	2014-12-05	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	0	Approved
14/12/16/3/3/2/899	DEA/EIA/000258/2016	2014	Scoping and EIA	140 MW Rietkloof WE, near Sutherland, Northern Cape and Western Cape	2016-01-19	Rietkloof Wind Farm (Pty) Ltd	EOH Coastal and Environmental Services (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind	36	Approved
14/12/16/3/3/2/810	To Review	2014	Scoping and EIA	75 MW Montague Road Solar PV SEF on Vredefort No. 34 Near Touws River within the Breede Valley Local Municipality in the Western Cape Province	2015-05-29	Montague Road Energy (Pty) Ltd	Sharples Environmental Services cc	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	75	Approved
14/12/16/3/3/2/900	DEA/EIA/0000259/2016	2014	Scoping and EIA	147 MW Brandvalley Wind Energy Facility north of the town of Matjiesfontein within Karoo Hoogland Local Municipality	2016-01-19	Brandvalley Wind Farm (Pty) Ltd.	EOH Coastal and Environmental Services	!Kheis Local Municipality	Z F Mgcawu District Municipality	Western Cape	Onshore Wind	147	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1983	DEA/EIA/0001036/2018	2014	BAR	Proposed Development of the Tooverberg On-site Eskom Substation and 132kV Power Line for the proposed Tooverberg Wind Energy Facility near Touws River, Western Cape Province	2018-12-06	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Approved

Renewable Energy and EGI Projects - Source: SAHRIS

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
14/12/16/3/3/1/1984	Not provided	2014	BAR	Proposed Development of the Tooverberg Wind Energy Facility (WEF) near Touws River, Western Cape Province	06 12 2018	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	264	Approved
Not provided	Not provided	2014	BAR	Powerline between the Perdkekraal West Wind	22 03 2016	Perderkraal West Wind Farm (Pty) Ltd	Savannah Environmental	Breede River Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Not confirmed

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
				Energy Facility and the Eskom Kappa Substation, Western Cape Province									
14/12/16/3/3/2/1115	Not provided	2014	Scoping and EIA	Proposed Construction of the 325MW Rondekop Wind Energy Facility between Matjiesfontein and Sutherland, Northern Cape Province	14 11 2018	Rondekop Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved

Planned Eskom Lines:

Status / layer source	SUB_PROJECT	Voltage	TDP_ID	TDP_SCHEME	New_Date	GP_Project
Tx Planned Lines	Gamma-Kappa 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2022	GPP0288
Tx Planned Lines	Kappa-Sterrekus 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2021	GPP0502

Existing Eskom Lines

Status / layer source	LABEL	DESIGN_VOL	LINE_STATU	SUB_CAT		
Tx Existing Lines	BACCHUS DROERIVIER 1	400	EXISTING	400kv_line		
Tx Existing Lines	DROERIVIER MULDERSVLEI 2	400	EXISTING	400kv_line		
Tx Existing Lines	Gamma-Kappa 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2013	GPP0283
Tx Existing Lines	Kappa-Sterrekus (Omega) 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2015	GPP0500

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.7

Socio-Economic Assessment

SOCIO ECONOMIC SPECIALIST ASSESSMENT

BASIC ASSESSMENTS FOR THE PROPOSED DEVELOPMENT OF FOUR 175 MW SOLAR PHOTOVOLTAIC FACILITIES, ELECTRICAL GRID INFRASTRUCTURE, AND ASSOCIATED INFRASTRUCTURE FOR THE HOEK DOORNEN PROJECTS PV 1, PV 2, PV 3, AND PV 4 – NEAR TOUWS RIVER, WESTERN CAPE PROVINCE

Report prepared for:	*Report prepared by:*
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4 November 2020

Executive Summary

This socio-economic impact study, includes the individual land parcels on which the proposed projects will be developed if approved, the surrounding area known as the Tankwa Karoo (of which the land parcels are a part), and the nearest towns, Touws River and Ceres, as the anticipated socio-economic impacts will be spread to varying degrees across these localities. While Touws River falls within the Breede Valley Local Municipality, the project sites and Ceres fall within the Witzenberg Local Municipality.

The following socio-economic risks and challenges characterise the study area:

- High levels of unemployment
- Poverty
- Food insecurity
- Slow economic growth
- Marginalisation of rural communities
- Persisting drought
- Poor service delivery
- High levels of drug and/or alcohol abuse
- Deteriorating education outcomes
- Increasing rate of teenage pregnancy
- Social grant dependency
- Increasing gang activity
- COVID-19 hotspots (Touws River and Ceres) and the continuing impact of the pandemic on lives and livelihoods

Positive socio-economic impacts likely to result from the proposed projects include the creation of skilled and unskilled employment opportunities for the duration of the construction and the operational phases. While the developer may not be able to fill skilled positions with locals, unskilled labour positions can be filled locally should the recommended mitigation measures be implemented. Communities will also likely benefit from the concomitant growth opportunities for local businesses and support service industries, and increased local spending. These impacts will benefit local communities through the creation of income generation opportunities and human development through skills development and training. In addition, local communities will benefit from the proposed Economic Development Plan if well designed and well implemented.

On a macro level, positive impacts also include the generation of clean energy for the national grid which is under severe pressure and unable to meet demand, thereby curtailing the economic advancement of the country. Therefore, the proposed development can also be seen as creating a positive social benefit for society.

Negative socio-economic impacts likely to result from the project include an influx of opportunistic job seekers which could strain social structures and support networks, increase risky social behaviour such as prostitution and drug abuse, and burden existing services. Unsuccessful job seekers and other disenchanted community members who, realistically or unrealistically, expect to gain from the proposed development could engender ill feelings towards the proposed projects, and potentially lead to protest, damage to project property, and/or intimidation of staff.

Furthermore, given the time-bound nature of the development, the inevitable job losses at the end of each phase are high. The additional movement of people and vehicles to the site, particularly during the construction phase may increase the chances of crime on surrounding properties and a decline in eco-tourism. This (negative impact) can be managed by implementing recommended mitigation measures.

The overall significance rating of the negative socio-economic impacts associated with the proposed projects during the construction phase is very low to low; whereas the overall significance rating of the positive socio-economic associated with the proposed projects during construction is low to moderate, should mitigation and enhancement measures be implemented respectively.

The overall significance rating of the positive socio-economic impacts associated with the proposed projects during the operation phase is very low to high, should enhancement measures be implemented.

The overall significance rating of the socio-economic impacts associated with the proposed projects during decommissioning phase is low (negative) and low (positive), should mitigation measures and enhancement measures be implemented, respectively.

The cumulative impact during the construction and operational phases is low (negative) to moderate (positive). There is no cumulative impact of the decommissioning phase.

Given the overall very low to low significance of potential negative impacts associated with the projects, as compared to the overall very low to high significance of potential positive impact of the projects; it can be concluded that the prospective socio-economic benefits of the proposed projects outweigh the socio-economic losses/impacts.

From a social impact perspective, in light of the above argument, the specialist conducting this Socio-economic Assessment is of the opinion that the proposed projects should be authorised by the competent authority.

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List of Abbreviations

ART	Anti-retroviral Treatment
BA	Basic Assessment
BVLM	Breede Valley Local Municipality
CSIR	Council for Scientific and Industrial Research
CWDM	Cape Winelands District Municipality
DEFF	Department of Environment, Forestry and Fisheries
EA	Environmental Authorisation
ECD	Early Childhood Development
EDP	Economic Development Plan
EEA	Employment Equity Act
EIA	Environmental Impact Assessment
FET	Further Education and Training
HDI	Human Development Indicator/Index
MLL	Minimum Living Level
MW	Megawatt
NMR	Neonatal Mortality Rate
PV	Photovoltaic
NEMA	National Environmental Management Act
NMD	Notified Maximum Demand
IDP	Integrated Development Plan
REDZs	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Program
SDF	Spatial Development Framework
SIA	Socio-economic Impact Assessment
WLM	Witzenberg Local Municipality

Glossary

Definitions	
Dependency ratio	Refers to the number of persons on average dependent on every working person in a region (the number of people supported by each economically active person. The lower the dependency ratio the better.
Poverty	The inability to attain a minimal standard of living.
Minimum Living Level	Reflects the minimum amount a household needs to meet their basic need. The MLL for the Western Cape was R1606 per month in 2017.
Working Age Population	The portion of the population aged between 15 – 64.
Unemployment Rate	Refers to individuals without work, but actively seeking work in a recent past period (usually four weeks), and are currently available for work.
Gross Domestic Product	The sum of value added created by all residents within a certain period which is commonly a year.
Human Development Indicator/Index	The HDI serves as a composite indicator of social and economic development and overall well-being.
Human Capital	Refers to the physical and mental ability and the well-being of the population of an area.
Study Area	Refers to the area surrounding the site of the proposed development within an approximately 80km radius.

SOCIO-ECONOMIC IMPACT ASSESSMENT

This report serves as the Socio-economic Specialist Assessment that was prepared as part of the Basic Assessment (BA) for the proposed development of four 175 MW Solar Photovoltaic (PV) facilities, electrical grid infrastructure (EGI), and associated infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4) near Touws River in the Western Cape Province.

The Applicant is proposing to develop nine solar PV facilities, nine power lines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities are being proposed on the Farm Hoek Doornen 172. This Socio-economic Impact Assessment deals with the Hoek Doornen projects.

1. Introduction

1.1. Scope, Purpose and Objectives of this Specialist Report

This Socio-economic Impact Assessment (SIA) Report investigates the potential social disruptors and possible associated social impacts that may ensue from the development of the four proposed 175 MW Solar PV facilities and associated infrastructure on the farm Hoek Doornen 172.

This Socio-economic impact study includes the individual land parcels on which the proposed projects will be developed if approved, the surrounding area known as the Tankwa Karoo (of which the land parcels are a part), and the two nearest towns, Touws River and Ceres, as the anticipated socio-economic impacts will be spread to varying degrees across these localities.

The project is located within the Witzenberg Local Municipality (WLM). However, the closest town, Touws River (76 km by road), is located in the Breede Valley Local Municipality (BVLM), while the next closest town, Ceres (78 km by road) lies in the WLM.

Social disruptors and impacts most likely to significantly influence social and cultural concerns, values, consequences, and benefits to communities are the focus of this SIA.

The objective of this SIA is to assist with informed decision-making by the competent authority, Department of Environment, Forestry and Fisheries (DEFF), as well as the development of appropriate management measures relating to socio-economic impacts linked to the proposed project.

The purpose of the SIA is as follows:

- Undertake a policy review and assess the alignment of the proposed project with the national, provincial, and local socio-economic policies, with a focus on the compatibility of the project with the spatial planning, development objectives and land use management plans of the respective authorities.
- Profile the socio-economic status quo of the study area using secondary data.
- Identify and analyse the potential socio-economic impacts (direct, indirect, and cumulative) of the proposed project.
- Evaluate the potential positive impacts versus any negative socio-economic effects that may ensue as a result of the change in status quo of the affected and benefiting communities and economies.

1.2. Details of Specialist

This specialist assessment has been undertaken by Sandra Hill, an independent social science consultant, in response to a request by the Council for Scientific and Industrial Research (CSIR) on behalf of Veroniva (PTY) Ltd (the project developer), and forms part of a BA for the development of the proposed 175 MW Solar PV facilities, EGI, and associated infrastructure in the Tankwa Karoo, equidistant from the towns of Touws River and Ceres in the Komsberg Renewable Energy Development Zone (REDZ) (REDZ 2), located in the Western Cape Province. A curriculum vitae is included in Appendix A of this specialist assessment.

1.3. Terms of Reference

The following terms of reference were provided for this study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320 (i.e. Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed).
- Compile a Socio-economic Assessment in compliance with Appendix 6 of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations (as amended). The Specialist Assessment must also be in adherence to any additional relevant legislation and guidelines that may be deemed necessary.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification (as applicable).
- Describe the socio-economic context of the study area, focusing on aspects that are potentially affected by a solar PV project and associated infrastructure, and taking into consideration the current situation as well as the trends, the local planning (Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs)), other developments in the area.
- Apply a variety of appropriate options for sourcing information, such as a review of analogous studies, available databases and social indicators, and use of interviews with key affected parties such as local communities, local landowners and government officials (local and regional) etc. and a site visit, if necessary. The REDZ Phase 1 Strategic Environmental Assessment (SEA) (DEA, 2015) should also be considered.
- Consider social issues such as potential in-migration of job seekers, opportunities offered by training and skills development, phasing of employment over the duration of the Renewable Energy Independent Power Producer Procurement Program (REIPPPP), cumulative effects with other REIPPPP projects in the local area, implications for local planning and resource use.
- Evaluate the implications of the social investment programme associated with REIPPPP projects on the local socio-economic context.
- Identify and assess the potential direct, indirect and cumulative impacts of the proposed development on the receiving environment from a socio-economic perspective.
- Identify any protocols, legal and permit requirements that are relevant to this project and the implications thereof.
- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts. Also identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts for inclusion in the EMPr.
- Incorporate and address all issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site-specific impact management outcomes and actions that are not included in the pre-approved generic EMPr (Part B – Section 1).

2. Approach and Methodology

The approach to and methodology adopted for the SIA is discussed in this section.

Type of Specialist Investigation	Socio-economic Impact Assessment
Date and Duration of Specialist Site Visit	7 September 2020 (1 day)
Season	Spring – however the season is not relevant to the assessment and has no bearing on its findings.
Relevance of Season	The season in which the site visit was undertaken has no relevance and bearing on the findings of the assessment.

Approach: SIA Guidelines
The Guideline for Social Impact Assessment (Barbour, 2007) is used to provide policy and quality control guidelines for the SIA process used in this report. The guideline's key activities, objectives and areas of particular interest for assessment are elaborated on below.

Social Impact Assessment Guidelines (Barbour, 2007)
1. Key Activities
Describe and obtain an understanding of the proposed intervention (type, scale, location), the communities likely to be affected and determine the need and scope of the SIA
Collect baseline data on the current social environment and historical social trends
Identify and collect data on the SIA variables and social change processes related to the proposed intervention
Assess and document the significance of social impacts associated with the proposed intervention
Identify alternatives and mitigation measures
2. Key Objectives
Assess the proposed development in terms of its fit with the relevant legislative, policy and planning requirements
Identify and assess the factors that contribute to the overall quality of life (social wellbeing) of people not just their standard of living
Identify and assess the needs of vulnerable, at risk, groups and/or ethnic minorities or indigenous peoples
Clearly identify which individuals, groups, organisations and communities stand to benefit from the proposed intervention and those that stand to be negatively affected. In so doing the assessment must identify and emphasize vulnerable and underrepresented groups
Recognise that social, economic and biophysical systems and impacts are inextricably interconnect, and identify and understand the impact pathways created when changes in one domain trigger impacts across other domains
Acknowledge and incorporate local knowledge and experience into the assessment process
Identify and assess development opportunities and not merely the mitigation of negative or unintended outcomes
3. Key Areas of Particular Interest
Where vulnerable communities are present
With high poverty and unemployment levels
Where access to services, mobility and community networks are affected
Where local livelihoods depend on access to and use of environmental resources and services
Of important tourism or recreation value
Where the existing character and "sense of place" will be altered

Data Collection
To create a comprehensive understanding of the socio-economic environment that might be affected by the proposed development, a socio-economic overview was developed incorporating both secondary and primary data collection.

Data sources consulted to compile the socio-economic baseline include internet sources, for example, Statistics South Africa, to provide a broad overview of the socio-economic setting of the area; National, provincial and local policy and plans to determine whether the proposed project is aligned with the planning objectives of the various spheres of government, as well as previously conducted EIAs conducted to determine the potential impact and linkages to this assessment.

Primary data collection was done through face-to-face and/or telephonic interviews with land owners of the affected properties, municipal officials and community role-players to obtain additional context-specific information.

A site visit was undertaken on 7 September 2020 to the affected project farms, Touws River, and Ceres.

Data Analysis
Data analysis was conducted by evaluating relevant data from various sources published over different time periods in order to gain a long-term perspective. Information was analysed to establish status quo socio-economic conditions, prevailing social structures, local demographic trends, and potential change processes present in the study area.

The overview was then used to interpret the impacts and measure the extent of socio-economic impacts that could be derived from the proposed activities.

2.1. Information Sources

The project made use of both primary and secondary data to assess the impacts and desirability of the proposed project. Secondary data analysed was mainly derived from the following sources:

Data / Information	Source	Date	Type	Description
The South African Guideline for Involving Social Assessment Specialists in EIA (Barbour, 2007)	Western Cape Government	2007	Guidelines	Professional guidelines for conducting social impact assessment studies in South Africa
Statistics South Africa Census, 2011	Stats SA	2011	Census	Latest available census data
Statistics South Africa Community Survey, 2016	Stats SA	2016	Census	Latest available community survey data
Cape Winelands District Municipality Integrated Development Plan (IDP)	CWDM	2017/18 – 2021/22	Overview and planning document	Updated contextual overview and IDP
Witzenberg Local Municipality (WLM) Amended IDP	WLM	2017 – 2022	Overview and planning document	Updated contextual overview and IDP
Breede Valley Local (BVLM) Municipality Review of the IDP	BVLM	2020 - 2021	Overview and planning document	Updated contextual overview and IDP
National Development Plan 2030	National Government	2012	National planning document	Outlines long term development plan for South Africa
Municipal Capacity Assessment Witzenberg WC022	Municipal Demarcation Board	2018	Assessment	Overview of the environmental situation of the municipality, and summary of capacity information
Municipal Capacity Assessment Breede Valley WC025	Municipal Demarcation Board	2018	Assessment	Overview of the environmental situation of the municipality, and summary of capacity information
Socio-economic Profile: BVLM	Western Cape Government	2019	Profile	Socio-economic overview
Socio-economic Profile: WLM	Western Cape Government	2018	Profile	Socio-economic overview
Farmworker Household Survey Report	Western Cape Government	2014/15	Census	Comprehensive census of farm workers and dwellers in the CWDM.
CWDM Draft Spatial Development Framework (SDF)	Western Cape Government	2019	Strategic planning	Strategic planning
WLM SDF	WLM	2019	Spatial development	Spatial development planning

Primary data was generated through face-to-face and/or telephonic interviews with the following:

Name	Designation	Location	Technique	Date 2020
Jan Minnaar	Farm representative	Farm Grootfontein 149	Telephonic	8 September
Philip van Heerden	Farm Manager	Farm Witte Wall 171	Face-to-face	7 September
Erhard Buhr	Land Owner	Farm Hoek Doornen 172	Telephonic	5 October
Andre Vermeulen	Land Owner and interim chairperson of the Tankwa Ceres Karoo Farmers' Union	Farm Die Brak 241	Face-to-face	2 November
Leon Teunissen	Land Owner	Farm Karee Kolk 174	Telephonic	2 November
Brian Stander	National Department of Public Works	Farm Platfontien 240	Telephonic	23 October
Adwin Zinkfontein	Operational Manager	Touws River Clinic BVLM	Face-to-face	7 September
Riaan Fick	Socio-economic Development Manager	WLM	Telephonic	8 September
Nina King	Business Owner	Touws River	Face-to-face	7 September
Ashleigh Sibanda	Programme Manager at Knowledge Pele	Johannesburg	Telephonic	10 September

2.2. Assumptions, Limitations and Disclaimer

This SIA is based on several key assumptions, which are aligned with industry practice, and is consequently, subject to certain limitations. Therefore, relevant assumptions and limitations should be considered when deliberating this report. However, the assumptions and limitations are not expected to invalidate the findings of this report.

Key assumptions:

- The SIA is based on the technical information provided by the Applicant and which is assumed to be accurate (e.g. the proposed location, extent, scale of the project).
- The SIA is primarily based on secondary data. Accordingly, except for a single site visit and interviews as listed above, no primary research or social surveys have been conducted as part of this assessment. However, the level of assessment and its attendant data sources were deemed adequate for this study.
- The accuracy of secondary data sources directly influences the quality of this SIA. However, the data used in this assessment is published by reputable authors and therefore deemed to be of sufficient quality for this study.
- With regard to the primary data sources, it is assumed that the questions asked during the interviews were answered accurately.
- It is assumed that the socio-economic conditions, as found during the assessment, will not undergo significant changes between the date of data collection and the release of this report.

Key limitations:

- While of high quality and reputability, most secondary sources were published before the outbreak of COVID-19 and the concomitant widespread social and economic devastation.
- Socio-economic impacts are inherently interconnected and do not lend themselves to clear disaggregation into distinct impacts.
- Socio-economic impacts are notoriously difficult to quantify and represents different levels of significance to different individuals. Accordingly, the same impact might be experienced in vastly different ways by different individuals within the same community.

- Socio-economic impacts, being the product of human behaviour, are derived from baseline information and anticipated project implications; as opposed to being empirically measured.
- Humans and the communities in which they live are adaptable, dynamic and open systems. Accordingly, the communities under investigation in this SIA might react to various factors not necessarily related to the proposed development; thereby complicating clear inference of observed social change to anticipated project impacts.
- Secondary baseline information is useful in establishing a municipal-wide picture of the most prominent socio-economic trends; it is not particularly informative with regards to the specific conditions present in the Tankwa Karoo and in the towns of Touws River or Ceres.
- As at October 2020, there are no sensitivity layers on the Screening Tool for socio-economic features, and as such the environmental sensitivity as identified by the Screening Tool cannot be confirmed or disputed.

Approved and proposed energy developments within a 30 km radius were taken into consideration as they have the potential to create supplementary positive or negative socio-economic impacts identified in this study or vice versa. A list of these projects is provided in Section 6 of this report.

2.3. Consultation Processes Undertaken

Face-to-face and telephonic interviews were conducted with selected landowners, farm representatives, and Breede Valley, and Witzenberg Municipal officials. Participant observation conducted during a one-day site visit encompassing the affected project farms, Ceres, and Touws River.

3. Description of Project Aspects relevant to Socio-economic Assessment

As noted above, the Project Applicant is proposing to design, construct and operate nine 175 MW Solar PV power generation facilities north-east of Ceres in the Western Cape Province (referred to as Ceres Solar PV Development). The proposed project will make use of PV solar technology to generate electricity from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation, and will connect to the Eskom Kappa Substation via a 132 kV power line. The proposed projects will take place within REDZ 2, known as the Komsberg REDZ.

The proposed facilities will be constructed on portions of the following farms:
- Grootfontein (5/149 and RE 149)
- Hoekdooren (172)
- Witte Wall (171)

The power lines will traverse the aforementioned farms, as well as Die Brak (Farm 241) and Platfontein (Farm 240). Assessment of nine 132kV power lines covers the worst-case scenario. However, this number may be reduced depending on which projects win preferred bidder status in terms of the REIPPPP.

As noted above, this SIA deals with the proposed Hoek Doornen PV 1; Hoek Doornen PV 2; Hoek Doornen PV 3; and Hoek Doornen PV 4 projects.

Each 175 MW plant will cover an approximate footprint of 250 hectares. The footprint includes the PV facility and infrastructure such as internal roads for each PV facility, while some of the main access roads will be outside of the 250 hectares.

From a socio-economic perspective, the most important project as aspects are:
- Employment creation over the lifetime of the project; and
- The Economic Development Plan (EDP) the Applicant is to develop for implementation should the project obtain preferred bidder status in terms of the REIPPPP.

Approximately 90 to 150 skilled and 400 to 460 unskilled employment opportunities will be generated during the construction phase (per project) which is expected to extend for 12 to 14 months.

Approximately 20 skilled and 40 unskilled employment opportunities will be generated during the operational phase of an expected 20 years. Unskilled jobs will be linked to services such as panel

cleaning, maintenance, and security. Employment opportunities to be created during this phase equate to approximately 4800 person months (for skilled opportunities) and approximately 9600 person months (for unskilled opportunities) per project over the 20-year plant lifespan.

It should be noted that the employment opportunities provided in this report are estimates and depend on the final engineering design and the REIPPPP Request for Proposal (RFP) provisions at that point in time.

While the Applicant does not yet have a fully articulated EDP as this will be dependent on the RFP IPP requirements, the broad objectives of the EDP are to:

- Create a local community trust which has an equity share in the project life to benefit historically disadvantaged communities.
- Initiate a training strategy to facilitate employment from local communities.
- Give preference to local suppliers of components and/or services for the construction of the facility.

The creation of employment opportunities, as well as the EDP, is likely to serve as an economic pull factor that may result in in-migration to the Tankwa Karoo, Touws River and/or Ceres area, as well as serve to provide potential positive project benefits to these local communities.

Refer to the key mitigation measures proposed by the specialist, and which needs to be included in the Environmental Management Programme (EMPr) listed in Section 9 of this report.

4. Baseline Environmental Description / Description of Receiving Environment

4.1. General Social and Economic Description

This baseline description is the same for Hoek Doornen PV 1; Hoek Doornen PV 2; Hoek Doornen PV 3; and Hoek Doornen PV 4 projects.

Secondary data sources

The study area is located within the Cape Winelands District Municipality (CWDM). The actual project footprint is located in the WLM. However, the closest town, Touws River, is located in the BVLM, while the next closest town, Ceres, lies in the WLM.

The Tankwa Karoo, colloquially described as the empty space on your map between Ceres, Calvinia and Sutherland, is sparsely populated and reflects the overall trend towards depopulation in the Karoo. The decline in the rural population and of many of its small towns is one of the area's most important changes since the mid-1950s. The Karoo is home to fewer than a million people (1.9% of the country's population), of whom three out of every four live in small country towns. The Karoo is politically and economically marginal, and administratively fragmented. Large scale land use shifts are impacting the region's economy and social fabric. These developments include renewable energy production facilities (solar and wind power), additional electricity power transmission corridors and the issuing of prospecting and mining rights over large areas for uranium and the extraction of shale gas. Agricultural production has intensified, with the expansion of irrigated croplands. Game farming and eco-tourism has also intensified, as has the trend towards 'lifestyle farmers', property owners whose income is not from farming. (Henschel, J; Hoffman, M; Walker, C. 2018)

The region has great potential for eco-tourism, not only for the Cape metropolitan market, but also international visitors with a range of tourism offerings such as wilderness experience, hunting, stargazing, mountain biking, bird watching, game viewing, plant-spotting, hiking, and several festivals.

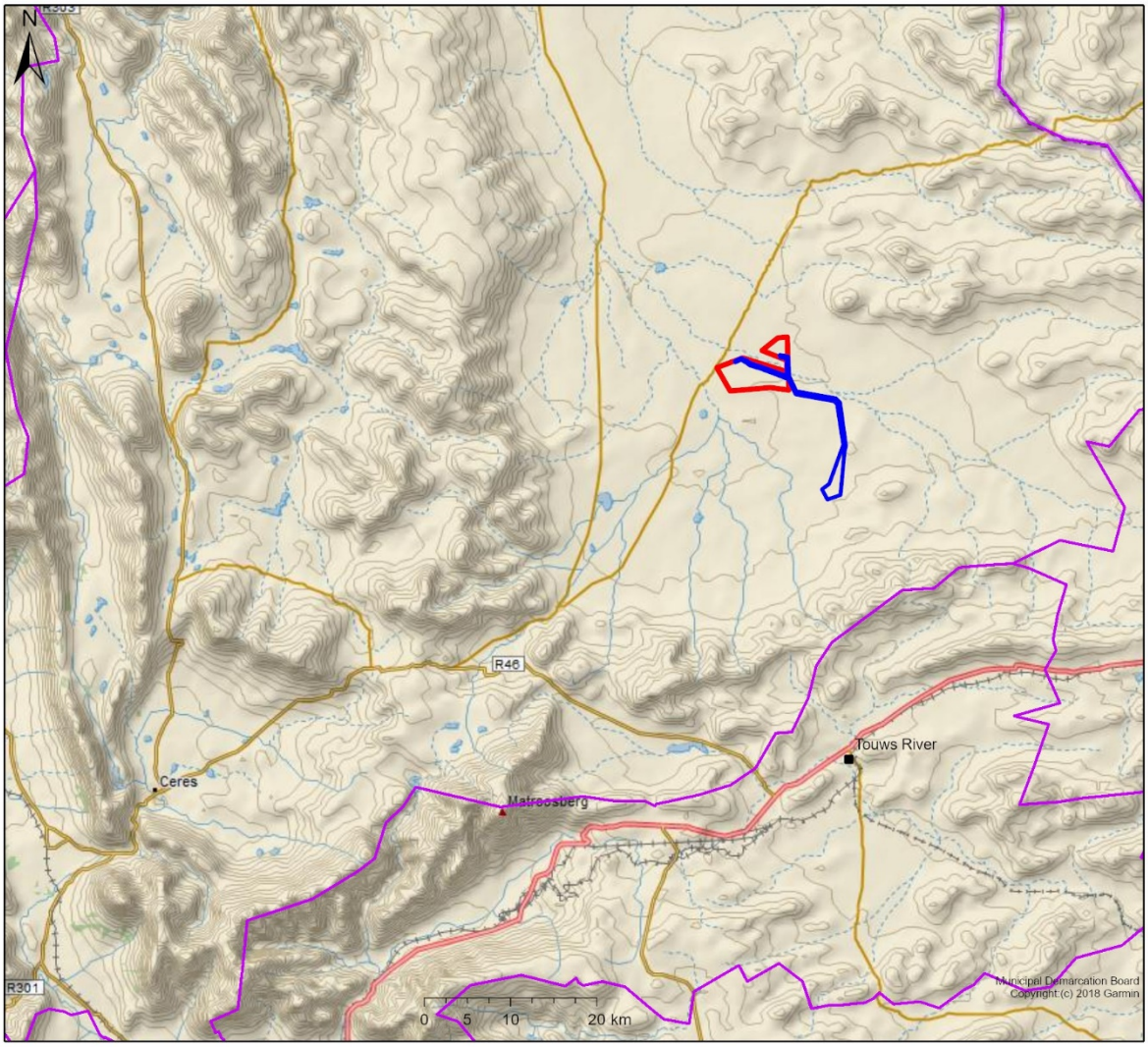

Figure 1: Map of project site, nearest towns and municipal boundaries

The map in Figure 1 shows Hoek Doornen project sites (yellow), EGI corridor (blue), location of Touws River and Ceres, the BVLM and WLM boundaries (purple) and the N1 (pink).

The CWDM is a Category C municipality situated in the Western Cape Province adjacent to the City of Cape Town Metropolitan area. The CWDM is a landlocked area between the West Coast and Overberg coastal districts and includes five local municipalities, namely: Drakenstein, Stellenbosch, Witzenberg, Breede Valley and Langeberg. The language most often spoken in the household in Western Cape Province is Afrikaans representing 46,6%, followed by English representing 19,6%.

The BVLM covers an area of 3 834km² and serves the rural towns of De Doorns, Rawsonville, Touws River, and Worcester as well as the rural areas adjacent to and between these towns, and the Matroosberg rural area. Worcester serves as the administrative headquarter of the municipality and is also regarded as the primary economic service node.

The small town of Touws River falls within the BVLM. It is located on the southern edge of the Great Karoo, roughly 180 km by road from Cape Town, and 76km from the proposed development. The town lies adjacent to the national route (N1) between Cape Town and the North. It covers an area of 21,6km² and comprises several distinct areas including the old central part of town known as Paddasvlei, Topkamp (the oldest housing area), Steenvliet, the original township for Coloured people, and Zion Park, an informal settlement.

Originally established as a railway town servicing trains travelling from Cape Town to the interior of the country since 1877, Touws River enjoyed almost a century of prosperity before the decline and subsequent total withdrawal of the railways in the 1980s led to its virtual collapse. The demise of the railways resulted in mass unemployment in Touws River as most people were at that time employed either directly by the railways or by one of the associated industries or businesses. Touws River today faces multiple socio-economic problems, a high level of human need, and low economic potential and development resources to stimulate and support recovery.

The major socio-economic risks and challenges facing the BVLM include (Breede Valley Review IDP 2020-2021; 2019 Socio-economic Profile BVLM):

- Income inequality;
- Food insecurity;
- Rising unemployment;
- Deteriorating education outcomes;
- Demand for adequate housing;
- The persisting drought in the Western Cape and in-migration of people to the Breede Valley;
- Adequate service delivery;
- The effect of poverty, especially on smaller towns such as Touws River;
- Culture of violence fuelled by gang activity;
- Load shedding adversely affecting the local economy; and
- The impact of COVID-19 on current and future municipal planning and operations, as well as society in general.

The WLM covers an area of 10 753km² and serves the rural towns of Ceres, Op-Die-Berg, Prince Alfred Hamlet, Tulbagh, and Wolseley, as well as the rural areas adjacent to and between these towns.

Ceres is the administrative centre and largest town in the WLM and serves as a regional hub for the surrounding towns. It is situated about 170 km north-east of Cape Town, and 78km from the proposed development. Established in the mid-1800s as more and more farmers moved into the area, Ceres is located along the original route north between Cape Town and Johannesburg. Ceres covers an area of 77,12km² and includes the residential areas of the old town, Bella Vista, historically a township for Coloured people, and Nduli, historically a township for Black people.

Ceres's importance within the broader agricultural economy and its role as a primary regional service centre has been recognized through the identification of a possible Agri-park development. While this bodes well for economic development, future development will be severely constrained by insufficient bulk services: the town has been crippled by water shortages and has already run at its Notified Maximum Demand (NMD) of 42,8 MVA of power that Eskom is required to provide. The implications thereof are four years and R360m of investment, meaning that 2021 is the earliest that NMD can be upgraded. Without significant bulk infrastructure upgrades – specifically related to electricity – the WLM will be unable to support any further growth (WLM SDF 2019).

The major socio-economic challenges facing the Witzenberg Municipal area include (Witzenberg Amended IDP 2017 – 2022; Witzenberg Municipality Spatial Development Framework 2019):

- The marginalization of rural communities, exacerbated by a general lack of skills and access to opportunities/ services in these areas;
- Predominance of seasonal agriculture-based labour shrinks revenue base;
- Rising level of unemployment
- People in poverty;
- Social Grant dependency;
- Increasing TB and HIV/Aids prevalence;
- Social ills – Crime, vandalism and substance abuse;
- Lack of economic growth; and
- Increasing population and demand for services.

Demographics

Table 1: Demographics of municipal areas and towns
(2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM; Stats SA Community Survey 2016)

Population estimates 2018	**Households** actual 2016
BREEDE VALLEY	
186 796	**47 569**
Touws River: 8 768 actual population 2016	
WITZENBERG	
140 124	**35 976**
Ceres: 36 043 actual population 2016	

The BVLM has a population of 186 796 (estimates in 2018), making it the second most populated municipal area in the CWDM (BVLM IDP Review 2020 – 2021 citing Stats SA Community Survey 2016). The BVLM area comprises 47 569 households[1] of which approximately 14,7% (7 000) are classified as indigent. The BVLM's 2020 average household size is 3,8 persons. (2019 Socio-economic Profile: BVLM). It is worth noting that although the number of households in the area is increasing, the actual size of households is trending downwards. This potentially implies an inflow of young professionals (either single, as couples or with small family groupings) into the area as a result of enhanced urbanisation. Other contributing factors include, but are not limited to, lower fertility rates, occurrences of divorce, ageing population, etc. (2019 Socio-economic Profile: BVLM). In 2016, Touws River actual population stood at 8 768 persons. (Stats SA Community Survey 2016).

The WLM has a population of 140 124, comprising 35 976 households (based on 2018 and 2016 data, respectively). The average household size is 3,6 persons. (2018 Socio-economic Profile: WLM). In 2016, Ceres actual population stood at 36 043 persons. (Stats SA Community Survey 2016).

According to a 2014/15 survey, 34 074 people live and or work on farms in the Cape Winelands area. Witzenberg had the highest number of households (2482) and individuals (8181), followed by Breede Valley, which contained 1005 households and 4222 individuals (Western Cape Government Farmworker Household Survey Report 2014/15).

[1] A household is seen as a group of persons who live together and provide themselves jointly with food or other essentials for living, or a single person who lives alone. (Municipal Capacity Assessment 2018)

Demographics by Age

Table 2: Demographic profile of Breede Valley and Witzenberg by age cohort
(2019 Socio-economic Profile: BVLM; 2018 Socio-economic Profile: WLM)

Year	Children: 0 – 14 Years	Working Age: 15 – 65 Years	Aged: 65+	Dependency Ratio (%)
Breede Valley: Age Cohorts, 2019 - 2025				
2019	55 143	121 646	10 007	53.6
2022	56 671	125 281	11 199	54.2
2025	58 057	128 072	12 056	54.7
Growth	0.9%	0.9%	3.2%	-
Witzenberg: Age Cohorts, 2011 - 2024				
2011	29 460	81 634	4 849	42.0
2019	34 457	100 049	8 974	43.4
2024	36 098	112 780	11 143	41.9
Growth	Not available			

The above table depicts the BVLM and WLM population composition per age cohorts. These groupings are also expressed as a dependency ratio which indicates the number of people supported by each economically active person. A higher dependency ratio means a more vulnerable community, higher pressure on social systems and the delivery of basic services.

In the BVLM area the largest population growth between 2019 and 2025 was estimated in the aged cohort which grew at an annual average rate of 3.2%. This is expected to increase the dependency ratio from 53.6% in 2019 to 54.7% towards 2025. The child and working age cohorts grew by 0.9% respectively (2019 Socio-economic Profile: BVLM).

According to a 2014/15 survey, over 66% of individuals living on farms in the Cape Winelands were below the age of 35, while only just over 1% were above 65 years of age. A large part of the Cape Winelands farming population (30.09%) was youth i.e. between the ages of 19 and 35 years old (Western Cape Government Farmworker Household Survey Report 2014/15).

Witzenberg's population shows an estimated relatively small increase in the children cohort between 2019 and 2024. Coupled with strong growth in the working and aged categories, this is expected to decrease the dependency ratio in Witzenberg (2018 Socio-economic Profile: WLM). However, according to Stats SA (2016) the area's biggest population cohort is youth aged 15–34 representing 38,4%. Of the youth cohort, the biggest number is aged between 15-19 (Stats SA Community Survey 2016). These demographics must be taken into account when considering education levels, youth unemployment, and teenage pregnancies.

Demographics by Gender
The sex ratio (number of men to 100 women) provides an indication of the gender breakdown in an area, and it is suggestive of labour force composition. levels.

The 2020 sex ratio for BVLM is 91.9, indicating in general considerably fewer males than females in the area. This ratio further decreases towards 2023 (91.4) which can be attributed to a wide range of factors such as an increase in male mortality rates and the potential outflow of working males. This typically results in more female headed households, larger household sizes, and higher grant dependency levels.

Conversely, the 2020 sex ratio for WLM is 106.7, indicating in general more males than females in the region. This ratio further increases towards 2023 (106,9) which suggests continued growth as a migrant receiving area.

South Africa's average sex ratio is around 95 men to 100 women. (Witzenberg Municipal Capacity Assessment 2019).

Demographics by Race
The population of both the BVLM and WLM is predominantly Coloured (63% and 66% respectively), followed by African (24% and 25% respectively) and Whites (10% and 7% respectively).

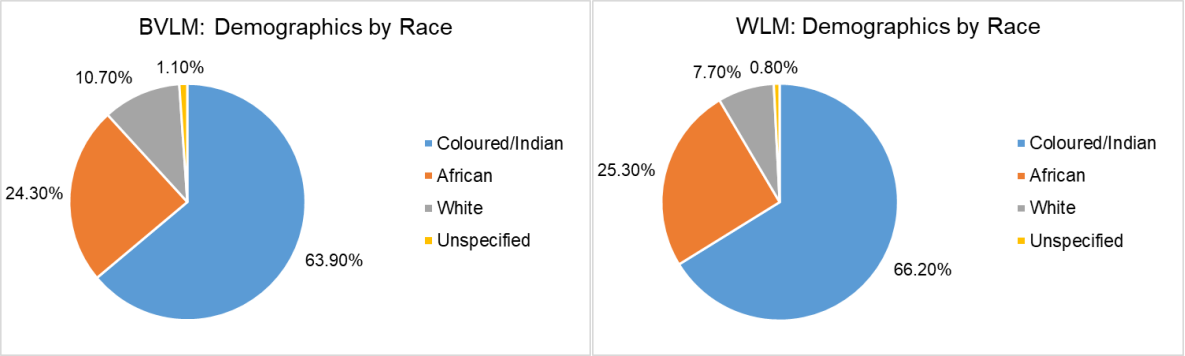

Figure 2: Demographics by race
(Breede Valley Municipal Capacity Assessment 2018; Witzenberg Municipal Capacity Assessment 2019)

Population Density
In 2019, the population density in BVLM was 49 people/km² while the WLM had only 13 people/km² (2019 Socio-economic Profile: BVLM).

Population Projections 2019 – 2024
The total population is estimated to increase to 194 104 by 2023 which equates to a 1% annual average growth rate for the BVLM. For the WLM, the total population is estimated to increase to 153 987 by 2023.

Table 3: BVLM and WLM Population Projections 2019 – 2024
(Western Cape Department of Social Development, 2019)

	2019	2020	2021	2022	2023	2024
BVLM	186 796	188 948	191 048	193 150	194 104	196 126
WLM	142 466	145 181	149 189	152 498	153 987	157 143

Education
Only 40,8% of children in the BVLM and 42,6% of children in the WLM aged 0–5 years attend an educational institution. In real terms, this means that 10 965 children in the BVLM and 8100 children in the WLM are not benefitting from early childhood education.

However, the distribution of the population aged 5–24 years attending an educational institution increases in both the BVLM and WLM to 57,8% and 63% respectively. This represents a drop in this population attending an educational institution in BVLM from 67,8% and an increase in WLM from 61,3% in 2011.

In the BVLM there is a lower proportion of the population aged 20+ without schooling (2,7%) compared to the WLM (3,9%). The adult population with some primary schooling is 10,5% in the BVLM and 14,2% in the WLM. The adult population that completed primary schooling is 6,5% in the BVLM and 9,2% in the WLM. The adult population who have completed secondary schooling is higher in the BVLM (34,2%) compared to 25,5% in the WLM. Only 40,5% of residents in BVLM and 41,2% of

residents in the WLM have some secondary schooling. The proportion of the population that has a higher education, however, is higher in the WLM (6,1%) than in the BVLM (5,7%) (Stats SA Community Survey 2016).

Matric Pass Rate

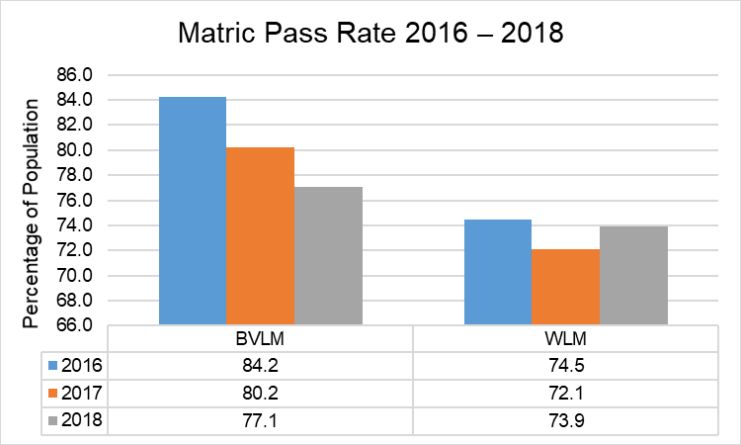

Figure 3: Matric pass rate 2016 – 2018
(2019 Socio-economic Profile: BVLM)

The matric pass rate in the BVLM dropped from 84.2% in 2016 to 77.1% in 2018, and in the WLM from 74,5% to 73,9% over the same period.

Factors affecting school performance include learner-teacher ratios which dropped in the BVLM from 27% in 2016 to 26.6% in 2018, and in the WLM from 34.4% in 2015 to 33.8% in 2017. This may be attributed to schools' declining ability to collect fees and to employ more teachers when needed. Educational performance could also be attributed to the availability (lack thereof) of adequate education facilities such as Early Childhood Development (ECD) centres, schools and Further Education and Training (FET) colleges as well as the availability of key learning resources such as libraries and access to internet.[2]

In 2018, 58 public schools were recorded in the BVLM, of which 79% of these were classified as no-fee schools. The majority of the schools are characterised as Quintile 1 or Quintile 2 schools, which indicates that they are situated in communities where high poverty indices are recorded by national government (BVLM IDP Review 2020-2021).

Learner enrolment in the BVLM increased at an annual average growth rate of 2.5% between 2016 and 2018. This could be attributed to several factors including changing demographics and socio-economic conditions. The learner retention rate, however, reflects a declining trend between 2016 and 2018 dropping from 67% in 2016 to 64% in 2018 and is likely influenced by a range of economic factors such as unemployment, poverty, indigent households, and teenage pregnancies. Learner enrolment in the WLM tapered off from 2015 to 2016 but increased slightly to 18 070 learners in 2017. This could be attributed to several factors including demographics and socio-economic context. The grade 12 dropout rate for Witzenberg learners increased from 35.5% to 36.6% between 2016 and 2017. Again, these high levels may be due to a number of economic factors such as unemployment, poverty, and teenage pregnancies (2019 Socio-economic Profile: BVLM; 2018 Socio-economic Profile: WLM).

According to a 2014/15 survey, a mere 8% of the Cape Winelands farming population obtained their matric qualification with less than 1% having some type of tertiary qualification. High school learners are more likely to travel further than 4,9km to school, and many in the WLM and BVLM areas travel up to 10km. Walking and bus are the most common forms of transport (Western Cape Government Farmworker Household Survey Report 2014/15).

[2] Only 13,8% of the population in BVLM and 12.3% in WLM had access to internet (Stats SA Community Survey 2016)

The decrease in learner enrolment, high Grade 12 dropout rate, and the decreasing Matric pass rates are alarming. Low education means more people becoming less employable and labour productivity that is lower than it could be in an environment where sectors that traditionally absorb low-skilled labour are declining.

Health

Health is another major factor contributing to the general quality of life. The COVID-19 pandemic has led to the widespread loss of lives and livelihood across South Africa. HIV/AIDS, Tuberculosis, health of children, and maternal health are important health indicators.

COVID-19

According to Dr. Jantjie Taljaard, an infectious diseases physician at Stellenbosch University, the infection risk in farming communities is significant because people often work together in large numbers or confined spaces like factories or packhouses[3]. With agriculture deemed an essential service, many farm workers worked during the National Lockdown, choosing to risk their lives above their livelihood.

The BVLM and WLM were identified as a COVID-19 hotspot, with 3 464 cases and 194 deaths as a result of COVID-19 in the BVLM, and 1 614 cases and 97 deaths in the WLM. The increase of infection in youth between the ages of 25-35 was noted as an alarming trend.

Table 4: COVID-19 cases and recoveries

(25 September 2020: www.coronavirus.westerncape.gov.za/news/update-coronavirus)

Municipality	Cases	Recoveries
Cape Winelands District Municipality	**12 694**	**11 962**
Breede Valley	**3 464**	**3 270**
Witzenberg	**1 614**	**1 517**

HIV/AIDS

The BLM shows improvement in the number of patients that remain with treatment between 2017 and 2019, and a decrease in the number of new patients over the same period. The WLM also shows a drop in the number of new HIV/AIDS cases and an increase in the number of patients receiving Anti-retroviral Treatment (ART) between 2016 and 2018.

Table 5: ART treatment and HIV transmission rate

(2019 Socio-economic Profile: BVLM & 2018 Socio-economic Profile: WLM)

Area	Clients that remain with treatment		Number of new ART patients		HIV Transmission Rate	
	2017/18	2018/19	2017/18	2018/19	2017/18	2018/19
Breede Valley	6 524	6 746	1178	1004	No data	No data
Area	**Registered patients receiving ART**		**Number of new ART patients**		**HIV Transmission Rate**	
	2016/17	2017/18	2016/17	2017/18	2016/17	2017/18
Witzenberg	5 370	5 730	1 194	1 047	1.9	1.1

[3] https://www.foodformzansi.co.za/covid-19-virus-spreads-in-cape-farming-communities/

Tuberculosis (TB)
The number of TB patients in the BVLM area decreased from 2 005 in 2016/17 to 1 764 in 2017/18. It decreased slightly further to 1 738 in 2018/19. The WLM, had 924 TB patients in 2017/18 compared to 1 094 in 2016/17, also reflecting a decline in TB infections (2019 Socio-economic Profile BVLM & 2018 Socio-economic Profile WLM).

Child and Maternal Health
Immunisation rates in the BVLM municipal area increased from 60.8% in 2017/18 to 65.8% in 2018/19. The number of malnourished children under five years (per 100 000) decreased from 11.0 in 2017/18 to 9.0 in 2018/19. The neonatal mortality rate (NMR) (per 1 000 live births) improved from 17.2 in 2017/18 to 13.6 in 2018/19.

The immunisation rate in the WLM improved from 59.9% in 2016 to 67.3% in 2016. The number of malnourished children under five years (per 100 000 people) in 2016 was 2.9, and increased to 3.7 in 2017. The NMR (per 1 000 live births) improved from 15.0 in 2016/17 to 13.0 in 2016/17.

The maternal mortality rate (deaths per 100 000) in the BVLM area increased threefold between 2017/18 (59) and 2018/19 (193). Breede Valley's delivery rate to women under 20 years has improved from 16.8% in 2017/18 to 15% in 2018/19. The termination of pregnancy rate reflects a marginal increase from 0.9 in 2017/18 to 1.0 in 2018/19.

The maternal mortality rate in the WLM area remained at zero deaths per 100 000 live births in 2016/17 and 2017/18. The delivery rate to women 10 -14 years and 15 - 19 years deteriorated between 2015/16 and 2017/18 in WLM with 18.8 per 1 000 births to teenage mothers in 2017/18. This is of concern as these teenage girls are of school going age and pregnancies typically contribute to the high dropout rate. The termination of pregnancy rate remains steady at zero for 2016/17 and 2017/18 in the WLM Area (2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM).

Public Health Services
In 2018, the BVLM had 15 primary healthcare clinics which comprised of six fixed and nine mobile clinics. In addition, there is also one community day centre, one district hospital, as well as eight ART clinics/ sites and 21 TB clinics/sites.

In 2018, the WLM had 15 public healthcare clinics which comprised of eight fixed primary health clinics and six mobile clinics, as well as one community day centre. In addition, there is one district hospital, as well as seven ART treatment clinics/sites and 19 TB treatment clinics/sites.

Both municipalities have two ambulances per 10 000 inhabitants which are on par with the district average. Access to emergency medical services is critical for rural inhabitants due to the distances they have to travel to access health facilities (2019 Socio-economic Profile: BVLM; 2018 Socio-economic Profile: WLM).

Poverty
Poverty can be defined as the inability to attain a minimal standard of living. GDP per capita, income inequality, and human development and income levels are key indicators of poverty.

At R44 489 in 2018, the BVLM area had the second lowest GDPR per capita in the CWDM which recorded a figure of R50 717. At R67 180 in 2017, WLM's GDPR per capita was marginally below that of the CWDM's figure of R71 426. While a useful indicator of overall per capita income, the GDPR does not reflect the distribution of that income, which according to Professor Murray Leibbrandt of The Southern Africa Labour and Development Research Unit, is stacked in favour of the top 10%, with the lowest 5% of the population getting only a fraction of that income. This is a major sign of growing inequality.

The National Development Plan set a target of reducing income inequality in South Africa from a Gini coefficient of 0.7 in 2010 to 0.6 by 2030. However, income inequality in the BVLM area increased from 0.565 in 2012 to 0.581 in 2015 and 0.594 in 2018. Similarly, income inequality has been on the increase in the WLM between 2012 and 2017. The sharp increase in inequality levels can be attributed to the severe drought and slow economic growth which have harmed livelihoods and employment during this period.

There has been a general increase in the Human Development Index (HDI)[4] in the BVLM from 0.66 in 2012 to 0.69 in 2018. The HDI has also increased in the WLM from 0.66 in 2016 to 0.67 in 2017. The HDI serves as a composite indicator of social and economic development and overall well-being. The per capita income as per definition is expected to mimic the trend of the HDI (2019 Socio-economic Profile: BVLM; 2018 Socio-economic Profile: WLM).

In real terms, 14,6% of households in the BVLM and 15% of households in the WLM ran out of money to buy food in the 12 months before the 2016 Statistics SA Community Survey. In the BVLM and WLM, 11,8% and 8,3% of households respectively reported skipping at least one meal in the 12 months before the survey (Stats SA 2016).

While more recent data is not available, it is a fair assumption that poverty levels have been exacerbated by the COVID-19 pandemic as discussed above.

Household income

Household income is an indicator of current poverty levels and provides information about the living standards prevalent in a particular community. A community's ability to meet their basic needs is determined by the level of household income.

Table 6: Household income distribution

(WLM Amended IDP 2017 – 2022)

Income Category	Cape Winelands	Witzenberg	Drakenstein	Stellenbosch	Breede Valley	Langeberg	
No income	13.1	6.4	12.8	20.4	12.0	10.0	
R1 - R6 314	1.9	1.7	1.8	2.0	1.7	2.5	
R6 315 - R12 628	3.5	4.0	3.2	3.5	3.1	4.3	Low Income
R12 629 - R25 257	13.4	18.7	10.7	10.6	15.2	15.8	
R25 258 - R50 514	20.1	25.8	17.1	16.6	21.8	24.3	
Subtotal	**51.9**	**56.6**	**45.5**	**53.1**	**53.8**	**57.0**	
R50 515 - R101 028	18.4	20.6	18.7	15.5	18.6	19.8	
R101 029 - R202 055	12.3	10.6	13.9	11.6	12.7	10.8	Middle Income
R202 056 - R404 111	8.8	6.8	10.7	8.5	8.5	7.3	
Subtotal	39.4	38.0	43.2	35.6	39.8	38.0	
R404 112 - R808 221	5.7	3.9	7.6	6.5	4.7	3.6	
R808 222 - R1 616 442	2.0	1.1	2.5	3.3	1.0	1.0	
R1 616 444 - R 3 232 885	0.5	0.3	0.6	1.0	0.3	0.2	High Income
R3 232 886+	0.4	0.2	0.4	0.7	0.3	0.2	
Subtotal	**8.6**	**5.4**	**11.2**	**11.4**	**6.4**	**5.0**	

The majority of households in the BVLM (53,8 %) fall under the low-income brackets. This could indicate that an increasing number of households find it difficult to survive and will ultimately become dependent on social assistance in the form of social grants in the absence of targeted sustainable employment creation programmes (BVLM IDP Review 2020-2021).

Within the CWDM, the WLM had the lowest level of households without income (6.4%) but the second highest level of low-income earners (56.6%), followed by the BVLM (53.8%).

According to a 2014/15 survey, an average of 43.9% of farm worker households in the Cape Winelands received at least one child support grant. The WLM had the lowest proportion of child support grants received (Western Cape Government Farmworker Household Survey Report 2014/15).

[4] The HDI is represented by a number between 0 and 1, where 1 indicates a high level of human development and 0 represents no human development.

Basic Services and Housing

Access to services is vital for the livelihoods of households. Lack of provision and lack of basic services often impact the poorest households in a given area.

Table 7: Access to services and housing

(2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM)

Community Survey 2016	Breede Valley	Witzenberg
Total number of households	**47,569**	**35,976**
Formal main dwelling	36 964 77.7%	29 969 83.3%
Water (piped inside dwelling/within 200m	46 077 96.9%	35 730 99.3%
Electricity (primary source of lighting)	45 105 94.8%	34 734 96.5%
Sanitation (flush or chemical toilet)	42 848 90.1%	34 017 94.6%
Refuse removal (at least weekly)	36 976 77.7%	31 343 87.1%

The table above indicates that the vast majority of households in the BVLM and WLM live in formal dwellings, have piped water inside or within 200m of their dwelling, use electricity for lighting, have a flush or chemical toilet, and at least weekly refuse removal.

One of the most important indicators of backlogs in service delivery is provided through examining the number of people living in informal settlements. In the BVLM and WLM, 4% and 5% of the population respectively live in informal areas both of which are above the national average of 3,2% (Municipal Capacity Assessment 2018).

The BVLM and WLM do not provide basic services to rural communities, including farm dwellers. Basic services are provided by the land owner with Eskom providing bulk electricity provision. The 2014/15 survey found that approximately 90% of the farmworker households have piped water, electricity, and flush toilets. Water is provided free to 90% of the farmworkers living on farms across the regions while refuse and sanitation service are free for all farmworkers (Western Cape Government Farmworker Household Survey Report 2014/15).

Crime

Crime rates within the BVLM show a decreasing trend since 2017. The murder rate (per 100 000 people) decreased from 50 to 42 in 2018/19. There were 111 reported sexual offenses in the area in 2017/18. Drug related crimes within the area decreased from 3 784 reported cases in 2017/18 to 2 921 cases in 2018/19. Residential burglary cases also decreased from 1 238 in 2017/18 to 949 in 2018/19 (2019 Socio-economic Profile BVLM).

However, crime in the WLM area shows an increasing trend since 2017. The murder rate increased by 11% from 36 in 2017 to 40 in 2018. Drug-related crimes (per 100 000 population) displayed an increase, up by 1.9% from 2 393 cases in 2017 to 2 438 cases in 2018. Residential burglary cases (per 100 000 population) decreased by 15.9% from 571 in 2017 to 480 in 2018. Sexual offenses reported dropped from 125 to 105, which equates to a reduction of 16% (2018 Socio-economic Profile: WLM).

The BVLM has 2,25 police stations per 100 000, while the WLM has 3,24%. These are both below the national average of 4,68 (Municipal Capacity Assessment 2018).

Crime statistics are reported at precinct level and it is difficult to gauge the level of crime on farms and in remote areas. Farm and rural dwellers have difficulty accessing police services, given distance to police stations, lack of transport, airtime, connectivity, and implicit costs. With regards to gender-based violence, it is widely recognised that credible statistics is scarce, a phenomenon more extreme in rural and farming areas.

Economy

Economic Performance

In 2017, the BVLM local economy was dominated by the finance, insurance, real estate and business services (R2.506 billion; 20%); wholesale and retail trade; catering and accommodation (R2.307 billion; 18.4%); and manufacturing (R1.705 billion; 13.6%) sectors. Combined, these top three sectors contributed R6.518 billion (or 51.8%) to the area's economy.

The 10-year trend shows the economy grew by an average annual rate of 2.5%, but tapered off significantly to 1.7% in more recent times (2014 to 2018). From 2008 to 2017, the finance, insurance, real estate, and business services sector registered the highest average growth rate (5%), followed by the construction (5%) and the wholesale and retail trade; catering and accommodation (3%) sectors. Growth in the agriculture, forestry, and fishing sector was robust at 10% in 2017. However, the sector was estimated to contract by 3.9% in 2018 as the effects of the drought intensifies (BVLM IDP Review 2020-2021; 2019 Socio-economic Profile BVLM).

Table 8: Three largest economic sectors of the BVLM and WLM
(2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM)

Breede Valley Contribution to GDP 2017	**Finance, insurance, real estate & business services** **20%**	**Wholesale & retail trade, catering & accommodation** **18,4%**	**Manufacturing** **13,6%**
Witzenberg Contribution to GDP 2016	**Wholesale & retail trade, catering & accommodation** **17,4%**	**Finance, insurance, real estate & business services** **15,9%**	**Agriculture, forestry & fishing** **15,2%**

In 2016, the WLM local economy was dominated by the wholesale and retail trade, catering and accommodation sector (R1.4 billion or 17.4%), followed by the finance, insurance and real estate, and business services sector (R1.3 billion or 15,9%); agriculture, forestry and fishing sector (R1.2 billion or 15.2%); manufacturing (R1.2 billion or 14%) and general government (R928.9 million or 11%). Combined, these top five sectors contributed R6.1 billion (or 74%) to the WLM municipal economy, which was estimated be worth R8.2 billion in 2016.

The 10-year trend, between 2006 and 2016, showed that the construction sector registered the highest average growth rate (9%) in Witzenberg during this period, followed by the finance and business services sector (7.7%), general government (5.8%); community and social services (5.3%) and wholesale trade (5%). It is concerning that sectors with a significant contribution to the economy, such as agriculture (15%) and manufacturing (14%), registered the lowest growth rates in the period, 2.5% and 2.9% respectively. Growth of the agriculture sector shrunk into negative territory in 2015 and 2016 due to the severe drought but the estimated growth rate for 2017 was a healthy 6% (2018 Socio-economic Profile WLM).

Agriculture remains the largest employer (50%), however, the sector is experiencing a high rate of net job losses, and often only provides seasonal opportunities (Witzenberg Municipality Spatial Development Framework 2019).

Labour

Employment is the primary means by which individuals who are of working age can earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being.

Employment by sector

Table 9: Three largest employers by sector in the BVLM and WLM
(2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM)

Breede Valley	**Agriculture, forestry & fishing** **24%**	**Wholesale & retail trade, catering & accommodation** **20,8%**	**Finance, insurance, real estate & business services** **15,7%**
Witzenberg	**Agriculture, forestry & fishing** **32%**	**Wholesale & retail trade, catering & accommodation** **18,6%**	**Community & social services** **13%**

The agriculture, forestry, and fishing sector contributed the most jobs (24%) in the BVLM and the WLM (32%). This is followed by the wholesale and retail trade, catering and accommodation, 20.8% in the BVLM and 18.6% in WLM; and finance, insurance, real estate, and business services (15.7%) in the BVLM and community and social services (13%) in the WLM.

The agriculture, forestry, and fishing sector reported net job losses (-9 051) between 2008 and 2017 in the BLM, while the WLM reported an average decrease in jobs (-9 517) between 2006 and 2016. Despite increased activity, the sector's contraction between 2008 and 2017 can be attributed to national recession and negative impacts of environmental factors, such as the drought experienced in the area over the past few years. This is a cause for concern, not least because it is one of the top three largest employers. Job shedding in a key economic sector such as agriculture is problematic, given that the local economy is based on the agricultural industry. Despite the contraction, agriculture remains the key economic driver and largest employer in the BVLM. (2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM; WLM IDP).

The sector which reported the largest increase in jobs between 2008 and 2017 in the BVLM was the wholesale and retail trade, catering and accommodation sector (5 412) followed by finance, insurance, real estate and business services (5 131), community, social & personal services (3 032), construction (1 529) and the transport, storage and communication (1 207) sectors. The sector which reported the largest increase in jobs between 2006 and 2016 in the WLM was wholesale, retail, and trade (4 528), followed by community and social services (3 127); general government (2 848); and financial and business services (2 726) (2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM).

Skill level
The majority of workers in both the BVLM (2017) and WLM (2016) labour force were low-skilled (42% and 50% respectively) and semi-skilled (40% and 35% respectively). Only 18% of labour in BVLM and 14,8% in the WLM were considered to be skilled. The increase in the number of semi-skilled workers outpaced the growth in low-skilled and skilled workers during the period of 2014 and 2018 in BVLM, while in the WLM, the number of skilled workers increased much more than that of semi-skilled workers during the period 2006 – 2016, with a slight decrease experienced in the number of low-skilled workers (2019 Socio-economic Profile BVLM; 2018 Socio-economic Profile WLM).

Low-skilled jobs are most commonly adversely affected during an economic downturn and suggest low skilled workers are most vulnerable and face greater risks to income security due to socio-economic shocks.

Unemployment
In 2018, the unemployment rate, referring to individuals without work, but actively seeking work in a recent past period (usually four weeks), and are currently available for work, is 14,4% in the BVLM and 7,6% in the WLM. The youth unemployment rate is a serious problem in both areas and has reached 20% in the BVLM and 9,9% in the WLM. The youth unemployment rate refers to unemployed individuals aged 15 – 24 who are without work, actively seeking work in a recent past period (past four weeks), and currently available for work. (BVLM Municipal Capacity Assessment 2018; WLM Municipal Capacity Assessment 2019).

The proportion of formal to informal employment is 25,5% in the BVLM and 17,4% in the WLM. Informal employment identifies persons who are in precarious employment situations irrespective of whether or not the entity for which they work is in the formal or informal sector. Persons in informal employment, therefore, comprise all persons in the informal sector, employees in the formal sector, and persons working in private households who do not get basic benefits such as pension or medical aid contributions from their employer, and who do not have a written contract of employment. (BVLM Municipal Capacity Assessment 2018; WLM Municipal Capacity Assessment 2019).

The Farmworker Household Survey Report of 2014/15 reports on general demographic trends of farmworker households within the Cape Winelands. According to the study, BVLM had 1005 households and approximately 4222 people living and working on farms, while WLM had the highest number of households at 2482, and 8181 number of people. The study found that an overall of 62.6% of individuals living in farmworker households had permanent jobs both on and off the farm on which they reside. Approximately 18% of individuals living on farms were unemployed, while 19% had either temporary or seasonal work. It is important to note that these statistics presented are based on a survey conducted by the Western Cape Department of Agriculture during the 2014/15 financial period. It is therefore likely that figures have changed over the past six years. (Western Cape Government Farmworker Household Survey Report 2014/15; BVLM IDP Review 2020-2021).

4.2. Fieldwork and sourcing local knowledge

As discussed above, brief participant observation and a limited number of interviews were conducted to supplement secondary data. Fieldwork conducted for the SIA cannot be considered exhaustive by any means.

Key socio-economic issues listed by respondents confirm themes identified by the secondary data and include:

- Lack of economic development and job opportunities – especially for youth;
- Lack of recreational opportunities for youth;
- Increasing level of school dropout, lack of access to post school training, and other future enhancing opportunities among the youth resulting in despondency, apathy and growing rate of social ills;
- Increasing rate of teenage pregnancies;
- Poverty;
- Food insecurity; and
- Rising levels of crime, drug abuse and gangsterism.

The respondent representing Tankwa Ceres Karoo Farmers' Union added the following to this list:

- Lack of municipal services, such as road maintenance, transport, and policing; and
- Marginalization from renewable energy developments.

4.3. Lessons Learned from REIPPPP Social Investment Programs

In addition to its core business of renewable energy, the REIPPPP is designed to contribute to various developmental objectives such as job creation, social upliftment, and economic transformation. It also requires approved energy projects to share ownership with local communities.

According to the South African Government News Agency (2019)[5], the REIPPPP has attracted ZAR 209.4 billion (approx. USD 14.2 billion) in committed private sector investment into South Africa and created 38,701 jobs (full time for one year) since its inception in 2011. Many of these jobs have been for youth and women from surrounding communities. According to analysts (Nomjana, L., 2020)[6] other educational, health, and enterprise benefits experienced include:

- Over R1 billion spent by Independent Power Producers (IPPs) on education, by upskilling teachers, providing extra teachers and classrooms.
- Over 600 bursaries awarded to students from disadvantaged communities.

[5] https://www.sanews.gov.za/south-africa/renewable-energy-programme-attracts-r2094-billion-sa-economy
[6] https://www.futuregrowth.co.za/newsroom/reippp-comes-of-age/

- The provision of health facilities, while contributing to social development through feeding schemes, supporting old age homes, and early childhood development initiatives.
- Helping to establish more than 1 000 small enterprises.

Community trusts
Local community ownership is commonly structured through the establishment of a community trust who then receives the share dividends and is responsible for spending the funds on community projects. The board of trustees is typically made up of independent trustees, community representatives, and, if applicable, beneficiary representatives or power company representatives. However, while best placed to understand and address their community's needs, community trusts do not necessarily have all the skills, knowledge, or development expertise to function effectively. In the worst-case scenario community trusts become dysfunctional, and corrupt: "… as soon as monetary resources are introduced into a local impoverished area it raises significant potential for tensions, mistrust and corruption." (Tait, et al., 2013 page 18). Similarly, local municipalities lack skill and/or capacity for effective partnership.

In the absence of stronger guidance and leadership from the Department of Minerals Resources and Energy and the IPP Office, and effective institutional capacity on the ground, preferred bidders face several challenges, from the selection of trustees to the practicalities of operating trusts over the 20-year project life span. Furthermore, with a core business of producing energy, these companies themselves often lack the requisite knowledge, capacity and skill to set up and manage community trusts. In this context third party social development practitioners can fill the missing link: an advisory board to steward and/or mentor the process, trustees, an association to provide training and support to community trusts, and a body to advise industry on how to structure community trusts, are needed. (Roundtable Conversation Series – Economic Development in REIPPPP July 2016)[7].

Third-party approach
A possible solution mooted by the D.G Murray Trust (DGMT) is to include a civil society-based third-party organisation as a benefactor, while still ensuring that 100% of funds are directed back into the community. This would allow a community trust to use the experience of a social development specialist with a proven track record in implementing programmes that are well established and have demonstrated economies of scale. The lack of institutional capacity in or even near communities closest to renewable energy plants, which are typically located in remote rural areas, is another reason to consider this solution: trusts may have limited experience identifying the urgent needs of a community and finding the right implementation partners. In 2012, Lesedi Solar Park Trust (near Kimberly in the Northern Cape) opted for the third-party approach, appointing DGMT as a beneficiary organisation. Similarly, Letsatsi Solar Park Trust (in the Free State) appointed DGMT and the Rural Education Access Programme (REAP) as co-beneficiaries. (Horwitz, D., 2019)[8]

Community engagement, communication and collaboration
Communication with the beneficiary community is critical for success of the EDP as well as smooth development of the plant itself. It is vital that community members and organisations, local municipalities, ward councillors, and development organisations are not only well informed, but also have the capacity to understand implications for local job creation and wider development planning. Communication and capacity will foster community engagement in developing locally suitable processes and projects thereby maximising the potential value of the EDP.

As the REIPPPP stipulates that communities within a 50-kilometre radius of the project must benefit, beneficiary areas often overlap. Coordination between community trusts operating in overlapping areas is essential but likely insufficient. The competitive nature of the bidding process should not extend to projects' community benefits, and industry players should facilitate an enabling environment for collaboration. This collaboration could include general information sharing, commissioning research, or other support that would benefit the sector as a whole. In addition, regional government bodies or industry associations, with appropriate community accountability mechanisms, should oversee projects in broader regional areas to enable collaboration, streamline processes, give oversight, and improve the efficiency of revenue spending (Tait, L; et al., 2013).

[7] https://sawea.org.za/wp-content/uploads/2016/05/Report_2nd-Roundtable_Community-trusts_27July-2016.pdf
[8] https://dgmt.co.za/wp-content/uploads/2019/11/Renewable-Energy-September-Opp1-Single-FinalDigital.pdf

IPP community trust in Touws River
A concentrated photovoltaic (CPV) solar plant, owned by IPP Pele Green Energy, was constructed near Touws River in 2013, and has been running since 2015, with a 20-year licence to operate. The plant created 600 job opportunities in Touws River during its construction, and established a community trust to help ensure a more sustainable economy in the long term (Buthelezi, L., 2013[9]; Omarjee, L., 2018[10]).

"Our power plant, CPV1, invests a share of annual revenues in the socio-economic and enterprise development of our host community, Touwsrivier. The community also owns 5% of the power plant. Our focus is on the economic revival of the community. Our approach in working with rural communities is on self-sufficiency. Instead of viewing these communities as labour reserves, we've taken a view to see them as economic hubs and we are working to help them achieve economic independence." Gqi Raoleka, Managing Director, Pele Green Energy (A solar project in Touwsrivier is powering ahead. Global Africa Network January 29, 2018)[11]

Knowledge Pele is the part of Pele Energy group of companies which focuses on the social development aspects of the IPP's investments. Committed to using their investment to grow the local economy and ensure the community becomes self-sustaining, Knowledge Pele has a number of initiatives in Touws River, including a bursary programme, accredited enterprise development programmes for start-up and existing SMMEs, work experience programme, a hydroponic farm, and a rooftop solar panel system set up on a local no-fees primary school.

Potential future collaboration should the Applicant receive preferred bidder status
Regrettably, Knowledge Pele's programme manager responsible for their programme in Touws River declined to discuss their interventions with the specialist conducting this SIA (despite several attempts), citing non-disclosure agreements with the community. However, given the merits of collaboration outlined above, it would be well worth the Applicant and the appointed community development practitioner pursuing consultation with this organisation should development of the proposed solar projects go ahead (i.e. receive preferred bidder status and environmental authorisation).

It is worth repeating: The competitive nature of the bidding process should not extend to projects' community benefits, and industry players should facilitate an enabling environment for collaboration (Tait et al., 2013).

4.4. Project Site Specific Description

4.4.1. HOEK DOORNEN PV 1, PV 2, PV 3, AND PV 4: PV Facilities, Electrical Grid Infrastructure, and Associated Infrastructure

The Hoek Doornen PV 1, PV 2, PV 3, and PV 4 sites are located on the farm Hoek Doornen, located approximately 76 km northwest of the town of Touws River, in the Western Cape Province. The farm covers an area of 2,372 hectares, while each 175 MW solar PV plant will cover an approximate footprint of 250 hectares.

Historically used as a winter grazing area for sheep, there is currently no agricultural activity on the farm.

Hoek Doornen is owned by a non-resident landowner who visits occasionally, and has a small residence on the farm. There are no employees on the farm, and only three residents.

The servitude to the neighbouring farm, Witte Wall, crosses Hoek Doornen 172 and Karree Kolk 174.

[9] https://www.iol.co.za/business-report/companies/concentrated-solar-plant-to-deliver-22mw-1610703
[10] https://www.news24.com/fin24/economy/how-a-solar-plant-is-changing-the-fortunes-of-a-small-town-economy-20181014

[11] https://www.globalafricanetwork.com/company-news/a-solar-project-in-touwsrivier-is-powering-ahead/

According to landowner and two of his immediate neighbours, the proposed project will not inhibit current activities on their farms, disrupt social conditions, or employment. No concerns regarding visual impact, land use impact, security or good relations with neighbouring landowners were expressed. Respondents view the proposal as contributing significantly to the economic well-being of their properties which have been particularly hard hit during the recent drought, (2015-present). Income received from leasing some of their land to the Applicant will assist in allowing these respondents to generate revenue from the farm and invest in its upkeep.

However, two neighbouring farmers, who live permanently on their farms, expressed a very different view: Speaking as immediate neighbours of the project site and the interim chairperson of the recently formed Tankwa Ceres Karoo Farmers' Union, the respondents raised several concerns. Negative impacts anticipated by the respondents include:

- Road degradation resulting in withdrawal of government services (including transportation to schools), increase transport costs to towns, damage to vehicles, road accidents, and a decline in tourism;
- Lack of traffic control and concomitant increase in road accidents;
- Dust clouds and storms precipitated by traffic and stripping of veld on construction sites;
- Dust damage to crops;
- Dangerous consequences of dust affecting visibility during hunts;
- Increase in itinerant job seekers and vagrancy;
- Lack of security for residents;
- Increased crime levels;
- Decrease in eco-tourism due to poor road conditions, dust, traffic, and damage to the area's reputation as quiet and pristine;
- Marginalisation of local stakeholders by the developer;
- Lack of open communication; and
- Lack of rehabilitation as part of the decommissioning phase.

The respondents stressed the desire for local residents to be consulted and kept informed about the proposed project. Moreover, they stressed the imperative that local residents should benefit from the proposed project as they are most affected by it. They strongly object to positive impacts such as employment opportunities and the economic development plan solely benefitting the nearby towns of Ceres and Touws River, and expressed concern that any monies received by municipalities from the proposed projects for development initiatives would not be used for social upliftment in the Tankwa Karoo, but be confined to towns. To this end several suggestions were made:

- Roads be upgraded prior to construction to cater for changed patterns in road use (frequency and weight);
- Roads be adequately maintained during the construction phase;
- Roads be upgraded after the construction phase;
- Stop go system and speed limits should be implemented to help prevent dust clouds;
- Tankwa Karoo residents should be given preference in employment: this will require an innovative recruitment process that does not rely on locals registering in a nearby town, as well as the provision of transport from decentralised points within the area (such as the Tankwa Farmstall for example);
- The loss of eco-tourism during the construction phase should be compensated for by use of local accommodation by consultants, contractors, and sub-contractors;
- Security should be provided for more than just project infrastructure and should include mechanisms that benefit the surrounding community such as visual policing, cameras along access roads, a repeater necessary for a radio system, and/or participation in the farm watch initiative;
- The veld should not be stripped of vegetation during construction as this will create a dust bowl that will be difficult if not impossible to rehabilitate;
- Donation of water tanks or solar panels to assist the most indigent community members;
- Sponsorship of events to support and/or generate tourism to the area;
- Drought relief for indigent farmers;
- Appoint a contact person responsible for liaising with local residents; and
- Establish good will and open communication with local residents.

4.5. Identification of Environmental Sensitivities

The identification of environmental sensitivities is not applicable (as discussed in Section 2.2 of this report). There are no socio-economic themes on the Screening Tool that could be confirmed or disputed, therefore no site sensitivity verification report is required. The current use of the land is confirmed and described above. Additional detail is provided in Appendix C.

5. Issues, Risks and Impacts

5.1. Identification of Potential Impacts/Risks

The potential impacts identified during the SIA are described in detail below for the construction, operational, and decommissioning phase of the proposed development as well as the cumulative impacts.

The impacts below apply to the Hoek Doornen PV 1, PV 2, PV 3, PV 4 projects, and it applies to all infrastructure proposed as part of these projects i.e. for the Solar PV Facility, power lines and the associated infrastructure.

Construction Phase
Potential impact 1: Disruption of local social structures
Potential impact 2: Increased social ills and risky behaviours
Potential impact 3: Increased burden on existing social and bulk services
Potential impact 4: Increased road use and road traffic related accidents and/or damage
Potential impact 5: Loss of privacy, safety and sense of place adjacent to the project site
Potential impact 6: Unrealistic expectations regarding local job creation
Potential impact 7: Creation of temporary employment
Potential impact 8: Increased household income attainment and standard of living
Potential impact 9: Potential increase in crime
Potential impact 10: Potential decrease in local eco-tourism
Potential impact 11: Potential marginalisation of local residents
Potential impact 12: Development and/or growth of locally-owned support industries

Operational Phase
Potential impact 1: Creation of long-term employment
Potential impact 2: Development and/or growth of locally-owned industries
Potential impact 3: Human development via the EDP

Decommissioning Phase
Potential impact 1: Job losses
Potential impact 2: Local economy stimulation

Cumulative Impacts
Cumulative impact 1: Exacerbated in-migration of job seekers
Cumulative impact 2: Combined impact of multiple EDPs

The no-go option
The no-go alternative implies that the proposed project would not be executed. Assuming that the solar facilities and associated infrastructure would not be developed at the proposed sites, there would be no increase in electricity generation from the facilities, and no economic benefit to the landowners, or additional socio-economic benefits associated with the potential income generated through the construction and operation of the facilities. Indeed, one of the impacts identified (discussed in Section 6 below) will materialise, should the proposed project not be developed. However, this does not imply that the no-go option has no impacts.

It should be noted that the development's potential negative impacts may well come into being, regardless of the proposed development as most are associated with non-project-related phenomena which could trigger similar job-seeking, influx, and socio-economic impacts as identified for the proposed development.

The potential positive impacts primarily relate to employment opportunities and the EDP. With the exception of the 60 jobs for each project created during the operation phase with an approximate 20-year lifespan, all other employment, while of direct benefit to employees for the duration of their contract, is temporary in nature. The EDP has potential to sustainably benefit a far wider number of people and is likely to result in positive impact. The benefits of both employment and the EDP are not inconsequential, and should be pursued.

Accordingly, the no-go option is likely to result in negative economic impacts on the project area, as the potentially positive impacts from the construction, operational, and decommissioning phases, including the EDP, employment and growth in the small-scale support industry, will be not be realised.

The no-development alternative also poses a lost opportunity for South Africa to supply renewable energy to its consumers. This in effect represents a negative social cost. In addition, the no-go option will not assist National or Provincial governments in achieving their renewable energy commitments.

5.2. Summary of Issues identified during the Public Consultation Phase

This will be documented, if relevant, after the BA Report has been released for public comment. This SIA did not include a public consultation process.

6. Impact Assessment

The impacts below apply to the Hoek Doornen PV 1, PV 2, PV 3, PV 4 projects, and it applies to all infrastructure proposed as part of these projects i.e. for the Solar PV Facility, power lines and the associated infrastructure.

6.1 Potential Impacts during the Construction Phase

6.1.1.1. Impact 1: Disruption of local social structures

The size of the anticipated workforce is the result of the scale of the proposed development. It is likely that job seekers from outside the study area will be attracted to the Tankwa Karoo and to the towns of Touws River and/or Ceres by the anticipated 400 to 460 unskilled jobs, and the 90 to 150 skilled jobs to be created during the 12 to 14 months construction period of the proposed development (i.e. per project). Such influx inevitably disrupts the existing social order which is challenged by alternative values, beliefs and practices. Social order disturbance can lead to general disorientation and deterioration of social capital, particularly in small and/or vulnerable communities.
Status: Negative
Mitigation required:

- The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Where possible, subcontract to local construction companies.

Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Low

6.1.1.2. Impact 2: Increased social ills and risky behaviours

An increase in the number of people in the study area seeking work or working on the proposed development is likely to cause an increase in the number of social ills that are present in the study area. It is likely that substance abuse, the spread of communicable diseases, early sexual debut, prostitution, and increased criminal behaviour may manifest due to the likely disturbance of local social structures (discussed above) and temporary increase in spending power expected to result from increased local employment and/or workforce influx to the area. Even though such influx is not expected to be long-term, the impacts associated with risky social behaviour are of a long-term nature (for example addition, teenage motherhood, Foetal Alcohol Syndrome, school dropout, HIV/Aids transmission).
Status: Negative
Mitigation required:

- The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Where possible, subcontract to local construction companies.

- The developers should be mindful of and regularly engage with landowners, farm residents and with Touws River and/or Ceres local communities. The former can be achieved through liaison with the Tankwa Ceres Karoo Farmers' Union. The latter can be achieved in collaboration with local community organisations.
- The developer should develop and clearly communicate a Code of Conduct for all employees related to the project, which includes zero tolerance of activities such as violence, alcohol and drug abuse.
- Introduce weekly randomized alcohol and drug testing for all employees related to the project.
- Make condoms freely available to all employees related to the project.
- No construction workers should be allowed to sleep at the construction site.
- All COVID regulations and safety precautions in force at the time of construction, operation and decommissioning must be communicated to workforce, enforced and upheld by the developer.
- The construction workforce should receive COVID-19 and HIV awareness training before the commencement of construction.
- HIV and TB testing and counselling should be made available to the construction workforce free of charge.
- Local HIV infection rates/ARV treatment loads must be monitored annually through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the developers (or the appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.

Impact significance (Pre-Mitigation): Moderate
Impact Significance (Post Mitigation): Low

6.1.1.3. Impact 3: Increased burden on existing social and bulk services

Jobseekers and migrant labour will by necessity be accommodated in the area. This influx, depending on its size, can place pressure on social structures and local government to provide housing, services and social facilities, albeit temporarily. It should be noted that the bulk of the unskilled workforce is likely to be housed in backyard dwellings within existing settlements, with its attendant health challenges (e.g. poor sanitation and variable access to electricity for heating and lighting purposes), and contributing to increased densification.
Status: Negative
Mitigation required:

- It is strongly suggested that a 'locals first' policy with regard to labour needs is implemented. The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Where possible, subcontract to local construction companies.

Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Low

6.1.1.4. Impact 4: Increased road use and road traffic related accidents and/or damage

An increase in traffic, including construction and/or vehicles carrying heavy loads associated with the construction phase of the proposed project can damage access road surfaces and/or cause excessive dust, impacting on road safety, access to and by social services (including inter-alia social grants, health facilities, transport), schools and retail, potentially damage vehicles and/or crops, and lead to a decline in tourism. It must also be noted that a Traffic Impact Statement was also commissioned to inform the BA Processes, which concluded that overall the proposed traffic generated during the construction phase is regarded as low to very low significance without the implementation of mitigation measures. The TIS also provided recommendations for management actions, and if these are adhered to, the proposed development is supported from a traffic engineering perspective.
Status: Negative
Mitigation required:

- Traffic expert should be consulted post Environmental Authorisation and prior to construction, and a road and traffic management plan devised and implemented to mitigate potential negative consequences of increased road use during construction.

Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Low

6.1.1.5. **Impact 5: Loss of privacy, safety and sense of place**

The farm worker homes on Hoek Doornen flank a servitude, currently proposed as the access road to the Witte Wall PV 1 & PV 2 sites. Deliveries, and transportation of 400 – 460 unskilled and 90 – 150 skilled workers across their homestead will lead to a loss of privacy and potentially pose a threat to their safety, sense of place and well-being.

Status: Negative

Mitigation Required:

- No construction workers should be allowed to sleep at the construction sites.
- A maximum 60 km/h speed limit should be enforced on private roads.

Impact significance (Pre-Mitigation): Low

Impact Significance (Post Mitigation): Low

6.1.1.6. Impact 6: Unrealistic expectations regarding local job creation

Tankwa Karoo, Touws River and/or Ceres residents, as well as local and itinerant job seekers will have hopes and expectations of the proposed projects. These expectations need to be informed by accurate information from the developer or the appointed agent as soon as possible, to minimize unrealistic expectations and avoid potential negativity towards the proposed projects where possible. Failure to communicate honestly and proactively may lead to negative impacts such as public opposition, protests, damage to property and/or intimidation of project employees.

Status: Negative

Mitigation required:

- It is strongly suggested that a 'locals first' policy with regard to labour needs is implemented. The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- The developer must engage the local communities in the study area on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations have been granted.
- The developer should establish employment desks in the Tankwa Karoo, Touws River and/or Ceres to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates.
- Employment procedures should not preclude the educationally and resource poor. As discussed in this report, education and skill level within the study area is low, and access to resources such as computers and printers is negligible, particularly in the Tankwa Karoo.
- The existence of the employment desks and the relevant procedures associated with the selection and appointment of workers must be communicated to the local communities.
- Where possible, the developer should subcontract to local construction companies.

Impact significance (Pre-Mitigation): Low

Impact Significance (Post Mitigation): Very Low

6.1.1.7. Impact 7: Creation of temporary employment

As the construction of the facilities and associated infrastructure will require temporary employment of construction workers, supervisors, and engineers on-site, a limited number of temporary jobs will be created. According to information provided by the Applicant, these are anticipated to be between 400 and 460 unskilled employment opportunities, and 90 to 150 skilled employment opportunities for a period of up to 12 - 14 months. As discussed in this report, education and skill level within the study area is low, thereby rendering the majority of locals best suited for unskilled positions. While contributing to the employment situation primarily in the short term, even temporary employment will provide sorely needed income and, additionally provide opportunity for garnering work experience and developing new skills in an environment where such opportunities are extremely rare and which may enable future employment. Debt is a potential negative impact associated with temporary employment and is likely to occur given the financial stressors facing communities within the project area. However, the risk of this negative impact is offset by the positive impacts created by employment, albeit temporary.

Equality is a fundamental principle of the South African Constitution and Bill of Rights. Remuneration, employment benefits, terms and conditions of employment as well as job classification and grading

are expressly listed as employment policies or practices in respect of which unfair discrimination is prohibited by the Employment Equity Act (EEA) (Laubscher, T 2015)[12]. The EEA's amendment bill of July 2019, will regulate the setting of sector-specific employment targets (in some instances by 2025) to address the under-representation of certain population groups. It will also ensure that an employment equity certificate of compliance becomes a precondition for access to state contracts (BusinessTech).[13] Equal access to employment must be given due consideration in line with relevant legislation and the area's demographics: This is especially pertinent to the employment of women in the BVLM given its 2020 sex ratio of 91.9 as discussed in Section 4 above.

Status: Positive

Enhancement required:

- The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Where possible, the developer should subcontract to local construction companies.
- The developer should comply with the EEA and make every effort to ensure equal access to employment, taking the demographics of the area into account.
- The developer should establish local employment desks in the Tankwa Karoo, Touws River and/or Ceres to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details.
- Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates.
- Employment opportunities and the existence of the employment desk must be communicated to the local communities in the Tankwa Karoo, Touws River and/or Ceres.
- The developer should offer debt education workshops for all project related employees.
- The developer is encouraged to provide on-the-job training and additional training programs to improve the chances of skills development during the construction phase.

Impact significance (Pre-Enhancement): Moderate

Impact Significance (Post Enhancement): Moderate

6.1.1.8. Impact 8: Increased household income attainment and standard of living

Employment created by the proposed development will provide opportunity to improve the standard of living for benefitting households, enhance purchasing power within the local community, and help stimulate the local economy, albeit temporarily. Therefore, the local business owners and individuals employed at these businesses as well as project employees will also likely experience some improvement in their income and pass these benefits onto their households.

Status: Positive

Enhancement required:

- The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Employment opportunities and the existence of the employment desks must be communicated to the local communities in the Tankwa Karoo, Touws River and/or Ceres.

Impact significance (Pre-Enhancement): Moderate

Impact Significance (Post Enhancement): Moderate

6.1.1.9. Impact 9: Potential increase in crime

The construction phase, in particular, will create an additional movement of people and vehicles to the project site, which can increase the chances of crime in the surrounding area. This impact could cause the loss of a sense of safety and security, loss of livestock, flora, or valuables, as well as harm to person and/or property.

Status: Negative

Mitigation required:

- Access to the project site should be controlled with only authorised staff permitted entry.
- Movement to and from the project site should be controlled where construction workers are transported to and from the pick-up area and project site by the developer or the appointed agent only.

[12] https://islssl.org/wp-content/uploads/2015/10/SouthAfrica-TalitaLaubscher.pdf

[13] https://businesstech.co.za/news/business/370656/south-africas-big-employment-equity-shake-up-is-coming/

- The developer could consider forming or participating in a local safety forum and/or community watch to address any concerns related to possible crime escalation.
- The developer could consider erecting and/or contributing to the costs of erecting security cameras and/or a repeater to help improve crime prevention and management in the area.

Impact significance (Pre-Mitigation): Moderate
Impact Significance (Post Mitigation): Low

6.1.1.10. Impact 10: Potential decrease in local eco-tourism

The potential deteriorating road conditions, increase in dust, traffic, and likelihood of crime, as well as damage to the public perception of the area as attractive, quiet and pristine may lead to a decline in tourism in the Tankwa Karoo, particularly in areas close to the proposed project sites. Loss of revenue, albeit primarily during the construction phase, will negatively impact local eco-tourism business owners.

Status: Negative

Mitigation required:

- The developer should make use of local eco-tourism services and product providers where possible.
- The developer should provide consultants, contractors and other skilled project related staff with a list of local eco-tourism services and product providers with a clear request to support local eco-tourism, where possible.

Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Very Low

6.1.1.11. Impact 11: Potential marginalisation of local residents

To build goodwill and support for the proposed development and avoid alienation and potential negativity among Tankwa Karoo residents, the developer should liaise with local organisations, such as the Tankwa Ceres Karoo Farmers Union. Failure to communicate with local residents honestly and proactively may lead to negative impacts such as lack of cooperation, public opposition, and protests.

Status: Negative

Mitigation required:

- The developer should consider appointing a community liaison person tasked with establishing and maintaining effective communication with local residents and/or their representatives.

Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Low

6.1.1.12. Impact 12: Development and/or growth of locally-owned industries

There is limited opportunity for the growth of locally owned service industries such as local accommodation, catering, transport, construction, and suppliers of goods, such as construction materials, in response to construction-related activities and possible influx of consultants, contractors and other employees associated with the proposed development. Such opportunities are expected to be temporary.

Status: Positive

Enhancement required:

- The developer should make use of local service and goods providers where possible.
- The developer should provide consultants, contractors and other skilled project related staff with a list of local service and goods providers with a clear request to support local businesses where such services are required.

Impact significance (Pre-Enhancement): Low
Impact Significance (Post Enhancement): Low

6.1.1.13. Impact Summary Tables: Potential Impacts during the Construction Phase

Impact	*Impact Criteria*		*Significance & Ranking (Pre-Mitigation / Pre-Enhancement)*	*Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)*	*Significance & Ranking (Post-Mitigation / Post-Enhancement)*	*Confidence Level*
DIRECT IMPACTS						
CONSTRUCTION PHASE						
Disruption of local social structures	*Status*	Negative	Low Level 4	• The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres. • Where possible, subcontract to local construction companies.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Medium term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	Moderate				
Increased social ills and risky behaviours	*Status*	Negative	Moderate Level 3	• The developer should make every effort to ensure the majority of construction workers are de facto residents of Tankwa Karoo, Touws River and/or Ceres. • Where possible, subcontract to local construction companies • The developers should be mindful of and regularly engage with landowners, farm residents and with Touws River and/or Ceres local communities. The former can be achieved through liaison with the Tankwa Ceres Karoo Farmers' Union. The latter can be achieved in collaboration with local community organisations. • The developer should develop and clearly communicate a Code of Conduct for all employees related to the project, which includes zero tolerance of activities such as violence, alcohol and drug abuse. • Introduce weekly randomized alcohol and drug testing for all employees related to the project. • Make condoms freely available to all employees related to the project. • No construction workers should be allowed to sleep at the construction site. • All COVID regulations and safety precautions in	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Medium term				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	n/a				

Impact	Impact Criteria		Significance & Ranking (Pre-Mitigation / Pre-Enhancement)	Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)	Significance & Ranking (Post-Mitigation / Post-Enhancement)	Confidence Level
DIRECT IMPACTS						
				force at the time of construction, operation and decommissioning must be communicated to workforce, enforced and upheld by the developer. • The construction workforce should receive COVID-19 and HIV awareness training prior to the commencement of construction. • HIV and TB testing and counselling should be made available to the construction workforce free of charge. • Local HIV infection rates/ARV treatment loads must be monitored annually through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the developers (or the appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.		
Increased burden on existing social and bulk services	*Status*	Negative	Low Level 4	• It is strongly suggested that a 'locals first' policy with regard to labour needs is implemented. The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres. • Where possible, subcontract to local construction companies	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Short to medium term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	n/a				
Increased road use and road traffic related accidents and/or damage	*Status*	Negative	Low Level 4	Traffic expert should be consulted, post Environmental Authorisation and prior to construction, and a road and traffic management plan devised and implemented to mitigate potential negative consequences of increased road use during and construction.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Short to medium term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	n/a				

Impact	Impact Criteria		Significance & Ranking (Pre-Mitigation / Pre-Enhancement)	Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)	Significance & Ranking (Post-Mitigation / Post-Enhancement)	Confidence Level
DIRECT IMPACTS						
Loss of privacy, safety and sense of place adjacent to the project site	*Status*	Negative	Low Level 4	• No construction workers should be allowed to sleep at the construction sites. • A maximum 60 km/h speed limit should be enforced on private roads.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	High				
	Irreplaceability	n/a				
Unrealistic expectations regarding local job creation	*Status*	Negative	Low Level 4	• It is strongly suggested that a 'locals first' policy with regard to labour needs is implemented. The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres. • The developer must engage the local communities in the study area on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations has been granted. • The developer should establish employment desks in the Tankwa Karoo, Touws River and/or Ceres to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. • Employment procedures should not preclude the educationally and resource poor. As discussed in this report, education and skill level within the study area is low, and access to resources such	Very Low Level 5	Medium
	Spatial Extent	Local				
	Duration	Medium to long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	n/a				

Impact	Impact Criteria		Significance & Ranking (Pre-Mitigation / Pre-Enhancement)	Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)	Significance & Ranking (Post-Mitigation / Post-Enhancement)	Confidence Level
DIRECT IMPACTS						
				as computers and printers is negligible, particularly in the Tankwa Karoo. • The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local communities. • Where possible, the developer should subcontract to local construction companies.		
Creation of temporary employment	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	Positive Local Long term Substantial Very likely High n/a	Moderate Level 3	• The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres. • Where possible, the developer should subcontract to local construction companies. • The developer should comply with the EEA and make every effort to ensure equal access to employment, taking the demographics of the area into account. • The developer should establish local employment desks in the Tankwa Karoo, Touws River and/or Ceres to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. • Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. • Employment opportunities and the existence of the employment desk must be communicated to the local communities in the Tankwa Karoo, Touws River and/or Ceres. • The developer should offer debt education workshops for all project related employees. • The developer is encouraged to provide on-the-job	Moderate Level 3	Medium

Impact	Impact Criteria		Significance & Ranking (Pre-Mitigation / Pre-Enhancement)	Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)	Significance & Ranking (Post-Mitigation / Post-Enhancement)	Confidence Level
DIRECT IMPACTS						
				training and additional training programs to improve the chances of skills development during the construction phase.		
Increased household income attainment and standard of living	*Status*	Positive	Moderate Level 3	• The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres local communities. • Employment opportunities and the existence of the employment desk must be communicated to the local communities in Tankwa Karoo, Touws River and/or Ceres.	Moderate Level 3	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	High				
	Irreplaceability	n/a				
Potential increase in crime	*Status*	Negative	Moderate Level 3	• Access to the project site should be controlled with only authorised staff permitted entry. • Movement to and from the project site should be controlled where construction workers are transported to and from the pick-up area and project site by the developer or the appointed agent only. • The developer could consider forming or participating in a local safety forum and/or community watch to address any concerns related to possible crime escalation. • The developer could consider erecting and/or contributing to the costs of erecting security cameras, and/or a repeater to help improve crime prevention and management in the area.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Medium				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	n/a				
Potential decrease in local tourism	*Status*	Negative	Low Level 4	• The developer should make use of local eco-tourism services and product providers where possible. • The developer should provide consultants, contractors and other skilled project related staff with a list of local eco-tourism services and product providers with a clear request to support local eco-tourism, where possible.	Very Low Level 5	Medium
	Spatial Extent	local				
	Duration	Short to medium term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	n/a				

Impact	*Impact Criteria*		*Significance & Ranking (Pre-Mitigation / Pre-Enhancement)*	*Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)*	*Significance & Ranking (Post-Mitigation / Post-Enhancement)*	*Confidence Level*
DIRECT IMPACTS						
Potential marginalisation of local residents	*Status*	Negative	Low Level 4	• The developer should consider appointing a community liaison person tasked with establishing and maintaining effective communication with local residents and/or their representatives. •	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Permanent				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low				
	Irreplaceability	n/a				
Development and/or growth of locally-owned industries	*Status*	Positive	Low Level 4	• The developer should make use of local service and goods providers where possible. • The developer should provide consultants, contractors and other skilled project related staff with a list of local service and goods providers with a clear request to support local businesses where such services are required.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	High				
	Irreplaceability	n/a				

6.1.2. Potential Impacts during the Operations Phase

6.1.2.1. Impact 1: Creation of long-term employment

A total of approximately 60 job opportunities will be created, comprising 20 skilled and 40 unskilled opportunities during the operation phase of the proposed development (for each project). Unskilled jobs will be linked to services such as panel cleaning, maintenance and security. Employment opportunities to be created during this phase equate to approximately 4800 person months (for skilled opportunities) and approximately 9600 person months (for unskilled opportunities) per project over the 20-year plant lifespan. As discussed in this report, education and skill level within the study area is low, thereby rendering the majority of locals best suited for unskilled positions. Equal access to employment must be given due consideration in line with relevant legislation and the area's demographics: This is especially pertinent to the employment of women in the BVLM given its 2020 sex ratio of 91.9 as discussed in Section 4 above.

These long-term job opportunities may provide income resilience to some community members employed by the proposed development and introduce an additional income stream to the area, thereby helping to diversify the areas economic base. Unskilled workers will likely benefit from skills transfer and knowledge development and this will contribute to expanding their skills set and enhance their future employment opportunities.

Status: Positive

Enhancement required:

- The developer should make every effort to ensure the majority of unskilled workers employed during this phase are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
- Employment opportunities and the existence of the employment desks must be communicated to the local communities in the Tankwa Karoo, Touws River and/or Ceres.
- The employment desk registers compiled during construction phase should be consulted to identify appropriately qualified candidates.
- The developer must comply with the EEA and make every effort to ensure equal access to employment, taking the demographics of the area into account.
- Contracts ensuring that knowledge sharing and on-the-job training should be enforced as a condition for the development of the project.

Impact significance (Pre-Enhancement): Very low

Significance of impact (Post Enhancement): Very low

6.1.2.2. Impact 2: Development and/or growth of locally-owned industries

There is limited opportunity for the growth of locally owned service industries such as local accommodation, catering, transport, and suppliers of goods, such as cleaning and maintenance materials, in response to operation-related activities and possible influx of consultants, contractors and other employees associated with the proposed development.

Status: Positive

Enhancement required:

- The developer should procure goods and services locally where possible.
- The developer should provide consultants, and other project related staff with a list of local service providers with a clear request to support local businesses where such services are required.

Impact significance (Pre- Enhancement): Very low

Impact Significance (Post Enhancement): Very low

6.1.2.3. Impact 3: Human development via the EDP

The Applicant indicated that an EDP will be developed, should the proposed project be selected as a preferred bidder in terms of the REIPPPP. The positive impacts thereof relate to the creation of employment, local spending and human capacity development. However, the attainment of these positive impacts will create substantial social and economic pull factors which are likely to attract job seekers (i.e. a potential negative impact). Such negative impacts are however considered to be completely acceptable in light of the much-needed development in the area.

Status: Positive

Enhancement required:

- The EDP to be developed must be prepared by community development practitioners, to ensure that it can be effectively implemented and managed, bringing maximum benefit to the community. A third-party approach (as discussed in Section 4.3 of this report) is recommended.
- The developer or the appointed agent must engage with local communities, religious organisations, organised agriculture, NGOs, CBOs and local government structures to identify and agree upon priorities.
- Such priorities must then be included in the EDP.
- Where possible, the EDP should align with the IDPs of the relevant Local Municipalities.

Impact significance (Pre-Enhancement): Moderate
Impact Significance (Post Enhancement): High

6.1.2.4. Impact Summary Tables: Potential Impacts during the Operational Phase

Impact	*Impact Criteria*		*Significance & Ranking (Pre-Mitigation / Pre-enhancement)*	*Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)*	*Significance & Ranking (Post-Mitigation / Post-enhancement)*	*Confidence Level*
DIRECT IMPACTS						
OPERATIONAL PHASE						
Creation of long-term employment	*Status*	Positive	Very Low Level 5	• The developer should make every effort to ensure the majority of unskilled workers employed during this phase are de facto residents of the Tankwa Karoo, Touws River and/or Ceres. • Employment opportunities and the existence of the employment desks must be communicated to the local communities in the Tankwa Karoo, Touws River and/or Ceres. • The employment desk registers compiled during construction phase should be consulted to identify appropriately qualified candidates. • The developer must comply with the EEA and make every effort to ensure equal access to employment, taking the demographics of the area into account. • Contracts ensuring that knowledge sharing and on-the-job training should be enforced as a condition for the development of the project.	Very Low Level 5	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Slight				
	Probability	Very unlikely				
	Reversibility	High				
	Irreplaceability	n/a				
Development and/or growth of locally-owned industries	*Status*	Positive	Very Low Level 5	• The developer should procure goods and services locally where possible. • The developer should provide consultants, contractors and other project related staff with a list of local service providers with a clear request to support local businesses where such services are required.	Very Low Level 5	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Slight				
	Probability	Very unlikely				
	Reversibility	n/a				
	Irreplaceability	n/a				
Human development via the EDP	*Status*	Positive	Moderate Level 3	• The EDP to be developed must be prepared by community development practitioners, to ensure that it can be effectively implemented and	High Level 2	Medium
	Spatial Extent	Local				
	Duration	Long term				

Impact	Impact Criteria		Significance & Ranking (Pre-Mitigation / Pre-enhancement)	Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)	Significance & Ranking (Post-Mitigation / Post-enhancement)	Confidence Level
DIRECT IMPACTS						
	Consequence	Substantial		managed, bringing maximum benefit to the community. A third-party approach (as discussed in section 4.3) is recommended • The developer or the appointed agent must engage with local communities, religious organisations, organised agriculture, NGOs, CBOs and local government structures to identify and agree upon priorities • Such priorities must then be included in the EDP. • Where possible, the EDP should align with the IDPs of the relevant Local Municipalities.		
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	n/a				

6.1.3. Potential Impacts during the Decommissioning Phase

6.1.3.1. Impact 1: Job losses

The proposed development has an expected 20-year life span after which it could be decommissioned. Decommissioning will result in job losses. Though unavoidable in such projects, appropriate measures should be taken to plan for retrenchments and to provide the affected community with alternatives where practical and appropriate.

Status: Negative

Mitigation required:

- The developer should comply with relevant South African labour legislation when retrenching employees.
- The developer should implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning.

Impact significance (Pre-Mitigation): Low

Impact Significance (Post Mitigation): Low

6.1.3.2. Impact 2: Local economy stimulation

Expenditure will be allocated for decommissioning activities which will commence after the 20-year life span of the facility. Such expenditure will generate positive impacts on production, GDP, employment and household income, albeit relatively small and for a temporary period. Decommissioning activities will stimulate demand for transport services, accommodation and construction and other industries amongst others. The local economy will thus be stimulated for the duration of the decommissioning phase.

Status: Positive

Enhancement required: None available

Impact significance (Pre-Enhancement): Low

Impact Significance (Post Enhancement): Low

6.1.3.3. Impact Summary Tables: Potential Impacts during the Decommissioning Phase

Impact	*Impact Criteria*		*Significance & Ranking (Pre-Mitigation / Pre-enhancement)*	*Potential mitigation measures (Negative Impacts) Potential enhancement measures (Positive Impacts)*	*Significance & Ranking (Post-Mitigation / Post-enhancement)*	*Confidence Level*
DIRECT IMPACTS						
DECOMMISSIONING PHASE						
Job losses	*Status*	Negative	Low Level 4	• The developer should comply with relevant South African labour legislation when retrenching employees. • The developer should implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning.	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	n/a				
	Irreplaceability	n/a				
Local economy stimulation	*Status*	Positive	Low Level 4	None	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Short term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	n/a				
	Irreplaceability	n/a				

6.1.4. Cumulative Impacts

Table 10 provides a list of other renewable energy projects (approved) and proposed renewable energy projects (i.e. the proposed Ceres PV Development), and authorised and proposed EGI projects within the 30 km radius.

Table 10: List of projects to be considered for the cumulative impact assessments
(Adapted from Lanz, J. 2020)

DEA Reference	Title	Technology	MegaWatts
Approved Renewable Energy Projects			
14/12/16/3/3/1/1976	Kudusberg WEF	Wind	325
12/12/20/1783/1	Perdekraal 1	Wind	150
12/12/20/1783/2	Perdekraal 2	Wind	150
12/12/20/1787	Konstabel	Wind and Solar PV	170
12/12/20/1956	Touwsrivier	Solar PV	36
12/12/20/1988	Roggeveld Wind Farm	Wind	750
14/12/16/3/3/2/899	Rietkloof	Wind	36
14/12/16/3/3/2/810	Montague Road	Solar PV	75
14/12/16/3/3/2/900	Brandvalley WEF	Wind	147
14/12/16/3/3/1/1984	Tooverberg WEF	Wind	264
14/12/16/3/3/2/1115	Rondekop WEF	Wind	325
Proposed Renewable Energy Projects			
Pending	Proposed Ceres PV Development (9 PV Facilities)	Solar PV	1575
Existing Power Lines / EGI Projects			
Existing Line	Eskom BACCHUS DROERIVIER 1	EGI	N/A
Existing Line	Eskom DROERIVIER MULDERSVLEI 2	EGI	N/A
Existing Line	Eskom Gamma-Kappa 1st 765kV line	EGI	N/A
Existing Line	Eskom Kappa-Sterrekus (Omega) 1st 765kV line	EGI	N/A
Authorised Power Lines / EGI Projects			
14/12/16/3/3/1/1983	Tooverberg EGI	EGI	N/A
Not provided	Perdkekraal West EGI	EGI	N/A
Proposed Power Lines / EGI Projects			
Not applicable – in screening stage	Planned Eskom Gamma-Kappa 2nd 765kV line	EGI	N/A
Not applicable – in screening stage	Planned Eskom Kappa-Sterrekus 2nd 765kV line	EGI	N/A
Pending	Proposed Ceres PV Development (9 Power Lines)	EGI	N/A

The cumulative impacts apply to the construction and operational phases.

6.1.4.1. Impact 1: Exacerbated in-migration of job seekers

The incidence and severity of the in-migration of job seekers as well as increases in social deviance might increase as more solar energy facilities and associated EGI are developed in the area. This is of importance as several other solar energy developments are being proposed in the area, as listed in Table 10 above. However, such increases are similarly associated with most other forms of economic and social development and should therefore be expected from any industrial-scale developments in the study area. It should also be borne in mind that influx of job seekers does not necessarily equate in social deviance; i.e. influx of job seekers is a social disruptor which could result in social impacts.
Status: Negative
Mitigation required: None available
Impact significance (Pre-Mitigation): Low
Impact Significance (Post Mitigation): Low

6.1.4.2. Impact 2: Combined human development caused by multiple EDPs being implemented

Should more than one solar PV facility be developed in the study area; it is very likely that multiple community development funds/initiatives might be implemented by the relevant project developers as part of their respective obligations under REIPPPP. Such multiple EDPs is likely to enhance the creation of employment, local spending and human capacity development.
Status: Positive
Enhancement required: None available
Impact significance (Pre-Enhancement): Moderate
Impact Significance (Post Enhancement): Moderate

6.1.4.3. Impact Summary Tables: Cumulative Impacts

Impact	*Impact Criteria*		*Significance & Ranking (Pre-Mitigation / Pre-enhancement)*	*Potential mitigation measures / Potential enhancement measures (Positive Impacts)*	*Significance & Ranking (Post-Mitigation / Post-enhancement)*	*Confidence Level*
CUMULATIVE IMPACTS						
Exacerbated in-migration of job seekers	*Status*	Negative	Low Level 4	None	Low Level 4	Medium
	Spatial Extent	Local				
	Duration	Medium to long term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	n/a				
	Irreplaceability	n/a				
Combined human development caused by multiple EDPs being implemented	*Status*	Positive	Moderate Level 3	None	Moderate Level 3	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Substantial				
	Probability	Likely				
	Reversibility	n/a				
	Irreplaceability	n/a				

7. Impact Assessment Summary

The overall impact significance findings, following the implementation of the proposed mitigation measures are shown in Table 11 below:

The impacts below apply to the Hoek Doornen PV 1, PV 2, PV 3, PV 4, and it applies to all infrastructure proposed as part of these projects i.e. for the Solar PV Facility, power lines and the associated infrastructure.

Table 11: Overall impact significance (post mitigation)

Phase	Overall Impact Significance
Construction	Very low to Low (negative) / Low to Moderate (positive)
Operational	Very low to high (positive)
Decommissioning	Low (negative) / Low (positive)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low (negative) / Moderate (positive)
Cumulative - Operational	Low (negative) / Moderate (positive)
Cumulative - Decommissioning	No impact

8. Legislative and Permit Requirements

No licences or permits are required in terms of the socio-economic impact of the proposed development.

However, it is important to note that the proposed project is aligned with the goals of national legislation down to local level. Specifically, it is aligned with the National Development Plan 2030 as it is linked to creating jobs and livelihoods, expanding infrastructure, and transitioning to a low-carbon economy. It is also linked to the 2019 Integrated Resources Plan (IRP), which notes that solar PV will account for 10.52 % of the total installed capacity by 2030. If these projects are selected as preferred bidders, then they will contribute towards this installed capacity. Furthermore, the proposed project falls within the Komsberg REDZ, in line with GN 114, which has gazetted a total of eight REDZs as an outcome of the Wind and Solar Phase 1 SEA, wherein wind and solar PV developments are incentivised and most suitable.

9. Environmental Management Programme Inputs

The key mitigation measures proposed by the specialist, and which needs to be included in the EMPr. are listed below.

Construction Phase

- Management Measures:
    - The developer should make every effort to ensure the majority of construction workers are de facto residents of the Tankwa Karoo, Touws River and/or Ceres.
    - Where possible, subcontract to local construction companies.
    - Tankwa Karoo residents should be given preference in employment: this will require an innovative recruitment process that does not rely on technology or locals registering in a nearby town, as well as the provision of transport from decentralised points within the area (such as the Tankwa Farmstall for example).
    - The developers should be mindful of and regularly engage with local landowners and farm residents and with Touws River and/or Ceres communities. The former can be achieved by liaising with the Tankwa Ceres Karoo Farmers' Union. The latter can be achieved in collaboration with local community organisations.

- The developer should develop and clearly communicate a Code of Conduct for all employees related to the project, which includes zero tolerance of activities such as violence, alcohol and drug abuse.
- Introduce weekly randomized alcohol and drug testing for all employees related to the project.
- Make condoms freely available to all employees related to the project.
- No construction workers should be allowed to sleep at the construction site.
- A maximum speed limit of 60 km/hour should be enforced on private roads.
- All COVID regulations and safety precautions in force at the time of construction, operation and decommissioning must be communicated to workforce, enforced and upheld by the developer.
- The construction workforce should receive COVID-19 and HIV awareness training before the commencement of construction.
- HIV and TB testing and counselling should be made available to the construction workforce free of charge.
- Local HIV infection rates/ARV treatment loads must be monitored annually through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the developers (or the appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.
- The developer must engage the local communities in the study area on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations has been granted.
- The developer should establish employment desks in the Tankwa Karoo, Touws River and/or Ceres to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates.
- Employment procedures should not preclude the educationally and resource poor. As discussed in this report, education and skill level within the study area is low, and access to resources such as transport, computers and printers is negligible, particularly in the Tankwa Karoo.
- The existence of the employment desks and the relevant procedures associated with the selection and appointment of workers must be communicated to local communities.
- Traffic expert should be consulted, post Environmental Authorisation and prior to construction, and a road and traffic management plan devised and implemented to mitigate potential negative consequences of increased road use during and construction.
- The developer could consider forming or participating in a local safety forum and/or community watch to address any concerns related to possible crime escalation.
- The developer could consider erecting and/or contributing to the costs of erecting security cameras and/or a repeater to help improve crime prevention and management in and around the project area.
- The developer should make use of local eco-tourism services and product providers where possible.
- Appoint a contact person responsible for liaising with local residents.

- <u>Monitoring Actions:</u>
  - Composition of workforce to be monitored during construction to assess number of de facto local residents employed.
  - Compliance with employment legislation to be monitored.
  - Undertake a review of the following as stipulated in the EMPr:
    - Community communication strategy, dates and outcomes of engagement;
    - Code of Conduct, date and means of communication;
    - Testing dates and results;
    - Security records;

- Dates, duration, and content outline of prevention of disease training and register of attendance;
- Site access records;
- Location of access roads;
- Workforce and contractors register;
- Community engagement dates and outcomes of engagement records;
- Work desk/s work register/s;
- Record of debt education workshops and other skills training; and
- Access and transport arrangement records reviewed.

Operational Phase

- Management Measures:
  - The developer should make every effort to ensure the majority of unskilled workers employed during this phase are de facto residents of the Tankwa Karoo, Touws River and/or Ceres;
  - Employment opportunities and the existence of the employment desk must be communicated to the local communities in Tankwa Karoo, Touws River and/or Ceres;
  - The employment desk registers compiled during construction phase should be consulted to identify appropriately qualified candidates with preference given to Tankwa Karoo residents where possible;
  - The developer must comply with the EEA and make every effort to ensure equal access to employment, taking the demographics of the area into account;
  - Contracts ensuring that knowledge sharing and on-the-job training should be enforced as a condition for the development of the project;
  - The developer should procure goods and services locally where possible;
  - The developer should provide consultants, contractors and other project related staff with a list of local service providers with a clear request to support local businesses where such services are required;
  - The EDP to be developed must be prepared by community development practitioners, to ensure that it can be effectively implemented and managed, bringing maximum benefit to communities. A third-party approach (as discussed in section 4.3) is recommended;
  - The developer or the appointed agent must engage with local communities, religious organisations, organised agriculture, NGOs, CBOs and local government structures to identify and agree upon priorities;
  - Such priorities must then be included in the EDP;
  - Where possible, the EDP should align with the IDPs of the relevant Local Municipalities;
  - Retain a contact person responsible for liaising with local residents.

- Monitoring Actions:
  - Review all employment records, and registers for compliance;
  - Review community engagement reports;
  - Review knowledge sharing and job training reports;
  - Review procurement records;
  - Review list of local good and service providers and distribution thereof to relevant parties;
  - Review EDP, public participation records and local IDPs.

Decommissioning Phase

- Management Actions:
  - The developer should comply with relevant South African labour legislation when retrenching employees;
  - The developer should implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning;
  - All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse;
  - Retain a contact person responsible for liaising with local residents.

- Monitoring Actions:
  - Review retrenchment plans;
  - Review training reports.

10. Final Specialist Statement and Authorisation Recommendation

Socio-economic impacts and the respective significance of these impacts are highly dependent on the receiving social and economic environment or context in which the impacts occur. For example, a small community like Touws River, with high unemployment rates and a declining economy would experience impacts differently compared to a community where everyone is fully employed and there is a growing economy with various economic drivers.

Secondary and primary data present the study area as characterised by substantial poverty, low employment and limited livelihood strategies. A depressed economy, lack of public and private enterprise together with seasonal nature of agricultural employment contributes to the high level of unemployment, depriving community members of realising an income, constraining empowerment and further economic development. While larger and better resourced with far more economic drivers, Ceres, too, has high levels of poverty, seasonal employment patterns and high rates of unemployment.

Risky social behaviour (i.e. teenage pregnancy, alcohol and drug addiction, school drop-out and gangsterism) is a major challenge in the area. Such deviance could threaten social capital on which much of the existing livelihood strategies depend.

Positive socio-economic impacts likely to result from the project include the creation of 90 to 150 skilled and 400 to 460 unskilled employment opportunities for the duration of the 12 to 14-month construction phase, 20 skilled and 40 unskilled employment opportunities during the operational phase of an expected 20 years. While the developer may not be able to fill skilled positions with locals, unskilled labour positions can be filled locally should the recommended mitigation measures be implemented. Local communities will also likely benefit from the concomitant growth opportunities for local businesses and support service industries and increased local spending which in turn will likely benefit local socio-economic development. These impacts will benefit communities through the creation of income generation opportunities and human development through skills development and training. In addition, local communities will benefit from the proposed EDP if well designed and well implemented.

On a macro level, positive impacts also include the generation of clean energy for the national grid which is under severe pressure and unable to meet demand, thereby curtailing economic advancement of the country. Therefore, the proposed development can also be seen as creating a positive social benefit for society.

Negative socio-economic impacts likely to result from the project include influx of opportunistic job seekers which could strain social structures and support networks, increase risky social behaviour such as prostitution and drug abuse, and burden existing services. Frustrated expectations of employment, created by the proposed development, could also contribute to feelings of distrust in the developer, and in isolated instances, damage to project property and/or potential intimidation of staff. Furthermore, given the time-bound nature of the development, the inevitable job losses at the end of each phase is high. The construction phase in particular will create an additional movement of people and vehicles to the site, which could increase the chances of theft in the surrounding properties. This impact could cause the loss of livestock, flora, or valuables. This (negative impact) can be managed by implementing recommended mitigation measures.

The overall significance rating of the negative socio-economic impacts associated with the proposed project during the construction phase is very low to low; whereas the overall significance rating of the positive socio-economic associated with the proposed project during construction is low to moderate, should mitigation and enhancement measures be implemented respectively.

The overall significance rating of the positive socio-economic impacts associated with the proposed projects during the operation phase is very low to high, should enhancement measures be implemented.

The overall significance rating of the socio-economic impacts associated with the proposed projects during decommissioning phase is low (negative) and low (positive) should mitigation measures and enhancement measures be implemented, respectively.

The cumulative impact during the construction and operational phases is low (negative) to moderate (positive). There is no cumulative impact of the decommissioning phase.

Mitigation measures included within Section 9 above should be included within the Environmental Authorisations, should it be granted by the DEFF. Based on the current socio-economic context of the area and the impacts identified, it is the opinion of the specialist that the project can go ahead, provided that the mitigation measures proposed are adopted and adhered to by the EA holder.

10.1 Statement and Reasoned Opinion

It should be accepted that the development of the proposed projects is likely to result in some form of negative social impact to the local community. However, such a negative impact needs to be weighed against the potential benefit likely to result from the same development. Given the overall very low to low significance of potential negative impacts associated with the project, as compared to the overall very low to high significance of potential positive impact of the project; it can be concluded that the prospective socio-economic benefits of the proposed project outweigh the socio-economic losses/impacts.

10.2 EA Condition Recommendations

From a socio-economic impact perspective, in light of the above argument, the specialist conducting this SIA is of the opinion that the proposed projects should be authorised by the competent authority.

11. References

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Appendices: Appendix A - Specialist Expertise

CURRICULUM VITAE of SANDRA HILL
Social Scientist & Community Development Practitioner
October 2020

Address: Wynberg, Cape Town
Phone: +27 82 729 2351
E-mail: sandra@write-now.co.za

CAREER PROFILE
Social scientist and community development practitioner

As a social scientist, I have been involved with the social and economic advancement of people in one form or another, for over twenty years. I have worked as a community worker, project coordinator, learning facilitator, non-profit organisation director, and development consultant. Community engagement, research, and writing have been key components in all these roles.

I am committed to ethical and well-conducted social science research that generates reliable information to help role-players anticipate future impacts and find solutions to social problems. Over the years, my fields of research included: gender, poverty, land reform, labour, project evaluation, participatory appraisal, social change, and organisational learning.

I hold an Honours degree in Social Science with undergraduate majors in sociology and social work. My formal training equipped me with the necessary theory, data gathering and analytical tools, and modes of meaningful community engagement to practice my profession.

EDUCATION

- MA in English (cum laude), University of the Western Cape, 2012 - 2013
- Honours in Social Science, Rhodes University, 1990
- Bachelor of Social Science (BSocSci), University of Cape Town, 1987 – 1989

PROFESSIONAL HISTORY

2012 - present: Writer, independent social science consultant, researcher, editor & facilitator (self-employed)
I engage with companies and development organisations to produce engaging written work. I have a strong ability to generate, distil, and present key information from a range of sources in an accessible and engaging form. This skill is rooted in more than twenty years' experience in social change practice at a community level.

Currently, I am involved in a series of articles investigating COVID-19's impact on various aspects of society including banking, fintech, health, and social innovation. I have worked on Meridian Economics' report on Eskom's financial crisis and the viability of coal-fired power in South Africa; Singiz's Evaluation of the Dell Young Leaders Programme; Environmental Monitoring Group's workshops and five-year report; Seed Knowledge Initiative publications and small-scale farmer workshop; NIMD's publication on inter-party dialogue; and the Barefoot Collective's practitioners' manual on learning and social change. I am also involved in Socio-economic Impact Assessments, including the proposed nine Solar PV and EGI projects near Touws River proposed by Veroniva (PTY)

Ltd, as well as seven proposed Solar PV Rinkhals projects near Kimberly proposed ABO Wind renewable energies (PTY) Ltd.

2006 - 2011: Community Development Resource Association (CDRA): Researcher & Organisational Development Practitioner

I was the lead facilitator of an international, three-year, action research project inquiring into social change. My role included designing the research methodology and training co-practitioners in research and writing skills. I also played a key role in analysing findings and compiling the final report.

1999 - 2006: Sandra Hill Consulting: Organisational Development Practitioner

I set up my own organisational development consultancy to assist other practitioners engaged in social change processes.

1995 - 1998: The Women on Farms Project: Founding Director

I established the Women on Farms Project as an independent organisation and was responsible for strategic planning; staff; organisational learning; design and implementation of programmes; monitoring and evaluation; fund-raising; and governance.

1992 - 1995: Lawyers for Human Rights: Women on Farms Project Coordinator

I initiated and co-ordinated the Women on Farms Project. During this time, I initiated and ran women's groups on Boland farms with a focus on adult education, empowerment, and community development.

1991: Foundation for Community Work: Community Worker

Using participatory processes, the purpose of my interventions was to build on local knowledge, enhance capacity development, and foster community empowerment.

KEY SKILLS & EXPERIENCE

Understanding of Social Change & Community Development

- My degrees in social science and subsequent short courses in Developmental Evaluation and Monitoring (CDRA 2011) and Observation, Insight and Intervention (Proteus Initiative 2009) have equipped me with both a broad theoretical framework but also a practical ability to understand social dynamics and to interpret social challenges and their potential impact on individuals, organisations, and communities at large.

Writing & Research Skills

- Excellent writing and editing skills.
- Good interviewing and group facilitation skills.
- Excellent ability to analyse and understand complex, and often nuanced data.

Facilitation and Interpersonal Skills

- Excellent facilitation skills supported by a thorough understanding of community development, group dynamics, and adult education.

REFERENCES

Elfrieda Pschorn-Strauss: Seed and Knowledge Initiative
elfrieda@seedandknowledge.org
+27 82 413 0502

Jessica Wilson: Independent Evaluator and Environmental Specialist
jessicawilson@theprocess.org.za
+27 83 326 4216

Appendix B - Specialist Statement of Independence

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

THE PROPOSED HOEK DOORNEN 1, 2, 3 AND 4 SOLAR PV FACILITIES AND THEIR ASSOCIATED ELECTRICAL GRID INFRASTRUCTURE NEAR TOUWS RIVER, WESTERN CAPE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Sandra Hill – Social Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Sandra Hill			
Specialist Qualifications:	BSocSci (Honours)			
Professional affiliation/registration:	n/a			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 729 2351	
Telephone:	082 729 2351	Fax:	n/a	
E-mail:	sandra@write-now.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Sandra Hill**, 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

Sandra Hill – Social Scientist (sole proprietor)

Name of Company:

8 OCT 2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Sandra Hill**, swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true & correct.

Signature of the Specialist

Sandra Hill – Social Scientist (sole proprietor)

Name of Company

8 OCT 2020

Date

Signature of the Commissioner of Oaths

724452 - CONSTABLE
A.F. MASETI-MZINGELWA

SUID-AFRIKAANSE POLISIEDIENS

09 OCT

Date

Appendix C: Site Sensitivity Verification

It is important to note that there are no socio-economic themes on the National Web-based Environmental Screening Tool (Screening Tool) (as at October 2020), therefore the environmental sensitivity of the proposed project area as identified by the Screening Tool is not applicable. Therefore, no site sensitivity verification report is required.

However, prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site visit was undertaken in order to confirm the current land use.

The details of the site visit are noted below:

Date of Site Visit	7 September 2020 (1 day)
Specialist Name	Sandra Hill
Professional Registration Number	Not Applicable
Specialist Affiliation / Company	Private

The land use confirmation was undertaken using desktop analysis, using available policy data and literature, as well as a site inspection and relevant municipal Spatial Development Plans and Integrated Development Plans.

Historically used as a winter grazing area for sheep, there is currently no agricultural activity on the farm.

Appendix D: Impact Assessment Methodology

The impact assessment methodology followed for the specialist assessment is noted below.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
    - *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*

- *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
- *Moderate reversibility of impacts;*
- *Low reversibility of impacts; or*
- *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1).

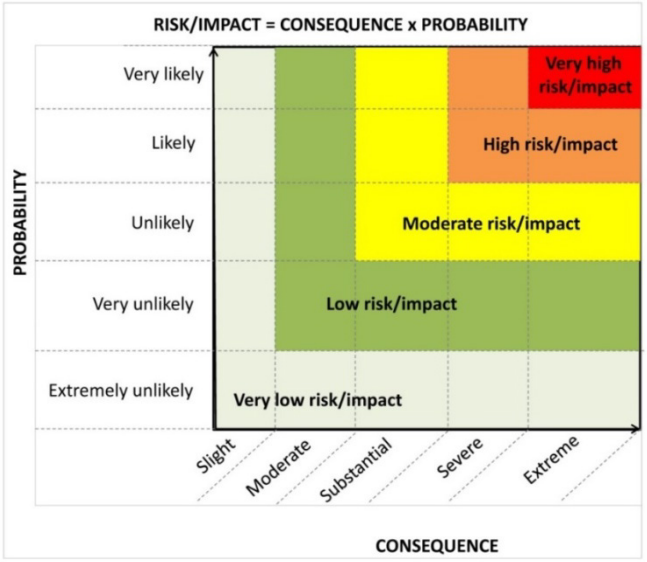

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
  - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
  - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
  - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-*

making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been 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;*	*i. Section 1.2* *ii. Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
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 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 3 and Section 4*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 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 2*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Section 4.3 and Not Applicable*
g) an identification of any areas to be avoided, including buffers;	*Not Applicable*
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;	*Not Applicable*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2.2*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 5 and Section 6*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Section 9*
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 10.1 and Section 10.2*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Section 2.1 and Section 5.2*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable at this stage, refer to the BA Report*
q) any other information requested by the competent authority.	*Not Applicable at this stage*
(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.	*Not Applicable*

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.8

Geohydrology Assessment

GROUNDWATER SPECIALIST ASSESSMENT:

Basic Groundwater Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure at Hoek Doornen Farm (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4), near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	Charl Muller GEOSS South Africa (Pty) Ltd P.O. Box 12412 Die Boord, Stellenbosch 7613 South Africa Stellenbosch 7600 South Africa

30 October 2020

Executive Summary

GEOSS South Arica (Pty) Ltd was appointed by the Council for Scientific and Industrial Research (CSIR) to complete a basic groundwater assessment for the proposed development of four 175 MW solar photovoltaic (PV) facilities and associated electrical grid infrastructure, near Touws River in the Western Cape. This geohydrological assessment includes a **desktop review** of groundwater characteristics and users in the area, with the aim of determining the potential for groundwater to be used for panel cleaning, as well as risk to nearby groundwater users, in both the construction and operational phases.

The area of interest receives most of its rainfall during the winter months with an average of 197 mm per year with increased evaporation rates during the summer months. The regional geological setting consists of sedimentary deposits underlain by five distinct geological formations which directly correlate with the regional geohydrological characterization. According to the regional scale groundwater map the greater portion of the study area hosts a “fractured” aquifer (i.e. fractures within the bedrock constitute an aquifer) with borehole yields being in the range of 0.1 – 0.5 L/s. The regional groundwater quality, using Electrical Conductivity (EC) as an indicator, is “moderate to poor” (EC of 70 – 1 000 mS/m). Data sources for the area indicates that the EC varies from 118 mS/m to a maximum of 1 377 mS/m. The DRASTIC groundwater vulnerability rating methodology (Department of Water Affairs and Forestry, 2005) indicates that the larger study area can be classified as having a “low” groundwater vulnerability rating.

The potential impacts of the proposed development on groundwater are:

- Accidental oil spillages or fuel leakages;
- Over-abstraction of groundwater; and
- Groundwater contamination due solar panel cleaning agents.

These issues can be easily managed and potential groundwater impacts completely mitigated if appropriate measures are implemented.

The author considers groundwater to be a viable source for use during the construction phase and operational phase. Prior to use, all boreholes being used should be tested to ensure their yield and quality meets necessary requirements. Furthermore, any abstraction boreholes should be equipped with water level and water quality monitoring infrastructure; as well as a flow meter, prior to use. Water use authorisation must also be addressed. The planned groundwater use is likely to fall within the General Authorization (GA) (based on anticipated volumes) so the groundwater use need only be registered (assuming the water use meets the relevant GA requirements).

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List of Abbreviations

BH	Borehole
CGS	Council for Geoscience
DHSWS	Department of Human Settlements, Water and Sanitation
DWA	Department of Water Affairs (used to be Department of Water Affairs and Forestry)
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EC	electrical conductivity
GIS	Geographic Information System
L/s	litres per second
m	metres
mbch	meters below collar height
mbgl	metres below ground level
mm	millimetre
mS/m	milli-Siemens per metre
NGA	National Groundwater Archive
WARMS	Water Authorisation and Registration Management System

Glossary

Definitions	
Aquifer	A geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)].
Borehole	Includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
DRASTIC	An acronym for a groundwater vulnerability assessment methodology: D = depth to groundwater / R = recharge / A = aquifer media type / S = soil type / T = topography / I = impact of the unsaturated zone / C = hydraulic conductivity. The methodology uses a rating and weighting approach and was developed by the Environmental Protection Agency (USA)
Electrical Conductivity	The ability of groundwater to conduct electrical current, due to the presence of charged ionic species in solution (Freeze and Cherry, 1979).
Fractured aquifer	Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
Inferred	Where a geological contact or fault is believed to exist however is not confirmed.
Intergranular aquifer	Generally unconsolidated but occasionally semi-consolidated aquifers. Groundwater occurs within intergranular interstices in porous medium. Typically occur as alluvial deposits along river terraces.
Intergranular and fractured aquifers	Largely medium to coarse grained granite, weathered to varying thicknesses, with groundwater contained in intergranular interstices in the saturated zone, and in jointed and occasionally fractured bedrock.
Vulnerability	The tendency or likelihood for contaminants to reach a specified position in the ground-water system after introduction at some location above the uppermost aquifer (National Research Council, 1993).

Groundwater Specialist Assessment

This report serves as the Groundwater Specialist Assessment prepared as part of the Basic Assessments (BAs) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (Specifically Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4), near Touws River, Western Cape.

1. Introduction

GEOSS South Arica (Pty) Ltd was appointed by the Council for Scientific and Industrial Research (CSIR) to complete a basic groundwater assessment for the proposed project (**Map 1**). This geohydrological assessment includes a desktop review of groundwater characteristics and users in the area, with the aim of determining the potential for groundwater to be used for construction and operational purposes, including panel cleaning, as well as risk to nearby groundwater users.

The study area can be divided into three separate farms namely Witte Wall, Grootfontein and Hoek Doornen. The total water requirement is estimated to be 5 million to 8 million litres per year during operation per project (i.e. per Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4). At the time of writing this report the amount of groundwater to be used during construction was uncertain, however in this report it has been assumed that groundwater will be used during this phase. In terms of groundwater quality, optimally the water should be of drinking water quality. The groundwater might have to be treated to make it suitable for the intended use.

This report outlines the work completed to assess the likelihood of using groundwater for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 developments (**Map 2**), including the potential impact the development may have on groundwater resources in the area.

1.1. Scope, Purpose and Objectives of this Specialist Report

The scope of work is to provide groundwater specialist services, including the tasks outlined below:

- Desktop assessment for groundwater to be used for construction and operational purposes for each proposed project, including solar panel cleaning.
- Assessment of the impact on geohydrological resources as a result of the proposed development.
- Provide recommendations to minimize or mitigate impacts.
- Confirm what type of authorisation is required to make use of the groundwater.

The results of the investigation are presented in this report along with the data analysis and interpretation.

1.2. Details of Specialist

This specialist assessment has been undertaken by Charl Muller of GEOSS South Africa. Charl Muller is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 123456 in the field of Hydrogeology. A curriculum vitae is included in **Appendix B** of this specialist assessment.

1.3. Terms of Reference

The procedure adopted for this study involved a **desktop study** of all available data and databases. The study involved obtaining and reviewing all relevant data to the proposed projects. This included analysing data from the National Groundwater Archive (NGA), Water Authorisation and Registration Management System (WARMS) and GEOSS's internal database, as well as groundwater yield, groundwater chemistry and geological maps of the area. A site visit was not carried out as the study was desktop based.

2. Approach and Methodology

The specialist study was completed as follows:

Task 1: Obtain all relevant data to the proposed projects (i.e. obtain data from the NGA and associated groundwater use databases, e.g. WARMS, GEOSS internal database). Obtain any data from local Department of Water and Sanitation (DWS) [now operating as the Department of Human Settlements, Water and Sanitation (DHSWS)] monitoring boreholes. Obtain relevant geological maps and geohydrological maps. Obtain relevant groundwater reports. Compile a project Geographic Information System (GIS).

Task 2: Analyse the data, using geohydrological methods and address the questions raised in the project objectives.

Task 3: Document the results in a report.

The report is also required to comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, Government Notice (GN) 320 (i.e. Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no specific Assessment Protocol has been prescribed). There is no specific Assessment Protocol devised for Geohydrology or Groundwater Assessments. Therefore, the report needs to comply with Appendix 6 of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) Environmental Impact Assessment (EIA) Regulations.

2.1. Information Sources

The following information sources were used in this study:

Data / Information	Source	Date	Type	Description
Geological Map	Council for Geosciences	2009	Spatial	1:1 000 000 scale Geological Map series of South Africa
Geological Map	Council for Geosciences	1991	Spatial	1:250 000 scale Geological Map Series of 3320 Ladismith
Geological Map	Council for Geosciences	2001	Spatial	1:250 000 scale Geological Map Series of 3319 Worcester
Geological Map	Council for Geosciences	1973	Spatial	1:250 000 scale Geological Map Series of 3218 Clanwilliam
Geological Map	Council for Geosciences	1983	Spatial	1:250 000 scale Geological Map Series of 3218 Sutherland
Groundwater recharge and vulnerability mapping	GWD Conference Bloemfontein	2007	Spatial	A National scale approach to groundwater recharge and vulnerability mapping
Hydrogeological map series	Department of Water Affairs and Forestry	2002	Spatial	Hydrogeological map series of the republic of South Africa
NGA Database	NGA	27 October 2020	Database and Spatial	Spatial delineation of NGA registered boreholes

Data / Information	Source	Date	Type	Description
WARMS Database	Water use Authorization & Registration Management System	June 2019	Database and Spatial	Spatial delineation of WARMS registered boreholes
GEOSS Database	GEOSS South Africa	2015	Report	Consulting report from a neighbouring property.
Climatology and Geohydrology	2009	Cape Farm Mapper	Database	SA Atlas of Climatology and Geohydrology; obtained from Western Cape Government Agriculture

2.2. Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations apply:

- A limitation experienced during this investigation was that no site visit was carried out, and therefore no hydrocensus could be undertaken. Despite this, this desktop study is considered suitable to meet the objectives of the study
- The geohydrological assessment is based on previous studies and available literature for the study area. Regional scale GIS datasets based on 1: 500 000 and previous hydrogeological work completed have been assumed to be correct.
- No drill records or yield test data exists for production or wind pump boreholes to clarify yields and geological logs.
- The acquisition of accurate groundwater levels proved to be difficult, therefore data was limited to information obtained from local parties. Nonetheless these limitations have not negatively impacted the conclusions of the project.
- The NGA data is available at a local scale, although is known to sometimes contain false information.

The information obtained was sufficient to provide comprehensive geohydrological characterization of the regional setting.

It must be noted that there are no areas on site that should be avoided from a groundwater sensitivity perspective.

2.3. Consultation Processes Undertaken

No site visit was undertaken; however, involved land owners were contacted (if possible) to gather as much information on existing boreholes surrounding the proposed development.

3. Description of Project Aspects relevant to the Geohydrological Assessment

As mentioned above, the Project Applicant intends to make use of existing boreholes to source groundwater (if available and if suitable) for the construction and operational phases (i.e. cleaning of panels). As a result, water pipelines may need to be constructed in order to transfer groundwater from existing boreholes or they may be transported by trucks from the boreholes to the sites. Groundwater will need to be stored on site in suitable containers or reservoir tanks during the construction and operational phases. The process required to ensure use of the groundwater in terms of the National Water Act is also addressed in this study. As noted in the BA Reports, if groundwater is not suitable, then the water will be trucked in from the municipality.

Generally, groundwater can be impacted negatively in two manners, namely:

- Over-abstraction (where groundwater abstraction exceeds recharge rates) which can result in the alteration of groundwater flow directions and gradients.

- Quality deterioration (i.e. from anthropogenic activities negatively impacting groundwater quality).

There is currently limited groundwater abstraction taking place in relation to the size of the study area (based on regional datasets). Groundwater is mostly used for drinking, agricultural purposes and livestock watering. The low rainfall and high evapotranspiration rates within the study area are a limiting factor for the recharge of the aquifer underlying the study area.

The groundwater requirement for the project can be met by using the existing boreholes. However, agreements will have to be put in place with the current land owners for the use of groundwater. These agreements will have to be legally valid documents and the necessary endorsements will be required from the DHSWS. If no such agreements can be put in place, then additional boreholes will need to be drilled on the relevant farm portions/developments, followed by yield and water quality testing, and then authorization from DHSWS to use the groundwater will be required. The groundwater will need to be stored in water tanks on site. The groundwater required for the construction and operational phase per project will be very low.

4. Baseline Environmental Description (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4)

4.1. General Description

The nearest town to the centroid of the study area (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4) is Touws River, approximately 40 km to the south. The Hoek Doornen farm landscape is arid with transported sands occurring widely along plains with shales and sandstones dominating the mountainous areas.

4.2. Project Specific Description (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 - PV Facilities, Electrical Grid Infrastructure and Associated Infrastructure)

The Hoek Doornen Farm experiences a semi-arid climate, with most of the rainfall occurring during the winter months. **Figure 1** shows the monthly average air temperature and rainfall distribution and **Figure 2** shows the monthly median rainfall and evaporation distribution for the Hoek Doornen Farm (Schulze, 2009). The long term (1950 – 2000) mean annual precipitation for the Hoek Doornen Farm is 197 mm/a. The rainfall does not exceed evaporation during the winter rainy season.

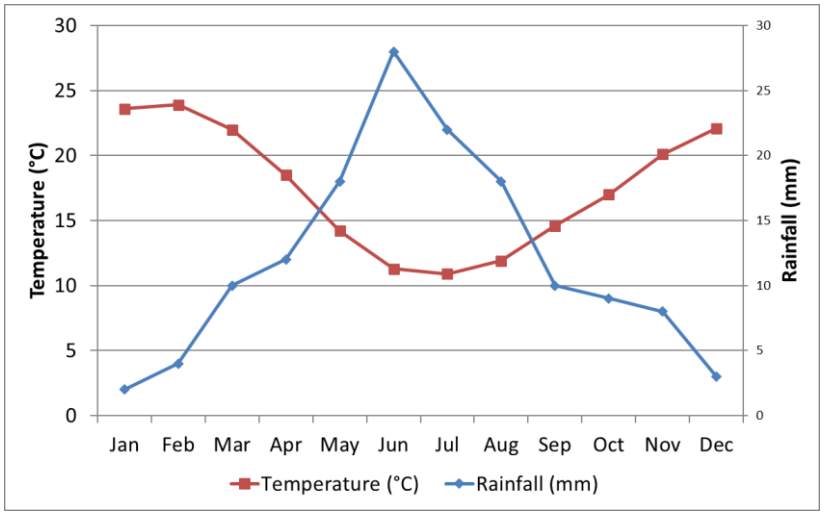

Figure 1: Monthly average air temperature and rainfall distribution for the Hoek Doornen Farm (Schulze, 2009).

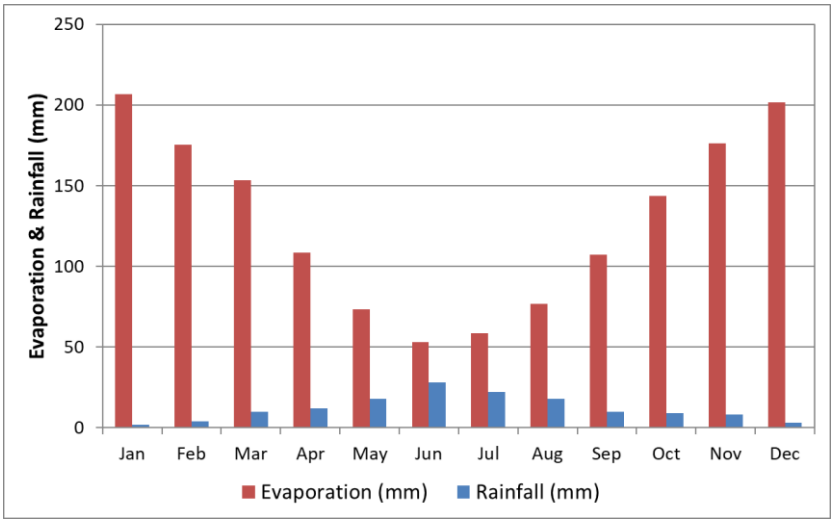

Figure 2: Monthly average rainfall and evaporation distribution for the Hoek Doornen Farm (Schulze, 2009).

4.3. Regional Geology

The Geological Survey of South Africa (now the Council for Geoscience) has mapped the area at 1:1M scale (South Africa). The geological setting is shown in **Map 3**. The main geology of the area is listed in **Table 1**.

Table 1: Geological formation within the study area.

Symbol	Formation	Group	Lithology
N-Qg	n/a - Quaternary Age		Alluvium and terrace gravel.
PA-Ng	Grahamstown Formation	n/a	High-level terrace gravel, silcrete, ferricrete.
Pak	Abrahamskraal Formation	Beaufort Group	Mudstone, siltstone, sandstone and thin chert beds.
Pk	Kookfontein Formation	Ecca Group	Shale, siltstone, subordinate sandstone.
Ps	Skoorsteenberg Formation		Mudrock and siltstone, sandstone
Pt	Tierberg Formation		Dark-grey shale and siltstone.
Ppw	1. Collingham Formation 2. Whitehill Formation 3. Prince Albert Formations		1. Siltstone, chert and sandstone with thin interbedded shale and yellow weathering mudstone/tuff. 2. Dark-grey shale, light-grey weathering with cherty siltstone beds 3. Dark-grey shale with reddish-brown-weathering siltstone.
C-Pd	Dwyka Formation		Tillite, diamictite, and subsidiary shale.
Cl	n/a	Witteberg Group	Mudrock, micaceous shale, siltstone, quartzose and arkosic sandstone, diamictite.
Dw			Reddish to white quartz arenite, red to brown thin-bedded sandstone, minor micaceous red or purple siltstone and shale, rhythmite

The Hoek Doornen Farm Portion is underlain by the Grahamstown Formation deposits which comprises of high-level terrace gravel, silcrete and ferricrete. This is most likely underlain by (in order of youngest to oldest):

- dark-grey shale and siltstone (the Tierberg Formation)
- siltstone, chert and sandstone with thin interbedded shale and yellow weathering mudstone/tuff (the Collingham Formation)
- dark-grey shale, light-grey weathering with cherty siltstone beds (the Whitehill Formation)
- dark-grey shale with reddish-brown-weathering siltstone (the Prince Albert Formation)
- tillite, diamictite, and subsidiary shale (the Dwyka Formation)

The proposed development is located southwest of two faults trending from north-east towards the south-west. These faults are prominent in the Kookfontein, Skoorsteenberg and Grahamstown Formations resulting in fracturing of the bedrock (**Map 3**). Whereas, to the southeast of the Hoek Doornen Farm portion is a mapped Dolerite Dyke (Kf). These faults and dyke structures are good target zones if further groundwater development is going to take place.

4.4. Regional Hydrogeology

The regional aquifer directly underlying the Hoek Doornen Farm portion is classified by the Department of Water Affairs and Forestry (DWAF) (DWAF, 2002) as a fractured aquifer with an average yield potential of 0.1 – 0.5 L/s (**Map 4**). A fractured aquifer describes an aquifer where groundwater only occurs in narrow fractures within the bedrock.

Based on the DWAF (2002) mapping of the regional groundwater quality, as indicated by electrical conductivity (EC), the majority of the farm portion is in the range of 300 – 1 000 mS/m with the northern corner of the portion in the range of 70 – 300 mS/m. This is considered to be "moderate to poor" quality for water (**Map 5**) with respect to drinking water standards.

Both these classifications are based on regional datasets, and therefore only provide an indication of conditions to be expected.

4.4.1. NGA Database

A desktop assessment was initially carried out around the property to determine if there were any groundwater users in the area. The NGA database provides data on borehole positions, groundwater chemistry and yield, where available. The NGA indicated there are nine boreholes surrounding the Hoek Doornen portion (**Map 6**) These NGA sites are summarized in **Table 2**.

Table 2: Summary of NGA borehole.

NGA Label	Latitude (DD, WGS84)	Longitude (DD, WGS84)	WL (mbgl)	Yield (L/s)	EC (mS/m)	Depth (m)	Lithology
3319BB00012	-33.1274	19.91708			673	36.6	Tillite
3320AA00009	-33.1117	20.02777	14		118	80	Shale
3319BB00013	-33.0838	19.9518	9.15		333	36.6	Tillite
3320AA00010	-33.0656	20.08249	3	0.25	286	80	Shale
3320AA00023	-33.0656	20.0825		0.25	286	80	Shale
3319BB00011	-33.0647	19.87847		0.63	398	12.2	Tillite
3319BB00004	-33.0344	19.88263	6.1		432	36.6	Tillite
3319BB00005	-33.0161	19.87097	7.63		1192	36.6	Sandstone & Shale
3319BB00003	-33.0099	19.98597	10.68		496	67.1	Sandstone & Shale

Overall, the NGA sites indicate a relatively shallow drill depth (12 – 80 m), drilled into varying lithologies of tillite, shale and sandstone. Yields are low, ranging from 0.25 to 0.63 l/s and EC's are moderate to poor ranging from 118 to 1192 mS/m.

4.4.2. WARMS Database

There are 4 registered boreholes (WARMS site) located within a search radius of 1 km around the Hoek Doornen Farm portion boundary, as shown on **Map 6**. The information is summarised in **Table 3**. This groundwater use is registered to neighbouring farm portions.

Table 3: Summary of WARMS borehole details.

WARMS no.	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Registered Volume (m^3/a)	Status
22137787	-33.0718	19.9709	27375	Registered
22138090	-33.079	19.9597	27375	Registered
22124933	-33.1047	20.0114	7300	Complete
22138697	-33.0404	20.1098	2190	Registered

4.4.3. Witte Wall Boreholes

A representative of the Witte Wall Farm, was contacted regarding groundwater use from boreholes on the Witte Wall farm portion, shown on **Map 6**. These boreholes are summarised in **Table 4**.

Table 4 – Summary of Witte Wall Boreholes.

Borehole Name	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Comment
WW_1	-32.995951	19.980220	Only used for domestic use and livestock watering. Airlift yield of 4 500 L/h. Depth between 80 and 100 m.
WW_2	-32.996100	19.980193	Only used for domestic use and livestock watering. Airlift yield of 4 500 L/h. Depth between 80 and 100 m.
WW_3	-32.996183	19.980102	Only used for domestic use and livestock watering. Airlift yield of 4 500 L/h. Depth between 80 and 100 m.
WW_4	-33.010868	19.986994	Only used for domestic use and livestock watering. Airlift yield of 6 500 L/h. Depth between 80 and 100 m.
WW_5	-33.009423	20.023950	Only used for domestic use and livestock watering. Airlift yield of 6 000 L/h. Depth between 80 and 100 m.

From the information provided it is clear that the boreholes are relatively high yielding (airlift yields) for the area. The water is mainly used for domestic use and livestock watering. The status and condition of these boreholes will need to be accessed during the hydrocensus.

4.4.4. Grootfontein Boreholes

A representative of Grootfontein Farm, was contacted regarding groundwater use from boreholes on his farm, shown on **Map 6**. These boreholes are summarised in **Table 5**.

Table 5: Summary of Grootfontein Boreholes.

Borehole Name	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Comment
GF_1	-32.9448	19.94878	Brackish water used only for drinking water and gardening.
GF_2	-32.9439	19.94818	Used for drinking water. Low yielding.
GF_3	-32.9386	19.95211	Reportedly strong borehole, pumped at 6000 L/h from time to time. Has not been pumped for years
GF_4	-32.9375	19.95276	Reportedly strong borehole, pumped at 4000 L/h from time to time. Has not been pumped for years
GF_5	-32.9398	19.94759	Old borehole, water level at 1.5 mbgl. Has not been pumped in last 25 years.
GF_6	-32.9737	19.95309	Used for livestock watering.

From the information supplied it is clear that the water is brackish and is mostly used for domestic use. Two of the boreholes indicate relatively high yield for the area of 4 000 to 6 000 L/h. The status and condition of these boreholes will need to be accessed during the hydrocensus.

4.4.5. GEOSS Database

A search of GEOSS's internal database of previous projects conducted in the area indicated a total of 18 boreholes surrounding the Hoek Doornen Farm portion (**Map 6**). The results are summarised in **Table 6**.

From GEOSS's internal database, it is clear that groundwater quality is poor (ranging from 169 to 1377 mS/m) with low yields ranging from 0.5 to 1.47 L/s. Water levels range from shallow (1.00 mbgl) to relatively deep (8.80 mbgl).

Table 6: Summary of GEOSS's internal database borehole details.

ID no.	WL (mbgl)	Yield (L/s)	EC (mS/m)	TDS (mg/L)	pH
GD_1	8.215	-	-	-	-
GD_2	8.8	1.47	478.2	3102	7.09
GD_3	-	-	-	-	-
GD_4	-	-	-	-	-
GD_5	6.4	-	356.5	2400	7.25
GD_6	8.62	-	305.7	2082	7.76
GD_7	4.24	-	1377.5	9263	7.33
GD_8	1.09	0.5	169.5	1114	8.87
GD_9	1.00		299.8	1917	8.04
GD_10	1.47		287.32	-	-
GD_11	1.03		435.94	-	
GD_12	-		405.4	2821	7.88
GD_13	-		-	-	-
GD_14	-		305	1918	7.86
GD_15	-		-	-	-
GD_16	8.10		215.9	1398	8.33
GD_17	-		-	-	-
GD_18	-		-	-	-

4.4.6. Kareekolk Borehole

The Kareekolk Farm contains the access road to the Hoek Doornen and Witte Wall Farm portions delineated for the proposed solar development. Mr Leon Theunissen (owner of Kareekolk Farm) indicated the possible use of his dam water for construction and operations, including solar panel cleaning. It was established that this dam (**Figure 3**) is filled with borehole water supplied by the KK_1 borehole, shown on **Map 6** and summarised in **Table 7**. This borehole, reportedly, is pumped at a high rate of 40 000 L/h for 9 hours per day. Quality at this stage is unknown. The preliminary findings for the determination of the existing lawful use, for this borehole, indicates a lawful use of 2694 m3/a (~0.08L/s). This is not enough to supplement the required amount of water of 5 to 8 million litres per year per project (~1.0 L/s). This will require a General Authorisation to make use of this volume of water.

Table 7: Kareekolk Borehole Summary.

Borehole Label	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Reported Yield (L/s)	Quality
KK_1	-32.9836030	19.938373	11.1	Unknown

Figure 3: Dam located on Kareekolk Farm.

4.5. Geohydrological Characterisation (Aquifer Vulnerability) - Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4

The Hoek Doornen Farm portion overlies a fractured aquifer that possesses water bearing properties due to fracturing. Several methods have been developed to classify an aquifer's vulnerability. The DRASTIC method has been applied to this study.

4.5.1. Aquifer Vulnerability (DRASTIC)

Groundwater vulnerability can be defined as the "tendency for contaminants to reach a specified position in the groundwater system after introduction at some location" (Vrba and Zaporozec, 1994). Key physical parameters which determine groundwater vulnerability include lithology, thickness, effective porosity, groundwater flow direction, age and residence time of water. Generally, the residence time of a contaminant in groundwater and the distance that it travels in the aquifer are considered important measures of vulnerability.

There are two main groups of methods for assessing groundwater vulnerability, namely:

- Index or subjective rating methods, and
- Statistical or process-based methods.

The “index or subjective rating method” is relatively easily addressed within a GIS framework. The cell-based layer approach facilitates the assignment of ratings and weights and rapid achievement of a final result of relative groundwater vulnerability. This approach also means that the algorithm can easily be repeated as new or more detailed data sets are obtained or if ratings and weightings need to be adjusted as a result of a sensitivity analysis for example. The most well-known “index or subjective rating method” is the “DRASTIC” method (Aller et al., 1987). The DRASTIC method of Aller et al. (1987) uses the typical overlay technique often applied in subjective rating methods. The DRASTIC approach is based on four major assumptions:

- The contaminant is introduced at ground surface;
- The contaminant is flushed into the groundwater by precipitation;
- The contaminant has the mobility of water; and
- The area evaluated using DRASTIC is 40.5 ha or larger.

The implication of these assumptions is that DRASTIC should not be used for contaminants that do not have the mobility of water or for point assessment (such as storage tanks). In addition, groundwater conditions in South Africa are dominated by secondary/fracture-controlled flow conditions. The DRASTIC method does not consider local preferential flow paths of fractured aquifer systems particularly well. The DRASTIC method takes into account the following factors:

D	=	depth to groundwater	(5)
R	=	recharge	(4)
A	=	aquifer media	(3)
S	=	soil type	(2)
T	=	topography	(1)
I	=	impact of the vadose zone	(5)
C	=	conductivity (hydraulic)	(3)

The number indicated in parenthesis at the end of each factor description is the weighting or relative importance at that factor.

Groundwater vulnerability maps developed using the DRASTIC method have been produced in many parts of the world. In spite of the widespread use of DRASTIC, the effectiveness of the method has been met with mixed success due to hydrogeological heterogeneity and the many assumptions that need to be made in determining groundwater vulnerability. In addition, the use of a generic vulnerability map only gives a broad indication of relative vulnerability and in many instances detailed scale, contaminant specific vulnerability assessments are required. From the assumptions outlined by Aller et al. (1987), DRASTIC can only be applied to non-point source pollution, as DRASTIC is inaccurate in point source assessments.

As part of the Groundwater Resources Assessment Project (DWAF, 2005), numerous data sets were produced and this enabled the mapping of groundwater vulnerability at the national scale on a 1 km by 1 km cell (pixel) size basis (Conrad and Munch, 2007). This national scale map indicates the relative vulnerability of groundwater resources throughout the country and provides project planners a clear idea of what level of groundwater protection is required.

A national scale map of groundwater vulnerability has been completed for South Africa (DWAF, 2005). The groundwater vulnerability for the study area is shown in **Map 7**. The development area on the Hoek Doornen portion has a **very low** groundwater vulnerability.

4.6. Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) are defined as “areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b)” (Le Maitre et al., 2018:1 in DEFF, 2019: Page 61). Thirty-seven groundwater SWSAs have been identified in South Africa and are considered to be strategically important at a national level for water and economic security (Le Maitre et al. 2018 in DEFF, 2019: Page 61). The total area for groundwater SWSAs extends approximately 104 000 km^2, and covers approximately 9% of the land surface of South Africa (Le Maitre et al. 2018, in DEFF 2019: Page 61).

According to the Solar PV Theme on the National Web-based Environmental Screening Tool, there are no SWSAs on the Hoek Doornen Farm. Refer to Figure 4 below.

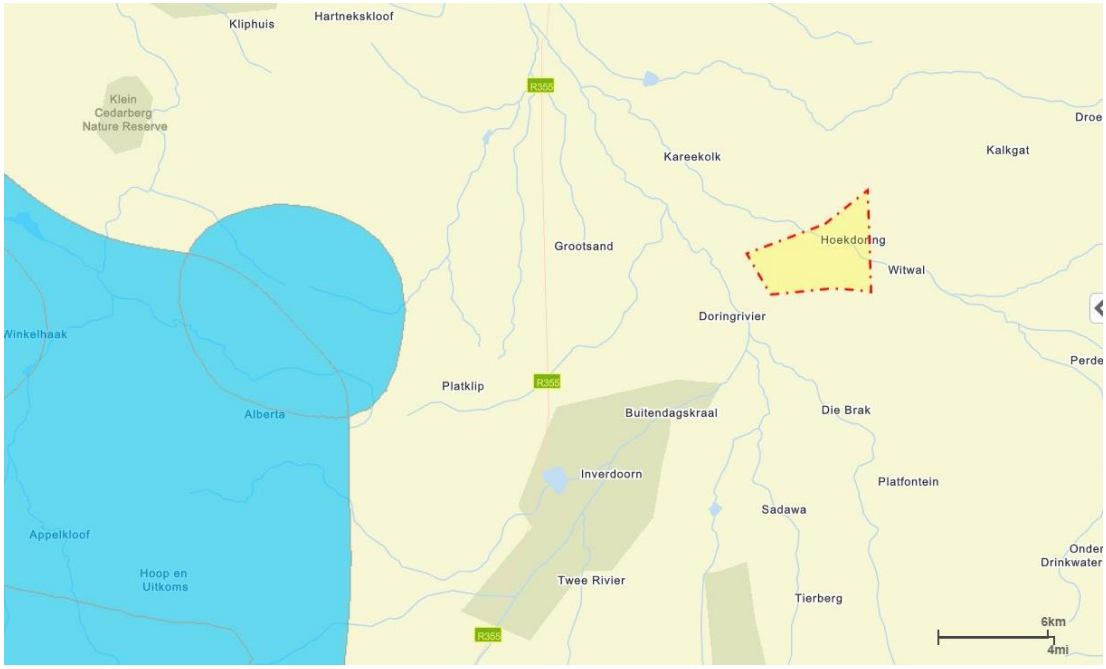

Figure 4: SWSAs from the National DEFF Screening Tool (DEFF, 2020).

5. Issues, Risks and Impacts (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4)

5.1. Identification of Potential Impacts/Risks

The following potential impacts on groundwater of the proposed project activities are as follows:

- Lowering of the groundwater level due to abstraction (5 to 8 million litres per year per PV project);
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages during the construction, operational and decommissioning phases; and
- Potential impact on groundwater quality as a result of cleaning agents used for cleaning the solar panels.

Any construction activities such as the excavation and installation of foundations and piling (narrow diameter holes for foundation purposes) will have minimal to no impact on the groundwater of the site or region, as the groundwater level is approximately 3 – 8 mbgl.

The potential impacts identified during the BA are:

Construction Phase

- Potential lowering of the groundwater level; and
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.

Operational Phase

- Potential lowering of the groundwater level; and
- Potential impact on groundwater quality as a result of using cleaning agents for cleaning the solar panels.

Decommissioning Phase

- None

Cumulative Impacts

- Due to the large spatial extent and low water demand in the study area, including other groundwater users within a 30 km radius, the cumulative impact is regarded as insignificant.
- It is assumed that not all 9 PV facilities will be constructed at the same time, hence the requirements will not be 8 million litres * 9 per year per PV project, allowing for sufficient recharge.

No indirect impacts are identified.

In terms of the no-go alternative, if the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects do not go ahead, there will be no need to use approximately 5 – 8 million litres per year of ground water per project. However, as noted above, there is a low water demand in the study area and a large spatial extent; and the impacts relating to the use of ground water is not considered as highly significant.

6. Impact Assessment - Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4

It must be noted that the impacts provided below are the same for all the Hoek Doornen PV 1, Hoek Doornen PV2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, as well as the Electrical Grid Infrastructure.

6.1. Potential Impacts during the Construction Phase

6.1.1. Impact 1: Groundwater impact as a result of over-abstraction abstraction

This impact is only applicable during the construction and operational phases. At the peak requirement of 8 million litres per year per project (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 requires 0.25 L/s each ~ 1.0 L/s) the proposed groundwater abstraction is higher than the yield potential of the underlying aquifer (0.1 – 0.5 L/s).

The status of this impact is rated as negative with a local spatial extent and a long-term duration (i.e. for the life of the project). The consequence and probability of the impact is respectively rated as substantial and unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated low. The significance of the impact without the implementation of mitigation measures is rated as moderate. With effective implementation of prevention / mitigation actions (i.e. to adhere to the borehole's safe yield and to monitor water levels and flow), the impact of the proposed abstraction on groundwater is predicted to be of low significance.

6.1.2. Impact 2: Potential Impact on Groundwater Quality as a result of Accidental Oil Spillages or Fuel Leakages

If there is an accidental oil spill or fuel leakage during the construction phase, then the low permeability of the unsaturated zone will provide significant attenuation capacity. The status of this impact (for the construction phase) is rated as negative with a site-specific spatial extent and short-term duration (i.e. for the life of the facility). The consequence and probability of the impact is respectively rated as slight and extremely unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated as low. The significance of the impact without the implementation of mitigation measures is rated as very low.

A precautionary approach must be implemented and reasonable measures must be undertaken to prevent oil spillages and fuel leakages from occurring. During the construction phase, vehicles must be regularly serviced and maintained to check and ensure there are no leakages. Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks, if required, should be above ground on an impermeable concrete surface in a bunded area. Construction vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for this purpose, if off-site refuelling is not possible. If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, and reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.

With effective implementation of these prevention / mitigation actions, the impact of the project on groundwater as a consequence of accidental oil spillages and fuel leakages is predicted to be of very low significance.

6.1.2.1. Impact Summary Tables: Construction Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Lowering of groundwater levels as a result of over-abstraction	***Status***	*Negative*	*Moderate*	*Adhere to the borehole's safe yield and to monitor water levels and flow.* *Boreholes must be correctly yield tested according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This includes a Step Test, Constant Discharge Test and recovery monitoring.*	*Low*	*High*
	Spatial Extent	*Local*				
	Duration	*Long Term*				
	Consequence	*Substantial*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Accidental oil spillage / fuel leakage	***Status***	*Negative*	*Very Low*	*Vehicles must be regularly serviced and maintained to check and ensure there are no leakages. Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks, if required, should be above ground on an impermeable surface in a bunded area. Vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for this purpose, if off-site refuelling is not possible. If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, as reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes*	*Very Low*	*High*
	Spatial Extent	*Site Specific*				
	Duration	*Short Term*				
	Consequence	*Slight*				
	Probability	*Extremely Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.2. Potential Impacts during the Operational Phase - Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4

It must be noted that the impacts provided below are the same for both the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects. The power lines do not have any operational water usage and thus not considered to have an impact on the groundwater.

6.2.1. Impact 1: Groundwater impact as a result of over-abstraction abstraction

This impact is only applicable during the construction and operational phases. At the peak requirement of 8 million litres per year per project (Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 requires 0.25 L/s each ~ 1.0 L/s) the proposed groundwater abstraction is higher than the yield potential of the underlying aquifer (0.1 – 0.5 L/s).

The status of this impact is rated as negative with a local spatial extent and a long-term duration (i.e. for the life of the project). The consequence and probability of the impact is respectively rated as substantial and unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated low. The significance of the impact without the implementation of mitigation measures is rated as moderate. With effective implementation of prevention / mitigation actions (i.e. to adhere to the borehole's safe yield and to monitor water levels and flow), the impact of the proposed abstraction on groundwater is predicted to be of low significance.

Impact 2: Potential impact on groundwater quality as a result of using cleaning agents

The low permeability of the unsaturated zone will provide significant attenuation capacity. The status of this impact (for the operational phase) is rated as negative with a site-specific spatial extent and long-term duration (i.e. for the life of the project). The consequence and probability of the impact is respectively rated as slight and extremely unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated as low. The significance of the impact without the implementation of mitigation measures is rated as very low. Recommended mitigation includes using an environmentally safe cleaning agent that breakdown naturally and do not cause adverse effects.

6.2.1.1. Impact Summary Tables: Operational Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Lowering of groundwater levels as a result of over-abstraction	***Status***	*Negative*	*Moderate*	*Adhere to the borehole's safe yield and to monitor water levels and flow.* *Boreholes must be correctly yield tested according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This includes a Step Test, Constant Discharge Test and recovery monitoring.*	*Low*	*High*
	Spatial Extent	*Local*				
	Duration	*Long Term*				
	Consequence	*Substantial*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Potential impact on groundwater quality as a result of using cleaning agents	***Status***	*Negative*	*Very Low*	*Use environmentally safe cleaning agents that breakdown naturally and do not cause adverse effects.*	*Very Low*	*High*
	Spatial Extent	*Site Specific*				
	Duration	*Long Term*				
	Consequence	*Slight*				
	Probability	*Extremely Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7. Impact Assessment Summary - Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4

The overall impact significance findings, following the implementation of the proposed mitigation measures are shown in the **Table 8**.

Table 8: Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Low-Very Low
Operational	Low-Very Low
Decommissioning	None
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Insignificant
Cumulative - Operational	Insignificant
Cumulative - Decommissioning	None

8. Legislative and Permit Requirements

The National Water Act (Act 36 of 1998) (NWA) is administered by the DWS and is the main legislation for managing water resources in South Africa. The purpose of the NWA is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorization and register as users. The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 development areas are located within quaternary catchment E22E which forms part of the Olifants Catchment in Western Cape. The General Authorisation (GA) Limit for the taking of groundwater in this quaternary catchment is 45 m^3/ha/a (published on 2 September 2016, in Government Gazette 40243, Government Notice (GN) 538 (i.e. Revision of General authorisation for the taking and storing of water). The Hoek Doornen Farm portion is 2 372 hectares; equating to 106 740 m^3/a. The allowable abstraction under the GA is capped at 40 000 m^3/a. This equates to approximately 1.27 L/s (continuous abstraction) for the entire Hoek Doornen Farm portion. The proposed groundwater use for each project is less than this (peak usage is 1.0 L/s annually for all 4 Hoek Doornen PV projects) and will thus fall within the GA. Only a registration process will have to be followed for the groundwater use; i.e. Section 39 of the NWA is applicable. Although the assessed development footprint is 1910 ha, (and each PV Facility will have an estimated footprint of 260 ha within the assessed development footprint), the total farm portion is 2 372 ha and it's the total farm area that is used for the GA calculation. If other water uses in terms of Section 21 of the NWA is applicable to the farm portion, this will need to be incorporated in the registration process.

9. Environmental Management Programme Inputs

Certain measures need to be put in place to ensure that the l groundwater of local and regional aquifers is not significantly negatively impacted by the proposed projects. The following aspects are considered to be applicable to the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 Facilities, Electrical Grid Infrastructure and Associated Infrastructure.

9.1. Accidental oil spillage / fuel leakages

- All vehicles and other equipment (generators etc.) must be regularly serviced to ensure they do not spill oil. Vehicles should be refuelled on paved (impervious) areas, optimally off-site. If liquid product is being transported it must be ensured this does not spill during transit.
- Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.
- Diesel fuel storage tanks, if required, must be above ground on a concrete surface in a bunded area.
- Engines that stand in one place for an excessive length of time must have drip trays.
- Vehicle and washing areas must also be on paved surfaces and the by-products removed to an evaporative storage area or a hazardous waste disposal site (if the material is hazardous).

9.2. Groundwater abstraction (if groundwater is to be used)

- The production boreholes that are to be used should be yield tested prior to use (according to SANS10299) so that the correct pump sizes and installation depths can be determined.
- The planned production boreholes should also be sampled and chemically and microbiologically analysed by a SANAS accredited laboratory.
- Once the boreholes are in use they should be equipped with:
    - Observation pipes - so that the water levels can be measured (either manually or by data loggers);
    - Flow meters – to assess how much water is used and thereby all authorisations in place for use of the water are adhered to; and
    - Sampling tap – to enable annual sampling to ensure the groundwater is safe for continued use – especially if it is to be used as drinking water.

9.3. Cleaning agents used solar panel cleaning

- Environmentally safe cleaning agents that breakdown naturally must be used for cleaning the panels. No chemical that that could cause adverse effects to the natural environment should be allowed.

10. Final Specialist Statement and Authorisation Recommendation

The allowable general abstraction volume for the Hoek Doornen Farm Portion is 40 000 m^3/year (1.27 L/s). The entire development is estimated to require 5 to 8 million litres per year per PV project (0.25 L/s per project ~ total 1.0 L/s). Therefore, the amount of water required for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 developments falls within the abstraction volume allowed under GA. Only a registration process will have to be followed for the groundwater use; i.e. Section 39 of the NWA is applicable. Although the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 assessed development footprint is approximately 1910 ha, (and each PV Facility will have an estimated footprint of 260 ha within the assessed development footprint), the total farm portion is 2 372 ha and it is the total farm area that is used for the GA calculation.

It is recommended that site visit and hydrocensus be undertaken to quantify the number of potential boreholes that could be used for abstraction, as well as, their proximity to the development and other nearby groundwater sources and users. Groundwater quality sampling is also recommended to determine whether the quality of the water meets the quality recommendations for the cleaning of solar panels, and for other purposes during the construction and operational phases.

10.1.Statement and Reasoned Opinion

It is the opinion of this specialist that the proposed activity be allowed to proceed. No impacts of significance could be identified and therefore does not pose any risk to the geohydrological conditions on site. It is imperative that proper yield testing and quality analysis of groundwater be undertaken should it be considered for use.

10.2.EA Condition Recommendations

A site visit and hydrocensus conducted by groundwater specialist should be undertaken to determine the number of groundwater users and abstraction points. This must include water level recording and groundwater sampling of potential boreholes to be used for the development.

11. References

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Parsons R., and Conrad, J., (1993). South African aquifer system management classification'; WRC Report No: KV 77/95; Author: Mr. Parsons R; Date Published: 12 January 1993.

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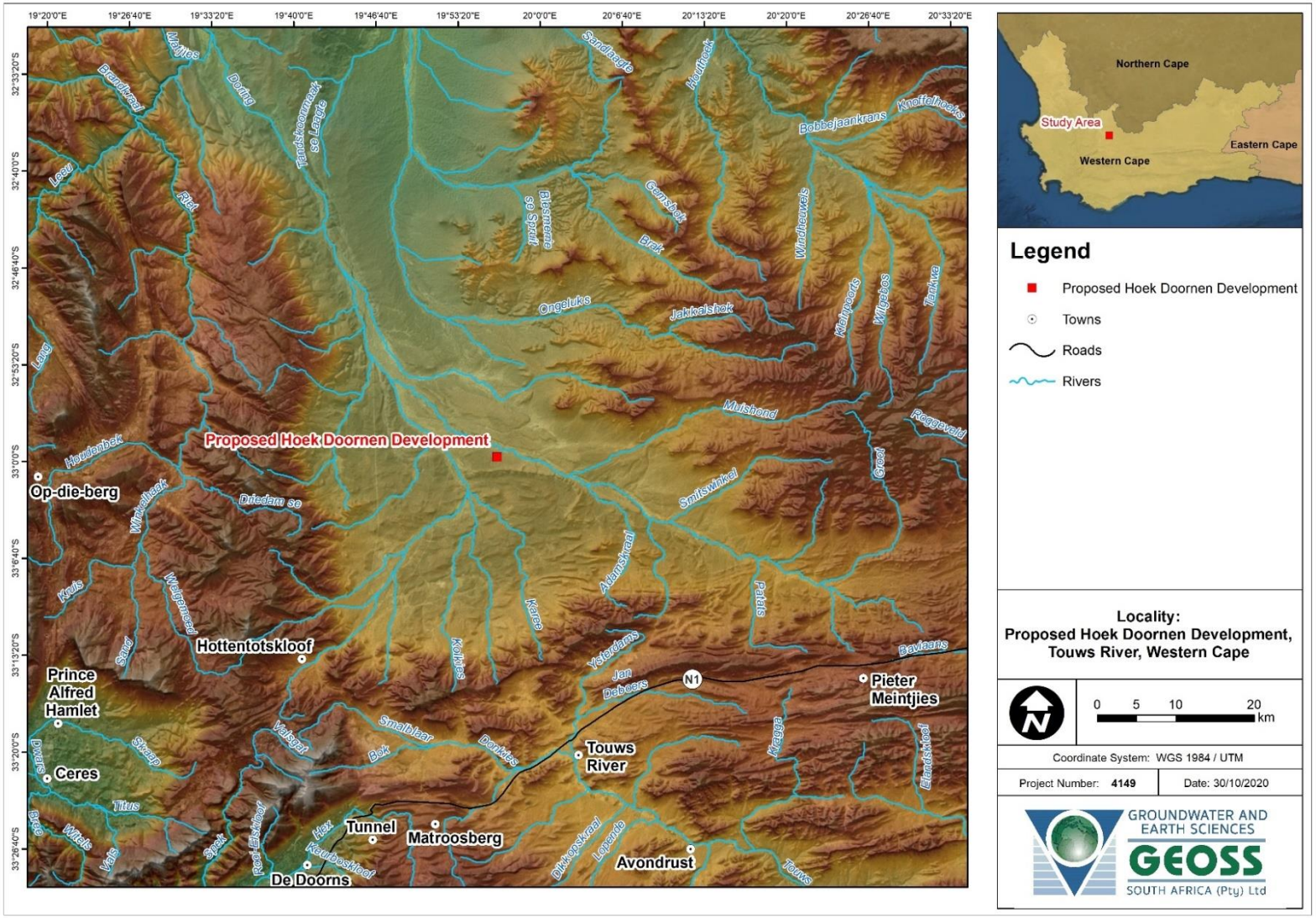
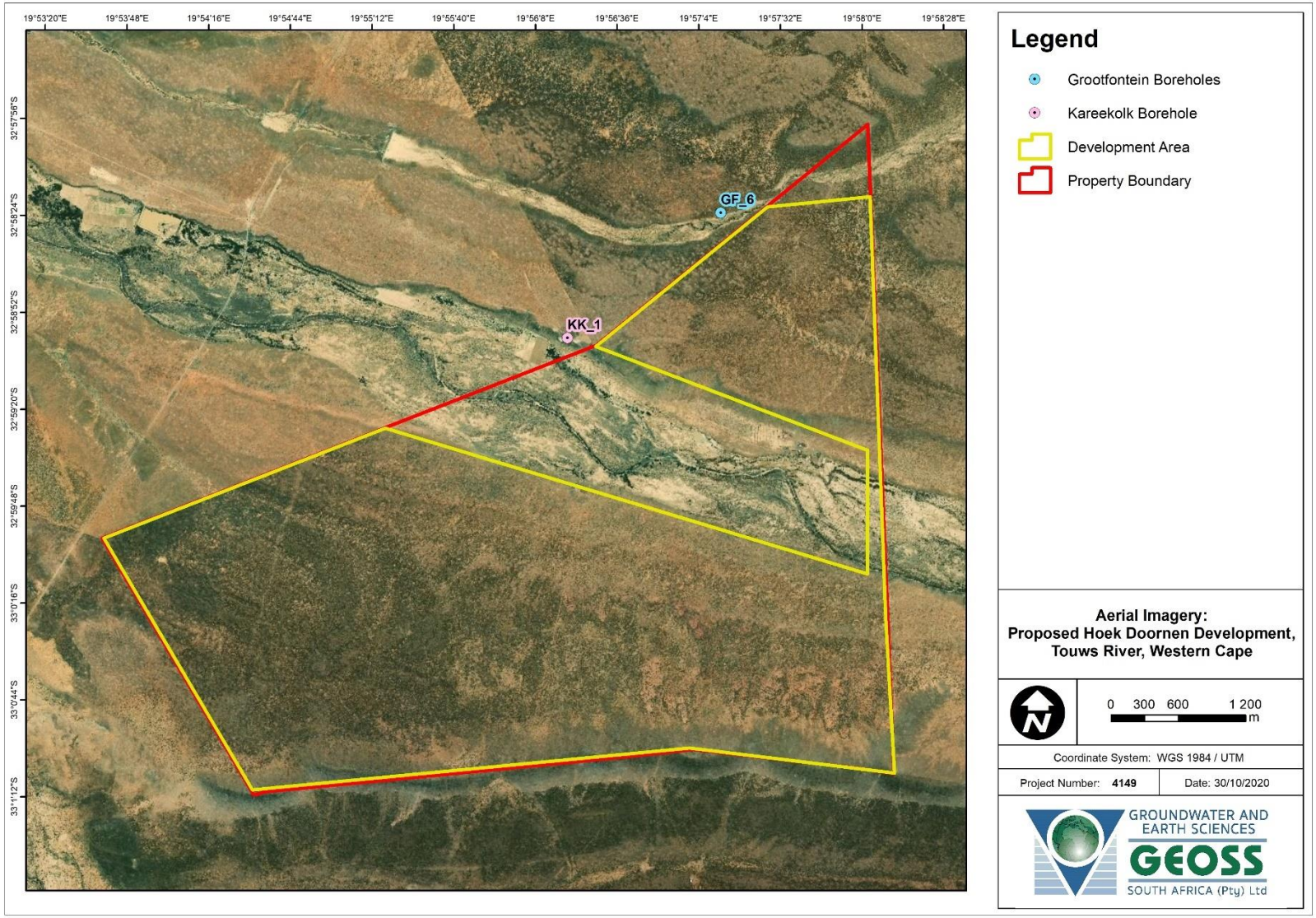
Vrba, J. and A. Zaporozec (eds.) 1994. Guidebook on Mapping Groundwater Vulnerability. Verlag Heinz Heise, Hannover, Germany, International Contributions to Hydrogeology, Vol. 16, 131 pp. Conrad and Munch, 2007

WRC, 2012. A Groundwater Planning Toolkit for the Main Karoo Basin: Identifying and quantifying groundwater development options incorporating the concept of wellfield yields and aquifer firm yields. WRC Report No. 1763/1/11, Pretoria, South Africa.

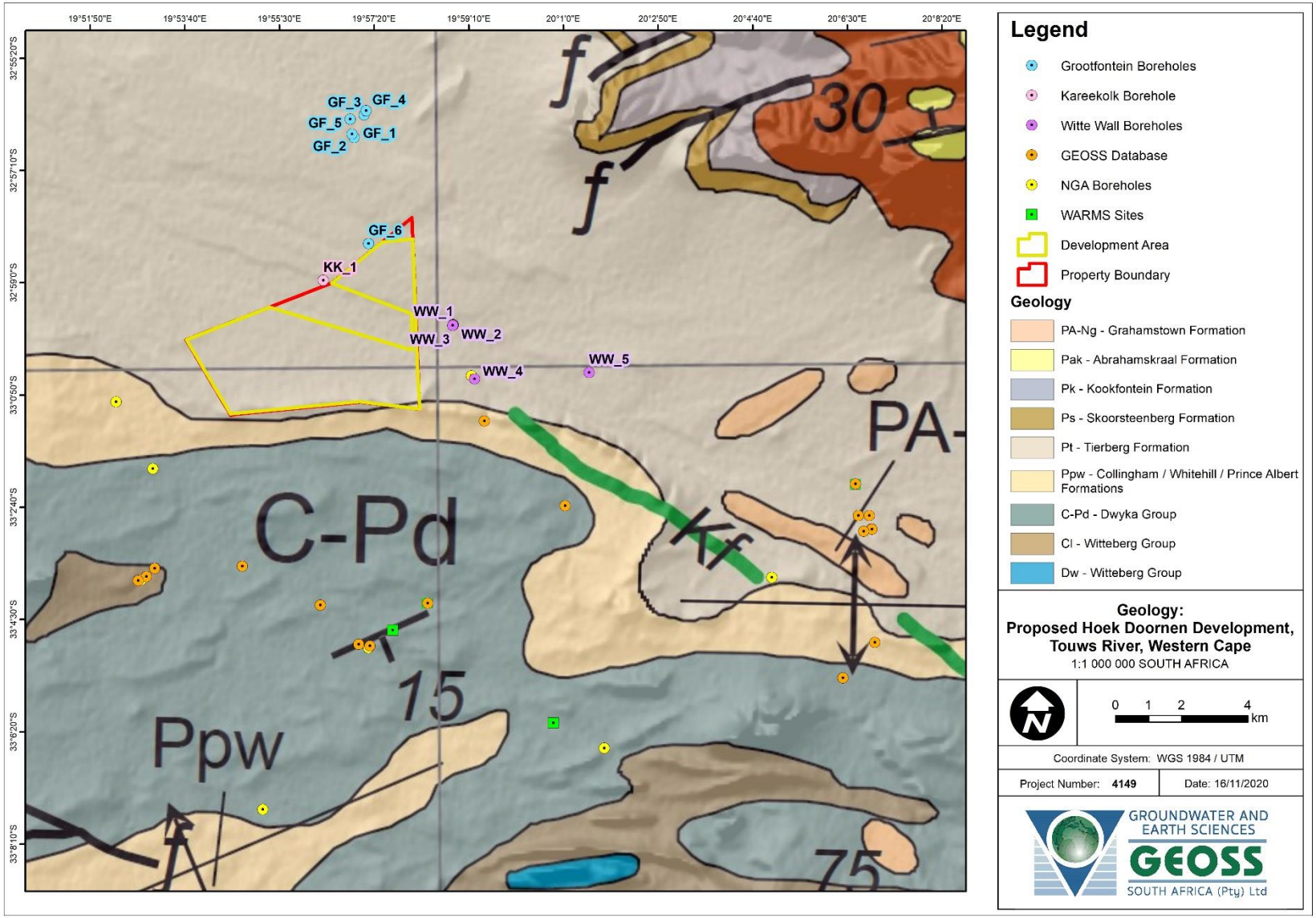
Appendix A - Maps



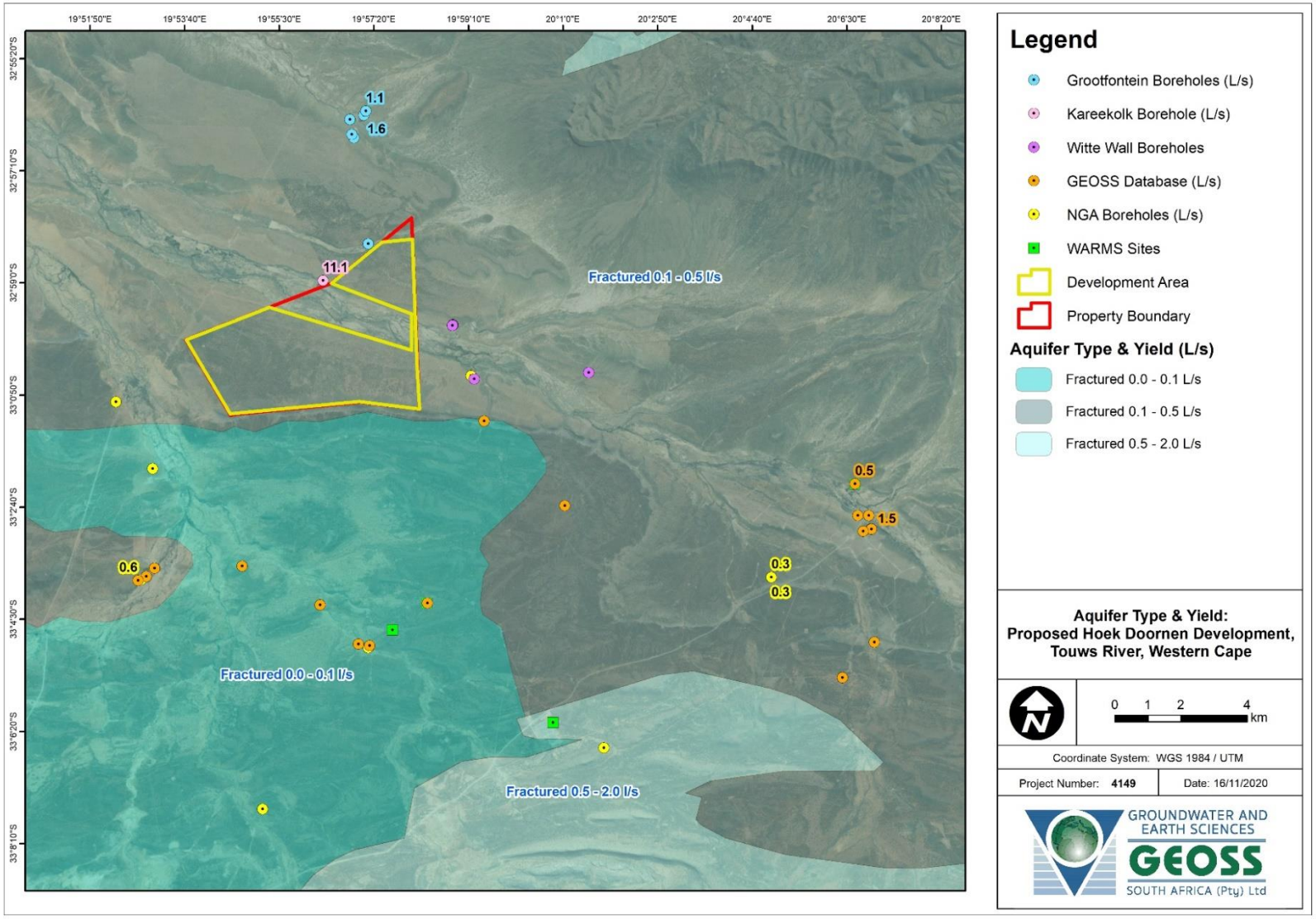
Map 1: Locality of the proposed development of four 175 MW solar PV facilities and associated electrical grid infrastructure, Touws River, Western Cape.



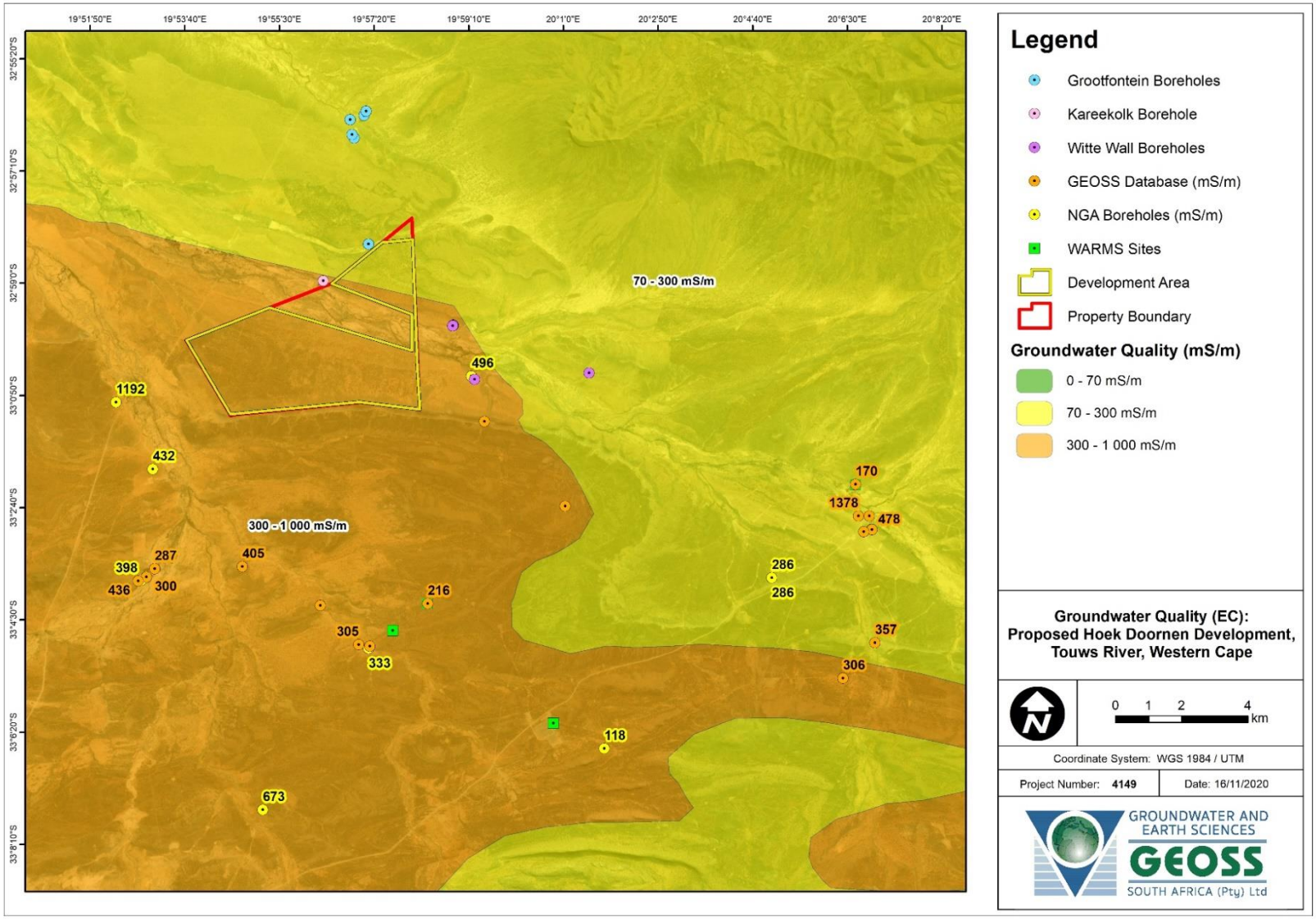
Map 2: Aerial view delineating the Hoek Doornen Wall Farm portion and proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 development assessed area (Note that each PV Facility will cover an estimated area of 260 ha).



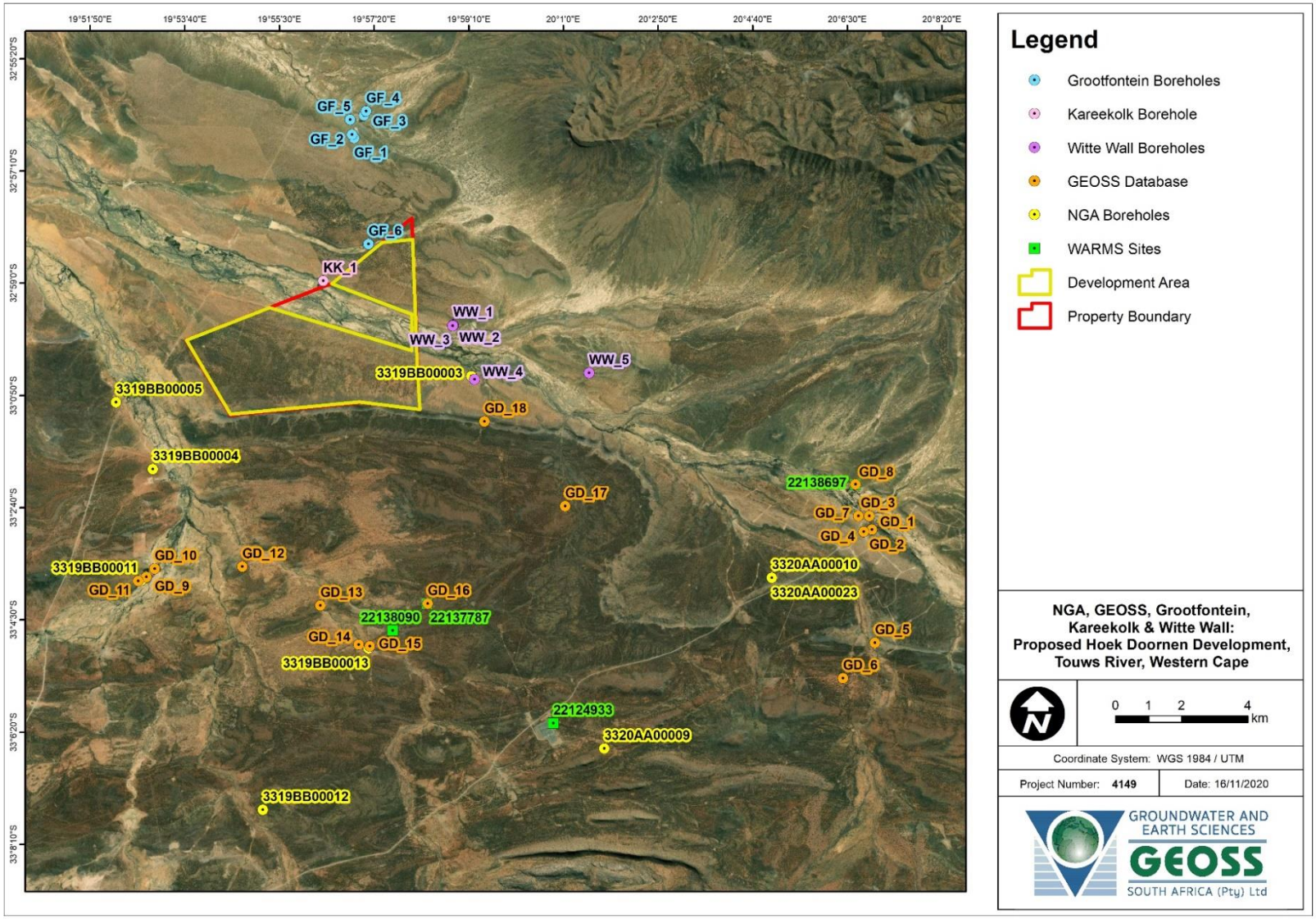
Map 3: Geological setting of the study area (CGS (2019) map: 1:1 00 000 scale South Africa).



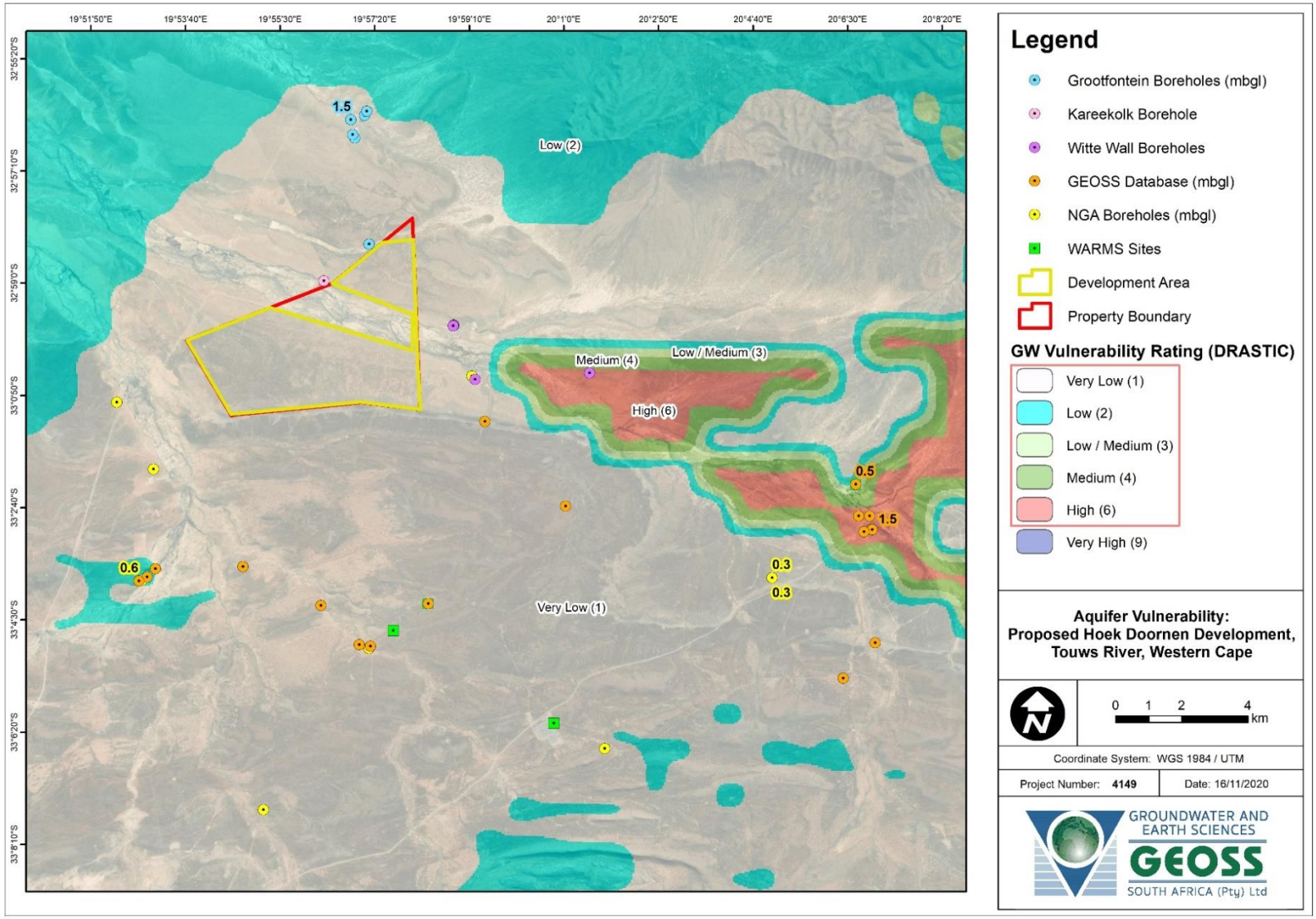
Map 4: Regional aquifer yield (DWAF, 2002) and borehole yields (L/s).



Map 5: Regional groundwater quality (mS/m) from DWAF (2002) and borehole groundwater quality (EC in mS/m).



Map 6: NGA, WARMS, Grootfontein, Witte Wall and Kareekolk and GEOSS internal database boreholes.



Map 7: Vulnerability rating (DWAF, 2005) and groundwater depths (mbgl).

Appendix B - Specialist Expertise

GENERAL

Nationality:	South African and Namibian
Profession:	Geohydrologist
Specialization:	Groundwater exploration, development, sampling and monitoring.
Position in firm:	Geohydrologist at GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd
Date commenced:	16th October 2017
Year of birth & ID #:	1991 – 9105216400083
Language skills:	English (good – speaking, reading and writing) Afrikaans (good - speaking, reading and writing).

KEY SKILLS

- Groundwater sampling, soil sampling, field measurements, borehole logging, data logging for groundwater monitoring, borehole depth and water level measurements, augering for piezometer installation, groundwater geophysics and conducting hydrocensus studies.

RELEVANT EXPERIENCE

- Numerous groundwater exploration - this includes aerial photo interpretation, resistivity, magnetic and electromagnetic geophysical surveys for borehole siting purposes, data analysis and interpretation and hydrogeological conceptualization, development, monitoring and management projects.
- Extensive satellite image data processing (including geo-referencing) for the Validation and Verification projects within the Breede-Overberg Catchment Management Agency.
- Smaller projects involving borehole sitings (aerial photo interpretation, geological mapping, geophysical profiling).
- Projects involving drilling supervision and pumping test supervision with associated data interpretation (FC Method) and writing of geohydrological reports.
- Groundwater and groundwater quality monitoring projects involving appropriate sampling, measurements, data analysis and reporting.
- Numerous Groundwater Impact Assessments

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2017	MEng (Geotechnical Engineering):	University of the Free State, South Africa
2015	BSc Hon – Earth Science Degree:	University of the Stellenbosch, South Africa
2014	BSc - Earth Science Degree:	University of the Stellenbosch, South Africa

Memberships

- Groundwater Division of the Geological Society of South Africa – Member No. 6080/16
- South African Council for National Scientific Professions (SACNASP) Mem. No. 123456

EMPLOYMENT RECORD

October 2017 to March 2019:	GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd, Stellenbosch
March 2019 to present	GEOSS SOUTH AFRICA (Pty) Ltd

Appendix C - Specialist Statement of Independence

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	GEOSS SOUTH AFRICA (PTY) LTD			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Charl Muller			
Specialist Qualifications:	BSc Hons (Earth Science) AND MEng (Civil Engineering)			
Professional affiliation/registration:	SACNASP Reg. no. 123456			
Physical address:	Unit 12, Technostell Building, 9 Quantum st, Techno Park, Stellenbosch 7600			
Postal address:	P.O. Box 12412, Die Boord, Stellenbosch			
Postal code:	7613	Cell:	079824 6157	
Telephone:	021 850 1079	Fax:	086 605 1121	
E-mail:				

2. DECLARATION BY THE SPECIALIST

I, Charl Muller, 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

GEOSS SOUTH AFRICA (PTY) LTD

Name of Company:

30 / October / 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Charl Muller, 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

GEOSS SOUTH AFRICA (PTY) LTD

Name of Company

30/ October /2020

Date

Signature of the Commissioner of Oaths

Date

STASIE BEVELVOERDER
STELLENBOSCH
2020 -10- 30
STELLENBOSCH
STATION COMMANDER
SOUTH AFRICAN POLICE SERVICE

Appendix D: Site Sensitivity Verification

It is important to note that there are no dedicated Geohydrology or Groundwater themes on the National Web-based Environmental Screening Tool (Screening Tool) (as at October 2020), therefore the environmental sensitivity of the proposed project area as identified by the Screening Tool is not applicable. Therefore, no site sensitivity verification report is required. Furthermore, there is no dedicated assessment protocol prescribed for Geohydrology or Groundwater. Therefore, the specialist assessment has been undertaken in compliance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014. All relevant desktop information, consultation with landowners, and previous assessments undertaken by the author in the study area have been taken into consideration in this assessment.

Appendix E: Impact Assessment Methodology

The following impact assessment has been used in this assessment.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1).

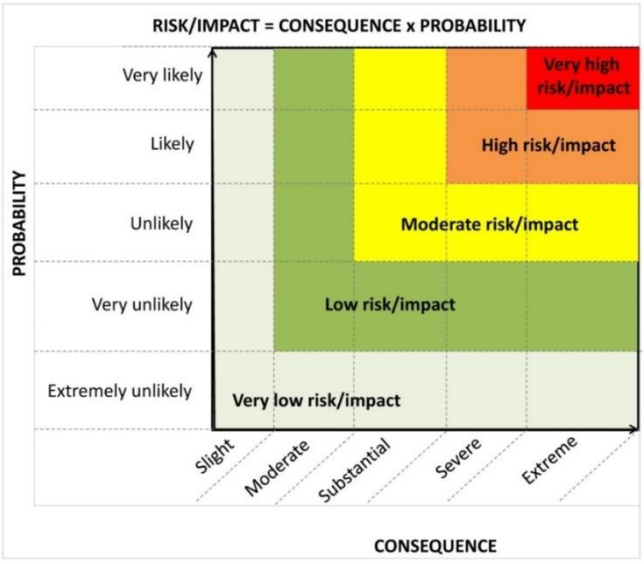


Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix F: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been 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;*	*Section 1.2 and Appendix B*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix C*
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 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Not Applicable (Desktop Study undertaken)*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 2 and 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;	*Section 4 and Maps*
g) an identification of any areas to be avoided, including buffers;	*Not Applicable*
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;	*Section 4 and Maps*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2.2*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 5 and Section 6*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Section 7*
l) any conditions for inclusion in the environmental authorisation;	*Section 10*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Section 7*
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*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Section 2.3*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable at this stage*
q) any other information requested by the competent authority.	*Not Applicable*
(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.	*Not Applicable*

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.9

Civil Aviation Site Sensitivity Verification

Appendix C.9: Civil Aviation Site Sensitivity Verification

1. Introduction

This report serves as the Site Sensitivity Verification for Civil Aviation for the Basic Assessment (BA) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape. The projects are being proposed by Veroniva (PTY) Ltd, and forms part of a cluster of nine Solar PV Facilities and associated infrastructure.

2. Need for the Site Sensitivity Verification

On 20 March 2020, in Government Gazette 43110, Government Notice (GN) 320, the Department of Environment, Forestry and Fisheries (DEFF) published procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) when applying for an Environmental Authorisation (EA). GN 320 prescribes general requirements for undertaking Site Sensitivity Verification, as well as protocols for assessment and minimum report content requirements of environmental impacts associated with specified environmental themes for activities requiring EA. GN 320 was enforced within 50 days of publication of the notice i.e. on 9 May 2020.

GN 320 specifically includes a protocol that provides the criteria for the specialist assessment and minimum report content requirements for impacts on civil aviation installations for activities requiring EA. This protocol replaces the requirements of Appendix 6 of the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (as amended).

This specific protocol states that proposed developments that occur on sites identified as Very High, High or Medium sensitivity, as depicted on the National Web-Based Environmental Screening Tool (Screening Tool), must include a Civil Aviation Compliance Statement. It further states that there are no requirements if the proposed developments occur on sites identified as Low sensitivity on the Screening Tool. However, a Site Sensitivity Verification is required for the Civil Aviation Protocol.

Therefore, since the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects require an EA in terms of the 2014 NEMA EIA Regulations (as amended), and Civil Aviation was identified as a relevant theme for the Solar Methodology on the Screening Tool, as well as a required study, GN 320 must be complied with.

3. Methodology

The Site Sensitivity Verification Process and Report has been compiled based on the following methodology:

- Existing spatial databases were used to determine the location of civil aviation installations in relation to the proposed project area, and to identify preliminary areas of concern in terms of impacts to civil aviation installations;
- The proposed project sites and footprints were plotted on the Screening Tool to identify the sensitivity allocated;
- A site visit was undertaken to confirm the current land use and the environmental sensitivity as it relates to Civil Aviation;
- Additional research was undertaken to substantiate the Site Sensitivity Verification process; and
- A Site Sensitivity Verification Report was compiled (i.e. this report).

The information sources listed in Table 1 were used in the Site Sensitivity Verification process.

Table 1: Information Sources used for the Site Sensitivity Verification process

Data / Information	Source	Date	Type	Description
National Web-Based Environmental Screening Tool (Screening Tool)	Department of Environment, Forestry and Fisheries (DEFF)	2020	Spatial / Online Assessment	The Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an Application for EA in terms of the 2014 NEMA EIA Regulations (as amended) to screen the proposed site for any environmental sensitivity[1].
RSA Airspaces in 3D	Air Traffic and Navigation Services SOC Limited (ATNS)	2020	Google Earth KMZ File	The RSA Airspaces in 3D data KMZ file is an initiative undertaken by the ATNS to illustrate the definitions and complexities of airspace, routes, aerodromes and navigational facilities within South Africa to the public in the interest of safety[2].
Airport, Airfields and Obstacle Datasets [Note that this dataset was used in the Visual Impact Assessment undertaken for the proposed project]	Civil Aviation Authority (CAA)	2018	Spatial Vector Dataset	Location of airfields in RSA.
Wind and Solar PV Phase 1 Strategic Environmental Assessment (SEA)	Department of Environmental Affairs (DEA)	2015	Report	SEA commissioned by the DEA [now operating as the DEFF) in 2013 for an assessment of wind and solar PV energy in South Africa, with an aim of identifying eight Renewable Energy Development Zones (REDZs) to focus and incentivize such development (i.e. Phase 1 REDZs SEA: CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B).
Wind and Solar PV Phase 2 SEA	DEFF	2019	Report	SEA commissioned by the DEFF in 2016 for an assessment of wind and solar PV energy in South Africa, with an aim of identifying three additional REDZs to focus and incentivize such development (i.e. Phase 2 REDZ SEA. CSIR Report Number:

[1] https://screening.environment.gov.za/screeningtool/index.html#/pages/welcome

[2] https://www.atns.co.za/rsakmz.php

Data / Information	Source	Date	Type	Description
				CSIR/SPLA/SECO/ER/2019/0085).
Visual Impact Assessment for the proposed projects	Quinton Lawson and Bernard Oberholzer, QARC and BOLA	2020	Report	This Visual Impact Assessment was commissioned for the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project.

Therefore, the Site Sensitivity Verification was undertaken using desktop analysis, satellite imagery, preliminary on-site inspection, and other available and relevant information.

4. Proposed Project Location

The proposed projects are located entirely within the Komsberg Renewable Energy Development Zone (REDZ 2), one of the eight REDZs formally gazetted in South Africa for the purpose of developing solar and wind energy generation facilities (GN 114; 16 February 2018). The proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects are located on Portion 1 of Hoek Doornen Farm Number 172 (Surveyor General (SG) 21 Digit Code: C01900000000017200001).

5. Details of the Environmental Assessment Practitioner

GN 320 states that prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a Site Sensitivity Verification. GN 320 further notes that the Site Sensitivity Verification must be undertaken by an Environmental Assessment Practitioner (EAP) or specialist with expertise in radar.

This Site Sensitivity Verification has been undertaken by Lizande Kellerman, an EAP at the CSIR. Lizande Kellerman is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400076/10 in the field of Botanical Sciences. Inputs to the Site Sensitivity Verification Report were provided by Luanita Snyman-van der Walt and Rohaida Abed of the CSIR.

6. Findings of the Screening Tool

A Screening Tool Report was generated for the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project using the following classification: Utilities Infrastructure → Electricity → Generation → Renewable → Solar → PV → Solar PV.

The map of relative civil aviation (Solar PV) theme sensitivity generated and included in the Screening Tool depicted that the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project footprints are located in a low sensitivity area from a civil aviation perspective i.e. there are no major or other types of civil aviation aerodromes or buffers that intersect with the project footprint (Figure 1).

In terms of GN 320, this means that no further requirements are applicable i.e. a Compliance Statement is not required, if the site is indeed found to be of low sensitivity during the site visit.

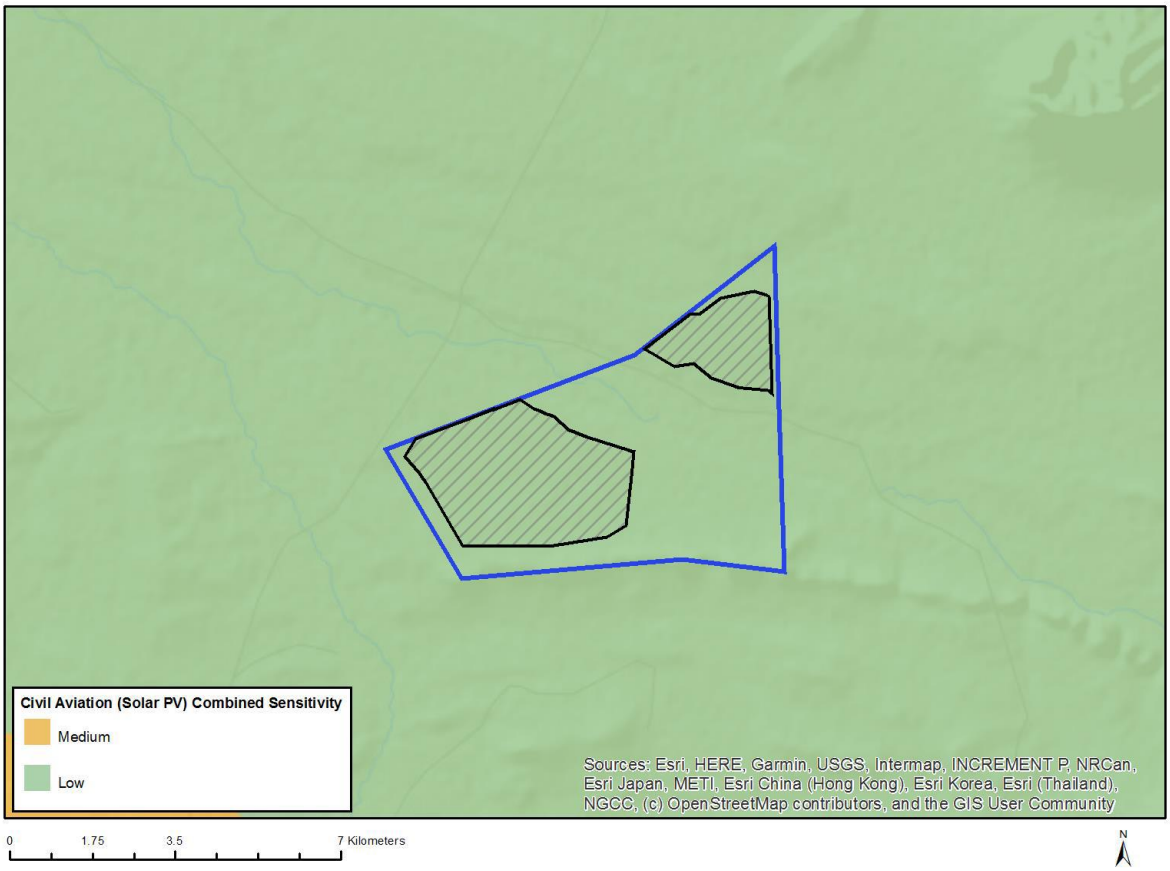


Figure 1: Screening Tool Map showing the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 Project Footprints in terms of Civil Aviation Sensitivity.

7. Details of the Site Visit

The details of the site visit are noted below:

Date of Site Visit	15 – 16 October 2020
Specialist Name	Lizande Kellerman (EAP)
Professional Registration Number	SACNASP Reg, No. 400076/10
Specialist Affiliation / Company	CSIR

8. Findings

The site visit confirmed that the proposed project sites currently do not have any agricultural activity but were historically used for sheep grazing. **No civil aviation installations were found within the proposed project footprint for Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4.** The area is arid and typified by short karroid shrubland vegetation characteristic of the Succulent Karoo Biome. Refer to Figures 2, 3 and 4 for views of the Hoek Doornen Farm, on which the proposed projects will take place.

Figure 2: View from R356 towards Hoek Doornen Farm (NE direction) (Photo: L. Kellerman)

Figure 3: View from R356 towards Hoek Doornen Farm (SE direction) (Photo: L. Kellerman)

Figure 4: View from Hoek Doornen Farm towards the adjacent Grootfontein Farm (NE direction) (Photo: L. Kellerman)

However, there is an airstrip and helicopter landing pad at the Sadawa Game Reserve (21 Digit SG Code: C01900000000047700000), which is located about 3 km away from the Hoek Doornen PV project. The airstrip and helicopter landing pad are only occasionally used for small aircraft (and scraped down before use only when required). The landing strip is approximately 1.3 km long and oriented NW-SE. Figures 5, 6 and 7 below show the airstrip and helicopter landing pad. The location of this private landing strip, potentially due to its small scale, is not shown on the Screening Tool. The Visual Impact Assessment undertaken for the proposed project has confirmed that the Sadawa airstrip is located away from the proposed project sites and outside of the high sensitivity areas allocated in the Visual Impact Assessment. Figure 8 provides a view from the Hoek Doornen Farm towards the Sadawa Game Reserve.

Figure 5: Sadawa Game Reserve helicopter landing pad (Photo: L. Kellerman)

Figure 6: Sadawa Game Reserve airstrip (view in NW direction) (Photo: L. Kellerman)

Figure 7: Sadawa Game Reserve airstrip (view in SE direction) (Photo: L. Kellerman)

Figure 8: View from Hoek Doornen Farm towards the Sadawa Game Reserve (SE direction) (Photo: L. Kellerman)

The Inverdoorn Private Nature reserve is also located more than 10 km to the south-west of the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 sites. Research and discussions with local landowners have indicated that the Inverdoorn Private Nature Reserve also has a landing strip. The location of the landing strip is shown on the Screening Tool; however, the actual civil aviation installation and its associated buffers do not fall within the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project sites.

Research has also indicated that the Rooikoppies airfield[3] is located near Touwsrivier, more than 25 km away from the proposed project sites, on the southern side of the Bontberg mountains.

The ATNS data has confirmed that there are two unlicensed aerodomes outside of the 30 km radius of the proposed project sites. The ATNS data further notes that Area Navigation Routes associated with the Cape Town International Airport Airspace intersect with the 30 km radius of the project area, however none intersect with the actual Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project sites. The ATNS data also notes that Conventional Routes associated with the Cape Town International Airport Airspace intersect with the 30 km radius of the project area, over the Hoek Doornen Farm. However, the proposed solar panels will range to a maximum height of 10 m from ground level, and is thus not likely to impact negatively on civil aviation installations or air traffic associated with the Cape Town International Airport.

The ATNS data also indicates the location of the Touws River Weapons Training area, which is classified as restricted airspace, located more than 25 km to the south-west of the project sites. Based on the location, it will not be impacted on by the proposed solar PV projects.

Most of the features noted above are in line with the findings of the Phase 1 and Phase 2 Wind and Solar SEA Reports.

Figure 9 indicates the location of the civil aviation features noted above, which informed this Site Sensitivity Verification.

[3] https://mapcarta.com/14265164

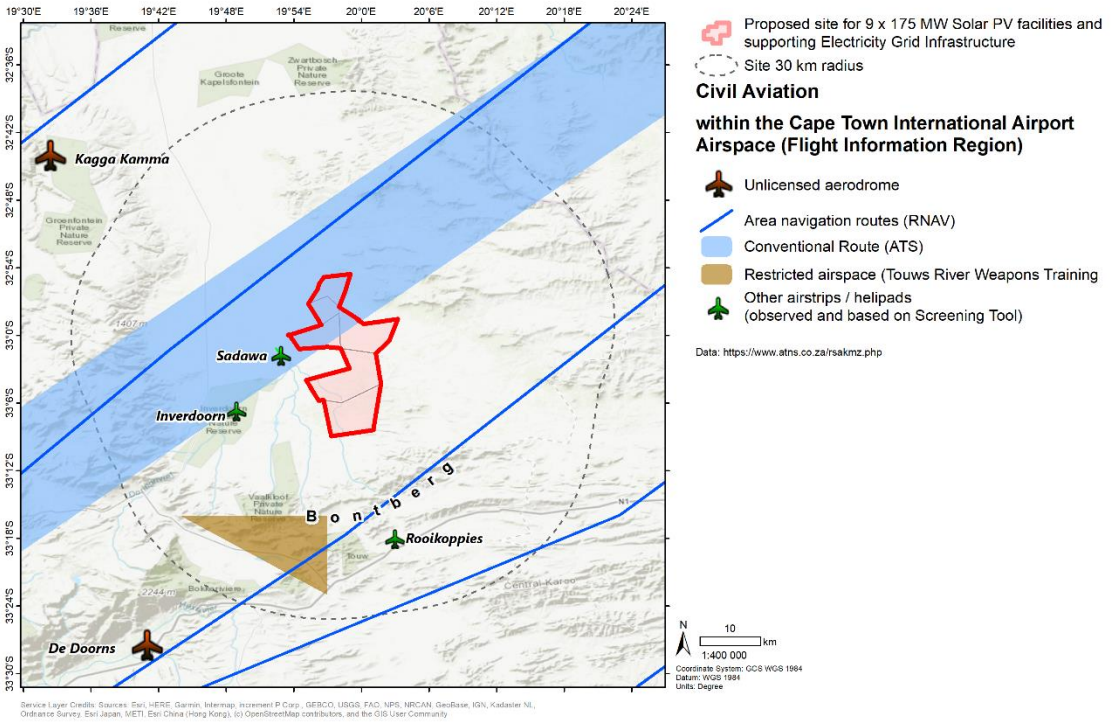


Figure 9: Civil Aviation Features relative to the proposed project sites based on the site visit and existing databases.

9. Concluding Statement

The proposed project sites were determined and verified to be of low sensitivity (as it relates to civil aviation). This was determined through a site visit and based on existing databases, and confirms the sensitivity allocated on the Screening Tool. Based on the above, in terms of GN 320, no further requirements are applicable i.e. a Compliance Statement is not required.

10. Appendix A: EAP Declaration

I, **Lizande Kellerman**, declare that –

- I act as the independent environmental assessment practitioner in this site sensitivity verification;
- I have expertise in conducting environmental impact assessments, 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 will perform the work relating to the site sensitivity verification in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I will take into account, to the extent possible, the matters listed in Regulation 13 of the Regulations when preparing the site sensitivity verification and any report relating to the site sensitivity verification;
- 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 site sensitivity verification by the Competent Authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the Competent Authority, unless access to that information is protected by law, in which case it will be indicated that such information exists and will be provided to the Competent Authority;
- I will perform all obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

_____
_____
_____

Signature of the Environmental Assessment Practitioner	
Name of Company	CSIR
Date	12 November 2020

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

APPENDIX C.10

Defence Site Sensitivity Verification

Appendix C.10: Defence Site Sensitivity Verification

1. Introduction

This report serves as the Site Sensitivity Verification for Defence for the Basic Assessment (BA) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Infrastructure (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape. The projects are being proposed by Veroniva (PTY) Ltd, and forms part of a cluster of nine Solar PV Facilities and associated infrastructure.

2. Need for the Site Sensitivity Verification

On 20 March 2020, in Government Gazette 43110, Government Notice (GN) 320, the Department of Environment, Forestry and Fisheries (DEFF) published procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) when applying for an Environmental Authorisation (EA). GN 320 prescribes general requirements for undertaking Site Sensitivity Verification, as well as protocols for assessment and minimum report content requirements of environmental impacts associated with specified environmental themes for activities requiring EA. GN 320 was enforced within 50 days of publication of the notice i.e. on 9 May 2020.

GN 320 specifically includes a protocol that provides the criteria for the specialist assessment and minimum report content requirements for impacts on defence installations for activities requiring EA. This protocol replaces the requirements of Appendix 6 of the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (as amended).

This specific protocol states that proposed developments that occur on sites identified as Very High, High or Medium sensitivity, as depicted on the National Web-Based Environmental Screening Tool (Screening Tool), must include a Defence Compliance Statement. It further states that there are no requirements if the proposed developments occur on sites identified as Low sensitivity on the Screening Tool. However, a Site Sensitivity Verification is required for the Defence Protocol.

Therefore, since the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects require an EA in terms of the 2014 NEMA EIA Regulations (as amended), and Defence was identified as a relevant theme for the Solar Methodology on the Screening Tool, as well as a required study, GN 320 must be complied with.

3. Methodology

The Site Sensitivity Verification Process and Report has been compiled based on the following methodology:

- Existing spatial databases were used to determine the location of defence installations in relation to the proposed project area, and to identify preliminary areas of concern in terms of impacts to defence installations;

- The proposed project sites and footprints were plotted on the Screening Tool to identify the sensitivity allocated;
- A site visit was undertaken to confirm the current land use and the environmental sensitivity as it relates to Defence;
- Additional research was undertaken to substantiate the Site Sensitivity Verification process; and
- A Site Sensitivity Verification Report was compiled (i.e. this report).

The information sources listed in Table 1 were used in the Site Sensitivity Verification process.

Table 1: Information Sources used for the Site Sensitivity Verification process

Data / Information	Source	Date	Type	Description
National Web-Based Environmental Screening Tool (Screening Tool)	Department of Environment, Forestry and Fisheries (DEFF)	2020	Spatial / Online Assessment	The Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an Application for EA in terms of the 2014 NEMA EIA Regulations (as amended) to screen the proposed site for any environmental sensitivity[1].
RSA Airspaces in 3D	Air Traffic and Navigation Services SOC Limited (ATNS)	2020	Google Earth KMZ File	The RSA Airspaces in 3D data KMZ file is an initiative undertaken by the ATNS to illustrate the definitions and complexities of airspace, routes, aerodromes and navigational facilities within South Africa to the public in the interest of safety[2].
Wind and Solar PV Phase 1 Strategic Environmental Assessment (SEA)	Department of Environmental Affairs (DEA)	2015	Report	SEA commissioned by the DEA [now operating as the DEFF) in 2013 for an assessment of wind and solar PV energy in South Africa, with an aim of identifying eight Renewable Energy Development Zones (REDZs) to focus and incentivize such development (i.e. Phase 1 REDZs SEA: CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B).
Wind and Solar PV Phase 2 SEA	DEFF	2019	Report	SEA commissioned by the DEFF in 2016 for an assessment of wind and solar PV energy in South Africa, with an aim of identifying three additional REDZs to focus and incentivize such development (i.e. Phase 2 REDZ SEA. CSIR Report Number: CSIR/SPLA/SECO/ER/2019/0085).

Therefore, the Site Sensitivity Verification was undertaken using desktop analysis, satellite imagery, preliminary on-site inspection, and other available and relevant information.

4. Proposed Project Location

The proposed projects are located entirely within the Komsberg Renewable Energy Development Zone (REDZ 2), one of the eight REDZs formally gazetted in South Africa for the purpose of developing solar and wind energy generation facilities (GN 114; 16 February 2018). The proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects are located on Portion 1 of Hoek Doornen Farm Number 172 (Surveyor General (SG) 21 Digit Code: C01900000000017200001).

[1] https://screening.environment.gov.za/screeningtool/index.html#/pages/welcome

[2] https://www.atns.co.za/rsakmz.php

5. Details of the Environmental Assessment Practitioner

GN 320 states that prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a Site Sensitivity Verification. GN 320 further notes that the Site Sensitivity Verification must be undertaken by an Environmental Assessment Practitioner (EAP) or specialist with expertise in radar.

This Site Sensitivity Verification has been undertaken by Lizande Kellerman, an EAP at the CSIR. Lizande Kellerman is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400076/10 in the field of Botanical Sciences. Inputs to the Site Sensitivity Verification Report were provided by Luanita Snyman-van der Walt and Rohaida Abed of the CSIR.

6. Findings of the Screening Tool

A Screening Tool Report was generated for the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project using the following classification: Utilities Infrastructure → Electricity → Generation → Renewable → Solar → PV → Solar PV.

The map of relative defence theme sensitivity generated and included in the Screening Tool depicted that the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 project footprints are located in a low sensitivity area from a defence perspective i.e. there are no major or other types of defence installations or buffers that intersect with the project footprint.

In terms of GN 320, this means that no further requirements are applicable i.e. a Compliance Statement is not required, if the site is indeed found to be of low sensitivity during the site visit.

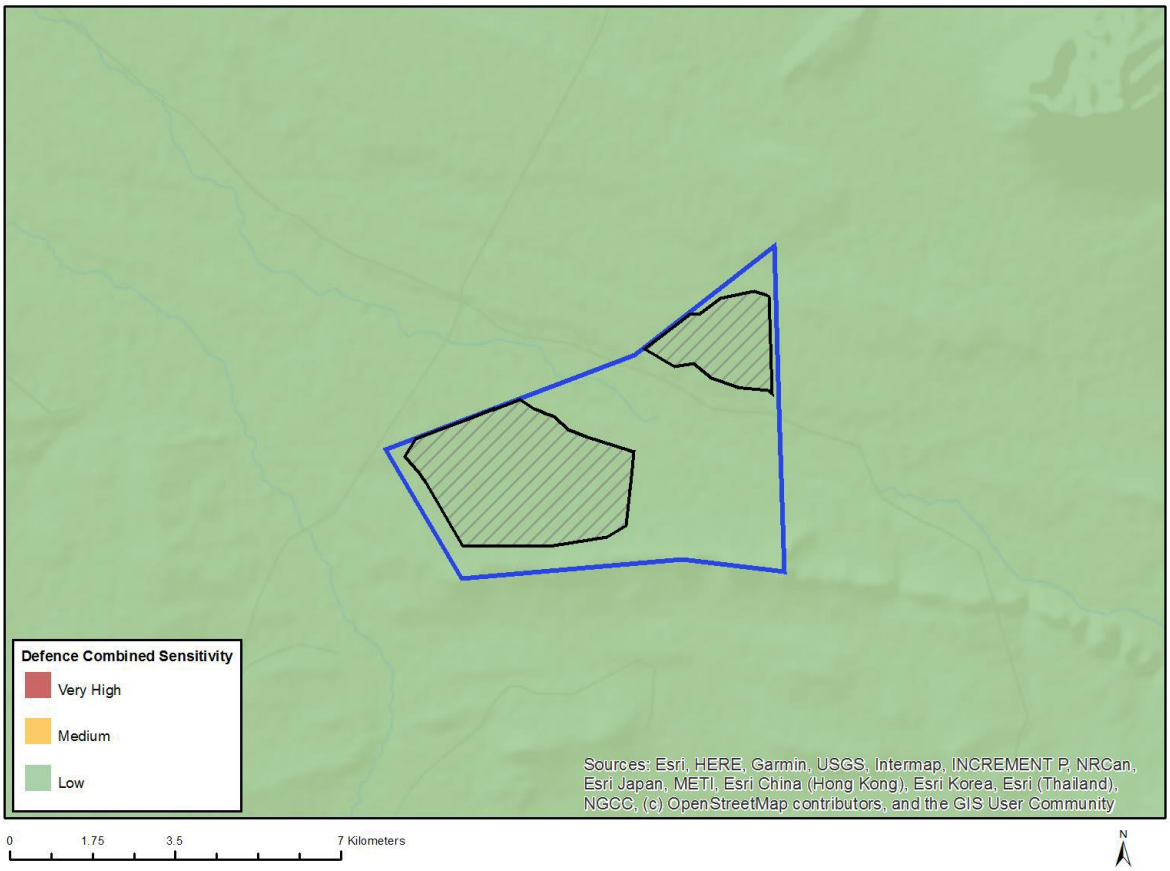


Figure 1: Screening Tool Map showing the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 Project Footprints in terms of Defence Sensitivity.

7. Details of the Site Visit

The details of the site visit are noted below:

Date of Site Visit	15 – 16 October 2020
Specialist Name	Lizande Kellerman (EAP)
Professional Registration Number	SACNASP Registration Number 400076/10
Specialist Affiliation / Company	CSIR

8. Findings

The site visit confirmed that the proposed project sites currently do not have any agricultural activity but were historically used for sheep grazing. **No defence installations were found within the proposed project footprint for Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4.** The area is arid and typified by short karroid shrubland vegetation characteristic of the Succulent Karoo Biome. Refer to Figures 2, 3 and 4 for views of the Hoek Doornen Farm, on which the proposed projects will take place.

Figure 2: View from R356 towards Hoek Doornen Farm (NE direction) (Photo: L. Kellerman)

Figure 3: View from R356 towards Hoek Doornen Farm (SE direction) (Photo: L. Kellerman)

Figure 4: View from Hoek Doornen Farm towards the adjacent Grootfontein Farm (NE direction) (Photo: L. Kellerman)

The Air Traffic and Navigation Services SOC Limited (ATNS) data indicates the location of the Touws River Weapons Training area, which is classified as restricted airspace, located more than 25 km to the south-west of the project sites. The Screening Tool shows this area as Very High sensitivity in relation to the solar methodology. However, based on the location, it will not be impacted on by the proposed solar PV projects.

The features noted above are in line with the findings of the Phase 1 and Phase 2 Wind and Solar SEA Reports.

Figure 5 indicates the location of the defence features noted above, which informed this Site Sensitivity Verification.

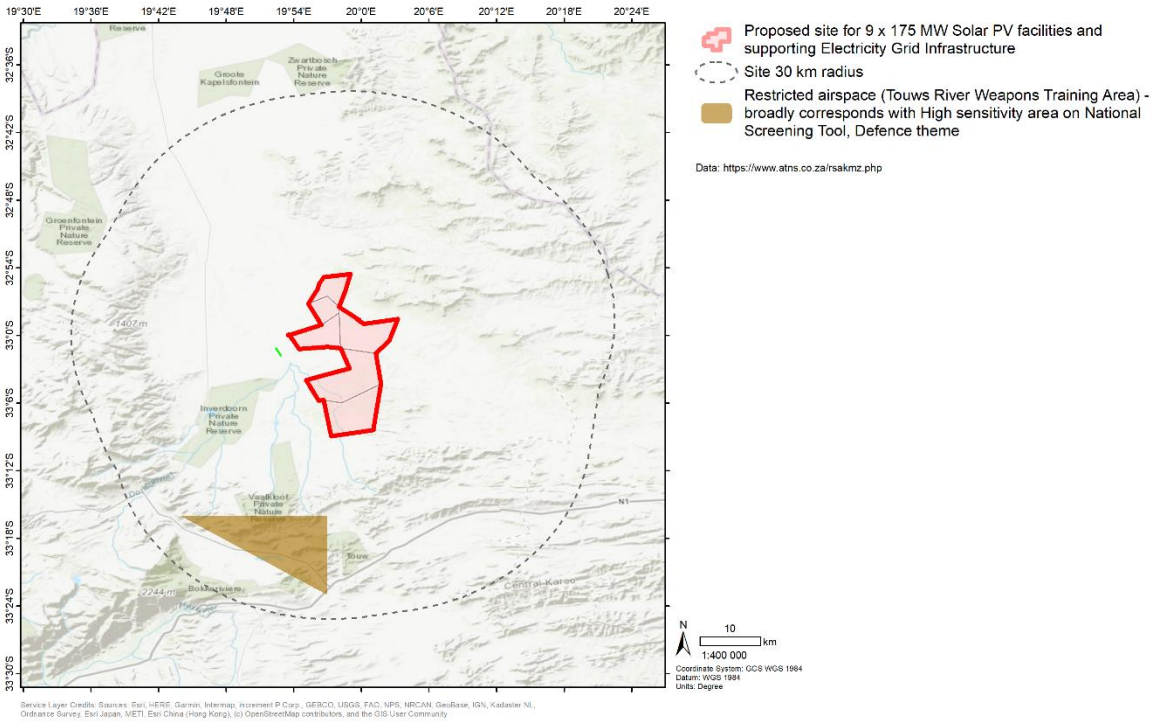


Figure 5: Defence Features relative to the proposed project sites based on the site visit and existing databases.

9. Concluding Statement

The proposed project sites were determined and verified to be of low sensitivity (as it relates to defence installations). This was determined through a site visit and based on existing databases, and confirms the sensitivity allocated on the Screening Tool. Based on the above, in terms of GN 320, no further requirements are applicable i.e. a Compliance Statement is not required.

10. Appendix A: EAP Declaration

I, **Lizande Kellerman**, declare that –

- I act as the independent environmental assessment practitioner in this site sensitivity verification;
- I have expertise in conducting environmental impact assessments, 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 will perform the work relating to the site sensitivity verification in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I will take into account, to the extent possible, the matters listed in Regulation 13 of the Regulations when preparing the site sensitivity verification and any report relating to the site sensitivity verification;
- 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 site sensitivity verification by the Competent Authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the Competent Authority, unless access to that information is protected by law, in which case it will be indicated that such information exists and will be provided to the Competent Authority;
- I will perform all obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

_____
_____
_____

Signature of the Environmental Assessment Practitioner	
Name of Company	CSIR
Date	12 November 2020