Appendix 6G

Surface Water Assessment

Review of Surface Water Impact Assessment for the Proposed Construction of the Umsobomvu Solar PV Energy Facilities, Eastern Cape and Northern Cape Provinces

4th November 2019

Stephen Burton Pr. Sci. Nat. (Registration Number: 117474)

Reviewer:
Dr BC Scott-Shaw
NatureStamp (PTY) Ltd
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Background

NatureStamp was requested by SiVEST Environmental to undertake an external review of a surface water impact assessment for three proposed solar farms. The following criteria were considered for this review:

1. *Determining adherence of the report in relation to the requirements of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) minimum specialist report requirements, which are presented within Appendix 6 of the NEMA: EIA Regulations (2014, as amended);*
2. *The general structure and grammar of the report;*
3. *The extent to which the report met the stated Terms of Reference;*
4. *The thoroughness and relevance of the methods followed and document in the report;*
5. *Evaluate the validity of the findings and consider whether the report is technically, scientifically and professionally credible (review data evidence);*
6. *Identify any limitation in the report that may have compromised the results;*
7. *The applicability and feasibility of the mitigation measures proposed; and*
8. *The overall findings and quality of the work.*

General Report Comments

This external review is based on a desktop assessment of the documentation only and no field verification of the results was undertaken. The report was extensive with, primarily as it covers three large study areas. There were some editorial changes suggested by the reviewer. These and all grammatical errors were submitted as track changes to the client. As it is an extensive report, it was suggested by the reviewer that the commonly tables for the wetland assessment, provided in the methodology be moved to the appendices. The methods proposed are the standard methods used elsewhere and generally accepted.

Many of the figure used in the report had a double legend. It was requested that these be combined into one legend to avoid confusion. In the results, three different systems were identified, a wetland area, numerous non-perennial systems and some perennial systems. These units did not clearly match *the subsequent results headings. As such, it was requested that the subsequent sections clearly link back to the spatial layout so that it is clear what system was being assessed. Some of the captions were more statements than an actual description of the image. The reviewer indicated that runoff is a direct impact. It also can't impact on the surrounding catchment but not on the immediate surroundings. It was requested that the wording be revised. There was some redundancy in the results which were requested to be reduced for ease of reading. Although not in the TOR, it would have been beneficial to include some detailed mitigation measures.*

No.	**Criteria**	**Addressed *(Y/N/P)**	
1	*Determining adherence of the report in relation to the requirements of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) minimum specialist report requirements, which are presented within Appendix 6 of the NEMA: EIA Regulations (2014, as amended);*	**Y**	The report was focused on the results in light of NEMA. Only road crossings were within the NEMA conditions.
2	*Determining the relevance to the National Water Act, 1998 (Act No. 36 of 1998) (NWA) The ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users.*	**Y**	The findings were assessed being relevant to (c) and (i). As such, a risk matrix was included which deemed the risk as low.
3	*The general structure and grammar of the report;*	**P**	There were some structural inconsistencies and grammatical errors which were submitted as comments and track changes
4	*The extent to which the report met the stated Terms of Reference;*	**Y**	The report did meet the TOR. However, it was hard to link each relevant task with the results. The structure of the results was requested to be revised.
5	*The thoroughness and relevance of the methods followed and document in the report;*	**Y**	The methods outlined were thorough. Less information was available on in-field assessments which would have supported the methods.
6	*Evaluate the validity of the findings and consider whether the report is technically, scientifically and professionally credible (review data evidence);*	**Y**	The results seem valid, however, the buffer applied on the wetland system appears to be too small.
7	*Identify any limitation in the report that may have compromised the results;*	**P**	The reviewer was unaware of how detailed the field study was, which may have resulted in some small sites being overlooked. However, if this detail were to be included it would provide further assurance that no systems were overlooked.
8	*The overall findings and quality of the work.*	**Y**	The report was generally too long and hard to follow. This is in part due to the extensive area. The report and its findings were of reasonable to good standards.

*Y: Yes, N: No, P: Partially

As this was a desktop review, the author cannot make a detailed interrogation of the findings without having gone to site. The key changes suggested were to reduce any redundancy in the report, ensure the wetland buffer is sufficient and include loss of vegetation/habitat in the operation phase. Beyond this, the author is aware that the PV plant has a lower impact than an active development that has a high waste output. However, due to the extent of the site and some sensitive areas, a detailed rehabilitation plan and mitigation measures would be key to reducing the identified impacts in this report.

Yours sincerely

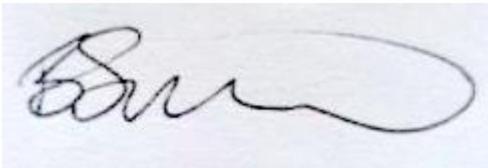
Dr Bruce Scott-Shaw
BSc, BSc Hons (Hydrology), MSc (Hydrology), PhD (Hydrology)
Candidate Natural Scientist (118673)

MOOI PLAATS SOLAR POWER (PTY) LTD / WONDERHEUVEL SOLAR POWER (PTY) LTD / PAARDE VALLEY SOLAR POWER (PTY) LTD

PROPOSED CONSTRUCTION OF THE UMSOBOMVU SOLAR PV ENERGY FACILITIES, IN THE EASTERN CAPE AND NORTHERN CAPE PROVINCES

Surface Water Impact Assessment Report

Issue Date: 04th November 2019
Revision No.: 4
Project No.: 15324

Date:	04th November 2019
Document Title:	Proposed Construction of the Umsobomvu Solar PV Energy Facilities, in the Eastern Cape and Northern Cape Provinces – Surface Water Impact Assessment Report
Author:	Stephen Burton *Pr. Sci. Nat.* (Registration Number: 117474)
Revision Number:	4
External Reviewer:	**Bruce Scott-Shaw**
Signature:	
Approved:	**Liandra Scott-Shaw**
Signature:	
For:	Mooi Plaats Solar Power (Pty) Ltd / Wonderheuvel Solar Power (Pty) Ltd / Paarde Valley Solar Power (Pty) Ltd

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Proposed Construction of the Mooi Plaats, Wonderheuvel and Paarde Valley Solar PV Energy Facilities and Associated Grid Connection Infrastructure, near Noupoort in the Northern and Eastern Cape Provinces.

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Project Consultant:	SiVEST South Africa (Pty) Ltd		
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4.2 The specialist appointed in terms of the Regulations_

I, Stephen Burton, declare that –

General declaration:

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:

SiVEST South Africa (Pty) Ltd

Name of company (if applicable):

04th November 2019

Date:

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations (2017) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations (2014), as amended		Clause	Section in Report
Appendix 6 – Section 1	(1)	A specialist report prepared in terms of these Regulations must contain —	N/a
	(a)	details of –	N/a
		(i) the specialist who prepared the report; and	Section 1.3 & Appendix A
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Section 1.3 & Appendix A
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Appendix A
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
	(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;	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 1.2
	(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 site alternatives;	Section 6
	(g)	An indication of any areas to be avoided, including buffers;	Section 5.5
	(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 16
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.2
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 6

	(k)	Any mitigation measures for inclusion in the EMPr;	Section 6
	(l)	Any conditions for inclusion in the environmental authorization;	Section 8
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Section 6
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Section 9
		(iA) regarding the acceptability of the proposed activity or activities; and	Section 9
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
	(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
	(q)	Any other information requested by the authority.	N/A
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

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PROPOSED CONSTRUCTION OF THE UMSOBOMVU SOLAR PV ENERGY FACILITIES, IN THE EASTERN CAPE AND NORTHERN CAPE PROVINCES

SURFACE WATER IMPACT ASSESSMENT REPORT

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PROPOSED CONSTRUCTION OF THE UMSOBOMVU SOLAR PV ENERGY FACILITIES, IN THE EASTERN CAPE AND NORTHERN CAPE PROVINCES

SURFACE WATER IMPACT ASSESSMENT REPORT

1 INTRODUCTION

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd are proposing the construction of three Solar PV Energy Facilities including associated infrastructure in the Eastern Cape and Northern Cape Provinces (hereafter referred to as, “the proposed development”). In order to inform the environmental management programme, an assessment of the best alternative for substation and laydown areas (as part of the Environmental Impact Assessment process being undertaken), the identification of any water use authorisation requirements for the development and the potential impacts on any freshwater resources need to be determined. As such, Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd have appointed SiVEST Environmental Consultants as the independent specialist to identify, delineate and assess the potential impacts on any surface water resources on the proposed study sites.

1.1 Terms of Reference

The terms of reference for this surface water resources delineation and impact assessment are as follows:

- Desktop assessment of current and available database to determine if there are any surface water resources (including wetland and riparian habitats) within the proposed development site and / or within a 500m radius;
- A review of the relevant legislation as pertaining to surface water resources (including wetland and riparian habitats), under the auspices of the proposed development;
- The study area is to include a 500m radius around the proposed development;
- All identified surface water resources (including wetlands and riparian habitat) identified on the ground will require delineation as per the **DWAF (2005)** guidelines, “A practical field procedure for the identification and delineation of wetlands and riparian areas”;
- Wetland Present Ecological Status (PES) determinations as per **Macfarlane *et al.* (2009)** methodology (if present);

- Vegetation Response Assessment Index (VEGRAI) using the **Kleynhans *et al.* (2007)** methodology;
- Wetland ecosystem services assessment to be undertaken in accordance with the WET-EcoServices (**Kotze *et al*., 2007**) methodology (if present);
- Riparian ecosystem services assessment to be undertaken qualitatively as no currently applicable or accepted methodology;
- Ecological Importance and Sensitivity Categorisation (EISC) in line with **Department of Water Affairs and Forestry (DWAF) (1999)** method;
- The determination of surface water resources (including wetlands and riparian habitat) buffer zones as developed by **Macfarlane *et al.* (2014)**;
- Potential impacts assessment using SiVEST methodology (**Appendix B**) or client's preferred methodology;
- Risk assessment in terms of **Government Notice 509 of August 2016 (Notice No. 40229)**;
- Meeting the minimum information requirements for wetland delineation reports as per **Government Notice 267 Regulations regarding the Procedural Requirements for Water Use License Applications and Appeals 24th March 2017** (if wetlands are identified);
- Assessment of alternative layouts; and
- Specialist recommendations are to be provided to inform the layout of the proposed development considering surface water resources (including wetland(s) and / or riparian habitat) identified on the study site.

1.2 Assumptions and Limitations

Where present, the investigation of both wetlands and riparian habitat were initially identified and delineated at a desktop level. These were then ground-truthed using a Global Positioning System (GPS) device and verified in the field work phase. The GPS used is expected to be accurate from 5m up to 15m depending on meteorological conditions. The initial delineations undertaken at a desktop level were refined following findings made in the field work phase and points recorded in the field.

The site visit was undertaken from the 05th to the 07th of February 2019. Due to seasonal wetland and riparian vegetation growth preferences, vegetation species can grow at different times / seasons of the year. As such, some hydrophytic wetland vegetation species may not have been present at the time of the assessment. Seasonal vegetation identification limitations therefore apply to this assessment given the short term once-off nature of the fieldwork component. The assessment should therefore not be undertaken to be a fully comprehensive study on wetland and riparian vegetation species occurrence.

This study has focused on the possible identification and delineation of wetlands and riparian habitat (as defined herein) that are to be affected by the layout of the proposed development on the study site. Identification and delineation of potential wetlands and riparian habitat in the wider area outside of the proposed development area was only undertaken for possible wetlands within 500m radius of the study site to make provision for **Government Notice 509 of 2016 (No. 40229)**. A comprehensive study of wetlands and riparian habitat in the wider area was not undertaken.

This study is limited to providing a surface water resources delineation, wetland and riparian zone ecological state (wetland Present Ecological State (PES) and Vegetation Response Assessment Index (VEGRAI) Ecological Condition (EC)) determination, wetland and riparian zone ecosystem services assessment, wetland and riparian habitat environmental importance and sensitivity classifications, an impact assessment and risk assessment in terms of **Government Notice 509 of 2016 (No. 40229)**, where each of these assessments are applicable. No other assessments were undertaken or formed part of this study. As such, aquatic studies including fish, invertebrates and amphibians have not been included in this report. Nor have water quality, hydrological, floodline or groundwater studies been included. These will be undertaken separately and where necessary for the project

Use of database information for the desktop assessment included the National Freshwater Ecosystem Priority Areas **(NFEPA, 2011)** database. This database is a national level database and some smaller surface water resources may not be contained in the database. Additionally, mainly permanently saturated wetlands are included in the database. Therefore, wetlands with seasonal and temporary saturation cycles may not be included. The fieldwork component was included in the assessment to verify the desktop database information in order to address these shortcomings should wetlands have been identified.

The risk assessment matrix as per **Government Notice 509 of 2016 (No. 40229)** was completed based on the current available layout plan. The risk assessment assumes a worst case scenario approach in which the current layout is implemented but which also takes into consideration the recommended control measures.

SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments. However, many of the documents are not currently publicly available to download. The information that could be obtained for the surrounding planned renewable energy developments was taken into account as part of the cumulative impact assessment.

1.3 Specialist Credentials

This surface water resources delineation and impact assessment study has been undertaken by Stephen Burton from SiVEST. Stephen Burton has a Master's (MSc) Qualification. Stephen has undertaken numerous wetland and riparian delineations, present ecological state determinations, wetland ecosystem service assessment as well as ecological importance and sensitivity classifications for projects countrywide as well as a number of short training courses. A full CV and *Pr. Sci. Nat.* certificate is attached as **Appendix A**.

1.4 Aims and Objectives

The aim of the surface water resources assessment was to identify, delineate and classify any possible wetland(s) and / or riparian habitat that may be impacted on by the proposed development. This was initially undertaken from a desktop approach. The information was then taken into the field for groundtruthing, verification, delineation and classification. The secondary aim was to determine the ecological state, ecosystem services and ecological importance and sensitivity of the wetland(s) and / or riparian habitat. Suitable buffer zones for the identified wetland(s) and / or riparian habitat were applied based on fieldwork findings and the results of the functional assessments.

The main objective was to determine the degree of potential impact on any identified wetlands and / or riparian habitat, taking into consideration the health and environmental importance and sensitivity of the identified features. The impact assessment was undertaken to determine the degree and significance of potential impacts as a result of the proposed development. Where identified, mitigation measures were stipulated in order to avoid or minimise potential impacts.

The second objective was to determine the risk of the proposed development on the receiving environment (identified wetland(s) and / or riparian habitat) in accordance with **Government Notice 509 of 2016 (No. 40229)**.

The tertiary objective was to evaluate the legislative implications of the proposed development affecting the wetland(s) and / or riparian habitat.

1.5 Legislative Context

1.5.1 National Water Act, 1998 (Act No. 36 of 1998)

The **National Water Act, 1998 (Act No. 36 of 1998)** (NWA) was created in order to ensure the protection and sustainable use of water resources (including wetlands) in South Africa. The NWA recognises that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users. Bearing these principles in mind, there are a number of stipulations within the NWA that are relevant to the potential impacts on rivers, streams and wetlands that may be associated with the proposed development. These stipulations are explored below and are discussed in the context of the proposed development.

Firstly, it is important to discuss the type of water resources protected under the NWA. Under the NWA, a 'water resource' includes a watercourse, surface water, estuary, or aquifer. Specifically, a watercourse is defined as (*inter alia*):

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

In this context, it is important to note that reference to a watercourse includes, where relevant, the bed and banks of the aforementioned definition. The extent of a water resource, is therefore, a critical aspect considering the NWA principles. For wetlands, determining the full extent usually includes up to the outer edge of a wetland that is delineated according to **DWAF (2005/2008)** delineation guidelines. For the extent of rivers or streams, either the 1:100 year floodline or the outer edge of the riparian habitat (whichever is greatest) is taken as the full extent of a river, stream or drainage line. Where wetlands are found to be associated with rivers or streams (for example, floodplain wetlands), whichever extends further is taken as the full extent of the river or stream. For example, where the 1:100 year floodline extends further than the floodplain wetland associated with a river, the edge of the 1:100 year floodline is taken as the full extent of the water resource. Importantly, direct impacts to a watercourse triggers a full water use license application process that will need to be undertaken in order to obtain a license. However, **Government Notice 509 of 2016 (No. 40229)** makes provision for activities and / or impacts within the outer edge of the 1:100 year floodline and / or delineated riparian habitat (whichever is greatest), in the absence of the 1:100 year floodline or riparian area the area within 100m from the edge of a watercourses and lastly, within a 500m radius from the delineated boundary of any wetland or pan. Importantly, where it is assessed that activities and / or impacts result in a LOW risk activity and this is accepted by the Department of Water and Sanitation (DWS), the activity will fall within the ambit of a General Authorisation (GA) and not a full water use license. If impacts are MODERATE (and cannot be motivated to a LOW level) or HIGH, a full water use license application process will need to be followed.

It must be noted that water resources, including wetlands, are protected under the NWA. 'Protection' of a water resource, as defined in the NWA entails the:

- maintenance of the quality and the quantity of the water resource to the extent that the water use may be used in a sustainable way;
- prevention of degradation of the water resource; and
- rehabilitation of the water resource.

The definition of pollution and pollution prevention contained within the NWA is relevant. 'Pollution', as described by the NWA, is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (*inter alia*):

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

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

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

- Cease, modify, or control any act or process causing the pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

From a licensing perspective, according to the NWA, the following are considered “water uses” and will require a water use license application:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in stream flow reduction activity contemplated in **Section 36** of the NWA;
e) Engaging in a controlled activity identified as such in **Section 37 (1)** or declared under **Section 38(1)** of the NWA;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing of waste in a manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

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

The **National Environmental Management, 1998 (Act No. 107 of 1998)** (NEMA) was created to establish:

- Principles for decision-making on matters affecting the environment;
- Institutions that will promote co-operative governance; and
- Procedures for coordinating environmental functions exercised by organs of the state to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment.

It is stipulated in NEMA, *inter alia,* that everyone has the right to an environment that is not harmful to his or her health or well-being. Moreover, everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Accordingly, several of the principles of NEMA contained in **Chapter 1 Section 2**, as applicable to wetlands, stipulate that:

- Development must be socially, environmentally and economically sustainable;
- Sustainable development requires the consideration of all relevant factors including the following:
    - That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
    - That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; and
    - That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

In line with the above, **Chapter 7** further elaborates on the application of appropriate environmental management tools in order to ensure the integrated environmental management of activities. This chapter addresses the tools that must be utilised for effective environmental management and practice. Under these auspices, the Environmental Impact Regulations (2006, 2010, and 2014 as amended) were promulgated in order to give effect to the objectives set out in NEMA. Subsequently, activities were defined in a series of listing notices for various development activities. Should any of these activities be triggered, an application for Environmental Authorisation subject to a Basic Assessment (BA) or Environmental Impact Assessment (EIA) process is to be applied for. Fundamentally, applications are to be applied for (if required) so that any potential impacts on the environment in terms of the listed activities are considered, investigated, assessed and reported on to the competent authority charged with granting the relevant environmental authorisation.

The above stipulations of the NWA and NEMA have implications for the proposed development in the context of surface water resources. Accordingly, the potential impacts / issues and legislative implications of the proposed development on potentially affected wetlands are addressed later in this report (**Section 6 & 7**).

1.6 Definition of Water Resources as Assessed in this Study

The definition of water resources, as assessed in this study, will be taken in line with the definition of a watercourse under the NWA. Watercourses are defined as follows:

"a river, a spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which, or from which, water flows" (**NWA, 1998**).

Watercourses may be perennial or non-perennial in nature. Moreover, non-perennial watercourses can encompass seasonal or ephemeral watercourses (including drainage lines) depending on the climate and other environmental constraints.

Going into finer detail however, wetlands and riparian habitats can be defined separately and more specifically. These definitions are provided in the sub-sections below.

1.6.1 Wetlands

The lawfully accepted definition of a wetland in South Africa is that within the NWA. Accordingly, the NWA defines a wetland as:

"*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*".

Moreover, wetlands are accepted as land on which the period of soil saturation is sufficient to allow for the development of hydric soils, which in normal circumstances would support hydrophytic vegetation (i.e. vegetation adapted to grow in saturated and anaerobic conditions).

Inland wetlands can be categorised into hydrogeomorphic (HGM) units. **Ollis *et al.* (2013)** have described several different wetland hydrogeomorphic forms which include the following:

- Channel (river, including the banks): a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit;
- Channelled valley-bottom wetland: a valley-bottom wetland with a river channel running through it. Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a "river";
- Unchanneled valley-bottom wetland: a valley-bottom wetland without a river channel running through it;

- Floodplain wetland: a wetland area on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank. Floodplain wetlands must be considered as wetland ecosystems that are distinct from but associated with the adjacent river channel itself, which must be classified as a “river”;
- Depression: a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates;
- Flat: a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench, closed elevation contours are not evident around the edge of a wetland flat; and
- Hillslope seep: a wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.

1.6.2 Riparian Habitat

Riparian habitats (also known as riparian areas or zones) include plant communities usually adjacent to or along natural channels that are affected by surface and subsurface flows (**DWAF, 2005**). Riparian habitats can be found on the edges of lakes, or drainage lines but are more commonly associated with channelled flowing systems like streams and rivers. Riparian habitats can also be associated with wetlands that are similarly associated with streams and rivers. These are defined as riparian wetlands.

The above mentioned wetland, riparian habitat and watercourse forms occurring within the study area will be classified in accordance with the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (**Ollis *et al*., 2013**). This is addressed later in the report (**Section 5.3**).

2 PROJECT TECHNICAL DESCRIPTION

2.1 Technical Details

It is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, will be developed. These being:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303ha, comprising the following farm portions:
  - Portion 1 of Leuwe Kop No 120
  - Remainder of Mooi Plaats No 121

- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652ha, comprising the following farm portions:

- Remainder of Mooi Plaats No 121
- Portion 3 of Wonder Heuvel No 140
- Portion 5 of Holle Fountain No 133

- ***Paarde Valley Solar PV Facility***, on an application site of approximately 3 695ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62: and
  - Portion 7 of the Farm Leeuw Hoek No. 61.

The study sites are shown in **Figure 1-3**.

2.2 Solar PV Components

Mooi Plaats Solar PV Energy Facility:

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.

- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.3 Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4ha.
- A new 132kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

Mooi Plaats Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a -** links Substation 2 and Substation 1a to the Hydra D MTS.

- **Corridor Option 1b -** links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a -** links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

- **Corridor Option 2b -** links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

Wonderheuvel Solar PV Grid Connection:

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

a. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

OPTION 2:

- **Corridor Option 2a -** links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b -** Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

OPTION 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

Paarde Valley Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.

ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.

ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.

ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

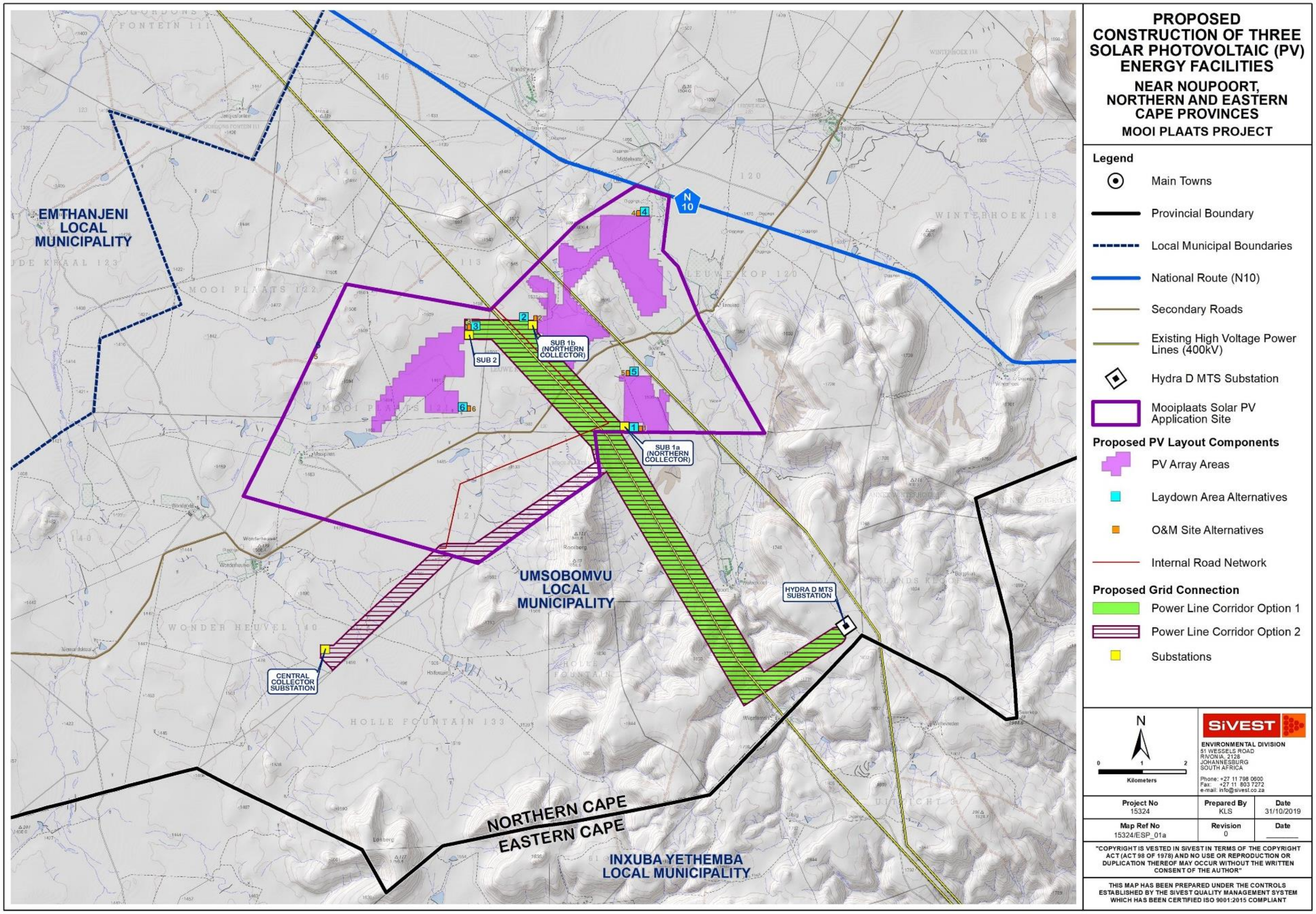

Figure 1. Mooi Plaats Solar PV Facility

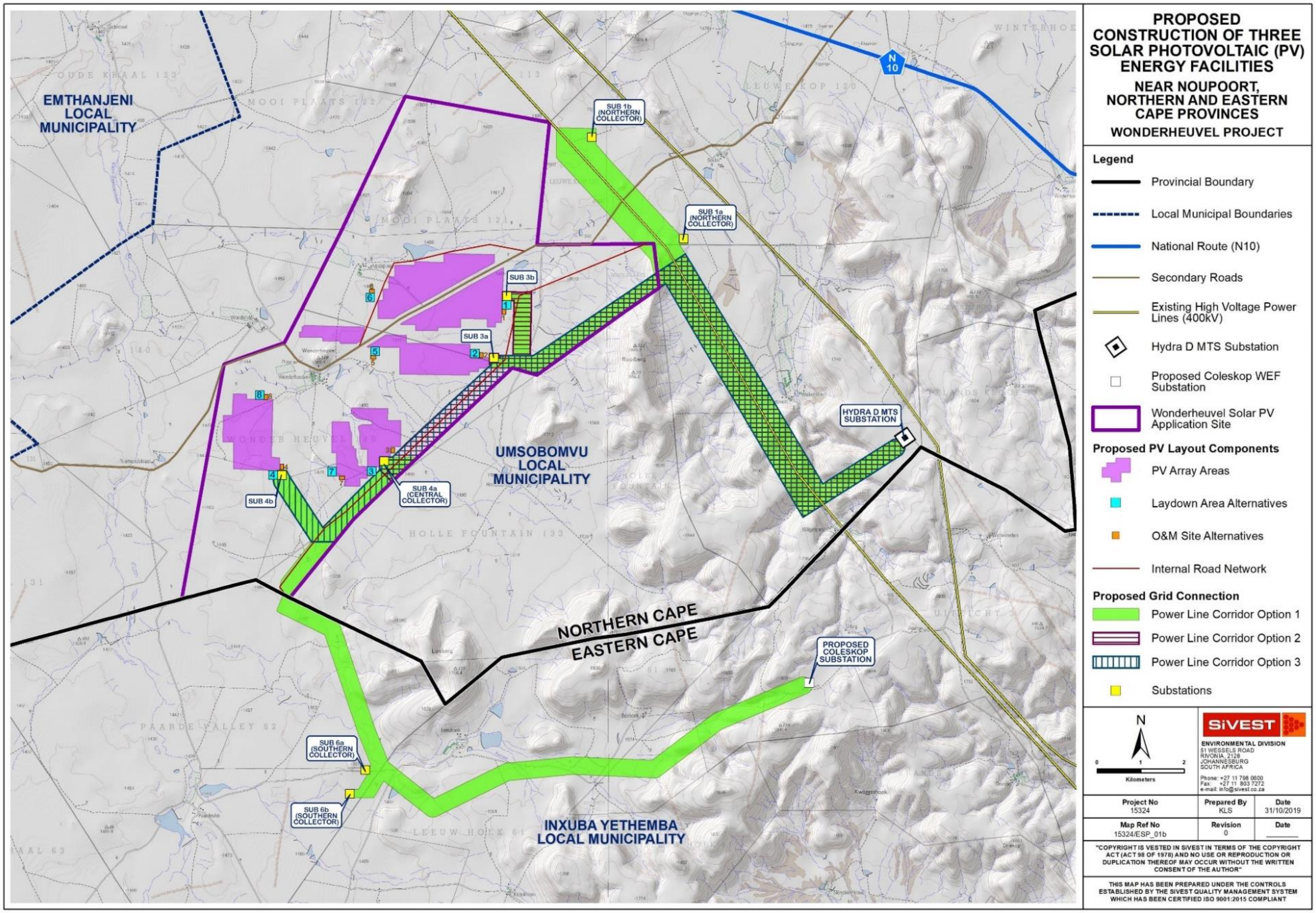

Figure 2. Wonderheuvel Solar PV Facility

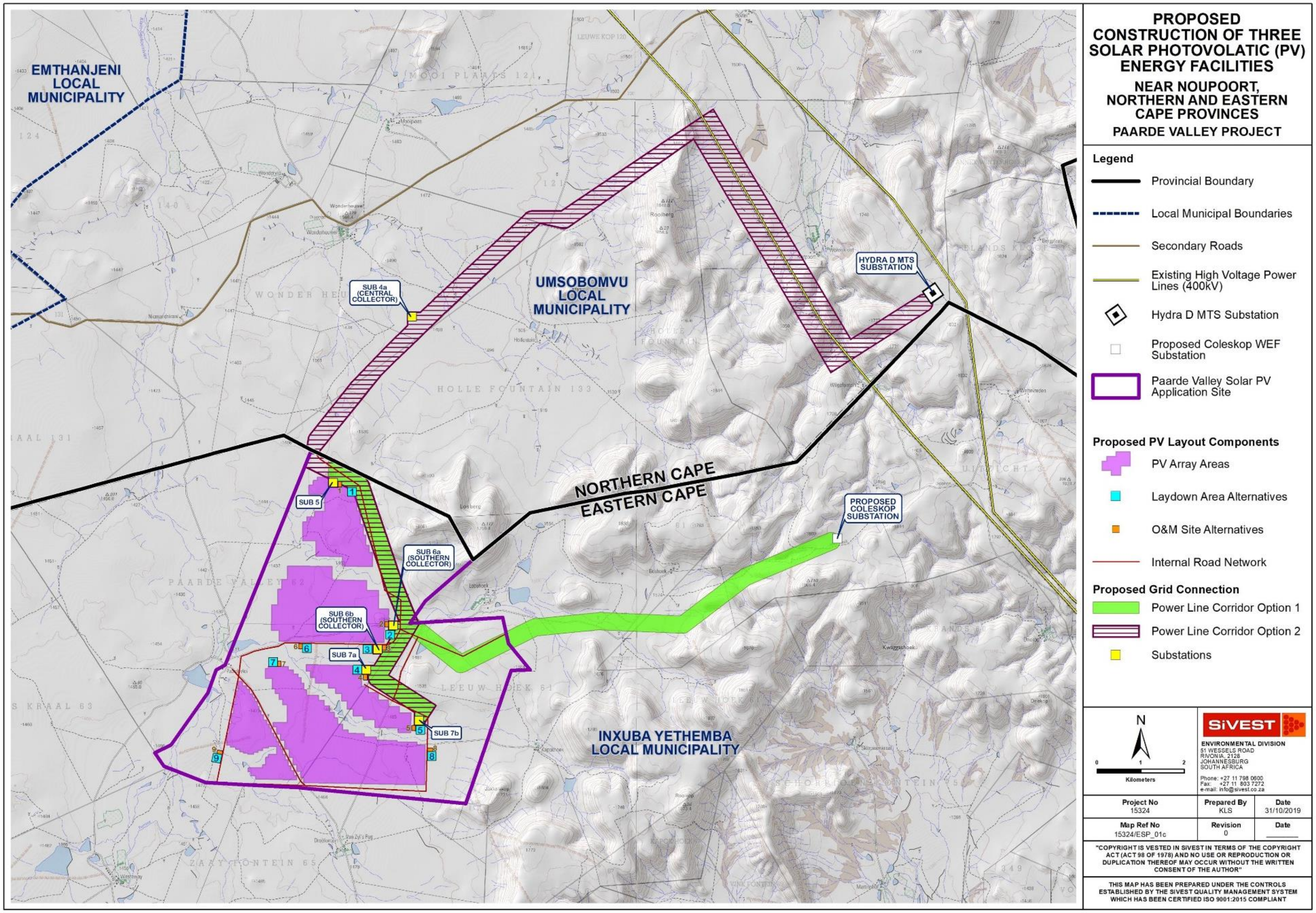

Figure 3. Paarde Valley Solar PV Energy Facility

3 METHODS

3.1 Desktop Delineation of Possible Wetlands and Riparian Habitat

The first step in the assessment was to identify all potential wetlands, drainage lines and associated riparian habitat on and within a 500m radius of the proposed development. This was undertaken using Geographic Information System (GIS) software. The software ArcGIS developed by ESRI was used. The collection of data source information encompassed (but is not limited to) 1:50 000 topographical maps, the National Freshwater Ecosystem Priority Areas **(NFEPA, 2011)** database, the National Environmental Potential Atlas **(ENPAT, 2000 & 2002)** database as well as the National Biodiversity Assessment **(SANBI, 2012)** database. The use of Google Earth™ imagery supplemented these data sources.

Utilising these resources, wetlands, drainage lines and associated riparian habitat that were identified were mapped and highlighted for the in-field phase of the assessment. The supplementary use of composite satellite imagery (**Google Earth™**) allowed for other potentially overlooked wetlands, drainage lines and riparian habitat not contained within the above mentioned databases, to be identified and ground-truthed in the field work phase.

3.2 Field-based Surface Water Resources Delineation Techniques

3.2.1 Wetlands

Wetland delineations are based primarily on soil characteristics or soil "wetness" indicators. For an area to be considered a wetland, redoximorphic features must be present within the top 50cm of the soil profile **(Collins, 2005)**. Redoximorphic features are the result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils alternate between aerobic (oxygenated) and anaerobic (oxygen depleted) conditions. Only once soils within 50cm of the surface display these redoximorphic features, can the soils be considered 'hydric soils'. Hydric soils, which are soils that are found within wetlands, are defined by the U.S. Department of Agriculture Natural Resources Conservation Service **(NRCS)** as being, "soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part". These anaerobic conditions would typically support the growth of hydromorphic vegetation (vegetation adapted to grow in soils that are saturated and starved of oxygen) and are typified by the presence of redoximorphic features. Redoximorphic features typically occur in three types **(Collins, 2005)**:

- A reduced matrix - i.e. an *in situ* low chroma (soil colour), resulting from the absence of Fe^{3+} ions which are characterised by "grey" colours of the soil matrix;

- Redox depletions - the “grey” (low chroma) bodies within the soil where Fe-Mn oxides have been stripped out, or where both Fe-Mn oxides and clay have been stripped. Iron depletions and clay depletions can occur;
- Redox concentrations - Accumulation of iron and manganese oxides (also called mottles). These can occur as:
  - Concretions - harder, regular shaped bodies;
  - Mottles - soft bodies of varying size, mostly within the matrix, with variable shape appearing as blotches or spots of high chroma colours; and
  - Pore linings - zones of accumulation that may be either coatings on a pore surface, or impregnations of the matrix adjacent to the pore. They are recognized as high chroma colours that follow the route of plant roots, and are also referred to as oxidised rhizospheres.

The potential occurrence / non-occurrence of wetlands and wetland (hydric) soils on the study site were assessed mainly according to the **DWAF (2005)** guidelines, “A practical field procedure for the identification and delineation of wetlands and riparian areas”. The draft **DWAF (2008)** guidelines, “Update Manual for the Identification and Delineation of Wetlands and Riparian Areas” was also consulted as a supplementary guideline. This document was only used as a supplementary guideline as it is currently not finalised.

According to the **DWAF (2005)** guidelines, soil wetness indicators (i.e. identification of redoximorphic features) are the most important indicator of wetland occurrence. This is mainly due to the fact that soil wetness indicators remain in wetland soils, even if they are degraded or desiccated. It is important to note that the presence or absence of redoximorphic features within the upper 50cm of the soil profile alone is sufficient to identify the soil as being hydric or non-hydric (non-wetland soil) **(Collins, 2005)**. Three other indicators (vegetation, soil form and terrain unit) are typically used in combination with soil wetness indicators to supplement findings. Where soil wetness and/or soil form could not be identified, information and personal professional judgment was exercised using the other indicators to determine what area would represent the outer edge of the wetland.

Importantly, it must be recognised that there can be up to three saturation zones to every wetland including a permanent zone, seasonal zone and the temporary zone. Each zone is differentiated based on the degree and duration of soil saturation. The permanent zone usually reflects soils that indicate saturation cycles that last more or less throughout the year, whilst the seasonal zone may only reflect soils that indicate saturation cycles for a significant period during the rainy season. Lastly, the temporary zone reflects soils that indicate the shortest period(s) of saturation that are long enough, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation **(DWAF, 2005)**. It must be noted that not all wetlands will have all three saturation zones. In arid and semi-arid regions, wetlands are often only associated with temporary saturation zones or temporary and seasonal saturation zones, thereby lacking the permanent zone.

Vegetation identification was based on identifying general plant species within the wetland boundaries focusing on the occurrence of hydrophytic (water loving) wetland vegetation. In identifying hydrophytic vegetation, it is important to distinguish between plant species that are **(DWAF, 2005)**:

- Obligate wetland species (ow): always grows in wetland - >99% chance of occurrence;
- Facultative wetland species (fw): usually grow in wetlands – 67-99% chance of occurrence;
- Facultative species (f): are equally likely to grow in wetlands and non-wetland areas – 34-66% chance of occurrence;
- Facultative dry-land species (fd): usually grow in non-wetland areas but sometimes grow in wetland = 1-34% chance of occurrence.

The actual delineation process essentially entailed drawing soil samples, at depths between 0-50 cm in the soil profile, using a soil augur. This is done in order to determine the location of the outer edge (mainly temporary zone) of the wetland(s). The outer edge of the temporary zone will usually constitute the full extent of the wetland, thereby encompassing any other inner lying zones that are saturated for longer periods. Where the appropriate wetland soil form is of interest, soil samples are drawn up to a depth of 1.2 metres (where possible).

Where a wetland was identified, a conventional handheld Global Positioning System (GPS) was used to record the points taken in the field. The GPS points were then imported into a GIS system for mapping purposes. A GIS shapefile was created to represent the boundaries of the delineated wetlands or other surface water resources.

3.2.2 Riparian Habitat (Including Drainage Lines)

In terms of watercourses (including drainage lines) and riparian habitats as required by the **DWAF (2005 & 2008)** guidelines, the assessment for riparian habitats requires the following aspects to be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

The topography associated with a watercourse can (but is not always limited to) comprise the macro channel bank. This is a rough indicator of the outer edge of the riparian habitat.

The riparian habitat relies primarily on vegetation indicators. The outer edge of the riparian habitat can be delineated where there is a distinctive change in the species composition to the adjacent terrestrial area or where there is a difference in the physical structure (robustness or growth forms – size, structure, health, compactness, crowding, number of individual plants) of the species from the adjacent terrestrial area (**DWAF, 2005**).

Riparian habitats are usually associated with alluvial soils (relatively recent deposits of sand, mud or any type of soil sediment) (**DWAF, 2005**). This indicator is not commonly viewed as the primary indicator but rather as a supplementary indicator to confirm either topographical or vegetation indicators, or both.

Where riparian habitats occur, the above mentioned indicators were used to identify the outer edge. A GPS was used to record the points taken in the field.

Where watercourses with associated riparian habitat are present, it is possible to determine the hydrological regime which provides information on the functionality of the systems. **Ollis *et al.,* (2013)** maintain that the hydrological regime can be characterised by the frequency and duration of flow (i.e. perenniality), classified as follows:

- Perennial – flows continuously throughout the year in most years;
- Non-perennial – does not flow continuously throughout the year, although pools may persist. Can be subdivided as follows:
  - Seasonal – with water flowing for extended periods during the wet season/s (generally between 3 to 9 months duration) but not during the rest of the year;
  - Intermittent – water flows for a relatively short time of less than one season's duration (i.e. less than approximately 3 months), at intervals varying from less than a year to several years;
  - Unknown – for rivers where it is not known whether a non-perennial system is seasonal or intermittent.; and
- Unknown – for rivers where the flow type is not known.

Additionally, once identified, it is possible to classify watercourses into three channel types. The channel types are based on the changing frequency of saturation of the soils in the riparian zone which can be classified *inter alia* as follows **(DWAF, 2005)**:

- A Section – Least sensitive watercourses in terms of impacts on water yield from the catchment. They are situated in the unsaturated zone and do not have riparian habitats or wetlands. Not as hydrologically sensitive as B and C Sections;
- B Section – In the zone of the fluctuating water table and only have base flow at any point in the channel when the saturated zone is in contact with the channel bed. Base flow is intermittent in this section, with flow at any point in the channel dependent on the current height of the water table. The gradient of the channel bed is flat enough for deposition of material to take place and initial signs of flood plain development may be observed; and
- C Section – Always in contact with the zone of saturation and therefore always have base flow. These are perennial streams with flow all year round, except perhaps in times of extreme droughts. Channel gradients in these sections are very flat and a flood plain is usually present.

3.3 Wetland and River Classification Methods

For the purposes of this assessment, the classification of the wetland and rivers (drainage lines) were undertaken applying the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (**Ollis *et al*., 2013**). This classification system applies to inland systems which are defined as, “an aquatic ecosystem with no existing connection to the ocean”. There are three broad types of inland systems that are dealt with by the classification system including the following:

- Rivers, which are ‘lotic’ aquatic ecosystems with flowing water concentrated within a distinct channel, either permanently or periodically;
- Open waterbodies, which are permanently inundated ‘lentic’ aquatic ecosystems where standing water is the principal medium within which the dominant biota live. In the Classification System, open waterbodies with a maximum depth greater than 2 m are called limnetic (lake-like) systems; and
- Wetlands, which are transitional between aquatic and terrestrial systems, and are generally characterised by (permanently to temporarily) saturated soils and hydrophytic vegetation. These areas are, in some cases, periodically covered by shallow water and / or may lack vegetation.

The inland system classification works on a six-tiered structure (**Table 1**). The tiered structure progresses from Systems (Marine vs. Estuarine vs. Inland) at the broadest spatial scale (Level 1), through Regional Setting (Level 2) and Landscape Units (Level 3), to HGM Units at the finest spatial scale (Level 4). At Level 5, Inland Systems are distinguished from each other based on the hydrological regime and, in the case of open waterbodies, the inundation depth class. At Level 6, six ‘descriptors’ have been incorporated into the Classification System. These descriptors allow you to distinguish between aquatic ecosystems with different structural, chemical, and/or biological characteristics. For the purposes of this assessment only a Level 4 classification was undertaken. The Level 4 classification can be further elaborated on and is shown in **Table 2** below.

Table 1. Inland System Classification (adapted from Ollis *et al*., 2013)

Distinguishing between Marine, Estuarine and Inland Systems	Wetland/Aquatic Ecosystem Context		Functional Unit		Wetland/Aquatic Ecosystem Characteristics
Level 1: Type of System	**Level 2: Regional Setting**	**Level 3: Landscape Unit**	**Level 4: Hydrogeomorphic (HGM) Unit**	**Level 5: Hydrological Regime**	**Level 6: Descriptors**
▪ Marine ▪ Estuarine ▪ Inland System	▪ Department of Water Affairs (DWA) Ecoregions ▪ NFEPA WetVeg Groups ▪ Other Spatial Framework	▪ Valley Floor ▪ Slope ▪ Plain ▪ Bench	River	Perenniality	▪ Natural vs Artificial ▪ Salinity ▪ pH ▪ Substratum Type ▪ Vegetation Cover Type ▪ Geology
			Floodplain Wetland	▪ Period and Depth of Inundation ▪ Period of Saturation	
			Channelled Valley Bottom Wetland		
			Depression		
			Seep		
			Wetland Flat		

Table 2. Hydrogeomorphic Units for Inland Systems

Level 4: Hydrogeomorphic (HGM) Unit		
HGM Type	**Longitudinal Zonation/Landform/Outflow Drainage**	**Landform/Inflow Drainage**
A	**B**	**C**
River	Mountain Headwater Stream	Active Channel
		Riparian Zone
	Mountain Stream	Active Channel
		Riparian Zone
	Transitional	Active Channel
		Riparian Zone
	Upper Foothills	Active Channel
		Riparian Zone
	Lower Foothills	Active Channel
		Riparian Zone
	Lowland River	Active Channel
		Riparian Zone
	Rejuvenated Bedrock Fall	Active Channel
		Riparian Zone
	Rejuvenated Foothills	Active Channel
		Riparian Zone
	Upland Floodplain	Active Channel
		Riparian Zone
Channelled Valley Bottom Wetland	Not Applicable	Not Applicable
	Not Applicable	Not Applicable
Unchannelled Valley Bottom Wetland	Not Applicable	Not Applicable
	Not Applicable	Not Applicable
Floodplain Wetland	Floodplain Depression	Not Applicable
	Floodplain Flat	Not Applicable
Depression	Exorheic	With Channelled Flow
		Without Channelled Flow
	Endorheic	With Channelled Flow
		Without Channelled Flow
	Dammed	With Channelled Flow
		Without Channelled Flow
Seep	With Channelled Flow	Not Applicable
	Without Channelled Flow	Not Applicable
Wetland Flat	Not Applicable	Not Applicable

For a Level 4 inland system classification, the HGM unit (as described in Section 1.2) is identified for a Level 4A classification. Going into finer detail for a Level 4B classification, the longitudinal zonation / landform / outflow drainage type is defined. Finally, the Level 4C classification goes a step further in defining the landform / inflow drainage type. A level 4C classification was undertaken in this assessment.

3.4 Wetland Present Ecological Status

To assess wetland health, it is essential to understand how the current hydrological, geomorphological and ecological functioning of the wetland deviates from the reference condition (i.e. how have the hydrological processes and components changed from natural reference condition). In this sense, the Present Ecological Status (PES) can be determined which provides information on the integrity/health/state of a wetland. WET-Health is a tool that is designed to provide a rapid assessment on the PES of a wetland and examines the deviation from the natural reference condition by analysing the hydrological, geomorphological and vegetation components of a wetland in terms of the extent, intensity and magnitude of an impact (**Macfarlane *et al*., 2007**). This is done by assigning a score on a scale of 1 to 10 which is translated into one of six health classes ranging from A to F, with A representing completely unmodified (natural) and F representing modifications that have reached a critical level (**Macfarlane *et al*., 2007**). This is provided in **Table 3** below.

Table 3. Impact Scores and Categories of Present Ecological State used by WET-Health for describing the integrity of Wetlands

Impact Category	Description	Impact Score Range	Present State Category
None	Unmodified, natural.	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some	6-7.9	E

Impact Category	Description	Impact Score Range	Present State Category
	remaining natural habitat features are still recognizable.		
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

Using a combination of threat and/or vulnerability, an assessment is also made for each component (hydrological, geomorphological and vegetation) on the likely Trajectory of Change within the wetland (**Macfarlane *et al*., 2007**). The five categories of likely change are: large improvement, slight improvement, remains the same, slight decline and rapid decline (**Macfarlane *et al*., 2007**). Overall health of the wetland is then presented for each module by jointly representing the Present State and likely Trajectory of Change (**Macfarlane *et al*., 2007**).

For this study, the Level 2 methodology was used to determine the PES for any wetlands identified directly on the study site.

3.5 Riparian Habitat Ecological Condition Determination

The riparian Vegetation Response Assessment Index (VEGRAI) is designed for a qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (**Kleynhans *et al*., 2007**). As **Kleynhans *et al.* (2007)** explains, the VEGRAI model firstly describes the status of riparian vegetation in both the current and reference states and secondly, compares differences between the two states as a measure of vegetation response to an impact regime. Essentially, the identified riparian vegetation zones (Marginal, Lower and Upper zones) are used as the metric groups which are then rated, weighted and an Ecological Category (A-F) can then be determined (see **Table 4** below). There are two levels that can be applied to the index assessment including a Level 3 and Level 4 assessment. The Level 3 index is aimed at general aquatic ecologists, whilst a Level 4 assessment is aimed at specialist riparian vegetation ecologists. A Level 3 assessment was applied to this study. The metric groups, for a Level 3 assessment, include the following:

- Woody
    - Cover
    - Abundance
    - Species Composition
- Non-woody
    - Cover

- Abundance
- Species Composition

Table 4. VEGRAI Ecological Category Classification (as taken from Kleynhans *et al* (2007))

Ecological Category	Description	Score (% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

Through application of the above VEGRAI assessment, the ecological condition (state) of the riparian habitats were determined.

3.6 Wetland Ecosystem Services Assessment

Individual wetlands differ as per the respective hydro-geomorphic characteristics and the ecosystem services that are potentially supplied to society **(Kotze *et al*., 2007)**. The ecosystem services that were assessed through the WET-EcoServices **(Kotze *et al*., 2007)** tool are listed in **Table 5** below. The overall goal of the WET-EcoServices assessment is to assist decision makers, government officials, planners, consultant and educators in undertaking quick assessments of wetlands to reveal the potential ecosystem services that they supply **(Kotze *et al*., 2007)**. This ultimately provides an indication of the importance of the wetland unit. The WET-EcoServices tool applies only to palustrine (non-tidal, inland) wetlands.

Table 5. Ecosystems Services included in WET-EcoServices (Kotze *et al*., 2007)

<table>
<tr><td rowspan="15">Ecosystem services supplied by wetlands</td><td rowspan="9">Indirect benefits</td><td rowspan="8">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">Streamflow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancement benefits</td><td>Sediment trapping</td></tr>
<tr><td>Phosphate assimilation</td></tr>
<tr><td>Nitrate assimilation</td></tr>
<tr><td>Toxicant assimilation</td></tr>
<tr><td>Erosion control</td></tr>
<tr><td colspan="2">Carbon storage</td></tr>
<tr><td colspan="3">Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits</td><td colspan="3">Provision of water for human use</td></tr>
<tr><td colspan="3">Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">Provision of cultivated foods</td></tr>
<tr><td colspan="3">Cultural significance</td></tr>
<tr><td colspan="3">Tourism and recreation</td></tr>
<tr><td colspan="3">Education and research</td></tr>
</table>

Each HGM wetland unit delineated within the study site was assessed using the WET-EcoServices tool. Each HGM unit was labelled according to the HGM wetland unit it was classified as (for example, Channelled Valley Bottom Wetland).

Finally, an output diagram indicating the degree of which each ecosystem service is potentially offered by a wetland was included and labelled according to the HGM unit as described above.

3.7 Riparian Habitat Ecosystem Services

To assess the importance of the riparian habitat and the ecosystem services supplied to society, the following functions of the riparian habitat were considered:

- Sediment Trapping;
- Nutrient Trapping;
- Bank Stabilisation and Bank Maintenance;
- Flood Attenuation;
- Maintenance of Biotic Diversity;
- Primary Production;
- Erosion Control; and
- Ecological Corridor for Migration.

As no currently applicable methodology is available for the assessment of riparian zone ecosystem services, a qualitative assessment was undertaken.

3.8 Surface Water Resources Ecological Importance and Sensitivity

The ecological importance of a water resource is an expression of the importance of the system to the maintenance of ecological diversity and functioning on local and wider scales (**DWAF, 1999**). The ecological sensitivity refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (**DWAF, 1999**). The ecological importance and sensitivity (EIS) can be calculated according to the determinants listed in **Table 6** below and attributing a suitable [1]score to each determinant. Information, where relevant, was taken from the Wetland and Riparian Ecosystem Services assessment (i.e. biodiversity maintenance information) as mentioned previously and applied to this section. Additionally, information on the conservation planning importance of a wetland and rivers were used. Wetlands and rivers are important in contributing to biodiversity targets. Wetland and rivers as biodiversity targets can be informed by the ecosystem threat status and protection level, the level of priority as assessed through the National Freshwater Ecosystem Priority Areas project (**Nel *et al*., 2011**), fine-scale biodiversity plans as well as bioregional plans (**Macfarlane *et al*., 2014**). As such, this information was used to inform scoring.

Once calculated, the EIS category (EISC) can be determined (**Table 7**). The category can range from A to D with A being Very High and D being Low / Marginal.

Table 6. Environmental Importance and Sensitivity Biotic and Habitat Determinants

Determinant
Primary Determinants
1. Rare & Endangered Species
2. Populations of Unique Species
3. Species/taxon Richness
4. Diversity of Habitat Types or Features
5. Migration route/breeding and feeding site for wetland and riparian species
6. Sensitivity to Changes in the Natural Hydrological Regime
7. Sensitivity to Water Quality Changes
8. Flood Storage, Energy Dissipation & Particulate/Element Removal

[1]Score guideline Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0

Confidence rating - Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1

Determinant
Modifying Determinants
9. Protected Status
10. Ecological Integrity
TOTAL
MEDIAN
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE

Table 7. Environmental Importance and Sensitivity Categories for Biotic and Habitat Determinants

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high Wetlands and riparian habitat that are considered ecologically important and sensitive on a national or even international level.	>3 and <=4	A
High Wetlands and riparian habitat that are considered to be ecologically important and sensitive.	>2 and <=3	B
Moderate Wetlands and riparian habitat that are considered to be ecologically important and sensitive on a provincial or local scale.	>1 and <=2	C
Low/marginal Wetlands and riparian habitat that are not ecologically important and sensitive at any scale.	>0 and <=1	D

3.9 Surface Water Resources Buffer Zones

An ecological resource buffer zone is typically an area of vegetated, un-developed land surrounding a resource that is maintained to protect, support and screen flora and fauna associated with a resource from the disturbances associated with neighbouring land uses and / or a proposed development. As wetlands and riparian habitats are regarded as inherently ecologically sensitive habitat units, the designation of conservation buffers allows for the protection of these habitat units that could potentially emanate from terrestrial-based activities. Ultimately, buffer zones are typically required to protect and minimise the edge impacts to the identified surface water resources.

The compilation of preliminary guidelines for the determination of wetland and watercourse buffer zones was developed by **Macfarlane *et al.* (2014)**. The current method according to **Macfarlane *et al.* (2014)** proposes highly conservative buffer widths based on generic relationships for broad-scale assessments, but also allows buffers to be modified based on more detailed site-level information. The conceptual framework utilises the following keys decisions in the design criteria **Macfarlane *et al.* (2014)**:

- Levels of user expertise;
- Precautionary principle;
- Predictability and administration;
- Data collection and assessment; and
- Buffer widths tailored according to risk.

The assessment procedure that was undertaken is an eight step process which is shown in **Figure 4** below.

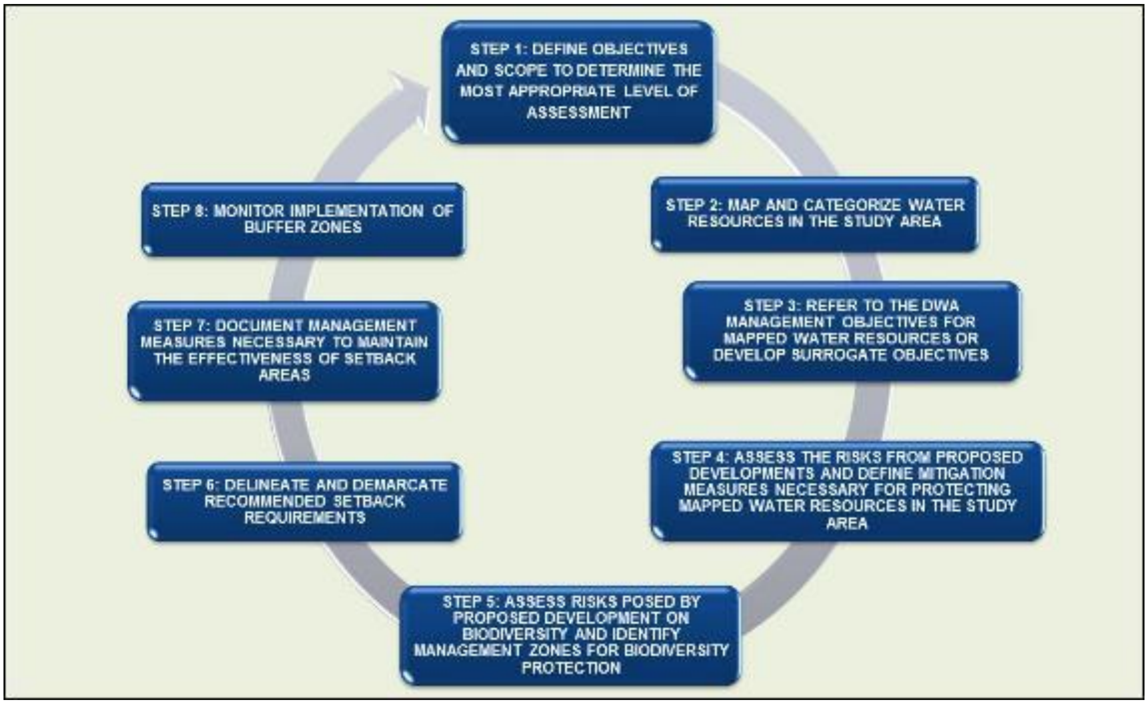

Figure 4. Buffer determination assessment procedure according to Macfarlane *et al.* (2014)

The method was applied at a site specific level for the impact assessment. Furthermore, it was based on grounded scientific principles. Accordingly, this method was applied herein.

3.10 Risk Assessment

In terms **Government Notice 509 of 2016 (No. 40229),** an assessment of activities and / or potential impacts within 500m of a wetland is to be undertaken to determine the risk of the proposed development, as well as the applicability of a general authorisation or water use license application to be undertaken with the Department of Water and Sanitation (DWS). The development is located within 500m of the closest wetland, but outside of the delineated extent of the watercourses on site, the Risk Assessment has therefore been completed as part of the current report. The assessment was undertaken in accordance with the Risk Assessment Protocol methodology. The Risk Assessment Protocol considers the phase (construction, operation, decommissioning) of the proposed development, aspect and impacts. A scoring system was then applied to a spreadsheet matrix which was applied to the following metrics which provides the final risk rating:

- Severity;
- Spatial Scale;
- Duration;
- Frequency of Activity;
- Frequency of Impact;
- Legal Issues;
- Detection;
- Likelihood; and
- Significance.

The severity of the potential impact was evaluated against the following drivers of the wetland:

- Flow Regime;
- Physico-chemical (Water Quality);
- Habitat (Geomorphology & Vegetation); and
- Biota.

The risk assessment also considers the PES and EIS of the water resource.

The keys aspect that were applicable when assessing the above mentioned metrics, in the risk assessment protocol, are shown in **Table 8** to **Table 15** below.

Table 8. Severity

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great/ harmful	4
Disastrous / extremely harmful and / or wetland(s) are involved	5
Where “or wetland(s) are involved” it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table 9. Spatial Scale

Area specific (at impact site)	1
Whole site (entire surface)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3

National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond South Africa boundary)	5

Table 10. Duration

One day to one month, PES, EIS and / or REC not impacted	1
One month to one year, PES, EIS and / or REC impacted but no change in status	2
One year to ten years, PES, EIS and / or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and / or REC permanently lowered	4
More than life of the organisation / facility, PES and EIS scores, E or F	5
PES and EIS (sensitivity must be considered)	

Table 11. Frequency of the Activity

Annually or less	1
Six monthly	2
Monthly	3
Weekly	4
Daily	5

Table 12. Frequency of the Incident / Impact

Almost never / almost impossible / > 20%	1
Very seldom / highly unlikely / > 40%	2
Infrequent / unlikely / seldom / > 60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 13. Legal Issues

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table 14. Detection

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table 15. Rating Classes

Rating	Class	Management Description

1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourse(s) and resource quality small and easily managed.
56 – 169	(M) Moderate Risk	Risk and impact on watercourse(s) are notable and require mitigation measures on a higher level, which costs more and require specialist input. License required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. License required.

Where it is assessed that activities and / or potential impacts result in a LOW risk activity, the activity may fall within the ambit of a General Authorisation (GA). Where risks are assessed as borderline Low / Moderate, risk scores can be manually adapted downwards in class subject to listing additional mitigation measures listed. Where activities and / or potential impacts are MODERATE / HIGH, a water use license application will need to be submitted to the DWS.

The risk assessment provided in this report is based on a detailed construction and operational method statement and the final layout plan shown in **Figure 1**.

3.11 Impact Assessment Method

Current and potential impacts will be identified based on the proposed project and potential impacts that may result from the proposed project. The identified potential impacts will be evaluated using the SiVEST impact rating method **(Appendix B)**. This is addressed in **Section 6**.

4 GENERAL STUDY AREA

The proposed SEFs are located on adjoining farms lying south-west of Noupoort in the Northern Cape Province (**Figure 5**).

Mooi Plaats Solar PV project is located in the Umsobomvu Local Municipality, within the Pixley ka Seme District of the Northern Cape Province. The application site lies immediately south of the N10 national route, some 23kms from Noupoort, and comprises the following farm portions:

- Portion 1 of Leuwe Kop No 120
- Remainder of Mooi Plaats No 121

Wonderheuvel Solar PV project is also located in the Umsobomvu Local Municipality, within the Pixley ka Seme District of the Northern Cape Province. The application site lies between the Mooi Plaats Solar PV application site and the Paarde Valley Solar PV application site, some 30kms from Noupoort, and comprises the following farm portions:

- Remainder of Mooi Plaats No 121
- Portion 3 of Wonder Heuvel No 140
- Portion 5 of Holle Fountain No 133

Paarde Valley Solar PV project is located in the Inxuba Yethemba Local Municipality, within the Chris Hani District District of the Eastern Cape Province. The application site is located on the southern boundary of the Wonderheuvel Solar PV application site, some 38kms from Noupoort, and 32kms from Middelburg. The application site comprises the following farm portion:

- Portion 2 of Paarde Valley No 62

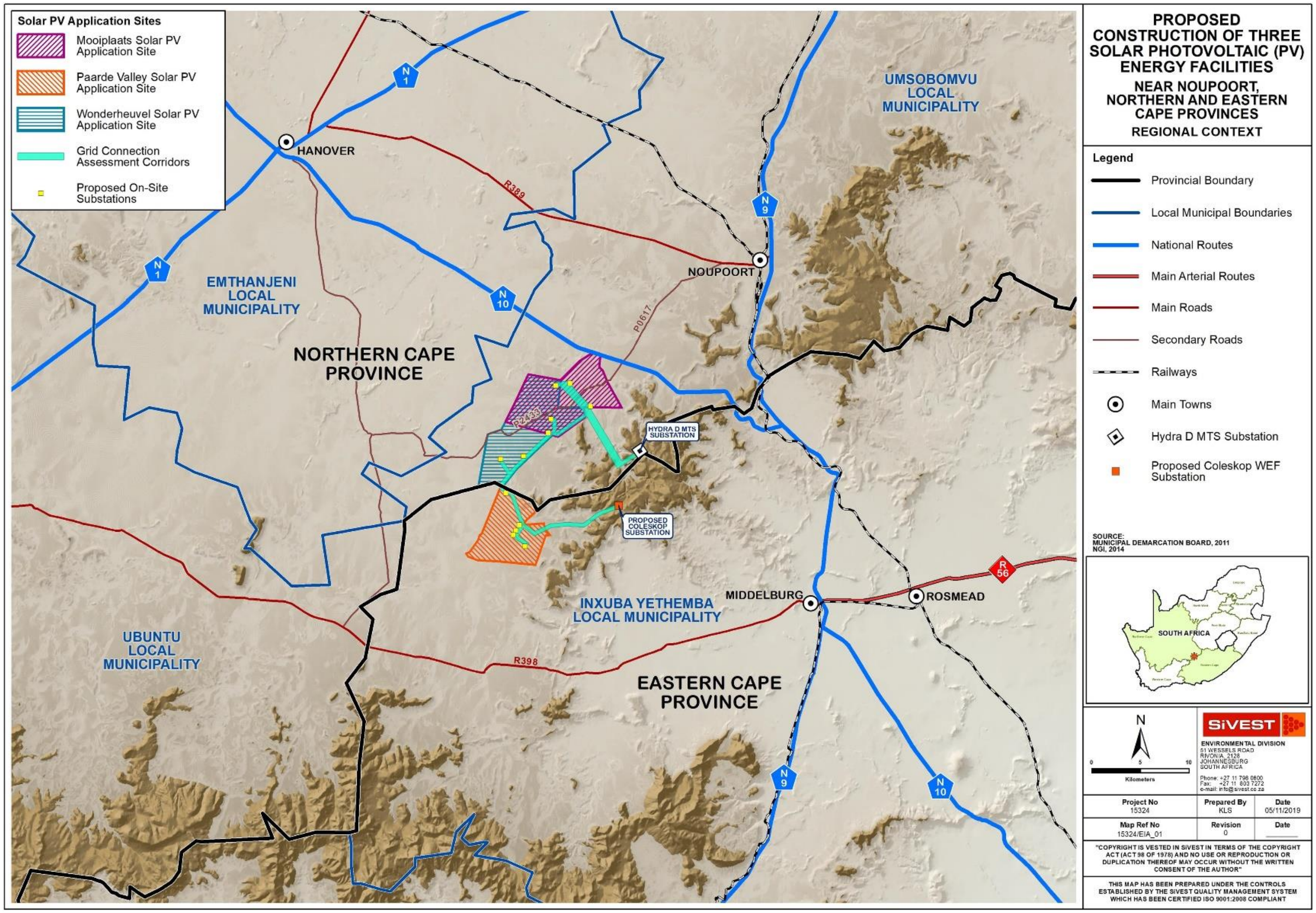

Figure 5. Regional Context Map

According to Mucina and Rutherford (2012), the areas are characterised by flatter Karoo plains which are largely covered by the Eastern Upper Karoo vegetation type, while the hillier areas in the east of the study area are characterised by Besem Karee Koppies shrubland. The aridity of the area has restricted the vegetation to low shrubs distributed uniformly across the landscape, except in areas of hillier terrain which tend to be more densely vegetated with more tree species in evidence.

Additional tree species are also present in the study area, particularly where exotic tree species and other typical garden vegetation has been established around farmsteads.

Much of the study area however is still characterised by natural low shrubland with transformation limited to patches of cultivation and a few isolated areas where pastoral activities such as livestock rearing are taking place.

5 FINDINGS OF THE WETLAND ASSESSMENT

5.1 Desktop Findings

In terms of the **ENPAT (2002)** national database, from a catchment perspective, the study site is located within the Orange Primary Catchment (**Figure 6**). More specifically, the study area is situated within the quaternary catchments D32C and D32B. The study site falls within the newly defined Water Management Areas (WMAs) of South Africa, as stated in Government Notice No. 1056 (16th of September 2016), within the Upper Orange WMA.

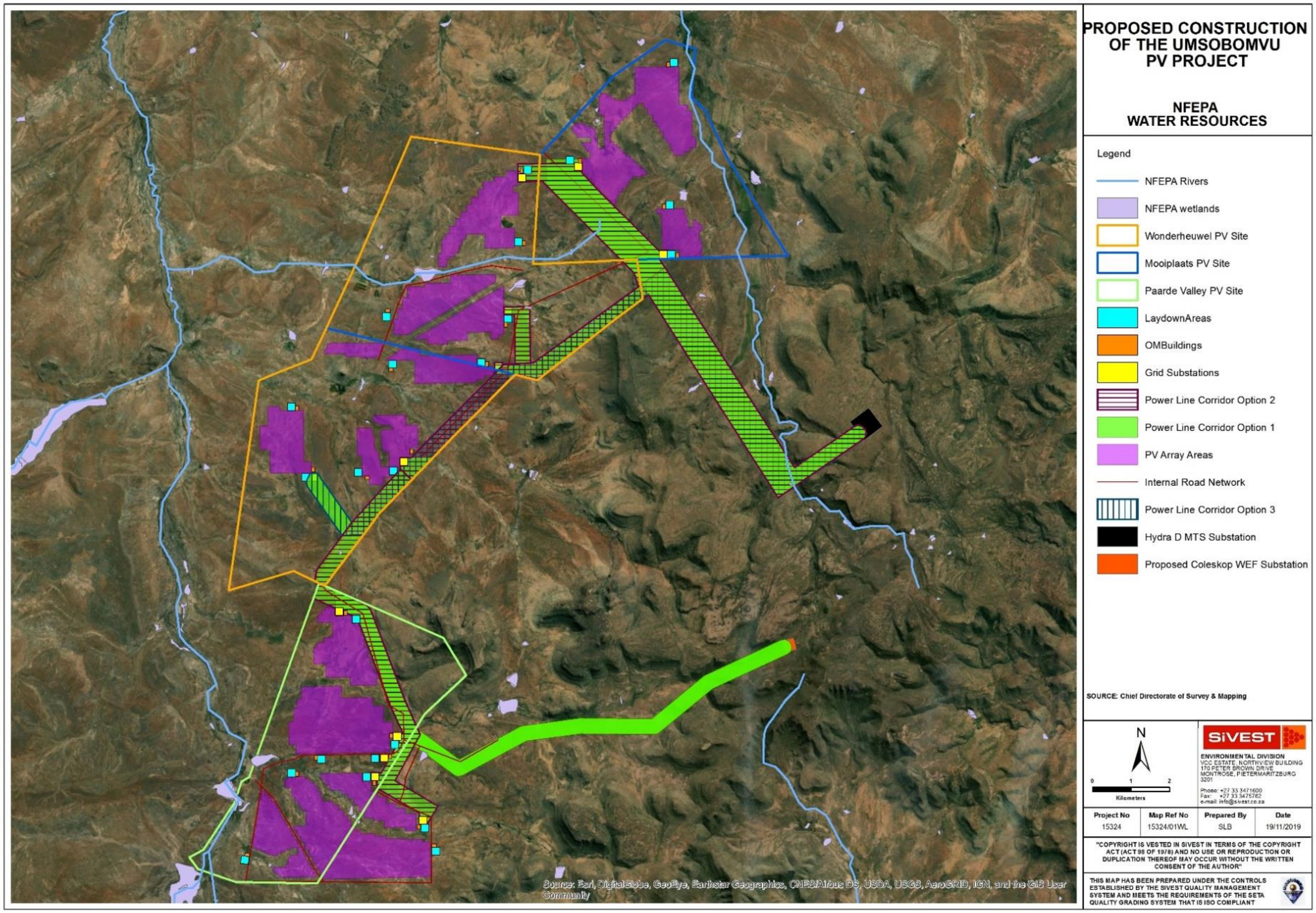

Figure 6: NFEPA Surface Water Resources Occurrence Map

Three rivers are shown within the study site according to the **NFEPA (2011)** database, while a number of small wetlands are shown to occur at points associated with farm dams. The closest main river, the Klein-Seekoei River, as contained in the **NFEPA (2011)** database, crosses the western boundary of the Paarde Valley PV site, is approximately 1 500m west of the Wonderheuwel PV study site, and is approximately 3 700m west of the Mooiplats PV study site. The sites all drain towards the Klein-Seekoei River to the West of the sites. The topography of the site indicates the potential presence of watercourses running east to west, and north to south, across the site. Two perennial rivers are present on the site. Both perennial rivers are tributaries of the Klein-Seekoei River, and both have a class C rating, meaning they are moderately modified. No other conservation sensitive areas were identified on the study site.

5.2 In-field Findings and Delineations

The in-field wetland delineation assessment took place between the 05th and 07th of February 2019. Conditions were hot and sunny with partial cloud cover. The study site has historically been used for grazing by sheep, and most of the palatable plants have been selectively grazed out, with many of the remaining plants being poisonous for livestock. It was noted that the first decent rain (50mm) in a number of years had fallen just prior to the site visit, and as such, a number of inundated areas were present that would normally be dry.

The fieldwork ground-truthing, verification and delineation assessment was undertaken to scrutinise the results of the desktop assessment, as well as to identify any potentially overlooked wetlands and / or riparian habitat in the field within the study site. The delineation results are displayed in **Figure 7**.

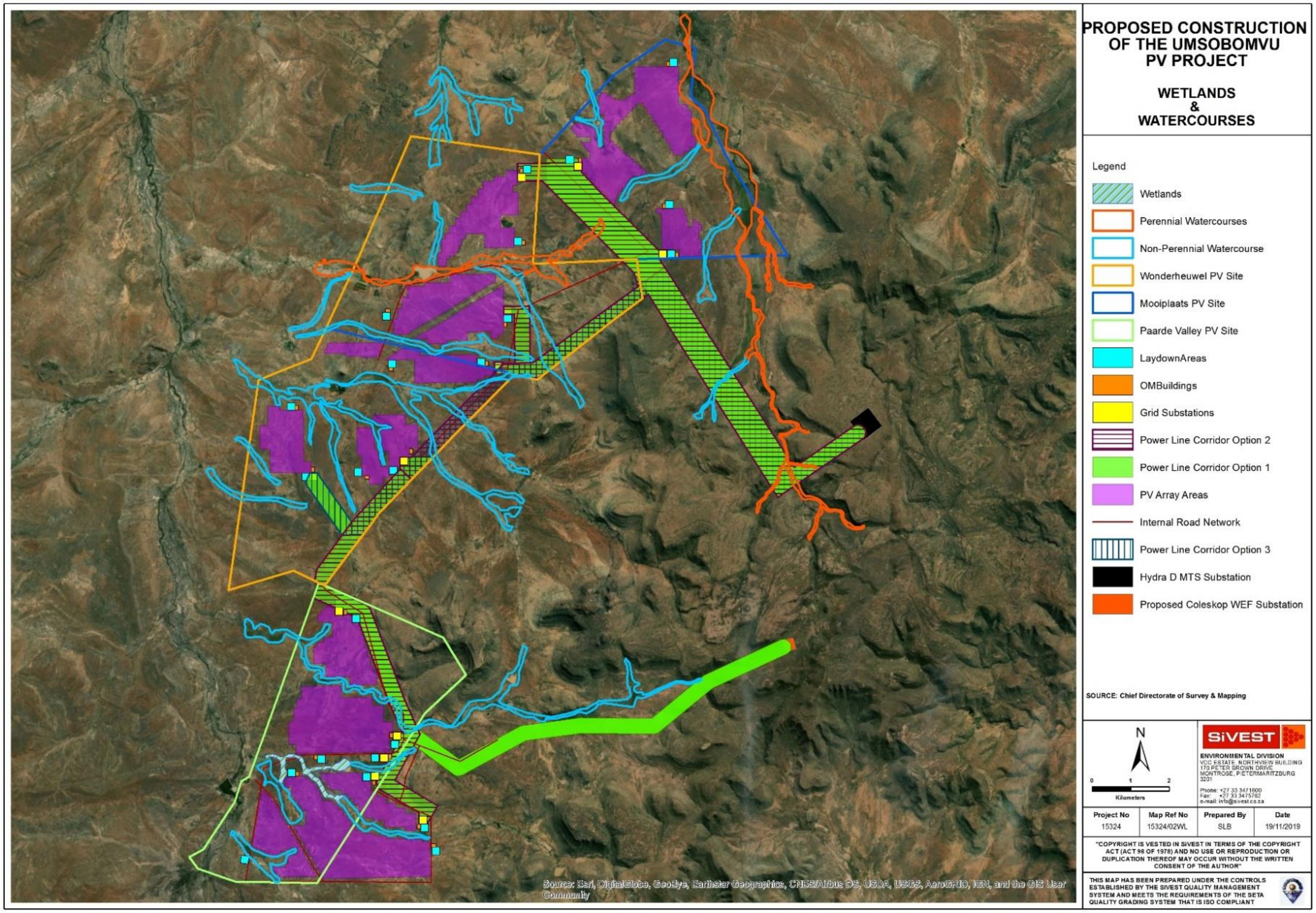

Figure 7: Drainage Line and Wetland Delineation Map

The fieldwork investigation confirmed that there are a number of non-perennial drainage channels which can be found flowing through the study site in an east to west direction, and south to north direction. In addition, a number of tributaries of the Klein-Seekoei River flows from within the sites to the actual Klein-Seekoei River, which runs adjacent to the western boundary of the study areas. A channelled valley bottom wetland system was noted within the Paarde Valley PV site.

Aside from the non-perennial watercourses, a number of man-made farm dams are present on the property, but many of these appear to have been dry for an extended period.

Overall from the above, the following water resources were identified in the field on the study site:

- A number of non-perennial watercourses without associated Riparian Habitat.
- A number of perennial watercourses with associated Riparian Habitat.
- One Channelled Valley Bottom Wetland System.

The biophysical characteristics and indicators of the above mentioned water resources are provided in the Sub-sections below.

5.2.1 Non-Perennial Watercourses without Riparian Habitat

5.2.1.1 Topography Associated with a Watercourse

The watercourses are shaped by a poorly to moderately developed channel which varies along the length of the watercourses within the study site. Some parts of the channel are better defined than other areas where the channel becomes more diffuse. For example, some of the mid-sections of the watercourse are well defined, whereas the lower reaches of the watercourses are much more diffuse. Overall, a macro-channel is present with a smaller defined active (when in flow) channel (**Figure 8**). The width of the macro-channel therefore varies. The macro-channel can be as little as 15m at the narrowest areas and up to 250m at the widest point on the study site.

Figure 8: Photo of the typical Channel Structure. Broad Macro-channel Section of the Watercourses are evident, but may have a number of smaller channels and flow paths within the macro-channel.

In terms of flow, as previously mentioned, the watercourses are non-perennial and flow from an east to west direction, or a south to north direction. The watercourse can be classified as an A-Section watercourse. The watercourse is above the zone of saturation, although relatively minimal soil depth (ranging from approximately 50mm to 600mm) along some sections of the active channel means that during the wet season, storm water run-off / overland flow can be expected for a relatively brief period (hours to days). This is especially true where bedrock can be found extruding from the watercourses in the channel, as well as in eroded areas.

5.2.1.2 Alluvial Soils and Deposited Materials

Deposited alluvial soils were clearly evident within the active channel as well as within the greater macro-channel bank (**Figure 9**). Sediments were sandy in texture ranging from fine to sandy sized grains. Detrital deposits were also observed in the form of leaves and small twigs.

Soil samples were taken where possible to determine whether soil wetness or wetland soil forms could be identified. Most areas were subject to soil augur restrictions due to the presence of exposed and / or deposited bedrock. Soils that have been deposited via wind or run-off from the surrounding area have however provided some substrate for which vegetation has established.

Soil samples that were taken showed no signs of mottling (which are typically associated with wetlands). The soils did not indicate hydromorphism which typically takes place in wetlands indicating that soil conditions are not favourable to wetland conditions.

Figure 9: Alluvial Sand Deposits within the Active Channel of the Watercourses

5.2.1.3 Vegetation

There are no riparian vegetation zones along any of the watercourses across the site (**Figure 10**). Of the vegetation species identified, none can be described as specifically hydrophytic. Presumably, this is a consequence of the semi-arid climate and other environmental constraints (including soil type and depth) limiting the study site.

Figure 10: Typical non-riparian vegetation associated with the watercourses at the site

5.2.2 Perennial Watercourses with Riparian Habitat

5.2.2.1 Topography Associated with a Watercourse

The perennial watercourses are shaped by a well-developed channel which varies along the length of the watercourses within the study site. Most parts of the channel are well defined, with only a few areas where the channel becomes more diffuse (**Figure 11**).

Figure 11: A perennial watercourse observed on site with a well-defined channel

5.2.2.2 Vegetation

There is a distinct riparian vegetation zone along the perennial watercourses on site (**Figure 12**). Of the vegetation species identified, many can be described as specifically hydrophytic.

Figure 12: The Perennial Watercourses have distinct riparian vegetation.

5.2.3 Channelled Valley Bottom Wetland System

5.2.3.1 Topography Associated with the Wetland

The channelled valley bottom wetland system on the Paarde Valley study site is characterised by a well-developed channel which varies from shallow to deep along the length of the wetland (**Figure 13**). Most parts of the channel are well defined, with only a few areas where the channel becomes more diffuse

Figure 13: The wetland system has a well-developed channel along much of its length.

5.2.3.2 Soils and Deposited Materials

In general, the soils within the wetland were only slightly mottled (**Figure 14**), which indicates that the wetland is only wet for perhaps a single season of the year. There is evidence of alluvial material overlaying the wetland clay deposits, and this indicates that surface flow is likely to occur during rainfall events.

Figure 14: The soils within the wetland show slight mottling, which indicates a seasonal wetland that is not inundated for extended periods.

5.2.3.3 Vegetation

There is a distinct wetland vegetation zone along the wetland channel on site (**Figure 15**). Of the vegetation species identified, many can be described as specifically hydrophytic.

Figure 15: Wetland obligate sedge present along the channelled wetland system.

5.3 Ecological Condition

5.3.1 Non-Perennial Watercourses without Riparian Habitat

Since no riparian or wetland habitat is present along the watercourses over most of the site, it is difficult to apply a quantitative assessment of the present ecological state of the systems. As such, the assessment is qualitative in nature, and appropriate reference conditions have been estimated from the level of disturbance that was obvious on the site.

5.3.1.1 Present Ecological Condition

The results of the Present Ecological State assessment for the watercourses are as follows:

- Watercourse Ecological Condition – C Moderately Modified.

From the above, existing impacts are moderately affecting the current state of the watercourses. The factors affecting the various systems are explained below.

The area is semi-arid to arid, and the vegetation on site should be dominated by a range of drought tolerant succulent species, with a limited graminoid component. Minimal encroachment of alien species was noted. Overgrazing impacts were extremely apparent along with associated onset of erosion due to animal movement and vegetation removal. Overall, cover was not high and the habitat could be described as open scrubland.

Overall the impacts identified to be affecting vegetation cover, abundance and composition includes overgrazing due to sheep, erosion due to sheep trampling and the excavation of the dams. Water quantity impacts are mainly indirect because of run-off impacts due to infrastructure (dirt roads, tar roads, rail etc.) and decreased vegetation cover due to overgrazing. Water quality impacts affecting the watercourse mainly relate to sedimentation originating from run-off from the surrounding areas and roads. In general, however, the sedimentation impacts are a relatively moderate factor affecting water quality (and geomorphology) which in turn contributes to the current perceived change in state.

5.3.2 Perennial Watercourses with Riparian Habitat

In order to apply the VEGRAI index, it is essential to qualify the reference conditions (Kleynhans *et al*., 2007). The reference conditions are essentially a determination of the state of the riparian habitat that is completely natural and unmodified / affected by existing impacts. When assessing the state of the riparian habitat, the habitat can be broken down into two components including, the marginal zone and non-marginal zone. The marginal zone includes the area from the water level at low flow, if present, to those features that are hydrologically activated for the greater part of the year (Kleynhans *et al*., 2007). The non-marginal zone collectively includes the lower and upper zone. The lower zone extends from the marginal zone and ends where a marked increase occurs in lateral elevation, whilst the upper zone extends from the end of the lower zone to the end of the riparian corridor which is usually characterised by steeper slopes and the presence of both riparian and terrestrial vegetation species (Kleynhans *et al*., 2007).

5.3.2.1 Present Ecological Condition

The results of the VEGRAI assessment for the Klein-Seekoei River, its tributaries and riparian habitat are as follows:

- Klein-Seekoei River, and tributaries, Riparian Habitat Ecological Condition – C Moderately Modified (67.5% of the reference condition).

From the above, existing impacts are moderately affecting the current state of the riparian habitats on site. The factors affecting the various systems are explained below.

Currently the marginal zone appears to be in a graminoid dominated state. Few tree species were present in this zone. This contrasts with what the reference state would be. The reference state should ideally be tree dominated. Nonetheless, graminoid cover was estimated at approximately 50%, whilst few sub-adult tree species were also observed making up approximately 30% of the vegetation cover. The remaining area directly in the channel was bare owing to scouring effect from flows. Extensive overgrazing, and recent frosts affected the percentage of cover observed during the assessment. Otherwise, minimal encroachment of alien species was noted. Overgrazing impacts were also apparent along with the associated onset of erosion due to animal movement and vegetation removal. Overall, cover was not high and the habitat could be described as open grassland to open woodland.

The non-marginal zone generally contains a mixture of tree, shrub and graminoid species. The overall state of the non-marginal zone appears to be in transition to a graminoid dominated state. Like the marginal zone, the reference state should be tree dominated. As such, the degree of vegetation cover is somewhat reduced with less vegetation cover from tree species. Removal for firewood is also likely to contribute to decreased tree occurrence. Finally, overgrazing by cattle is similarly affecting general vegetation cover. It is estimated that tree cover percentage is approximately 30%, whilst herbaceous cover is approximately 20% and graminoid cover is approximately 45%. The remaining is bare soils. Abundance of vegetation in the general non-marginal zone was higher in species diversity, compared to adjacent areas. The moderately higher abundance owes mostly to the increased occurrence of tree and shrub species. Despite the increased tree and shrub occurrence, the current state differs from what should be a tree dominated state.

Overall the impacts identified to be affecting vegetation cover, abundance and composition includes overgrazing due to sheep and cattle, removal of vegetation of firewood, and erosion due to animal trampling. Water quantity impacts are mainly indirect because of run-off impacts due to infrastructure (dirt roads) and decreased vegetation cover due to overgrazing. Water quality impacts affecting the watercourse mainly relate to sedimentation originating from run-off from the surrounding areas and roads. In general however, the sedimentation impacts are a relatively moderate factor affecting water quality (and geomorphology) which in turn contributes to the current perceived change in state from a tree dominated reference state to a graminoid dominated current state.

5.3.3 Channelled Valley Bottom Wetland

A single Channelled Valley Bottom wetland system was identified on the Paarde Valley PV site. The relatively short inundation period that the wetland soils are prone to has led to a vegetation community that is hydrophilic, but also capable of surviving dry conditions. The wetland has been impacted upon by overgrazing, which has allowed some alien invasive plant species to enter the system. In addition, the high foot traffic of animals within the channel, has caused some changes to the geomorphology of the system through compaction and subsequent erosion.

5.3.3.1 *Present Ecological Condition*

The formal health assessment of the wetland unit indicates that the wetland unit is Largely Modified resulting from past and current land uses and activities. A summary of the Present Ecological Status (PES) based on results from the WET-Health Tool is provided in **Table 16** below.

Table 16. WET-Health Score for the CVB

	MODULE				
Unit	**Hydrology Impact Score and Class**	**Geomorphology Impact Score and Class**	**Vegetation Impact Score and Class**	**Combined Impact Score**	**PES Category**
1	3.7 (C)	3.5 (C)	3.1 (C)	3.47	C (Moderately Modified)

5.4 Ecological Importance and Sensitivity Categorisation

The environmental importance and sensitivity of the watercourses was assessed. A detailed description and reasons for the scoring of the EISC results are displayed in **Table 17** below.

Considering conditions on-site, a fair amount of disturbance has affected the study site. Despite this disturbance avi-faunal species of conservation concern (Blue Cranes) were observed within the watercourses, riparian zones and wetland system. The disturbance caused by sheep grazing may influence the potential occurrence of sensitive species. Nonetheless, this does not preclude the occurrence of protected species that were noted on site, and other species of conservation significance that may occur during other times of the year as seasonal fluctuations may also have a bearing on the potential occurrence.

Table 17. Environmental Importance and Sensitivity Category for the Biotic and Habitat Determinants associated with the Identified Watercourses, riparian zones and wetland.

Determinant	Score	Confidence	Reason
Primary Determinants			
1. Rare & Endangered Species	3	2	No specific red data flora species of conservation importance associated with the watercourses were noted during the field assessment. There is a possibility that red data species may grow in the study area at different times of the year and were simply not noticed however during the field assessment.
2. Populations of Unique Species	3	2	No populations of unique species were observed during the site visit. However, Blue Cranes were noted to be feeding within the study sites. This elevates the importance and sensitivity of the watercourses.
3. Species/taxon Richness	2	2	Species and taxon richness was moderate in terms of vegetation species. Disturbance due to sheep grazing is an important factor deterring the possible occurrence of indigenous faunal species.
4. Diversity of Habitat Types or Features	2	3	The diversity of habitat types is relatively homogenous.
5. Migration route/breeding and feeding site for water dependent species	3	3	The watercourses have small crossing points for access, which should therefore not act as barriers for species using the watercourses as migration route/breeding and feeding sites. In addition, the watercourses potentially act as a link between river systems.
6. Sensitivity to Changes in the Natural Hydrological Regime	2	3	The watercourses are highly sensitive to changes in the natural hydrological regime as little or no vegetation is present within the watercourses and they are sand based, thus leading to increased risk of erosion.

7. Sensitivity to Water Quality Changes	2	3	The watercourses are moderately sensitive to water quality changes, this is evident due to current sedimentation impacts within the affected watercourse.
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	2	3	One of the main potential watercourse ecosystem services / functions provided is the ability to provide flood attenuation. The watercourses are therefore regarded as relatively significant in terms of the role it performs in the greater landscape.
Modifying Determinants			
9. Protected Status	3	4	Portions of the study site are classified as CBA areas required for conservation.
10. Ecological Integrity	2	4	The overall EC of the watercourses are classified as C Moderately Modified.
TOTAL	24	29	
MEDIAN	2,4	2,9	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**B**		

Given the presence of Blue Cranes within numerous watercourses, the wetland, and the riparian zones, the importance and sensitivity of the watercourse habitat is elevated.

Whilst the condition of the vegetation surrounding the watercourses identified on the study site is somewhat disturbed, the habitat is moderately intact and does not contain any highly sensitive species. The sensitivity is therefore reduced to a limited extent in this regard. However, the potential presence of conservation worthy species within the watercourses across the site leads to an increase in sensitivity.

Taking the above into account, as well as the EC and ecosystem services results, the EISC for the Watercourses, riparian zones and wetland was categorised as a Class B (High).

5.5 Ecological Buffer Zones

An adequate buffer zone is required that is suitable for the type of construction to be undertaken for the proposed development in provision of anticipated impacts. In consideration of this, limited clearance of vegetation will take place in the footprint of the internal roads, operation and maintenance building, lay-down area and under the actual PV panels. Shallow excavations can also be expected for underground cabling and other services that will be required.

Potential impacts to be expected include construction disturbance, habitat edge effects, indirect increased run-off and consequent sedimentation and erosion impacts. These are identified as the main threats to the watercourse, and wetland drivers (flow, water quality, geomorphology).

From an operation phase perspective, increased surface area characterised by hard impermeable structures (i.e. foundations, road infrastructure etc.) are expected to contribute to increased run-off rates. For the operation phase, a critical factor is the duration of potential impacts that may take place for the lifecycle of the proposed development. A consideration that was accordingly factored into the assessment. Accelerated flow resulting in increased run-off may pose an erosion and sedimentation risk to the watercourses and wetland given the shallow soil profile and characteristics of the study site. The increased flow rates are also likely to have flow alteration effects on the watercourses and wetland if not managed properly. Therefore, adequate protection of the watercourses and wetland will assist in minimising potential impacts downstream. With the implementation of mitigation measures, the identified potential impacts can be minimised.

It must be noted that the buffer zone has been determined bearing in mind that a number of mitigation measures have been proposed in **Section 6** below to reduce the potential impact to the delineated watercourses and wetland. The buffer zones that were determined include the following:

- All Watercourses, rivers and the wetland Aquatic Buffer
    - Construction Phase Buffer: 15m

- Operation Phase Buffer: 15m

5.6 Risk Assessment

A risk assessment undertaken as per **Government Notice 509 of 2016 (No. 40229)** needs to consider the "regulated area of a watercourse". The outer edge of the delineated riparian habitat in addition to the 1:100 year flood line delineation (whichever is greatest) have therefore been taken as the full "extent of the watercourses".

Importantly, the regulated area of the watercourse has been regarded as an exclusion zone for the PV foundations, building components of the plant (operation and maintenance buildings etc.) and underground cabling infrastructure given the sensitivity of the features. The only component that will be within the extent of the watercourse will be the proposed access roads that will make use of existing crossing points to minimise potential increased disturbance.

Given the above, as it is assumed that the proposed development will not directly encroach on the extent of the watercourse, the completion of the risk assessment protocol matrix in terms of **Government Notice 509 of 2016 (No. 40229)** has been undertaken to show the low risk values and to ascertain the applicability of a general authorisation process, if required.

A map illustrating the above-mentioned regulated area and buffer zones are shown in **Figure 16**. The detailed results of the risk protocol assessment are provided in **Appendix D**.

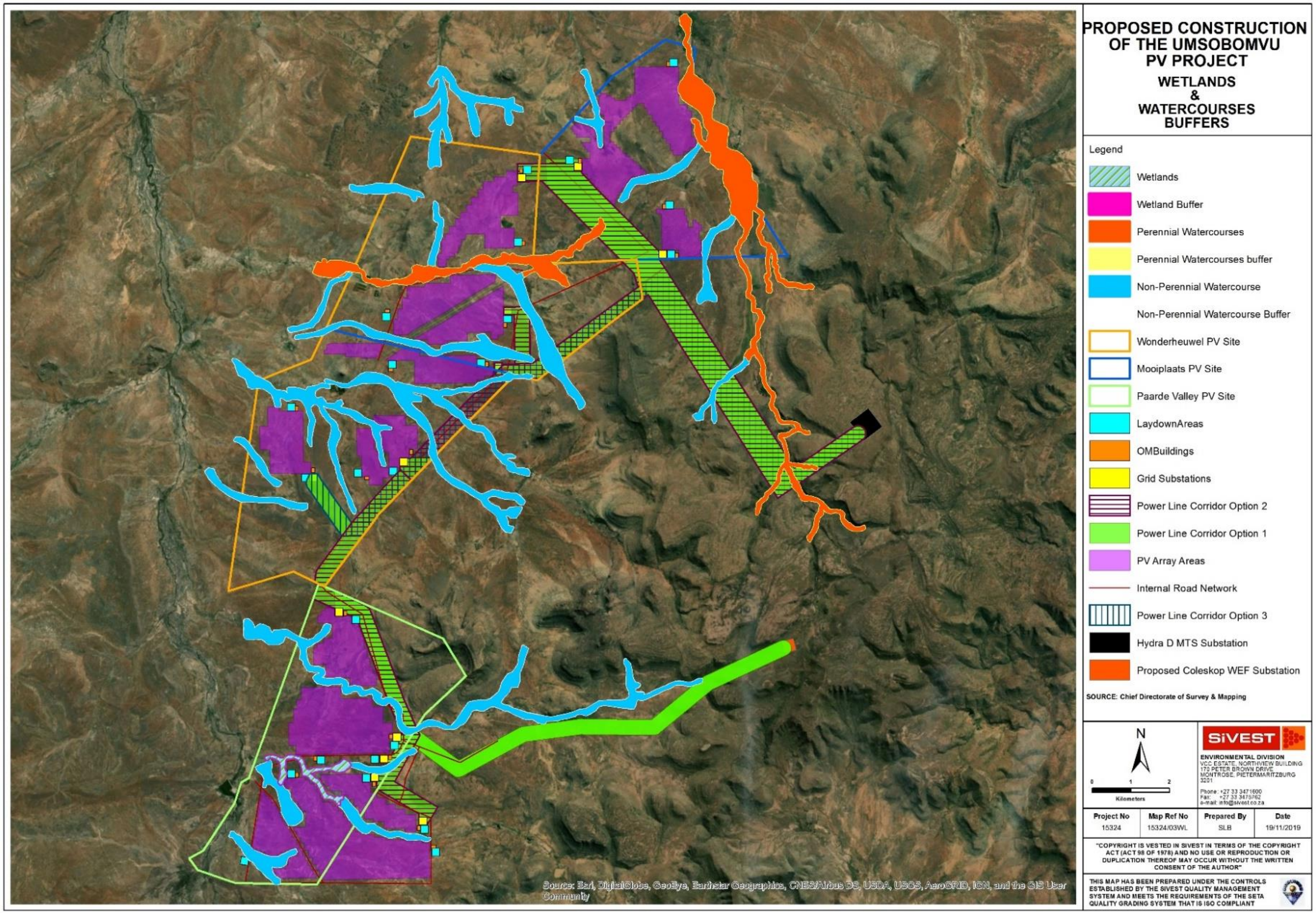

Figure 16: Risk Assessment Map

Overall, the above findings show that the risk of potential impacts on the watercourse was assessed to be in the LOW risk class. Where risks were identified, a number of control measures have been stipulated which will assist in maintaining this low level of risk. In accordance with the implementation of control measures, all potential risks are classed as LOW. Importantly, only minor impact will take place on the identified watercourses, and within the surrounding catchment. Therefore, registration for General Authorisation can be undertaken, where required and agreed with the DWS.

6 NATURE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED DEVELOPMENT

From a watercourse perspective, this section will identify and contextualise the potential impacts within the context of the proposed development and the identified watercourses and wetland. This section will rate the impacts according to an impact rating system (see **Appendix B** for a full methodology and description of the impact rating system), determine the effect of the environmental impact, and provide recommendations towards mitigating the anticipated impact. The identification and rating of impacts will be undertaken (where applicable) for the construction and operation phases of the proposed development. It must be noted that the impact assessment determines a pre-mitigation rating (impacts based on current layout as is) and post-mitigation impact rating (impacts based on implementation of mitigation measures). Therefore, the impact assessment assumes automatic implementation of mitigation measures for the post-mitigation ratings.

The three PV projects are identified and assessed individually below, as well as their respective grid connection alternatives.

6.1 Mooi Plaats PV Site Impact Assessment

6.1.1 Construction Phase Potential Impacts

6.1.1.1 Impacts to the Watercourses

During the construction phase, watercourses may be disturbed due to nearby construction. Note that no direct clearance of watercourses will take place, as the development footprint has been positioned outside of the extent of the delineated watercourse. Limited clearance of vegetation in the terrestrial area will be undertaken where the PV panel and power lines, operation and maintenance building, underground cable trenching and internal roads are to be constructed. It is expected that vegetation clearance will only take place potentially up to the edge of the watercourses. Edge effects afford opportunities to alien vegetation to colonise the Watercourses. Additionally, the disturbance may result in temporary displacement of the biota inhabiting the watercourses during construction. However, these biota may well return following the construction phase, assuming strict adherence to mitigation measures.

Further details identified from the assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 18** on **page 62**.

6.1.1.2 Impacts to the Hydrology of the Watercourse

With the clearance of vegetation and increased run-off potential, the alteration of the hydrology of the watercourses can be expected. Increased flood peaks during and following rainfall events are likely whilst surfaces remain exposed following clearance and compaction during construction. However, it must be noted that the region is semi-arid and the watercourses are non-perennial systems. Hence, flows are fairly infrequent and the impacts to the hydrology will be temporary / short lived. Should adequate measures be implemented, the potential impacts can be successfully mitigated.

Further details identified from the assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 18** on **page 62**.

6.1.1.3 Impacts to Water Quality

During the construction process, potential contamination impacts can be expected as a result of stored oils, fuels, and other hazardous substances or materials being transported *via* storm water run-off and / or direct leaks from construction vehicles and machinery. Should this occur, contamination impacts are likely to occur.

Water quality impacts can also result from workers using the watercourses for various purposes (such as for sanitation). Usage of sanitary substances (for example, soap) in the watercourses can alter the chemical balance or water quality thereby causing pollution to these hydrological systems. Additionally, usage of watercourses for urine and faecal waste is another potential negative water quality impact. Use of water for building purposes can also lead to impaired water quality.

Mixing cement and cleaning construction tools in the watercourses can furthermore affect the water quality. Impacts to the water quality may affect any organisms or vegetation inhabiting these systems *via* contamination impacts.

Lastly, water quality can be impaired as a result of sedimentation. Additional sediment loads emanating from construction areas that are contained in run-off entering watercourses can be regarded as pollution in accordance with the NWA, and therefore requires mitigation.

The assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 18 on **page 62**.

6.1.2 Operation Phase Potential Impacts

6.1.2.1 Impacts to the Hydrology of the Watercourse

Once the proposed development is in operation, increased run-off, associated erosion and sedimentation impacts from storm water is likely. The impact of storm water run-off is primarily related to the types of structures and surfaces that will need to be established for the proposed development. Hard impermeable surfaces will be associated with the PV cells, internal access roads, and maintenance and operation buildings. In general, flat and hard surfaces aid with the generation and acceleration of run-off which can impact on the watercourses through the alteration of floodpeaks as well as other knock-on effects including onset of erosion and increased sedimentation. The increase in hardened surfaces in likely to cause a reduction in the groundwater recharge, and the drainage off of the panels in likely to be high energy, and thus pose an erosion risk to the area directly below the panels.

In addition, the PV cells will require water for cleaning of the panels to ensure that dust build up doesn't cause reduced efficiency of the panels.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 18** on **page 62**.

6.1.3 Decommissioning Phase Potential Impacts

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar potential impacts can therefore be expected to occur and the stipulated mitigation measures (where relevant) must be employed as appropriate to minimise impacts.

Assessment of the potential negative impacts associated with the decommissioning phase and mitigation measures thereto are provided in **Table 18** on **page 62** below.

Table 18: Rating of Surface Water Impacts for Mooi Plaats PV Site (all phases)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**<u>Avoiding Direct Impacts to the Watercourses</u>** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place in accordance with recommendations of the vegetation specialist. **<u>Preventing Temporary Increased Run-off Impacting on Watercourses</u>** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where construction will only take place in the future.	1	3	1	1	2	1	8	-	Low

											<u>Preventing Littering of Watercourses</u> – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **<u>Alien Eradication Programme</u>** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development										
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**<u>Preventing Increased Run-off and associated Erosion Impacting on Watercourses</u>** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion. An appropriate construction storm water management plan formulated by a suitably qualified professional must	1	2	2	2	2	1	9	-	Low

										accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.									
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes; as well as sedimentation via	2	3	2	3	3	3	39	-	Medium	**Storage of Oils, Fuels and Hazardous Substances / Liquids** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **Preventing Soil and Surface Water Contamination** – All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the	1	1	2	2	3	1	9	-	Low

	run-off polluting the watercourse.										construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.									

											No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from the watercourse and the associated buffer zone where required. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. **<u>Preventing Sedimentation Impacting on Surface Water Resources</u>** – Adequate structures, where required, must be put into place (temporary or permanent where necessary in extreme cases) to deal with sedimentation. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations, and maintenance and operation buildings can be used where required to prevent and / or reduce sediments entering the watercourse and the associated buffer zone. An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation.									

		2	3	2	2	3	3	36	-	Medium	An ECO must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor sedimentation impacts. Where additional mitigation measures are stipulated by the ECO in order to control sedimentation, this is to be undertaken accordingly.										Low
Operational Phase																					
Watercourse - Impacts to the Hydrology of the Watercourse	Increased run-off as well as associated erosion and sedimentation impacts	2	3	2	2	3	3	36	-	Medium	**Minimising Storm Water Impacts to Watercourses** – The access roads, and maintenance and operation buildings must have energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering adjacent areas or surface water resources. This will assist in erosion prevention as well. Structures can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). It is also recommended that the area beneath the PV panels be maintained as grass (vegetation of some sort) if possible. A buffer strip of vegetation and rock reinforcement should be maintained downslope of the PV cells, as this will allow a reduction in erosion and sedimentation from increased overland flows from the hardened surfaces.	1	2	2	1	3	2	18	-	Low

											Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the watercourses thereby, also preventing erosion. ECO monitoring is to take place during the post-construction rehabilitation phase. Monitoring is to take place for erosion as well as re-establishment of vegetation where trenching has taken place.									
Decommissioning Phase																				
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**Avoiding Direct Impacts to the Watercourses** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place accordance with recommendations of the vegetation specialist. **Preventing Temporary Increased Run-off Impacting on Watercourses** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where	1	3	1	1	2	1	8	-	Low

											construction will only take place in the future. **Preventing Littering of Watercourses** – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **Alien Eradication Programme** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development									
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**Preventing Increased Run-off and associated Erosion Impacting on Watercourses** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion.	1	2	2	2	2	1	9	-	Low

											An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.									
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes;	2	3	2	3	3	3	39	-	Medium	**Storage of Oils, Fuels and Hazardous Substances / Liquids** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **Preventing Soil and Surface Water Contamination** – All vehicles and	1	1	2	2	3	1	9	-	Low

	as well as sedimentation via run-off polluting the watercourse.										machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, refuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the									

											watercourse and associated buffer zone. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from the watercourse and the associated buffer zone where required. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. **Preventing Sedimentation Impacting on Surface Water Resources** – Adequate structures, where required, must be put into place (temporary or permanent where necessary in extreme cases) to deal with sedimentation. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations, and maintenance and operation buildings can be used where required to prevent and / or reduce sediments entering the watercourse and the associated buffer zone. An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed									

											development to deal with sedimentation. An ECO must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor sedimentation impacts. Where additional mitigation measures are stipulated by the ECO in order to control sedimentation, this is to be undertaken accordingly.									

6.2 Wonderheuwel PV Site Impact Assessment

6.2.1 Construction Phase Potential Impacts

6.2.1.1 Impacts to the Watercourses

During the construction phase, watercourses may be disturbed due to nearby construction. Note that no direct clearance of watercourses will take place, as the development footprint has been positioned outside of the extent of the delineated watercourse. Limited clearance of vegetation in the terrestrial area will be undertaken where the PV panel and power lines, operation and maintenance building, underground cable trenching and internal roads are to be constructed. It is expected that vegetation clearance will only take place potentially up to the edge of the watercourses. Edge effects afford opportunities to alien vegetation to colonise the Watercourses. Additionally, the disturbance may result in temporary displacement of the biota inhabiting the watercourses during construction. However, these biota may well return following the construction phase, assuming strict adherence to mitigation measures.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 19 on **page 77**.

6.2.1.2 Impacts to the Hydrology of the Watercourse

With the clearance of vegetation and increased run-off potential, the alteration of the hydrology of the watercourses can be expected. Increased flood peaks during and following rainfall events are likely whilst surfaces remain exposed following clearance and compaction during construction. However, it must be noted that the region is semi-arid and the watercourses are non-perennial systems. Hence, flows are fairly infrequent and the impacts to the hydrology will be temporary / short lived. Should adequate measures be implemented, the potential impacts can be successfully mitigated.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 19** on **page 77**.

6.2.1.3 Impacts to Water Quality

During the construction process, potential contamination impacts can be expected as a result of stored oils, fuels, and other hazardous substances or materials being transported *via* storm water run-off and / or direct leaks from construction vehicles and machinery. Should this occur, contamination impacts are likely to occur.

Water quality impacts can also result from workers using the watercourses for various purposes (such as for sanitation). Usage of sanitary substances (for example, soap) in the watercourses can alter the chemical balance or water quality thereby causing pollution to these hydrological systems. Additionally, usage of watercourses for urine and faecal waste is another potential negative water quality impact. Use of water for building purposes can also lead to impaired water quality.

Mixing cement and cleaning construction tools in the watercourses can furthermore affect the water quality. Impacts to the water quality may affect any organisms or vegetation inhabiting these systems *via* contamination impacts.

Lastly, water quality can be impaired as a result of sedimentation. Additional sediment loads emanating from construction areas that are contained in run-off entering watercourses can be regarded as pollution in accordance with the NWA, and therefore requires mitigation.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 19 on **page 77**.

6.2.2 Operation Phase Potential Impacts

6.2.2.1 Impacts to the Hydrology of the Watercourse

Once the proposed development is in operation, increased run-off, associated erosion and sedimentation impacts from storm water is likely. The impact of storm water run-off is primarily related to the types of structures and surfaces that will need to be established for the proposed development. Hard impermeable surfaces will be associated with the internal access roads, and maintenance and operation buildings. In general, flat and hard surfaces aid with the generation and acceleration of run-off which can impact on the watercourses through the alteration of floodpeaks as well as other knock-on effects including onset of erosion and increased sedimentation. The increase in hardened surfaces in likely to cause a reduction in the groundwater recharge, and the drainage off of the panels in likely to be high energy, and thus pose an erosion risk to the area directly below the panels.

In addition, the PV cells will require water for cleaning of the panels to ensure that dust build up doesn't cause reduced efficiency of the panels.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 19** on **page 77**.

6.2.3 Decommissioning Phase Potential Impacts

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar potential impacts can therefore be expected to occur and the stipulated mitigation measures (where relevant) must be employed as appropriate to minimise impacts.

Assessment of the potential negative impacts associated with the decommissioning phase and mitigation measures thereto are provided in **Table 19** on **page 77** below.

Table 19: Rating of Surface Water Impacts for Wonderheuvel PV Site (all phases)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**Avoiding Direct Impacts to the Watercourses** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place accordance with recommendations of the vegetation specialist. **Preventing Temporary Increased Run-off Impacting on Watercourses** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where construction will only take place in the future.	1	3	1	1	2	1	8	-	Low

											<u>Preventing Littering of Watercourses</u> – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **<u>Alien Eradication Programme</u>** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development									
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**<u>Preventing Increased Run-off and associated Erosion Impacting on Watercourses</u>** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion. An appropriate construction storm water management plan formulated by a suitably qualified professional must	1	2	2	2	2	1	9	-	Low

										accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.									
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes; as well as sedimentation via	2	3	2	3	3	3	39	-	Medium	**<u>Storage of Oils, Fuels and Hazardous Substances / Liquids</u>** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **<u>Preventing Soil and Surface Water Contamination</u>** – All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the	1	1	2	2	3	1	9	-	Low

	run-off polluting the watercourse.										construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.									

											No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from the watercourse and the associated buffer zone where required. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. **Preventing Sedimentation Impacting on Surface Water Resources** – Adequate structures, where required, must be put into place (temporary or permanent where necessary in extreme cases) to deal with sedimentation. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations, and maintenance and operation buildings can be used where required to prevent and / or reduce sediments entering the watercourse and the associated buffer zone. An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation.									

											An ECO must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor sedimentation impacts. Where additional mitigation measures are stipulated by the ECO in order to control sedimentation, this is to be undertaken accordingly.									
Operational Phase																					
Watercourse - Impacts to the Hydrology of the Watercourse	Increased run-off as well as associated erosion and sedimentation impacts	2	3	2	2	3	3	36	-	Medium	**<u>Minimising Storm Water Impacts to Watercourses</u>** – The access roads, and maintenance and operation buildings must have energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering adjacent areas or surface water resources. This will assist in erosion prevention as well. Structures can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). It is also recommended that the area beneath the PV panels be maintained as grass (vegetation of some sort) if possible. A buffer strip of vegetation and rock reinforcement should be maintained downslope of the PV cells, as this will allow a reduction in erosion and sedimentation from increased overland flows from the hardened surfaces.	1	2	2	1	3	2	18	-	Low

										Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the watercourses thereby, also preventing erosion. ECO monitoring is to take place during the post-construction rehabilitation phase. Monitoring is to take place for erosion as well as re-establishment of vegetation where trenching has taken place.									
Decommissioning Phase																			
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**Avoiding Direct Impacts to the Watercourses** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place accordance with recommendations of the vegetation specialist. **Preventing Temporary Increased Run-off Impacting on Watercourses** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where	1	3	1	1	2	1	8	-	Low

											construction will only take place in the future. **<u>Preventing Littering of Watercourses</u>** – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **<u>Alien Eradication Programme</u>** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development									
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**<u>Preventing Increased Run-off and associated Erosion Impacting on Watercourses</u>** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion.	1	2	2	2	2	1	9	-	Low

											An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.										
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes;	2	3	2	3	3	3	39	-	Medium	**Storage of Oils, Fuels and Hazardous Substances / Liquids** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **Preventing Soil and Surface Water Contamination** – All vehicles and	1	1	2	2	3	1	9	-	Low

	as well as sedimentation via run-off polluting the watercourse.										machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, refuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the									

											watercourse and associated buffer zone. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from the watercourse and the associated buffer zone where required. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. **<u>Preventing Sedimentation Impacting on Surface Water Resources</u>** – Adequate structures, where required, must be put into place (temporary or permanent where necessary in extreme cases) to deal with sedimentation. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations, and maintenance and operation buildings can be used where required to prevent and / or reduce sediments entering the watercourse and the associated buffer zone. An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed									

											development to deal with sedimentation. An ECO must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor sedimentation impacts. Where additional mitigation measures are stipulated by the ECO in order to control sedimentation, this is to be undertaken accordingly.									

6.3 Paarde Valley PV Site Impact Assessment

6.3.1 Construction Phase Potential Impacts

6.3.1.1 Impacts to the Watercourses

During the construction phase, watercourses may be disturbed due to nearby construction. Note that no direct clearance of watercourses will take place, as the development footprint has been positioned outside of the extent of the delineated watercourse. Limited clearance of vegetation in the terrestrial area will be undertaken where the PV panel and power lines, operation and maintenance building, underground cable trenching and internal roads are to be constructed. It is expected that vegetation clearance will only take place potentially up to the edge of the watercourses. Edge effects afford opportunities to alien vegetation to colonise the Watercourses. Additionally, the disturbance may result in temporary displacement of the biota inhabiting the watercourses during construction. However, these biota may well return following the construction phase.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 20** on **page 92**.

6.3.1.2 Impacts to the Hydrology of the Watercourse

With the clearance of vegetation and increased run-off potential, the alteration of the hydrology of the watercourses can be expected. Increased flood peaks during and following rainfall events are likely whilst surfaces remain exposed following clearance and compaction during construction. However, it must be noted that the region is semi-arid and the watercourses are non-perennial systems. Hence, flows are fairly infrequent and the impacts to the hydrology will be temporary / short lived. Should adequate measures be implemented, the potential impacts can be successfully mitigated.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 20 on **page 92**.

6.3.1.3 Impacts to Water Quality

During the construction process, potential contamination impacts can be expected as a result of stored oils, fuels, and other hazardous substances or materials being transported *via* storm water run-off and / or direct leaks from construction vehicles and machinery. Should this occur, contamination impacts are likely to occur.

Water quality impacts can also result from workers using the watercourses for various purposes (such as for sanitation). Usage of sanitary substances (for example, soap) in the watercourses can alter the chemical balance or water quality thereby causing pollution to these hydrological systems. Additionally, usage of watercourses for urine and faecal waste is another potential negative water quality impact. Use of water for building purposes can also lead to impaired water quality.

Mixing cement and cleaning construction tools in the watercourses can furthermore affect the water quality. Impacts to the water quality may affect any organisms or vegetation inhabiting these systems *via* contamination impacts.

Lastly, water quality can be impaired as a result of sedimentation. Additional sediment loads emanating from construction areas that are contained in run-off entering watercourses can be regarded as pollution in accordance with the NWA, and therefore requires mitigation.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 20 on **page 92**.

6.3.2 Operation Phase Potential Impacts

6.3.2.1 Impacts to the Hydrology of the Watercourse

Once the proposed development is in operation, increased run-off, associated erosion and sedimentation impacts from storm water is a possibility. The impact of storm water run-off is primarily related to the types of structures and surfaces that will need to be established for the proposed development. Hard impermeable surfaces will be associated with the internal access roads, and maintenance and operation buildings. In general, flat and hard surfaces aid with the generation and acceleration of run-off which can impact on the watercourses through the alteration of floodpeaks as well as other knock-on effects including onset of erosion and increased sedimentation. The increase in hardened surfaces in likely to cause a reduction in the groundwater recharge, and the drainage off of the panels in likely to be high energy, and thus pose an erosion risk to the area directly below the panels.

In addition, the PV cells will require water for cleaning of the panels to ensure that dust build up doesn’t cause reduced efficiency of the panels.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in Table 20 on **page 92**.

6.3.3 Decommissioning Phase Potential Impacts

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar potential impacts can therefore be expected to occur and the stipulated mitigation measures (where relevant) must be employed as appropriate to minimise impacts.

Assessment of the potential negative impacts associated with the decommissioning phase and mitigation measures thereto are provided in **Table 20** on **page 92** below.

Table 20: Rating of Surface Water Impacts for Paarde Valley PV Site (all phases)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**Avoiding Direct Impacts to the Watercourses** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place accordance with recommendations of the vegetation specialist. **Preventing Temporary Increased Run-off Impacting on Watercourses** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where construction will only take place in the future.	1	3	1	1	2	1	8	-	Low

											<u>Preventing Littering of Watercourses</u> – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **<u>Alien Eradication Programme</u>** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development									
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**<u>Preventing Increased Run-off and associated Erosion Impacting on Watercourses</u>** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion. An appropriate construction storm water management plan formulated by a suitably qualified professional must	1	2	2	2	2	1	9	-	Low

										accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.									
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes; as well as sedimentation via	2	3	2	3	3	3	39	-	Medium	**<u>Storage of Oils, Fuels and Hazardous Substances / Liquids</u>** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **<u>Preventing Soil and Surface Water Contamination</u>** – All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the	1	1	2	2	3	1	9	-	Low

	run-off polluting the watercourse.										construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.									

											No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from the watercourse and the associated buffer zone where required. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. **<u>Preventing Sedimentation Impacting on Surface Water Resources</u>** – Adequate structures, where required, must be put into place (temporary or permanent where necessary in extreme cases) to deal with sedimentation. The use of silt fencing and potentially sandbags or hessian “sausage” nets or other appropriate measures along the boundaries of the PV panel and power line foundations, and maintenance and operation buildings can be used where required to prevent and / or reduce sediments entering the watercourse and the associated buffer zone. An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation.									

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Operational Phase																				
Watercourse - Impacts to the Hydrology of the Watercourse	Increased run-off as well as associated erosion and sedimentation impacts	2	3	2	2	3	3	36	-	Medium	<u>**Minimising Storm Water Impacts to Watercourses**</u> – The access roads, and maintenance and operation buildings must have energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering adjacent areas or surface water resources. This will assist in erosion prevention as well. Structures can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). It is also recommended that the area beneath the PV panels be maintained as grass (vegetation of some sort) if possible. A buffer strip of vegetation and rock reinforcement should be maintained downslope of the PV cells, as this will allow a reduction in erosion and sedimentation from increased overland flows from the hardened surfaces.	1	2	2	1	3	2	18	-	Low

										Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the watercourses thereby, also preventing erosion. ECO monitoring is to take place during the post-construction rehabilitation phase. Monitoring is to take place for erosion as well as re-establishment of vegetation where trenching has taken place.									
Decommissioning Phase																			
Watercourses – Impacts to the Watercourses	Impacts associated with disturbance and edge effects to watercourses	1	3	2	2	2	2	20	-	Low	**Avoiding Direct Impacts to the Watercourses** – No vegetation trimming and / or pruning must take place along the existing access roads running through the extent of the watercourse. However, where nearby vegetation trimming and / or pruning is required outside the extent of the watercourse, this must take place accordance with recommendations of the vegetation specialist. **Preventing Temporary Increased Run-off Impacting on Watercourses** – Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not in areas where	1	3	1	1	2	1	8	-	Low

											construction will only take place in the future. **<u>Preventing Littering of Watercourses</u>** – Provide sufficient facilities for litter disposal. Regular clean-ups are required to keep the construction area and adjacent watercourses clean. **<u>Alien Eradication Programme</u>** - An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development										
Watercourse – Impacts to the Hydrology of the Watercourse	Impacts associated with accelerated run-off and associated increased flood peaks to the watercourse	2	3	2	2	1	2	20	-	Low	**<u>Preventing Increased Run-off and associated Erosion Impacting on Watercourses</u>** – Adequate structures, where necessary, must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and potential erosion. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV panel and power line foundations and maintenance and operation buildings can be used where required to slow run-off entering the watercourses and the associated buffer zones, thereby preventing increase in flood peaks, run-off volumes and also the likelihood of erosion.	1	2	2	2	2	1	9	-	Low

											An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off and associated sedimentation and erosion. An Environmental Control Officer (ECO) must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor increased run-off and associated erosion impacts. Where additional mitigation measures are stipulated by the ECO in order to control increased run-off and erosion, this is to be undertaken accordingly.										
Watercourse – Impacts to Water Quality	Potential impacts associated with the leakage / spillage of oils, fuels and other potentially hazardous substances from construction vehicles / machinery entering run-off and flowing into the watercourse. Pollution from workers using the watercourse for sanitation and cleaning purposes;	2	3	2	3	3	3	39	-	Medium	**Storage of Oils, Fuels and Hazardous Substances / Liquids** – All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourse and the associated buffer zone, unless such storage is unavoidable and is approved by the ECO. Where these items are stored, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. **Preventing Soil and Surface Water Contamination** – All vehicles and	1	1	2	2	3	1	9	-	Low

	as well as sedimentation via run-off polluting the watercourse.										machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, refuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourse and the associated buffer zone. The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. No cement mixing is to take place in the watercourse or the associated buffer zone. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in ready-mix vehicles. Importantly, no mixing of cement or concrete directly within the									

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											development to deal with sedimentation. An ECO must be appointed during the construction phase to oversee construction activities undertaken by contractors. The ECO must also monitor sedimentation impacts. Where additional mitigation measures are stipulated by the ECO in order to control sedimentation, this is to be undertaken accordingly.									

6.4 Cumulative Impacts

Cumulative impacts are hard to predict even with knowledge of other sites in the general area that are also going to be developed (**Figure 17**). A single solar energy farm has little impact beyond the borders of the site, however, when several solar energy facilities are developed in an area, there is potentially a large cumulative impact. Negative impacts linked to roads are frequently cited as one of the major effects of renewable energy developments on watercourses and water resources. These impacts include increased hardened surfaces, erosion, and direct loss of watercourse habitat. However, given the semi-arid to arid system that the project will impact upon it is unlikely that large scale impacts will be imparted by the construction of the solar energy farm on the site, and the cumulative impact of the other developments in the area on water resources is likely to still pose a low risk to these systems if correct mitigation measures are implemented. The majority of the drainage of the site does not join that found on the sites to the south of the study area, and thus the effects of the neighbouring land parcels being developed will have little impact on the study area drainage. There are however, a few developments to the east and north of the site that also drain towards the Klein-Seekoei River but correct use of mitigation measures within the Umsobomvu sites will ensure that the cumulative impact will have minimal impact on the other sites in the area. Thus, no immediate cumulative impact to the drainage patterns of the site are predicted.

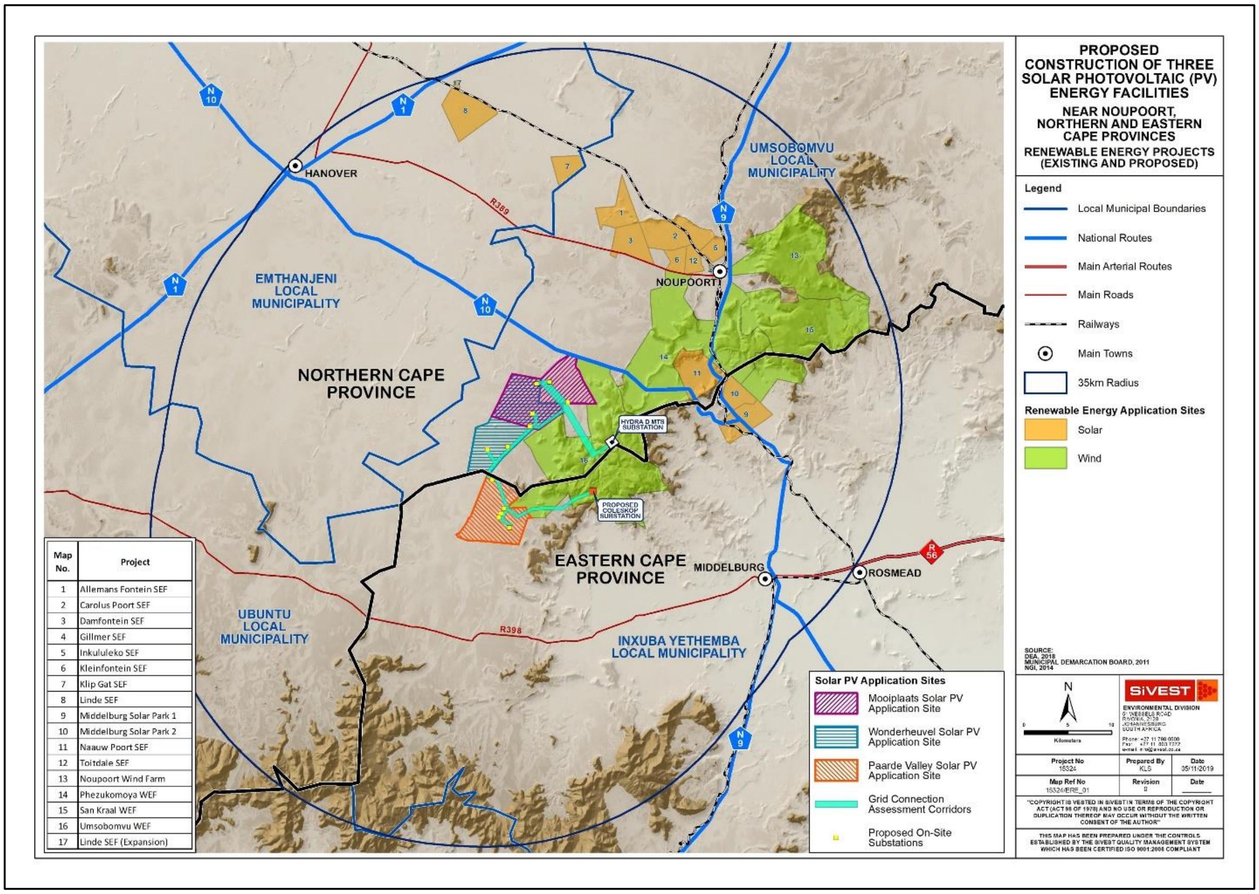

Figure 17: Other Proposed Renewable Energy Developments Within the Region

On a larger scale, all the drainage of the sites enters the Klein-Seekoei River which flows into the Orange River away from site. Thus, if the sites to the north cause a hydrological impact, and the Umsobomvu sites causes a hydrological impact, these impacts (increased run-off as well as associated erosion and sedimentation impacts) will eventually meet in the Seekoei River, and exacerbate each other. However, the risk of either site causing a significant impact is small if all appropriate mitigation (as contained in **Table 21** below) that has been proposed for all sites is implemented.

Table 21: Impact Rating for Cumulative Impacts to the Hydrology of the Region

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Watercourse - Cumulative Impacts to Hydrology of Region	Increased run-off as well as associated erosion and sedimentation impacts	2	3	2	2	3	3	36	-	Medium	**Minimising Storm Water Impacts to Watercourses** – The substation, access road, and maintenance and operation buildings must have energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering adjacent areas or surface water resources. This will assist in erosion prevention as well. Structures can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the	2	2	2	1	3	2	20	-	Low

											watercourses thereby, also preventing erosion. ECO monitoring is to take place during the post-construction rehabilitation phase. Monitoring is to take place for erosion as well as re-establishment of vegetation where trenching for cabling has taken place.									

SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments. However, many of the documents are not currently publically available to download. The information that could be obtained for the surrounding planned renewable energy developments was taken into account as part of the cumulative impact assessment.

6.5 Assessment of alternatives

The construction of the PV sites has been proposed with a number of substation and Power line route alternatives available. The comparative assessment of the alternatives, in terms of preference, is detailed below.

Table 22. Substation and Grid Connection Alternatives

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.
Grid Connection Option 1b	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.
Grid Connection Option 2a	**FAVOURABLE**	The impact will be relatively insignificant but the line distance will be longer.
Grid Connection Option 2a	**FAVOURABLE**	The impact will be relatively insignificant but the line distance will be longer.
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 1b	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 1c	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 1d	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 2a	**FAVOURABLE**	The impact will be relatively insignificant but the line distance will be longer.
Grid Connection Option 2b	**FAVOURABLE**	The impact will be relatively insignificant but the line distance will be longer.
Grid Connection Option 3	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 1b	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 1c	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 1d	**LEAST PREFERRED**	The alternative will result in a high impact on the watercourses than the other options.
Grid Connection Option 2a	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		D Substation, and thus pylon number is minimised.
Grid Connection Option 2b	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.
Grid Connection Option 2c	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.
Grid Connection Option 2d	**PREFERRED**	The alternative will result in a low impact since a relatively short line is required to evacuate power to Hydra D Substation, and thus pylon number is minimised.

Table 23. Laydown and Infrastructure Alternatives

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 2	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 3	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 4	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 5	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 6	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 2	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 3	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 4	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 5	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 6	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 7	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 8	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 2	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 3	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 4	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 5	**PREFERRED**	The alternative will result in a low impact since impacts will be close to or within disturbance corridors for the power lines.
Laydown Area and O&M Building Site Option 6	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 7	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 8	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.
Laydown Area and O&M Building Site Option 9	**LEAST PREFERRED**	The alternative is away from other impact zones, and is closer to watercourses.

7 LEGISLATIVE IMPLICATIONS

In the context of the proposed development and potential impacts affecting the watercourse, the environmental and water legislation implications from a surface water perspective are included in the sub-sections below.

7.1 National Environmental Management Act, 1998 (No. 107 of 1998) & Environmental Impact Assessment Regulations (2014), as Amended

Note that the definition of the watercourse in accordance with NEMA is in line with that provided in the NWA and is as follows (**NWA, 1998**),

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

From the above, it is important to note that the edge of the watercourse as per NEMA is defined by the channel which *inter alia* includes the bed and banks. This differs from the extent of the watercourse as defined by the NWA which includes the 1:100 floodline and/or the edge of the riparian habitat (whichever is greater. As such, the macro-channel bank was delineated along with a 32m NEMA threshold. This is shown in **Figure 16**. From the map, it can be seen that although the various components are along the boundary of the 32m threshold, only the access roads are directly within the 32m threshold and therefore trigger activities in terms of the EIA Regulations (2014, as amended).

7.2 National Water Act, 1998 (Act No. 36 of 1998)

From the above, water uses c) and i) are potentially applicable since the access roads will need to cross the watercourses at various points. In terms of the risk assessment undertaken in **Section 5.8** as per **Government Notice 509 of 2016 (No. 40229)**, the findings show that the risk of potential impacts on the watercourses were assessed to be in the LOW risk class. Additionally, a number of control measures have been stipulated that will assist in decreasing the level of risk to the watercourse to an even lower level. Should this be undertaken, all risks are classed as LOW and registration for General Authorisation can be undertaken, where required and agreed with the DWS.

The decision on whether the proposed development is to proceed will rest on environmental and water governmental departments whom will need to make a trade-off between meeting the conservation targets of the province or meeting the energy demands of the country. However, it is the opinion of the specialist that the proposed development may proceed where the relevant control measures and mitigation measures stipulated above are implemented.

8 SPECIALIST RECOMMENDATIONS

There are a number of recommendations to be implemented for the proposed development. These include the following:

- Storm water management plan for all phases of the proposed development is required to be compiled prior to construction and implemented which accounts for control of increased run-off, erosion and sedimentation; and
- An Alien Eradication and Removal Programme is to be compiled prior to construction and implemented for the duration of the proposed development.

9 CONCLUSIONS

A surface water resources delineation and impact assessment are provided in this report for the proposed development. Findings were based on the method for delineating wetlands and riparian habitats as per the **DWAF (2005 & 2008)** guidelines. At a broad level, the study site is located within the Orange Catchment. More specifically, the study area is situated within the quaternary catchments D32B & D32C. The fieldwork assessment found that there is one wetland on the Paarde Valley study site. However, a number of watercourses, both perennial and non-perennial, were identified throughout the entire study area.

In terms of the Ecological Condition of the non-perennial, and perennial watercourses, Ecological Condition was assessed to be a class C – Moderately Modified systems.

The Environmental Importance and Sensitivity Class for the watercourses was determined. The results showed that the EISC for the watercourses and wetland were categorised as a Class B (High). The classification of high EISC was primarily due to the condition of the watercourses assessed, as well as the presence of endangered species.

The buffer zone determination for the watercourses took into account the type of the proposed development, potential impacts, condition of the habitat as well as other characteristics of the watercourse. As a result, the following buffer zones were assessed and are to be implemented as far as possible:

  - Construction Phase Buffer: 15m
  - Operation Phase Buffer: 15m

Foreseen potential negative impacts related to the proposed development were identified and assessed. The potential construction related impacts included impacts to watercourses (-20 low pre- and -8 low post-mitigation impact rating), hydrology of the watercourses (-20 low pre- and -9 low post-mitigation impact rating) and water quality impacts (-39 medium pre- and -9 low post-mitigation impact rating). The operational impacts identified included impacts to the hydrology of the watercourse (-36 medium pre- and -18 low post-mitigation impact rating). Overall, all impacts were assessed to be low, post implementation of mitigation measures.

In terms of potentially applicable environmental and water related legislation, listed activities were identified to be triggered in terms of NEMA (1998) and the EIA Regulations (2014, as amended) from a surface water perspective. With respect to the NWA (1998), water uses (c) and (i) were identified as being potentially applicable. However, the application of the risk assessment matrix protocol as per **Government Notice 509 of 2016 (No. 40229)** was undertaken, the findings show that the risk of potential impacts on the watercourse was assessed to be in the LOW risk class. Where risks were identified, a number of control measures have been stipulated which will assist in decreasing the level of risk to an even lower level. In accordance with the implementation of control measures, all potential risks are classed as LOW. Therefore, registration for General Authorisation can be undertaken where required and agreed upon with the DWS.

The decision on whether the proposed development is to proceed will rest on environmental and water governmental departments whom will need to make a trade-off between meeting the conservation targets of the province or meeting the energy demands of the country. However, it is the opinion of the specialist that the proposed development may proceed where the relevant control measures and mitigation measures stipulated above are implemented.

There are a number of recommendations to be implemented for the proposed development. These include the following:

- Storm water management plan for all phases of the proposed development is required to be compiled and implemented which accounts for control of increased run-off, erosion and sedimentation; and
- An Alien Eradication and Removal Programme is to be compiled and implemented for the duration of the proposed development.

Based on the findings above, with the implementation of the control and mitigation measures stipulated herein, it is the opinion of the specialist that the proposed development may proceed.

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Appendix A:
Specialist Credentials

Name	Stephen Burton
Profession	Environmental Scientist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Environmental Scientist: Environmental Division
Years with Firm	11 Years
Date of Birth	12 January 1979
ID Number	7901125138083
Nationality	South African

Education

Matric Exemption (Natal Education Department)
Maritzburg College, PMB, KZN (1991 – 1996)

Professional Qualifications

B.Sc. (Zoology 2002), University of Natal PMB, KZN
B.Sc. Honours (Zoology 2003), University of Natal PMB, KZN
M.Sc. (Zoology 2006), University of KwaZulu-Natal PMB, KZN
Pr.Sci.Nat. Registration No. 117474

Years of Experience

12 Years

Membership to Professional Societies

International Association for Impact Assessment South Africa (IAIAsa)
South African Council for Natural Scientific Professions (SACNASP) Pr. Sci. Nat. Reg No. 117474

Employment Record

April 2008 – present	SiVEST SA (Pty) Ltd: Environmental Division - Environmental Scientist
May 2007 – March 2008	UDIDI Project Development Company: Environmental Planner

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent
Afrikaans	Good	Good	Good

Key Experience

Field of Specialisation in Environmental Science, Zoology (specifically Ornithology and Mammology), Entomology and Wetland Ecology. Stephen is skilled in the following fields:-

- Evaluation of Biodiversity

- Management Recommendations
- Scoping Reports and Environmental Impact Assessments
- Bird Identification
- Grass Identification
- Tree Identification
- Mammal Identification
- Wetland Ecology
- Wetland Delineation
- Wetland Functionality Assessments
- Wetland Rehabilitation Plans
- GIS Package Skills, particularly ESRI products
- Statistical Package Skills, particularly STATISTICA, PDAP and R-Statistics.

Stephen has completed a Bachelor of Science Degree with a Zoology Major (University of Natal, PMB), as well as a Bachelor of Science (Honours) in Zoology (University of Natal, PMB). Stephen has also completed a Master of Science Degree in Zoology (University of KwaZulu-Natal, PMB). This post-graduate degree was fieldwork and lab based and provided practical experience in conceptualising, planning, modelling and executing of a project.

Stephen has been involved in consulting since May 2007, which included scoping reports, environmental management plans, integrated management plans, rezoning applications, development facilitation act applications, basic assessment reports, environmental impact reports and strategic environmental assessments. He has been involved in a number of faunal assessments for developments ranging from power lines and water pipelines, to housing developments and light industrial developments. In addition, Stephen has undertaken a number of wetland assessments, and wetland rehabilitation plans, for developments ranging from pipelines through housing and industrial developments.

Since Joining SiVEST Environmental Division in April 2008, Stephen has been involved in a number of projects ranging from Environmental Management Planning for Eskom Power lines to the writing up of scoping reports and environmental impact reports for various projects, and the auditing of Eskom Power lines, district roads and Umgeni Water pipelines and dams. In addition, he has developed specialist skills in faunal and wetland assessments for a range of development types.

Projects Experience

April 2008 – present

POWERLINE/ROADS PROJECTS

- D1562 Road Upgrade
- Franklin Overhead Power Line
- Eskom Grassridge Melkhout Power Line Rebuild
- Bulwer-Lamington Power Line
- Lukhanyeni and Maduna Access Roads, Umzimkhulu, Basic Assessment Class Application
- D1131 and D1137 Roads in Msunduzi
- Harvard-Soutdrift Power Line (Solar Reserve South Africa)
- Lengau Sub-Station & Switching Yard (Solar Reserve South Africa)
- Eskom Corinth-Mzongwana
- Eskom Ndwedwe to Appelsbosch
- Eskom Empangeni-Mandeni / Fairbreeze
- Spoornet Coal Link Upgrade
- Eskom Eros to Port Edward 132kV distribution lines
- Eskom Royal Substation
- Eskom Corinth-Lamington

DEVELOPMENT PROJECTS

- Shemula Water Treatment Works Expansion
- Mooi River Industrial Park Development, EIA
- MiddelFontein Housing Development, Kokstad, EIA
- Thanda Integrated Management Plan Development
- Ladysmith Extension 15 Development EIA
- Ladysmith Shopping Mall EIA
- Ladysmith Pedestrian Bridges BA
- Peacetown Taxi Rank BA
- Crookes Brothers EMF – Analysis Report

WATER PROJECTS

- Swayimane Community Water Supply Scheme
- Mooi-Mgeni Water Transfer System – Phase 2 (Trans-Caledon Tunnel Authority)
- Middeldrift Phase 2 Community Water Supply Scheme
- Shemula Water Treatment Works Expansion and Rising Main
- Richmond Pipeline, Umgeni Water
- Imvutshane Dam, Umgeni Water
- Shemula Water Treatment Works Expansion
- Bulwer Dam EIA
- Hazelmere Pipeline, Umgeni Water
- Sundumbilli Community Water Supply Scheme
- Bulwer Farm Community Water Supply Scheme
- Umhlumayo Phase 4 (Fitty Park) Water Supply Scheme
- Raisethorpe Canal

ENVIRONMENTAL AUDITING / ENVIRONMENTAL CONTROL OFFICER (ECO)

- Mooi-Mgeni Water Transfer System – Phase 2 (Trans-Caledon Tunnel Authority)
- Zimbali Golf Course Estate Development
- Middeldrift Phase 2 Community Water Supply Scheme
- Shemula Water Treatment Works Expansion and Rising Main
- Zwelethu - Port Edward Power Line
- Richmond Pipeline, Umgeni Water
- Imvutshane Dam, Umgeni Water
- Hazelmere Pipeline, Umgeni Water
- Mpumulanga Town Centre Precinct, Shopping Centre Development
- Lukhanyeni and Maduna Access Roads, Umzimkhulu Environmental Auditing
- Rainbow Farms Broiler Houses (B17/B18)
- Ludeke-Zwelethu Power Lines, Port Edward
- Sundumbilli Community Water Supply Scheme
- Eros to Kokstad Power Line
- Roads in the Msunduzi Municipality
- Raisethorpe Canal
- Eskom Empangeni-Mandeni / Fairbreeze(Obanjeni) Power Line
- Eskom Mandeni-Dlangezwa Power Line
- Brewitt Park Housing Development, Escourt

GIS INPUT MAPPING

- Arcelor-Mittal Newcastle Vegetation Assessment – Mapping & Desktop Assessment
- Normandien Farms – Mapping & Desktop Assessment

- Zimbali Lakes and Golf Course Estate - Mapping
- Cornubia Industrial Development Zone - Mapping
- Mshwathi Pipeline - Mapping
- Porritt Access Road Dispute, Snowdon Farm Trust - Mapping
- SNA Roads - Mapping & Desktop Assessment
- Ballito Flats - Mapping & Desktop Assessment
- DOW Veterinary Quarantine - Mapping & Desktop Assessment
- Farm Isonti - Mapping
- Hawaan CT - Mapping
- Izinga Phase 3 EIA - Mapping
- Ellingham Estate - Mapping
- Motala Housing - Mapping
- Ndundula Road - Mapping & Desktop Assessment
- Okhahlamba Landfill and Cemetery Project - Mapping & Desktop Assessment
- SNA Roads - Mapping & Desktop Assessment
- Woodridge Estate - Mapping
- Umgeni Water Ngcebo Biodiversity - Mapping
- Alton Warehouse - Mapping & Desktop Assessment
- Shell Hans Dettman - Mapping & Desktop Assessment
- Lower Tugela Bulk Water Supply Scheme Extension - Mapping & Desktop Assessment

WETLAND ASSESSMENTS AND REHABILITATION PLANS

- Rockdale Wetland Assessment
- Tooverberg Wind Energy Farm
- Sibaya Node 5 Development
- Transnet Wetland Functionality and Biodiversity Assessment for Port of Richards Bay
- Cornubia Rem 68 Development
- Dube Tradeport State of the Environment Report
- Eshowe SSA1 Bulk Water Supply Scheme
- Umgeni Water Waste Water Treatment Plant Offsets
- Osizweni Industrial Development
- Bishopstowe Strategic Environmental Assessment
- Ezaheni D Housing Development
- Izinga Phase 3 Residential Development Amendment
- Dannhauser Bulk Water Supply
- Transnet Richards Bay Port Wetland Assessment
- Raisethorpe Canal Phase 2
- Mimosadale Bulk Water Supply
- Greater Edendale EMF
- Shemula Phases 2-6 Pipeline
- Sumitomo New Rubber Plant
- Riverside Cemetery Development
- DTP Support Zone 2 Development
- Wosiyane/Swayimane Pipeline
- IRPTN Corridor 4 Development
- Sibaya Development
- Cornubia North Development
- Tinley Manor North Development
- Izinga Phase 3 Development
- Nonoti-Zinkwazi Development
- Zimbali Estate Properties
- Mthandeni Irrigation Scheme

- Strode Property Development
- Ethekwini Integrated Rapid Public Transport Network Corridor 9
- D1562 Road Upgrade
- Cornubia Phase 2 Development
- Compensation Flats Development
- Zimbali Estate Development
- Mandeni Cemetery
- Fairmont Hotel
- Tinley Manor South Development
- Maidstone Mill Development
- Mnambithi Substation and Powerline
- Nquthu Town Erf 16 & 17 Development
- Goswell Platform Development - Cato Ridge
- Driefontein Pipeline Route - Ladysmith
- Blaaubosch Housing Development - Newcastle
- Madadeni Housing Development - Newcastle
- Hyde Park Country Estate
- Newcastle Municipality New Cemetery Sites

FAUNAL ASSESSMENTS

- Umlaas Gate Faunal Assessment
- Ntunjambili Bulk Water Supply Scheme
- In-depth specialist studies (including faunal) for Port of Richards Bay
- Kassier Road North Mixed Use Development
- Transnet Richards Bay Port Faunal Assessment
- Greater Edendale EMF
- Shemula Phase 2-6 Pipeline
- Milky Way Shopping Centre Development
- Dudley Pringle Development
- Lindokuhle Housing Development
- Shongweni Bulk Water Pipeline
- Ethekwini Integrated Rapid Public Transport Network Corridor 1
- Ethekwini Integrated Rapid Public Transport Network Corridor 3
- Ethekwini Integrated Rapid Public Transport Network Corridor 9
- Newcastle Municipality New Cemetery Sites
- Shongweni Mixed-Use Development
- Nonoti Beach Tourism Development
- Proposed Shoprite & Checkers Distribution Centre Development, Marianhill
- Proposed Cornubia Development, Umhlanga
- Lower Tugela Bulk Water Supply Scheme Extension
- Proposed Redcliffe Housing Development in Ethekwini Municipality

AVI- FAUNAL ASSESSMENTS

- Proposed High Voltage Powerline to Cygnus Substation, Empangeni
- Proposed High Voltage Powerline between Corinth and Lamington Substations, Underberg
- Proposed High Voltage Powerline between Corinth and Mzongwana Substations

Appendix B:
Impact Rating Methodology

The determination of the effect of an environmental impact on an environmental parameter (in this instance, wetlands) is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global) whereas intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence). Significance is calculated as per the example shown in **Table 24**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System Methodology

Impact assessments must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is usually assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

In this case, a unique situation is present whereby various scenarios have been posed and evaluated accordingly. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

Table 24. Example of the Significance Impact Rating Table

NATURE		
Includes a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		

This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).

4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and

		remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".

74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Appendix C:
Risk Assessment Protocol Matrix Results

Drainage Lines
Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
Project Name: 15324 Umsobomvu PV Arrays and Infrastructure
Name and Registration No. of SACNASP Professional Member: Stephen Burton Registration number - 117474

					Severity																	
No.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico-Chemical (Water Quality)**	**Habitat (Geomorphology+ Vegetation)**	**Biota**	**Severity**	**Spatial Scale**	**Duration**	**Consequence**	**Frequency of Activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance Risk Rating**	**Confidence Level**	**Control Measures**	**Borderline LOW MODERATE Rating Classes**	**PES and EIS of Watercourse**
1	**Construction Phase**	**Clearance of Vegetation and Levelling in the Local Catchment for PV array, Operation and Maintenance Buildings:** Limited clearance of vegetation on the study site will affect catchment level roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during construction.	1.5	2	2	1	1.625	2	2	5.625	2	2	1	2	7	39.375	High	- Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not additional areas where construction will only take place in the future. - Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV array bases are to be used where necessary to prevent run-off containing sediment entering the watercourse as well as potential erosion in susceptible areas near to the watercourse and the associated buffer zone. - An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during construction. Change to hydrology of the watercourse during construction.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV array bases can be used where necessary to prevent run-off containing sediment entering the watercourses as well as potential erosion in susceptible areas near to the watercourses and the associated buffer zones.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
2		**Possible Leakage, Spills of Fuel, Oil and other Hazardous Substances:** Fuel, oils and other hazardous substances entering the downstream watercourse via storm water run-off.	Water Quality	Vehicles and machinery my leak oil which can accumulate in storm water run-off generated on the construction site and enter the watercourse downstream. Additionally, stored fuels, oils and other hazardous substances may leak from storage areas and enter the downstream watercourse via storm water run-off.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	Medium	-All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourses and the associated buffer zones, unless such storage is unavoidable and approved by the ECO. Where these items are stored within 100m from the full extent of the watercourse, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. -All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourses and the associated buffer zones. -The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited to) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. -No cement mixing is to take place in the watercourse or the associated buffer zones. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in readymix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
3	**Operation Phase**	**Increased Hardened Surfaces in the Local Catchment due to PV array bases:** With the development of the PV array and Associated Infrastructure, there will an increase in hard impermeable surfaces which will affect catchment level dynamics including surface roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during operation. Change to hydrology of the watercourse during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required (preferably surrounding the PV array bases and access roads) to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)

Drainage Lines
Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
Project Name: 15324 Umsobomvu Grid Connections
Name and Registration No. of SACNASP Professional Member: Stephen Burton Registration number - 117474

					Severity																	
No.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico-Chemical (Water Quality)**	**Habitat (Geomorphology+ Vegetation)**	**Biota**	**Severity**	**Spatial Scale**	**Duration**	**Consequence**	**Frequency of Activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance Risk Rating**	**Confidence Level**	**Control Measures**	**Borderline LOW MODERATE Rating Classes**	**PES and EIS of Watercourse**
1	**Construction Phase**	**Stringing of Power lines in the extent of the Watercourse:** Disturbance to the soils and vegetation will take place where stringing of the power lines is undertaken within the extent of the watercourse.	Water Quality	Physical disturbance to the soils and vegetation within the servitude of the power lines in the extent of the watercourse.	1	1	2	2	1.5	2	2	5.5	1	1	1	3	6	33	High	--Stringing of the power line (pilot line) is to be undertaken by hand and walked through the extent of the watercourse within the servitude of the power line. No disturbance or entry by workers outside of the servitude in the extent of the watercourse is allowed. -Alternatively, the pilot line can be pulled around the extent of the watercourse by vehicle if the pilot line does not damage any vegetation within the extent of the watercourse. Importantly, no vehicle movement is allowed within the extent of the watercourse. -The extent of the servitude must be demarcated and visible to workers when undertaking the stringing of the power lines through the extent of the watercourse to prevent prohibited entry into the extent of the watercourse.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
2		**Clearance of Vegetation and Levelling in the Local Catchment for the Substation and pylons:** Limited clearance of vegetation on the study site will affect catchment level roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during construction.	1.5	2	2	1	1.625	2	2	5.625	2	2	1	2	7	39.375	High	- Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not additional areas where construction will only take place in the future. - Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the substation and pylons are to be used where necessary to prevent run-off containing sediment entering the watercourse as well as potential erosion in susceptible areas near to the watercourse and the associated buffer zone. - An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during construction. Change to hydrology of the watercourse during construction.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the pylon foundations can be used where necessary to prevent run-off containing sediment entering the watercourses as well as potential erosion in susceptible areas near to the watercourses and the associated buffer zones.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
3		**Possible Leakage, Spills of Fuel, Oil and other Hazardous Substances:** Fuel, oils and other hazardous substances entering the downstream watercourse via storm water run-off.	Water Quality	Vehicles and machinery my leak oil which can accumulate in storm water run-off generated on the construction site and enter the watercourse downstream. Additionally, stored fuels, oils and other hazardous substances may leak from storage areas and enter the downstream watercourse via storm water run-off.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	Medium	-All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourses and the associated buffer zones, unless such storage is unavoidable and approved by the ECO. Where these items are stored within 100m from the full extent of the watercourse, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. -All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourses and the associated buffer zones. -The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited to) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. -No cement mixing is to take place in the watercourse or the associated buffer zones. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in readymix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
4	**Operation Phase**	**Increased Hardened Surfaces in the Local Catchment due to substation and access road:** With the development of the Substation and Associated Infrastructure, there will an increase in hard impermeable surfaces which will affect catchment level dynamics including surface roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site. -Additionally, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the wetland thereby, also preventing possible associated erosion impacts.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during operation. Change to hydrology of the watercourse during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required (preferably surrounding the substation and access roads) to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)

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Appendix 6H

Terrestrial Ecology Assessment

Ecology Assessment

Umsobomvu Solar PV Energy Facilities near Noupoort in the Northern Cape Province and Middelburg in the Eastern Cape Province

David Hoare Consulting (Pty) Ltd

David Hoare
Consulting (Pty) Ltd

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0040

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Lynnwood Manor
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Ecological Scoping study on the potential impacts of the proposed Umsobomvu Solar PV Energy Facilities near Noupoort in the Northern Cape Province and Middelburg in the Eastern Cape Province.

Location:
Umsobomvu Local Municipality within the Pixley ka Seme District Municipality, and Inxuba Yethemba Local Municipality within the Chris Hani District Municipality

for

SiVEST Environmental Division
P O Box 2921,
Rivonia. 2128

on behalf of

Mooi Plaats Solar Power (Pty) Ltd / Wonderheuvel Solar Power (Pty) Ltd / Paarde Valley Solar Power (Pty) Ltd

20 November 2019

Report version: 3rd draft

Details of specialist consultant

Company name	David Hoare Consulting (Pty) Ltd
Registration no.:	CK2017/308639/07
Address	Postnet Suite #116 Private Bag X025 Lynnwood Ridge 0040
Contact person	Dr David Hoare
Contact details	Cell: 083 284 5111 Email: dhoare@lantic.net
Qualifications	PhD Botany (Nelson Mandela Metropolitan University MSc Botany (University of Pretoria) BSc (Hons) Botany (Rhodes University) BSc Botany, Zoology (Rhodes University)

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EXECUTIVE SUMMARY

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd appointed SiVEST SA (Pty) Ltd as the Environmental Assessment Practitioners (EAP) to undertake the required Environmental Impact Assessment (EIA) process for the proposed Umsobomvu Solar PV Energy Facilities, which includes three separate projects (Paarde Valley, Wonderheuwel and Mooi Plaats). Dr David Hoare of David Hoare Consulting (Pty) Ltd was commissioned by SiVEST Environmental Division to provide specialist biodiversity consulting services for the EIAs for the three proposed projects. The consulting services comprise an assessment of potential impacts on the general ecology in the study area by the three proposed projects. The study excludes Avifauna and Invertebrates. This report provides details of the results of the ecology Scoping study, based on a desktop assessment of the study area, mapping from aerial imagery and a site visit. The study area for the three projects is located on several farms that are situated near to Noupoort and Middelburg, located on the boundary between the Eastern and Northern Cape Provinces.

The first section of the report provides an outline of the Terms of Reference for the study, Limitations, Asumptions and Uncertainties, a list of acronyms, abbreviations and a short glossary, and a table indicating compliance with Appendix 6 of the EIA Regulations. This is followed by an introduction to the project and a description of layout alternatives for each of the three projects.

The following section provides an outline of the methodology used to undertake the ecology assessment. This includes the approach taken to assess the sensitivity of the three sites and a summary of the background information used to undertake the assessments. Background information includes electronic databases with species information, Red Data Lists, published field guides and National and Provincial legislation, specifically regulations with published lists of species and/or ecosystems.

The next section of the report provides details on legislation that applies to development of the sites with respect to the ecological receiving environment. There are various Acts that limit development or require permits before development can proceed. The most important of these are permits required in terms of protected species that could potentially occur on site, including the National Environmental Management: Biodiversity Act, the Northern Cape Nature Conservation Act and the National Forests Act.

The next section provides a description of the ecological receiving environment, including details on the location of the three sites, the regional vegetation patterns, local habitat patterns occurring on the sites, lists of plant and animal species of concern that are likely to occur there and a list of species that were observed on site during the site visit. Based on the similarity of the sites to one another and the fact that they border upon one another as well as share some infrastructure components, the description of biodiversity applies identically to all three sites, except where it is specifically indicated otherwise. Details of this section are summarised as follows:

1. The study area (including all three sites together) is situated in an area that is on the boundary between relatively flat plains and a low mountain range with moderately to steeply sloping topography. Habitat on site is in a largely natural state and is in a rural environment. There is very little transformation or serious degradation on site.
2. There are two regional vegetation types occurring in the project study area, Eastern Upper Karoo (most of the area), and Besemkaree Koppies Shrubland (mountain areas). There are three other national vegetation types in the vicinity, namely Southern Karoo Riviere, Tarkastad Montane Shrubland and Karoo Escarpment Grassland. Floristic components of all five of these units occur in the study area, even though they are not all mapped as occurring within the study area. All these vegetation types are listed in the scientific literature as Least Threatened and none are listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
3. All habitat in the Northern Cape part of the study area is mapped as "Critical Biodiversity Area 2" (CBA2) or "Critical Biodiversity Area 1" (CBA1) in the Provincial Conservation Plan and there are also patches mapped as "Ecological Support Area" (ESA). The remaining natural vegetation on site on the Northern Cape side, therefore has high value for conservation of vegetation in the Province according to the broadscale CBA maps. The Paarde Valley project site is within the Eastern Cape and this therefore does not apply to that project for the

solar array. However, one of the grid connection options for Paarde Valley is across the other two sites in the Northern Cape.

4. Habitats on site were divided into five units, namely “Mountain Vegetation”, “Lowland Plains Vegetation”, “Low Ridges and Koppies”, “Broad Drainage Areas” and “Mountain Stream”. The vegetation on the plains on site was found to be a karroid dwarf shrubland that resembles the description for Eastern Upper Karoo, but the mountain vegetation was a mixed grassy shrubland that appears to be a floristic mix of Besemkaree Koppies Shrubland and Karoo Escarpment Grassland. The mountain vegetation has the highest local diversity and greatest variation in species composition. A map of natural habitats of the study area was produced by mapping from aerial imagery, based on information collected in the field.
5. There are no plant species occurring on site or likely to occur on site that are protected according to the National Environmental Management: Biodiversity Act (Act No 10. Of 2004) (NEM:BA).
6. There are a number of plant species occurring on site that are protected according to the Northern Cape Nature Conservation Act (Act 9 of 2009). It is likely that additional protected species occur there that were not observed during the field survey. None of these are of conservation concern, but a permit is required from the Provincial authorities to destroy them. These are listed in the text in the body of this report.
7. There are no protected tree species that are likely to occur in the study area.
8. A total of 79 mammal species have a geographical distribution that includes the general study area in which the sites are found. Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), the following are considered to have a very high, high or medium probability of occurring on site, based on habitat suitability and evidence collected in the field: the Black-footed Cat (Vulnerable), the Cape Clawless Otter (Near Threatened), the South African Hedgehog (Near Threatened), Grey Rhebok (Near Threatened), White-tailed Rat (Vulnerable), and the Spectacled Dormouse (Near Threatened). There is strong evidence to suggest that the Black-footed Cat and the Cape Clawless Otter both definitely occur on site.
9. The study area contains habitat that is suitable for a small number of frog species. One protected frog species, the Giant Bullfrog, could potentially occur on site.
10. A total of 55 reptile species have a geographical distribution that includes the general study area in which the sites are found. No reptile species of conservation concern could potentially occur in the study area.
11. A preliminary sensitivity map of the study area (including all three sites) was produced that identifies areas of higher sensitivity that should be taken into account during activities on site. This includes drainage areas and associated wetland-related habitat, low ridges, parts of the mountain area, and CBA1 and CBA2 areas.

The section of the report following the above identifies a number of potential impacts for the three proposed projects, including direct and indirect impacts for the construction, operation and decommissioning phases of the project, as well as cumulative impacts taken together with similar projects in the region. These are described and assessed. The preliminary assessment of impacts indicates that all impacts are of low significance or can be reduced to low significance with mitigation, with the exception of loss of natural vegetation, for which the impact remains of medium significance after mitigation. The assessed impacts were found to be the same for all three projects.

The next section of the report provides some possible mitigation measures for managing potential impacts related to this project. Proposed mitigation measures include the following: shifting infrastructure positions to avoid sensitive habitats, select infrastructure options that cause the least amount of damage to natural habitats, cross watercourses at right angles, install appropriate structures at watercourse crossings to minimise impacts on these systems, minimise vegetation clearing and disturbance, formalise a rehabilitation programme, undertaking a pre-construction botanical walk-through survey of the footprint of the selected options, obtaining permits for any protected species that may be affected, undertaking a search and rescue of plants for which it is appropriate to rescue, compile an alien plant management plan and undertaking regular monitoring.

The report concludes that there are some sensitivities in the study area related to natural habitat and to individual species, but that these can be minimised or avoided with the application of appropriate mitigation or management measures. There will be residual impacts, primarily on natural habitat, but the amount of habitat that will be lost to the project is insignificant compared to the area in hectares of the regional vegetation type that occurs on site and therefore the residual impacts are considered acceptable, on condition local sensitivities of biodiversity importance are avoided. On this basis it is recommended that the project be authorised.

The report includes a comprehensive list of Appendices containing lists of species and species of concern with a geographical distribution that includes the site as well as lists of species protected according to National legislation.

SPECIALISTS DECLARATION

I, David Hoare as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- act as the independent specialist in this application;
- 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;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- 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;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- 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;
- 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;
- 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
- 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 specialist: DHoare

Name of specialist: Dr D B Hoare

Date: 12 November 2019

TERMS OF REFERENCE

The study was to adhere to the following:

- A field investigation to survey the study area and six (6) PV sites and associated grid corridors;
- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.
- Adherence to all best practice guidelines, relevant legislation and authority requirements.
- Identification of sensitive areas to be avoided (including providing shapefiles/kmls).
- Separate assessment and impact significance ratings for each phase of the six (6) proposed PV developments, noting the impacts during the Pre-construction, Construction, Operation, and Decommissioning Phases (according to SiVEST's impact rating methodology).
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered).
- Assessment of the significance of the cumulative impacts (according to SiVEST's impact rating methodology).
- Comparative assessment of alternatives to be provided for each of the six (6) phases and grid connection.
- Recommend mitigation measures in order to minimise the impact of the proposed development and note any specific mitigation measures for a particular phase; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc).

LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the Umsombomvu site:

- The assessment is based on a single reconnaissance site visit from 4-8 February 2019. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was not adequate for describing seasonal floristic patterns on site in detail, but is adequate for understanding general patterns across affected areas. If necessary, additional surveys will be recommended to compenstate for any short-coming related to this.
- The vegetation was in reasonably good condition for sampling at the time of the field assessment, although extensive parts of the mountainous areas had been burnt prior to the field survey and could not be adequately sampled. Nevertheless, there are few limitations with regards to the vegetation sampling of the lowland areas and the species lists obtained for these areas is considered reliable and relatively comprehensive.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints, this was not possible for this study.
- Rare and threatened plant and animal species are, by their nature, usually very difficult to locate and can be easily missed.
- The faunal component of the study relies primarily on existing information, as available in various spatial databases and published accounts. These databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many remote areas have not been well sampled with the result that the species lists for an area do not always adequately reflect the actual fauna and flora present at the site. In order to counter the likelihood that the area has not been well sampled in the past and in order ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study area and are likely to include a much wider array of species than actually occur at the site. The study excludes Bats, Avifauna, Aquatic Ecology and Invertebrates.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments of a similar nature that are within a 50 km radius of the site.

ACRONYMS

AIS	Alien and Invasive species
CBA	Critical Biodiversity Area
CBD	Convention on Biological Diversity
CEPF	Critical Ecosystem Partnership Fund
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographical Information System
I&AP	Interested and Affected Party
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
NBA	National Biodiversity Assessment
NBSAP	National Biodiversity Strategy Action Plan
NC	Northern Cape province
NCNCA	Northern Cape Nature Conservation Act
NDP	National Development Plan
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Areas
PA	Protected Area
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SCC	Species of Conservation Concern
SEA	Strategic Environmental Assessment
ToPS	Threatened and Protected Species
ToR	Terms of Reference

ABBREVIATIONS

%	Percentage
MW	Megawatt
kV	Kilovolt
cm	Centimetres
m	Metres
km	Kilometres

GLOSSARY

Definitions	
Alternative	Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.
Biodiversity	The diversity of genes, species and ecosystems, and the ecological and evolutionary processes that maintain that diversity.
Biodiversity offset	Conservation measures designed to remedy the residual negative impacts of development on biodiversity and ecological infrastructure, once the first three levels of the mitigation hierarchy have been explicitly considered (i.e. to avoid, minimize and rehabilitate / restore impacts). Offsets are the last resort form of mitigation, only to be implemented if nothing else can mitigate the impact.
Biodiversity priority areas	Features in the landscape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. These are identified using a systematic spatial biodiversity planning process and include the following categories: Protected Areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas, Ecological Support Areas, and Focus Areas for land-based Protected Area expansion.
Category 1a Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as a species that must be combatted or eradicated. These species are contained in Notice 3 of the AIS list, which is referred to as the National List of Invasive Species. Landowners are obliged to take immediate steps to control Category 1a species.
Category 1b Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as species that must be controlled or 'contained'. These species are contained in Notice 3 of the AIS list, which is referred to as the National List of Invasive Species. However, where an Invasive Species Management Programme has been developed for a Category 1b species, then landowners are obliged to "control" the species in accordance with the requirements of that programme.
Category 2 Listed Invasive Species	Species which require a permit to carry out a restricted activity e.g. cultivation within an area specified in the Notice or an area specified in the permit, as the case may be. Category 2 includes plant species that have economic, recreational, aesthetic or other valued properties, notwithstanding their invasiveness. It is important to note that a Category 2 species that falls outside the demarcated area specified in the permit, becomes a Category 1b invasive species. Permit-holders must take all the necessary steps to prevent the escape and spread of the species.
Category 3 Listed Invasive Species	A species listed by notice in terms of section 70(1)(a) of the act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the act, as specified in the notice. Category 3 species are less-transforming invasive species which are regulated by activity. The principal focus with these species is to ensure that they are not introduced, sold or transported. However, Category 3 plant species are automatically Category 1b species within riparian and wetland areas.
CBA Maps	A map of Critical Biodiversity Areas and Ecological Support Areas based on a systematic biodiversity plan.
Connectivity	The spatial continuity of a habitat or land cover type across a landscape.
Corridor	A relatively narrow strip of a particular type that differs from the areas adjacent on both sides.
Critical Biodiversity Areas	Areas required to meet biodiversity targets of representivity and persistence for ecosystems, species and ecological processes, determined by a systematic conservation plan. They may be terrestrial or aquatic, and are mostly in a good ecological state. These areas need to be maintained in a natural or near-natural state, and a loss or degradation must be avoided. If these areas were to be modified, biodiversity targets could not be met.
Cumulative impact	Past, current and reasonably foreseeable future impacts of an activity, considered together with the impact of the proposed activity, that in itself may not be significant, but may become

	significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.
Ecological consition	An assessment of the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference consition of natural.
Ecological infrastructure	Naturally functioning ecosystems that generate or deliver valuable ecosystem services, e.g. mountain catchment areas, wetlands, and soils.
Ecological process	The functions and processes that operate to maintain and generate biodiversity.
Ecological Support Areas	An area that must be maintained in at least fair ecological condition in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or necessary to meet them in natural or near natural areas. It is one of five broad categories on a CBA map, and a subset of biodiversity priority areas.
Ecosystem resilience	The ability of an ecosystem to maintain its functions (biological, chemical, and physical) in the face of disturbance or to recover from external pressures.
Ecosystem threshold	The tipping point where ongoing disturbance or change results in an irreversible change in its composition, structure and functioning. Surpassing ecosystem thresholds diminishes the quality and quantity of ecosystem services provided, rapidly reduces the ability of the ecosystem to sustain life, and results in less resilient ecosystems.
Ecosystem services	The benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth.
Edge	The portion of an ecosystem or cover type near its perimeter, and within which environmental conditions may differ from interior locations in the ecosystem.
Endemic	Restricted or exclusive to a particular geographic area and occurring nowhere else. Endemism refers to the occurrence of endemic species.
Exempted Alien Species	An alien species that is not regulated in terms of this statutory framework - as defined in Notice 2 of the AIS List.
Forbs	Herbaceous plants with soft leaves and non-woody stems.
Fragmentation	The breaking up of a habitat or cover type into smaller, disconnected parcels, often associated with, but not equivalent to, habitat loss.
Geophyte	Perennial plants having underground perennating organs, such as bulbs, corms or tubers.
Global Hotspot	An area characterised by high levels of biodiversity and endemism, and that faces significant threats to that biodiversity.
Habitat	The area of an environment occupied by a species or group of species, due to the particular set of environmental conditions that prevail there.
Habitat loss	Conversion of natural habitat in an ecosystem to a land use or land cover class that results in irreversible change to the composition, structure and functional characteristics of the ecosystem concerned.
Keystone species	A species that has a disproportionately large effect on its environment relative to its abundance.
Prohibited Alien Species	An alien species listed by notice by the Minister, in respect of which a permit may not be issued as contemplated in section 67(1) of the act. These species are contained in Notice 4 of the AIS List, which is referred to as the List of Prohibited Alien Species.
Mitigate	The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.
"No-Go" option	The “no-go” development alternative option assumes the site remains in its current state, i.e. there is no construction of a WEF and associated infrastructure in the proposed project area.
Patch	A surface area that differs from its surroundings in nature or appearance.
Red List	A publication that provides information on the conservation and threat status of species, based on scientific conservation assessments.
Rehabilitation	Less than full restoration of an ecosystem to its predisturbance condition.
Restoration	To return a site to an approximation of its condition before alteration.
Riparian	The land adjacent to a river or stream that is, at least periodically, influenced by flooding.
Runoff	Non-channelized surface water flow.

Succulent	Plants that have some parts that are more than normally thickened and fleshy, usually to retain water in arid climates or soil conditions.
Species of special / conservation concern	Species that have particular ecological, economic or cultural significance, including but not limited to threatened species.
Systematic biodiversity conservation planning	Scientific methodology for determining areas of biodiversity importance involving: mapping biodiversity features (such as ecosystems, species, spatial components of ecological processes); mapping a range of information related to these biodiversity features and their condition (such as patterns of land and resource use, existing protected areas); setting quantitative targets for biodiversity features, analysing the information using GIS; and developing maps that show spatial biodiversity priorities. Systematic biodiversity planning is often called 'systematic conservation planning' in the scientific literature.
Threatened ecosystems	An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on analysis of ecosystem threat status. A threatened ecosystem has lost, or is losing, vital aspects of its structure, composition or function. The Biodiversity Act makes provision for the Minister or Environmental Affairs, or a provincial MEC of Environmental Affairs, to publish a list of threatened ecosystems.
Threatened species	A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

COMPLIANCE WITH APPENDIX 6 OF THE EIA REGULATIONS AND AMENDMENTS

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		**Clause**	**Section in Report**
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Page ii
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Appendix 8
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Page viii
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Page ix
	(cA)	An indication of the quality and age of base data used for the specialist report;	Page 23
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Page 33
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Page 26-27
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	Page 22-27
	(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;	Page 57-59
	(g)	An indication of any areas to be avoided, including buffers;	Page 59
	(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;	Pages 81, 84 & 87
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Page x
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Page 60-74
	(k)	Any mitigation measures for inclusion in the EMPr;	Page 69-70
	(l)	Any conditions for inclusion in the environmental authorization;	Page 72
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Page 72

	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Page 71-72
		(iA) regarding the acceptability of the proposed activity or activities; and	Page 71-72
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Page 69-70
	(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
	(q)	Any other information requested by the authority.	N/A
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Background

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd appointed SiVEST SA (Pty) Ltd as the Environmental Assessment Practitioners (EAP) to undertake the required Environmental Impact Assessment (EIA) process for the proposed Umsobomvu Solar PV Energy Facilities. On 11 January 2019 David Hoare Consulting (Pty) Ltd was commissioned by SiVEST Environmental Division to provide specialist Terrestrial Ecology consulting services for the EIA for the proposed project. The proposed facility is situated near to Noupoort and Middelburg, located in the Northern and Eastern Cape Provinces, on the border between the two Provinces. The consulting services comprise an assessment of potential impacts on the general ecology in the study area by the proposed project. The study excludes Bats, Avifauna, Aquatic Ecology and Invertebrates.

Project description

It is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, will be developed, these being:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303ha, comprising the following farm portions:
  - Portion 1 of Leuwe Kop No 120
  - Remainder of Mooiplaats No 121

- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652ha, comprising the following farm portions:
  - Remainder of Mooiplaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133

- ***Paarde Valley Solar PV Facility***, on an application site of approximately 3 695ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62
  - Portion 7 of the Farm Leeuw Hoek No. 61

Solar PV Components

<u>Mooi Plaats Solar PV Energy Facility:</u>

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.

- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.

- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each PV facility, each occupying an area of up to 4ha.
- A new 132kV overhead power line connecting the on-site substations or collector substations to either Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

<u>Mooi Plaats Solar PV Grid Connection:</u>

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

<u>OPTION 1:</u>

- **Corridor Option 1a** - links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b** - links Substation 2 and Substation 1b to the Hydra D MTS.

<u>OPTION 2:</u>

- **Corridor Option 2a** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b** - links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

<u>Wonderheuvel Solar PV Grid Connection:</u>

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

<u>OPTION 1:</u>

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.

ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

<u>OPTION 2:</u>

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2c** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

- **Corridor Option 2d** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

<u>OPTION 3:</u>

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

<u>Paarde Valley Solar PV Grid Connection:</u>

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

<u>OPTION 1:</u>

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

No-Go alternative

The no development alternative option assumes the site remains in its current state, i.e. there is no construction of a Solar PV Facility and associated infrastructure in the proposed project area and the status quo would prevail.

APPROACH & METHODOLOGY

The study commenced as a desktop-study followed by a site-specific field study from the 4th – 8th February 2019. This report provides a Scoping level description of the site and assessment of the proposed project from and ecology perspective. The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on the site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

1. threatened plant species;
2. protected trees; and
3. threatened animal species.

Ecosystems

1. threatened ecosystems;
2. protected ecosystems;
3. critical biodiversity areas;
4. areas of high biodiversity; and
5. centres of endemism.

Processes

1. corridors;
2. mega-conservancy networks;
3. rivers and wetlands; and
4. important topographical features.

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998); and
2. National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004).

Species of conservation concern

There are two types of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

Red List plant species
Determining the conservation status of a species is required to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the International Union for Conservation of Nature (IUCN) Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo *et al*., 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (http://redlist.sanbi.org/). According to the website of the Red List of Southern African Plants (http://redlist.sanbi.org/), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: http://www.iucnredlist.org*. The South African assessment is used in this study.

The purpose of listing Red List species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.

Protected trees
Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

Other protected species
National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

- National Environmental Management: Biodiversity Act (Act No 10 of 2004); and
- Northern Cape Nature Conservation Act (Act No. 9 of 2009).

This legislation contains lists of species that are protected. These lists were used to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, if it is possible that they could occur on site, this was stated.

Red List animal species

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem *et al*., 2010). The likelihood of any of them occurring was evaluated based on habitat preference and habitats available within the study area. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

Mammal threat status is according to Child et al. (2016), reptile threat status is according to Bates et al. 2014, and amphibian threat status is according to Minter et al. (2004).

Species probability of occurrence

Some species of plants may be cryptic, difficult to find, rare, ephemeral or generally not easy to identify while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected flora that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- <u>LOW</u>: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- <u>MEDIUM</u>: habitats on site match general habitat description for species (e.g. karoo shrubland), but detailed microhabitat requirements (e.g. mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- <u>HIGH</u>: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain shrubland on shallow soils overlying sandstone);
- <u>DEFINITE</u>: species found in habitats on site.

Habitat sensitivity

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks *et al*., 2000) using available satellite imagery and aerial photography. From this, it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

<table>
<tr><th>Sensitivity</th><th>Factors contributing to sensitivity</th><th>Example of qualifying features</th></tr>
<tr><td>VERY HIGH</td><td>Indigenous natural areas that are highly positive for <u>any</u> of the following:
presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species.
<u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk).
<u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)
And may also be positive for the following:
<u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique ecosystems)
<u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value)
<u>Low</u> ability to respond to disturbance (low resilience, dominant species very old).</td><td>CBA 1 areas.
Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable.
Protected forest patches.
Confirmed presence of populations of threatened species.</td></tr>
<tr><td>HIGH</td><td>Indigenous natural areas that are positive for any of the following:
<u>High</u> intrinsic biodiversity value (<u>moderate/high</u> species richness and/or turnover).
presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species).
<u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age).
<u>Moderate</u> conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk).
<u>Moderate to high</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).
And may also be positive for the following:
<u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)</td><td>CBA 2 “critical biodiversity areas”.
Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records).
Confirmed habitat for species of lower threat status (near threatened, rare).
Habitat containing individuals of extreme age.
Habitat with low ability to recover from disturbance.
Habitat with exceptionally high diversity (richness or turnover).
Habitat with unique species composition and narrow distribution.
Ecosystem providing high value ecosystem goods and services.</td></tr>
<tr><td>MEDIUM-HIGH</td><td>Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above, but not a combination of factors.</td><td>CBA 2 “corridor areas”.</td></tr>
</table>

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
		• Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	• Natural habitat with no specific sensitivities.
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	• Highly degraded areas or highly disturbed areas in which the original species composition has been lost.
LOW	No natural habitat remaining.	• Transformed areas.

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

Field surveys

The study area was visited and assessed to confirm patterns identified from the desktop assessment. One site visit was undertaken on 4th – 8th February 2019. The site visit was undertaken at the height of the summer growing season. Vegetation was in a moderate state, although affected by a multi-year drought. Many plant species could be identified, and habitats were generally in a good state to assess. This means that botanical diversity and species composition were possible to assess.

Specific features of potential concern were investigated in the field, including the following:

- General vegetation status, i.e. whether the vegetation was natural, disturbed/secondary or transformed;
- Presence of habitats of conservation concern in terms of high biodiversity, presence of SCC, specific sensitivities, e.g. wetlands, and any other factors that would indicate an elevated biodiversity or functional value that could not be determined from the desktop assessment;

- Presence of protected trees; and
- Potential presence of SCC, including observation of individual plants found on site or habitats that are suitable for any of the species identified from the desktop assessment.

Key parts of the development site were visited during the reconnaissance site visit in such a way as to ensure all major variation was covered and that any unusual habitats or features were observed. A preliminary checklist of species occurring on site was collected during the survey (Appendix 3, highlighted in green). Plant names follow Germishuizen *et al*. (2005). The season of the survey was favourable, and it there is high confidence that many of species present on site were identifiable at the time of the survey. The survey was of adequate duration and intensity to characterise the flora of the development site as per the regulations.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Convention on Biodiversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

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

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by DEA but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied." ,
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

This report considers the Environmental Impact Assessment (EIA) Regulations of 2014 (NEMA, 2014) as amended in 2017 (NEMA, 2017), under the National Environmental Management Act, (Act No. 107 of 1998). According to these Regulations under Listing Notice 1 (GRN No. 327), Listing Notice 2 (GRN No 325) and Listing Notice 3 (GRN No 324), the activities listed are identified as activities that may require Environmental Authorisation prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of the Act.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

As the principal national act regulating biodiversity protection, NEM:BA, which is administered by DEA, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term biodiversity according to the Convention on Biodiversity (CBD) refers to the variability among living organisms from all sources including, inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Alien and Invasive Species

Chapter 5 of NEM:BA relates to species and organisms posing a potential threat to biodiversity. The Act defines alien species and provides lists of invasive species in regulations. The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEM:BA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEM:BA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEM:BA, 2016).

According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. The purpose of Chapter 5 is:

a) to prevent the unauthorized introduction and spread of alien species and invasive species to ecosystems and habitats where they do not naturally occur;
b) to manage and control alien species and invasive species to prevent or minimize harm to the environment and to biodiversity in particular;
c) to eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

According to Section 65 of the Act, "Restricted activities involving alien species":

1) A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7. Restricted activities include the following:
    a. Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
    b. Having in possession or exercising physical control over any specimen of a listed invasive species.
    c. Growing, breeding or in any other way propagating any specimen of a listed invasive species, or causing it to multiply.
    d. Conveying, moving or otherwise translocating any specimen of a listed invasive species.
    e. Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any other way acquiring or disposing of any specimen of a listed invasive species.
    f. Spreading or allowing the spread of any specimen of a listed invasive species.
    g. Releasing any specimen of a listed invasive species.
    h. Additional activities that apply to aquatic species.

2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.
3)

An "**alien species**" is defined in the Act as:

a) a species that is not an indigenous species; or
b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by means of migration or dispersal without human intervention.

According to Section 71 of the Act, "Restricted activities involving listed invasive species":

1) A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.
2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**invasive species**" is defined in the Act as any species whose establishment and spread outside of its natural distribution range:

a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
b) may result in economic or environmental harm or harm to human health.

A "**listed invasive species**" is defined in the Act as any invasive species listed in terms of section 70(1).

According to Section 73 of the Act, "Duty of care relating to listed invasive species":

2) A person who is the owner of land on which a listed invasive species occurs must-
    a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
    b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
    c) take all the required steps to prevent or minimize harm to biodiversity.

According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The EIA Regulations (2014, as amended) include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (GNR. 327 of 2014, as amended),
- Listing Notice 2: activities that require a full environmental impact assessment report (EIR) (GNR. 325 of 2014, as amended),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (GNR. 324 of 2014, as amended).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List
Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy
Published under the National Environmental Management Act (Act No. 107 of 1998). The aim of the Policy is to ensure that significant residual impacts of developments are remedied as required by NEMA, thereby ensuring sustainable development as required by section 24 of the Constitution of the Republic of South Africa, 1996. This policy should be taken into consideration with every development application that still has significant residual impact after the Mitigation Sequence has been followed. The mitigation sequence entails the consecutive application of avoiding or preventing loss, then at minimizing or mitigating what cannot be avoided, rehabilitating where possible and, as a last resort, offsetting the residual impact. The Policy specifies that one impact that has come across consistently as unmitigatable is the rapid and consistent transformation of certain ecosystems and vegetation types, leading to the loss of ecosystems and extinction of species. The Policy specifically targets ecosystems where the ability to reach protected area targets is lost or close to being lost. However, the Policy states that "*[w]here ecosystems remain largely untransformed, intact and functional, an offset would not be required for developments that lead to transformation, provided they have not been identified as a biodiversity priority*". Biodivesity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance. Residual impacts of 'very high' significance are a fatal flaw for development and residual biodiversity impacts of 'low' significance would usually not require offsets. The Policy indicates that impacts should preferably be avoided in protected areas, CBAs, verified wetland and river features and areas earmarked for protected area expansion.

National Forests Act (Act no 84 of 1998)

Protected trees
According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests
Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Water Act (Act 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

Northern Cape Nature Conservation Act, No. 9 of 2009

This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project:

- Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;
- Aquatic habitats may not be destroyed or damaged;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

The Act provides lists of protected species for the Province. According to Northern Cape Nature Conservation officials, a permit is required for the removal of any species on this list.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Lake Areas Development Act (Act No. 39 of 1975)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- Integrated Coastal Zone Management Act (Act No. 24 of 2008)

DESCRIPTION OF STUDY AREA

Location

The combined projects (Mooiplaats, Paarde Valley and Wonderheuwel) are located 20 km south-west of Noupoort and 30 km north-west of Middelburg, straddling the border between the Eastern and Northern Cape Provinces, South Africa (Figure 1). The proposed facilities are located within the Umsobomvu Local Municipality within the Pixley ka Seme District Municipality, and Inxuba Yethemba Local Municipality within the Chris Hani District Municipality. The N10 national road from Port Elizabeth to Upington passes along the northern border of the combined site. A farm access road from the N10 passes through the combined site. The combined site (study area) is in the quarter degree grids 3124BC, and BD, between 31°15’47.9” S and 31°27’24.3 S latitude, and between 24°37’57.7 E and 24°49’30.8 E longitude.

Site conditions

The entire study area is largely in a natural state, but used for animal production. There is well-established farm infrastructure on each land holding, including homesteads, farm buildings, camps, dams, small areas of cultivated lands, and some stands of exotic trees used as shade and wind-screens. There are also access roads, narrow gravel roads, jeep tracks and fences. The vegetation in the study area is used primarily for livestock grazing and is affected to some degree by this useage, but not to the extent that any severe degradation was noted on site. With the exception of this

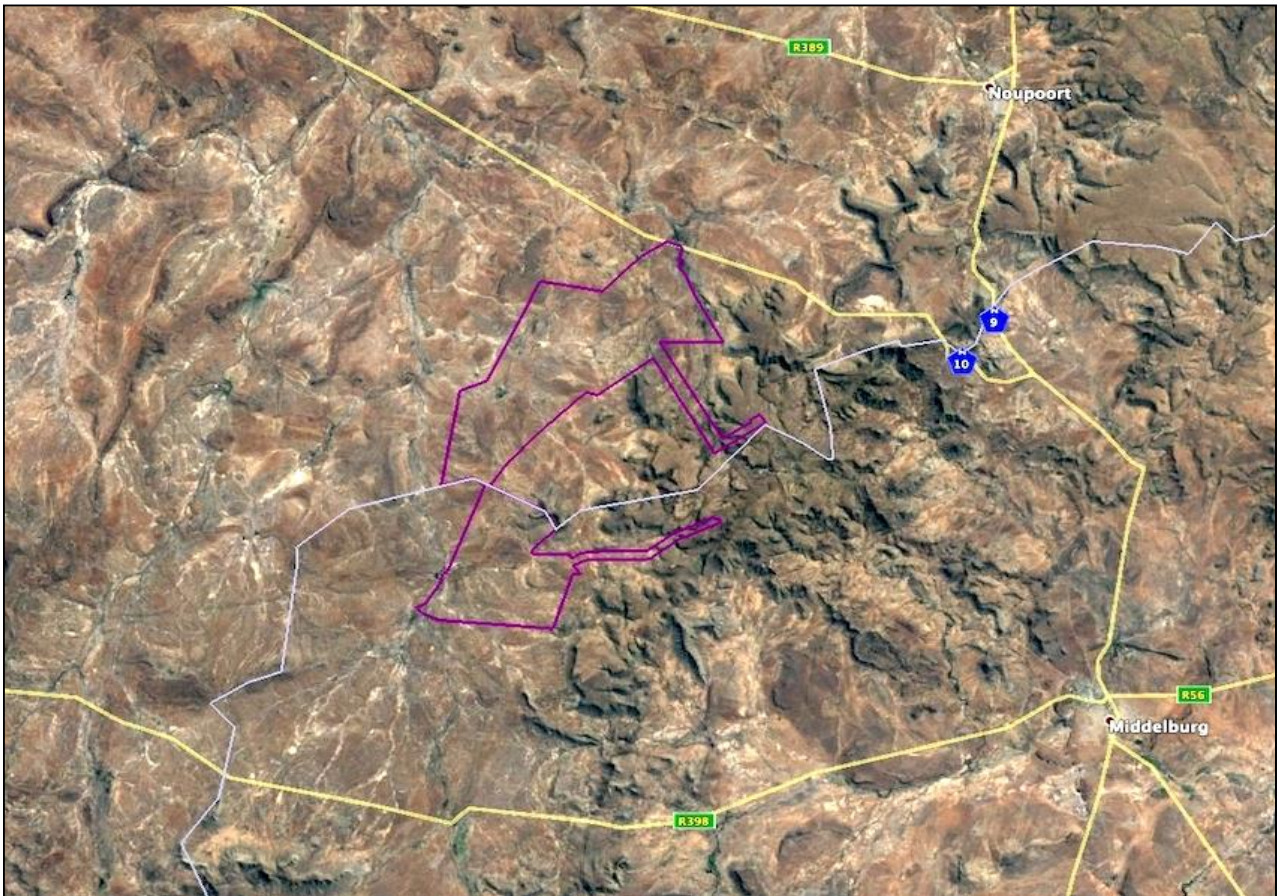

Figure 1: Location of the study area (Mooiplaats, Paarde Valley and Wonderheuwel).

infrastructure, the vegetation and habitats in the study area appear to be largely in a natural state and reflecting what would be expected according to the natural relationship between the physical environment and the vegetation. This natural pattern extends beyond the study area in all directions and gives the general area a sense of being relatively untransformed and largely natural.

Topography and drainage

The study area is situated in an area along the boundary between plains and mountain ranges, with moderately to steeply sloping topography in the south-eastern parts, and relatively flat to undulating terrain in the remainder of the area (Figure 2).

The elevation on site varies from 1430 to 1855 m above sea level, an elevation difference of approximately 425 m across a distance of around 15,0 km. The mountains rise fairly steeply from the surrounding plains resulting in much steeper gradients along this interface. The mountain areas are incised by steep valleys and are dissected and variable in topography. The plains are relatively flat to undulating, but with regular low ridges and koppies to break the landscape, some isolated and others linked into long, low ridges.

The study area is drained by several dry drainage valleys, most of which drain eventually towards the north-west. The dry stream beds on site coalesce into the Klein Seekoeirivier that runs northwards out of the study area.

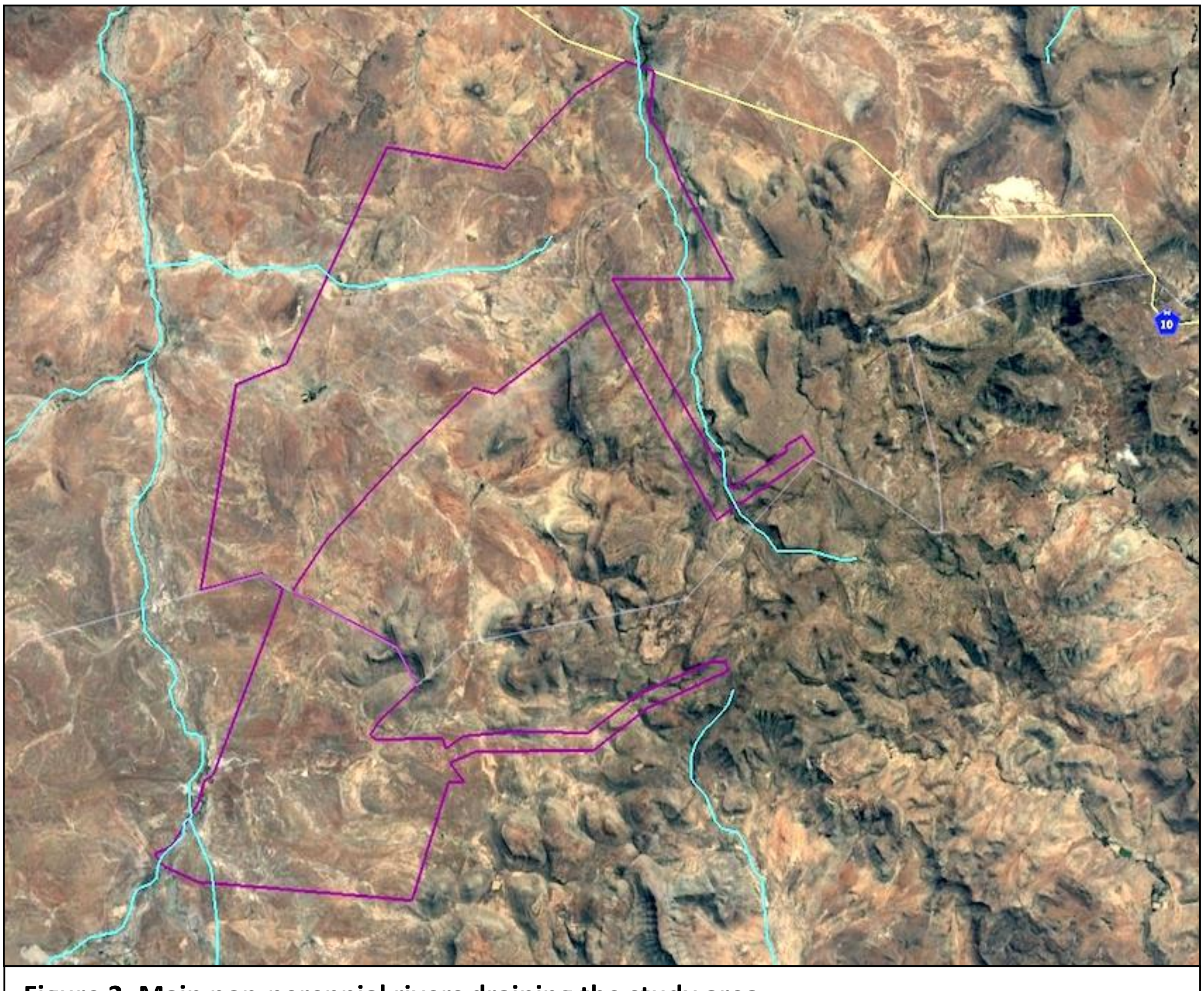

Figure 2: Main non-perennial rivers draining the study area.

Soils

Detailed soil information is not available for broad areas of the country. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). The landtypes described below provide a generalized description of soils on site that may differ in detail from site-specific patterns, but not in overall trends. There are three land types in the study area. These are the Fb and Ib landtypes in the mountains, and the Da landtype in the remainder of the study area (Land Type Survey Staff, 1987).

The F-group of landtypes accommodates pedologically young landscapes that are not predominantly rock and not predominantly alluvial or aeolian, and in which the dominant soil-forming processes include rock weathering, the formation of orthic topsoil horizons and commonly, clay illuviation, giving rise typically to lithocutanic horizons. The Fb landtype refers to land where the soils are shallow and/or rocky, often on steep slopes. The soils are slightly leached and there is usually lime in some of the bottomlands. The Ib landtype indicates areas with exposed rock (exposed country rock, stones or boulders) covering 60 – 80% of the area.

The D-group of land types refers to lands where prismacutanic, pedocutanic and/or gleycutanic diagnostic horizons (duplex soils – sandier topsoil abruptly overlying more clayey subsoil) are common (MacVicar *et al*., 1974). Unit Da refers to land in which duplex soils with red B-horizons comprise more than half the area covered by duplex soils.

Climate

The study area is within an arid environment with an annual rainfall of around 366 mm per annum. Rainfall can potentially occur at any time of the year, but is more likely in summer to late-summer, most often from October to April. Winters can be cold, with mean minimum temperatures approaching zero in July. Winter frost is common and occurs on average 30 days per year. In contrast, summers can be very hot with mean maximum temperatures in January exceeding 30^{o}C.

Broad vegetation patterns

There are two regional vegetation types occurring in the study area, namely Eastern Upper Karoo (all areas not coloured in Figure 3) and Besemkaree Koppies Shrubland (purple area in Figure 3). The first of these two units (Eastern Upper Karoo) occurs across most of the stiudy area, whereas the second (Besemkaree Koppies Shrubland) is restricted to the mountainous areas and is only affected by small proportions of the proposed infrastructure (mostly the proposed power line corridors). There are three additional units that occur in nearby areas, namely Southern Karoo Riviere, Tarkastad Montane Shrubland and Karoo Escarpment Grassland. It is possible that floristic components and / or plant community patterns related to any of these could extend locally into the study area. This is especially true of Southern Karoo Riviere, which as a unit is only mapped as broad are, but is probably representative of all shallow drainage lines in the study area. The vegetation types that occur in the study area and nearby areas are briefly described below.

Eastern Upper Karoo

Distribution

Found in the Northern Cape, Eastern Cape and Western Cape Provinces: Between Carnarvon and Loxton in the west, De Aar, Petrusville and Venterstad in the north, Burgersdorp, Hofmeyr and Cradock in the east and the Great Escarpment and the Sneeuberge-Coetzeesberge mountain chain in the south. The vegetation type occurs at an altitude of between mostly 1 000–1 700 m.

Vegetation & Landscape Features

The vegetation occurs on flats and gently sloping plains (interspersed with hills and rocky areas of Upper Karoo Hardeveld in the west, Besemkaree Koppies Shrubland in the northeast and Tarkastad Montane Shrubland in the

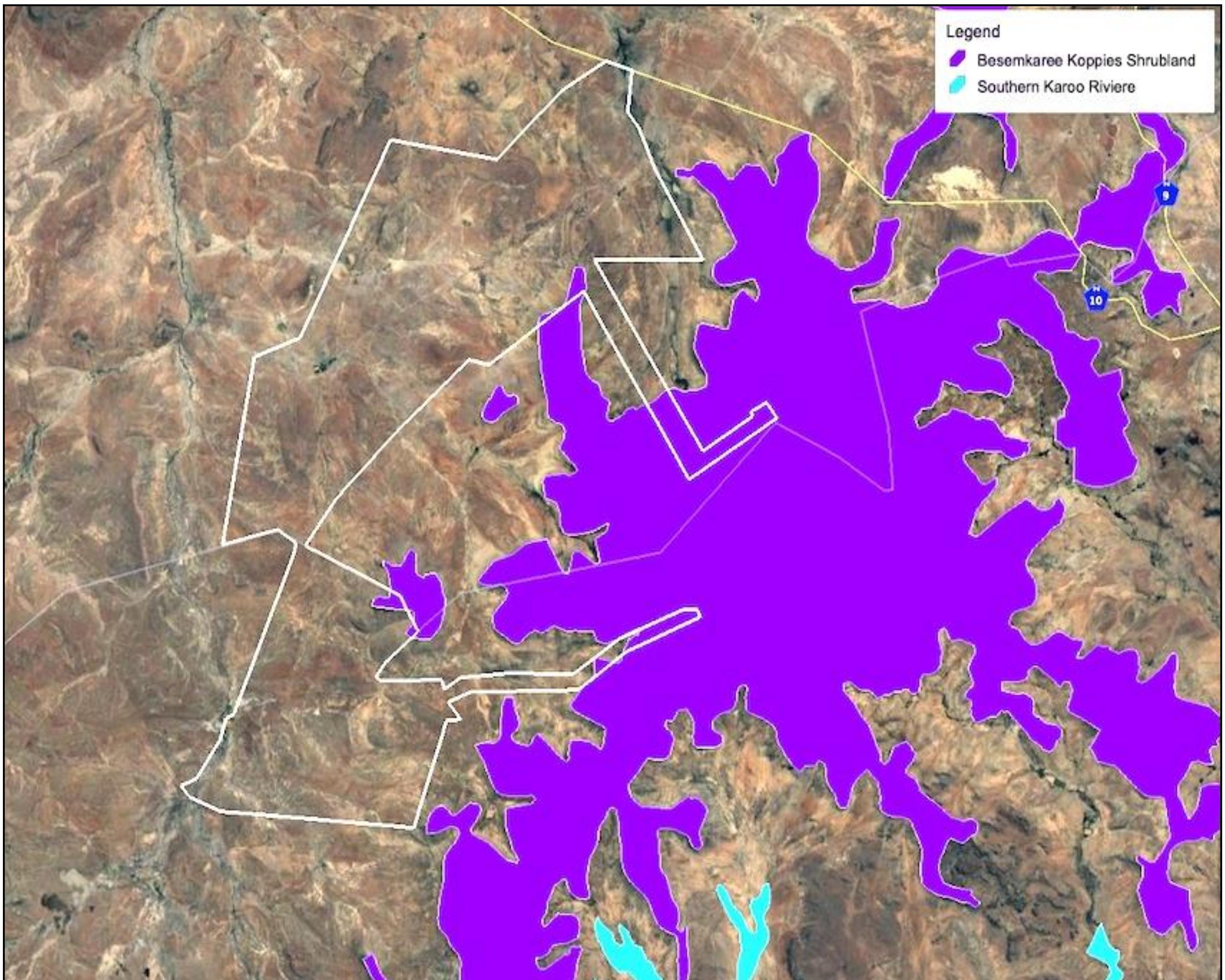

Figure 3: Broad vegetation types of the study area.

southeast), dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains). The grass cover increases along a gradient from southwest
to northeast.

<u>Geology & Soils</u>

Mudstones and sandstones of the Beaufort Group (incl. both Adelaide and Tarkastad Subgroups) supporting duplex soils with prismacutanic and/or pedocutanic diagnostic horizons dominant (Da land type) as well as some shallow Glenrosa and Mispah soils (Fb and Fc land types). In places, less prominent Jurassic dolerites (Karoo Dolerite Suite) are also found.

<u>Climate</u>

Rainfall mainly in autumn and summer, peaking in March. MAP ranges from about 180 mm in the west to 430 mm in the east. Incidence of frost is relatively high, but ranging widely from <30 days (in the lower-altitude Cradock area) to >80 days of frost per year (bordering the Upper Karoo Hardeveld on the Compassberg and mountains immediately to the west). Mean maximum and minimum monthly temperatures in Middelburg (Grootfontein) are 36.1°C and –7.2°C for January and July, respectively. Corresponding values are 37°C and –8°C for Victoria West and 36.6°C and –4.2°C for Hofmeyr. See also climate diagram for NKu 4 Eastern Upper Karoo.

<u>Important Taxa</u>

Succulent Shrubs	*Euphorbia hypogaea*, *Ruschia intricata*.
Tall Shrub	*Lycium cinereum* (d), *L. horridum*, *L. oxycarpum*.
Low Shrubs	*Chrysocoma ciliata* (d), *Eriocephalus ericoides* subsp. *ericoides* (d), *E. spinescens* (d), *Pentzia globosa* (d), *P. incana* (d), *Phymaspermum parvifolium* (d), *Salsola calluna* (d), *Aptosimum procumbens*, *Felicia muricata*, *Gnidia polycephala*, *Helichrysum dregeanum*, *H. lucilioides*, *Limeum aethiopicum*, *Nenax microphylla*, *Osteospermum leptolobum*, *Plinthus karooicus*, *Pteronia glauca*, *Rosenia humilis*, *Selago geniculata*, *S. saxatilis*.
Herbs	*Indigofera alternans*, *Pelargonium minimum*, *Tribulus terrestris*.
Geophytic Herbs	*Moraea pallida* (d), *Moraea polystachya*, *Syringodea bifucata*, *S. concolor*.
Succulent Herbs	*Psilocaulon coriarium*, *Tridentea jucunda, T. virescens*
Graminoids	*Aristida congesta* (d), *A. diffusa* (d), *Cynodon incompletus* (d), *Eragrostis bergiana* (d), *E. bicolor* (d), *E. lehmanniana* (d), *E. obtusa* (d), *Sporobolus fimbriatus* (d), *Stipagrostis ciliata* (d), *Tragus koelerioides* (d), *Aristida adscensionis*, *Chloris virgata*, *Cyperus usitatus*, *Digitaria eriantha*, *Enneapogon desvauxii*, *E. scoparius*, *Eragrostis curvula*, *Fingerhuthia africana*, *Heteropogon contortus*, *Sporobolus ludwigii*, *S. tenellus*, *Stipagrostis obtusa*, *Themeda triandra*, *Tragus berteronianus*

Endemic Taxa

Succulent Shrubs	*Chasmatophyllum rouxii*, *Hertia cluytiifolia*, *Rabiea albinota*, *Salsola tetrandra*
Low Shrub	*Aspalathus acicularis* subsp. *planifolia*, *Selago persimilis*, *S. walpersii*.
Tall Shrub	*Phymaspermum scoparium*

<u>Remarks</u>

This vegetation type has the largest mapped area of all vegetation units in the country, although it is likely that variations occur across the geographical range of the unit. The regions between Colesberg (Northern Cape) and Springfontein (Free State) fall within a broad ecotone where grassy Eastern Upper Karoo grades into Xhariep Karroid Grassland.

Besemkaree Koppies Shrubland

<u>Distribution</u>

Northern Cape, Free State and Eastern Cape Provinces: On plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Extensive dolerite-dominated landscapes along the upper Orange River belong to this unit as well. Extends northwards to around Fauresmith in the northwest and to the Wepener District in the northeast. Altitude 1 120–1 680 m.

<u>Vegetation & Landscape Features</u>

Slopes of koppies, butts and tafelbergs covered by two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs, namely *Rhus erosa*, *R. burchellii*, *R. ciliata*, *Euclea crispa* subsp. *ovata*, *Diospyros austro-africana* and *Olea europaea* subsp. *africana*.

Geology & Soils

Dolerite koppies and sills embedded within Karoo Supergroup sediments. The dolerite dykes and sills are igneous intrusions that are the result of extensive volcanic activity, which accompanied the break-up of Gondwana in the Jurassic. In places the slopes of mesas and butts carrying this vegetation type have a mixed geology where dolerites occur together with sandstones and mudstones of the Ecca and Beaufort Groups. Fb land type covers almost 60% of the area, followed by Ib.

Climate

Due to the large extent of the area, the rainfall pattern differs slightly from west to east. Seasonal summer rainfall prevails when the patches are found embedded within other units of the Grassland Biome, but the southern and southwestern regions show hints of bimodal climate patterns typical of the Nama-Karoo. Far more importantly, despite an overall MAP of almost 400 mm, MAP ranges from about 280 mm in the west (De Aar) to more than double, 580 mm, in the east (Edenburg). Much of the rainfall is of convectional origin. MAT 15°C.

Important Taxa

Small trees	*Cussonia paniculata*, *Ziziphus mucronata*.
Tall shrubs	*Diospyros austro-africana* (d), *Euclea crispa* subsp. *ovata* (d), *Olea europaea* subsp. *africana* (d), *Rhus burchellii* (d), *R. ciliata* (d), *R. erosa* (d), *Buddleja saligna*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Grewia occidentalis*, *Gymnosporia polyacantha*, *Tarchonanthus minor*
Low Shrubs	*Asparagus suaveolens* (d), *Chrysocoma ciliata* (d), *Amphiglossa triflora*, *Aptosimum elongatum*, *Asparagus striatus*, *Diospyros pallens*, *Eriocephalus ericoides*, *E. spinescens*, *Euryops empetrifolius, Felicia filifolia* subsp. *filifolia*, *F. muricata*, *Helichrysum dregeanum*, *H. lucilioides*, *Hermannia multiflora*, *H. vestita*, *Lantana rugosa*, *Limeum aethiopicum*, *Lycium cinereum*, *Melolobium candicans*, *M. microphyllum*, *Nenax microphylla*, *Pegolettia retrofracta*, *Pentzia globosa*, *Rhigozum obovatum*, *Selago saxatilis*, *Stachys linearis*, *S. rugosa*, *Sutera halimifolia*, *Wahlenbergia albens*
Succulent Shrubs	*Aloe broomii*, *Chasmatophyllum musculinum*, *C. verdoorniae*, *Cotyledon orbiculata* var. *dactylopsis*, *Pachypodium succulentum*
Graminoids	*Aristida adscensionis* (d), *A. congesta* (d), *A. diffusa* (d), *Cenchrus ciliaris* (d), *Cymbopogon caesius* (d), *Cynodon incompletus* (d), *Digitaria eriantha* (d), *Eragrostis curvula* (d), *E. lehmanniana* (d), *Heteropogon contortus* (d), *Setaria lindenbergiana* (d), *Themeda triandra* (d), *Tragus koelerioides* (d), *Cymbopogon pospischilii*, *Enneapogon scoparius*, *Eragrostis chloromelas*, *E. obtusa*, *Eustachys paspaloides*, *Fingerhuthia africana*, *Hyparrhenia hirta*, *Sporobolus fimbriatus*
Herbs	*Convolvulus sagittatus*, *Dianthus caespitosus* subsp. *caespitosus*, *Gazania krebsiana* subsp. *krebsiana*, *Hibiscus pusillus*, *Indigofera alternans*, *I. rhytidocarpa*, *Lepidium africanum* subsp. *africanum*, *Pollichia campestris*
Herbaceous Climber	*Argyrolobium lanceolatum*
Geophytic Herbs	*Albuca setosa*, *Asplenium cordatum*, *Cheilanthes bergiana*, *C. eckloniana*, *Freesia andersoniae*, *Haemanthus humilis* subsp. *humilis*, *Oxalis depressa*, *Pellaea calomelanos*
Succulent Herbs	*Aloe grandidentata*, *Crassula nudicaulis*, *Duvalia caespitosa, Euphorbia pulvinata, Huernia piersii, Stapelia grandiflora, S. olivacea, Tridentea gemmiflora*

Endemic Taxa

Succulent Shrubs	*Euphorbia crassipes*, *Neohenricia sibbettii*, *N. spiculata*
Small tree	*Cussonia* sp. nov. (*P.J. du Preez 3666* BLFU).

Remarks

The diversity of the shrub component is lower than in the Gm 5 Basotho Montane Shrubland—a similar shrubland unit occurring on the Drakensberg foothills. The density of shrubs marking the slopes of the koppies decreases along a northeast-southwest gradient. On the southern edges of the distribution area of this unit, shrubs retreat to drainage lines and onto the base of dolerite caps, while the slopes themselves remain covered by dwarf shrublands of the NKu 4 Eastern Upper Karoo. In the northeastern areas which receive a higher rainfall, the sheltered sites have larger trees such as *Rhus lancea* and *Celtis africana*.

Southern Karoo Riviere

Distribution

Western and Eastern Cape Provinces: Alluvia of the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega, and Sundays Rivers and their tributaries), east of Laingsburg as far west as Graaff-Reinet and Jansenville. This vegetation unit is embedded within the Koedoesberge-Moordenaars Karoo, Prince Albert Succulent Karoo, Gamka Karoo, Eastern Lower Karoo, and southern parts of the Eastern Upper Karoo as well as some parts of the Albany Thicket Biome south of Cradock. Altitude ranging from 250–1 550 m.

Vegetation & Landscape Features

Narrow riverine flats supporting a complex of *Acacia karroo* or *Tamarix usneoides* thickets (up to 5 m tall), and fringed by tall *Salsola*-dominated shrubland (up to 1.5 m high), especially on heavier (and salt-laden) soils on very broad alluvia. In sandy drainage lines *Stipagrostis namaquensis* may occasionally also dominate. Mesic thicket forms in the far eastern part of this region (see Van der Walt 1980: Table 4) may also contain *Leucosidea sericea*, *Rhamnus prinoides* and *Ehrharta erecta*.

Geology & Soils

Recent sandy-clayey alluvial deposits rich in salt occurring on mudrocks and sandstones of the Adelaide Subgroup (Beaufort Group of the Karoo Supergroup) that support soils typical of Ia land type. Torrential convectional rains in summer cause sudden flood surges which remodel the riverbed and adjacent alluvium.

Climate

Transitional, bimodal (equinoctial) rainfall patterns with peaks in March (major) and November (minor). Climate is subarid on the whole, with overall MAP of 243 mm (range from 165 mm in the Gamka Karoo basin to 430 mm in the vicinity of Bedford). Overall warm-temperate regime, with MAT of 16.3°C, ranging from 14.6°C (Upper Karoo) to 18.3ºC (upper reaches of Sundays River). Frost occurs frequently in winter.

Important Taxa: Riparian Thickets

Small trees	*Acacia karroo* (d), *Rhus lancea* (d).
Tall shrubs	*Diospyros lycioides* (d), *Tamarix usneoides* (d), *Cadaba aphylla*, *Euclea undulata*, *Grewia robusta*, *Gymnosporia buxifolia*, *Melianthus comosus*
Low Shrubs	*Asparagus striatus*
Succulent Shrubs	*Lycium cinereum* (d), *Amphiglossa callunoides*, *Lycium hirsutum*, *L. oxycarpum*

Important Taxa: Rocky slopes of river canals

Graminoids	*Stipagrostis namaquensis* (d).

Important Taxa: Alluvial shrublands and herblands

Low shrubs	*Ballota africana*, *Bassia salsoloides*, *Carissa haematocarpa*, *Pentzia incana*
Succulent shrubs	*Malephora uitenhagensis* (d), *Salsola aphylla* (d), *S. arborea* (d), *Drosanthemum lique*, *Salsola geminiflora*, *S. gemmifera*
Graminoids	*Cynodon incompletus* (d), *Cenchrus ciliaris*, *Cyperus marginatus*
Megagraminoids	*Phragmites australis* (d).

Endemic Taxa: Alluvial shrublands and herblands

Graminoid	*Isolepis expallescens*

Remarks

Plants of drainage lines may be resistant to damage by hail storms. At the Tierberg Karoo Research site, 36 of the 44 species in drainage lines were undamaged after a hail storm, with the remaining species only slightly damaged (Milton & Collins 1989). This contrasted with much higher levels of damage to plants of the surrounding habitats (flats and heuweltjies).

Tarkastad Montane Shrubland

Distribution

Eastern Cape and marginally into Northern Cape Province: Noupoort, Middelburg and a point west of Cradock define the western extent of this unit and Cathcart, Queenstown and Sterkstroom the eastern extent. The unit falls within the area between the Great Escarpment in the north, marked by the Bamboesberg and Stormberg Mountains, and the minor escarpment, marked by the Winterberg and Amathole Mountains in the south. Altitude 1 020–1 780 m.

Vegetation & Landscape Features

Ridges, hills and isolated mountain slopes, characterised by high surface rock cover, this often consisting of large, round boulders. The vegetation is low, semi-open, mixed shrubland with 'white' grasses and dwarf shrubs forming a prominent component of the vegetation.

Geology & Soils

Sedimentary rocks of the Tarkastad Subgroup (Beaufort Group, Karoo Supergroup), widely affected by intrusions of Jurassic dolerites forming numerous dykes and sills. Soils typical of land types Ib, Fb and Fc.

Climate

Rainfall in late summer to autumn (peak in February–March). MAP 280–720 mm (overall MAP 470 mm), increasing from west to east. Coefficient of variation of MAP from 22–35% across the unit (31% overall APCV), decreasing with distance eastwards. Incidence of frost 7–68 days (average: 39 days), increasing with proximity to the Escarpment.

Important Taxa

Succulent tree	*Aloe ferox* (d).
Small trees	*Acacia karroo*.
Tall shrubs	*Diospyros austro-africana* (d), *Cadaba aphylla*, *Ehretia rigida*, *Rhus burchellii, Tarchonanthus minor*
Woody Climbers	*Asparagus racemosus*, *A. retrofractus*.
Low Shrubs	*Euryops annae* (d), *Aptosimum elongatum*, *Asparagus striatus*, *Blepharis mitrata*, *B. villosa*, *Chrysocoma ciliata*, *Diospyros pallens*, *Eriocephalus ericoides*, *Felicia filifolia* subsp. *filifolia*, *F. muricata*, *Gymnosporia heterophylla*, *Helichrysum dregeanum*, *H. zeyheri*, *Hermannia filifolia*, *Indigofera sessilifolia*, *Lantana rugosa*, *Limeum aethiopicum*, *Melolobium microphyllum*, *Nenax microphylla*, *Pegolettia retrofracta*, *Pentzia globosa*, *Phymaspermum parvifolium*, *Rosenia humilis*, *Sutera pinnatifida*, *Wahlenbergia albens*.
Succulent Shrubs	*Lycium schizocalyx*, *Pachypodium succulentum*, *Sarcocaulon camdeboense*
Semiparasitic shrub	*Thesium hystrix*
Graminoids	*Aristida adscensionis* (d), *A. congesta* (d), *A. diffusa* (d), *Cynodon incompletus* (d), *Enneapogon scoparius* (d), *Eragrostis chloromelas* (d), *E. lehmanniana* (d), *E. obtusa* (d), *Heteropogon contortus* (d), *Tragus berteronianus* (d), *T. koelerioides* (d), *Chloris virgata*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis curvula*, *Eustachys paspaloides*, *Fingerhuthia africana*, *Sporobolus fimbriatus*, *Themeda triandra*, *Tragus racemosus*
Herbs	*Commelina africana*, *Gazania krebsiana* subsp. *krebsiana*, *Hibiscus pusillus*, *Indigofera alternans*, *Lepidium africanum* subsp. *africanum*, *Tribulus terrestris*
Geophytic Herbs	*Asplenium cordatum*, *Boophone disticha*, *Cheilanthes deltoidea*, *C. hirta*, *Oxalis depressa*
Succulent Herbs	*Crassula muscosa*

Biogeographically Important Taxa ([SE]Sub-Escarpment Grassland endemic, [E]Eastern distribution limit)

Small tree	*Encephalartos friderici-guilielmi*[SE]
Low shrubs	*Eriocephalus africanus*[E], *Senecio acutifolius*[E]

Remarks

Physiographically similar landscapes to the north support Gh 4 Besemkaree Koppies Shrubland and to the west (along the Great Escarpment) NKu 2 Upper Karoo Hardeveld. These two units and the current unit are all shrublands primarily associated with dolerite intrusions. The Upper Karoo Hardeveld has lower rainfall, but the Besemkaree Koppies Shrubland is distinguishable climatically (on the basis of slightly lower minimum temperatures and higher summer rainfall) and floristically.

Karoo Escarpment Grassland

Distribution

Eastern, Northern and Western Cape Province: Occurs on the Karoo Escarpment, running in an east-west direction from Molteno to Noupoort in the north, and from Somerset East in a northwesterly direction towards Nieu-Bethesda. Also found on the north-facing slopes of the Winterberg Mountains around Tarkastad. The westernmost locality is on the highest-altitude flat-topped mesas of the Escarpment in the Karoo National Park near Beaufort West. Altitude about 1 100–2 502 m at the summit of the Kompasberg.

Vegetation & Landscape Features

Mountain summits, low mountains and hills with wiry, tussock grasslands, usually dominated by *Merxmuellera disticha*. Other common species include the grasses typical of dry grasslands (genera *Eragrostis*, *Tetrachne*, *Karroochloa*, *Helictotrichon*, *Melica*, *Tragus*, *Elionurus* and *Aristida*). An important low shrub component occurs throughout this grassland unit.

Geology & Soils

Shallow soils typical of Ib, Fb and Fc land types on mudstones and sandstones of the Beaufort Group (Karoo Supergroup). Jurassic dolerite intrusions form ridges in the area.

Climate

Rainfall showing minor (possibly insignificant) peaks in March and November–December. Very dry winters. MAP 300–580 mm, increasing from west to east as well as with increasing elevation. The coefficient of variation of MAP 27–36% across the unit. The incidence of frost is from less than 20 to more than 100 days, the higher values occurring at higher elevation. There may be a number of days of snow per year, especially at higher elevations and near the edge of the Great Escarpment.

Important Taxa

Graminoids	*Aristida congesta* (d), *A. diffusa* (d), *Cynodon incompletus* (d), *Ehrharta calycina* (d), *Eragrostis chloromelas* (d), *Heteropogon contortus* (d), *Merxmuellera disticha* (d), *Themeda triandra* (d), *Tragus koelerioides* (d), *Cymbopogon pospischilii*, *Cynodon dactylon*, *Elionurus muticus*, *Eragrostis curvula*, *E. lehmanniana*, *E. obtusa*, *Eustachys paspaloides*, *Karroochloa purpurea*, *Melica decumbens*, *Panicum stapfianum*, *Tetrachne dregei*.
Herbs	*Berkheya pinnatifida*, *Convolvulus sagittatus*, *Dianthus caespitosus* subsp. *caespitosus*, *Diascia capsularis*, *Dimorphotheca zeyheri*, *Galium capense* subsp. *capense*, *Gazania krebsiana* subsp. *krebsiana*, *Hebenstretia dentata*, *Helichrysum nudifolium* var. *nudifolium*, *H. tysonii*, *Lasiospermum bipinnatum*, *Lepidium africanum* subsp. *africanum*, *Rumex lanceolatus*, *Senecio asperulus*
Geophytic Herbs	*Boophone disticha*, *Cheilanthes bergiana*, *C. hirta*, *Eucomis autumnalis* subsp. *autumnalis*, *Haemanthus humilis* subsp. *humilis*, *Oxalis depressa*.
Succulent Herbs	*Tripteris aghillana* var. *integrifolia*
Low Shrubs	*Chrysocoma ciliata* (d), *Felicia muricata* (d), *Anthospermum rigidum* subsp. *pumilum*, *Atriplex semibaccata* var. *appendiculata*, *Elytropappus rhinocerotis*, *Erica caespitosa*, *E. caffrorum* var. *caffrorum*, *E. woodii*, *Eriocephalus eximius*, *Euryops annae, E. anthemoides* subsp. *astrotrichus, E. candollei, E. floribundus, E. oligoglossus* subsp. *oligoglossus, Felicia filifolia* subsp. *filifolia*, *Helichrysum asperum* var. *albidulum*, *H. dregeanum*, *H. lucilioides*, *H. niveum*, *H. rosum*, *H. zeyheri*, *Indigofera sessilifolia*, *Limeum aethiopicum*, *Nemesia fruticans*, *Passerina montana*, *Selago albida*, *S. saxatilis*, *Senecio burchellii*, *Sutera pinnatifida*, *Wahlenbergia albens*
Succulent Shrubs	*Euphorbia clavarioides* var. *clavarioides*, *E. mauritanica*
Tall shrubs	*Cliffortia arborea*, *Diospyros austro-africana*, *Rhus lucida*.

Biogeographically Important Taxa ([C]Camdebo endemic, [D]Link to Drakensberg Alpine CE)

Graminoids	*Pentaschistis cirrhulosa*[D], *P. microphylla*[D].
Low shrubs	*Helichrysum sessile*[D], *Pentzia cooperi*[D].
Succulent shrub	*Delosperma congestum*[D]
Succulent herb	*Duvalia modesta*[C]

Endemic Taxa

Graminoid	*Schoenoxiphium rufum* var. *dregeanum*
Herbs	*Lithospermum diversifolium*, *Wahlenbergia sphaerica*
Geophytic herbs	*Kniphofia acraea*, *Syringodea pulchella*
Low shrubs	*Euryops dentatus*, *E. trilobus, Helichrysum scitulum*, *Selago bolusii*.
Succulent shrub	*Delosperma gramineum*

Remarks

Remark 1 This unit occurs across a wide geographical area with associated floristic variability. The biome classification of this unit is controversial since both Karoo and Grassland elements are strongly represented in the species composition. However, the presence of many (and dominant) C3 grasses surrounded by vegetation containing C4 grasses as well as the remarkable share of fynbos-related elements (*Elytropappus rhinocerotis*, *Erica caffra*, *Cliffortia ramosissima*, *Ursinia montana*, *Pentzia cooperi*, *Euryops* species, *Passerina montana*, *Cliffortia arborea* and also a new species of *Erica*—E.G.H. Oliver, personal communication) supports the decision to classify this vegetation within the Grassland Biome (see also Acocks 1988, Low & Rebelo 1996).

Remark 2 The mountain ranges with this arid type of grassland are one of the centres of diversification of the genus *Euryops* (Nordenstam 1968).

Conservation status of broad vegetation types

On the basis of a scientific approach used at national level by SANBI (Driver *et al*., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 2 below, as determined by best available scientific approaches (Driver *et al*., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*., 2005).

Determining ecosystem status (Driver *et al*., 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 2: Conservation status of different vegetation types occurring in the study area.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al*. 2005; Mucina *et al*., 2006	National Ecosystem List (NEM:BA)
Eastern Upper Karoo	21	3	2	Least threatened	Not listed
Besemkaree Koppies Shrubland	28	5	3	Least threatened	Not listed
Southern Karoo Riviere	24	3	12	Least threatened	Not listed
Tarkastad Montane Shrubland	28	1	3	Least threatened	Not listed
Karoo Escarpment Grassland	24	3	3	Least threatened	Not listed

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in Table 2, all regional vegetation types described here are listed as Least Threatened. The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. None of the vegetation types described here are listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

Biodiversity Conservation Plans

The study area straddles the provincial boundary between the Northern Cape and the Eastern Cape. There are biodiversity conservation plans for both provinces, but the closest designated feature in the Eastern Cape Biodiversity Conservation Plan for the site is over 20 km away. There are therefore no features of concern from the Eastern Cape conservation plan and only the conservation plan for the Northern Cape is considered further here.

The Northern Cape Critical Biodiversity Area (CBA) Map (Figure 4) was published in 2016 (Holness & Oosthuysen 2016) and it "*updates, revises and replaces all older systematic biodiversity plans and associated products for the province*". This includes the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008), from which the Northern Cape CBA Map derived identified CBA1 and CBA2 areas (and added additional CBA1 and CBA2 areas). This is important, since the rationale for defining the recent (2016) CBA areas is derived from the earlier (2008) conservation plan. CBA1 and CBA2 areas in the 2016 map include the following areas:

1. Important Bird Areas;
2. SKEP expert identified areas;
3. Threatened species locations;
4. Features from previous conservation plans (including CBA1 and CBA2 areas from the Namakwa District Biodiversity Sector Plan);
5. Areas supporting climate change resilience, e.g. areas of high diversity, topographic diversity, strong biophysical gradients, climate refugia, including kloofs, south-facing slopes and river corridors;
6. Conservation Plans from adjacent provinces; and
7. Landscape structural elements, e.g. rocky outcrops, koppies, dolerite dykes, boulder fields, woody vegetation on outwash plains.

The Northern Cape CBA map classifies the natural vegetation of the province according to conservation value in decreasing value, as follows:

1. Protected
2. Critical Biodiversity Area One (Irreplaceable Areas)

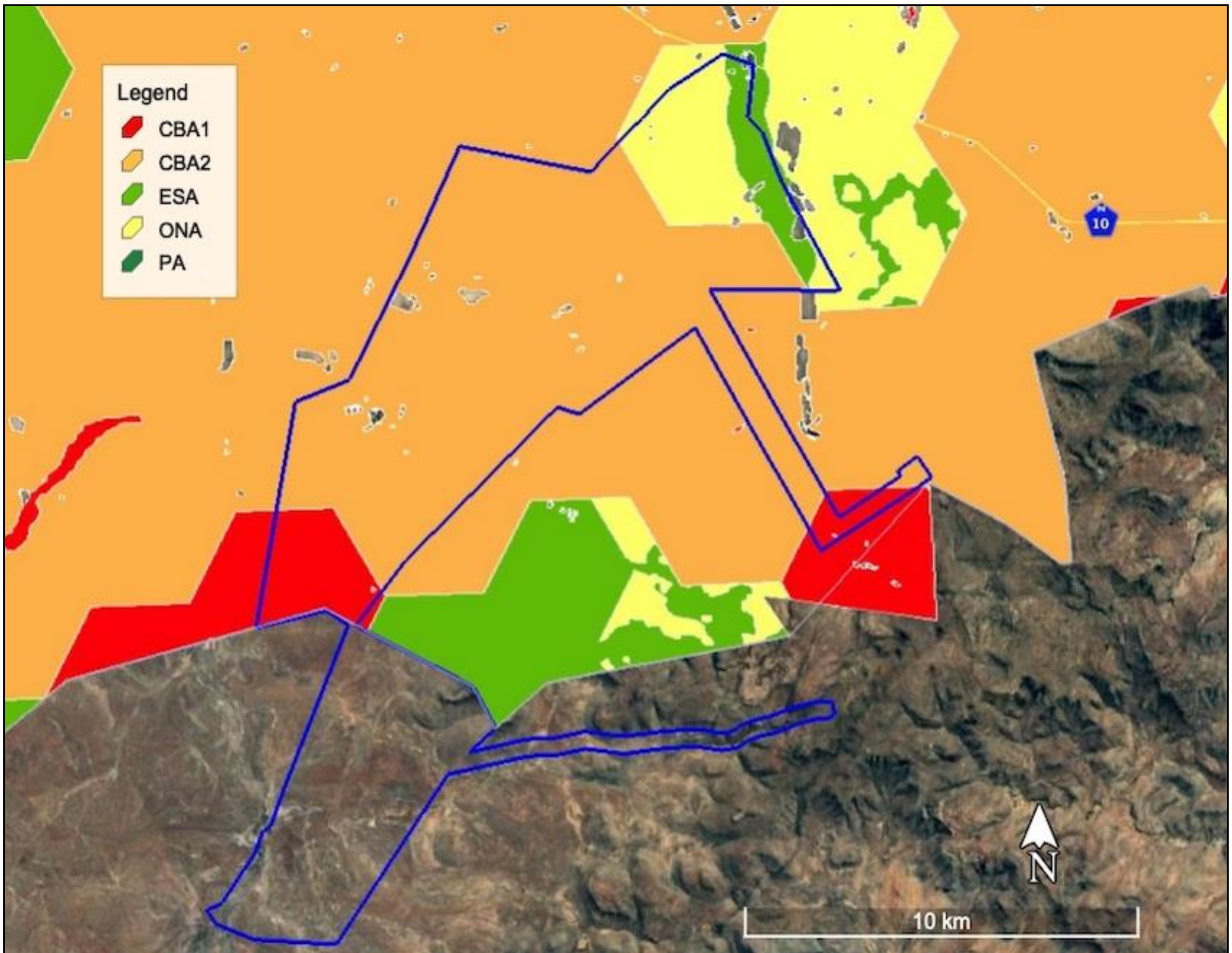

Figure 4: Northern Cape CBA map for the study area.

3. Critical Biodiversity Area Two (Important Areas)
4. Ecological Support Area
5. Other Natural Area

This map shows features within the study area within three of these classes, as follows:

1. Critical Biodiversity Areas (CBA): Most of the northern site is within a CBA2 area with two patches of CBA1 areas, one in the Wonderheuwel project area and one in the corridor area associated with the Hydra D MTS .
2. Ecological Support Areas (ESA): The drainage valley in the extreme north-eastern part of the study area (within the Mooi Plaats project area) is within an ECA*.*
3. Other Natural Areas (ONA): Areas surrounding the drainage valley in the north-eastern part of the study area (within the Mooi Plaats project area) are within an area mapped as ONA

The presence of CBA areas 1 and 2 in the Wonderheuwel and Mooiplaats parts of the study area, as well as the Hydra D MTS corridor affecting all three projects, indicate that these areas are considered important for biodiversity conservation in the Northern Cape. Additionally, the ESA in the northern half and to the south of the site indicate that the site has importance in a wider ecological context for supporting biodiversity patterns.

The Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008) provides recommended guidelines for land-use activities within different CBA categories. Those that are relevant to the current project are as follows:

Land use	CBA1	CBA2	ESA	ONA
Major/extensive development projects	N	N	R	R
Linear engineering structures	R	R	R	R

N=No, not permitted, R=Restricted, only when unavoidable, not usually permitted.

In CBA1 areas, the land management objective is to maintain the area in a natural state with no biodiversity loss and no biodiversity offsets are possible for developments that result in the transformation of natural habitat. It is interpreted here that solar arrays would not be desirable within CBA1 areas, but that linear infrastructure could be constructed there, if impacts are comprehensively managed to avoid habitat loss or degradation.

In CBA2 areas the land management objective is to maintain the landscape in a near natural state, possibly allowing some loss in ecosystem integrity and functioning. Biodiversity compatible land uses are strongly encouraged, and industries encouraged to adopt and implement acceptable biodiversity management plans. It is further recommended to restrict expansion of any activity that would cause loss of natural habitat and where possible utilise existing transformation or degraded areas for hard development. Biodiversity offsets are required where development impacts on land management objectives. This affects proposed solar arrays for all of Wonderheuwel and most of Mooi Plaats.

Proposed protected areas

According to the National Parks Area Expansion Strategy (NPAES), there are only small areas within the study area that have been identified as priority areas for inclusion in future protected areas. These are located approximately where the two Eskom substations will be built (see Figure 5). The majority of the study area is therefore **outside the NPAES focus area**. There is a large core block of area to the south-east of the study site that is included as being part of future protected areas (see Figure 5).

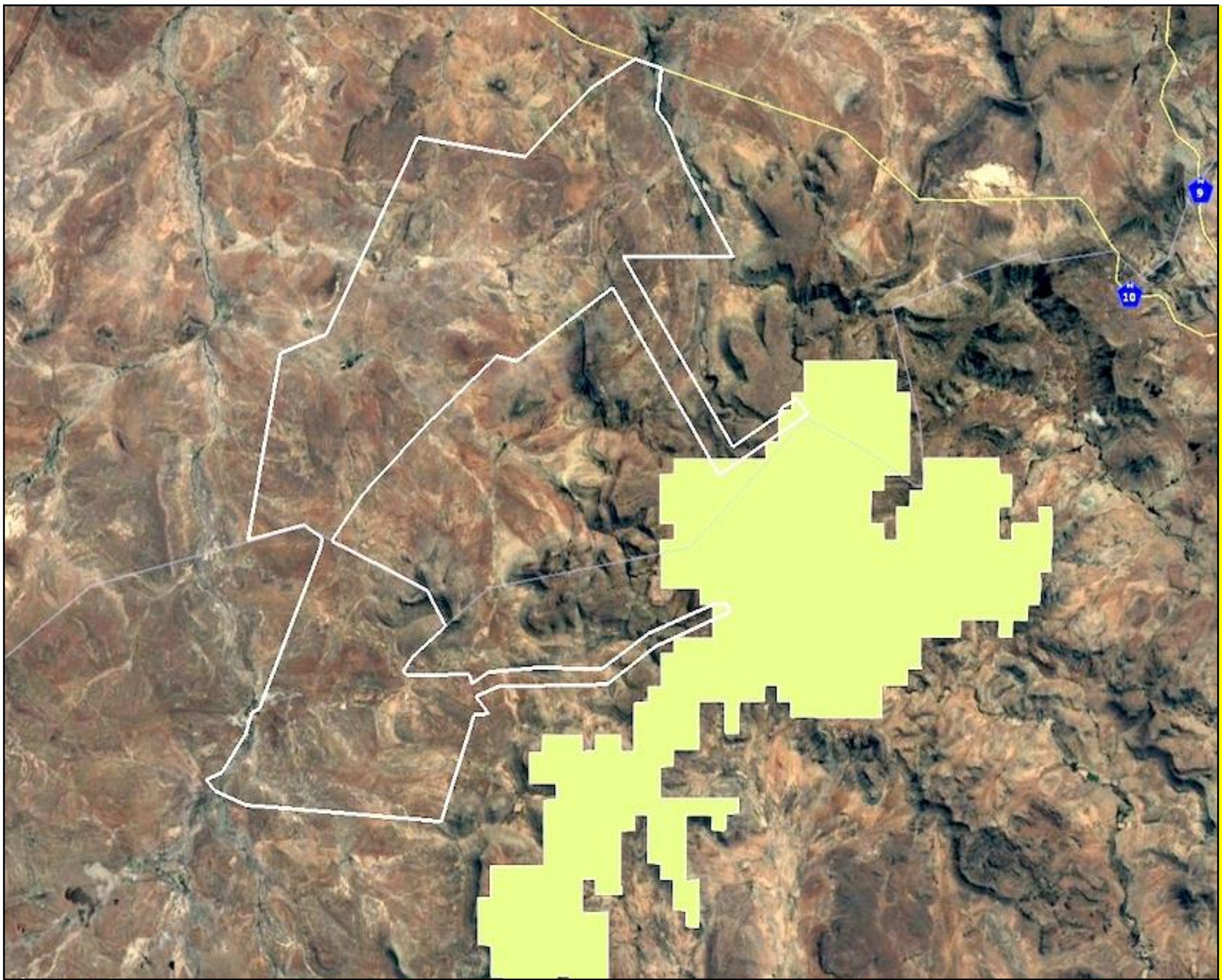

Figure 5: Proposed protected areas, according to the NPAES.

Red List plant species of the study area

Lists of plant species previously recorded in the study area were obtained from the South African National Biodiversity Institute (SANBI) website (http://newposa.sanbi.org/). These are listed in Appendix 3. There are very few collection records for this part of the country so a much larger area was searched for potential species of concern. Despite this broader search, there are very few species that were identified of conservation concern that could potentially occur in the broad area that includes the project area.

Table 3: Explanation of IUCN Version 3.1 categories (IUCN 2001) and Orange List categories (Victor & Keith 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

The list contains 2 species listed in an IUCN threat category (Critically Endangered, Endangered or Vulnerable (see Table 3 above) of which **2 have a moderate possibility of occurring in the general area** and in the type of habitats available in the study area. This does not mean that they will occur there, only that the review has identified that these are species that should be assessed as possibly occurring in the area. None of these species were encountered on site. The first of the two species, *Gnaphalium simii*, listed as DDT, would only occur in calcareous vleis, which could occur in any of the drainage lines in any of the three project areas. The second species, *Trichodiadema rogersiae*, also listed as DDT, is found in mountain areas. Both power line corridor areas affect mountain areas, but none of the main project areas.

None of the species recorded on site (see Appendix 3) are listed in any threat category.

Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in Appendix 6. None of the species on this list were encountered on site and none are considered likely to occur there, because they do not have a geographical distribution that includes the study area.

Protected plants (Northern Cape Nature Conservation Act)

Plant species protected under the Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) are listed in Appendix 5. A number of species were found on site that are protected according to the Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009). From the field survey, this includes the following: *Ruschia intricata* (Aizoaceae), *Ruschia* species (Aizoaceae), *Trichodiadema setulifera* (Aizoaceae), *Pelargonium abrotanifolium*, *Pelargonium exhibens*, *Cotyledon* *orbiculata* (Crassulaceae), *Erica* species (Ericaceae), *Deverra denudata* (Apiaceae), and *Aloe broomii* (Asphodolaceae). Despite not being threatened, any impacts on these species will require a permit from the relevant authorities. Note that many of these species are widespread and not of any conservation concern, but protected due to the fact that the Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) protects entire families of flowering plants irrespective of whether some members are rare or common. The implication is that a comprehensive list of species occurring within the footprint of the proposed infrastructure is required and a permit application submitted for any of those listed as protected. The current list is therefore not considered to be complete and must be supplemented by a comprehensive walk-through survey, once the final footprint of infrastructure has been decided.

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 2. There are none with a geographical distribution that includes the region in which the proposed project is located. There are two species that have a geographical distribution that ends south of the study area, namely *Boscia albitrunca* and *Pittosporum viridiflorum*.

Boscia albitrunca
This is a small to medium-sized of up to 7 m tall with a dense, roundish crown and smooth, white to greyish-white trunk. It is found in the drier parts of South Africa, as well as in the northern savanna parts of the country, but also extending some of the way down the eastern seaboard. There are scattered records of this species in the general area that includes the project site, although it's main area of occurrence is further north. It is therefore possible that it could occur in the study area. However, no trees of this species were seen on site and it is considered unlikely that it occurs there. In the unlikely event that it is found to occur there, it is unlikely that any more than a few individuals would be found.

Pittosporum viridiflorum
This species occurs primarily in a band along the southern part of the country, extending up the east coast, where, from Lesotho northwards, it extends further inland. In the part of the country around the study area, the occurrence is generally south of the Great Escarpment, although there is one record from Pillipstown and two from near Graaff-Reinet. it is considered unlikely that it occurs in the study area. In the unlikely event that it is found to occur there, it is unlikely that any more than a few individuals would be found.

In summary, no species of protected trees were found or are likely to occur in the geographical area that includes the site.

Vertebrate animal species of the study area

Vertebrate species (mammals, reptiles, amphibians) with a geographical distribution that includes the study area are listed in Appendix 4. All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals that could occur in the study area and have habitat preference that includes habitats available in the study area, are discussed further below.

Mammals
There are 79 mammal species that have a geographical distribution that includes the study area, of which eleven are listed in a conservation category of some level (see Appendix 3). This is a relatively moderate diversity of mammals compared to other parts of South Africa. Based on the natural state of the study area and surrounding areas, it is considered likely that some of these species could occur on site. Listed species with a geographical range that includes the site are discussed in more detail below to evaluate the potential for them to ocur on site.

<u>Black Rhinoceros</u>
The Black Rhinoceros (*Diceros bicornis bicornis*), listed as Endangered, has a geographical distribution that includes the study area. The species is confined to formal conservation areas as well as a few individuals held on private land.

Although the habitat on site is suitable for this species, it does not occur there and would not be found there unless deliberately introduced.

Grey Rhebok

The Grey Rhebok (*Pelea capreolus*), listed as Near Threatened, is endemic to South Africa, Lesotho and parts of Swaziland. In the south and southwest, their distribution is associated with the rocky hills of mountain Fynbos and the Little Karoo (Taylor et al. 2016). They are predominantly browsers, feeding on ground-hugging forbs, and largely water independent, obtaining most of their water requirements from their food (Taylor et al. 2016). Local declines in their population have been attributed to increased densities of natural predators, such as Black-backed Jackal, Caracals and Leopards. It has not been recorded in the grid in which the site is located, but has been recorded in the grid to the north-east and many grids further to the south, so the site is within the overall distribution range of the species. There is therefore a moderate likelihood that it could occur on site within any suitable habitat. However, it is a relatively mobile species and not necessarily dependent on any particular habitat. It is likely to move away from the path of any construction and development of parts of the study area. **The proposed development is therefore highly unlikely to have any negative effect on the species, even though it could possibly occur there.**

Black-footed Cat

The Black-footed Cat (*Felis nigripes*), listed as Vulnerable, has been previously recorded in the grid in which the project is located, as well as in most surrounding grids. It's known distribution is on the inland part of most of South Africa, but seemingly not within the winter-rainfall part of the country. It also occurs in Botswana and Namibia. The current project area is within the core of the distribution range of the species and the species is therefore highly likely to occur in the area. The species is nocturnal and carnivorous, favouring any vegetation cover that is low and not too dense. They make use of dens in the daytime, which can be abandoned termite mounds, or dens dug by other animals, such as aardvark, springhares or cape ground squirrels. Local declines in their population have been attributed to increased densities of natural predators, such as Black-backed Jackal, Caracals and Leopards. They are highly vulnerable to domestic carnivores. The study area is definitely suited to this species and it probably occurs there. It is possible that it has interbred with cats on the farm – two kittens seen on site had colour characteristics of this species, such as black paws and markings similar to black-footed cats. **The proposed developments may possibly have a negative effect on the species.**

Leopard

The Leopard (*Panthera pardus*), listed as Vulnerable, has a wide habitat tolerance, but with a preference for densely wooded areas and rocky areas. In montane and rocky areas of the Eastern, Western and Northern Cape, they prey on dassies and klipspringers. They have large home ranges, but do not migrate easily, males having ranges of about 100 km^2 and females 20 km^2. It has not been recorded in any of the adjacent or nearby grids and the overall distribution shows a gap in its distribution that includes the current study area. There is therefore a low probability of this species occurring on site, and if it did occur there it would probably be at very low densities. **The proposed project could possibly displace individuals, in the unlikely event that they occur there, but is unlikely to have a significant effect on overall population densities.**

Cape Clawless Otter

The Cape Clawless Otter (*Aonyx capensis*), listed as Near Threatened, is widely but patchily distributed throughout South Africa, and is also the most widely found otter in Africa. It is aquatic and seldom found far from permanent water, which needs to be fresh. They may be found in seasonal rivers in the Karoo, provided suitable-sized pools persist. The site is within the known distribution of this species and there are historical records for one adjacent grid to the south, although not from the current grid. There is suitable habitat for this species on site. Paw-prints in the mud adjacent to water on site were identified as belonging to an otter and it is considered most likely that it would be this species. The area where it occurs is in the power line corridor associated with the Hydra D MTS, which is an option for all three projects. **It is therefore considered definite that it occurs on site and that individuals could be affected by construction activities, if suitable habitat is damaged.**

African Striped Weasel

The African Striped Weasel (*Poecilogale albinucha*), listed as Near Threatened, is found throughout most of South Africa, except for the arid interior, and into central Africa (excluding Namibia). It has not been recorded in the grid in which the site is located or any surrounding grid, but the site is within the overall distribution range for the species. It is found primarily in moist grasslands and fynbos, where adequate numbers of prey may be found. **It is considered unlikely to occur in the study area and the proposed development will therefore not affect this species**.

<u>*Brown Hyaena*</u>
The Brown Hyaena (*Hyaena brunnea*), listed as Near Threatened, is found in a band running down the centre of the country, expanding into the entire northern parts of the the country. There is a gap in the distribution around the current study area, but there is a possibility that vagrant individuals could extend into this area. The species is found in desert areas, particularly along the west coast, semi-desert, open scrub and open woodland savannah (Mills & Hes 1997). It is a solitary scavenger that travels vast distances every day in search of food. It has a medium chance of occurring in the study area since the distribution range includes the study area, however there are no historical records from nearby. It is a mobile animal that is likely to move away from the path of any construction and development of parts of the site is therefore highly unlikely to have any negative effect on the species. **It is considered that there is a low likelihood of it occurring on site or that individuals could be affected by construction activities.**

<u>*South African Hedgehog*</u>
The South African Hedgehog (*Atelerix frontalis*), listed as Near Threatened, is found in a large part of the central part of South Africa, extending down to the south-eastern coast, and is also found in Namibia, Botswana, Zimbabwe, Lesotho and Swaziland. It requires ample ground cover for cover, nesting and foraging and prefers dense vegetation and rocky outcrops. The site is well-within the known distribution of this species and there are historical records for nearby grids in all directions, and it has been recorded from the current grid. There is therefore a high probability of the study area being suitable for this species, including all three projects. **It is considered likely that it could occur on site and individuals could be affected by construction activities, if suitable habitat is damaged.**

<u>*White-tailed Rat*</u>
The White-tailed Rat (*Mystromys albicaudatus*), listed as Vulnerable, is endemic to South Africa and Lesotho, where it is found primarily in Highveld grasslands, but extending into adjacent Fynbos and Karoo areas. It is terrestrial, but never found in soft, sandy substrates, rocks, wetlands or river banks, and do not occur in transformed habitat. The study area is on the edge of the known distribution of this species, but there are historical records for the grid in which the projects are located, as well as two adjacent grids. There is therefore a high probability of the study area being suitable for this species. **It is considered likely that it could occur on site and individuals could be affected by construction activities, if suitable habitat is damaged.**

<u>*Vlei Rat*</u>
The Vlei Rat (Grassland-type) (*Otomys auratus*), listed as Near Threatened, is near-endemic to South Africa, occurring in the north-eastern half of the country, associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions. It is likely to be associated with sedges and grasses in densely-vegetated wetlands with wet soils. The study area is on the very edge of the known distribution of this species and there are no historical records for grid in which the study area is located, not any adjacent grids. There is therefore a low probability of the study area being suitable for this species. **It is considered unlikely that it occurs on site and the proposed development will therefore probably not affect this species.**

<u>*Spectacled Dormouse*</u>
The Spectacled Dormouse (*Graphiurus ocularis*), listed as Near Threatened, is endemic to South Africa, where it is found in the Northern, Eastern and Western Cape Provinces. It is associated with rock piles, crevices, outcrops and stone kraals. They may be territorial. The study area is within the known distribution of this species and there are historical records for three adjacent grids to the north, north-east and east, although not from the current grid. There is therefore a moderate probability of the study area being suitable for this species, including suitable habitat within all three project areas. **It is considered likely that it could occur on site and individuals could be affected by construction activities, if suitable habitat is damaged.**

Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), those listed in Table 4 are considered to have a probability of occurring on site and being potentially negatively affected by proposed activities associated with the proposed projects.

Table 4: Mammal species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
Felis nigripes	Black-footed Cat	Vulnerable, protected	Very High
Aonyx capensis	Cape Clawless Otter	Near Threatened, protected	Very high
Atelerix frontalis	South African Hedgehog	Near Threatened, protected	High
Pelea capreolus	Grey Rhebok	Near Threatened, protected	Medium
Mystromys albicaudatus	White-tailed Rat	Vulnerable	Medium
Graphiurus ocularis	Spectacled dormouse	Near Threatened	Medium
Panthera pardus	Leopard	Vulnerable, protected	Low
Poecilogale albinucha	African Striped Weasel	Near Threatened	Low
Hyaena brunnea	Brown hyaena	Near Threatened	Low
Otomys auratus	Vlei Rat	Near Threatened	Low

Reptiles

A total of 55 reptile species have a geographical distribution that includes the study area in which the three project sites are found (Alexander & Marais 2007, Bates *et al*. 2014, Branch 1988, Marais 2004, Tolley & Burger 2007). This is a moderate diversity compared to average diversity in other parts of the country. Of the reptile species that could potentially occur in the study area, none have been listed in a threat category.

There are therefore no reptile species of conservation concern that could potentially occur in the study area and that may therefore be affected by the proposed projects.

Table 5: Reptile species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likel;ihood of occurrence
None	None	N/A	N/A

Amphibians

A total of only 10 frog species have a geographical distribution that includes the general study area in which the project sites are found (Du Preez & Carruthers 2009). Some of these species are only marginally present in the study area due to the fact that their distribution range ends close to the study area. Of the frog species that could potentially occur in the study area, none are listed in a threat category, but one species is listed as protected, according to National legislation, the Giant Bullfrog.

<u>The Giant Bull Frog</u>

The Giant Bull Frog (*Pyxicephalus adspersus*) previously listed as Near Threatened, is found in seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna and, at the limits of its distribution, in Nama Karoo and thicket. For most of the year the species remains buried up to 1 m underground. They emerge only during the peak of the rainy season to forage and breed. If conditions are extremely dry, they may remain cocooned underground for several years. Long distances often separate suitable breeding sites. In order to breed, they require shallow, rain-filled depressions that retain water long enough for the tadpoles to metamorphose. Before and after breeding, bullfrogs forage in open grassland, feeding mostly on insects, but also on other frogs, lizards, snakes, small birds and rodents. After breeding males generally bury themselves within 100 m of the breeding site, but females may disperse up to 1 km away. Based on habitat requirements, there is a medium probability that this species occurs in the study area.

It is concluded that the site contains habitat that is suitable for various frog species, although only one species of conservation concern is likely to occur in the study area. One frog species of concern is therefore potentially likely to be affected by development in the study area, including all three proposed projects, as shown in Table 6.

Table 6: Amphibian species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
Pyxicephalus adspersus	Giant Bullfrog	Protected	Medium

Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "*a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7*". Such activities include any that are "*of a nature that may negatively impact on the survival of a listed threatened or protected species*". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in Appendix 6, marked with the letter "N". This includes the following species: Black Rhinoceros (does not occur on site), Black-footed Cat, Leopard (probably does not occur on site), Cape Clawless Otter, Cape Fox, South African Hedgehog, Brown Hyena,and Giant Bullfrog.

Due to habitat and forage requirements, and the fact that some species are restricted to game farms and/or conservation areas, only the Black-footed Cat, Cape Clawless Otter, Cape Fox, South African Hedgehog, and Giant Bullfrog have any likelihood of occurring on site. Most of these species are territorial with small home ranges or may be dependent on specific habitat to exist on site. They could therefore be affected by the development of the three proposed projects.

Habitats on site

A preliminary map of habitats within the study area and adjacent areas is provided in Figure 6. Transformed areas where no vegetation occurs were insignificant in area and were not mapped. This included roads, farm buildings and similar existing disturbances. The broad natural habitat units on site are as follows:

1. Lowland plains vegetation (karroid dwarf shrubland);
2. Mountain vegetation (shrubland);
3. Low ridges (shrubland);
4. Broad drainage areas;
5. Mountain stream.

Lowland plains vegetation
The general study area is characterised by a low succulent, dwarf shrubland, typical of the regional vegetation type, **Eastern Upper Karoo**, which is described as "dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis*" (Mucina & Rutherford 2006). A typical view of this vegetation, as found on site in all three project areas, is shown in Figure 7. This was the most widespread vegetation community on site, occurring on all the relatively flat plains areas.

The general floristic character of this vegetation on site is fairly uniform across wide areas, often dominated by the same suite of species, including *Ruschia intricata*, *Aristida diffusa*, *Tragus koelerioides*, *Eragrostis lehmanniana*, *Amphiglossa triflora*, *Wahlenbergia nodosa*, *Lycium cinereum*, *Pteronia glomerata, Pteronia mucronata, Chrysocoma ciliata* and *Eriocephalus spinescens*. However, any local variation in topography can lead to localized increase in richness associated with a more diverse species composition.

Figure 7: Photo showing Nama-karoo vegetation on plains with steeper topography in background.

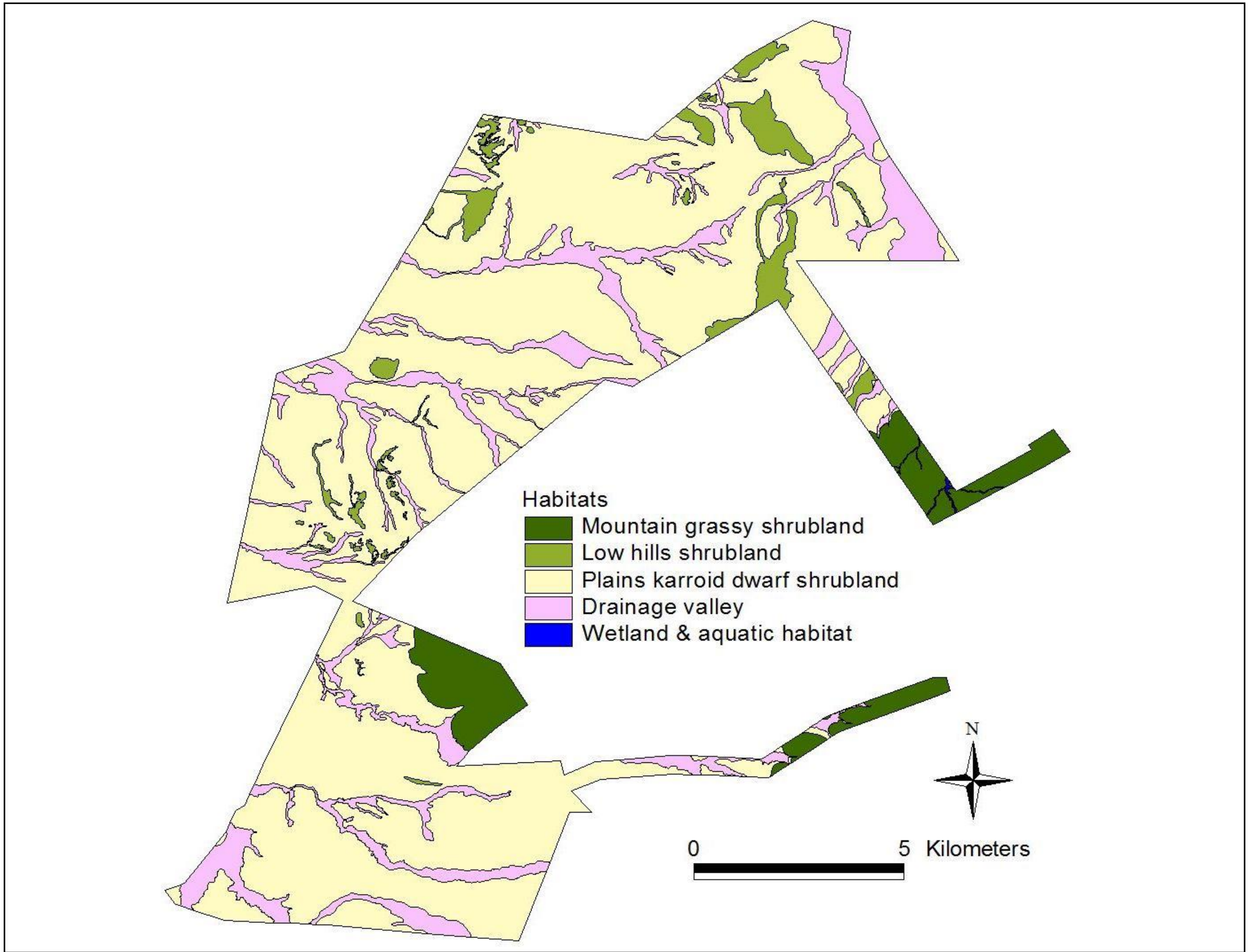

Figure 6: Main habitats of the study area.

Mountain vegetation

This vegetation is somewaht typical of **Besemkaree Koppies Shrubland**, described in a section above, in terms of structure, species composition and location in the landscape, with the exception of having the common presence of the grass, *Tenaxia stricta*, which is more expected in **Karoo Escarpment Grassland**. The vegetation community is found in all the more significant mountains in the study area, with steep topography and higher elevation than the surrounding plains. At the time of the field survey, most of these mountain areas had been recently burnt, but unburnt patches showed a consistency in species composition and structure across the study area that suggested that observed patterns could be generally extrapolated to burnt areas. An example is shown in Figure 9. This species composition and structure included a shrub layer dominated by woody species, such as *Searsia erosa*, *Euclea crispa*, *Felicia filifolia*, *Elytropappus rhinocerotis*, *Diospyros lycioides*, *Tarchonanthus minor*, and *Diospyros austro-africanus*, and a grass layer dominated by *Tenaxia stricta*, along with *Themeda triandra*, *Eriocephalus ericoides*, *Chrysocoma ciliata*, *Ehrharta calycina*, *Cheilanthes eckloniana* and *Cymbopogon pospischilii*. There is likely to be some ecological variation in structure and species composition in different parts of the landscape, although this could not be verified within burnt vegetation. The topography introduces variation in slope and aspect, with some slopes facing hotter northern or western directions and others facing cooler southern and eastern directions, all of which introduces ecological variation into the landscape, providing new habitats for different species. Due to the sedimentary origin of the substrates, there are often bands of more resistant rock layers at specific heights on the mountain slopes. These substrates manifest themselves as small cliffs and rocky outcrops. There is a known diversity relationship between increased surface rockiness and increased local floristic species richness, which is likely to be true for the current study area. This generalization is supported by the fact that many of the more rare floristic sitings on site were within rocky areas.

Low ridges and koppies

There are low ridges and koppies scattered throughout the plains area of the study area. They appear to mostly be associated with dolerite outcrops. The soils in these areas are mostly shallow and rocky, there are often more boulders

Figure 8: Shrubby vegetation in unburnt mountainous areas in the study area.

and the vegetation consists of a distinct open shrub canopy with a sparse grassy understorey. The floristic diversity is slightly higher in these areas than in surrounding plains and the structure of the vegetation almost certainly provides shelter and refuge for animals. Common shrubs on these ridges include *Rhus erosa*, *Euclea crispa*, *Lycium cinereum*, *Diospyros austro-africana* and *Diospyros lycioides*. The species composition is not similar to any of the main vegetation units described for the study area and surrounding areas, but is probably most similar to *Tarkastad Montane Shrubland*. An example of typical vegetation found on low ridges is shown in Figure 9.

Broad drainage areas
There is a network of shallow drainage areas throughout the lower-lying parts of the study area. These are sometimes indistinct from surrounding areas, but often resolve into channels, or include areas with woody shrubs. It also includes bare areas, erosion gulleys, and empty farm dams (at the time of the survey). Most of the homesteads in the study area are built on or adjacent to drainage areas, including buildings, roads, camps and often stands of exotic trees, some of which are dense and fairly substantial in extent. The small amount of formal cultivation also occurs almost entirely within this unit.

The unit is equivalent to the vegetation unit, Southern Karoo Riviere, although there is considerable variation from one part of the study area to another: in the wide open plains, the vegetation on site is more in line with the description for **Southern Karoo Riviere**, but closer to hills, it becomes more grassy, but with the inclusion of typical wetland species, such as *Afroscirpoides dioeca*, *Pseudoschoenus inanis* and *Juncus rigidus*. Some areas where permanent channel formation had taken place were almost completely dominated by the robust grass, *Miscanthus ecklonii*, along with *Pennisetum sphacelatum* and *Searsia pyroides*. Where these channelled systems were larger and approaching being more perennial in terms of water presence, there was increasing dominance by woody species, such as *Diospyros*

Figure 9: Typical habitat on low ridges and koppies in the study area.

lycioides, *Helichrysum trilineatum*, *Melianthus comosus*, *Lycium cinereum*, *Deverra burchellii*, *Asparagus laricinus* and *Diospyros austro-africana*. A typical view of this more structurally developed habitat is shown in Figure 10.

The drainage areas are important habitat for animals, providing refuge and shelter, water, when it is available, palatable vegetation, when surrounding areas are in drought, and softer and deeper soils for burrowing animals. The habitat is also an important flood-attenuation component of the landscape, and a reservoir for soil water. If it occurs on site, this is the habitat in which the protected Giant Bullfrog would be found.

Mountain stream

Strictly, this is part of the broad drainage area in the study area, which varies from broad, wide areas with no aquatic characteristics, to semi-permanent pools, but is discussed separately due to the fact that they are within the mountains and have different characteristics to other parts of the landscape. The mountain stream map unit occurs only in the eastern part of the study area in the mountains (within the power line corridor associated with Hydra D MTS), and is part of a valley that eventually exits into a wider drainage valley, as described in the previous section. Within the mountains, the stream is contained by the surrounding rocky mountain slopes, has a rocky bed with sandy banks in places, and consists of permanent wetlands, aquatic habitats, rocky slabs and other micro-habitats. A typical view is shown in Figure 11.

The riparian areas have a species composition and structure that is almost completely different to the surrounding landscape. The habitat contains a combination of bare rock and deeper sands, so it is able to support a flora that is adapted to these substrate conditions, in addition to the sporadic flooding and scouring that takes place in these habitats as a result of rare large rainfall events. Although not necessarily floristically sensitive, the habitat that is derived under these ecological conditions is critically important for fauna, providing food and shelter as well as corridors for

Figure 10: Typical drainage line habitat in the study area.

undetected movement. In times of drought, riparian areas may offer the only slightly green vegetation as a source of food. The deeper sands are important for burrowing animals and the shrubs and low trees offer shelter and browse.

Riparian habitats are disproportionately important in terms of the proportion of the area that they occupy in the landscape – they provide a unique and important habitat for both flora and fauna in this arid part of the country. The plant species occurring within these habitats are not necessarily rare in a global sense, but degradation of this interconnected system can cause floristic loss and change in areas far removed from any impact. For this reason, and for the utilitarian importance to fauna, the riparian vegetation is considered to be ecologically sensitive. In addition, this is the habitat in which the Near Threatened and nationally protected Cape Clawless Otter is found on site.

Habitat sensitivity

To determine ecological sensitivity in the study area, local and regional factors were taken into account. There are some habitats in the study area that have been described as sensitive in their own right, irrespective of regional assessments. This includes primarily the stream beds and associated riparian zones and adjacent floodplains. A detailed assessment of these areas has been undertaken by an aquatic specialist and they are only considered here in terms of being important habitat for flora and fauna. Mountain areas and steep slopes, especially at higher elevations are more sensitive than surrounding areas, mainly due to higher floristic diversity and the likelihood of plant species with low local abundance occurring there.

At a regional level, the Critical Biodiversity Area (CBA) map for Northern Cape indicates various parts of the study area as being important for conservation. There are two small patches of CBA1 in the eastern and western parts of the study

Figure 11: Mountain stream habitat.

area (see Figure 4 on page 47) – it is speculated that these are the location of species of concern, although this is not confirmed from any other information and the assumption is therefore speculative. Most of the remainder of the study area is CBA2, indicating regional importance for the entire escarpment region in which the study area is located. It should be assumed that, over and above the designation of CBAs in other parts of the study area, all high-lying areas should be treated as ESAs. This co-incides with the areas mapped here as Mountain Vegetation.

In terms of other species of concern, including both plants and animals (with the exception of the Cape Clawless Otter that has already been discussed), there are no specific locations where conservation of habitat would benefit a specific species based on the existing data available. All mammal species of concern and all protected plant species described previously could occur on any part of the site, whether in the mountains or on the lowlands, although it is probable that low ridges and drainage areas are of more importance than plains areas.

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

1. Drainage areas;
2. Mountain stream;
3. High-lying areas, i.e. mountain vegetation;
4. CBA areas, especially CBA1.

Based on this information, a map of habitat sensitivity on site is provided in Figure 12. This shows main habitat sensitivity classes on site, as follows:

1. MEDIUM-LOW for lowland plains vegetation outside of CBAs. In the absence of CBAs, all lowland plains on site would be within this sensitivity class.
2. MEDIUM for all rocky ridges and drainage areas outside of CBAs. In the absence of CBAs, all rocky ridges and drainage areas would be within this sensitivity class.
3. MEDIUM-HIGH for mountain areas outside of CBAs.
4. HIGH for CBA1 areas, and mountain areas surrounding aquatic habitat where the Cape Clawless Otter occurs. The aquatic habitat and surrounding mountain slopes would be within this sensitivity class in the absence of the CBA1 classification.
5. VERY HIGH for aquatic habitat where the Cape Clawless Otter occurs and a buffer, also inside a CBA1 area.

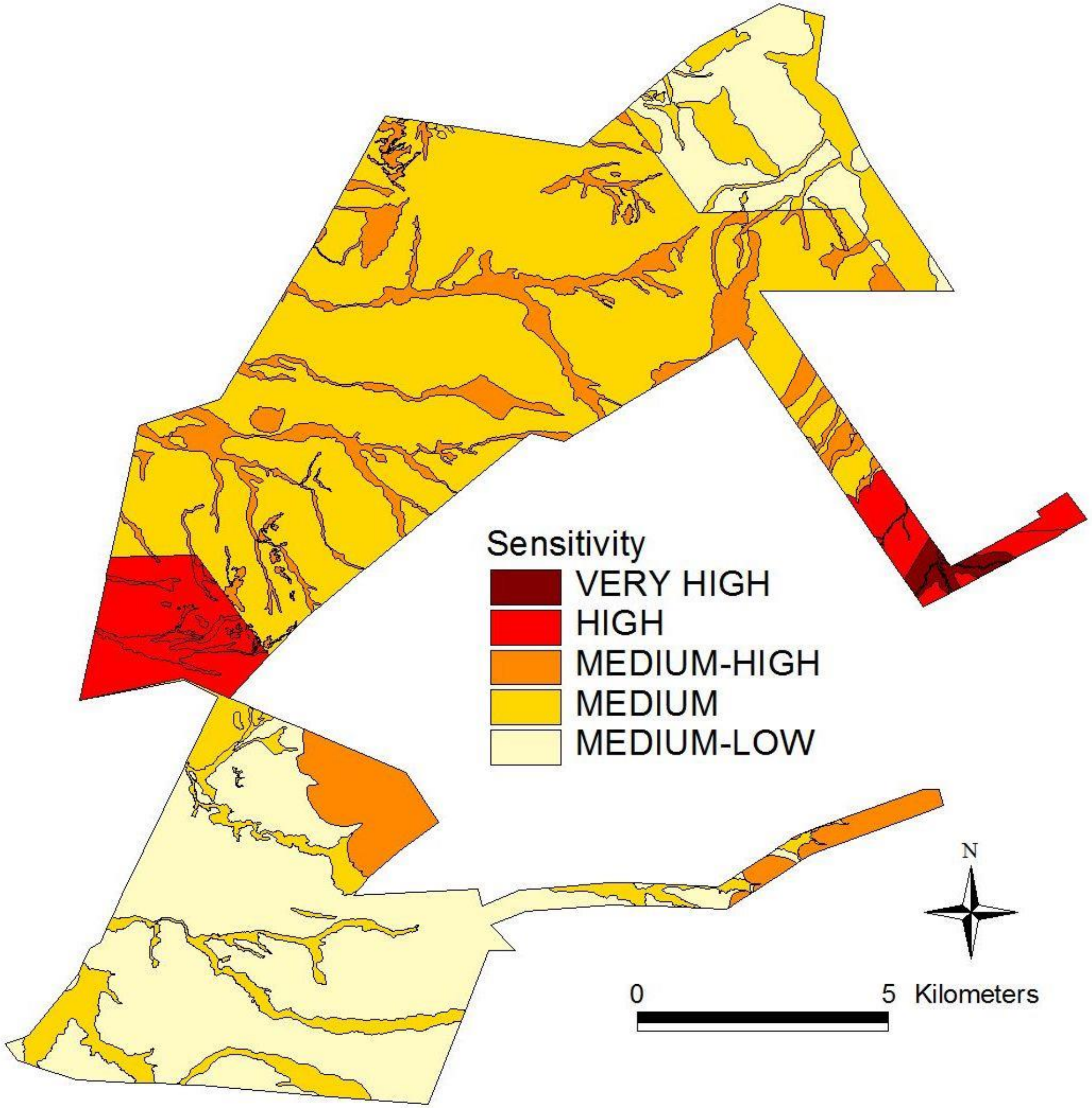

Figure 12: Habitat sensitivity of the study area, including CBAs.

DESCRIPTION OF POTENTIAL IMPACTS

Potential issues relevant to impacts on the ecology of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including indigenous grassland and wetland vegetation that leads to direct or indirect loss of such habitat.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
    - disruption to nutrient-flow dynamics;
    - impedance of movement of material or water;
    - habitat fragmentation;
    - changes to abiotic environmental conditions;
    - changes to disturbance regimes, e.g. increased or decreased incidence of fire;
    - changes to successional processes;
    - effects on pollinators;
    - increased invasion by alien plants.

Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

Potential sensitive receptors in the general study area

A summary of the potential ecological issues for the study area is as follows (issues assessed by other specialists, e.g. on birds and on wetland and hydrological function, are not included here):

- Presence of natural vegetation on site, much of which has high conservation value due to being within Critical Biodiversity Areas (CBA1 and CBA2). Although in CBAs, the vegetation types are not nationally transformed to a high degree and none are listed.
- Presence of shallow drainage valleys and associated vegetation on site, assessed as being sensitive to impacts associated with development as well as being important habitat for various plant and animal species.
- Presence of various plant species protected according to the Northern Cape Nature Conservation Act (Act 9 of 2009). The identity of such species requires detailed floristic surveys within the footprint of the proposed project.
- Potential presence of one protected frog species, namely the Giant Bullfrog, not listed, but protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).
- Presence of two mammal species of concern, the Black-footed Cat (Vulnerable), and Cape Clawless Otter (Near Threatened), both protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).
- Potential presence of other mammal species of concern, the South African Hedgehog (Near Threatened), Grey Rhebok, White-tailed Rat (Vulnerable) and Spectacled Dormouse (Near Threatened), the first three also protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).

- Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. There are a large number of alien invasive species present on site or in neighbouring areas, all of which have the potential to invade more widely, given the right circumstances.

Construction Phase Impacts

Direct impacts

Direct impacts include the following:

1. Loss and/or fragmentation of indigenous natural vegetation due to clearing;
2. Loss of individuals of plant species of conservation concern and/or protected plants;
3. Loss of faunal habitat and refugia;
4. Direct mortality of fauna due to machinery, construction and increased traffic;
5. Displacement and/or disturbance of fauna due to increased activity and noise levels;
6. Increased poaching and/or illegal collecting due to increased access to the area.

Operational Phase Impacts

Direct impacts

Ongoing direct impacts will include the following:

1. Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure;

Indirect impacts

These will include the following:

1. Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors;
2. Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape;

Decommissioning Phase Impacts

Direct impacts

These will include the following:

1. Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites;
2. Direct mortality of fauna due to machinery, construction and increased traffic;
3. Displacement and/or disturbance of fauna due to increased activity and noise levels;

Indirect impacts

These will occur due to renewed disturbance due to decommissioning activities, as follows:

1. Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors;
2. Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape;

ASSESSMENT OF IMPACTS

This section of the report provides an assessment of identified impacts for each of the three proposed projects. The assessment is identical for all three projects and therefore the tables below apply to all three projects.

Solar PV Infrastructure

There are various impacts that have been assessed as having medium significance prior to mitigation, but for which the significance is low after mitigation. This means that, with one exception, all impacts are assessed as having low significance after mitigation. The exception is the impact on indigenous natural vegetation, with a significance of medium before and after mitigation, where construction will lead to a loss of vegetation. The impact will definitely occur, will be permanent and is irreversible, and no mitigation can change these factors.

Table 7: Assessment of impacts for the solar PV infrastructure for all three facilities.

SOLAR PV FACILITY																						
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Indigenous natural vegetation	Loss and/or fragmentation of vegetation due to clearing for construction of infrastructure.	1	4	4	2	4	2	30	-	Medium	Use existing road infrastructure for access roads. Avoid construction of infrastructure within sensitive habitats. Minimise vegetation clearing and disturbance to footprint areas only. Compile a rehabilitation programme and rehabilitate disturbed areas.	1	4	3	2	4	2	28	-	Medium
Plant species of concern and protected plants	Loss of individuals due to clearing for construction of infrastructure.	1	4	2	2	3	2	24	-	Medium	Undertake a walk-through survey of footprint areas. Obtain all necessary permits.	1	4	1	2	1	1	9	-	Low

Fauna	Loss of habitat due to clearing for construction of infrastructure	1	3	2	2	3	2	22	-	Low	Use existing road infrastructure for access roads. Avoid construction of infrastructure within sensitive habitats. Minimise vegetation clearing and disturbance to footprint areas only. Compile a rehabilitation programme and rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Fauna	Direct mortality due to machinery, construction and increased traffic	1	2	2	2	1	2	16	-	Low	Avoid construction of infrastructure within sensitive habitats. Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low
Fauna	Displacement and disturbance due to increased activity and noise levels	1	2	2	2	1	2	16	-	Low	Avoid construction of infrastructure within sensitive habitats. Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low
Flora and fauna	Increased poaching and/or illegal collecting due to improved access to the area.	1	2	2	2	1	2	16	-	Low	Strict access control to the site. Environmental awareness education for staff and visitors. Report any infringements to law enforcement.	1	2	2	2	1	1	8	-	Low
Operational Phase																				

Fauna	Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure	1	2	2	2	1	2	16	-	Low	Implement traffic control measures, including speed limits. Environmental awareness education for staff and visitors.	1	2	2	2	1	1	8	-	Low
Vegetation	Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	Medium	Compile and implement Alien Invasive Management Plan. Rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Vegetation	Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	Compile and implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. Undertake regular monitoring to detect erosion features early so that they can be controlled. Implement control measures. Avoid building on or near steep or unstable slopes. Construct proper culverts, bridges and/or crossings at drainage-line crossings, and other attenuation devices to limit overland flow	1	2	2	2	3	1	10	-	Low
Decommissioning Phase																				
Vegetation	Loss and disturbance of natural vegetation	1	3	2	2	2	2	20	-	Low	No additional clearing of vegetation should take place without a proper assessment of	1	3	2	2	2	1	10	-	Low

	due to the removal of infrastructure and need for working sites										the environmental impacts and authorization from relevant authorities. If any additional infrastructure needs to be constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing infrastructure, and clustered to avoid dispersed impacts. No driving of vehicles off-road. Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. Access to sensitive areas outside of development footprint should not be permitted during operation. Surface runoff and erosion must be properly controlled and any issues addressed as quickly as possible									
Fauna	Direct mortality of fauna due to machinery, construction and increased traffic	1	2	2	2	3	2	20	-	Low	Personnel and vehicles to avoid sensitive habitats. No speeding on access roads – install speed control measures, such as speed humps, if necessary No illegal collecting of any individuals, particularly the Armadillo Girdled Lizard. No hunting of protected species or hunting of any other species without a valid permit. Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected	1	2	2	1	3	1	9	-	Low

										species. Report any sitings to conservation authorities. Prevent unauthorised access to the site – project roads provide access to remote areas that were not previously easily accessible for illegal collecting or hunting									
Fauna	Displacement and/or disturbance of fauna due to increased activity and noise levels	1	2	2	1	1	1	7	-	Low	Restrict impact to development footprint only and limit disturbance spreading into surrounding areas. Access to sensitive areas outside of infrastructure footprint should not be permitted during construction. No speeding on access roads – install speed control measures, such as speed humps, if necessary No hunting of protected species. Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species. Report any sitings to conservation authorities	1	2	2	1	1	1	7	-	Low
Vegetation	Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	Medium	Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. Undertake regular monitoring to detect alien invasions early so that they can be controlled. Post-decommissioning monitoring should continue for an	1	2	2	2	3	1	10	-	Low

											appropriate length of time to ensure that future problems are avoided. Do NOT use any alien plants during any rehabilitation that may be required.									
Vegetation	Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	Implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. Following decommissioning, undertake regular monitoring for an appropriate length of time to detect erosion features early so that they can be controlled. Implement any control measures that may become necessary. Avoid undertaking any activities on or near steep or unstable slopes.	1	2	2	2	3	1	10	-	Low

Grid Infrastructure

All assessed impacts have a low significance after the application of mitigation measures.

Table 8: Assessment of impacts of the grid connection infrastructure for all three projects.

GRID CONNECTION INFRASTRUCTURE																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Indigenous natural vegetation	Loss and/or fragmentation of vegetation due to clearing for construction of infrastructure.	1	3	2	2	3	2	22	-	Low	Use existing road infrastructure for access roads. Avoid construction of infrastructure within sensitive habitats. Minimise vegetation clearing and disturbance to footprint areas only. Compile a rehabilitation programme and rehabilitate disturbed areas.	1	3	2	2	2	2	20	-	Low

Plant species of concern and protected plants	Loss of individuals due to clearing for construction of infrastructure.	1	3	2	2	3	2	22	-	Low	Undertake a walk-through survey of footprint areas. Obtain all necessary permits.	1	3	1	2	1	1	8	-	Low
Fauna	Loss of habitat due to clearing for construction of infrastructure	1	3	2	2	3	2	22	-	Low	Use existing road infrastructure for access roads. Avoid construction of infrastructure within sensitive habitats. Minimise vegetation clearing and disturbance to footprint areas only. Compile a rehabilitation programme and rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Fauna	Direct mortality due to machinery, construction and increased traffic	1	2	2	2	1	2	16	-	Low	Avoid construction of infrastructure within sensitive habitats. Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low
Fauna	Displacement and disturbance due to increased activity and noise levels	1	2	2	2	1	2	16	-	Low	Avoid construction of infrastructure within sensitive habitats. Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low

Flora and fauna	Increased poaching and/or illegal collecting due to improved access to the area.	1	2	2	2	1	2	16	-	Low	Strict access control to the site. Environmental awareness education for staff and visitors. Report any infringements to law enforcement.	1	2	2	2	1	1	8	-	Low
Operational Phase																				
Fauna	Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure	1	2	2	2	1	2	16	-	Low	Implement traffic control measures, including speed limits. Environmental awareness education for staff and visitors.	1	2	2	2	1	1	8	-	Low
Vegetation	Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	Medium	Compile and implement Alien Invasive Management Plan. Rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Vegetation	Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	2	2	3	3	2	22	-	Medium	Compile and implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. Undertake regular monitoring to detect erosion features early so that they can be controlled. Implement control measures. Avoid building on or near steep or unstable slopes. Construct proper	1	2	2	2	3	1	10	-	Low

											culverts, bridges and/or crossings at drainage-line crossings, and other attenuation devices to limit overland flow									
Decommissioning Phase																				
Vegetation	Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	1	3	2	2	2	2	20	-	Low	No additional clearing of vegetation should take place without a proper assessment of the environmental impacts and authorization from relevant authorities. If any additional infrastructure needs to be constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing infrastructure, and clustered to avoid dispersed impacts. No driving of vehicles off-road. Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. Access to sensitive areas outside of development footprint should not be permitted during operation. Surface runoff and erosion must be properly controlled and any issues addressed as quickly as possible	1	3	2	2	2	1	10	-	Low
Fauna	Direct mortality of fauna due to machinery, construction and increased traffic	1	2	2	2	3	2	20	-	Low	Personnel and vehicles to avoid sensitive habitats. No speeding on access roads – install speed control measures, such as speed humps, if necessary No illegal	1	2	2	1	3	1	9	-	Low

											collecting of any individuals, particularly the Armadillo Girdled Lizard. No hunting of protected species or hunting of any other species without a valid permit. Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species. Report any sitings to conservation authorities. Prevent unauthorised access to the site – project roads provide access to remote areas that were not previously easily accessible for illegal collecting or hunting									
Fauna	Displacement and/or disturbance of fauna due to increased activity and noise levels	1	2	2	1	1	1	7	-	Low	Restrict impact to development footprint only and limit disturbance spreading into surrounding areas. Access to sensitive areas outside of infrastructure footprint should not be permitted during construction. No speeding on access roads – install speed control measures, such as speed humps, if necessary No hunting of protected species. Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species. Report any sitings to conservation authorities	1	2	2	1	1	1	7	-	Low
Vegetation	Continued establishment and spread of alien invasive plant	1	3	2	3	3	2	24	-	Medium	Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term	1	2	2	2	3	1	10	-	Low

	species due to the presence of migration corridors and disturbance vectors										control. Undertake regular monitoring to detect alien invasions early so that they can be controlled. Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. Do NOT use any alien plants during any rehabilitation that may be required.									
Vegetation	Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	Implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. Following decommissioning, undertake regular monitoring for an appropriate length of time to detect erosion features early so that they can be controlled. Implement any control measures that may become necessary. Avoid undertaking any activities on or near steep or unstable slopes.	1	2	2	2	3	1	10	-	Low

CUMULATIVE IMPACTS

The projects listed in Table 9 have been identified within a 50 km radius of the project area (shown in Figure 13 below) and are included in the Cumulative Impact Assessment. There are 17 projects listed that cover a fairly broad area, mostly to the east, north-east and north of the current project. The combination of all projects together also includes most of the natural environment in this quadrant relative to the current project (see Figure 13).

Table 9: Projects within a 50 km radius of the Umsombomvu PV Solar Energy Facility.

Project	DEA reference no.	Technology	Capacity	Status
Allemans Fontein SEF	14/12/16/3/3/1/730	Solar	20MW	Approved
Carolus Poort SEF	14/12/16/3/3/1/729	Solar	20MW	Approved
Damfontein SEF	14/12/16/3/3/1/728	Solar	20MW	Approved
Gillmer SEF	14/12/16/3/3/1/735	Solar	20MW	Approved
Inkululeko SEF	14/12/16/3/3/1/553	Solar	20MW	Approved
Kleinfontein SEF	12/12/20/2654	Solar	20MW	Approved
Klip Gat SEF	14/12/16/3/3/2/354	Solar	75M	Approved
Linde SEF	12/12/20/2258	Solar	40MW	In Operation
Linde SEF (Expansion)	14/12/16/3/3/1/1122	Solar	75MW	Approved
Middelburg Solar Park 1	12/12/20/2465/2	Solar	75MW	Approved
Middelburg Solar Park 2	12/12/20/2465/1	Solar	75MW	Approved
Naauw Poort SEF	14/12/16/3/3/2/355	Solar	75MW	Approved
Toitdale SEF	12/12/20/2653	Solar	20MW	Approved
Noupoort Wind Farm	12/12/20/2319	Wind	188MW	In Operation
Phezukomoya WEF	14/12/16/3/3/1/1028	Wind	315MW	EIA in Process
San Kraal WEF	14/12/16/3/3/1/1069	Wind	390MW	EIA in Process
Umsobomvu WEF	14/12/16/3/3/2/730	Wind	140MW	Approved

Environmental Impact Reports for a number of these projects were made available to assess cumulative impacts for the current project. A summary of the main impacts and associated mitigation measures are provided in the table below (Table 10).

Table 10: Ecological impacts and proposed mitigation measures for projects within a 50 km radius of the three projects.

Impact	Mitigation measures	Project
• *Loss of vegetation* • *Increase in runoff and erosion* • *Loss of and alteration of microhabitats* • *Establishment and spread of alien invasive species* • *Ecological degradation and loss of ecological integrity* • *Fragmentation and reduction in core habitat*	• Make use of existing tracks • Plant search and rescue • Minimise habitat loss • Remove and collect all succulent and bulbous plants from cleared areas and transplant into newly redistributed topsoils • Prevent pollution of the environment • Re-establish vegetation where possible • Implement an invasive/exotic species eradication programme • Keep new developments close to existing developed areas and/or keep components of the new development as close together as possible.	• Allemans Fontein Solar Energy Facility • Carolus Poort Solar Energy Facility • Damfontein PV Solar Energy Facility • Gillmer Solar Energy Facility

	• New powerlines should follow existing servitudes.	
• *Loss of vegetation* • *Increase in runoff and erosion* • *Loss of and alteration of microhabitats* • *Altered vegetation cover* • *Altered distribution of rainfall* • *Spread and establishment of alien invasive species* • *Oil and chemical contamination of habitats*	• Use existing roads • Keep affected footprint to a minimum • Create structures under roads to permit free-flow of water • Re-inforce existing roads and create berms to limit erosion • Prevent leakage of oil and other chemicals • Remove topsoil and redistribute to mimic microtopography of the original vegetation • Monitor the establishment of alien vegetation and remove as soon as detected • After decommissioning, rehabilitate disturbed areas • Maintain natural vegetation cover under panels • Place power line pylons as far as possible outside drainage lines	• Inkululeko Solar Energy Facility
• *Loss of protected plants* • *Loss of faunal habitat*	• Cause minimum damage to the environment with construction equipment • Restrict construction activities to development footprint • Use existing roads as far as possible • Check final footprint for burrows of small mammals	• Kleinfontein Solar Energy Facility • Toitdale Solar Energy Facility
• *Direct loss of vegetation* • *Spread of declared weeds and alien invader plants* • *Loss of faunal habitat*	• Keep development impact within footprint area. • Disturbed areas should be rehabilitated as soon as possible. • Establish a monitoring programme to detect alien invasive plant species. • An active re-vegetation plan should be implemented to assist the return of natural indigenous species.	• Klip Gat Solar Energy Facility • Tollie PV
• *Alteration of vegetation cover* • *Erosion* • *Disruption of ethology of species*	No specific measures proposed, habitat considered to be of low value.	Nine Scatec sites
• *Loss of individuals of species of concern* • *Loss of habitat / indigenous natural vegetation* • *Impacts on ecosystem function*	• Contain impacts to within footprint of infrastructure • Implement measures to minimize erosion • Implement a storm-water management plan • Limit disturbance to vegetation surrounding infrastructure • Rehabilitate disturbed areas as quickly as possible • Avoid translocating soil stockpiles from areas containing alien plants • Control aline plants • Establish a monitoring programme to detect and control alien plants	Middelburg Solar Park
• *Direct loss of vegetation* • *Disturbance to vegetation and associated habitats* • *Spread of declared weeds and alien invasive species*	• Search and Rescue all translocatable indigenous plants • Prevent contamination by oil, diesel and other contaminants • Mitigate disturbance or loss of natural vegetation • Control declared weeds and alien invasive plants	Naauwpoort Solar Energy Facility

	• Mitigate loss of fauna • Prevent damage to drainage systems • Minimise soil degradation and erosion	
• *Loss of natural vegetation* • *Loss of habitat for red data and general species* • *Loss of species richness* • *Edge effects* • *Erosion* • *Introduction of exotic species* • *Loss of habitat for fauna*	• Maintain footprint strictly during construction • Conduct walk-through survey prior to construction to conduct a search and rescue • Retain indigenous vegetation, where possible • Demarcate sensitive areas prior to construction • Vegetation to be removed only when necessary • No vegetation to be used for firewood • Implement a programme of weed control • Grass soil stockpiles to prevent weed invasion • Avoid emergence of alien invasive species • Use existing access roads • Compile a rehabilitation plan • Revegetate any disturbed areas as a priority to avoid erosion • Put in place suitable storm water / wind controls until rehabilitation is completed	Noupoort Wind Farm
• *Faunal habitat loss* • *Loss of vegetation and listed/protected plant species* • *Impacts on fauna*	• Avoid placement of infrastructure within High sensitivity areas and drainage lines • Preconstruction walk-through of approved development footprint • Rehabilitate disturbed areas, for example laydown areas, after use • Minimise development footprint • Rehabilitate disturbed areas that are no longer required by the operational phase of the development • Exact routing of roads should be adjusted to avoid sensitive habitats • Preconstruction environmental induction for all construction staff • Demarcate sensitive areas in close proximity to the development footprint as no-go areas • During construction, any fauna directly threatened by construction activities should be removed to a safe location • Illegal collection, hunting or harvesting should be strictly forbidden • No fires in open veld • No fuelwood collection on site • No dogs or cats should be allowed on site • Control type, nature and timing of night-time lighting • Store all haradous materials in an appropriate manner • No unauthorized persons to be allowed on site and implement site access control • Enforce speed limits • If electric fencing is required anywhere, this should be designed to minimize impacts on fauna • Manage erosion according to an Erosion Management Plan and Rehabilitation Plan	Phezukomoya Wind Energy Facility San Kraal Wind Farm

	• All roads and hardened surfaces should have runoff control features • Regular monitoring of erosion • All cleared areas should be revegetated with indigenous species from the local area • Wherever excavation is necessary, topsoil should be set aside and replaced after construction • Implement a long-term alien plant management plan • Regular monitoring for alien plants within the development footprint as well as surrounding areas • Undertake regular clearing of alien plants using best-practice methods for the species concerned • No excavated holes or trenches should be left open for extended periods • Regular monitoring for at least two years after decommissioning to ensure that no erosion problems develop • All erosion problems observed should be rectified as soon as possible using appropriate erosion control methods	

Note that none of the projects recorded threatened plant species or protected trees.

Description of cumulative impacts

There are various cumulative impacts that may occur as a result of the combined impact of a number of similar projects in the area, as follows:

1. Loss and/or fragmentation of indigenous natural vegetation due to clearing;
2. Loss of individuals of plant species of conservation concern and/or protected plants;
3. Changes to ecological processes at a landscape level;
4. Mortality, displacement and/or disturbance of fauna;
5. General increase in the spread and invasion of new habitats by alien invasive plant species;
6. Reduction in the opportunity to undertake or plan conservation, including effects on CBAs and ESAs, as well as on the opportunity to conserve any part of the landscape;
7. Positive cumulative impact on climate change.

Cumulative impacts on indigenous natural vegetation

The regional terrestrial vegetation types in the broad study area are listed as Least Threatened and generally have large areas. Loss of habitat will definitely occur for each project, each of which will be a small area in comparison to the total area of the vegetation type. The total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, the area lost in total will be small compared to the total area of the vegetation types concerned. Of more concern is the total degree of fragmentation due to the combination of all projects, which will be much more significant than gross loss of habitat, measured in hectares. Direct loss of habitat will not result in a change in the conservation status of the vegetation types, but overall degradation due to fragmentation effects may be cause for concern. The cumulative effect will therefore be low for vegetation loss, but possibly significant for fragmentation. In addition, the current project is located in a rural area with the no existing infrastructure nearby, as is the case with all the other proposed projects. This will fundamentally change the character of this area in terms of its remoteness and natural state.

Cumulative impacts on plant species of concern and protected plant species

There are no plant species of conservation concern for the site, but there are various protected plant species that may occur in the study area, all of which are relatively widespread. Constructing the current project increases the likelihood of individuals being affected, but unless large numbers of individuals are directly affected, there will only be small cumulative effects.

Cumulative impacts on ecological processes

There are various ecological processes that may be affected at a landscape level by the presence of multiple projects. This includes obvious processes, such as migration, pollination and dispersal, but also more difficult to interpret factors, such as spatial heterogeneity, community composition and environmental gradients, that can become disrupted when landscapes are disturbed at a high level. Disturbance can alter the pattern of variation in the structure or function of ecosystems. Fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. An important consequence of repeated, random clearing is that contiguous cover can break down into isolated patches. This happens when the area cleared exceed a critical level and landscapes start to become disconnected. Spatially heterogenous patterns can be interpreted as individualistic responses to environmental gradients and lead to natural patterns in the landscape. Disrupting gradients and creating disturbance edges across wide areas is very disruptive of natural processes and will lead to fundamental changes in ecosystem function. It is possible that this could be a cumulative consequence of the combined projects, but is difficult to determine without a detailed assessment of fragmentation of the combination of all the projects.

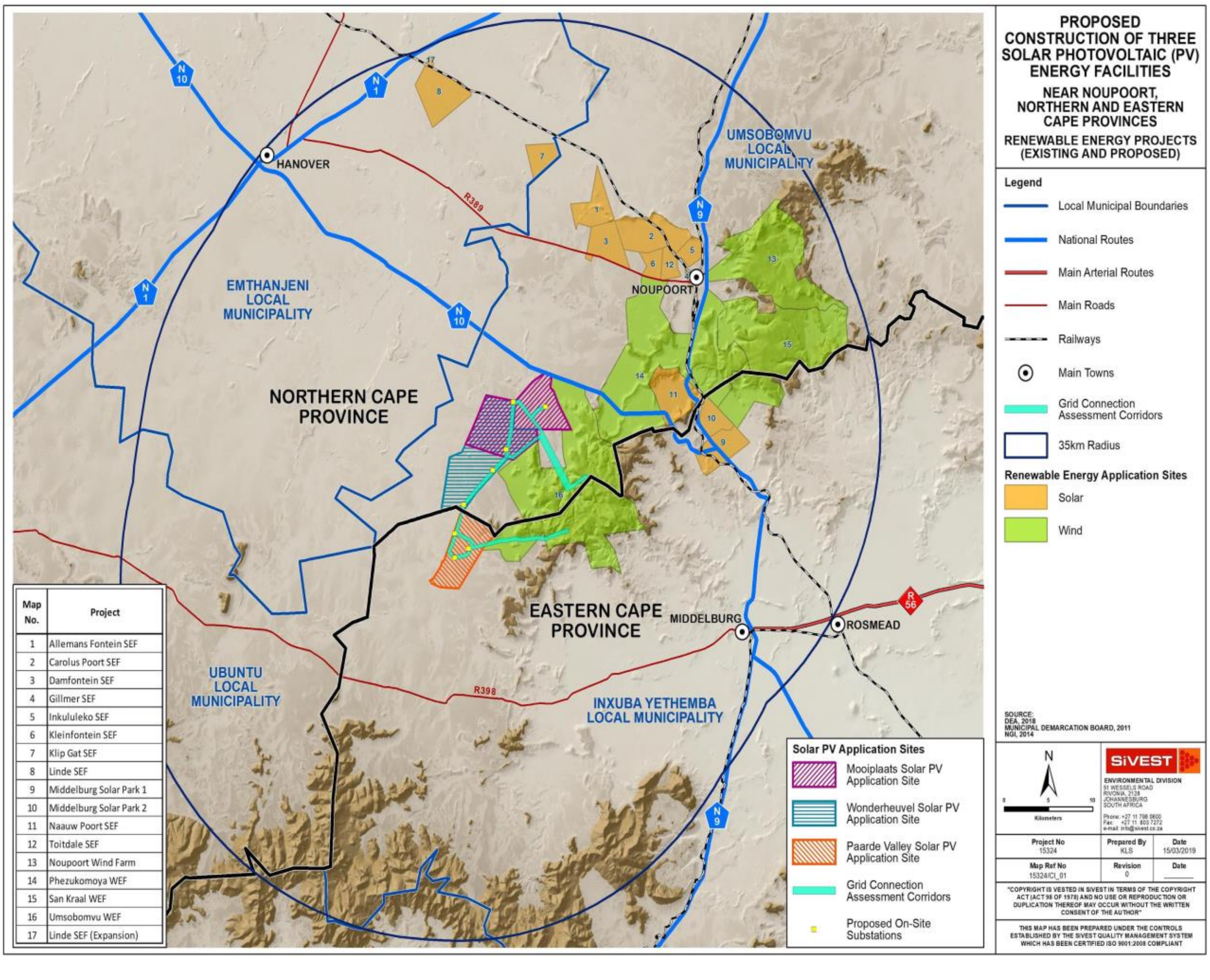

Figure 13: Other proposed renewable energy developments within 50 km radius.

Cumulative impacts on fauna
Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the area. This effect will be increased if there are a number of projects being constructed at the same time or in quick succession, so the effect is likely to be cumulative. However, the geographical ranges of the species of concern is wide and it is considered that the significance of the effect will be low in the long-term, although probably significant during the combined construction phase of the projects. It is possible that some species will be more significantly negatively affected than others, especially shy species, territorial species that get displaced, or those with large territories that get shrunk. It is also possible that some species will benefit from the increased presence of humans and will migrate into the area. This will possibly cause additional shifts in other species that are affected by the increase in numbers or new species.

Cumulative impacts due to spread of declared weeds and alien invader plants
There is a moderate to high possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. For the current site, the impact is predicted to be a moderate to high risk due to the current presence of various invasive species on site and in surrounding areas. The significance will probably be low if control measures are implemented. However, the increased overall disturbance of the landscape will create invasion opportunities and, if new invasions are not controlled, can create nodes that spread to new locations due to the heightened disturbance levels.

Cumulative impacts due to loss of protected animals
There are various animal species protected according to National legislation that occur in the geographical area covered by the combined projects. Some of these animals may be vulnerable to secondary impacts, such as hunting, road kill and illegal collecting. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. However, in all cases, the geographical distribution of each species is much wider than the combined project areas. The significance will therefore be low, especially if control measures are implemented.

Cumulative impacts on CBAs and conservation planning
Significant proportions of the site and surrounding sites are included in Critical Biodiversity Areas for the Northern Cape. Disruption of these areas means that conservation planners have to find alternative sites to include in future CBAs according to an algorithm that seeks a least-cost outcome for preserving biodiversity, i.e. the least amount of land space for preserving the greatest amount of area of biodiversity importance, as well as meeting specific conservation targets. At some point, the loss of suitable sites leads to a situation where it is no longer possible to plan effective conservation networks or the cost of doing so increases due to a lack of choice. The higher the density of similar projects in a uniform area, the less chance there is of finding sites suitable for conservation that contain all the attributes that are desired to be conserved, including both ecological processes and ecological patterns.

Cumulative impact on climate change
One of the primary reasons for promoting renewable energy projects is the desire to make South Africa compliant with international treaties regarding climate-change effects. The combined generation capacity of all the renewable energy projects considered here is just less than 1 600 MW, which is more than half of the average size of one of the 14 coal power stations in South Africa (Eskom's Generation Division has 14 coal-fired power stations with an installed capacity of 38 548 MW, www.eskom.co.za). A reduction in reliance on coal power would improve the air quality of the Mpumalanga Highveld (where many of these power stations are located), reduce the amount of coal-mining that would take place (which has a devastating effect on biodiversity resources and water quality) and would reduce the per capita carbon footprint of our country. Greater uptake of renewable energy would furthermore reduce the global risk of climate change, one of the factors taken into account in designing the conservation network in South Africa. The construction of renewable energy projects can be viewed as an offset for other carbon-generating technology.

Assessment of cumulative impacts

Cumulative impacts are identical for all three projects (Mooi Plaats, Wonderheuwel and Paarde Valley). The table below (Table 11) therefore applies to all three projects.

Based on the assessment provided, all cumulative impacts can be reduced to a LOW significance with mitigation measures, with the exception of "*Reduction in the opportunity to undertake or plan conservation, including effects on CBAs and ESAs, as well as on the opportunity to conserve any part of the landscape*", which has a residual significance of MEDIUM. Based on this assessment, it is considered that the cumulative impacts are acceptable.

Table 11: Assessment of cumulative impacts for all three proposed PV solar energy facilities.

MOOI PLAATS, WONDERHEUWEL AND PAARDE VALLEY SOLAR PV FACILITIES																					
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION									
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																					
Vegetation	Loss and/or fragmentation of indigenous natural vegetation due to clearing	2	4	4	2	4	2	32	-	Medium	Limit development within conservation zones, especially CBA1 areas.	2	4	4	2	4	1	16	-	Low
Plant species of concern and protected plants	Loss of individuals	2	4	2	3	3	2	28	-	Medium	It is a legal requirement to obtain permits for specimens that will be lost. Undertake a detailed pre-construction walk-through survey will be required during a favourable season to locate any additional individuals of protected plants. This survey must cover the footprint of all approved infrastructure, including internal access roads. Plants lost to the development can be rescued and planted in appropriate places in	2	4	2	2	2	1	12	-	Low

											rehabilitation areas. This will reduce the irreplaceable loss of resources as well as the cumulative effect. A Plant Rescue Plan must be compiled to be approved by the appropriate authorities. Where large populations of affected species of high value are encountered, consideration should be given to shifting infrastructure to avoid such areas. No authorization should be given that results in the loss of populations of threatened plants. Infrastructure should be relocated and a suitable buffer zone maintained around such populations. An ecological management plan must be compiled for such areas.									
Ecosystems	Changes to ecological processes at a landscape level	2	2	2	3	2	2	22	-	Low	Limit development within conservation zones, especially CBA1 areas.	2	2	2	2	2	2	20	-	Low
Fauna	Mortality, displacement and/or disturbance	2	2	2	2	1	2	18	-	Low	Apply site-specific mitigation measures.	2	2	2	1	1	1	8	-	Low
Vegetation, ecosystems and habitats	General increase in the spread and invasion of new habitats by alien plant invasive species	2	3	2	3	3	2	26	-	Medium	Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. Undertake regular monitoring to detect alien	2	2	2	2	3	1	11	-	Low

											invasions early so that they can be controlled. Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. Do NOT use any alien plants during any rehabilitation that may be required.									
Ecosystems and vegetation	Reduction in the opportunity to undertake or plan conservation, including effects on CBAs and ESAs, as well as on the opportunity to conserve any part of the landscape	3	3	2	3	4	2	30	-	Medium	Avoid development within conservation zones, especially CBA1 areas.	3	3	2	2	4	2	28	-	Medium

POSSIBLE MITIGATION MEASURES

This section of the report provides a description of mitigation measures that could be applied to minimize identified impacts for this project. However these will be confirmed during the deastiled site assessment in the EIA phase.

Mitigation measures

Use existing road infrastructure
There are existing gravel roads in the study area, as well as access roads along existing power lines. Where possible, these roads should be used for access to the proposed project areas.

Adjust infrastructure positions to avoid sensitive habitats
Where one infrastructure option is preferable over another, but there are still sensitive habitats affected, the infrastructure should be moved to avoid the sensitivity, wherever possible.

Install adequate structures at watercourse crossings
Where infrastructure, such as roads, crosses a watercourse, the crossing point must either consist of an adequately constructed dip or else must have sufficient culverts to allow natural function of the system. This means that the crossing structure must not reduce the width of the watercourse, nor result in impedence to flow of water and material. It must be both high enough and wide enough to allow natural function.

Minimise vegetation clearing and disturbance
For all construction activities, the amount of vegetation cleared should be as small as possible to minimize the amount of habitat that is lost as well as to minimize the amount of rehabilitation of disturbed areas that will be required. Areas outside the direct construction camp footprint must be fenced off or marked in some other appropriate manner and no activities must be permitted there. Vehicles and personnel must be prohibited from being in natural areas outside the footprint of the proposed construction. Access for unauthorised personnel must also be limited.

Rehabilitation Programme
A Biodiversity Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

Botanical walk-through survey
This is a requirement only to ensure legal compliance and should take place once the final layout has been determined. A Biodiversity pre-consruction walk-through survey should be undertaken to list the identity and location of all listed and protected species within the footprint of the proposed infrastructure. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. Required permits can then be obtained. This permit is the TOPS permit for which an application is submitted to the provincial department and requires the identity and an estimate of numbers for each species that will be affected.

Obtain permits for protected plants
It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. As indicated for the previous mitigation measure, this permit is the TOPS permit for which an application is submitted to the provincial department.

Search and rescue
Search and rescue operation of appropriate species within the activity footprint. This is not appropriate for all species and should only include species for which this action would be beneficial. The identity of such species will be determined during the more detailed floristic survey to be undertaken for the EIA phase. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device. The plants must be handled according to recommendations provided by the horticulturalist that will do the removal. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant. If rescued plants are housed in a temporary nursery, they may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.

Alien plant management plan
It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)), landowners are legally responsible for the control of alien species on their properties. This programme should include monitoring procedures.

Undertake regular monitoring
Monitoring should be undertaken to evaluate the success of mitigation measures. More detailed monitoring requirements will be compiled at the EIA phase of this project when more detailed information is available on potential impacts and how they will be managed.

COMPARISON OF ALTERNATIVES

Two grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for two different route alignments with associated substations contained within an assessment corridor of approximately 400m wide. These alternatives are described below for each project.

Mooi Plaats Solar PV Facility

There are two grid connection options for this project, as follows (see Figure 14):

Option 1:

a. Corridor **Option 1a** links **substation 2** and **substation 1a** to Hydra D MTS; and
b. Corridor **Option 1b** links **substation 2** and **substation 1b** to Hydra D MTS.

Option 2:

c. Corridor **Option 2a** links **Substation 2** and **Substation 1a** to Hydra D MTS via the proposed Central Collector substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV project application site.
d. Corridor **Option 2b** links **Substation 2** and **Substation 1b** to Hydra D MTS via the proposed Central Collector substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV project application site.

Grid Connection Option 1
This route is the shorter of the two options. It traverses habitat in all sensitivity classes (see Figure 15), including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 15). The option excludes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a shorter distance and requiring one less substation, this option is preferred. There is little difference between Option 1a and Option 1b, although substation 1b is probably in a slightly better position with regards to landscape topography.

Grid Connection Option 2
This route is the longer of the two options (approximately double the length). It traverses habitat in all sensitivity classes, including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 15). The option includes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a longer distance and requiring one more substation, this option is least preferred. There is little difference between Option 2a and Option 2b, although substation 1b is probably in a slightly better position with regards to landscape topography.

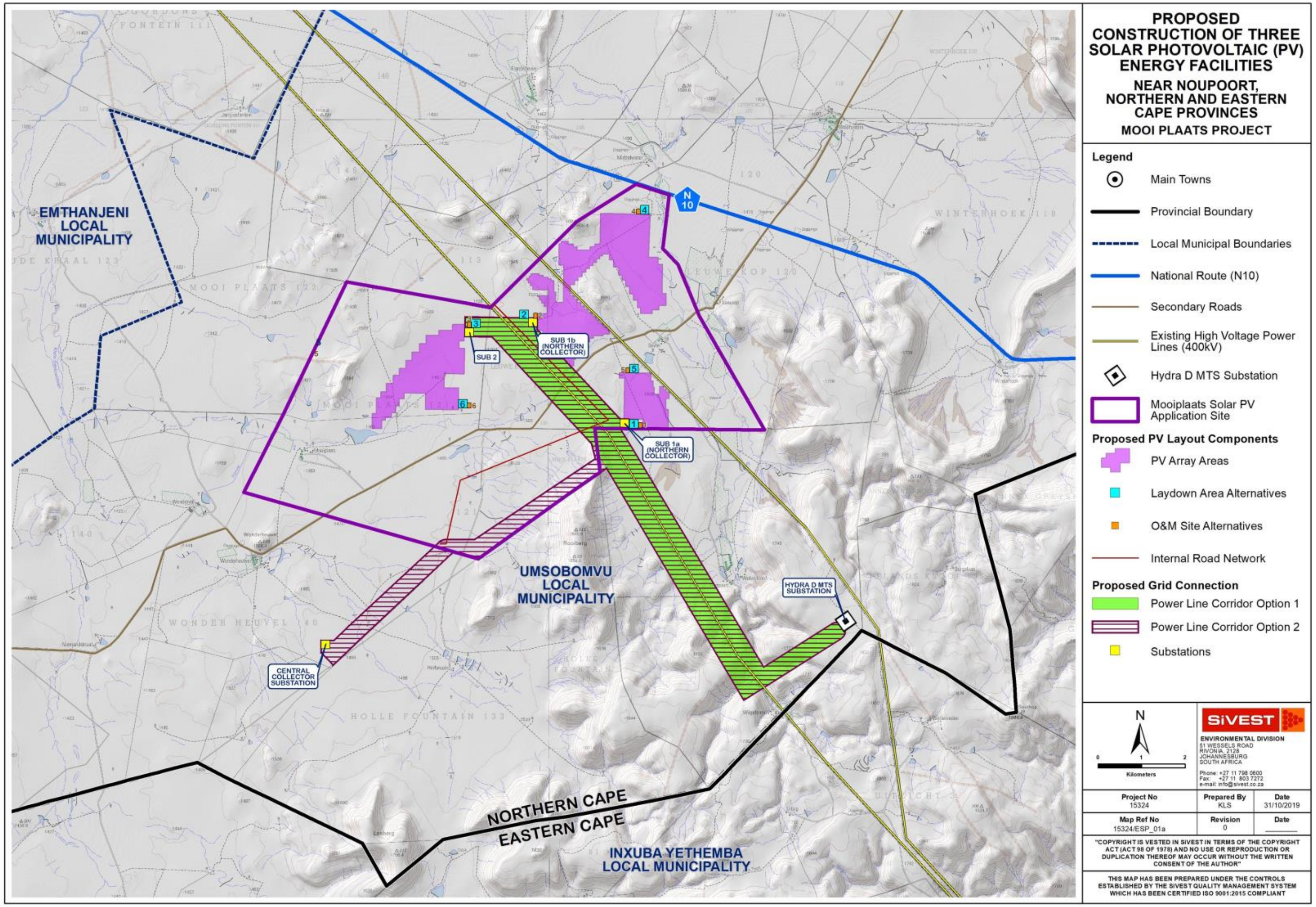

Figure 14: Mooi Plaats Solar PV Energy Facility.

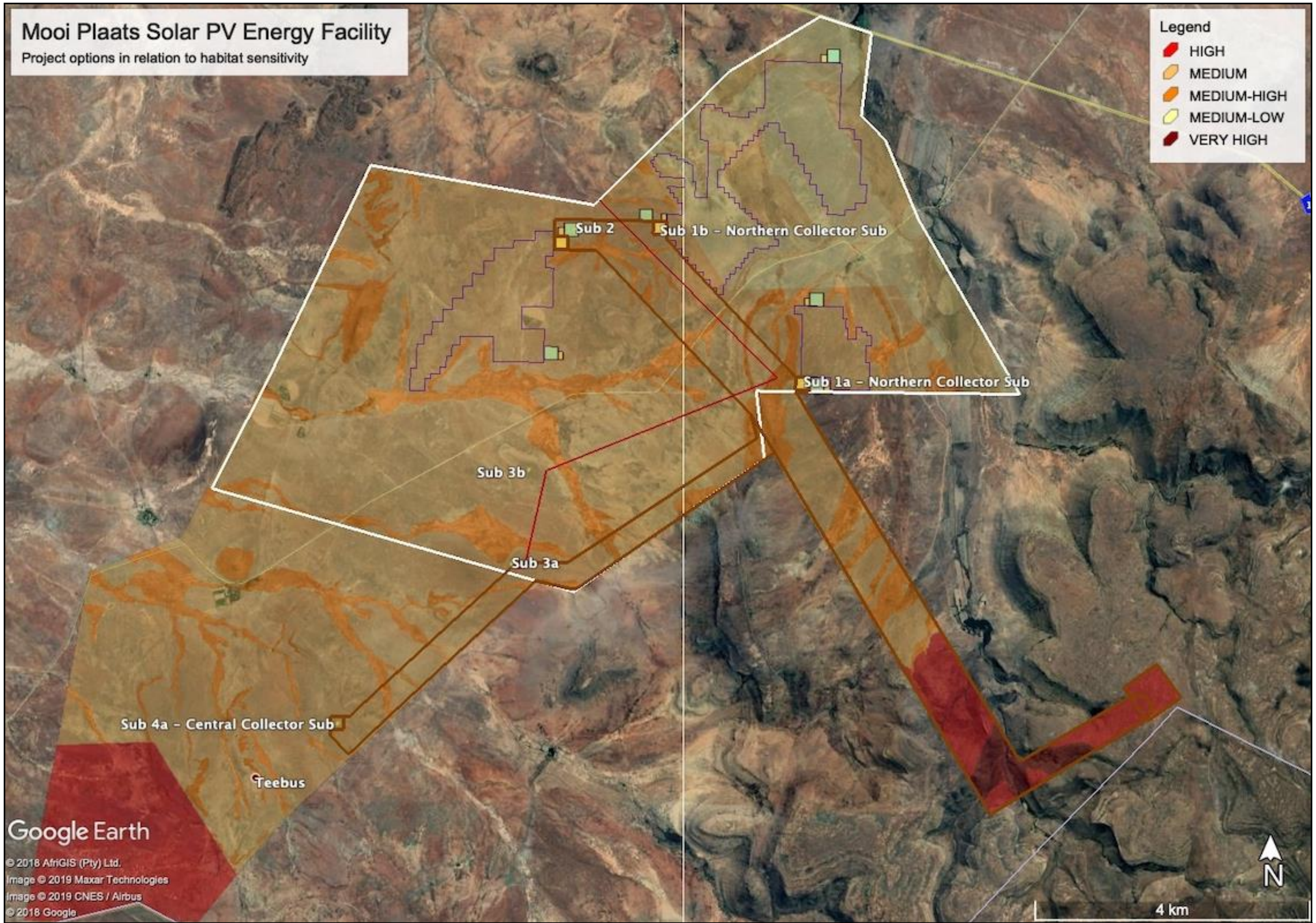

Figure 15: Mooi Plaats Solar PV Energy Facility in relation to sensitive habitats.

Wonderheuwel Solar PV Facility

There are two grid connection options for this project, as follows (see Figure 16):

Option 1:

a. Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   i. The *northern connection* links the Proposed **Substation 3a** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
   ii. The *southern connection* links the proposed **Substation 4a** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) located on the Paarde Valley PV Project application site.

b. Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   iii. The *northern connection* links the Proposed **Substation 3a** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
   iv. The *southern connection* links the proposed **Substation 4b** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) located on the Paarde Valley PV Project application site.

c. Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   v. The *northern connection* links the Proposed **Substation 3b** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
   vi. The *southern connection* links the proposed **Substation 4a** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) located on the Paarde Valley PV Project application site.

d. Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   vii. The *northern connection* links the Proposed **Substation 3b** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
   viii. The *southern connection* links the proposed **Substation 4b** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) located on the Paarde Valley PV Project application site.

Option 2:

e. Corridor **Option 2a** links **Substation 3a** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

f. Corridor **Option 2b** links **Substation 3b** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

Option 3:

g. Corridor **Option 3** links **Substation 4b** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

Grid Connection Option 1

This route is the longest of the three options (almost double the length, because it has separate lines going to two different substations, Hydra D MTS and Coleskop WEF)). It traverses habitat in all sensitivity classes, including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 17). The option includes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a longer distance, this option is least preferred. There is very little difference between the various sub-options for Option 1 (a, b, c, d).

Grid Connection Option 2

This route is the shorter of the three options. It traverses habitat in all sensitivity classes, including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 17). The option includes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a shorter distance, this option is preferred. There is very little difference between the two sub-options.

Grid Connection Option 3

This route is the shortest of the three options. It traverses habitat in all sensitivity classes, including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 17). The option includes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a shorter distance, this option is preferred.

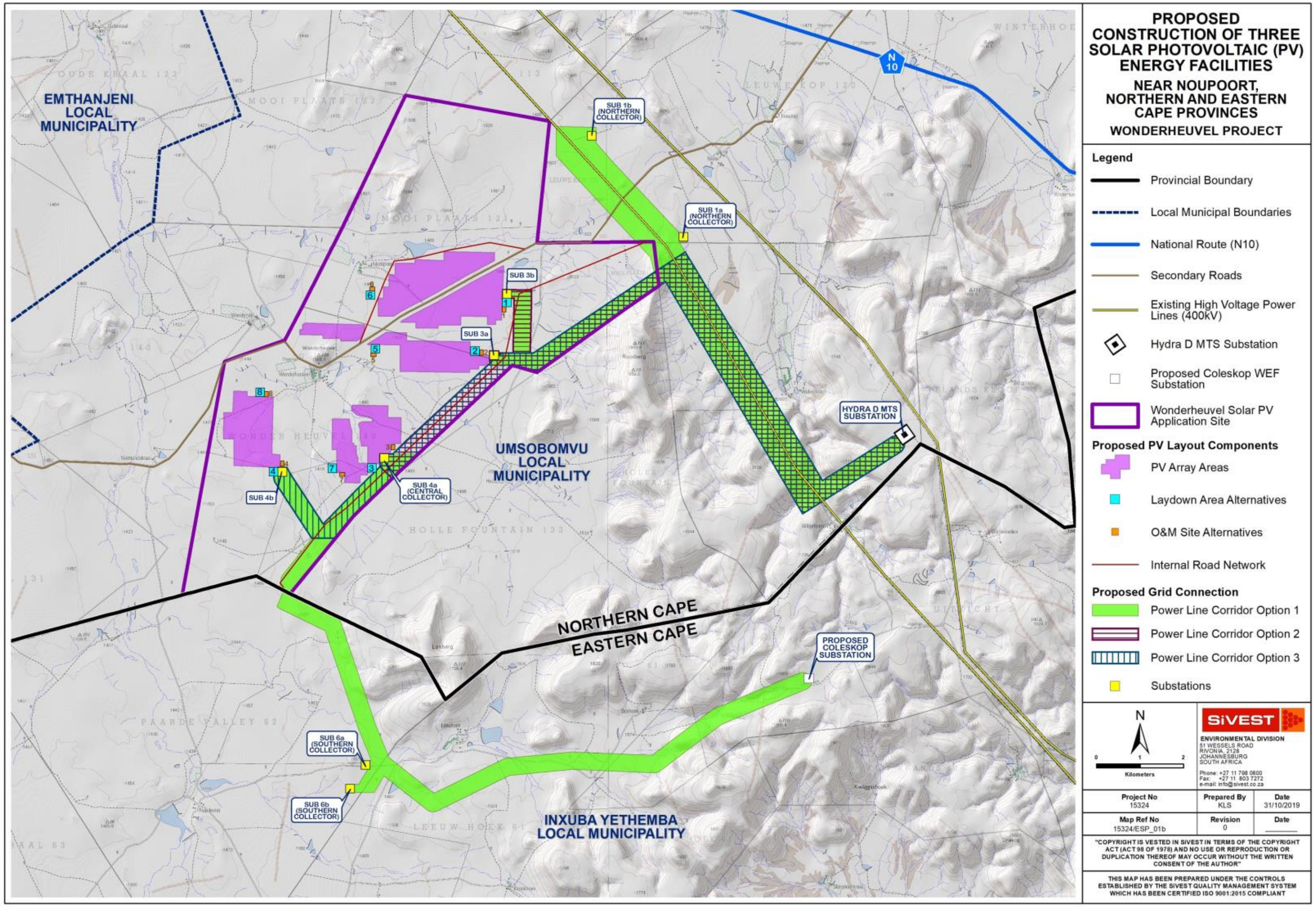

Figure 16: Wonderheuvel Solar PV Energy Facility.

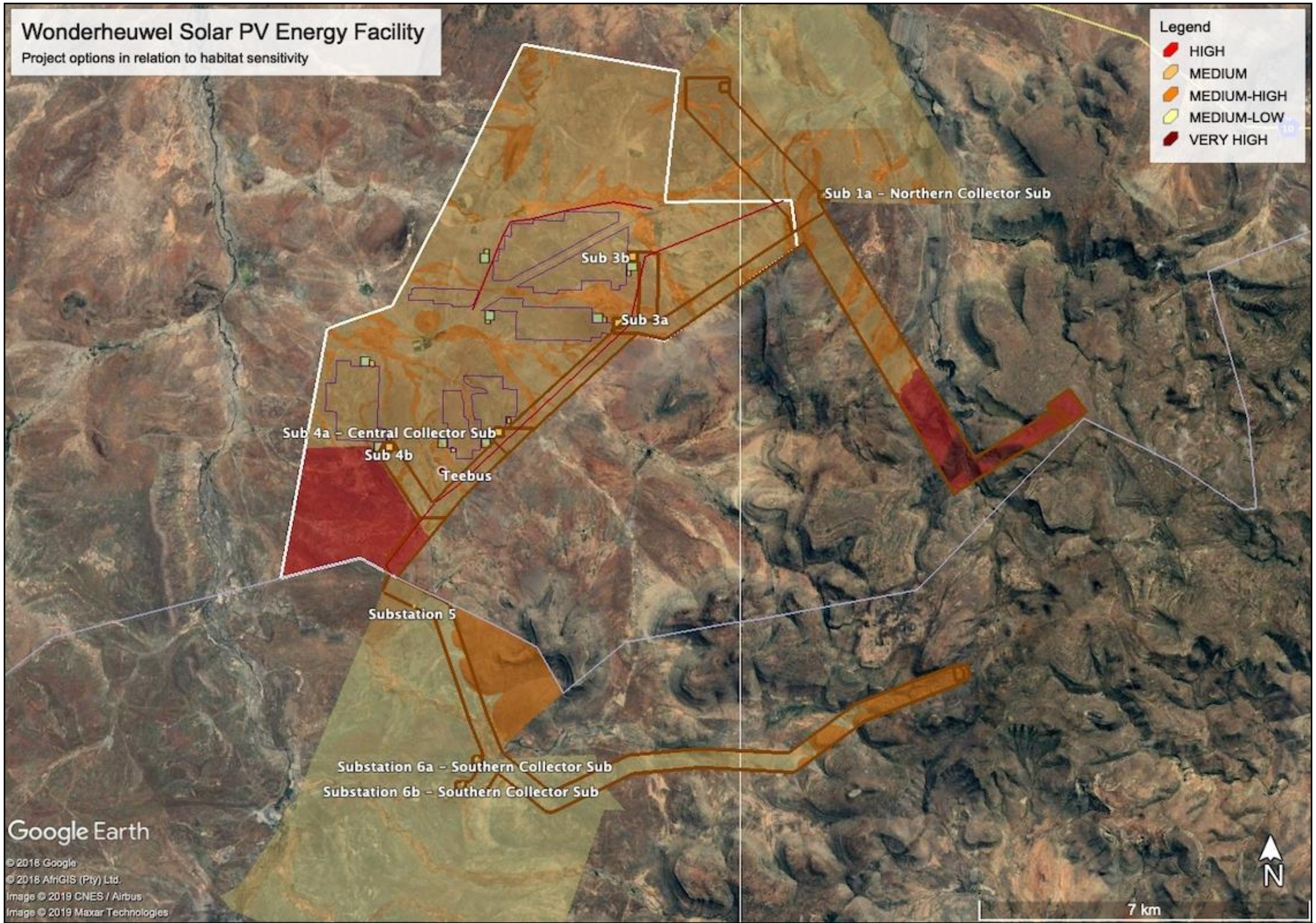

Figure 17: Wonderheuwel Solar PV Energy Facility in relation to sensitive habitats.

Paarde Valley Solar PV Facility

There are two grid connection options for this project, as follows (see Figure 18):

Option 1:

1. Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - ix. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
   - x. The *southern connection* links **Substation 7a** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

2. Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - xi. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
   - xii. The *southern connection* links **Substation 7a** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

3. Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - xiii. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
   - xiv. The *southern connection* links **Substation 7b** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

4. Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - xv. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
   - xvi. The *southern connection* links **Substation 7b** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

Option 2:

5. Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - xvii. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderveuvel PV Project application site.
   - xviii. The *southern connection* links **Substation 6a and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

6. Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   - xix. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
   - xx. The *southern connection* links **Substation 6b and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

7. Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
    xxi. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
    xxii. The *southern connection* links **Substation 6a and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

8. Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
    xxiii. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
    xxiv. The *southern connection* links **Substation 6b and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

Grid Connection Option 1

This route is the shorter of the two options. It traverses habitat in three sensitivity classes, from MEDIUM-LOW to MEDIUM-HIGH (see Figure 19). By virtue of traversing a shorter distance, this option is preferred. There is little material difference between the various sub-options (a, b, c, d), except the marginally longer distance (insignificant in relative terms) of using substation 7b rather than 7a, which means that sub-options a and b are minisculely preferred over sub-options c and d. However, the differences are so small as not to warrant serious mention.

Grid Connection Option 2

This route is the longer of the two options (almost double the length). It traverses habitat in all sensitivity classes, including areas of HIGH and VERY HIGH sensitivity near to Hydra D MTS (see Figure 19). The option includes the proposed Central Collector substation located on the Wonderheuvel PV project application site. By virtue of traversing a longer distance and being more complex (two separate routes), this option is least preferred. There is no material difference between the various sub-options (a, b, c, d).

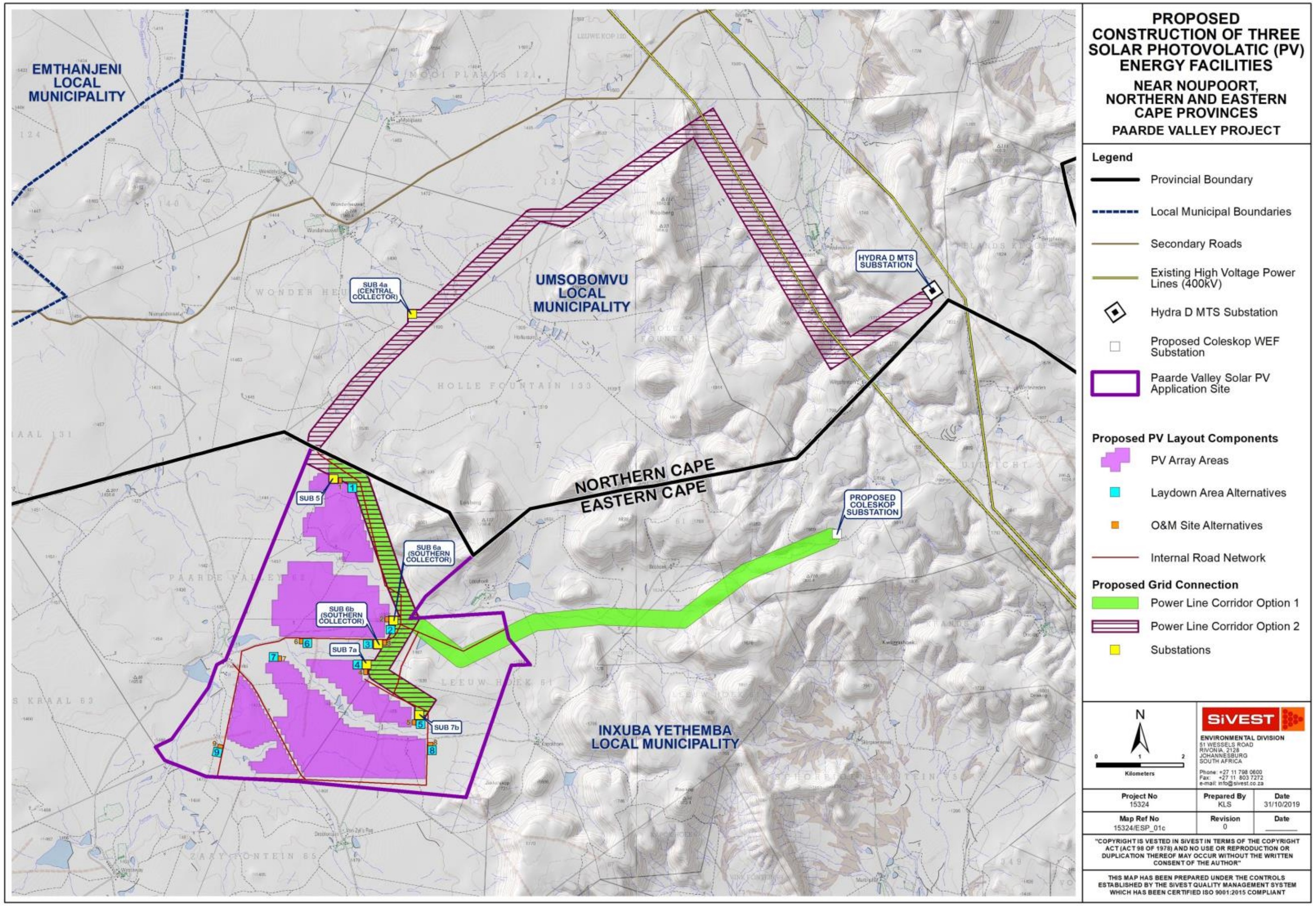

Figure 18: Paarde Valley Solar PV Energy Facility.

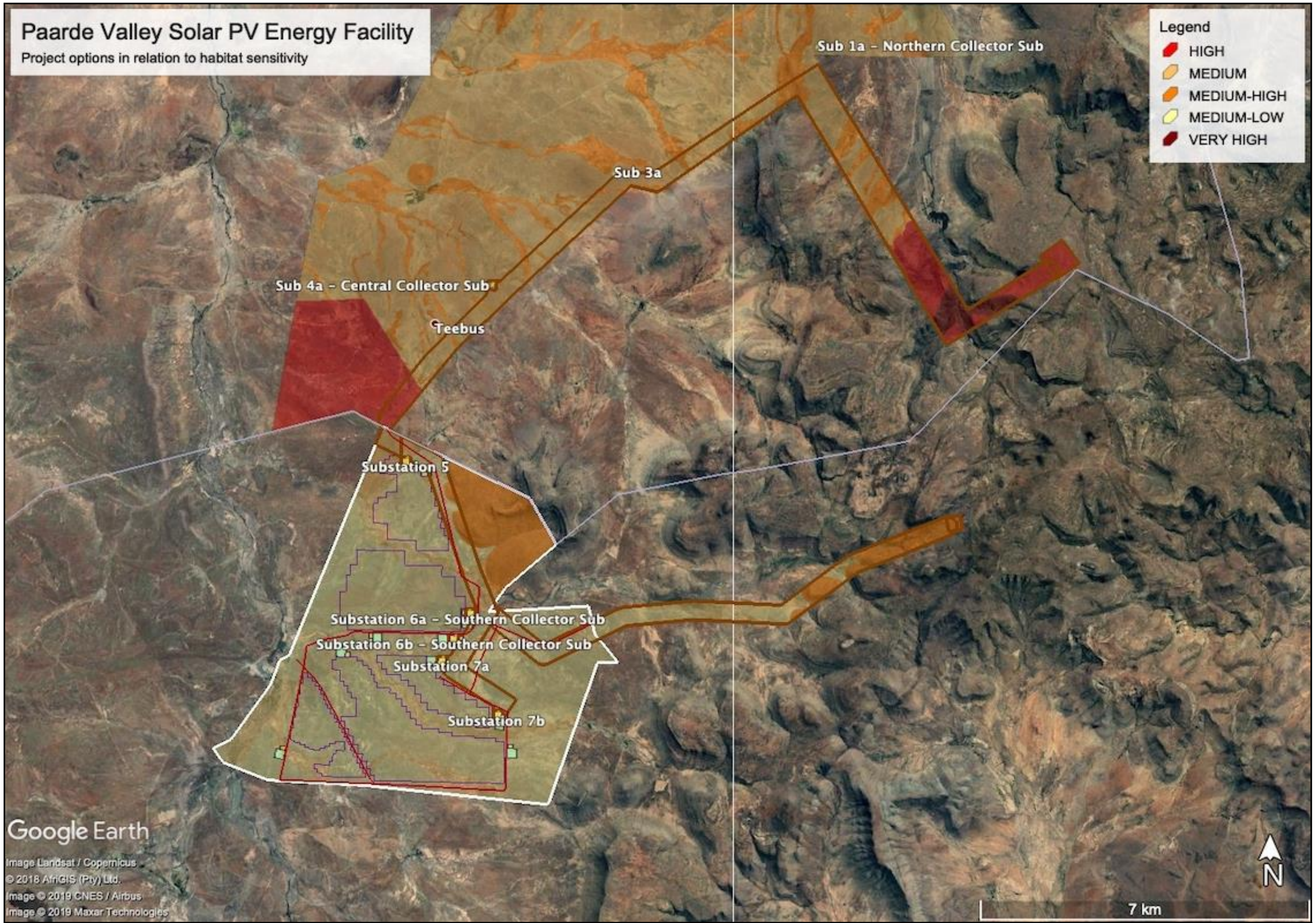

Figure 19: Paarde Valley Solar PV Energy Facility in relation to sensitive habitats.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 12: Comparative assessment of layout alternatives.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 2	FAVOURABLE	Assessed as favourable, but it is the least preferred of all the possible options, due to proximity of habitat that is slightly more sensitive than location.
Laydown Area and O&M Building Site Option 3	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 4	PREFERRED	Habitat in lowest sensitivity class
Laydown Area and O&M Building Site Option 5	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 6	FAVOURABLE	No issues
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 2	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 3	LEAST PREFERRED	Laydown Area is in a drainage line.
Laydown Area and O&M Building Site Option 4	FAVOURABLE	No site-specific issues, but immediately on boundary of CBA.
Laydown Area and O&M Building Site Option 5	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 6	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 7	LEAST PREFERRED	Laydown Area is in a drainage line.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 8	FAVOURABLE	No issues
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	LEAST PREFERRED	Laydown Area is in upper reaches of a drainage line.
Laydown Area and O&M Building Site Option 2	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 3	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 4	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 5	LEAST PREFERRED	Laydown Area is partially within a drainage line.
Laydown Area and O&M Building Site Option 6	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 7	LEAST PREFERRED	Laydown Area is on edge of a drainage line.
Laydown Area and O&M Building Site Option 8	FAVOURABLE	No issues
Laydown Area and O&M Building Site Option 9	LEAST PREFERRED	Laydown Area is in a drainage line.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	PREFERRED	Shorter distance, does not require proposed central collector substation, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 1b	PREFERRED	Shorter distance, does not require proposed central collector substation, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 2a	FAVOURABLE	Double the distance and requires an additional substation (central collector substation) , crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 2a	FAVOURABLE	Double the distance and requires an additional substation (central collector

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		substation) , crosses habitat in HIGH and VERY HIGH sensitivity classes.
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	LEAST PREFERRED	Almost double the distance and more complex, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 1b	LEAST PREFERRED	Almost double the distance and more complex, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 1c	LEAST PREFERRED	Almost double the distance and more complex, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 1d	LEAST PREFERRED	Almost double the distance and more complex, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 2a	PREFERRED	Shorter distance, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 2b	PREFERRED	Shorter distance, crosses habitat in HIGH and VERY HIGH sensitivity classes.
Grid Connection Option 3	PREFERRED	Shorter distance, crosses habitat in HIGH and VERY HIGH sensitivity classes.
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	PREFERRED	Shorter distance, does not require proposed central collector substation.
Grid Connection Option 1b	PREFERRED	Shorter distance, does not require proposed central collector substation.
Grid Connection Option 1c	PREFERRED	Shorter distance, does not require proposed central collector substation.
Grid Connection Option 1d	PREFERRED	Shorter distance, does not require proposed central collector substation.
Grid Connection Option 2a	LEAST PREFERRED	Double the distance, crosses habitat in HIGH and VERY HIGH sensitivity classes, and requires an additional substation (central collector substation).
Grid Connection Option 2b	LEAST PREFERRED	Double the distance, crosses habitat in HIGH and VERY HIGH sensitivity classes, and requires an additional

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		substation (central collector substation).
Grid Connection Option 2c	LEAST PREFERRED	Double the distance, crosses habitat in HIGH and VERY HIGH sensitivity classes, and requires an additional substation (central collector substation).
Grid Connection Option 2d	LEAST PREFERRED	Double the distance, crosses habitat in HIGH and VERY HIGH sensitivity classes, and requires an additional substation (central collector substation).

The requirement in this assessment is to evaluate three separate projects as part of a single assessment. In evaluating grid options, an initial assumption is made that each project is evaluated in isolation of the other two, but the outcome of the assessment may differ depending on whether all three projects are authorized, or whether only one or two is authorized. The argument is as follows:

1. The construction of new powerlines to the Hydra D MTS will affect sensitive habitat, **but there is already an existing powerline within this corridor**, which moderates the potential impact to some extent, because there is an existing above-ground barrier (cables) and there are existing service roads.
2. There are three separate Solar PV projects proposed here, of which **Mooi Plaats does not have any option, except to have a grid connection to Hydra D MTS**. If this project obtains authorization, then a grid connection will definitely be constructed to Hydra D MTS, whereas for the other two projects, there is a possibility to avoid this corridor completely.
3. If it is technically possible to share a powerline between all three projects, i.e. without having multiple powerlines adjacent to one another, then it is preferable to use a single corridor for all the projects, rather than splitting the projects. Due to the fact that Mooi Plaats only has the option to link to Hydra D MTS, it would be preferable to have all the projects link up to Hydra D MTS than to have an additional powerline linking up to Coleskop WEF – the overall impact will be less if only one corridor is utilized. **If projects share a single powerline then the potential impact is very different to if separate powerlines have to be constructed adjacent to one another.**

DISCUSSION AND CONCLUSIONS

The project study area for the combined three projects consists of natural habitat within a largely rural area. This is within an area where portions of the natural habitat have been assessed as having potential conservation value, although this project site mostly falls outside of the NPAES entirely and are therefore not earmarked for future conservation. Currently, the rates of transformation within the vegetation in this area is low. The regional vegetation types that occur on site, Eastern Upper Karoo and Besemkaree Koppies Shrubland, as well as three nearby units, Southern Karoo Riviere, Tarkastad Montane Shrubland and Karoo Escarpment Grassland, are listed as Least Threatened in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). However, significant parts of the study area in the Northern Cape side are within Provincial Critical Biodiversity Areas. Any remaining natural habitat on site therefore has to be considered to possibly have biodiversity value. The proposed project will therefore have impacts on areas of natural habitat that have potential biodiversity value.

There are no plant species occurring on site or likely to occur there that are protected according to the National Environmental Management: Biodiversity Act. There are a number of species protected according to the Northern Cape Nature Conservation Act that were recorded on site (all three projects) and it is highly probable that additional species protected according to this Act occur on site. None of these species are of conservation concern, but the fact that they are protected means that a permit will be required for their removal. This is a standard flora permit obtained from the provincial department, but which requires detailed field information to be collected.

There are a small number of fauna of possible conservation concern that were assessed as having a possibility of occurring on site (all three project sites). This includes the Vulnerable Black-footed Cat and the Near Threatened Cape Clawless Otter, for which there is evidence that they almost certainly currently occur on site. There is also a likelihood of the Vulnerable White-tailed Rat and the Near Threatened South African Hedgehog, Grey Rhebok and Spectacled Dormouse occurring on site, and a number of protected species, including the Cape Fox, Brown Hyena, and Giant Bullfrog. Some of them (Cape Fox, Brown Hyena, Grey Rhebok) are **highly mobile species that are unlikely to be affected by any activities on site, but others are more restricted or territorial and could be more significantly affected**. Of those that are more likely to be affected, are the Black-footed Cat, the Cape Clawles Otter, the White-tailed Rat, the Spectacled Dormouse, the South African Hedgehog and the Giant Bullfrog.

The vegetation on site is similar for all three project sites and consists largely of karroid dwarf shrubland on the plains and grassy shrubland in the mountains, more-or-less typical of the regional vegetation type, Eastern Upper Karoo and Besemkaree Koppies Shrubland. However, the pattern observed on site is that local diversity increases with increased elevation and with higher local surface rockiness. This means that the greatest diversity is in the mountains, outside the main proposed footprint of the proposed projects. For all infrastructure components, loss of habitat will occur. This will be relatively insignificant in comparison to the total area of the regional vegetation types concerned but may be significant in terms of local patterns and diversity that could be affected. Other than this general biodiversity pattern, the main sensitivity on site is the presence of various dry to periodic watercourses. This habitat is disproportionately important due to the functional value of these watercourses and the important habitat and forage that they provide for animal populations. The habitat is also interconnected and any damage to one point will affect all downstream areas.

The projects involve construction of arrays of solar panels with access roads, sub-stations, and power lines to take the power to the grid. The plains are relatively flat and accessible from existing roads, but the power lines will need to travel into the mountains to tie into the sites for grid substations that are going to be built. The topography of the mountains is relatively steep and this poses a challenge for construction, but also for causing damage to natural ecosystems – the most sensitive ecological receptors on site are within the mountains. There are some existing power lines crossing the study area and the opportunity exists to align with these, using existing service roads, which would assist in managing potential impacts.

Conclusions

At the site-specific scale, some sensitivities have been identified, primarily related to natural habitat, but also to some individual species. However, it is possible that these can be minimised or avoided with the application of appropriate mitigation or management measures. There will be residual impacts, primarily on natural habitat. **The amount of habitat that will be lost to the project is insignificant compared to the area in hectares of the regional vegetation type that occurs on site but may be significant in terms of local patterns and diversity that could be affected**. It is therefore important that the infrastructure be located to minimize impacts on sensitive receptors. From this perspective it is unlikely that the proposed project will have an unacceptable impact on the natural environment. The preliminary view is that it should be authorised.

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APPENDICES:

Appendix 1: Plant species of conservation importance (Threatened, Near Threatened and Declining) that have historically been recorded in the study area.

Sources: see text.

Taxon	Latest (IUCN version 3.1) Conservation Status**	Habitat	Flowering Time	Probability of occurrence*
Trichodiadema rogersiae AIZOACEAE	DDT	Terrestrial. Appears to be largely confined to mountainous areas associated with Cape mountains and the Great Escarpment. Current site is along the northern extreme of the known range.	Summer, probably mostly Jan-Mar following good rain.	**MODERATE**
Gnaphalium simii ASTERACEAE	DDT	Northern Cape, near Hanover. A very poorly known, and possibly localized species last collected in 1952 in the neighbouring grid. The area where it occurs remains botanically poorly explored, and it may be overlooked. It is possibly threatened by overgrazing. Found in calcareous vleis.	Probably summer	**MODERATE**

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

Appendix 2: List of protected tree species (National Forests Act).

Acacia (Vachellia) erioloba	Acacia haematoxylon
Adansonia digitata	Afzelia quanzensis
Balanites subsp. maughamii	Barringtonia racemosa
Boscia albitrunca	Brachystegia spiciformis
Breonadia salicina	Bruguiera gymnhorrhiza
Cassipourea swaziensis	Catha edulis
Ceriops tagal	Cleistanthus schlectheri var. schlechteri
Colubrina nicholsonii	Combretum imberbe
Curtisia dentata	Elaedendron (Cassine) transvaalensis
Erythrophysa transvaalensis	Euclea pseudebenus
Ficus trichopoda	Leucadendron argenteum
Lumnitzera racemosa var. racemosa	Lydenburgia abottii
Lydenburgia cassinoides	Mimusops caffra
Newtonia hildebrandtii var. hildebrandtii	Ocotea bullata
Ozoroa namaensis	Philenoptera violacea (Lonchocarpus capassa)
Pittosporum viridiflorum	Podocarpus elongatus
Podocarpus falcatus	Podocarpus henkelii
Podocarpus latifolius	Protea comptonii
Protea curvata	Prunus africana
Pterocarpus angolensis	Rhizophora mucronata
Sclerocarya birrea subsp. caffra	Securidaca longependunculata
Sideroxylon inerme subsp. inerme	Tephrosia pondoensis
Warburgia salutaris	Widdringtonia cedarbergensis
Widdringtonia schwarzii	

Boscia albitrunca and *Pittosporum viridiflorum* have a geographical distribution that is close to the study area.

Appendix 3: Plant species previously recorded in the general area.

This list was compiled by extracting a list of species that have been recorded within a rectangular area that includes the study area as well as similar habitats in surrounding areas, as obtained from http://newposa.sanbi.org/ accessed on 20 April 2019. It is probable that it includes some species that occur in habitats that do not occur on site. The list was supplemented from field observations, as well as observations from www.inaturalist.org, which are photographic observ ations verified by an online community.

The list is arranged by family in alphabetical order. Species listed in green are those that were found on site and those in blue are from iNaturalist.

Acanthaceae
Aptosimum procumbens
Monechma sp.

Aizoaceae
Chascanum pumilum
Delosperma lootsbergense
Delosperma multiflorum
Galenia subcarnosa
Mesembryanthemum articulatum
Mesembryanthemum coriarium
Plinthus karooicus
Ruschia intricata
Ruschia sp.
Stomatium middelburgense
Stomatium sp.
Trichodiadema pomeridianum
Trichodiadema setulifera

Amaranthaceae
Alternanthera pungens; Naturalised
Atriplex lindleyi subsp. inflata; Naturalised; Invasive, NEMBA Category 1b
Dysphania multifida; Naturalised; Invasive
Salsola glabrescens

Amaryllidaceae
Brunsvigia radulosa
Haemanthus humilis

Anacardiaceae
Searsia dregeana
Searsia erosa
Searsia lucida
Searsia pyroides

Apiaceae
Deverra burchellii

Apocynaceae
Gomphocarpus cancellatus
Pachypodium succulentum
Xysmalobium gomphocarpoides var. *gomphocarpoides*

Araliaceae
Cussonia spicata

Arecaceae
Phoenix canariensis; Naturalised

Asparagaceae
Albuca cooperi
Agave americana; Naturalised
Asparagus laricinus
Asparagus suaveolens
Asparagus sp.
Eriospermum zeyheri
Ledebouria sp.

Asphodelaceae
Aloe broomii
Astroloba foliolosa
Haworthiopsis tessellata

Aspleniaceae
Asplenium cordatum

Asteraceae
Amphiglossa triflora
Arctotis arctotoides
Artemisia afra
Athanasia minuta subsp. *minuta*
Berkheya sp.
Bidens bipinnata
Chrysocoma ciliata
Cichorium intybus
Conyza deserticola
Conyza podocephala
Crassothonna sedifolia
Dicerothamnus rhinocerotis
Dimorphotheca caulescens
Dimorphotheca cuneata
Eriocephalus eximius
Eriocephalus spinescens
Eriocephalus tenuifolius
Felicia filifolia subsp. *bodkinii*
Felicia hirsuta
Felicia muricata
Felicia ovata
Garuleum pinnatifidum
Gazania jurineifolia
Gazania krebsiana
Helichrysum trilineatum
Helichrysum zeyherii
Hertia pallens
Launaea rarifolia
Metalasia densa
Nidorella resedifolia
Nolletia ciliaris
Osteospermum scariosum var. *scariosum*
Osteospermum spinescens

Osteospermum tomentosum
Othonna pavonia
Pegolettia retrofracta
Pentzia quinquefida
Pentzia tortuosa
Phymaspermum
Phymaspermum scoparium
Pteronia glomerata
Pteronia mucronata
Pteronia sordida
Senecio inornatus
Senecio junceus
Tarchonanthus minor
Ursinia nana
Xanthium spinosum; Naturalised; Invasive, NEMBA Category 1b
Xanthium strumarium; Naturalised; Invasive, NEMBA Category 1b

Cactaceae
Cereus hildmannianus; Naturalised; Invasive, NEMBA Category 1b
Cylindropuntia imbricata; Naturalised; Invasive, NEMBA Category 1b
Opuntia ficus-indica; Naturalised; Invasive, NEMBA Category 1b
Opuntia humifusa; Naturalised; Invasive, NEMBA Category 1b
Opuntia robusta; Naturalised; Invasive, NEMBA Category 1a
Opuntia stricta; Naturalised; Invasive, NEMBA Category 1b
Trichocerus spachianus (previously *Echinopsis spachiana*); Naturalised; Invasive, NEMBA Category 1b

Campanulaceae
Wahlenbergia albens
Wahlenbergia nodosa

Celastraceae
Euonymus japonicus; Naturalised

Colchicaceae
Colchicum melanthoides

Convolvulaceae
Convolvulus sp.

Crassulaceae
Cotyledon orbiculata var *dactylopsis*
Crassula capitella
Crassula sarcocaulis subsp. *sarcocaulis*
Crassula umbellata
Crassula vaillantii; Naturalised

Cupressaceae
Cupressus sempervirens; Naturalised

Cyperaceae
Afroscirpoides dioeca
Cyperus austro-africanus
Cyperus capensis
Cyperus usitatus
Ficinia cinnamomea
Pseudoschoenus inanis

Dipsacaceae
Scabiosa columbaria

Ebenaceae
Diospyros austro-africana
Diospyros lycioides
Euclea coriacea

Ericaceae
Erica sp.

Euphorbiaceae
Euphorbia caterviflora
Euphorbia flaganii
Euphorbia mauritanica

Fabaceae
Acacia pendula; Naturalised
Caesalpinia gilliesii; Naturalised; Invasive, NEMBA Category 1b
Indigastrum niveum
Indigofera alternans
Lessertia frutescens
Lotononis pungens
Medicago polymorpha; naturalized
Medicago sativa; naturalized
Melolobium microphyllum
Vachellia karroo

Fagaceae
Quercus robur; Naturalised

Frankeniaceae
Frankenia pulverulenta

Geraniaceae
Pelargonium abrotanifolium
Pelargonium aridum
Pelargonium exhibens
Pelargonium glutinosum

Gigaspermaceae
Gigaspermum repens

Grimmiaceae
Grimmia pulvinata

Hyacinthaceae
Massonia sp.

Iridaceae
Moraea falcifolia
Moraea polystachya

Juncaceae
Juncus rigidus

Lamiaceae

Marrubium vulgare
Mentha longifolia
Salvia runcinate
Stachys rugosa

Malvaceae
Hermannia coccocarpa
Hermannia cuneifolia var. *glabrescens*
Hermannia filifolia
Hermannia pulchella
Malva parviflora

Melianthaceae
Melianthus comosus

Menispermaceae
Cissampelos capensis

Moraceae
Morus nigra; Naturalised

Myrsinaceae
Myrsine africana

Myrtaceae
Eucalyptus camaldulensis; Naturalised; Invasive, NEMBA Category 1b in riparian areas
Eucalyptus grandis; Naturalised; Invasive, NEMBA Category 1b in riparian areas

Oleaceae
Ligustrum lucidum; Naturalised; Invasive, NEMBA Category 1b

Orobanchaceae
Alectra orobanchoides

Orthotrichaceae
Orthotrichum diaphanum

Papaveraceae
Argemone ochroleuca; Naturalised; Invasive, NEMBA Category 1b

Pinaceae
Pinus sp. ; Naturalised; Invasive, NEMBA Category 1b or 2

Plantaginaceae
Plantago lanceolata; Naturalised;
Veronica persica; Naturalised;

Poaceae
Aristida adscensionis
Aristida congesta subsp. *congesta*
Aristida diffusa
Bromus leptoclados
Cymbopogon pospischilii
Digitaria eriantha
Dinebra retroflexa var. *condensata*
Ehrharta calycina
Enneapogon scoparius

Eragrostis bergiana
Eragrostis chloromelas
Eragrostis curvula
Eragrostis lehmanniana
Eragrostis mexicana subsp. *virescens*; Naturalised
Eustachys paspaloides
Heteropogon contortus
Hordeum stenostachys; Naturalised
Koeleria capensis
Miscanthus ecklonii
Panicum coloratum
Pennisetum clandestinum; Naturalised; Invasive, NEMBA Category 1b in wetlands
Pennisetum sphacelatum
Pennisetum villosum; Naturalised; Invasive, NEMBA Category 1b
Pentameris microphylla
Schismus barbatus
Setaria verticillate
Sporobolus fimbriatus
Tenaxia stricta
Tetrachne dregei
Themeda triandra
Tragus koelerioides

Polygalaceae
Polygala ephedroides

Polygonaceae
Rumex lanceolatus

Portulacaceae
Portulaca quadrifida

Pottiaceae
Didymodon australasii
Didymodon umbrosus
Didymodon xanthocarpus
Pseudocrossidium crinitum
Tortula atrovirens
Trichostomum brachydontium

Pteridaceae
Cheilanthes eckloniana
Cheilanthes hirta

Rosaceae
Rosa rubiginosa; Naturalised; Invasive, NEMBA Category 1b

Rubiaceae
Anthospermum rigidum subsp. *rigidum*
Nenax microphylla

Salicaceae
Populus x canescens; Naturalised; Invasive, NEMBA Category 2
Populus deltoides; Naturalised
Populus nigra; Naturalised
Salix babylonica; Naturalised

Santalaceae
Thesium confine
Thesium hystrix
Thesium namaquense

Scrophulariaceae
Cromidon corrigioloides
Gomphostigma virgatum
Jamesbrittenia filicaulis
Manulea plurirosulata
Selago sp.

Solanaceae
Datura stramonium; Naturalised; Invasive, NEMBA Category 1b
Lycium cinereum
Lycium horridum
Solanum elaegnifolium; Naturalised; Invasive, NEMBA Category 1b

Tamaricaceae
Tamarix ramosissima; Naturalised; Invasive, NEMBA Category 1b

Urticaceae
Urtica urens

Zygophyllaceae
Roepera lichtensteiniana

Appendix 4: Animal species with a geographical distribution that includes the study area.

Notes:
1. Species of conservation concern are in red lettering.
2. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) (see Appendix 6) marked with "N"

Mammals:
ARTIODACTYLA:
Bovidae:
Red hartebeest
Springbok
Black wildebeest
Blesbok
Klipspringer
Gemsbok
Grey rhebok NT
Steenbok
Common duiker
Eland

PERRISODACTYLA:
Rhinocerotidae:
[N]Black rhinoceros (arid ecotype) EN

HYRACOIDEA:
Procavidae:
Rock hyrax

CARNIVORA:
Felidae:
Caracal
[N]Black-footed cat VU
African wild cat
[N]Leopard VU
Mustelidae:
[N]Cape clawless otter NT
Striped polecat
[N]Honey badger
African striped weasel NT
Herpestidae:
(Water mongoose)
Yellow mongoose
Small grey mongoose
(White-tailed mongoose)
Suricate
Canidae:
Black-backed jackal
Bat-eared fox
[N]Cape fox
Viveridae:
Small-spotted genet
Hyaenidae:
[N](Brown hyaena) NT
Aardwolf

CHIROPTERA:
Vespertilionidae:
Lesueur's hairy bat
Lesser long-fingered bat
Natal long-fingered bat
Cape serotine bat
Yellow house bat
Nycteridae:
Egyptian slit-faced bat
Rhinolophidae:
Geoffroy's horseshoe bat
Darling's horseshoe bat
Molossidae:
Egyptian free-tailed bat

INSECTIVORA:
Eulipotyphla:
[N]South African hedgehog NT
Reddish-grey musk shrew
Tiny musk shrew
Lesser grey-brown musk shrew
Forest shrew
Chrysochloridae:
(Sclater's golden mole)

LAGOMORPHA:
Leporidae:
Cape/desert hare
Scrub/savannah hare
Hewitt's red rock rabbit

PRIMATA:
Cercopithecidae:
Chacma baboon

RODENTIA:
Muridae:
Grant's rock mouse
Namaqua rock mouse
Grey climbing mouse
Short-tailed gerbil
Hairy-footed gerbil
Large-eared mouse
Multimammate mouse
Pygmy mouse

White-tailed rat VU
Vlei rat (grassland type) NT
Saunder's vlei rat
Slogett's rat
Karoo bush rat
(Brant's whistling rat)
Striped mouse
Pouched mouse
Highveld gerbil
Bathyergidae:
Common mole rat
Myoxidae:
Spectacled dormouse NT
Hystricidae:
Cape porcupine
Pedelidae:
Springhare
Thryonomyidae:
Greater cane rat
Scluridae:
Cape ground squirrel

MACROSCELIDEA:
Macroscelididae:
Cape rock sengi
Karoo rock sengi
Eastern rock sengi
Western rock sengi
Karoo round-eared sengi

TUBULIDENTATA:
Orycteropodidae:
Aardvark

Reptiles:
Pelomedusidae:
Marsh terrapin
Testudinidae:
Greater dwarf tortoise
Tent tortoise
Leopard tortoise
Gekkonidae:
Bibron's gecko
Cape gecko
Spotted gecko
Common banded gecko
Golden spotted gecko
(Purcell's gecko)
Amphisbaenidae:
Lacertidae:
(Spotted desert lizard)
(Spotted sandveld lizard)
(Delalande's sandveld lizard)
(Karoo sandveld lizard)
Burchell's sand lizard
Karoo sand lizard
Common sand lizard
Namaqua sand lizard
Cordylidae:
Cape girdled lizard
Southern karusa lizard
Karoo crag lizard
Gerrhosauridae:
(Karoo plated lizard)
Cape long-tailed seps
Scincidae:
Short-headed legless skink
Cape skink
Red-sided skink
Western three-striped skink
Western rock skink
Variegated skink
Varanidae:
Southern rock monitor
Nile monitor
Chamaeleonidae:
Eastern Cape dwarf chameleon
Agamidae:
Western ground agama
Southern rock agama
Typhlopidae:
Delelande's beaked blind snake
Leptotyphlopidae
Pythonidae
Viperidae:
Puff adder
Horned adder
Lamprophiidae:
Common house snake
Aurora snake
Spotted rock snake
Dwarf beaked snake
Cross-marked grass snake
Karoo sand snake
Fork-marked sand snake
Spotted grass snake
(South African slug eater)
Sundevall's shovel-snout
Mole snake
Elapidae:
Coral shield cobra
Rinkhals
Cape cobra
Colubridae:
Red-lipped snake
Rhombic egg eater
(Boomslang)
(Beetz's tiger snake)
Natricidae:

Amphibians
Southern pygmy toad

Karoo toad
Bubbling kassina
Common platanna
Boettger’s caco
Common river frog
Cape river frog

[N]Giant bullfrog
Clicking stream frog
Tandy’s sand frog

Appendix 5: Flora protected under the Northern Cape Nature Conservation Act No. 9 of 2009.

SCHEDULE 1: SPECIALLY PROTECTED SPECIES
As per the Northern Cape Nature Conservation Act, No. 9 of 2009, Schedule 1

Family: AMARYLLIDACEAE		
Clivia mirabilis	Oorlofskloof bush lily / Clivia	Nieuwoudtville
Haemanthus graniticus	April fool	Namaqualand
Hessea pusilla		Nieuwoudtville
Strumaria bidentata		Alexander Bay
Strumaria perryae		Nieuwoudtville
Family: ANACARDIACEAE		
Ozoroa spp.	All species	
Family: APIACAEAE		
Centella tridentata		Namaqualand and Fynbos biome
Chamarea snijmaniae		Nieuwoudtville
Family: APOCYNACEAE		
Hoodia gordonii		
Pachypodium namaquanum	Elephant's trunk	
Family: ASPHODOLACEAE		
Aloe buhrii		
Aloe dichotoma		
Aloe dichotoma var. rumosissima	Maiden quiver tree	
Aloe dabenorisana		
Aloe erinacea		
Aloe meyeri		
Aloe pearsonii		
Aloe pillansii		
Trachyandra prolifera		
Family: ASTERACEAE		
Athanasia adenantha		
Athanasia spathulata		
Cotula filifolia		
Euryops mirus		
Euryops rosulatus		
Euryops virgatus		
Felicia diffusa subsp. khamiesbergensis		
Othonna armiana		
Family: CRASSULACEAE		
Tylecodon torulosus		
Family: DIOSCORACEAE		
Dioscorea spp.	Elephant's foot, all species	
Family: ERIOSPERMACEAE		
Eriospermum erinum		
Eriospermum glaciale		
Family: FABACEAE		
Amphithalea obtusiloba		
Lotononis acutiflora		
Lotononis polycephala		
Lessertia spp.		
Sceletium toruosum		
Sutherlandia spp.	Cancer Bush, all species	

Wiborgia fusca subsp. macrocarpa		
Family: GERANIACEAE		
Pelargonium spp.	Pelargonium, all species	
Family: HYACINTHACEAE		
Drimia nana		
Ornithogalum bicornutum		
Ornithogalum inclusum		
Family: IRIDACEAE		
Babiana framesii		
Ferraria kamiesbergensis		
Freesia marginata		
Geissorhiza subrigida		
Hesperantha minima		
Hesperantha oligantha		
Hesperantha rivulicola		
Lapeirousia verecunda		
Moraea kamiesensis		
Moraea namaquana		
Romulea albiflora		
Romulea discifera		
Romulea maculata		
Romulea rupestris		
Family: MOLLUGINACEAE		
Hypertelis trachysperma		
Psammotropha spicata		
Family: ORCHIDACEAE		
Corycium ingeanum		
Disa macrostachya	Disa	
Family: OXALIDACEAE		
Oxalis pseudo-hirta	Sorrel	
Family: PEDALIACEAE		
Harpagophytum spp.	Devils' claw	
Family: POACEAE		
Prionanthium dentatum		
Secale strictum subsp. africanum	Wild rye	
Family: PROTEACEAE		
Leucadendron meyerianum	Tolbos	
Mimetes spp.	All species	
Orothamnus zeyheri		
Family: ROSACEAE		
Cliffortia arborea	Sterboom	
Family: SCROPHULARIACEAE		
Charadrophila capensis	Cape Gloxinia	
Family: STANGERIACEAE		
Stangeria spp.	Cycads, all species	
Family: ZAMIACEAE		
Encephalartos spp.	Cycads, all species	

SCHEDULE 2: PROTECTED SPECIES
As per the Northern Cape Nature Conservation Act, No. 9 of 2009, Schedule 2

Family: ACANTHACEAE	
Barleria paillosa	
Monechme saxatile	

Peristrophe spp.	All species
Family: ADIANTHACEAE	
Adiantium spp.	Maidenhair Fern, all species
Family: AGAPANTHACEAE	
Agapanthus spp.	All species
Family: AIZOACEAE (MESEMBRYANTHEMACEAE)	All species
Family:AMARYLLIDACEAE	All species except those listed in Schedule 1
Family: ANTHERICACEAE	All species
Family: APIACEAE	All species except those listed in Schedule 1
Family: APOCYNACEAE	All species except those listed in Schedule 1
Family: AQUIFOLIACEAE	All species
Ilex mitis	
Family: ARACEAE	
Zantedeschia spp.	Arum lilies, all species
Family: ARALIACEAE	
Cussonia spp.	Cabbage trees, all species
Family: ASPHODOLACEAE	All species except those listed in Schedule 1 and the species *Aloe ferox*
Family: ASTERACEAE	
Helichrysum jubilatum	
Felicia deserti	
Gnaphalium simii	
Lopholaena longipes	
Senecio albo-punctatus	
Senecio trachylaenus	
Trichogyne lerouxiae	
Tripteris pinnatilobata	
Troglophyton acocksianum	
Vellereophyton lasianthum	
Family: BURMANNIACEAE	
Burmannia madagascariensis	Wild ginger
Family: BURSERACEAE	
Commiphora spp.	All species
Family: CAPPARACEAE	
Boscia spp.	Shepherd's trees, all species
Family: CARYOPHYLLACEAE	
Dianthus spp.	All species
Family: CELASTRACEAE	
Gymnosporia spp.	All species
Family: COLCHICACEAE	
Androcymbium spp.	All species
Gloriosa spp.	All species
Family: COMBRETACEAE	
Combretum spp.	All species
Family: CRASSULACEAE	All species except those listed in Schedule 1
Family: CUPPRESSACEAE	
Widdringtonia spp.	Wild cypress, all species
Family: CYATHEACEAE	
Cyathea spp.	Tree ferns, all species
Cyathea capensis	Tree Fern
Family: CYPERACEAE	
Carex acocksii	
Family: DROSERACEAE	
Drosera spp.	Sundews, all species

Family: DRYOPTERIDACEAE	
Rumohra spp.	Seven Weeks Fern, all species
Family: ERICACEAE	Erica, all species
Family: EUPHORBIACEAE	
Alchornea laxiflora	Venda Bead-string
Euphorbia spp.	All species
Family: FABACEAE	
Aspalathus spp.	Tea Bush, all species
Erythrina zeyheri	Ploughbreaker
Argyrolobium petiolare	
Caesalpinia bracteata	
Calliandra redacta	
Crotalaria pearsonii	
Indigofera limosa	
Lebeckia bowieana	
Polhillia involucrate	
Rhynchosia emarginata	
Wiborgia humilis	
Family: HYACINTHACEAE	
Daubenya spp	
Lachenalia spp.	Daubenya, all species
Veltheimia spp.	Viooltjie, all species
Eucomis spp.	Pineapple flower, all species
Neopatersonia namaquensis	
Ornithogalum spp.	All species
Family: IRIDACEAE	All species except those listed in Schedule 1
Family: LAURACEAE	
Ocotea spp.	Stinkwood, all species
Family: MESEMBRYANTHEMACEAE	All species
Family: MELIACEAE	
Nymania capensis	Chinese Lantern
Family: OLEACEAE	
Olea europea subsp. africana	Wild olive
Family: ORCHIDACEAE	Orchids, all species except those listed in Schedule 1
Family: OROBANCHACEAE	
Harveya spp.	Harveya, all species
Family: OXALIDACEAE	
Oxalis spp.	Sorrel, all species except those listed in Schedule 1
Family: PLUMBAGINACEAE	
Afrolimon namaquanum	
Family: POACEAE	
Brachiaria dura var. dura	
Dregeochloa calviniensis	
Pentaschistis lima	
Family: PODOCARPACEAE	
Podocarpus spp.	Yellowwoods, all species
Family: PORTULACACEAE	
Anacampseros spp.	All species
Avonia spp.	All species
Portulaca foliosa	
Family: PROTEACEAE	All species except those listed in Schedule 1
Family: RESTIONACEAE	All species
Family: RHAMNACEAE	

Phylica spp.	All species
Family: RUTACEAE	
Agathosma spp.	Buchu, all species
Family: SCROPHULARIACEAE	
Diascia spp.	All species
Halleria spp.	All species
Jamesbrittenia spp.	All species
Manulea spp.	All species
Nemesia spp.	All species
Phyllopodium spp.	All species
Polycarena filiformis	
Chaenostoma longipedicellatum	
Family: STRELITZIACEAE	
Strelitzia spp.	All species
Family: TECOPHILACEAE	
Cyanella spp.	All species
Family: THYMELAEACEAE	
Gnidia leipoldtii	
Family: ZINGIBERACEAE	
Siphonochilus aethiopicus	Wild ginger

Appendix 6: Flora and vertebrate animal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

Adenium swazicum
Aloidendron pillansii
Diaphananthe millarii
Dioscorea ebutsniorum (no such species!!)
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

ENDANGERED SPECIES

Flora

Angraecum stella-africae
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hildebrandtii

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture
Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

VULNERABLE SPECIES

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwilla plumbea
Zantedeschia jucunda

Aves

White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon

Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia
Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax
Roan antelope
Pangolin
Juliana's golden mole
Suni
Large-eared free-tailed bat
Lion
Leopard
Blue duiker

PROTECTED SPECIES
Flora
Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus
Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Amphibia
Giant bullfrog
African bullfrog

Reptilia
Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armadillo girdled lizard
Nile crocodile
African rock python

Aves
Southern ground hornbill
African marsh harrier
Denham's bustard
Jackass penguin

Mammalia
Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox

Appendix 8: Curriculum vitae: Dr David Hoare

Education

Matric - Graeme College, Grahamstown, 1984
B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993
B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction
M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction
PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005 – present. Reg. no. 400221/05 (Ecology, Botany)
Member, International Association of Vegetation Scientists (IAVS)
Member, Ecological Society of America (ESA)
Member, International Association for Impact Assessment (IAIA)
Member, Herpetological Association of Africa (HAA)

Employment history

1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.
1January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
1January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.
1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:

Refereed scientific articles (in chronological order):

Journal articles:

HOARE, D.B. & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.

HOARE, D.B., VICTOR, J.E., LUBKE, R.A. & MUCINA, L., 2000. Vegetation of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 87-96.

VICTOR, J.E., **HOARE, D.B.** & LUBKE, R.A., 2000. Checklist of plant species of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 97-101.

MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1-2.

HOARE, D.B. & BREDENKAMP, G.J. 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg / Drakensberg mountain region of the Eastern Cape, South Africa.. *South African Journal of Botany* 67: 595 – 608.

LUBKE, R.A., **HOARE, D.B.**, VICTOR, J.E. & KETELAAR, R. 2003. The vegetation of the habitat of the Brenton blue butterfly, Orachrysops niobe (Trimen), in the Western Cape, South Africa. *South African Journal of Science* 99: 201–206.

HOARE, D.B & FROST, P. 2004. Phenological classification of natural vegetation in southern Africa using AVHRR vegetation index data. *Applied Vegetation Science* 7: 19-28.

FOX, S.C., HOFFMANN, M.T. and HOARE, D. 2005. The phenological pattern of vegetation in Namaqualand, South Africa and its climatic correlates using NOAA-AVHRR NDVI data. South African Geographic Journal, 87: 85–94.

Pfab, M.F., Compaan, P.C., Whittington-Jones, C.A., Engelbrecht, I., Dumalisile, L., Mills, L., West, S.D., Muller, P., Masterson, G.P.R., Nevhutalu, L.S., Holness, S.D., **Hoare, D.B.** 2017. The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province. Bothalia, Vol. 47:1. a2182. https://doi.org/10.4102/abc.v47i1.2182.

Book chapters and conference proceedings:

HOARE, D.B. 2002. Biodiversity and performance of grassland ecosystems in communal and commercial farming systems in South Africa. Proceedings of the FAO's Biodiversity and Ecosystem Approach in Agriculture, Forestry and Fisheries Event: 12–13 October, 2002. Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla, Rome, Italy. pp. 10 - 27.

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited.* CEMEX, pp.218–229. ISBN 968-6397-77-9

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. http://www.biodiversityhotspots.org/xp/hotspots/maputaland/.

HOARE, D.B., MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets.* in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., **HOARE, D.B.**, LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome.* In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

RUTHERFORD, M.C., MUCINA, L., LÖTTER, M.C., BREDENKAMP, G.J., SMIT, J.H.L., SCOTT-SHAW, C.R., **HOARE, D.B.**, GOODMAN, P.S., BEZUIDENHOUT, H., SCOTT, L. & ELLIS, F., POWRIE, L.W., SIEBERT, F., MOSTERT, T.H., HENNING, B.J., VENTER, C.E., CAMP, K.G.T., SIEBERT, S.J., MATTHEWS, W.S., BURROWS, J.E., DOBSON, L., VAN ROOYEN, N., SCHMIDT, E., WINTER, P.J.D., DU PREEZ, P.J., WARD, R.A., WILLIAMSON, S. and HURTER, P.J.H. 2006. *Savanna Biome.* In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome.* In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

MUCINA, L., SCOTT-SHAW, C.R., RUTHERFORD, M.C., CAMP, K.G.T., MATTHEWS, W.S., POWRIE, L.W. and **HOARE, D.B.** 2006. *Indian Ocean Coastal Belt.* In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Conference Presentations:

HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994

HOARE, D.B., VICTOR, J.E. & LUBKE, R.A. *Description of the coastal fynbos south of George, southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994

HOARE, D.B. & LUBKE, R.A. *Management effects on fynbos diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995

HOARE, D.B. & BOTHA, C.E.J. *Anatomy and ecophysiology of the dunegrass Ehrharta villosa var. maxima*; Poster presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995

HOARE, D.B., PALMER, A.R. & BREDENKAMP, G.J. 1996. *Modelling grassland community distributions in the Eastern Cape using annual rainfall and elevation*; Poster presentation, South African Association of Botanists Annual Congress, Stellenbosch, January 1996

HOARE, D.B. Modelling vegetation on a past climate as a test for palaeonological hypotheses on vegetation distributions; Paper presentation, Randse Afriakaanse Universiteit postgraduate symposium, 1997

HOARE, D.B., VICTOR, J.E. & BREDENKAMP, G.J. *Historical and ecological links between grassy fynbos and afromontane fynbos in the Eastern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998

LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R. *The habitat of the Brenton Blue Butterfly*. Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998

HOARE, D.B. & PANAGOS, M.D. Satellite stratification of vegetation – structure or floristic composition? Poster presentation at the 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999.

HOARE, D.B. & WESSELS, K. Conservation status and threats to grasslands of the northern regions of South Africa, Poster presentation at the South African Association of Botanists Annual Congress, Potchefstroom, January 2000.

HOARE, D.B. Phenological dynamics of Eastern Cape vegetation. Oral paper presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.

HOARE, D.B., MUCINA, L., VAN DER MERWE, J.P.H. & PALMER, A.R. Classification and digital mapping of grasslands of the Eastern Cape Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.

HOARE, D.B. Deriving phenological variables for Eastern Cape vegetation using satellite data Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.

MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.

HOARE, D.B. 2003. Species diversity patterns in moist temperate grasslands of South Africa. Proceedings of the VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa. African Journal of Range and Forage Science. 20: 84.

Unpublished technical reports:

PALMER, A.R., HOARE, D.B. & HINTSA, M.D., 1999. Using satellite imagery to map veld condition in Mpumalanga: A preliminary report. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Grahamstown.

HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: methodology for mapping the vegetation communities of the South African savanna at a scale of 1:250 000. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.

HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: size and coverage of field data that exists on the database of vegetation data for South African savanna. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.

THOMPSON, M.W., VAN DEN BERG, H.M., NEWBY, T.S. & HOARE, D.B. 2001. Guideline procedures for national land-cover mapping and change monitoring. Report no. ENV/P/C 2001-006 produced for Department of Water Affairs and Forestry, National Department of Agriculture and Department of Environment Affairs and Tourism. Copyright: Council for Scientific and Industrial Research (CSIR) and Agricultural Research Council (ARC).

HOARE, D.B. 2003. Natural resource survey of node O R Tambo, using remote sensing techniques, Unpublished report and database of field data for ARC Institute for Soil, Climate & Water, ARC Range and Forage Institute, Grahamstown.

HOARE, D.B. 2003. Short-term changes in vegetation of Suikerbosrand Nature Reserve, South Africa, on the basis of resampled vegetation sites. Gauteng Department of Agriculture, Conservation, Environment and Land Affairs, Conservation Division.

BRITTON, D., SILBERBAUER, L., ROBERTSON, H., LUBKE, R., HOARE, D., VICTOR, J., EDGE, D. & BALL, J. 1997. The Life-history, ecology and conservation of the Brenton Blue Butterfly (*Orachrysops niobe*) (Trimen)(*Lycaenidea*) at Brenton-on-Sea. Unpublished report for the Endangered Wildlife Trust of Southern Africa, Johannesburg. 38pp.

HOARE, D.B., VICTOR, J.E. & MARNEWIC, G. 2005. Vegetation and flora of the wetlands of Nylsvley River catchment as component of a project to develop a framework for the sustainable management of wetlands in Limpopo Province.

Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.

Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.

VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.

BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques

South African Association of Botanists Annual Congress, Grahamstown, January 2002.

28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.

Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.

South African Association of Botanists Annual Congress, Potchefstroom, January 2000

National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.

Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.

WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.

34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999

Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.

South African Association of Botanists Annual Congress, Cape Town, January 1998

Randse Afriakaanse Universiteit postgraduate symposium, 1997.

South African Association of Botanists Annual Congress, Bloemfontein, January 1995.

Appendix 6I

Visual Assessment

Scientific Aquatic Services

Applying science to the real world

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

Name: Stephen van Staden
Date: Friday, 15 November 2019
Ref: SAS 219244

Attention: Ms Kerry Schwartz

TECHNICAL MEMORANDUM

Visual Impact Assessment (VIA) Report for the proposed construction of three Solar Photovoltaic Energy Facilities near Noupoort and Middelberg, Northern and Eastern Cape Provinces

Overview

Based on the review of the VIA report, overall the study is considered objective, comprehensive, and considerable focus has been placed on identifying potential sensitive receptors. The impact assessment undertaken is considered accurate. The recommendations presented in the report are appropriate and achievable. Even though there are limited mitigatory measures available it is considered the best options available. This review provides some guidelines for additional information to consider for inclusion to allow improved understanding of some comments in the document.

Scientific Aquatic Services was requested to undertake a specialist external review of the specialist visual impact assessment, by Mr. Kerry Schwartz (SiVest). The review was focused on the following Objectives:

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

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

This external review is based on a desktop assessment of the documentation only and no field verification of the results was undertaken. The 5 km visual assessment zone used for investigation is deemed acceptable due to the nature of the proposed project (i.e. the height of infrastructure) and the sparsely dispersed sensitive receptors in the area.

Less attention was paid to formatting and grammatical issues as these have no bearing on the scientific validity and independency of the work done. Notes were however made on the document on selected identified issues of this nature during the review process and forwarded to the project manager by means of comments within the word document. In addition, comments were made in the report to guide rectification of the report, where required, or where wording made interpretation cumbersome.

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

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

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

No.	Requirement	Status	Comments
a)	**Details of -**	NA	
(i)	The specialist who prepared the report.	✔	NA
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae.	✔ X	The Document Guide states that it is in Appendix A, please just insert Appendix A into the report.
b)	A declaration that the specialist is independent.	✔	NA
c)	An indication of the scope of, and the purpose for which, the report was prepared.	✔ X	The scope of work is not very clear / easily identifiable, thus it is recommended that a subheading "Scope of Work / Terms of Reference" be included.
cA)	An indication of the quality and age of base data used for the specialist report.	✔	NA
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	✔	Proposed and cumulative impacts have been well defined and presented.
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	✔	NA
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	✔	NA

No.	Requirement	Status	Comments
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	✔	NA
g)	An identification of any areas to be avoided, including buffers.	✔	NA
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	✔	NA
i)	A description of any assumption made and any uncertainties or gaps in knowledge.	✔	The term study area first appears in the assumptions and limitations list, as it is not explained in the introduction. This is confusing to the reader as to what the study area entails. It is thus recommended that study area be defined in the introduction.
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities.	✔	NA
k)	Any mitigation measures for inclusion in the EMPr.	✔	NA
l)	Any conditions for inclusion in the environmental authorisation.	✔	NA
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	X	Monitoring requirements in all phases of the project should be made clear in the report if necessary.
n)	A reasoned opinion -		
(i)	As to whether the proposed activity, activities or portions thereof should be authorised.	✔	NA
(iA)	Regarding the acceptability of the proposed activity or activities.	✔	NA
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan.	✔	NA
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report.	✔	NA
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	✔	NA
q)	Any other information requested by the competent authority.	✔	NA

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

Table 1 Review Outcomes of the specialist freshwater resource study prepared

ASSESSMENT CRITERION	COMMENTS	RECOMMENDATIONS
1. Assess the document/ report in terms of its fulfilment of the Terms of Reference set stated.	Assuming the terms of reference was to undertake an appropriate visual impact assessment for the project as defined in the section defining the aims of the study the study fulfilled the terms of reference.	NA
2. Consider whether the report is entirely objective.	As stated in the VIA report, the visual impact is highly subjective to the experience of the viewer, however the VIA report can be considered objective.	NA
3. Determining whether the methodology clearly explained and acceptable.	The method of assessment is clearly explained and considered acceptable. The sense of place of the area is however not discussed in great detail and could be elaborated upon.	It is recommended that the sense of place be discussed in more detail in the report.
4. Evaluate the appropriateness of the reference literature.	The referenced material is appropriate, sufficient and relevant.	NA
5. Evaluate the validity of the findings and consider whether the report is technically, scientifically and professionally credible (review data evidence).	The manner in which the VIA assessment has been set up is technically, scientifically and professionally credible and the information presented, including the impact assessment and mitigation measures can be considered reliable and used for decision making.	
6. Identify any information gaps, short comings and mitigation measures to address the short comings.	No substantial information gaps have been identified. The sense of place of the area is however not addressed. A viewshed analysis was only conducted for the portion of the N10 that would potentially be affected by the proposed project.	• It is recommended to present a legal framework / guidelines section within the report to define the legal, policy and planning context of VIAs section. • It is recommended that either a viewshed analysis be conducted to include all the potential sensitive receptors, or an assumption and limitation should be included to state that the viewshed was not undertaken due to the flat terrain of the area.
7. Indicate whether the article is well-written and easy to understand and to ensure that the work has adequately assessed the impacts of the proposed development.	• Overall the VIA study is well written, and easy to read. • Table 1 on page 45 does not clearly indicate what the rating of 1 to 10 means and the scale just below it is also not explained. • The report has adequately assessed the impacts of the proposed development. • The reasoned opinion of the visual specialist as set out in the conclusion will allow the EAP proponent and competent authority to take informed decisions.	• It is recommended that the rating of 1 to 10 be clearly defined and the scale below it be explained in detail.
8. Discuss the suitability of the mitigation measures and recommendations and Consider whether the recommendations presented are sensible and present	• The recommendations presented are appropriate, relevant/necessary, sensible and achievable. • The proposed mitigatory measures are considered the best options available.	

ASSESSMENT CRITERION	COMMENTS	RECOMMENDATIONS
the best options.		
9. To provide an independent opinion of the report, whether it is well written and easy to understand and ensure the work meets current requirements/best practice and normal standards of professional practice and competence have been met.	Based on the findings of this review it is the opinion of the independent reviewer that: • The manner in which the specialist report has been set up is technically scientifically and professionally credible and the results can be relied upon for decision making. • The specialist report is well written and easy to read. • The mitigatory measures presented are appropriate, relevant/necessary, sensible and achievable.	The recommendations above should be considered and where the author deems them appropriate included in the final specialist report to be submitted.

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

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

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

1 Mining Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)

6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

REFERENCES

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

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

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

Yours faithfully

Staden
STEPHEN VAN STADEN

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	Ecologist, GIS Technician, Faunal Specialist
Date of Birth	8 April 1991
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2014

EDUCATION

Qualifications

BSc Zoology	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, KwaZulu-Natal, Limpopo, Free State, Northern Cape

SELECTED PROJECT EXAMPLES

GIS Assessments

- Completed GIS mapping and GIS analysis for a significant number of ecological projects
- Desktop assessment of 45 wetland and river crossings identified along the proposed Fibreco Fibre Optic Cable Route changes between Cape Town to George, George to Port Elizabeth and from Port Elizabeth to Durban
- High level desktop ecological study and site sensitivity report as part of the site selection process for the possible Rapid Rail Extension to the Gauteng Rapid Rail Network
- Ecological scan and site sensitivity report as part of the environmental authorisation process prior to prospecting activities for two prospecting areas in Newcastle, Kwazulu-Natal
- High level desktop study and site sensitivity report as part of the environmental authorisation process prior to prospecting activities on Portion 4 of the Farm Kapstewel no 436, Administrative District of Hay, Northern Cape
- Cumulative Sensitivity Analyses using GIS Techniques for the Fuleni Anthracite Project, KwaZulu Natal.
- High level desktop study and site sensitivity report for mining activities on the farm Wessel 227 and Dibiaghomo, North of Black Rock, Northern Cape Province
- High level desktop study and site sensitivity report prior to prospecting activities for the Minerano Gold Fields Project, near Viljoenskroon, Free State Province

Wetland Assessments

- Wetland and aquatic ecological assessment for the proposed N3 De Beers Pass Route.
- Wetland assessment as part of the environmental authorisation process for the proposed Sappi Enstra Mill Wastewater Pipeline in Springs
- Wetland Verification and Rehabilitation Criteria for Aspen Hills Estate
- Wetland Ecological Assessment for development in Shoshanguve, adjacent to Tshwane University

of Technology

- Wetland assessment as part of the environmental authorisation process for the proposed Braakfontein Coal Mine near Newcastle, Kwazulu-Natal Province
- Wetland assessment as part of the water use license application for the proposed extension of a flood protection wall within the Sorex Estate, Centurion, Gauteng

Faunal Assessments

- Faunal assessment as part of the environmental authorisation process for the proposed New Belfast Mine Railway Siding, Mpumalanga
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed construction of a sewer system in the Ekangala Township, Gauteng Province
- Faunal assessment as part of the environmental authorisation process for the Ledig Water Project near Pilanesberg National Park, North West Province
- Faunal assessment as part of the ecological assessment for the Op Goedenhoop Section 102 Coal Project, Mpumalanga Province
- Terrestrial faunal, floral and wetland ecological assessment update for the proposed water supply pipeline upgrade at the Duvha Power Station, Mpumalanga

Rehabilitation Plan

- Wetland rehabilitation plan for Dorothy Road, Midrand, Gauteng Province
- Rehabilitation and Management Plan for the Freshwater Resources within the Proposed Rivierplaas Farm No 1486 Residential Development, Western Cape Province
- Wetland Rehabilitation and Management Plan for proposed mixed land use development (Kosmosdal extension 92) on the remainder of portion 2 of the farm Olievenhoutbosch 389 jr, Gauteng
- Wetland rehabilitation and management plan, including input into the storm water management, landscaping and Red Data Listed species conservation for the Olifantsvlei Cemetery, Gauteng

Risk Assessment

- Motivation for General Authorisation for the development of a pipeline at Sappi in Springs, Gauteng Province

Water Use Licence Application

- Assisting in the public participation for an Integrated Water Use Licence for the proposed sewer pipeline and upgrade of the Refengkgotso Waste Water Treatment Works (WWTW);
- Writing an emergency response plan for the proposed sewer pipeline and Refengkgotso WWTW

Visual Impact Assessment

- Assistance with the proposed Haga Haga Wind Energy Facility and Grid Connection between Komga and Soto, Eastern Cape Province.
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Transvaal Gold Mining Estates (TGME) Development Project: Gold Mining Project (GMP) – Pre-Mined Residue (PMR) And Hard Rock Mining (HRM) Near Sabie (Project 10161), Mpumalanga Province.
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Transvaal Gold Mining Estates (TGME) Development Project: Gold Mining Project (GMP) – Pre-Mined Residue (PMR) And Hard Rock Mining (HRM) Near Pilgrims Rest (Project 10167), Mpumalanga Province.
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed N3 Logistics Hub, adjacent to the N3 national highway, Gauteng Province.
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Mining of Gypsum on Portion 0 of the Farm Kanakies 332, near Loeriesfontein, Northern Cape Province.
- Visual Impact Assessment as part of the Environmental Authorisation Process for the Mining Right for opencast and underground mining of Gold for the Soweto Cluster West Wits Project, North of Soweto, Gauteng Province.
- Visual Impact Assessment as part of the Environmental Impact Assessment and Authorisation Process for the proposed construction of a New Water Treatment Plant at the Khutala Colliery,

Ogies, Mpumalanga Province.

- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Olievenhoutbosch Solar Facility, Centurion, Gauteng Province.
- Visual Impact Assessment as part of the Section 24G rectification process for the unauthorised activities at the Mamatwan Mine, near Hotazel, Northern Cape Province.
- Visual Impact Assessment as part of the Environmental Impact Assessment and Authorisation process for the proposed development of a coal washing plant, discard dump and associated activities on Portion 2 of Kromdraai 303 JS and Portion 5 of Elandsfontein 309 JS, east of Balmoral, Mpumalanga Province.
- Visual Impact Assessment as part of the Environmental Impact Assessment and Authorisation Process for the proposed Cygnus Mining Project, Limpopo Province.
- Visual Impact Assessment part of the Environmental Impact Assessment and Authorisation Process for the proposed TGME mine development project: amendment to MR83 to include the Theta, Browns and Iota Projects, near Pilgrim's Rest, Mpumalanga Province.

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Proposed Construction of Three Solar Photovoltaic Energy Facilities near Noupoort and Middelburg, Northern and Eastern Cape Provinces

Visual Impact Assessment Report – Impact Phase

DEA Reference: (14/12/16/3/3/2/1134; 14/12/16/3/3/2/1135; 14/12/16/3/3/2/1136)
Issue Date: 19 November 2019
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Project No.: 15324

Date:	19 11 19
Document Title:	Proposed Construction of Three Solar Photovoltaic Energy Facilities near Noupoort and Middelburg, Northern and Eastern Cape Provinces
Version Number:	1
Author:	Kerry Schwartz
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Externally Reviewed by:	Stephen Van Staden M.Sc. (Environmental Management), University of Johannesburg
Client:	Mooi Plaats Solar Power (Pty) Ltd / Wonderheuvel Solar Power (Pty) Ltd / Paarde Valley Solar Power (Pty) Ltd

Confidentiality Statement

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

Proposed Construction of three (3) Solar Photovoltaic Energy Facilities near Noupoort and Middelburg, Northern and Eastern Cape Provinces

Kindly note the following:

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

Departmental Details

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

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House

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

SPECIALIST INFORMATION

Specialist Company Name:	SiVEST			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	3	Percentage Procurement recognition	**110**
Specialist name:	Kerry Schwartz			
Specialist Qualifications:	BA			
Professional affiliation/registration:	SAGC (GISc Technician)			
Physical address:	51 Wessels Road, Rivonia			
Postal address:	PO Box 2921, Rivonia			
Postal code:	2128	Cell:		
Telephone:	011 798 0632	Fax:	011 803 7272	
E-mail:	kerrys@sivest.co.za			

DECLARATION BY THE SPECIALIST

I, **Kerry Schwartz**, 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.

KSchwenk

Signature of the Specialist

SiVEST

Name of Company:

03 May 2019

Date

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations, 2014 (as amended)Requirements for Specialist Reports (Appendix 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	**Section 1.4.** Specialist CV's are included in **Appendix A**
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Page 3 - 5**
(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 1.5.** **Section 3.**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Section 3.** **Section 4.** **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 1.3.** **Section 1.5.3.**
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Section 1.5.**
(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 3.** **Section 5.**
(g) an identification of any areas to be avoided, including buffers;	**Section 3.3.** **Section 3.5.** **Section 5.**
(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 5.**
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	**Section 1.3.**
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	**Section 5.5**
(k) any mitigation measures for inclusion in the EMPr;	**Section 5.5.**
(l) any conditions for inclusion in the environmental authorisation;	N/A
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**Section 5.5.** **.**
(n) a reasoned opinion—	**Section 7.1.**

i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**No feedback has been received from the public participation process regarding the visual environment.**
(p) any other information requested by the competent authority	**No information regarding the visual study has been requested from the competent authority.**
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**N/A**

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PROPOSED CONSTRUCTION OF THREE SOLAR PHOTOVOLTAIC ENERGY FACILITIES NEAR NOUPOORT AND MIDDELBURG, EASTERN AND NORTHERN CAPE PROVINCES

VISUAL IMPACT ASSESSMENT REPORT – IMPACT PHASE

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GLOSSARY OF TERMS

ABBREVIATIONS

DEIAR	Draft Environmental Impact Assessment Report
DM	District Municipality
DoE	Department of Energy
DSR	Draft Scoping Report
DTM	Digital Terrain Model
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FEIAR	Final Environmental Impact Assessment Report
FSR	Final Scoping Report
GIS	Geographic Information System
I&AP	Interested and/or Affected Party
IPP	Independent Power Producer
LM	Local Municipality
kV	Kilovolt
MW	Megawatt
NGI	National Geo-Spatial Information
REIPPP	Renewable Energy Independent Power Producer Programme
SACAA	South African Civil Aviation Authority
SANBI	South African National Biodiversity Institute
SPEF	Solar Photovoltaic Energy Facility
VIA	Visual Impact Assessment
VR	Visual Receptor
WEF	Wind Energy Facility

DEFINITIONS

Anthropogenic feature: An unnatural feature resulting from human activity.

Cultural landscape: A representation of the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee, 1992).

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Scenic route: A linear movement route, usually in the form of a scenic drive, but which could also be a railway, hiking trail, horse-riding trail or 4x4 trail.

Sensitive visual receptors: An individual, group or community that is subject to the visual influence of the proposed development and is adversely impacted by it. They will typically include locations of human habitation and tourism activities.

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Slope Aspect: Direction in which a hill or mountain slope faces.

Study area: The study area or visual assessment zone is assumed to encompass a zone of 10km from the outer boundary of the proposed WEF application site, and 5km from the proposed grid connection corridor alternatives.

Visual assessment zone: The visual assessment zone or study area or visual assessment zone is assumed encompass a zone of 10km from the outer boundary of the proposed WEF application site, and 5km from the proposed grid connection corridor alternatives.

Viewpoint: A point in the landscape from where a particular project or feature can be viewed.

Viewshed / Visual Envelope: The geographical area which is visible from a particular location.

Visual character: The pattern of physical elements, landforms and land use characteristics that occur consistently in the landscape to form a distinctive visual quality or character.

Visual contrast: The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.

Visual exposure: The relative visibility of a project or feature in the landscape.

Visual impact: The effect of an aspect of the proposed development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.

Visual receptors: An individual, group or community that is subject to the visual influence of the proposed development but is not necessarily adversely impacted by it. They will typically include commercial activities, residents and motorists travelling along routes that are not regarded as scenic.

Visual sensitivity: The inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards the new development, which are usually based on the perceived aesthetic appeal of the area.

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PROPOSED CONSTRUCTION OF THREE SOLAR PHOTOVOLTAIC ENERGY FACILITIES NEAR NOUPOORT AND MIDDELBURG, EASTERN AND NORTHERN CAPE PROVINCES

VISUAL IMPACT ASSESSMENT REPORT – IMPACT PHASE

1 INTRODUCTION

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd are proposing to construct three (3) Solar Photovoltaic (PV) Energy Facilities on adjoining sites near Noupoort and Middelburg in the Northern Cape and Eastern Cape Provinces. Each of the proposed PV Facilities will require a full Environmental Impact Assessment (EIA) process. Additionally, the associated grid infrastructure will require a Basic Assessment (BA) to be undertaken. As such, three (3) EIAs will be undertaken, one for each proposed PV Facility, and three (3) BAs will be undertaken, one for each associated grid infrastructure. Accordingly, SiVEST has been appointed to undertake the required EIAs and BAs.

This Visual Impact Assessment (VIA) is being undertaken as part of the EIA and BA processes. During the Scoping Phase of the EIA, a scoping-level VIA was conducted with the aim of identifying potential visual issues associated with the development of the proposed solar photovoltaic energy facilities (SPEFs), and determining the potential extent of visual impacts. This study characterised the visual environment of the area and identified areas of potential visual sensitivity, with the main focus on the potentially sensitive visual receptor locations. In addition, the study provided an assessment of the magnitude and significance of the visual impacts associated with each of the proposed SPEF developments.

1.1 Project Description

At this stage it is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities will be developed, these being:

- Mooi Plaats Solar PV (hereafter referred to as "Mooi Plaats"), on an application site of approximately 5303ha.
- Wonderheuvel Solar PV (hereafter referred to as "Wonderheuvel"), on an application site of approximately 5652ha.

- Paarde Valley Solar PV (hereafter referred to as "Paarde Valley"), on an application site of approximately 3962ha.

The generated electricity will be fed into the national grid at either the Hydra D MTS Substation or the proposed Coleskop WEF Substation via a 132kV power line.

The key components of the project are detailed below and the three application sites and associated grid connection proposals are shown in **Figure 1, Figure 2** and **Figure 3**.

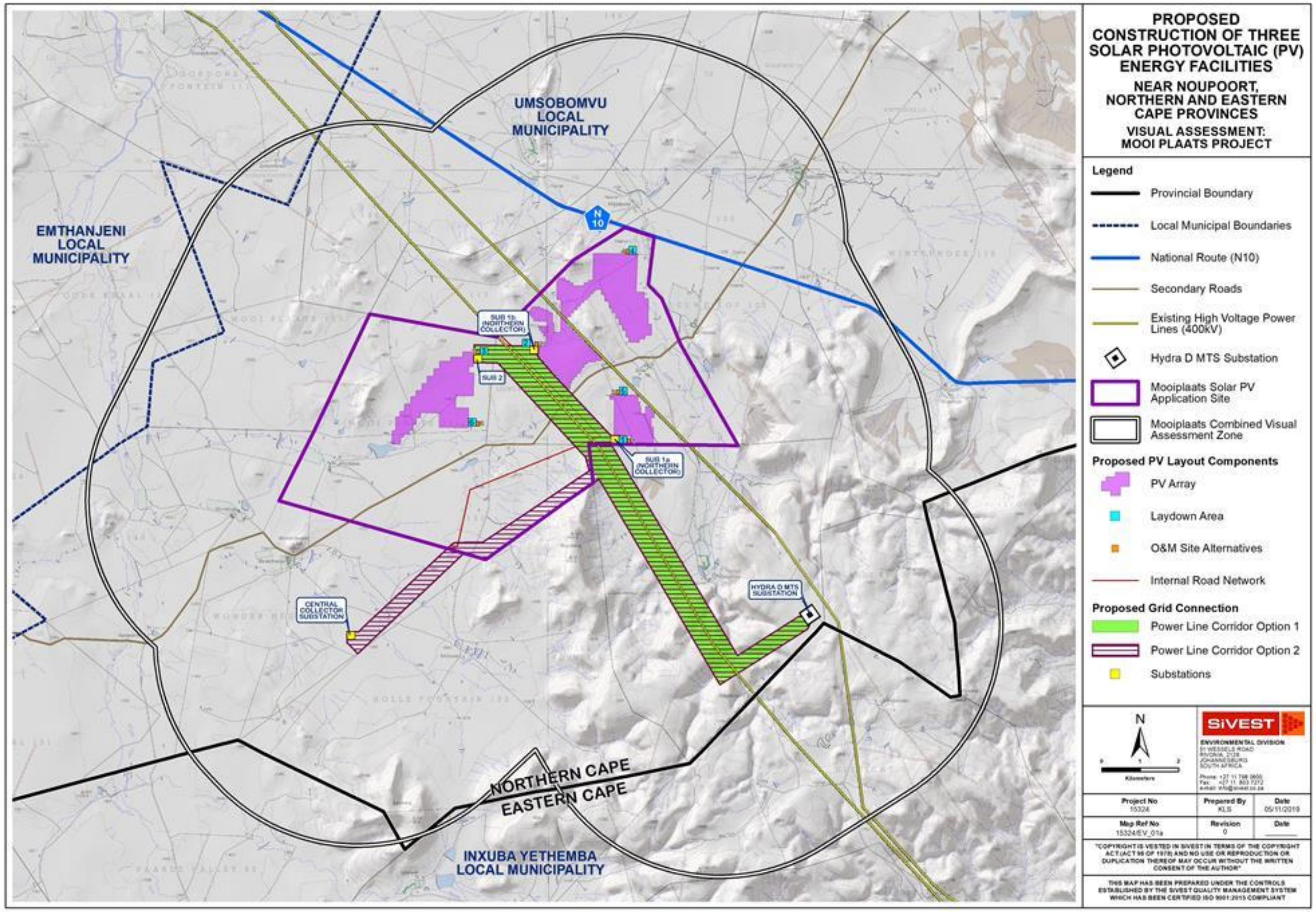

Figure 1: Proposed Mooi Plaats Solar PV Project

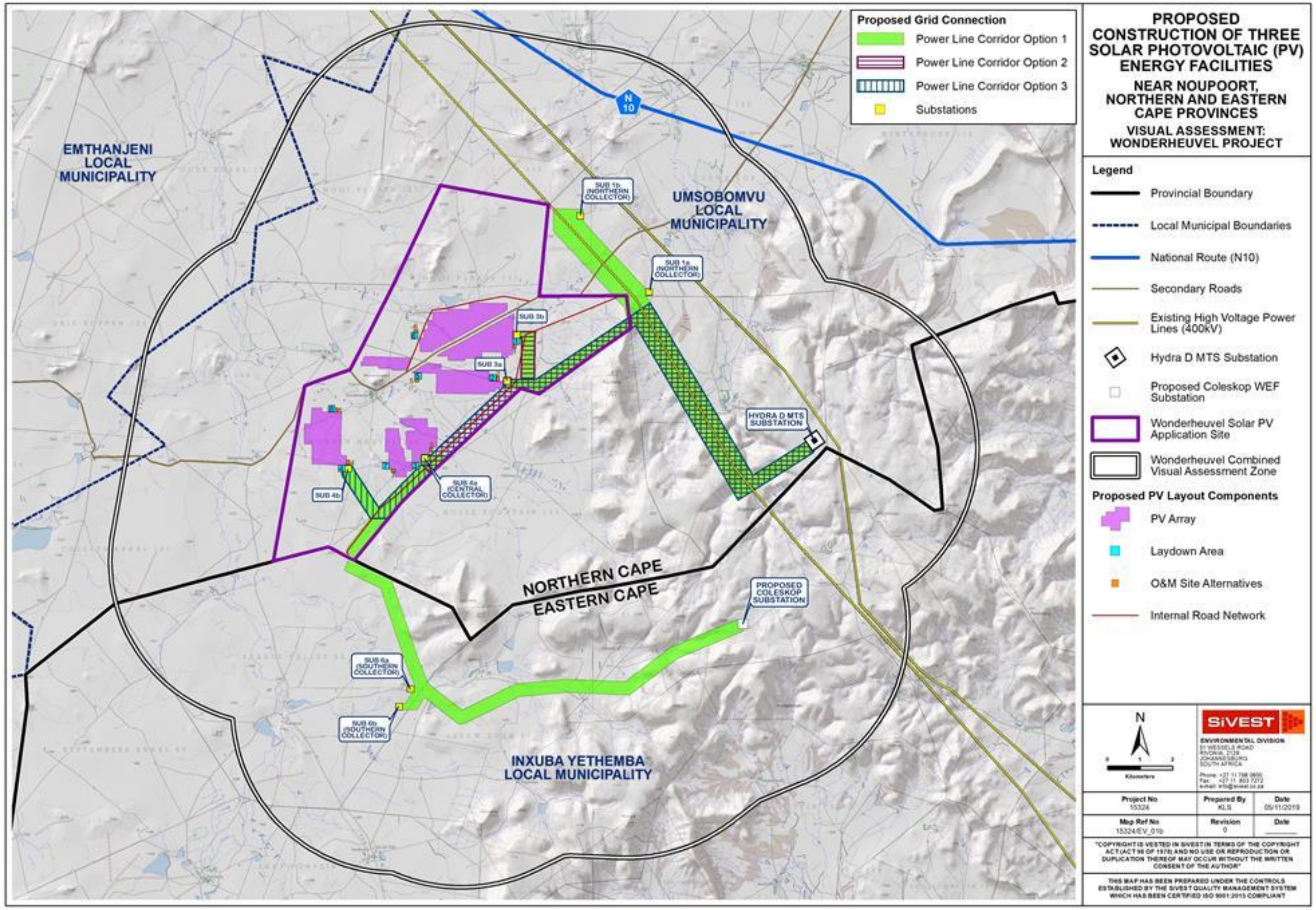

Figure 2: Proposed Wonderheuvel Solar PV Project

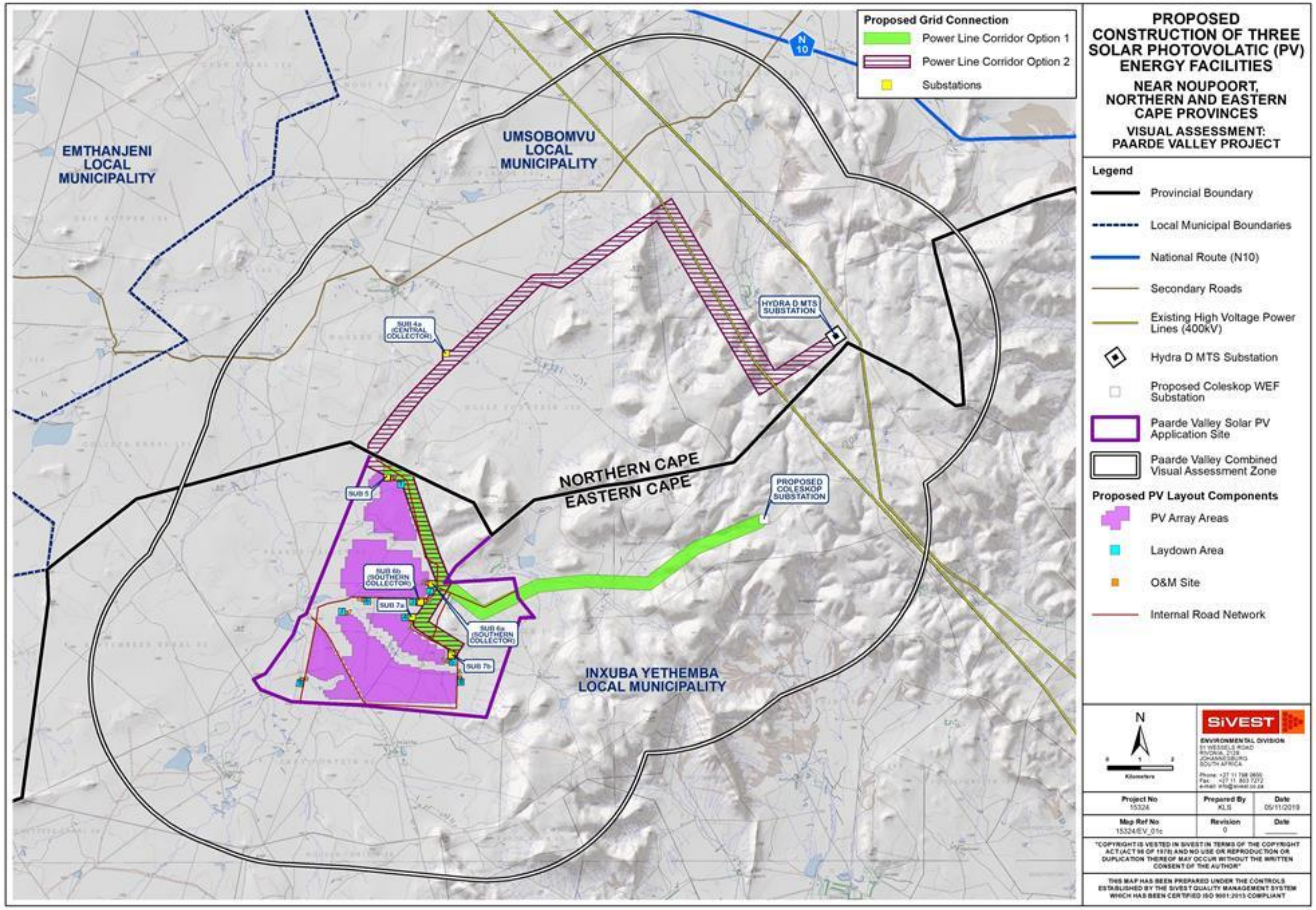

Figure 3: Proposed Paarde Valley Solar PV Project

1.1.1 Solar PV Facilities

Mooi Plaats Solar PV Energy Facility:

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting (**Figure 4**), and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible (**Figure 5**).

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.

- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

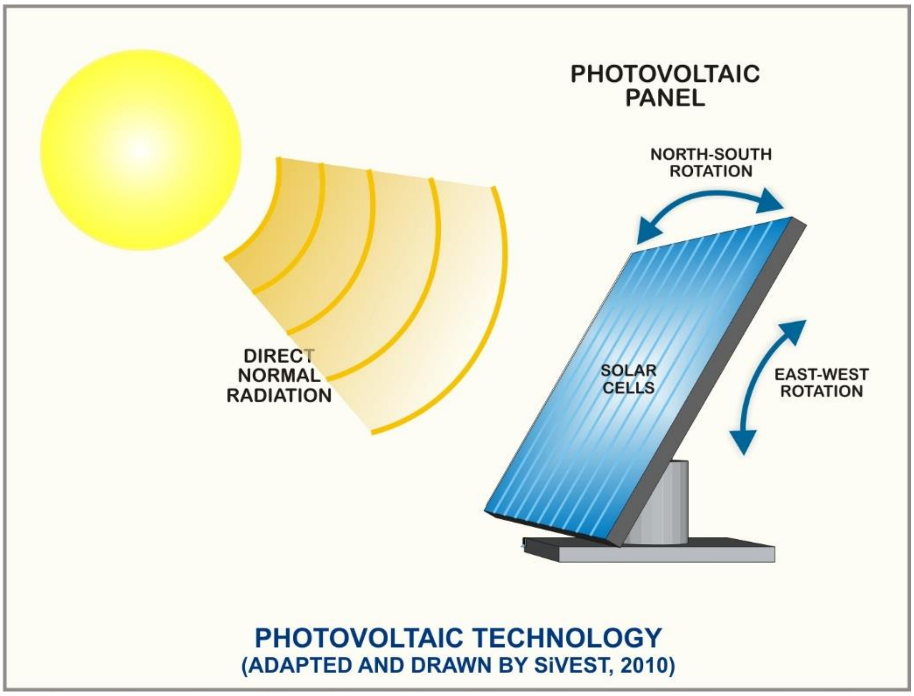

Figure 4: Typical components of a solar PV Panel

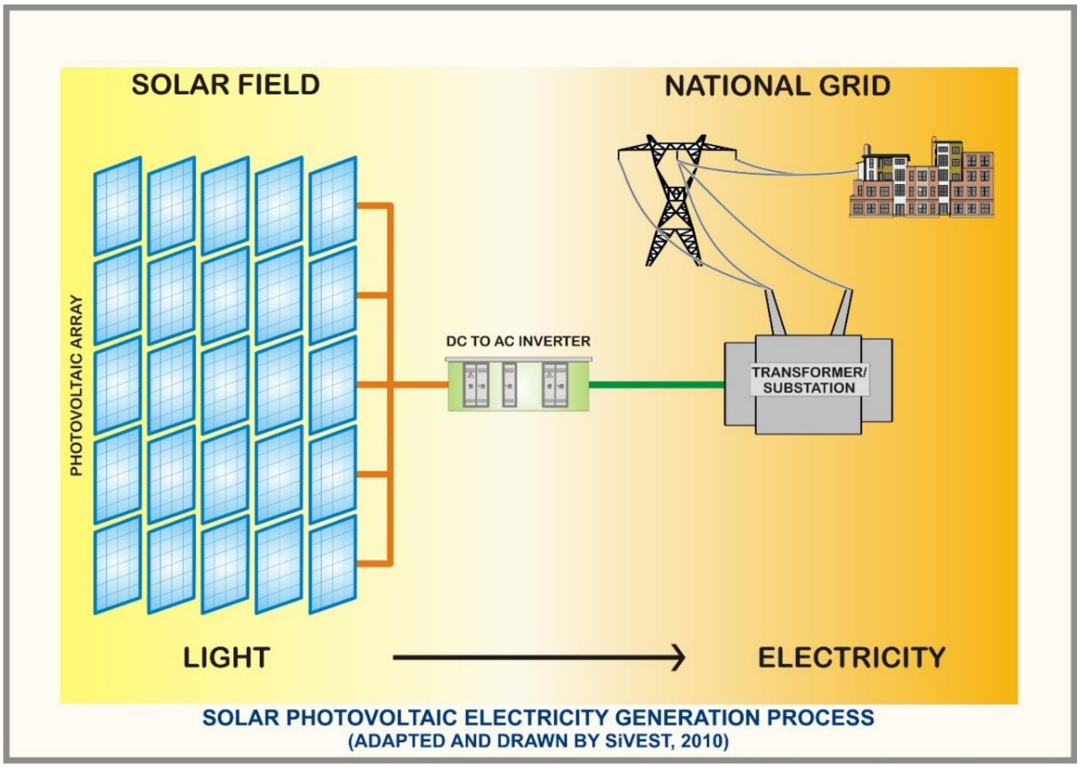

Figure 5: Conceptual PV electricity generation process showing electrical connections

1.1.2 Grid Connection Infrastructure

The proposed grid connection infrastructure for each PV facility is being assessed as part of a separate BA application. The grid connections will include the following components:

- New on-site substations and collector substations to serve each PV facility, each occupying an area of up to 4ha.
- A new 132kV overhead power line connecting the on-site substations or collector substations to either Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage will include both lattice and monopole towers which will be up to 25m in height and it is assumed that these towers will be located approximately 200m to 250m apart. The exact location of the towers will be determined during the final design stages of the power line.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor of between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

- ***Mooi Plaats Solar PV Grid Connection***

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** - links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b** - links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a** -links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b** - links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

- ***Wonderheuvel Solar PV Grid Connection***

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

a. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

<u>OPTION 2:</u>

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

<u>OPTION 3:</u>

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

- **Paarde Valley Solar PV Grid Connection**

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

<u>OPTION 1:</u>

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (<u>Substation 6a will act as Central Collector for this option)</u>.
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (<u>Substation 6a will act as Southern Collector for this option)</u>.

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (<u>Substation 6b will act as Southern Collector for this option</u>).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (<u>Substation 6b will act as Southern Collector for this option</u>).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (<u>Substation 6a will act as Southern Collector for this option</u>).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (<u>Substation 6a will act as Southern Collector for this option</u>).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (<u>Substation 6b will act as Southern Collector for this option</u>).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (<u>Substation 6b will act as Southern Collector for this option</u>).

<u>OPTION 2:</u>

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

1.2 Project Location

The proposed SEFs are located on adjoining farms lying south-west of Noupoort in the Northern Cape Province (**Figure 6**).

Mooi Plaats Solar PV project is located in the Umsobomvu Local Municipality, within the Pixley ka Seme District of the Northern Cape Province. The application site lies immediately south of the N10 national route, some 23kms from Noupoort, and comprises the following farm portions:

- Portion 1 of Leuwe Kop No 120
- Remainder of Mooi Plaats No 121

Wonderheuvel Solar PV project is also located in the Umsobomvu Local Municipality, within the Pixley ka Seme District of the Northern Cape Province. The application site lies between the Mooi Plaats Solar PV application site and the Paarde Valley Solar PV application site, some 30kms from Noupoort, and comprises the following farm portions:

- Remainder of Mooi Plaats No 121
- Portion 3 of Wonder Heuvel No 140
- Portion 5 of Holle Fountain No 133

Paarde Valley Solar PV project is located in the Inxuba Yethemba Local Municipality, within the Chris Hani District District of the Eastern Cape Province. The application site is located on the southern boundary of the Wonderheuvel Solar PV application site, some 38kms from Noupoort, and 32kms from Middelburg. The application site comprises the following farm portions:

- Portion 2 of Paarde Valley No 62; and
- Portion 7 of the Farm Leeuw Hoek No. 61.

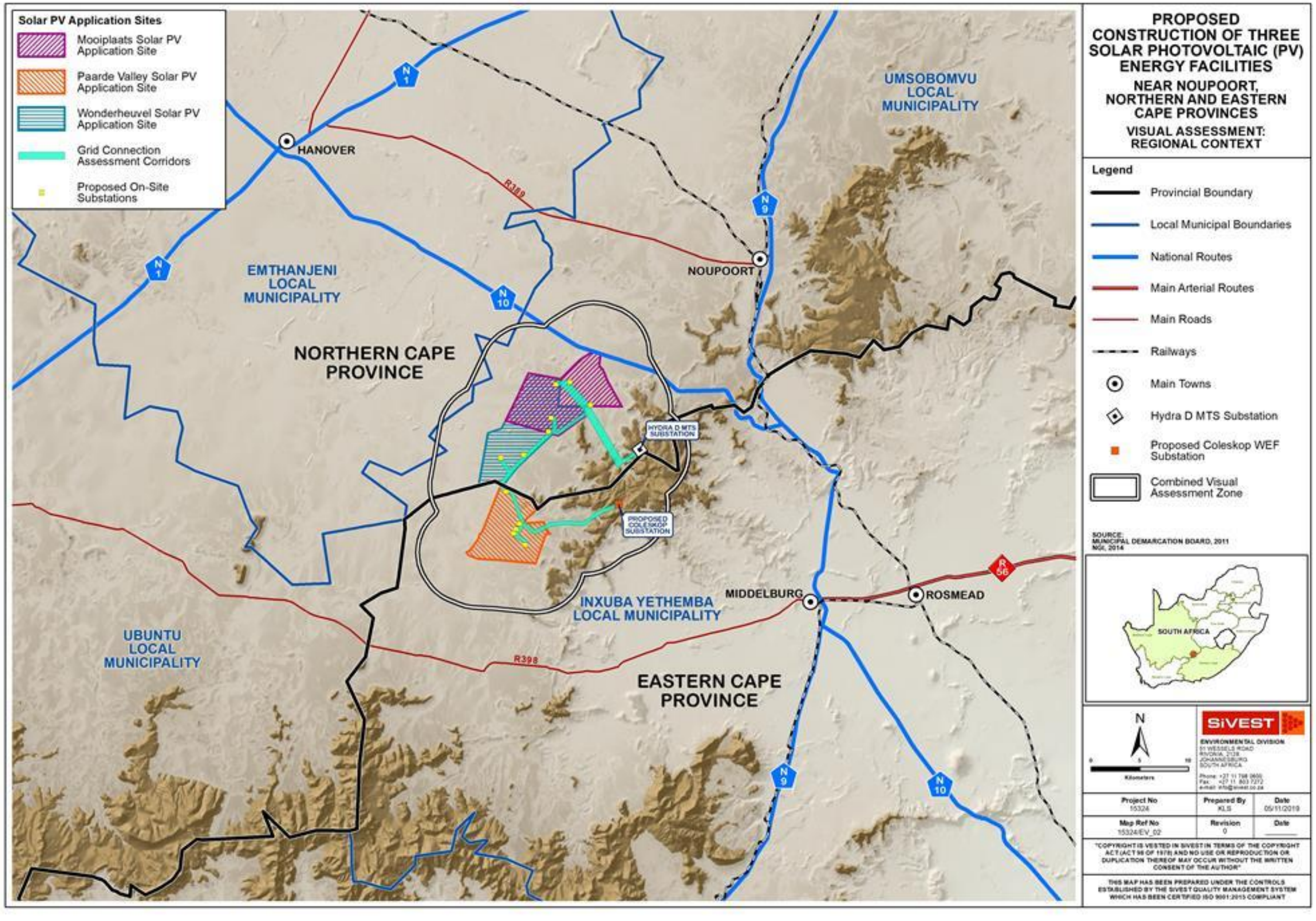

Figure 6: Regional Context

1.3 Assumptions and Limitations

- Given the nature of the receiving environment and the height of the proposed PV panels and power line towers, the study area or visual assessment zone is assumed to encompass an area of 5km from the boundary of the application sites. This limit on the visual assessment zone relates to the fact that visual impacts decrease exponentially over distance. Thus although the proposed development may still be visible beyond 5km, the degree of visual impact would diminish considerably. As such, the need to assess the impact on potential receptors beyond this distance would not be warranted.

- The identification of visual receptors involved a combination of desktop assessment as well as field-based observation undertaken during the scoping phase of the project. Initially Google Earth imagery was used to identify potential receptors within the study area. Where possible, these receptor locations were verified and assessed during a site visit which was undertaken between the 4th and the 7th of February 2019. Due to the extent of the study area however, and the fact that many of the identified receptors are farm houses on private property, it was not possible to visit or verify every potentially sensitive visual receptor location. As such, a number of broad assumptions have been made in terms of the likely sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility, the economic dependency of the occupants on the scenic quality of views from the facility and on people's perceptions of the value of "Green Energy". Sensitive receptor locations typically include sites such as tourism facilities and scenic locations within natural settings which are likely to be adversely affected by the visual intrusion of the proposed development. Thus, the presence of a receptor in an area potentially affected by the proposed development does not necessarily mean that any visual impact will be experienced.

- For the purposes of the EIA-level study, all analysis is based on a worst case scenario where PV panel height has been assumed to be 4m and power line towers and substation structure heights have been assumed to be 25m.

- Due to the varying scales and sources of information; maps may have minor inaccuracies. Terrain data for this area derived from the National Geo-Spatial Information (NGI)'s 25m DEM is fairly coarse and somewhat inconsistent and as such, localised topographic variations in the landscape may not be reflected on the Digital Elevation Model (DEM) used to generate the viewsheds.

- In addition the viewshed analysis does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. This analysis should therefore be seen as a conceptual representation or a worst case scenario.

- The potential visual impact at each visual receptor location was assessed using a matrix developed for this purpose. The matrix is based on three main parameters relating to visual impact and, although relatively simplistic, it provides a reasonably accurate indicative assessment of the degree of visual impact likely to be experienced at each receptor location as a result of the proposed development. It is however important to note the limitations of quantitatively assessing a largely subjective or qualitative type of impact and as such the matrix should be seen merely as a representation of the likely visual impact at a receptor location.

- No feedback regarding the visual environment has been received from the public participation process to date, however any feedback from the public during the review period of the Draft Environmental Impact Assessment Report (DEIAR) will be incorporated into further drafts of this report.

- At the time of undertaking the visual study no information was available regarding the type and intensity of lighting that will be required for the proposed SPEFs and therefore the potential impact of lighting at night has not been assessed at a detailed level. However, lighting requirements are relatively similar for all Solar PV Energy Facilities and as such, general measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.

- This study includes an assessment of the potential cumulative impacts of other renewable energy developments on the existing landscape character and on the identified sensitive receptors. This assessment is based on the information available at the time of writing the report and where information has not been available, broad assumptions have been made as to the likely impacts of these developments.

- At the time of writing this report, the proposed PV layouts were still in the preliminary design phase and as such, no visualisation modelling was undertaken for these solar PV projects. This can however be provided should the Public Participation process identify the need for this exercise.

- SiVEST made every effort to obtain information for the surrounding planned renewable energy developments (including specialist studies, assessment reports and Environmental Management Programmes), however some of the documents are not currently publicly available for download. The available information was factored into the cumulative impact assessment (Section 5.4).

- It should be noted that the site visit was undertaken in the first week of February 2019, during mid to late summer, when most rainfall occurs. Typically, the visual impact of a PV project would be less significant during the rainy periods of the year than it would during the drier periods when the surrounding vegetation is expected to provide less potential screening. The study area is however typically characterised by low levels of rainfall and the vegetation cover is largely dominated by low shrubs. Thus, the season is not expected to have a significant effect on the visual impact of the proposed development.

- The weather conditions in the study area also affect the visual impact of the proposed development to some degree. The site visit was undertaken in clear weather conditions which tend to prevail for most of the year due to the low levels of rainfall in the area. In these clear conditions, PV panels would present a greater contrast with the surrounding landscape than they would during overcast conditions. The weather conditions during the time of the study were therefore taken into consideration when undertaking this VIA.

1.4 Specialist Credentials

The scoping phase VIA was undertaken by Kerry Schwartz and reviewed by Andrea Gibb who was previously employed as a Divisional Manager at SiVEST. Andrea Gibb has 11 years' work experience and specialises in undertaking visual impact and landscape assessments, by making use of ArcGIS technology and field surveys.

Kerry Schwartz is a GIS specialist with more than 20 years' experience in the application of GIS technology in various environmental, regional planning and infrastructural projects undertaken by SiVEST. Kerry's GIS skills have been extensively utilised in projects throughout South Africa and in other Southern African countries. Kerry has also been involved in the compilation of VIA reports. Kerry's relevant VIA project experience is listed in the table below.

Environmental Practitioner	SiVEST (Pty) Ltd – Kerry Schwartz
Contact Details	kerrys@sivest.co.za
Qualifications	BA (Geography), University of Leeds 1982
Expertise to carry out the Visual Impact Assessment.	**<u>Visual Impact Assessments</u>:** ▪ VIAs (Scoping and Impact Phase) for the proposed Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province. ▪ VIA for the proposed Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province. ▪ VIA (EIA) for the proposed Paulputs WEF near Pofadder in the Northern Cape Province. ▪ VIA (EIA) for the proposed development of the Rondekop WEF near Sutherland in the Northern Cape Province.

	▪ VIA (BA) for the proposed development of the Tooverberg WEF near Touws Rivier in the Western Cape Province. ▪ VIA (BA) for the proposed development of the Kudusberg WEF near Sutherland, Northern and Western Cape Provinces. ▪ VIA (Scoping and Impact Phase) for the proposed development of the Kuruman Wind Energy Facility near Kuruman, Northern Cape Province. ▪ VIA (Scoping and Impact Phase) for the proposed development of the Phezukomoya Wind Energy Facility near Noupoort, Northern Cape Province. ▪ VIA (Scoping and Impact Phase) for the proposed development of the San Kraal Wind Energy Facility near Noupoort, Northern Cape Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Graskoppies Wind Farm near Loeriesfontein, Northern Cape Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Ithemba Wind Farm near Loeriesfontein, Northern Cape Province. ▪ VIAs (Scoping and Impact Phase) for the proposed Xha! Boom Wind Farm near Loeriesfontein, Northern Cape Province ▪ Visual Impact Assessments for 5 Solar Power Plants in the Northern Cape ▪ Visual Impact Assessments for 2 Wind Farms in the Northern Cape ▪ Visual Impact Assessment for Mookodi Integration Project (132kV distribution lines) ▪ Landscape Character Assessment for Mogale City Environmental Management Framework

Full CVs are attached as **Appendix B**. In addition, following best practice, an external peer review was undertaken by Stephen Van Staden of Scientific Aquatic Services (CV also attached – **Appendix B**).

1.5 Assessment Methodology

As mentioned above, this VIA has been based on a desktop-level assessment supported by field-based observation.

1.5.1 Physical landscape characteristics

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by NGI, the South African National Biodiversity Institute (SANBI) and the South African National Land Cover Dataset (Geoterraimage – 2014). The characteristics identified via desktop analysis were later verified during the site visit.

1.5.2 Identification of sensitive receptors

Visual receptor locations and routes identified in the study area during the scoping phase of the project were re-assessed in order to determine the impact of the amended and/or refined SPEF and grid infrastructure proposals on each of the identified receptor locations.

1.5.3 Fieldwork and photographic review

Fieldwork undertaken during the scoping phase of the VIA involved a four (4) day site visit undertaken between the 4th and the 7th of February 2019 (mid to late summer). The purpose of the site visit was to:

- verify the landscape characteristics identified via desktop means;
- conduct a photographic survey of the study area;
- verify, where possible, the sensitivity of visual receptor locations identified via desktop means;
- eliminate receptor locations that are unlikely to be influenced by the proposed development;
- identify any additional visually sensitive receptor locations within the study area; and
- inform the impact rating assessment of visually sensitive receptor locations (where possible).

The findings of the field assessment have been used to inform the EIA-level VIA and no further fieldwork was considered necessary.

1.5.4 Impact Assessment

A rating matrix was used to objectively evaluate the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) in an attempt to minimise the visual impact of the proposed development. The rating matrix made use of a number of different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration and intensity, in order to assign a level of significance to the visual impact of the project.

A separate rating matrix was used to assess the visual impact of the proposed development on each visual receptor location (both sensitive and potentially sensitive), as identified. This matrix is based on three (3) parameters, namely the distance of an identified visual receptor from the proposed development, the presence of screening factors and the degree to which the proposed development would contrast with the surrounding environment. The receptor impact rating developed during the scoping phase of this VIA was re-examined in order to determine the impact of the amended and/or refined SPEF and grid infrastructure proposals on each of the identified receptor locations.

1.5.5 Consultation with I&APs

Continuous consultation with Interested and Affected Parties (I&APs) undertaken during the public participation process will be used (where available) to help establish how the proposed development will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs have not yet provided any feedback in this regard, further drafts of this EIA phase report will be updated to include any relevant feedback or comments received during the review period of the Draft Environmental Impact Assessment Reports (DEIARs).

2 FACTORS INFLUENCING VISUAL IMPACT

2.1 Subjective experience of the viewer

The perception of the viewer/receptor toward an impact is highly subjective and involves 'value judgements' on behalf of the receptor. It is largely based on the viewer's perception and is usually dependent on the age, gender, activity preferences, time spent within the landscape and traditions of the viewer (Barthwal, 2002). Thus, certain receptors may not consider a SPEF to be a negative visual impact as it is often associated with employment creation, social up-liftment and the general growth and progression of an area, and thus the development could even have positive connotations.

2.2 Visual environment

SPEFs are not features of the natural environment, but are rather a representation of human (anthropogenic) alteration. As such, these developments are likely to be perceived as visually intrusive when placed in largely undeveloped landscapes that have a natural scenic quality and where tourism activities, based upon the enjoyment of (or exposure to) the scenic or aesthetic character of the area, are practiced. Residents and visitors to these areas could perceive the PV panels and associated infrastructure to be highly incongruous in this context and may regard these features as an unwelcome intrusion which degrade the natural character and scenic beauty of the area, and which could potentially even compromise the practising of tourism activities in the area. The experience of the viewer is however highly subjective and there are those who may not perceive features such as PV panels as a visual intrusion.

The presence of other anthropogenic features associated with the built environment may not only obstruct views but also influence the perception of whether a development is a visual impact. In industrial areas for example, where other infrastructure and built form already exists, the visual environment could be considered to be 'degraded' and thus the introduction of a SPEF into this setting may be considered to be less visually intrusive than if there was no existing built infrastructure visible.

2.3 Type of visual receptor

Visual impacts can be experienced by different types of receptors, including people living, working or driving along roads within the viewshed of the proposed development. The receptor type in turn affects the nature of the typical 'view', with views being permanent in the case of a residence or other places of human habitation, or transient in the case of vehicles moving along a road. The nature of the view experienced affects the intensity of the visual impact experienced.

It is important to note that visual impacts are only experienced when there are receptors present to experience this impact. Thus, where there are no human receptors or viewers present there are not likely to be any visual impacts experienced.

2.4 Viewing distance

Viewing distance is a critical factor in the experiencing of visual impacts, as beyond a certain distance, even large developments tend to be much less visible, and difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially as one moves away from the source of impact, with the impact at 1 000m being considerably less than the impact at a distance of 500m **(Figure 7)**.

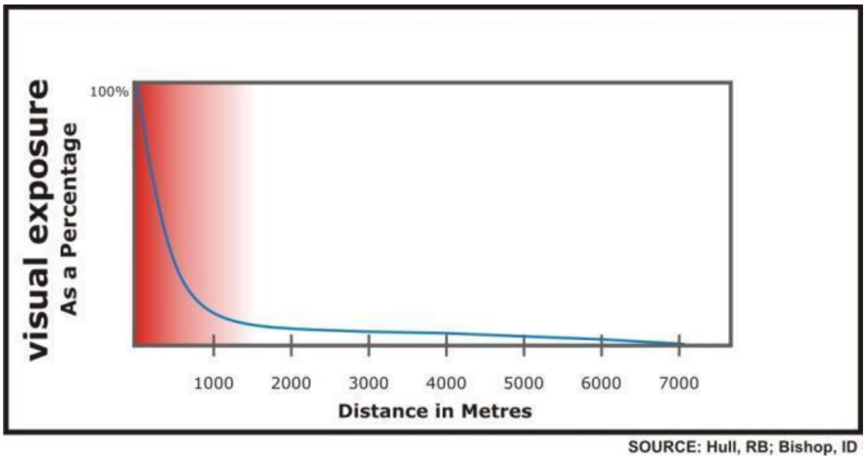

Figure 7: Conceptual representation of diminishing visual exposure over distance

3 VISUAL CHARACTER AND SENSITIVITY OF THE STUDY AREA

Defining the visual character of an area is an important factor in the assessment of visual impacts as it establishes the visual baseline or existing visual environment in which the development would be constructed. The visual impact of a development is measured by establishing the degree to which the development would contrast with, or conform to, the visual character of the surrounding area. The inherent sensitivity of the area to visual impacts or visual sensitivity is thereafter determined, based on the visual character, the economic importance of the scenic quality of the area, inherent cultural value of the area and the presence of visual receptors.

Physical and land use related characteristics, as outlined below, are important factors contributing to the visual character of an area.

3.1 Physical and Land Use Characteristics

3.1.1 Topography

As can be seen from the profile graph below (**Figure 8**), the combined assessment area slopes significantly downwards from a height of approximately 1 900 meters above sea level (m.a.s.l) in the east to approximately 1 400msl in the west. Hence the western sector of the study area is characterised by relatively flat terrain with undulating hills, typical of much of the Karoo (**Figure 9**). The eastern sector of the study area is however dominated by areas of greater relief where hilly terrain is characterised by incised valleys, steep slopes and flatter, higher lying plateaus with steep slopes (**Figure 10**).

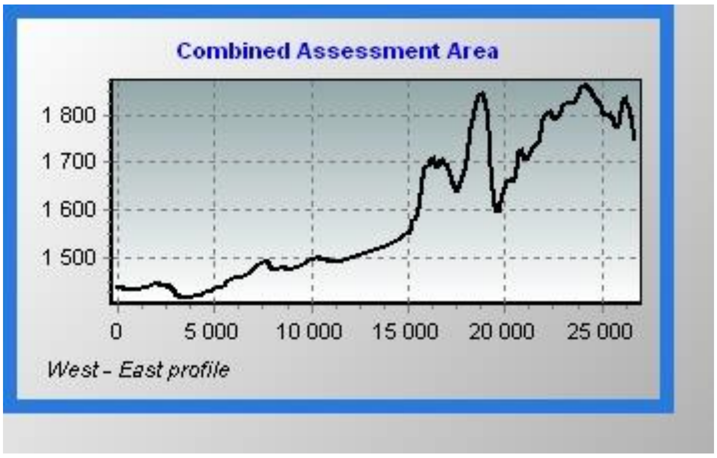

Figure 8: Topographic profile of the combined assessment area.

Maps showing the topography and slopes within and in the immediate vicinity of the combined assessment area are provided in **Figure 11** and **Figure 12.**

Figure 9: Flat to undulating terrain in the western sector of the study area

Figure 10: Hilly terrain in the eastern sector of the study area

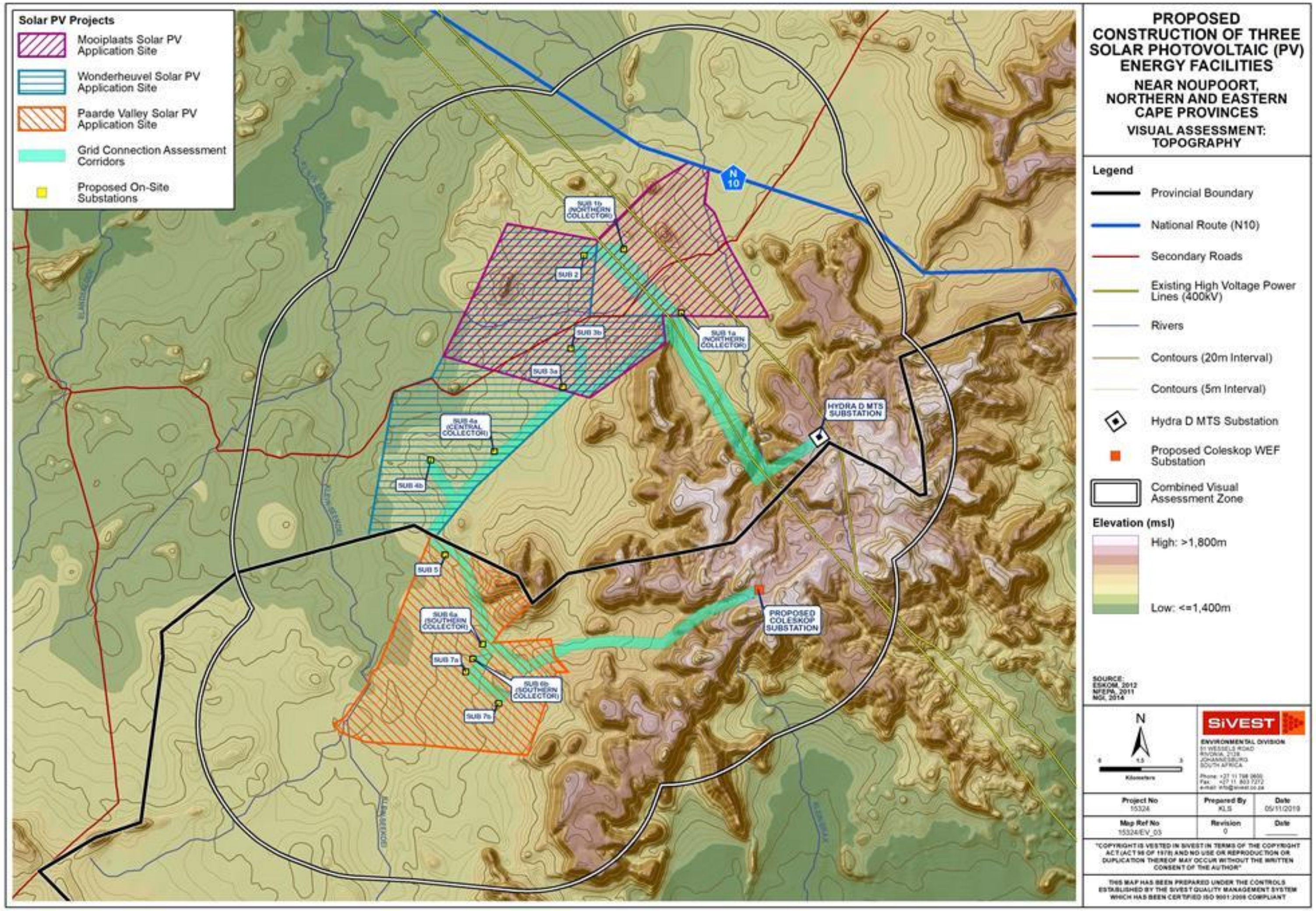

Figure 11: Topography of the study area

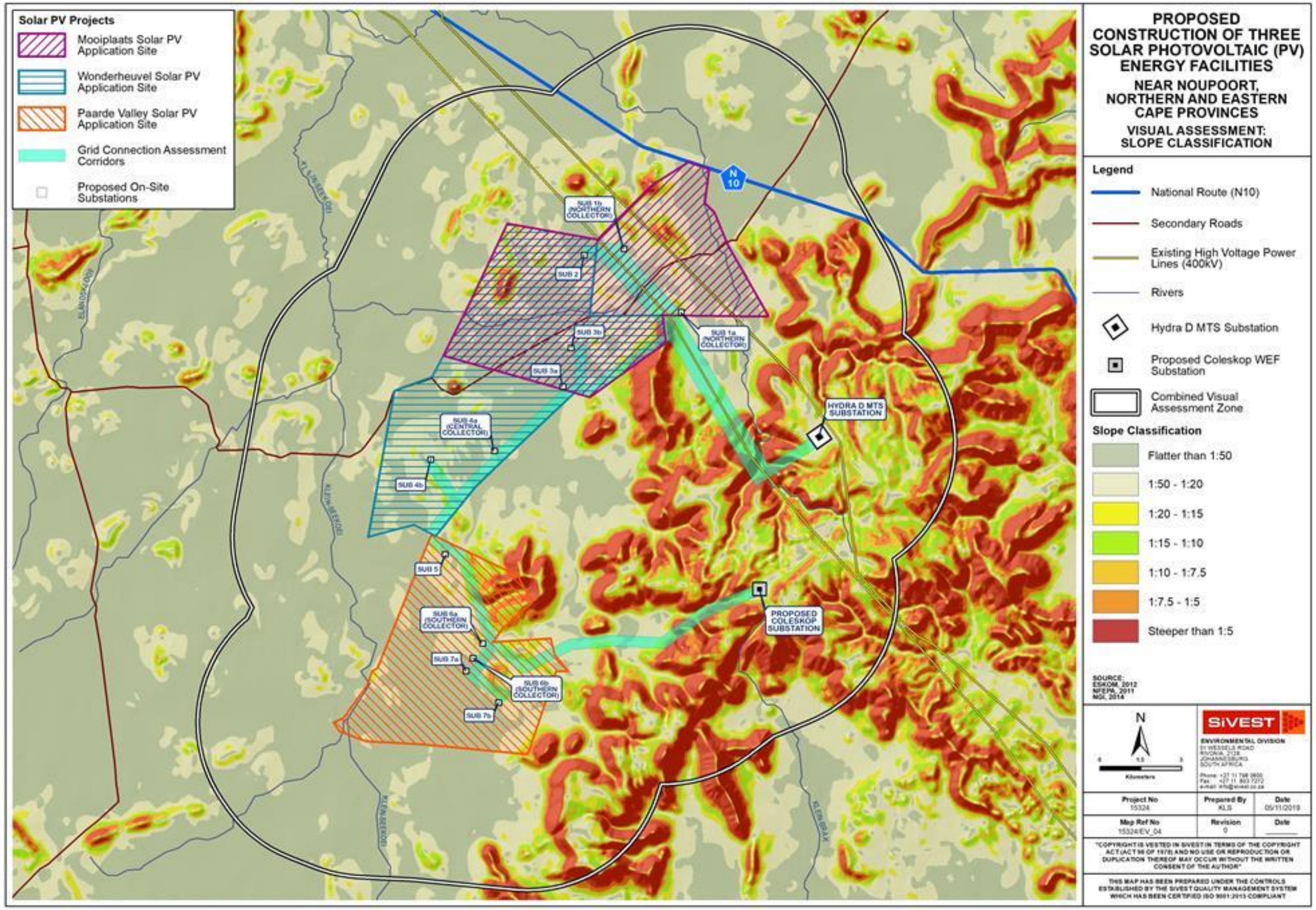

Figure 12: Slope classification

Visual Implications

Areas of flat relief, including the flat plains and the higher-lying plateaus, are characterised by wide ranging vistas (**Figure 13**), although views eastwards will be somewhat constrained by the hilly terrain in the western sector of the study area (**Figure 14**). In the hillier and higher-lying terrain, the vistas will depend on the position of the viewer. Viewers located within some of the more incised valleys for example, would have limited vistas, whereas a much wider vista would be experienced by viewers on higher-lying ridge tops or slopes. Importantly in the context of this study, the same is true of objects placed at different elevations and within different landscape settings. Objects placed on high-elevation slopes or ridge tops would be highly visible, while those placed in valleys or enclosed plateaus would be far less visible.

The PV arrays will not however be located on high elevation slopes or on ridgelines and as such there will be minimal impact on the skyline. Sections of the grid connection assessment corridor may however impact on the skyline, particularly where they traverse ridges. In addition, with little to no topographic shielding, the pylons and the steel structures of the proposed substations at a maximum height of 25m are likely to be visible from many of the locally-occurring receptor locations.

Figure 13: View northwards across the study showing area wide ranging vistas

.

Figure 14: Hilly terrain constraining views east and southeast

3.1.2 Vegetation

According to Mucina and Rutherford (2012), the areas of the visual assessment zone which are characterised by flatter Karoo plains are largely covered by the Eastern Upper Karoo vegetation type, while the hillier areas in the east of the study area are characterised by Besem Karee Koppies shrubland (**Figure 15**). The aridity of the area has restricted the vegetation to low shrubs distributed uniformly across the landscape (**Figure 16**), except in areas of hillier terrain which tend to be more densely vegetated with more tree species in evidence (**Figure 17**).

Additional tree species are also present in the study area, particularly where exotic tree species and other typical garden vegetation has been established around farmsteads. (**Figure 18**).

Much of the study area however is still characterised by natural low shrubland with transformation limited to patches of cultivation and a few isolated areas where pastoral activities such as livestock rearing are taking place.

<u>Visual Implications</u>

Vegetation cover across the study area is predominantly short and sparse and thus will not provide any visual screening. In some instances however, tall exotic trees planted around farmhouses will restrict views from receptor locations (**Figure 19**).

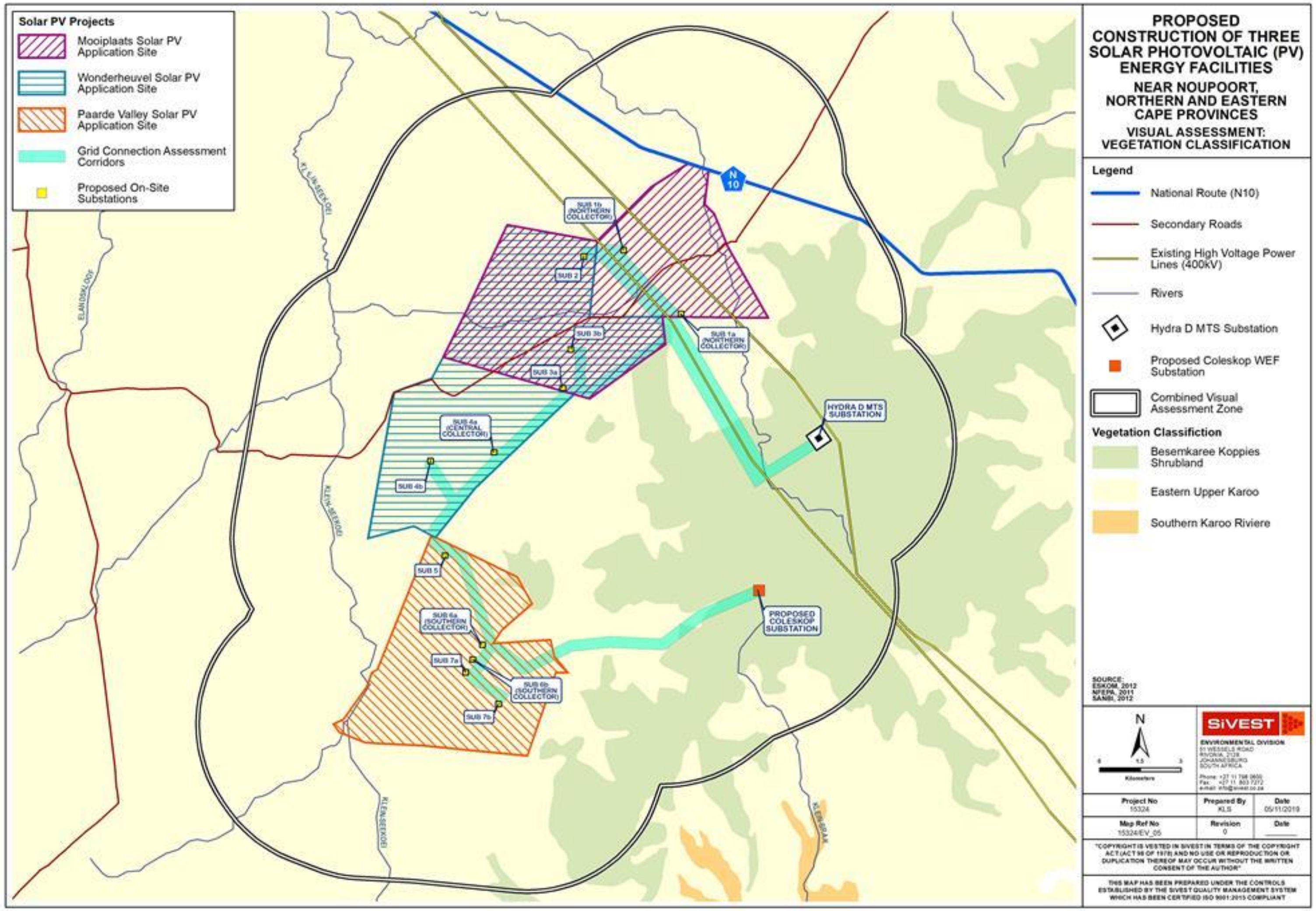

Figure 15: Vegetation Classification in the Study Area

Figure 16: Low shrubland prevalent on the flatter plains of the study area

Figure 17: Denser vegetation and tree species on hilly terrain

Figure 18: Typical trees and garden vegetation around farmhouses

Figure 19: Screening vegetation around farmhouses

3.1.3 Land Use

According to the South African National Land Cover dataset (Geoterraimage 2014), large sections of the visual assessment area are characterised by low shrubland with large areas of grassland and smaller patches of woodland / open bush and thicket / dense bush occurring in the hilly areas in the eastern sector of the study area. Significant tracts of land in the study area are classified as 'bare (none vegetated)', and while some of these 'bare' areas are representative of transformation due to human activity, in many cases these patches of land are merely undisturbed areas with very sparse vegetation cover (**Figure 20**).

Agricultural activity in the area is restricted by the arid nature of the local climate and areas of cultivation are largely confined to relatively limited areas distributed along drainage lines (**Figure 21**). As such, the natural vegetation has been retained across much of the study area. Livestock farming (mostly sheep) is the dominant activity (**Figure 22**), although the climatic and soil conditions have resulted in low densities of livestock and relatively large farm properties across the area. Thus, the area has a very low density of rural settlement, with relatively few scattered farmsteads in evidence. Built form in much of the study area is limited to isolated farmsteads, including farm worker's dwellings and ancillary farm buildings, gravel access roads, telephone lines, fences and windmills (**Figure 23**).

Further human influence is visible in the area in the form of the N10 national route which traverses the study area in a north-west to south-east direction (**Figure 24**). In addition, there are several small patches of land scattered across the study area which are classified as 'Mines / Quarries'. These areas appear to be small quarries or 'diggings' and are mostly located adjacent to the public roads, especially along the N10.

The closest built-up area is the town of Noupoort which is situated approximately 23km north-east of the Mooi Plaats application site while Middelburg is some 30km to the south-east of the Paarde Valley application site. These small towns are well outside the combined study area for these SPEFs and are thus not expected to have an impact on the visual character of the study area.

Existing power lines in this area are also significant man-made features in an otherwise undeveloped landscape. Two sets of high voltage (400kV) power lines traverse the northern section of the study area, bisecting the Mooi Plaats solar PV application site in a north-west to south-east alignment (**Figure 25**).

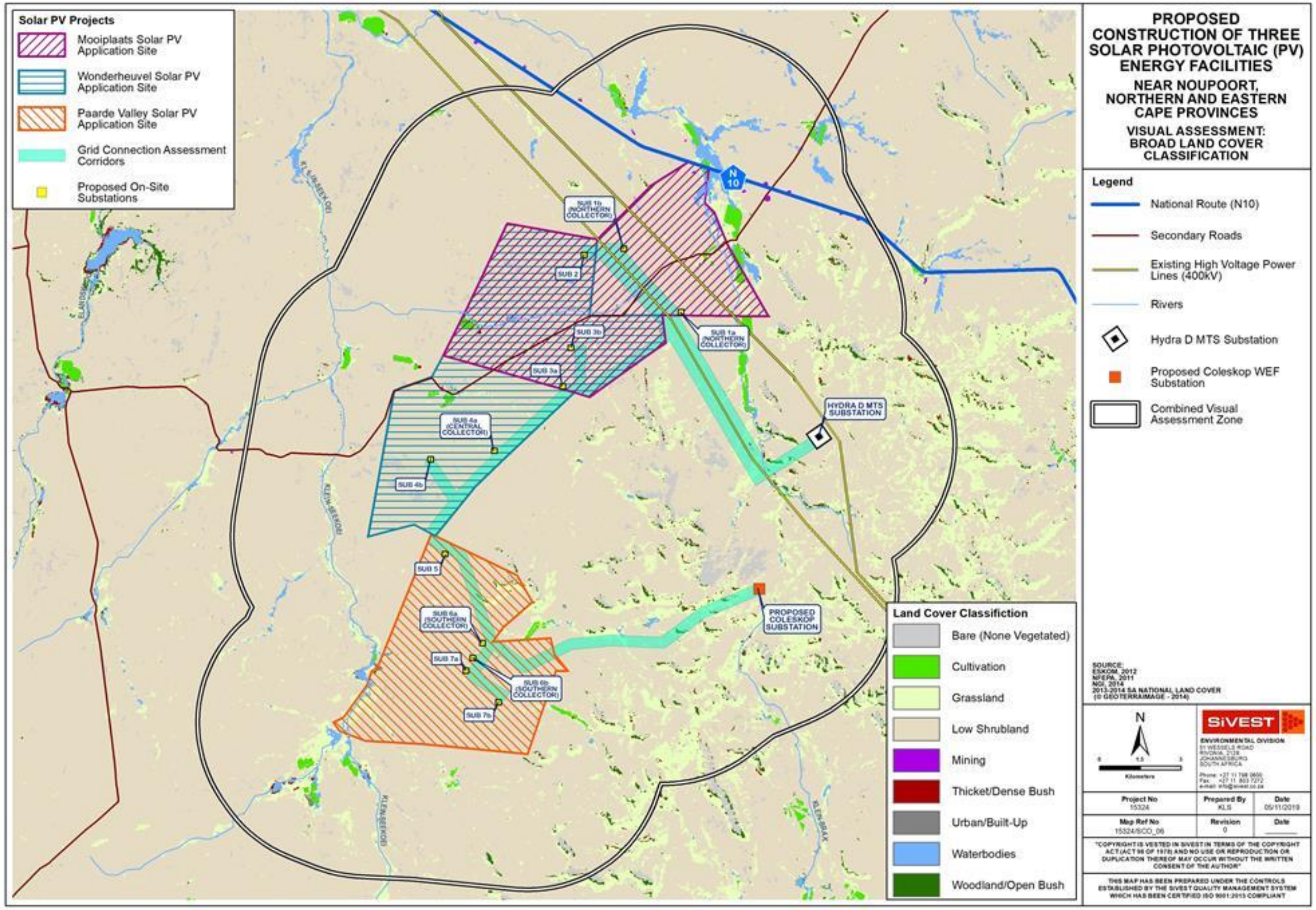

Figure 20: Land Cover Classification

Figure 21: View of cultivated land on Wonderheuvel solar PV application site

Figure 22: Evidence of sheep rearing in the assessment zone

Figure 23: Farm buildings and associated infrastructure on Mooi Plaats Solar PV application site.

Figure 24: View of the N10 National Route on the northern boundary of Mooi Plaats Solar PV application site.

Figure 25: 400kV power lines traversing the Mooi Plaats solar PV application site.

<u>Visual Implications</u>

As stated above, sparse human habitation and the predominance of natural vegetation cover across much of the study area would give the viewer the general impression of a largely natural setting with some pastoral elements. In addition, there are no towns or settlements in the study area and thus, there are very low levels of human transformation and visual degradation across much of the study area.

The short, scrubby or grassy vegetation that occurs over the entire study area offers no visual screening in itself, and thus terrain / topography is the most important factor in limiting vistas. Exceptions to this situation occur at some local farmsteads where trees and shrubs have been established around the farmstead, providing effective screening from the surrounding areas.

The influence of the level of human transformation on the visual character of the area is described in more detail below.

3.2 Visual Character and Cultural Value

The above physical and land use-related characteristics of the study area contribute to its overall visual character. Visual character largely depends on the level of change or transformation from a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as telephone or electrical infrastructure. The visual character of an area largely determines the **sense of place** relevant to the area. This is the unique quality or character of a place, whether natural, rural or urban which results in a uniqueness, distinctiveness or strong identity.

As mentioned above, much of the study area is characterised by natural landscapes with some pastoral elements and low densities of human settlement. Livestock grazing is the dominant land use. These activities have not transformed the natural landscape to any significant degree and as such a large portion of the study area has retained its natural character and is dominated by largely natural views.

There are no towns or built-up areas in the study area influencing the overall visual character and thus there are very low levels of human transformation and visual degradation across much of the study area. Built form is largely dominated by isolated farmsteads, gravel access roads, telephone lines, low voltage power lines, fences and windmills, although the N10 national route and existing high voltage power lines form significant anthropogenic elements in the study area. The presence of this infrastructure is an important factor in this context, as the introduction of a development such as a SPEF would result in less visual contrast where other anthropogenic elements are already present, especially where the scale of those elements is similar to that of the proposed development.

The greater area surrounding the development site is an important component when assessing visual character. The area can be considered to be typical of a Karoo or “platteland” landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa’s dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by scattered farmsteads and small towns. Over the last couple of decades an increasing number of tourism routes have been established in the Karoo and in a context of increasing urbanisation in South Africa’s major centres, the Karoo is being marketed as an undisturbed getaway. Examples of this may be found in the “Getaway Guide to Karoo, Namaqualand and Kalahari” (Moseley and Naude-Moseley, 2008).

The typical Karoo landscape can be considered a valuable ‘cultural landscape’ in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

- "a landscape designed and created intentionally by man";
- an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape"; and
- an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element".

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small towns, such as Noupoort and Middelburg, engulfed by an otherwise rural, almost barren environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In terms of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, “continuing” landscape.

In light of this, it is important to assess whether the introduction of a solar PV facility with associated infrastructure into the study area would be a degrading factor in the context of the natural Karoo character of the landscape. However, considering the fact that a number of SPEFs and WEFs have been developed or are likely to be developed across the Karoo, it is possible that renewable energy facilities, including wind turbines and PV panels, may in the future become an integral part of the typical Karoo cultural landscape.

In this instance visual impacts on the cultural landscape would be reduced by the fact that the area is relatively remote and there are relatively few tourism or nature-based leisure facilities in the study area. In addition, although the northern portion of the proposed Mooi Plaats application is visible from the N10 national route, the section of this route that traverses the study area does not form part of a designated tourism route and is not expected to experience heavy volumes of tourist traffic.

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3.3 Visual Sensitivity

Visual sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area, SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 1**), the visual sensitivity of the area is broken up into a number of categories, as described below:

i) **High** - The introduction of a new development such as a solar PV facility would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors.

ii) **Moderate** – Receptors are present, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 1: Environmental factors used to define visual sensitivity of the study area

FACTORS	DESCRIPTION	RATING									
		LOW									*HIGH*
		1	2	3	4	5	6	7	8	9	10
Pristine / natural / scenic character of the environment	Study area is largely natural with areas of scenic value and some pastoral elements.										
Presence of sensitive visual receptors	Relatively few sensitive receptors have been identified in the study area.										
Aesthetic sense of place / visual character	Visual character is typical of Karoo Cultural landscape.										
Irreplaceability / uniqueness / scarcity value	Although there are areas of scenic value within the study area, these are not rated as highly unique.										
Cultural or symbolic meaning	Much of the area is typical of a Karoo Cultural landscape.										
Protected / conservation areas in the study area	No protected or conservation areas were identified in the study area.										
Sites of special interest present in the study area	No sites of special interest were identified in the study area.										
Economic dependency on scenic quality	Few tourism/leisure based facilities in the area										
International / regional / local status of the environment	Study area is typical of Karoo landscapes										
**Scenic quality under threat / at risk of change	Introduction of an SPEF will alter the visual character and sense of place. In addition, the development of other renewable energy facilities in the broader area as planned will introduce an increasingly industrial character, giving rise to significant cumulative impacts										

**Any rating above '5' for this specific aspect will trigger the need to undertake an assessment of cumulative visual impacts.

Low				Moderate					High
10	20	30	40	50	60	70	80	90	100

Based on the above factors, the total score for the study area is 42, which according to the scale above, would result in the area being rated as having a low to moderate visual sensitivity. It should be stressed however that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of whether the landscape is likely to be sensitive to visual impacts, and is based on the physical characteristics of the study area, economic activities and land use that predominates. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs.

No formal protected areas were identified in the study area, and only one tourism facility was identified. In addition, relatively few sensitive or potentially sensitive receptors were found to be present.

3.4 Visual Absorption Capacity

Visual absorption capacity is the ability of the landscape to absorb a new development without any significant change in the visual character and quality of the landscape. The level of absorption capacity is largely based on the physical characteristics of the landscape (topography and vegetation cover) and the level of transformation present in the landscape.

The relatively flat topography in the study area and the relative lack of vegetation to provide screening would reduce the visual absorption capacity across much of the area. This would be offset to some degree where the landscape has already undergone significant transformation as a result of the N10 National route and the 400kV power lines, thus increasing the overall visual absorption capacity of the landscape.

Visual absorption capacity in the study area is therefore rated as low to moderate.

3.5 Visually Sensitive Areas on the Site

During the scoping phase, all project specialists were requested to indicate environmentally sensitive areas within the application sites. The aim of this exercise was to demarcate those areas of the application site which should be precluded from the solar PV development footprint. From a visual perspective, these would be areas where the establishment of PV panels or other associated infrastructure would result in the greatest probability of visual impacts on potentially sensitive visual receptors.

Using GIS-based visibility analysis, it was possible to determine which sectors of all three application sites would be visible to the highest numbers of receptors in the study area (**Figure 26**). This analysis took into account all the sensitive and potentially sensitive receptor locations identified as well as points along the N10 receptor roads at 500m intervals. The areas visible to the highest number of receptors were rated as areas of 'high sensitivity' which should preferably be precluded from SPEF development in order to reduce the potential visual impact on the identified sensitive and potentially sensitive receptor locations. However, as the study area as a whole is rated as having a low to moderate visual sensitivity (refer to **Section 3.3**), these zones are <u>not considered to be areas of high visual sensitivity or no go areas</u>, but rather should be viewed as zones where development should be limited, as the PV panels will still be highly visible.

It should be noted that this sensitivity rating applies to PV fields only. The visual impacts resulting from the associated infrastructure are considered to have far less significance when viewed in the context of multiple PV panels and as such the infrastructure has been excluded from the sensitivity analysis.

It should be noted that the visibility analysis is based purely on topographic data available for the broader study area and does not take into account any localised topographic variations or any existing infrastructure and / or vegetation which may constrain views. In addition, the analysis does not take into account differing perceptions of the viewer which largely determine the degree of visual impact being experienced.

The visual sensitivity analysis should therefore be seen as a conceptual representation or a worst-case scenario which rates the visibility of the site in relation to potentially sensitive receptors.

In addition to the sensitivity ratings, a 500 m exclusion zone has been delineated around the existing residences on the application sites and along the N10 receptor road. It was recommended that PV fields should not be developed within these buffer zones so as to prevent significantly adverse impacts of glint and glare on the local residents and on motorists using the N10.

These areas of visual sensitivity as identified above have been taken into account in the preliminary SPEF layouts as shown in **Figure 26**.

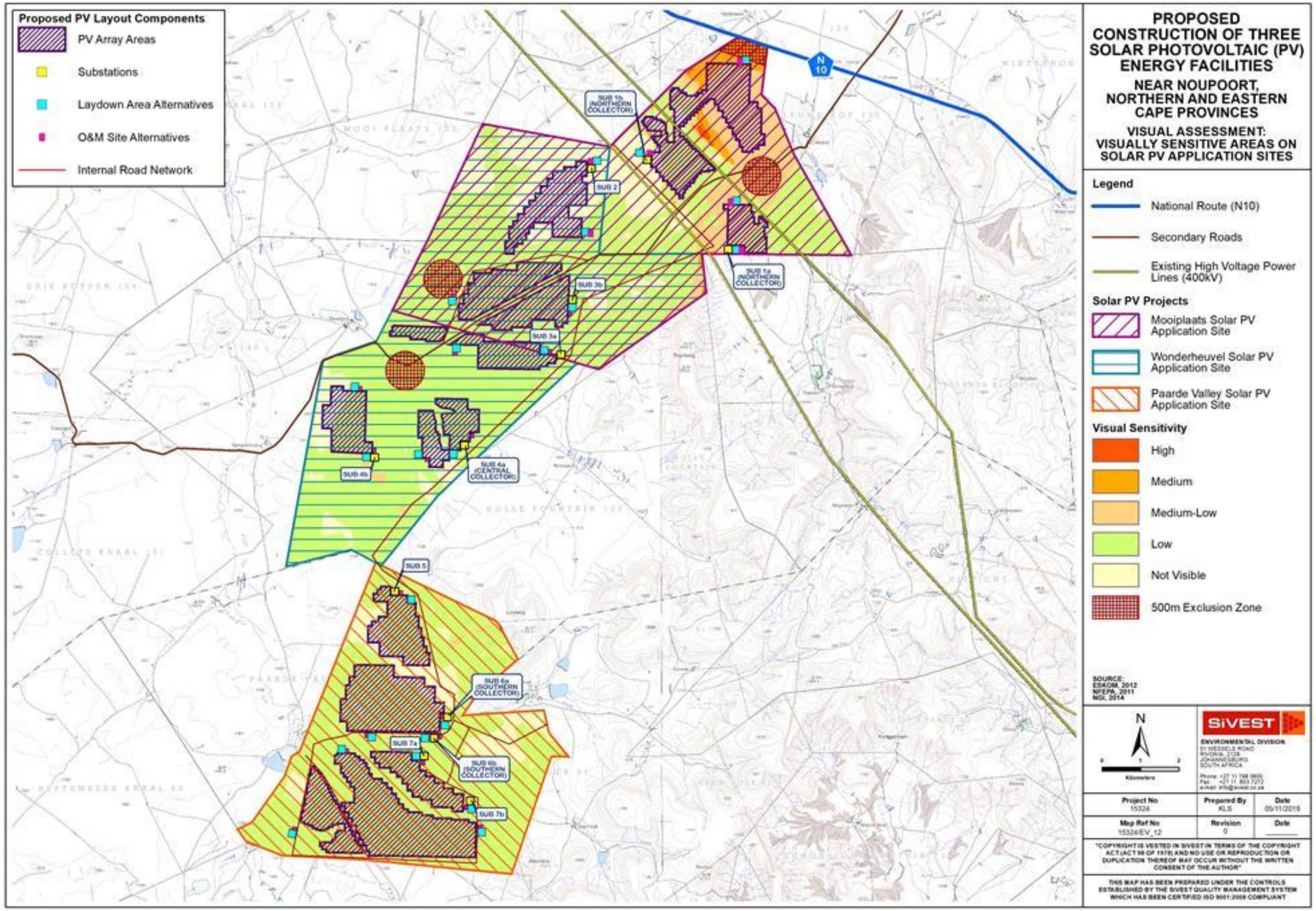

Figure 26: **Preliminary visual sensitivity analysis.**

4 GENERIC VISUAL IMPACTS ASSOCIATED WITH THE SOLAR PV ENERGY FACILITES

In this section, the typical visual issues related to the establishment of solar PV facilities and grid connection infrastructure as proposed are discussed. It is important to note that the renewable energy industry is still relatively new in South Africa and as such this report draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with solar energy facilities.

4.1 Solar Energy Facilities

4.1.1 Solar PV Fields

The solar power component of the proposed energy generation facility consists of photovoltaic (PV) panels, which grouped together form a 'solar field'. As mentioned above, each PV panel is a large structure that is typically up to 4m high (equivalent in height to a one-storey building). The height of these objects will make them visible, especially in the context of a relatively flat landscape.

More importantly, the concentration of these panels will make them highly visible, depending on the number of panels in each solar field. Solar fields with a large spatial extent (footprint) will become distinctly visible features that contrast with the landscape, especially where the landscape is natural in character or undeveloped. In this context the solar field could be considered to be a visual intrusion, potentially altering the visual environment towards a more industrial character.

The establishment of PV facilities generally requires the clearance of taller vegetation such as trees and shrubs. This will intensify the visual prominence of the solar energy facility, particularly in natural locations where little transformation has taken place (**Figure 27**).

Figure 27: Kathu Solar Power Plant (photo courtesy of "visits to the park"), near Kathu, Northern Cape Province.

4.1.2 Associated On-Site Infrastructure

The infrastructure typically associated with a solar PV energy facility will include the following:

- Internal access roads between 4m and 10m wide.
- Temporary construction laydown/staging areas.
- Operation and maintenance buildings, and
- Medium voltage, underground cabling (where feasible) connecting the PV plant to the grid connection infrastructure.

Surface clearance for cable trenches, access roads and laydown areas may result in the increased visual prominence of these features, thus increasing the level of contrast with the surrounding landscape. Buildings placed in prominent positions such as on ridge tops may break the natural skyline, drawing the attention of the viewer. In addition, security lighting on the site may impact on the nightscape (**Section 5.3**).

4.2 Grid Connection

Grid connection infrastructure for all three PV facilities will include:

- Collector and on-site substations to supply electricity to the Eskom grid;
- Overhead 132kV power lines to connect the substation to the Eskom grid;

Power line towers and substations are by their nature very large objects and thus highly visible. It is understood that the maximum tower height envisaged for the proposed power line is 25m (equivalent in height to an eight storey building). Although a pylon/tower structure would be less visible than a building, the height of the structure means that the pylon would still typically be visible from a considerable distance. Visibility would be increased by the fact that the power line comprises a series of towers typically spaced approximately 200m to 400m apart in a linear alignment.

As described above, power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration of the natural environment. Thus, elements of grid connection infrastructure could be perceived to be highly incongruous in the context of a largely natural landscape. The height and linear nature of the power line will exacerbate this incongruity, as the towers may impinge on views within the landscape. In addition, the practice of clearing taller vegetation from areas within the power line servitude can increase the visibility and incongruity of the power line. In a largely natural, bushy setting, vegetation clearance will cause fragmentation of the natural vegetation cover, thus making the power line more visible and drawing the viewer's attention to the servitude.

In this instance, the proposed grid connection infrastructure is intended to serve the three proposed solar PV projects and as such, will only be built if these projects go ahead. The power lines and substations are therefore likely to be perceived as part of the greater PV facility and the visual impact will be relatively minor when compared to the visual impact associated with the development as a whole.

5 SENSITIVE VISUAL RECEPTORS

A sensitive visual receptor location is defined as a location from where receptors would potentially be impacted by a proposed development. Adverse impacts often arise where a new development is seen as an intrusion which alters the visual character of the area and affects the 'sense of place'. The degree of visual impact experienced will however vary from one receptor to another, as it is largely based on the viewer's perception.

A distinction must be made between a receptor location and a sensitive receptor location. A receptor location is a site from where the proposed development may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Less sensitive receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. More sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include tourism facilities, scenic sites and residential dwellings in natural settings.

The identification of sensitive receptors is typically based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- the presence of leisure-based (especially nature-based) tourism in an area;
- the presence of sites or routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in a largely natural setting where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the EIA study.

As the visibility of the development would diminish exponentially over distance (refer to **section 2.4** above), receptor locations which are closer to the Solar PV facility or power line corridor would experience greater adverse visual impacts than those located further away. During the scoping phase of the project, zones of visual impact for each of the solar PV facilities and the grid connection infrastructure were delineated based on distance bands measured from the outer boundary of each application site and each power line corridor. These zones were refined during the EIA phase of the project to reflect distance bands measured from the proposed PV array areas and the amended power line corridors.

The degree of visual impact experienced will however vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

5.1 Receptor Identification

Preliminary desktop assessment of the study area during the scoping phase of the project identified 34 potentially sensitive visual receptor locations, most of which appear to be existing farmsteads or farm houses. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these locations, although sentiments toward the proposed development are unknown.

This assessment was refined according to the findings of the field visit conducted in February 2019 and eight (8) of the identified locations were removed from the list of potentially sensitive receptors. Some of these eight locations were found to be abandoned dwellings while others were identified as structures not considered to be visual receptors. As previously mentioned, due to access limitations during the time of the field investigation, it was not possible to fully investigate all of the identified potentially sensitive visual receptor locations from a visual perspective. Notwithstanding this limitation, these receptor locations were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA, via desktop means where required.

Three (3) of the identified receptor locations were confirmed to be sensitive receptors, as they are linked to leisure or nature-based activities within the study area. These three (3) receptors are all component facilities of Transkaroo Adventures, a nature based tourism undertaking providing secluded accommodation facilities, hiking trails and 4 x 4 routes in the scenic eastern sector of the assessment area.

In many cases, roads along which people travel, are regarded as sensitive receptors. The primary thoroughfare in the study area is the N10 national route which links Port Elizabeth on the Eastern Cape coast with Upington and the Namibian border to the west. In the local context, the N10 is the primary access route to Hanover and the N1 to the north-west and also to the N9 in the east which links Noupoort and Middelburg.

Thus although the section of the N10 traversing the study area does not form part of a designated tourism route, it is possible that the road is utilised, to some extent, for its tourism potential and as a result it is considered to be a potentially sensitive receptor road – i.e. a road being used by motorists who may object to the potential visual intrusion of the proposed solar PV facilities.

Other thoroughfares in the study area are primarily used as local access roads and do not form part of any scenic tourist routes. These roads are not specifically valued or utilised for their scenic or tourism potential and are therefore not regarded as visually sensitive.

5.2 Receptor Impact Rating

In order to assess the impact of the proposed facilities on the identified potentially sensitive receptor locations, a matrix that takes into account a number of factors has been developed and is applied to each receptor location. It should be noted that, given the spatial distribution of the three proposed solar PV facilities, not all of the receptors identified in the assessment area will be affected by all three facilities and as such, separate receptor impact ratings have been provided for each facility and its associated grid connection infrastructure.

The matrix is based on a number of factors as listed below:

- Distance of a receptor location away from the proposed development (zones of visual impact)
- Presence of screening elements (topography, vegetation etc.)

- Visual contrast of the development with the landscape pattern and form

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way of assigning a likely representative visual impact, which allows a number of factors to be considered. Experiencing visual impacts is however a complex and qualitative phenomenon, and is thus difficult to quantify accurately. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

As described above, distance of the viewer / receptor location from the development is an important factor in the context of experiencing visual impacts which will have a strong bearing on mitigating the potential visual impact. A high impact rating has been assigned to receptor locations that are located within 500m of the proposed solar PV facility and also within 500m of the nearest grid connection assessment corridor. Beyond 5km, the visual impact of a solar PV facility or power line diminishes considerably, as the development would appear to merge with the elements on the horizon. Hence any receptor location beyond this distance has been assigned an overriding nil impact rating. As such, despite the impact rating assigned to the other visual factors, the overall impact rating would remain negligible, as the proposed development is unlikely to visually influence any receptors located more than 5km from the development.

Based on the height and scale of the solar PV projects, and the likely height of the associated power line towers, the distance intervals chosen for the zones of visual impact are as follows:

- 0 - 500m (high impact zone)
- 500m – 2km (moderate impact zone)
- 2km - 5km (low impact zone)

The presence of screening elements is an equally important factor in this context. Screening elements can be vegetation, buildings and topographic features. For example, a grove of trees or a series of low hills located between a receptor location and an object could completely shield the object from the receptor. As such, where views of the proposed development are completely screened, the receptor has been assigned an overriding negligible impact rating, as the development would not impose any impact on the receptor.

The visual contrast of a development refers to the degree to which the development would be congruent with the surrounding environment. This is based on whether or not the development would conform to the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. The visual compatibility is an important factor to be considered when assessing the impact of the development on receptors within a specific context. A development that is incongruent with the surrounding area could have a significant visual impact on sensitive receptors as it may change the visual character of the landscape.

In order to determine the likely visual compatibility of the proposed development, the study area was classified into the following zones of visual contrast:

- **High –** undeveloped / natural / rural areas.
- **Moderate –**
  - areas within 500m of any existing power line; in undeveloped / natural / rural area;
  - areas within 150m of cultivated land / plantations / farm buildings.
- **Low –**
  - areas within 500m of N10 National Route;
  - areas within 250m of P2433 secondary road;
  - areas within 250m of small quarries / diggings.

These zones are depicted in **Figure 28** below.

The matrix returns a score which in turn determines the visual impact rating assigned to each receptor location (**Table 2**) below.

Table 2: Rating scores

Rating	Overall Score
High Visual Impact	8-9
Moderate Visual Impact	5-7
Low Visual Impact	3-4
Negligible Visual Impact	(overriding factor)

An explanation of the matrix is provided in **Table 3** below.

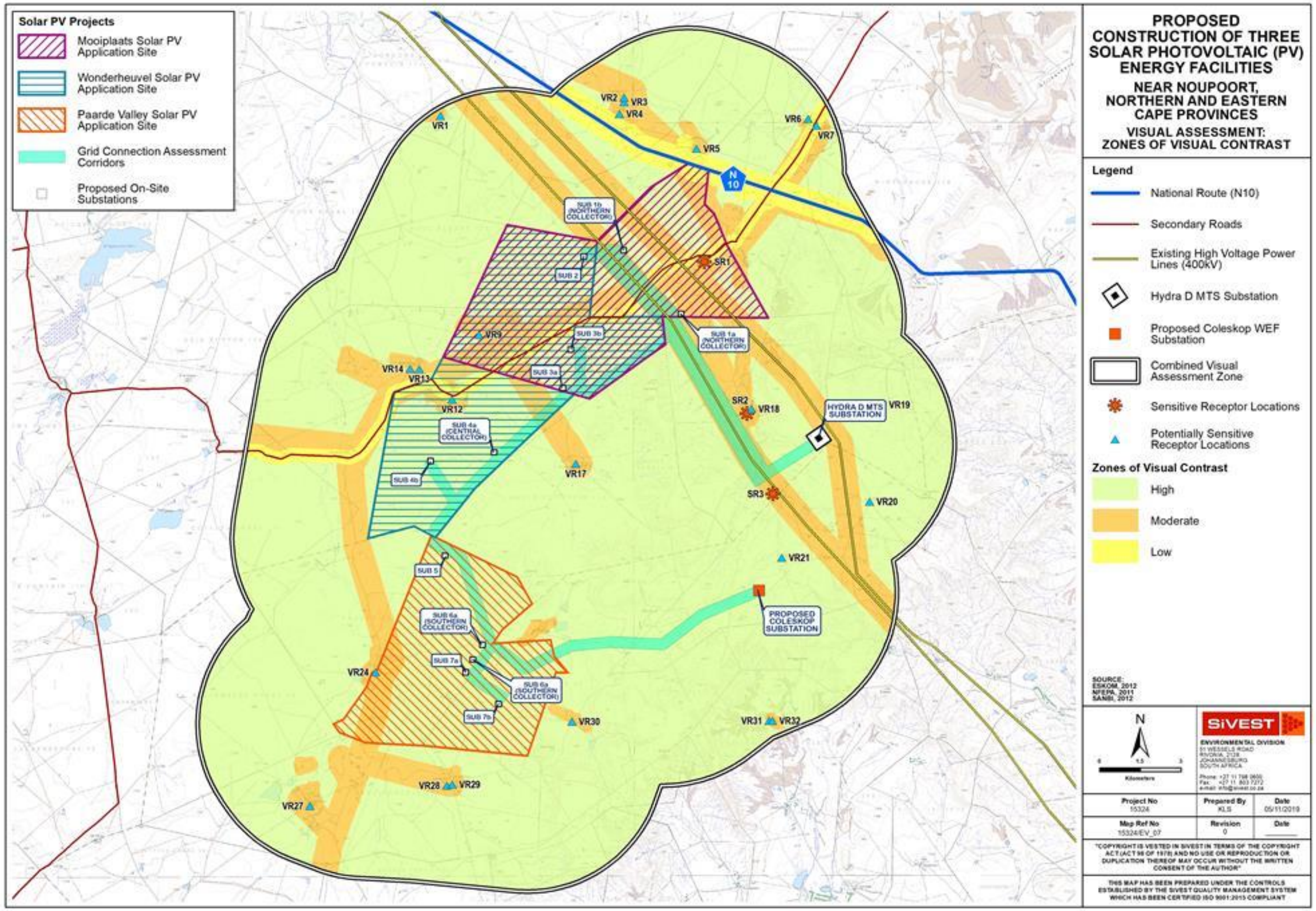

Figure 28: Zones of Visual Contrast

Table 3: Visual assessment matrix used to rate the impact of the proposed development on potentially sensitive receptors

	VISUAL IMPACT RATING			
VISUAL FACTOR	**HIGH**	**MODERATE**	**LOW**	**OVERRIDING FACTOR: NEGLIGIBLE**
Distance of receptor away from proposed development	<= 500m **Score 3**	500m < 2km **Score 2**	2km < 5km **Score 1**	>5km
Presence of screening factors	No / almost no screening factors – development highly visible **Score 3**	Screening factors partially obscure the development **Score 2**	Screening factors obscure most of the development **Score 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Visual Contrast	**High contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 3**	**Moderate contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 2**	**Corresponds** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 1**	

5.2.1 Mooi Plaats Solar PV Project

A total of fifteen (15) of the potentially sensitive receptors identified in the study area were found to be within 5kms of the Mooi Plaats PV application site. Only thirteen (13) of these are however located within 5kms of a PV array area. Two of the identified receptor locations, namely SR1 and SR2, are considered to be sensitive receptors as they are linked to leisure or nature-based activities within the study area. The remaining 13 receptors are existing farmsteads or farm houses which are regarded as potentially sensitive visual receptors. These receptor locations are indicated in **Figure 29**.

Fourteen (14) potentially sensitive receptors were also found to be within 5kms of the amended Mooi Plaats grid connection infrastructure. In this instance, three of the receptor locations, namely SR1, SR2 and SR3, are considered to be sensitive receptors as they are linked to leisure or nature-based activities while the remaining eleven (11) receptors are regarded as potentially sensitive visual receptors. These receptor locations are indicated in Figure 30.

Sections of the N10 receptor road are within 5kms of both the solar PV application site and the proposed grid connection infrastructure.

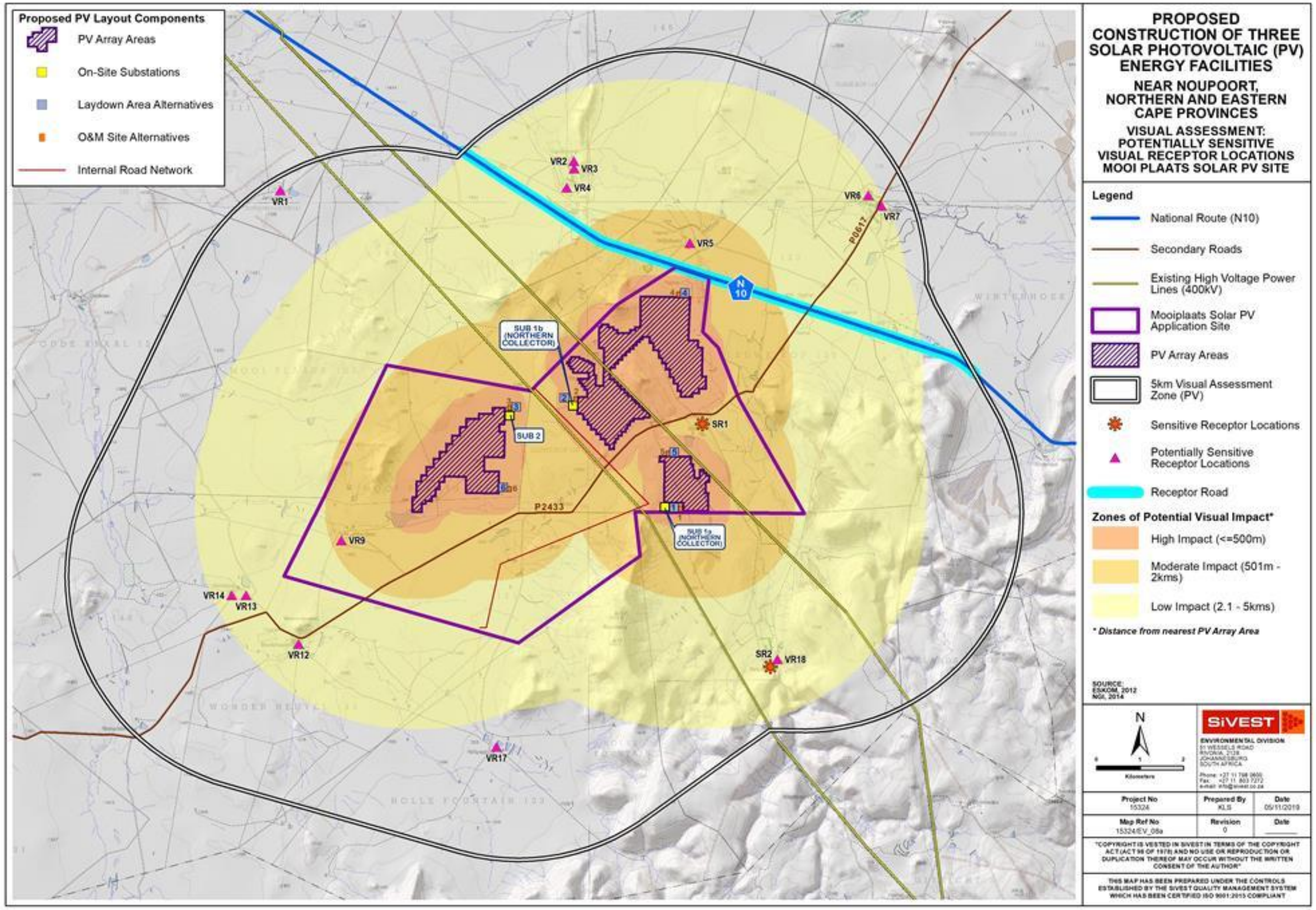

Figure 29: Potentially sensitive receptor locations within 5kms of the Mooi Plaats PV application site.

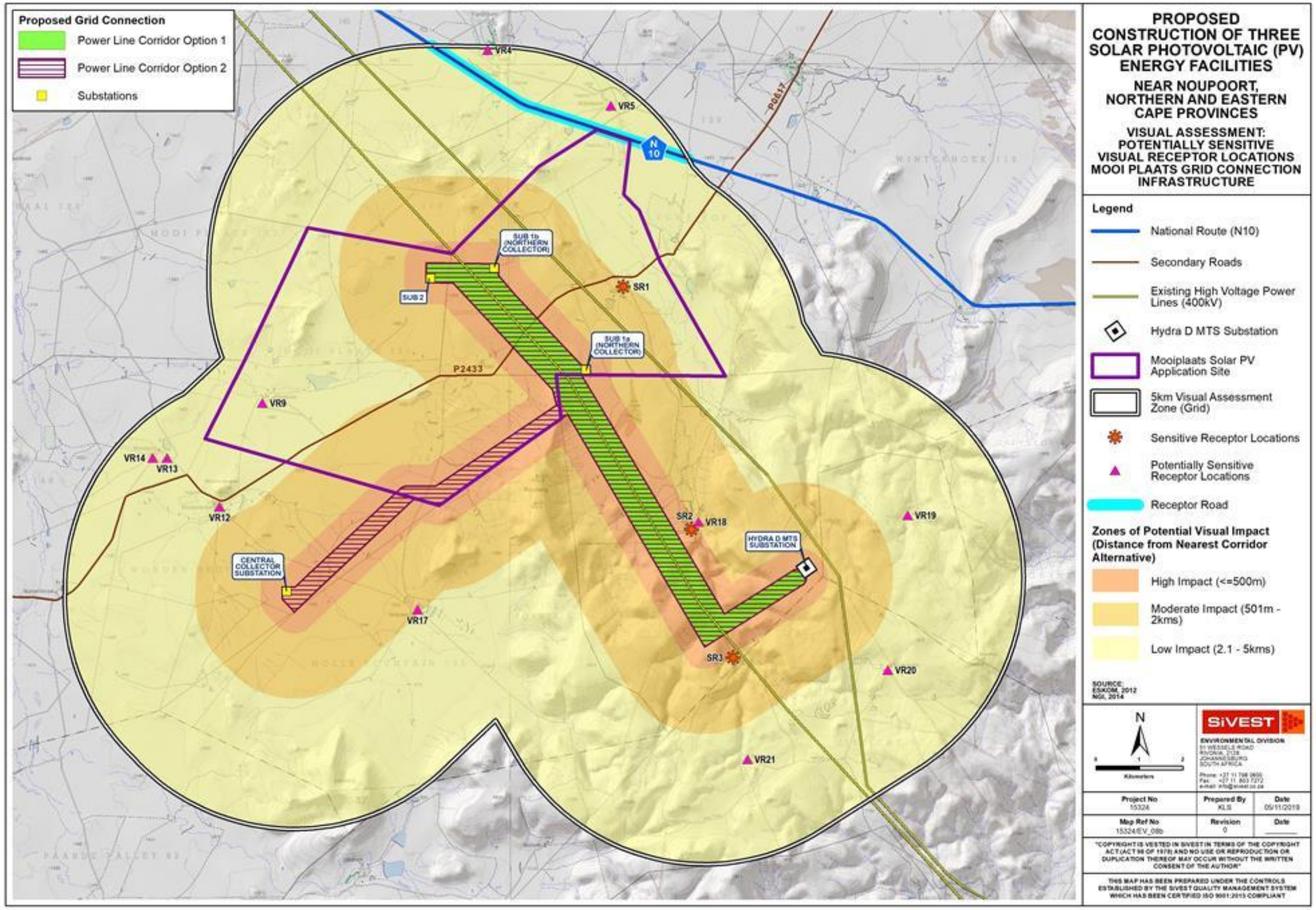

Figure 30: Potentially sensitive receptor locations within 5kms of the Mooi Plaats grid connection infrastructure.

Table 4 below presents a summary of the overall visual impact of the proposed Mooi Plaats solar PV facility and grid connection infrastructure on each of the potentially sensitive visual receptor locations which were identified within 5kms of the proposed development.

Table 4: Receptor impact rating for Mooi Plaats Solar PV Project

MOOI PLAATS SOLAR PV FACILITY					
Receptor Number	**Distance to nearest PV Array area**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
SR1 – Transkaroo Adventures*	Mod (2)	0.7km-	Mod (2)	Low (1)	**MODERATE (6)**
SR2 – Transkaroo Adventures	Low (1)	3.9km	Low (1)	Mod (2)	**LOW (4)**
VR 1 – Farmstead#	*Neg*	*6.8km*	*Negligable*		
VR 2 - Farmstead	Low (1)	3.5km	Mod (2)	Mod (2)	**MODERATE (5)**
RVR 3 - Farmstead	Low (1)	3.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 4 - Farmstead	Low (1)	3.0km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 5 - Farmstead	Mod (2)	1.2km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 6- Farmstead	Low (1)	4.7km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 7 - Farmstead	Low (1)	4.9km	Mod (2)	Low (1)	**LOW (4)**
VR 9 – Farmstead*	Mod(2)	1.7km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 12 - Farmstead	Low (1)	4.0km	Low (1)	Low (1)	**LOW (3)**
VR 13 - Farmstead	Low (1)	4.3km	Low (1)	Mod (2)	**MODERATE (4)**
VR 14 - Farmstead	Low (1)	4.6km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 17 – Farmstead#	*Neg*	*5.7km*	*Negligable*		
VR 18 - Farmstead	Low (1)	3.8km	Mod (2)	Mod (2)	**MODERATE (5)**
MOOI PLAATS GRID CONNECTION INFRASTRUCTURE					
Receptor Number	**Distance to nearest corridor alternative**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
SR1 – Transkaroo Adventures*	Mod (2)	1.9km	Mod (2)	Low (1)	**MODERATE (5)**
SR2 – Transkaroo Adventures	High (3)	0.4km	Low (1)	Mod (2)	**MODERATE (6)**
SR3 – Wilgerfontein Guest House	Mod (2)	0.6km	Low (1)	Mod (2)	**MODERATE (5)**
VR 4 - Farmstead	Low (1)	4.9km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 5 - Farmstead	Low (1)	4.5km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 9 – Farmstead*	Low (1)	3.6km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 12 - Farmstead	Low (1)	2.3km	Low (1)	Low (1)	**LOW (3)**
VR 13 - Farmstead	Low (1)	3.9km	Low (1)	Mod (2)	**LOW (4)**
VR 14 - Farmstead	Low (1)	4.2km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 17 - Farmstead	Mod (2)	1.9km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 18 - Farmstead	Mod (2)	0.5km	Mod (2)	Mod (2)	**MODERATE (6)**

VR 19 - Farmstead	Low (1)	2.7km	Mod (2)	High (3)	**MODERATE (6)**
VR 20 - Farmstead	Low (1)	2.8km	Mod (2)	High (3)	**MODERATE (6)**
VR 21 - Farmstead	Low (1)	2.8km	Mod (2)	High (3)	**MODERATE (6)**

**Farmstead / homestead is located within the proposed Mooi Plaats solar PV application site. It is assumed that the occupants would have a vested interest in the development and would therefore not perceive the proposed development in a negative light.*
[#] Receptor is more than 5kms from the nearest PV Array area and as such the overall impact rating is "negligible"

The table above shows that none of the potentially sensitive receptors would experience high levels of visual impact as a result of either the proposed Mooi Plaats solar PV development or the grid connection infrastructure. This is largely indicative of the presence of screening vegetation around many of the existing farmsteads in the area as well as the presence of existing power lines and other infrastructure which reduces the level of contrast.

Ten (10) receptor locations would be subjected to moderate levels of visual impact as a result of the proposed Mooi Plaats solar PV development and three (3) receptor locations will be subjected to low levels of visual impact. Two (2) of the receptors identified in the scoping phase are located more than 5kms from the nearest PV array area, and as such these receptors have been assigned a "Negligable" rating and effectively removed from any further assessment.

Twelve (12) receptor locations would experience moderate levels of visual impact from the grid connection infrastructure, while the remaining two (2) receptor locations will be subjected to low levels of visual impact.

As stated above, the N10 national route could be considered as a potentially sensitive receptor road and any development in the northern-most section of the Mooi Plaats application site is likely to be visible to motorists travelling along this route **(Figure 31)**. The degree of visibility is restricted to some extent by the topography and the likely visual impacts of the solar PV development would depend on the position of the different elements on the site. Elements of the grid connection infrastructure are between 3kms and 11kms from the N10 and will not result in any significant visual impacts on motorists travelling along this route **(Figure 32)**.

In light of this and the fact that this section of the N10 is does not form part of a recognised tourism route, visual impacts affecting the N10 are rated as moderate.

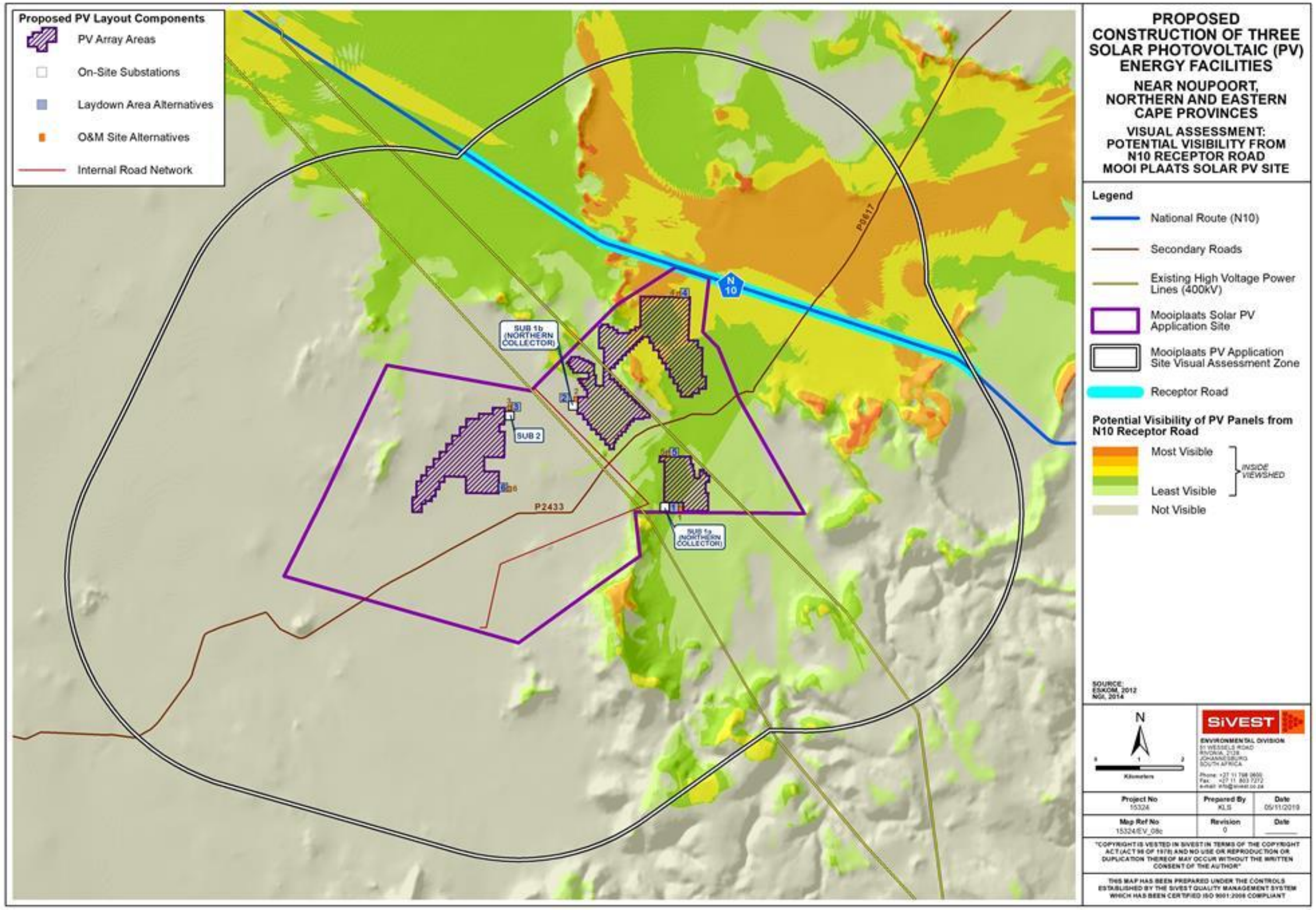

Figure 31: Potential visibility of PV Panels from N10 (Mooi Plaats project).

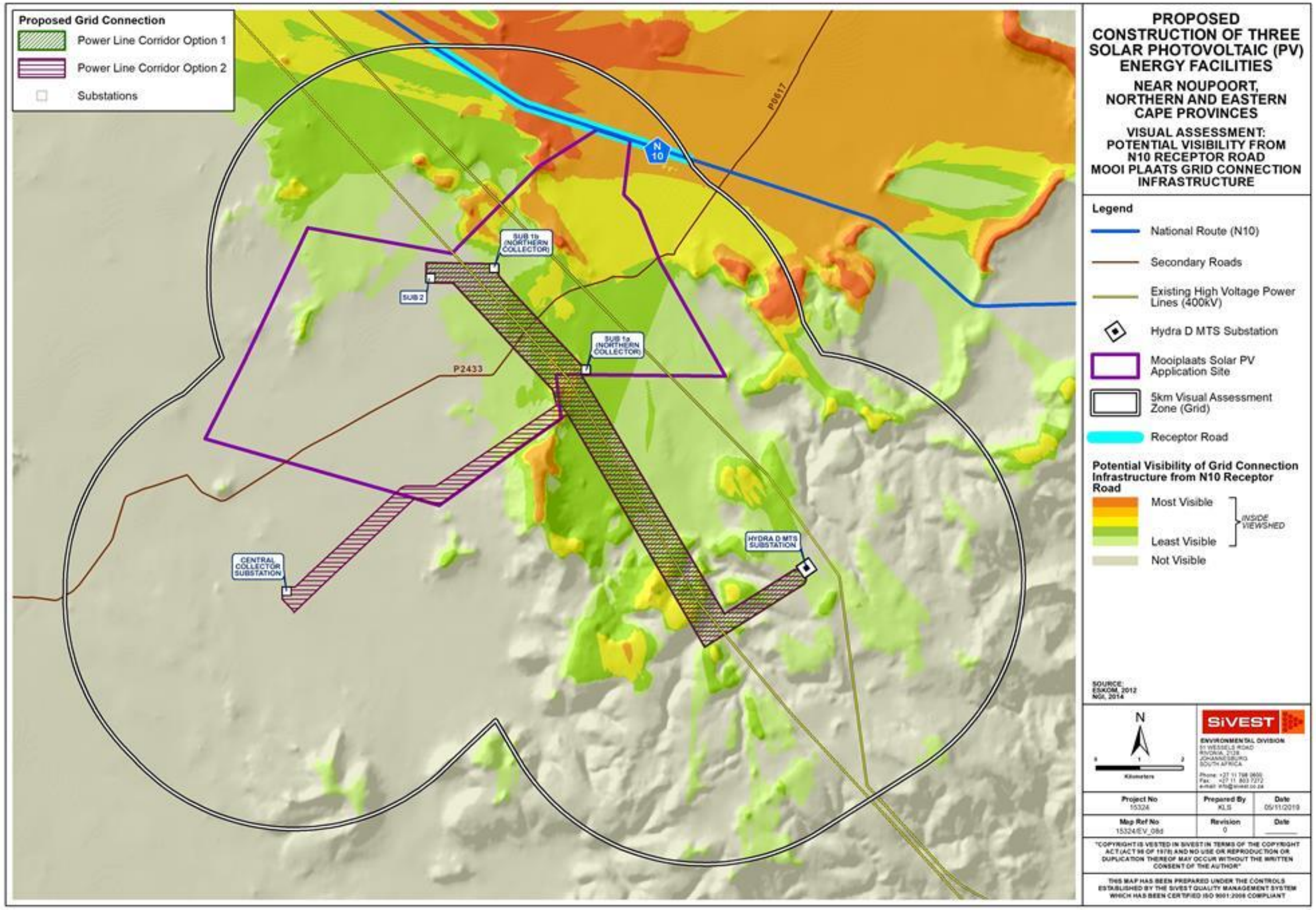

Figure 32: Potential visibility of Grid Connection Infrastructure from N10 (Mooi Plaats project).

5.2.2 Wonderheuvel Solar PV Project

A total of twelve (12) of the potentially sensitive receptors identified in the study area were found to be within 5kms of the Wondeheuvel PV application site. Only five (5) of these are however located within 5km of a PV array area. Two of the identified receptor locations, namely SR1 and SR2, are considered to be sensitive receptors as they are linked to leisure or nature-based activities within the study area. As these sensitive receptors are both more within 5km from the nearest PV Array area however, they are unlikely to experience any visual impacts as a result of the proposed development. The five (5) remaining receptors within 5km of a PV Array area are existing farmsteads or farm houses which are regarded as potentially sensitive visual receptors. These receptor locations are indicated in **Figure 33**.

Twenty (20) potentially sensitive receptors were also found to be within 5kms of the amended Wonderheuvel grid connection infrastructure. Three (3) of these receptor locations, namely SR1, SR2 and SR3, are considered to be sensitive receptors as they are linked to leisure or nature-based activities while the remaining seventeen (17) receptors are regarded as potentially sensitive visual receptors. These receptor locations are indicated in **Figure 34**.

Sections of the N10 receptor road are within 5kms of both the solar PV application site and the proposed grid connection infrastructure.

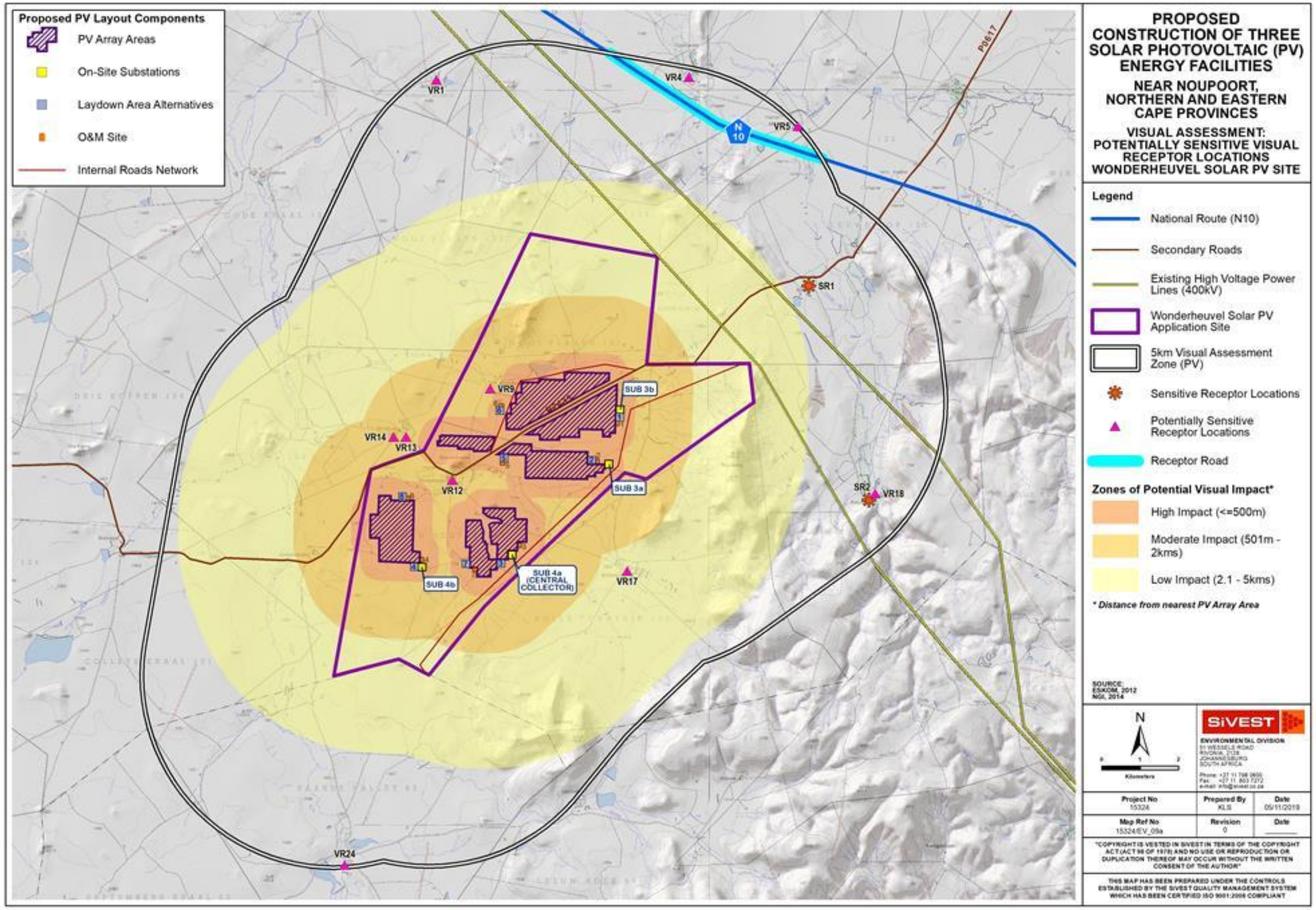

Figure 33: Potentially sensitive receptor locations within 5kms of the Wonderheuvel PV application site.

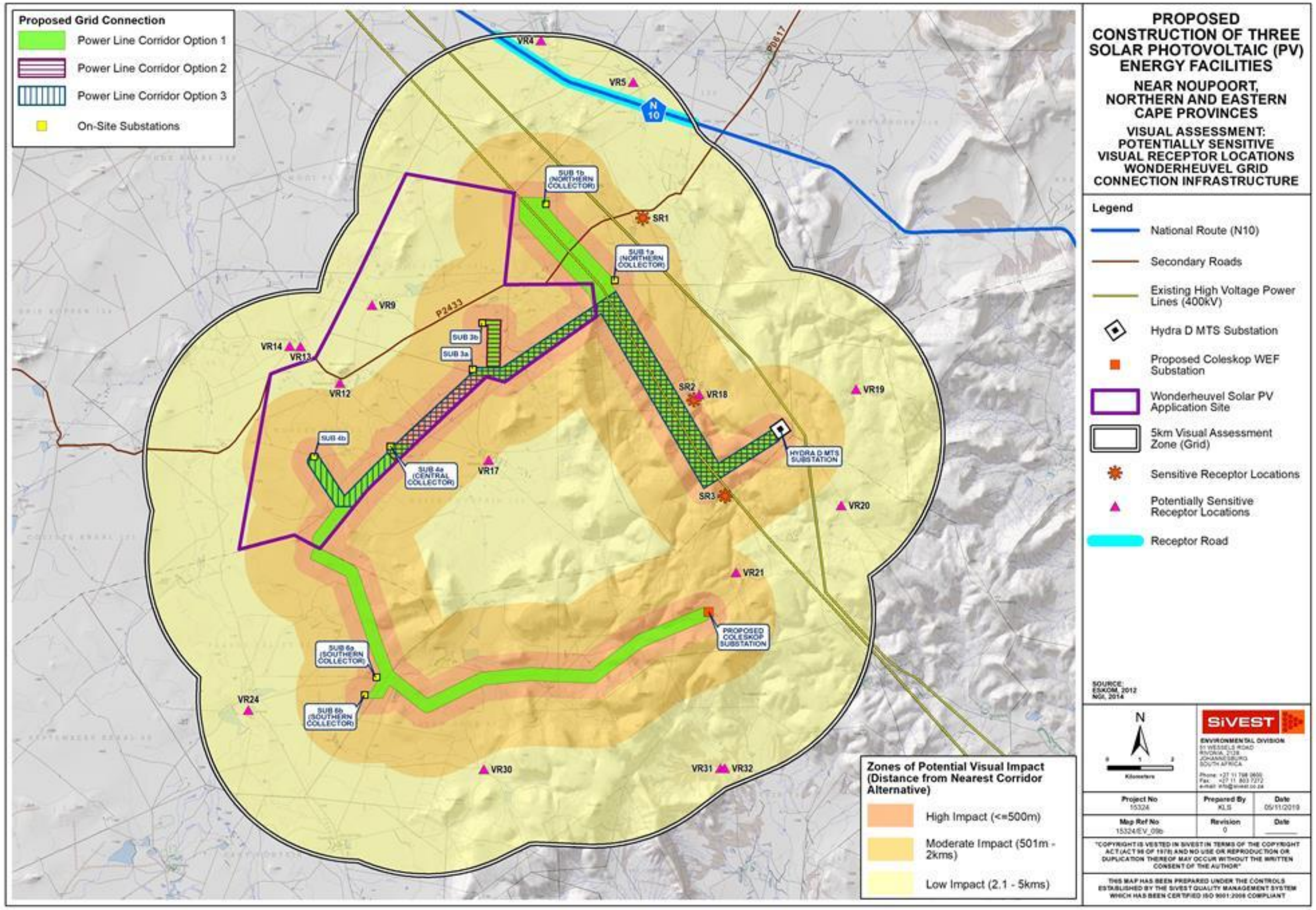

Figure 34: Potentially sensitive receptor locations within 5kms of the Wonderheuvel grid connection infrastructure.

Table 5 below presents a summary of the overall visual impact of the proposed Wonderheuvel solar PV facility and grid connection infrastructure on each of the potentially sensitive visual receptor locations which were identified within 5kms of the proposed development.

Table 5: Receptor impact rating for Wonderheuvel Solar PV Project

WONDERHEUVEL SOLAR PV FACILITY					
Receptor Number	**Distance to application site boundary**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
SR1 – Transkaroo Adventures	*Neg*	*5.6KM*	*Negligable*		
SR2 – Transkaroo Adventures	*Neg*	*6.9km*	*Negligable*		
VR 1 - Farmstead	*Neg*	*8.1km*	*Negligable*		
VR 4 - Farmstead	*Neg*	*7.9km*	*Negligable*		
VR 5 - Farmstead	*Neg*	*8.1km*	*Negligable*		
VR 9 – Farmstead*	Mod (2)	0.7km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 12 – Farmstead*	Mod (2)	0.8	Low (1)	Low (1)	**LOW (4)**
VR 13 - Farmstead	Mod (2)	0.8km	Low (1)	Mod (2)	**MODERATE (5)**
VR 14 - Farmstead	Mod (2)	1.1km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 17 - Farmstead	Low (1)	2.6km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 18 - Farmstead	*Neg*	*6.9km*	*Negligable*		
VR 24 - Farmstead	*Neg*	*7.9km*	*Negligable*		
WONDERHEUVEL GRID CONNECTION INFRASTRUCTURE					
Receptor Number	**Distance to nearest corridor alternative**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
SR1 – Transkaroo Adventures	Mod (2)	1.9km	Mod (2)	Low (1)	**MODERATE(5)**
SR2 – Transkaroo Adventures	High (3)	0.3km	Low (1)	Mod (2)	**MODERATE (6)**
SR3 – Wilgerfontein Guest House	Mod (2)	0.5km	Low (1)	Mod (2)	**MODERATE (5)**
VR 4 - Farmstead	Low (1)	4.8km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 5 - Farmstead	Low (1)	4.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 9 – Farmstead*	Low (1)	3.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 12 – Farmstead*	Low (1)	2.2km	Low (1)	Low (1)	**LOW (3)**
VR 13 - Farmstead	Low (1)	3.3km	Low (1)	Mod (2)	**LOW (4)**
VR 14 - Farmstead	Low (1)	3.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 17 - Farmstead	Mod (2)	1.9km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 18 - Farmstead	Mod (2)	0.6km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 19 - Farmstead	Low (1)	2.7km	Mod (2)	High (3)	**MODERATE (6)**

VR 20 - Farmstead	Low (1)	2.8km	Mod (2)	High (3)	**MODERATE (6)**
VR 21 - Farmstead	Mod (2)	1.4km	Mod (2)	High (3)	**MODERATE (7)**
VR 24 - Farmstead	Low (1)	3.4km	Low (1)	Mod (2)	**LOW (4)**
VR 28 - Farmstead	Low (1)	4.6km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 29 - Farmstead	Low (1)	4.5km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 30 - Farmstead	Low (1)	2.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 31 - Farmstead	Low (1)	4.4km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 32 - Farmstead	Low (1)	4.4km	Mod (2)	Mod (2)	**MODERATE (5)**

**Farmstead / homestead is located within the proposed Wonderheuvel solar PV application site. It is assumed that the occupants would have a vested interest in the development and would therefore not perceive the proposed development in a negative light.*

As shown in the table above, none of the potentially sensitive receptors would experience high levels of visual impact as a result of either the proposed Wonderheuvel solar PV development or the grid connection infrastructure. This is largely indicative of the presence of screening vegetation around many of the existing farmsteads in the area as well as the presence of existing power lines and other infrastructure which reduces the level of contrast.

Four (4) receptor locations would be subjected to moderate levels of visual impact as a result of the proposed Wonderheuvel solar PV development, while the remaining receptor location will be subjected to low levels of visual impact.

Seventeen (17) receptor locations would experience moderate levels of visual impact from the grid connection infrastructure, while the remaining three (3) receptor locations will be subjected to low levels of visual impact.

Although a section of the N10 receptor road is within 5kms of the Wonderheuvel PV application site, views of the site will be largely obstructed by the terrain (**Figure 35**). In addition, the N10 is more than 7kms from the nearest PV Array area and any visual impacts would be negligible at this distance. Elements of the grid connection infrastructure closest to the N10 are approximately 3.5km away and will not result in any significant visual impacts on motorists travelling along this route (**Figure 36**).

In light of this and the fact that this section of the N10 is does not form part of a recognised tourism route, visual impacts arising from the Wonderveuvel solar PV project affecting the N10 are rated as low to moderate.

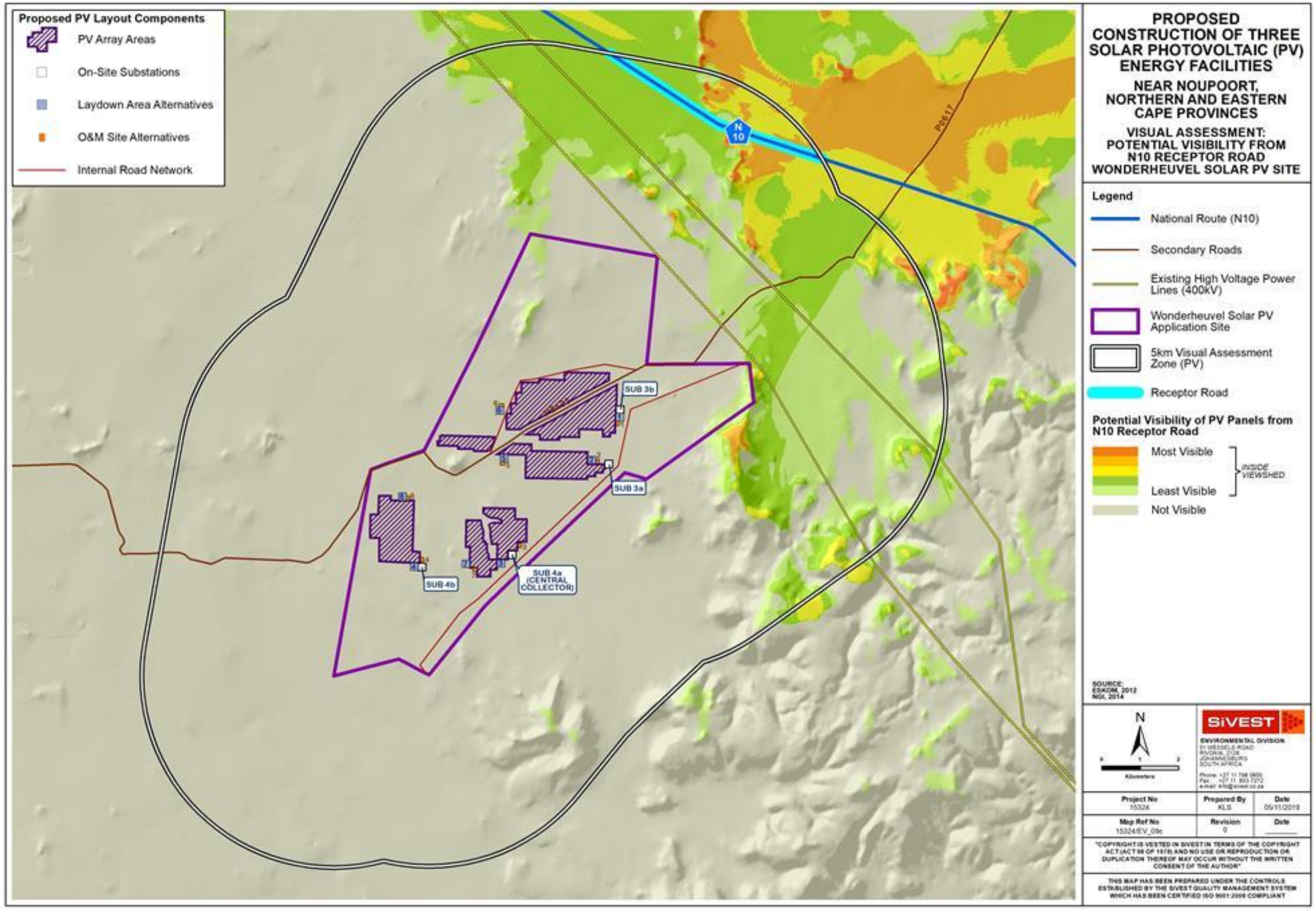

Figure 35: Potential visibility of PV Panels from N10 (Wonderheuvel project).

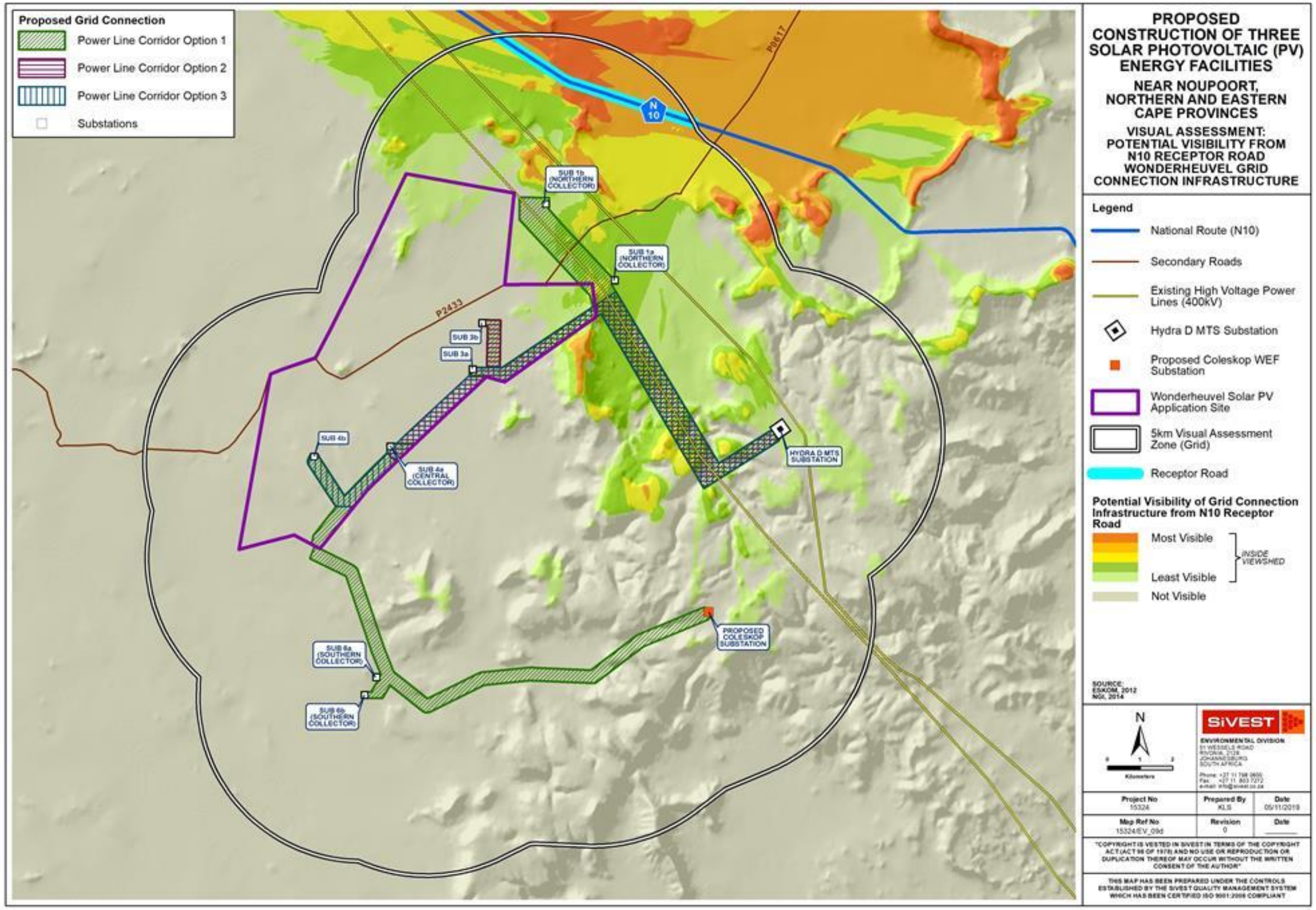

Figure 36: Potential visibility of Grid Connection Infrastructure from N10 (Wonderheuvel project).

5.2.3 Paarde Valley Solar PV Project

A total of six (6) of the potentially sensitive receptors identified in the study area were found to be within 5kms of the Paarde Valley PV application site. Only five (5) of these are however located within 5kms of a PV array area. None of these receptor locations are considered to be sensitive receptors, although all six (6) receptors are existing farmsteads or farm houses which are regarded as potentially sensitive visual receptors. These receptor locations are indicated in **Figure 37**.

Eighteen (18) potentially sensitive receptors were also found to be within 5kms of the proposed Paarde Valley grid connection infrastructure. Three (3) sensitive receptor locations are located in this area, namely SR1, SR2 and SR3, while the remaining fifteen (15) receptors, which are existing farm houses, are regarded as potentially sensitive visual receptors. These receptor locations are indicated in **Figure 38**.

No part of the N10 receptor road is within 5kms of the solar PV application site and as such motorists travelling along this route will not be affected by the proposed Paarde Valley solar PV facility. Elements of the grid connection infrastructure may however be visible to passing motorists, although the N10 is at least 3.5km from the grid assessment corridor and as such will not give rise to any significant visual impacts on motorists travelling along this route.

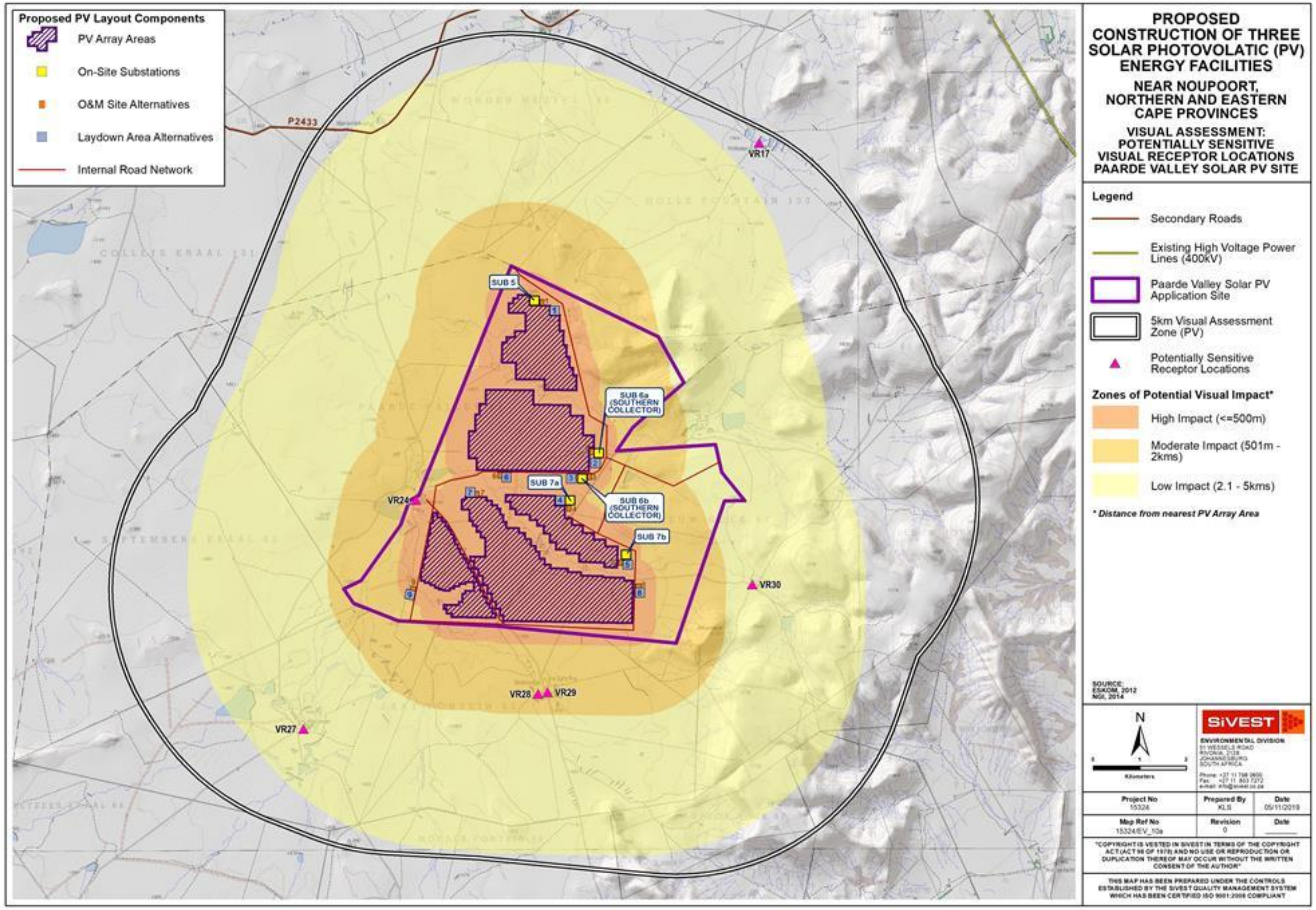

Figure 37: Potentially sensitive receptor locations within 5kms of the Paarde Valley PV application site.

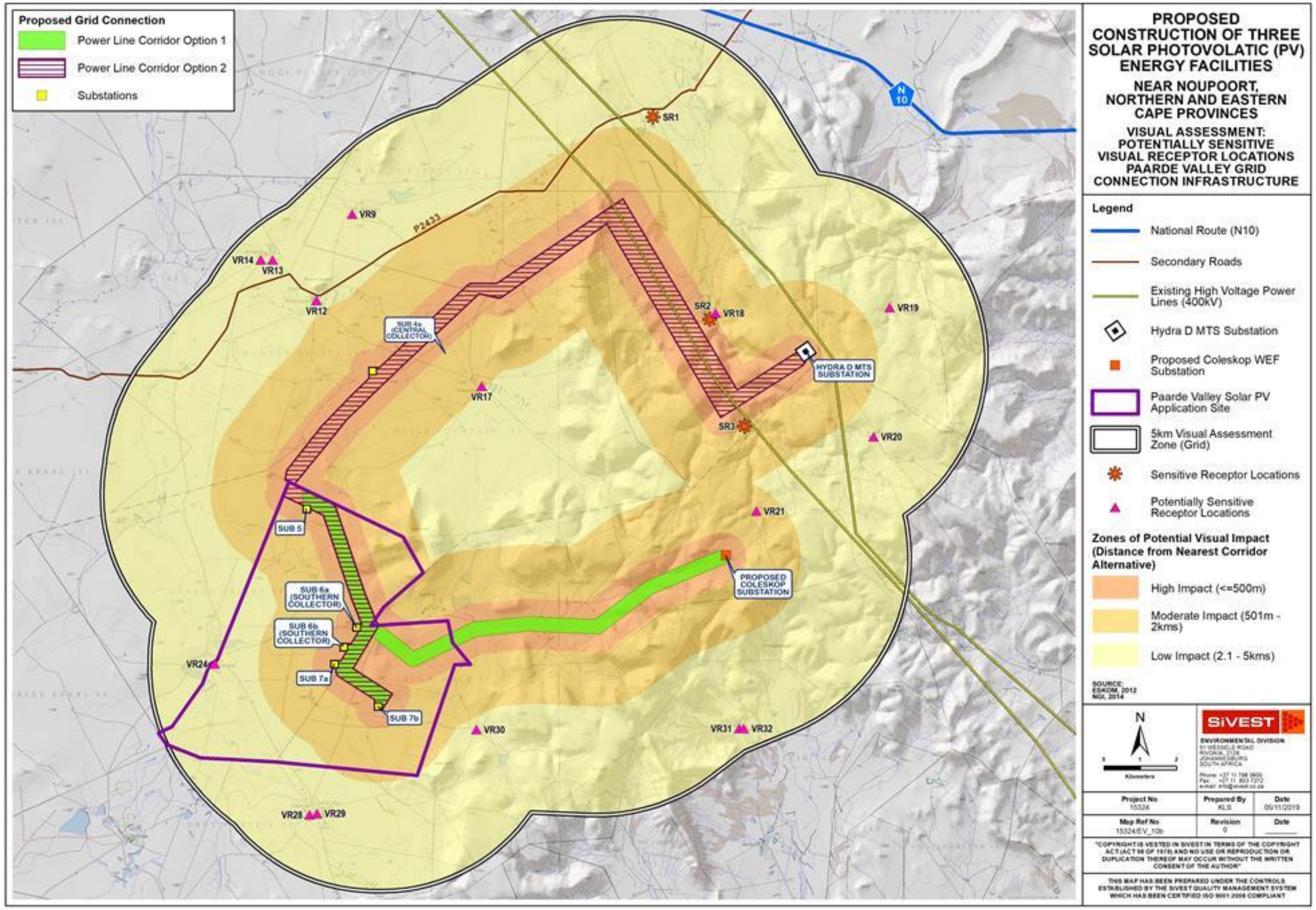

Figure 38: Potentially sensitive receptor locations within 5kms of the Paarde Valley grid connection infrastructure.

Table 6 below presents a summary of the overall visual impact of the proposed Paarde Valley solar PV facility and grid connection infrastructure on each of the potentially sensitive visual receptor locations which were identified within 5kms of the proposed development.

Table 6: Receptor impact rating for Paarde Valley Solar PV Project

PAARDE VALLEY SOLAR PV FACILITY					
Receptor Number	**Distance to application site boundary**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
VR 17 - Farmstead	*Neg*	*5.6km*	*Negligible*		
VR 24 – Farmstead*	High (3)	0.4km-	Low (1)	Mod (2)	**MODERATE (6)**
VR 27 – Farmstead	Low (1)	3.9km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 28 – Farmstead	Mod (2)	1.6km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 29 – Farmstead	Mod (2)	1.5km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 30 – Farmstead	Low (1)	2.6km	Mod (2)	Mod (2)	**MODERATE (5)**
PAARDE VALLEY GRID CONNECTION INFRASTRUCTURE					
Receptor Number	**Distance to nearest corridor alternative**		**Screening**	**Contrast**	**OVERALL IMPACT RATING**
SR1 – Transkaroo Adventures	Low (1)	2.4km	Mod (2)	Low (1)	**LOW (4)**
SR2 – Transkaroo Adventures	High (3)	0.3km	Low (1)	Mod (2)	**MODERATE (6)**
SR3 – Wilgerfontein Guest House	Mod (2)	0.6km	Low (1)	Mod (2)	**MODERATE (5)**
VR 9 – Farmstead	Low (1)	3.6km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 12 - Farmstead	Low (1)	2.3km	Low (1)	Low (1)	**LOW (3)**
VR 13 - Farmstead	Low (1)	3.9km	Low (1)	Mod (2)	**LOW (4)**
VR 14 - Farmstead	Low (1)	4.2km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 17 - Farmstead	Mod (2)	1.9km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 18 - Farmstead	Mod (2)	0.6km	Mod (2)	Mod (2)	**MODERATE (6)**
VR 19 - Farmstead	Low (1)	2.7km	Mod (2)	High (3)	**MODERATE (6)**
VR 20 - Farmstead	Low (1)	2.7km	Mod (2)	High (3)	**MODERATE (6)**
VR 21 - Farmstead	Mod (2)	1.4km	Mod (2)	High (3)	**MODERATE (7)**
VR 24 – Farmstead*	Mod (2)	3.2km	Low (1)	Mod (2)	**MODERATE (5)**
VR 28 - Farmstead	Low (1)	3.4km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 29 - Farmstead	Low (1)	3.2km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 30 - Farmstead	Low (1)	2.3km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 31 - Farmstead	Low (1)	4.4km	Mod (2)	Mod (2)	**MODERATE (5)**
VR 32 - Farmstead	Low (1)	4.4km	Mod (2)	Mod (2)	**MODERATE (5)**

**Farmstead / homestead is located within the proposed Paarde Valley solar PV application site. It is assumed that the occupants would have a vested interest in the development and would therefore not perceive the proposed development in a negative light.*

As shown in the table above, none of the potentially sensitive receptors would experience high levels of visual impact as a result of either the proposed Paarde Valley solar PV development or the grid connection infrastructure. This is largely indicative of the presence of screening vegetation around many of the existing farmsteads in the area as well as the presence of existing power lines and other infrastructure which reduces the level of contrast.

All receptor locations within 5km of the proposed Paarde Valley solar PV development would be subjected to moderate levels of visual impact. Fifteen (15) receptor locations would experience moderate levels of visual impact from the grid connection infrastructure, while the remaining three (3) receptor locations will be subjected to low levels of visual impact.

The N10 receptor road is more than 5kms from the solar PV application site and as such motorists travelling along this route will not be affected by the proposed Paarde Valley solar PV facility. In addition. Although elements of the grid connection infrastructure may be visible to passing motorists, the N10 is at least 3.5km from the grid assessment corridor, the grid infrastructure will not give rise to any significant visual impacts on motorists travelling along this route.

5.3 Night-time Impacts

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely to have a significant impact on the nightscape. In contrast, introducing new light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed SPEF at night.

Much of the study area is characterised by natural areas with pastoral elements and low densities of human settlement. As a result, relatively few light sources are present in the broader area surrounding the proposed development site. The closest built-up areas are the towns of Noupoort and Middelburg which are both situated more than 30kms from the application sites and are thus too far away to have significant impacts on the night scene. At night, the general study area is characterised by a picturesque dark starry sky and the visual character of the night environment across the broader area is largely ‘unpolluted’ and pristine. Sources of light in the area are largely limited to isolated lighting from surrounding farmsteads and transient light from the passing cars travelling along the N10 national route.

Given the scale of the proposed solar PV facilities, the operational and security lighting required for each of the proposed projects is likely to intrude on the nightscape and create glare, which will contrast with the dark backdrop of the surrounding area.

Power lines and associated towers or pylons are not generally lit up at night and, thus light spill associated with the proposed grid connection infrastructure is only likely to emanate from the proposed on-site substations. Lighting from these facilities is therefore expected to intrude on the nightscape to some degree. It should however be noted that the grid connection infrastructure will only be constructed if the proposed solar PV facilities are developed and thus the lighting impacts from the proposed substations would be subsumed by the glare and contrast of the lights associated with the PV facilities. As such, the grid connection infrastructure is not expected to result in significant lighting impacts.

5.4 Cumulative Impacts

Although it is important to assess the visual impacts of the proposed solar PV facilites and grid connection infrastructure specifically, it is equally important to assess the cumulative visual impact that could materialise if other renewable energy facilities (both wind and solar facilities) and associated infrastructure projects are developed in the broader area. Cumulative impacts occur where existing or planned developments, in conjunction with the proposed development, result in significant incremental changes in the broader study area. In this instance, such developments would include renewable energy facilities and associated infrastructure development.

Renewable energy facilities have the potential to cause large scale visual impacts and the location of several such developments in close proximity to each other could significantly alter the sense of place and visual character in the broader region. Although power lines and substations are relatively small developments when compared to renewable energy facilities, they may still introduce a more industrial character into the landscape, thus altering the sense of place.

Seventeen renewable energy projects were identified within a 35 km radius of the proposed solar PV facilities and grid connection infrastructure (**Figure 39**). These projects, as listed in **Table 7** below, were identified using the DEA's Renewable Energy EIA Application Database for SA in conjunction with information provided by Independent Power Producers operating in the broader region. It is assumed that all of these renewable energy developments include grid connection infrastructure, although few details of this infrastructure were available at the time of writing this report.

The relatively large number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts could significantly alter the sense of place and visual character in the broader region, as well as exacerbate the visual impacts on surrounding visual receptors, once constructed.

Table 7: Renewable energy developments proposed within a 35km radius of the Mooi Plaats, Wonderheuvel and Paarde Valley solar PV application sites.

Project	DEA Reference No	Technology	Capacity	Status of Application / Development
Allemans Fontein SEF	14/12/16/3/3/1/730	Solar	20MW	Approved
Carolus Poort SEF	14/12/16/3/3/1/729	Solar	20MW	Approved
Damfontein SEF	14/12/16/3/3/1/728	Solar	20MW	Approved
Gillmer SEF	14/12/16/3/3/1/735	Solar	20MW	Approved
Inkululeko SEF	14/12/16/3/3/1/553	Solar	20MW	Approved
Kleinfontein SEF	12/12/20/2654	Solar	20MW	Approved
Klip Gat SEF	14/12/16/3/3/2/354	Solar	75M	Approved
Linde SEF	12/12/20/2258	Solar	40MW	In Operation
Linde SEF (Expansion)	14/12/16/3/3/1/1122	Solar	75MW	Approved
Middelburg Solar Park 1	12/12/20/2465/2	Solar	75MW	Approved
Middelburg Solar Park 2	12/12/20/2465/1	Solar	75MW	Approved
Naauw Poort SEF	14/12/16/3/3/2/355	Solar	75MW	Approved
Toitdale SEF	12/12/20/2653	Solar	20MW	Approved
Noupoort Wind Farm	12/12/20/2319	Wind	188MW	In Operation
Phezukomoya WEF	14/12/16/3/3/1/1028	Wind	315MW	EIA in Process
San Kraal WEF	14/12/16/3/3/1/1069	Wind	390MW	EIA in Process
Umsobomvu WEF	14/12/16/3/3/2/730	Wind	140MW	Approved

As can be seen from this table, thirteen (13) of these projects are Solar Photovoltaic Energy facilities (SPEFs), most of which are located more than 10kms from the application sites, clustered on the western edge of Noupoort and also to the north of Main Road 389 and along an existing rail route . Given the distance from the study area and the concentration of these facilities in close proximity to existing built infrastructure, it is not anticipated that these developments will result in any significant cumulative impacts affecting the landscape or the visual receptors within the combined assessment zone for the three solar PV projects. It should be noted that although all of these SPEF applications were approved at least five years ago, to date only one has been constructed.

The remaining four (4) projects are wind energy facilities (WEFs), all of which are located on the hillier terrain to the east of the solar PV application site. Although WEFs are expected to have different impacts when compared to solar PV projects, these renewable energy developments are however relevant as they influence the cumulative visual impact of the proposed development.

The proposed San Kraal WEF is located well outside the combined visual assessment zone, just east of the N9 national route, while only a small portion of the Phezukomoya WEF, which is located immediately west of the N9, is located within 5kms of the proposed solar PV facilities. As such, these WEFs are not expected to give rise to any significant cumulative impacts on the landscape or visual receptors within the study area.

The remaining WEF, namely Umsobomvu WEF is however almost entirely within 5kms of the proposed solar PV facilities, and is in fact adjacent to sections of each of the application sites. It is understood that most of the proposed turbines on the WEF development site will be located on high-lying plateaus and ridges and as such they will be visible to many of the visual receptors in the combined assessment area.

This proposed WEF, in conjunction with the three proposed solar PV facilities and associated grid connection infrastructure, will inevitably introduce an increasingly industrial character into a largely natural, pastoral landscape, thus giving rise to significant cumulative impacts.

It should be noted however that PV panels, at an approximate height of 4m, are considerably less visible than wind turbines and as such the proposed solar PV facilities would be outside the viewshed of many of the potentially sensitive receptor locations identified in the study area. Cumulative impacts affecting these receptors would therefore be reduced and the severity of these impacts would depend on the perceptions of the receptors.

A cursory examination of the literature available for the environmental assessments undertaken for many of these renewable energy applications showed that the visual impacts identified and the recommendations and mitigation measures provided are largely consistent with those identified in this report. Where additional mitigation measures were provided in respect of the other renewable energy applications, these have been incorporated into this report where relevant.

From a visual perspective, the further concentration of renewable energy facilities as proposed will inevitably change the visual character of the area and alter the inherent sense of place, introducing an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommendations and mitigation measures put forward by the visual specialists in their respective reports.

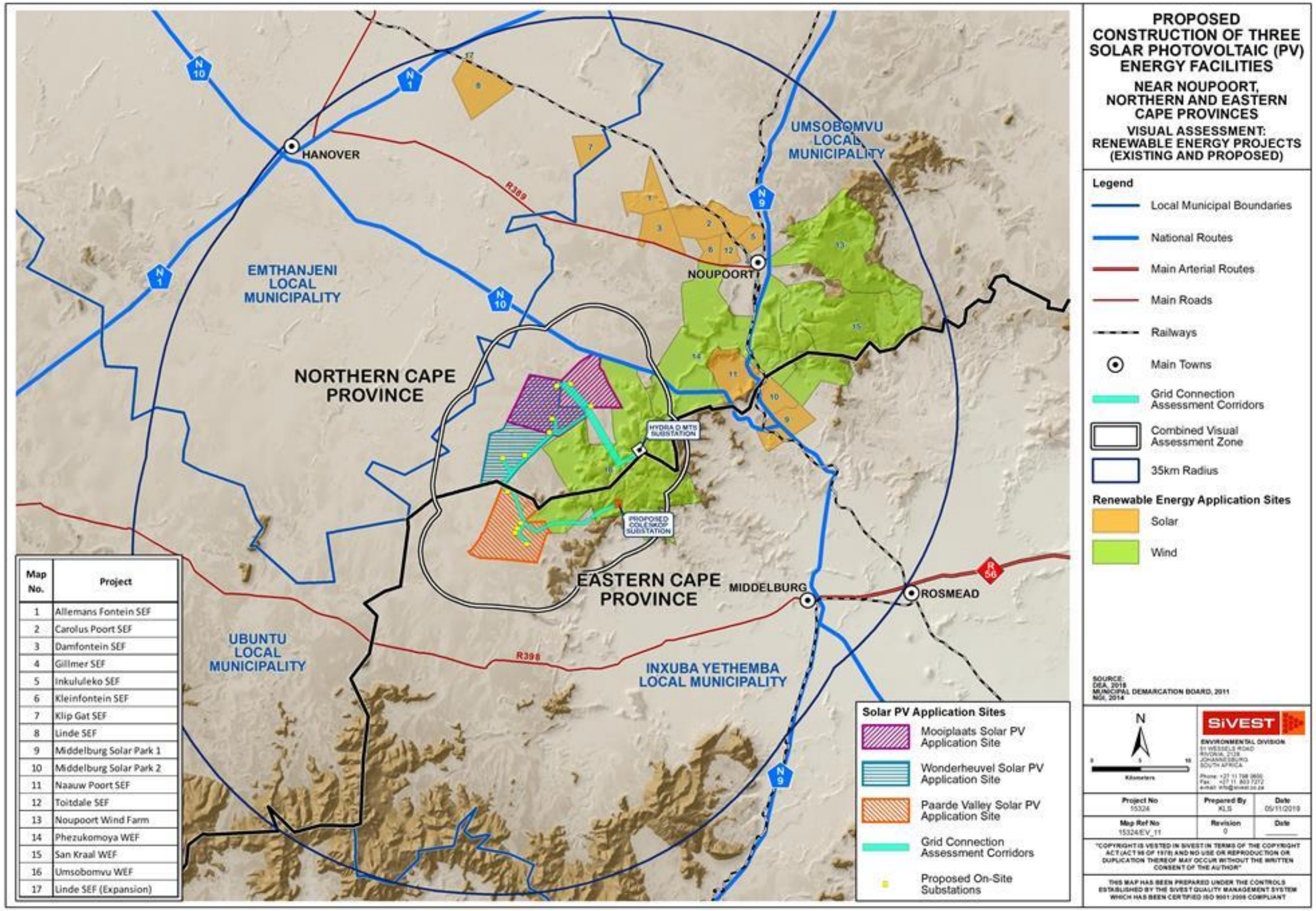

Figure 39: Renewable energy facilities proposed within a 35km radius of the Mooi Plaats, Wonderheuvel and Paarde Valley solar PV application sites.

5.5 Overall Visual Impact Rating

The EIA Regulations, 2014 (as amended) require that an overall rating for visual impact be provided to allow the visual impact to be assessed alongside other environmental parameters. The tables below present the impact matrix for visual impacts associated with the proposed construction and operation of the Mooi Plaats, Wonderheuvel and Paarde Kraal solar PV facilities the associated grid connection infrastructure. Preliminary mitigation measures have determined based on best practice and literature reviews.

Please refer to **Appendix A** for an explanation of the impact rating methodology.

5.5.1 Mooi Plaats solar PV Project

MOOI PLAATS SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
▪ Potential alteration of the visual character and sense of place ▪ Potential visual impact on receptors in the study area	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Locally occurring indigenous woody vegetation (trees and shrubs) should be planted along the northern boundary of the site to screen views from the N10. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Temporarily fence-off the construction site (for the duration of the construction period). ▪ Where possible, the operation and maintenance buildings and laydown areas should be consolidated to reduce visual clutter.	2	2	1	2	1	2	16	-	Low

											▪ Buildings and similar structures must be in keeping with relevant regional planning policy documents. ▪ Where possible, underground cabling should be utilised. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.									
Operational Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area. ▪ Potential visual impact on the night time visual environment.	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ The proposed solar PV facility will alter the visual character of the surrounding area and expose potentially sensitive visual receptor locations to visual impacts. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment will be altered as a result of operational and security lighting at the proposed PV facility.	2	3	3	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. ▪ Ensure that the PV arrays are not located within 500m of any farmhouses or the N10 national route in order to minimise visual impacts on these dwellings and on the receptor road. ▪ Locally occurring indigenous woody vegetation (trees and shrubs) should be planted along the northern boundary of the site to screen views from the N10. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the site. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads.	2	3	3	2	2	2	24	-	Medium

											▪ As far as possible, limit the amount of security and operational lighting present on site. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with relevant regional planning policy documents.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low

Cumulative																					
▪ Potential alteration of the visual character and sense of place in the broader area. ▪ Potential visual impact on receptors in the study area. ▪ Potential visual impact on the night time visual environment.	▪ Additional renewable energy developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy developments may be exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.	3	3	2	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on development sites to that which is required for the correct operation of the facility. ▪ Ensure that the PV arrays are not located within 500m of any farmhouses or national routes in order to minimise visual impacts on these dwellings and on the receptor road. ▪ Suitable buffers of intact natural vegetation should be provided along the perimeter of the development area and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the facility. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads. ▪ As far as possible, limit the amount of security and operational lighting present on site. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with relevant regional planning policy documents.	3	3	2	2	2	2	24	-	Medium

MOOI PLAATS GRID CONNECTION INFRASTRUCTURE																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil which could visually contrast with the surrounding environment. ▪ Vegetation clearance required for the construction of the proposed substation is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.	2	2	1	1	1	2	14	-	Low
Operational Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ The proposed power line and substations could alter the visual character of the surrounding area and expose sensitive visual receptor locations to visual impacts.	2	4	2	2	3	1	13	-	Low	▪ Where possible, limit the number of maintenance vehicles using access roads.	2	4	2	2	3	1	13		Low

	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment could be altered as a result of operational and security lighting at the proposed substation.										▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low
Cumulative																				
▪ Potential alteration of the visual character and sense of place in the broader area. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ Additional renewable energy and associated infrastructure developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy and infrastructure developments may be exacerbated, particularly in more natural undisturbed settings.	3	3	2	3	3	2	28	-	Medium	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation.	3	3	2	2	2	2	24	-	Medium

	▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.										▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.									

5.5.2 *Wonderheuval solar PV Project*

WONDERVEUVEL SOLAR PV FACILITY																					
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION									
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S	
Construction Phase																					
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Temporarily fence-off the construction site (for the duration of the construction period). ▪ Where possible, the operation and maintenance buildings and laydown areas should be consolidated to reduce visual clutter. ▪ Buildings and similar structures must be in keeping with regional planning policy documents. ▪ Where possible, underground cabling should be utilised.	2	2	1	2	1	2	16	-	Low	

											▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the proposed site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.									
▪ Operational Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ The proposed solar PV facility will alter the visual character of the surrounding area and expose potentially sensitive visual receptor locations to visual impacts. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment will be altered as a result of operational and security lighting at the proposed PV facility.	2	3	3	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. ▪ Ensure that the PV arrays are not located within 500m of any farmhouses in order to minimize visual impacts on these dwellings. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the site. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads. ▪ As far as possible, limit the amount of security and operational lighting present on site.	2	3	3	2	2	2	24	-	Medium

											▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with regional planning policy documents.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low
Cumulative																				
▪ Potential alteration of the visual character and sense of place in the broader area.	▪ Additional renewable energy developments in the broader area will alter the natural character of the study area towards a more industrial	3	3	2	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on development sites to that which is required for the correct operation of the facility.	3	3	2	2	2	2	24	-	Medium

▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy developments may be exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.										▪ Ensure that the PV arrays are not located within 500m of any farmhouses or national routes in order to minimise visual impacts on these dwellings and on the receptor road. ▪ Suitable buffers of intact natural vegetation should be provided along the perimeter of the development area and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the facility. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads. ▪ As far as possible, limit the amount of security and operational lighting present on site. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with relevant regional planning policy documents.									

WONDERHEUVEL GRID CONNECTION INFRASTRUCTURE																						
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil which could visually contrast with the surrounding environment. ▪ Vegetation clearance required for the construction of the proposed substation is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.	2	2	1	1	1	2	14	-	Low
Operational Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ The proposed power line and substations could alter the visual character of the surrounding area and expose sensitive visual receptor locations to visual impacts.	2	4	2	2	3	1	13	-	Low	▪ Where possible, limit the number of maintenance vehicles using access roads.	2	4	2	2	3	1	13	-	Low

	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment could be altered as a result of operational and security lighting at the proposed substation.										▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low
Cumulative																				
▪ Potential alteration of the visual character and sense of place in the broader area. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ Additional renewable energy and associated infrastructure developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy and infrastructure developments may be exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in	3	3	2	3	3	2	28	-	Medium	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.	3	3	2	2	2	2	24	-	Medium

	increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.																			

5.5.3 Paarde Valley solar PV Project

PAARDE VALLEY SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Temporarily fence-off the construction site (for the duration of the construction period). ▪ Temporarily fence-off the construction site (for the duration of the construction period). ▪ Where possible, the operation and maintenance buildings and laydown areas should be consolidated to reduce visual clutter.	2	2	1	2	1	2	16	-	Low

										▪ Buildings and similar structures must be in keeping with regional planning policy documents. ▪ Where possible, underground cabling should be utilised. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the proposed site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.									
Operational Phase																			
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ The proposed solar PV facility will alter the visual character of the surrounding area and expose potentially sensitive visual receptor locations to visual impacts. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment will be altered as a result of operational and security lighting at the proposed PV facility.	2	3	3	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. ▪ Ensure that the PV arrays are not located within 500m of any farmhouses in order to minimize visual impacts on these dwellings. ▪ Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development area (i.e. the CPV panel blocks) and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the site. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads. ▪ As far as possible, limit the amount of security and operational lighting present on site. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.	2	3	3	2	2	2	24	-	Medium

											▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with regional planning policy documents.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low
Cumulative																				
▪ Potential alteration of the visual character and sense of place in the broader area. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ Additional renewable energy developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy developments may be	3	3	2	3	3	2	28	-	Medium	▪ Restrict vegetation clearance on development sites to that which is required for the correct operation of the facility. ▪ Ensure that the PV arrays are not located within 500m of any farmhouses or national routes in order to minimise visual impacts	3	3	2	2	2	2	24	-	Medium

	exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.										on these dwellings and on the receptor road. ▪ Suitable buffers of intact natural vegetation should be provided along the perimeter of the development area and along the site boundary. ▪ Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. ▪ As far as possible, limit the number of maintenance vehicles which are allowed to access the facility. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads. ▪ As far as possible, limit the amount of security and operational lighting present on site. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Lighting fixtures should make use of minimum lumen or wattage. ▪ Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. ▪ If possible, make use of motion detectors on security lighting. ▪ The operations and maintenance (O&M) buildings should not be illuminated at night. ▪ The O&M buildings should be painted in natural tones that fit with the surrounding environment. ▪ Buildings and similar structures must be in keeping with relevant regional planning policy documents.									

PAARDE VALLEY GRID CONNECTION INFRASTRUCTURE																					
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**									
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**	
Construction Phase																					
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil which could visually contrast with the surrounding environment. ▪ Vegetation clearance required for the construction of the proposed substation is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Inform receptors of the construction programme and schedules. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: ▪ on all access roads; ▪ in all areas where vegetation clearing has taken place; ▪ on all soil stockpiles.	2	2	1	1	1	2	14	-	Low	
Operational Phase																					
▪ Potential alteration of the visual character and sense of place. ▪ Potential visual impact on receptors in the study area.	▪ The proposed power line and substations could alter the visual character of the surrounding area and expose sensitive visual receptor locations to visual impacts.	2	4	2	2	3	1	13	-	Low	▪ Where possible, limit the number of maintenance vehicles using access roads.	2	4	2	2	3	1	13	-	Low	

	▪ The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. ▪ The night time visual environment could be altered as a result of operational and security lighting at the proposed substation.										▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.									
Decommissioning Phase																				
▪ Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process; ▪ Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and ▪ Potential visual intrusion of any remaining infrastructure on the site.	▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil (scarring) which could visually contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	2	3	1	2	1	2	18	-	Low	▪ All infrastructure that is not required for post-decommissioning use should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	2	2	1	2	1	2	16	-	Low
Cumulative																				
▪ Potential alteration of the visual character and sense of place in the broader area. ▪ Potential visual impact on receptors in the study area. ▪ Potential impact on the night time visual environment.	▪ Additional renewable energy and associated infrastructure developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy and infrastructure developments may be exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in	3	3	2	3	3	2	28	-	Medium	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Non-reflective surfaces should be utilised where possible. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.	3	3	2	2	2	2	24	-	Medium

	increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.																			

6 COMPARATIVE ASSESSMENT OF ALTERNATIVES

The layout alternatives for the proposed laydown areas and O&M buildings identified for each PV project (as shown in **Figure 1**, **Figure 2** and **Figure 3**) are comparatively assessed in **Table 8** below.

As previously stated, grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor of between approximately 400m and 900m wide. Details of these alternatives are provided in **Section 1.1.2** above. These alternatives are comparatively assessed in Table 9 below.

The aim of the comparative assessment is to determine which of the alternatives would be preferred from a visual perspective. Preference ratings for each alternative are provided in the tables below. The alternatives are rated as preferred; favourable, least-preferred or no-preference.

The degree of visual impact and the preference rating has been determined based on the following factors:

- The location of each alternative in relation to areas of high elevation, especially ridges, koppies or hills;
- The location of each alternative in relation to sensitive visual receptor locations; and
- The location of each alternative in relation to areas of natural vegetation (clearing site for the development worsens the visibility).

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 8: Comparative Assessment of Alternatives: PV Infrastructure

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	Favourable	▪ Option 1 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 2kms away,

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		this being SR1. The visual impacts from Option 1 affecting this receptor are therefore rated as low to moderate. As SR1 is located on the Mooi Plaats application site, it is however assumed that the owner has a vested interest in the SPEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 1 is some 5.4kms from the nearest section of the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ Option 1 is relatively close to the existing 400kV power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 1 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 2	Favourable	▪ Option 2 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.1kms away, this being SR1. The visual impacts from Option 2 affecting this receptor are therefore rated as low. As SR1 is located on the Mooi Plaats application site, it is however assumed that the owner has a vested interest in the SPEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ Option 2 is some 3.6kms from the nearest section of the N10 receptor road, located in

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		an area which is not expected to be visible from the N10. ▪ Option 2 is relatively close to the existing 400kV power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 2 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 3	Favourable	▪ Option 3 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 4.3kms away, this being SR1. The visual impacts from Option 2 affecting this receptor are therefore rated as low. As SR1 is located on the Mooi Plaats application site, it is however assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ Option 3 is some 4.2kms from the nearest section of the N10 receptor road, located in an area which is not expected to be visible from the N10. ▪ Option 3 is some 600m from the existing 400kV power lines and as such is close to an area of moderate visual contrast where the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 3 and this alternative is considered favourable from a visual perspective.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 4	Least Preferred	1 Option 4 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. 2 The closest potentially sensitive receptor to this alternative is approximately 1.1kms away, this being VR5. The visual impacts from Option 4 affecting this receptor are therefore rated as moderate. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. 3 Option 4 is some 600m from the nearest section of the N10 receptor road, located in an area which is expected to be visible from the N10. 4 The proximity of the N10 places this alternative in a zone of low to moderate contrast where the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. 4.1 In light of the above, there are no fatal flaws associated with Option 4 and this alternative is considered least preferred from a visual perspective.
Laydown Area and O&M Building Site Option 5	Favourable	▪ Option 5 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 900m away, this being SR1. The visual impacts from Option 5 affecting this receptor are therefore rated as moderate. As SR1 is located on the Mooi Plaats application site, it is however assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 5 is some 4.1kms from the nearest section of the N10 receptor road,

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		development at this location is not expected to impact motorists travelling along this route. ▪ Option 5 is relatively close to the existing 400kV power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 5 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 6	Favourable	▪ Option 6 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 4km away, this being VR9. The visual impacts from Option 6 affecting this receptor are therefore rated as moderate. As VR9 is located on the Mooi Plaats application site, it is however assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 6 is some 4.1kms from the nearest section of the N10 receptor road, located in an area which is not expected to be visible from the N10. ▪ Option 6 is relatively close to the existing power lines and District Road P2433 and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 6 and this alternative is considered favourable from a visual perspective.
WONDERHEUVEL SOLAR PV FACILITY:		

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 1	Favourable	▪ Option 1 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.4kms away, this being VR9. The visual impacts from Option 1 affecting this receptor are therefore rated as low. As VR9 is located on the Wonderheuvel application site, it is assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 1 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ Option 1 is relatively close to existing power lines and District Road P2433 and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 1 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 2	Favourable	▪ Option 2 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.1kms away, this being VR17. The visual impacts from Option 2 affecting this receptor are therefore rated as low. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 2 is outside the viewshed for the N10 receptor road, development at this

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		location is not expected to impact motorists travelling along this route. ▪ Option 2 is relatively close to existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 2 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 3	Favourable	▪ Option 3 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 2.4kms away, this being VR12. The visual impacts from Option 3 affecting this receptor are therefore rated as low. As VR12 is located on the Wonderheuvel application site, it is assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 3 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ As Option 3 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 3 and this alternative is considered favourable from a visual perspective.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 4	Favourable	▪ Option 4 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 2.4kms away, this being VR12. The visual impacts from Option 4 affecting this receptor are therefore rated as low. As VR12 is located on the Wonderheuvel application site, it is assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 4 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ As Option 4 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 4 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 5		▪ Option 5 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptors to this alternative are approximately 1.4 and 1.8kms away, these being VR12 and VR9 respectively. The visual impacts from Option 5 affecting these receptors are therefore rated as moderate. As VR12 and VR9 are both located on the Wonderheuvel application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		negative light. The remaining receptors are all more than 2.5kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 5 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ Option 5 is relatively close to District Road P2433 and existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 5 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 6	Least Preferred	▪ Option 6 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 600m away, this being VR9. The visual impacts from Option 6 affecting this receptor is therefore rated as moderate. As VR9 is located on the Wonderheuvel application site, it is assumed that the owner has a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 2kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 6 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ Option 6 is relatively close to District Road P2433 and existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		and O&M buildings would be significantly reduced. ▪ Although there are no fatal flaws associated with Option 6, given the proximity of this alternative to VR9, this alternative is considered least preferred from a visual perspective.
Laydown Area and O&M Building Site Option 7	Favourable	▪ Option 7 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 2.3kms away, this being VR12. The visual impacts from Option 7 affecting these receptors are therefore rated as moderate. As VR12 is located on the Wonderheuvel application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 7 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ As Option 7 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 7 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 8	Least Preferred	▪ Option 8 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptors to this alternative are between 1.3 and 1.5kms away, these being VR12, VR3 and VR14.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		The visual impacts from Option 8 affecting these receptors are therefore rated as moderate. As VR12 is located on the Wonderheuvel application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 8 is outside the viewshed for the N10 receptor road, development at this location is not expected to impact motorists travelling along this route. ▪ Option 8 is relatively close to District Road P2433 and existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ Although there are no fatal flaws associated with Option 8, given the proximity of this alternative to three potentially sensitive receptors, this alternative is considered least preferred from a visual perspective.
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	Favourable	▪ Option 1 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 5.0kms away, this being VR24. The visual impacts from Option 1 affecting this receptor are therefore rated as low to negligable. The remaining receptors are all more than 5kms away and thus are not expected to be subjected to any visual impacts from this alternative. ▪ As Option 1 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 1 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 2	Favourable	▪ Option 2 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.9kms away, this being VR24. The visual impacts from Option 2 affecting this receptor are therefore rated as low. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 2 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 2 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 3	Favourable	▪ Option 3 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.5kms away, this being VR24. The visual impacts from Option 3 affecting this receptor are therefore rated as low. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 3 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 3 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 4	Favourable	▪ Option 4 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 3.1kms away, this being VR24. The visual impacts from Option 4 affecting this receptor are therefore rated as low. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 4 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 4 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 5	Favourable	▪ Option 5 is located on relatively flat terrain and as such would only be moderately exposed on the skyline.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		▪ The closest potentially sensitive receptor to this alternative is approximately 2.7kms away, this being VR30. The visual impacts from Option 5 affecting this receptor are therefore rated as low. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 5 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 5 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 6	Favourable	▪ Option 6 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 1.9kms away, this being VR24. The visual impacts from Option 6 affecting this receptor are therefore rated as moderate. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 6 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 6 and this alternative

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 7	Least Preferred	▪ Option 7 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 1.2kms away, this being VR24. The visual impacts from Option 7 affecting this receptor are therefore rated as moderate. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 4kms away and thus would only be subjected to low or negligible levels of impact. ▪ Option 7 is relatively close to existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ Although there are no fatal flaws associated with Option 7, given the proximity of this alternative to a potentially sensitive receptor, this alternative is considered least preferred from a visual perspective.
Laydown Area and O&M Building Site Option 8	Favourable	▪ Option 8 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 2.4kms away, this being VR30. The visual impacts from Option 8 affecting this receptor are therefore rated as low. The remaining receptors are all more than 3kms away and thus would only be subjected to low or negligible levels of impact. ▪ As Option 8 is not located close to any existing infrastructural development and the landscape is largely untransformed, the proposed development would result in significant visual contrast. The impact of this

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
		is however reduced by the distance from the nearest receptor. ▪ In light of the above, there are no fatal flaws associated with Option 8 and this alternative is considered favourable from a visual perspective.
Laydown Area and O&M Building Site Option 9	Favourable	▪ Option 9 is located on relatively flat terrain and as such would only be moderately exposed on the skyline. ▪ The closest potentially sensitive receptor to this alternative is approximately 1.9kms away, this being VR24. The visual impacts from Option 9 affecting this receptor are therefore rated as moderate. As VR24 is located on the Paarde Valley application site, it is assumed that the owners have a vested interest in the SEF project and thus the associated laydown area and O&M buildings would not be perceived in a negative light. The remaining receptors are all more than 3.5kms away and thus would only be subjected to low or negligible levels of impact. ▪ Option 9 is relatively close to existing power lines and as such the landscape has already undergone some transformation from its natural state. Thus the impacts of the proposed laydown area and O&M buildings would be significantly reduced. ▪ In light of the above, there are no fatal flaws associated with Option 9 and this alternative is considered favourable from a visual perspective.

Table 9: Comparative Assessment of Alternatives: Grid Connection Infrastructure

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	Preferred	▪ These corridor alternatives are almost identical to each other, although each one is

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 1b	Preferred	associated with a different combination of substations. As such, there is little difference between the alternatives from a visual perspective. ▪ Both options are approximately 13kms in length. ▪ Much of both these corridor alternatives is located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern section of the corridor does however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ Much of the northern sections of these corridor alternatives are in the viewshed of the N10 receptor road, although the distance from the road and the presence of the existing 400kV power lines would reduce visual impacts on passing motorists to low. According to the visibility analysis conducted however, the substation site which forms part of Option 1b would be less visible from the N10 than the substation site associated with Option 1a. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of both alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to the substation sites is SR1, which is between 2.1kms and 2.9kms from the nearest Substation 1a and 1b respectively. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Option 1a or Grid Connection Option 1b, and both of these alternatives are considered favourable from a visual perspective.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		▪ The Option 1 alternatives are preferred over the Option 2 alternatives as the route is shorter and most almost entirely aligned with the existing power lines.
Grid Connection Option 2a	Favourable	▪ These corridor alternatives are almost identical to each other, although each one is associated with a different combination of substations. As such, there is little difference between the alternatives from a visual perspective. ▪ Both options are approximately 21km in length. ▪ Much of both these corridor alternatives is located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern section of the corridor does however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ Much of the northern sections of these corridor alternatives are in the viewshed of the N10 receptor road, although the distance from the road and the presence of the existing 400kV power lines would reduce visual impacts on passing motorists to low. According to the visibility analysis conducted however, the substation site which forms part of Option 1b would be less visible from the N10 than the substation site associated with option 1a. The central collector substation will not be visible from the N10. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of both alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to the substation sites is SR1, which is between 2.1kms and 2.9kms
Grid Connection Option 2b	Favourable	

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		from the nearest Substation 1a and 1b respectively. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Option 2a or Grid Connection Option 2b, and both of these alternatives are considered favourable from a visual perspective. ▪ The Option 2 alternatives are less preferred than the Option 1 alternatives as the route is overall much longer.
WONDERHEUVEL SOLAR PV FACILITY		
Grid Connection Option 1a	Least Preferred	▪ These corridor alternatives are almost identical to each other, although each one is associated with a different combination of substations. As such, there is little difference between the alternatives from a visual perspective. ▪ All northern connection options are between 18 and 19km approximately in length, while all southern connection alternatives are approximately 19km in length. ▪ Large sections of all of these corridor alternatives are located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern sections of both the northern and southern connections of each option do however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ Much of the northern sections of these corridor alternatives are in the viewshed of the N10 receptor road, although the distance from the road and the presence of the existing 400kV power lines would reduce visual impacts on passing motorists to low. According to the visibility analysis conducted however, the substation sites and the southern connection will be not be visible from this road. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of the northern
Grid Connection Option 1b	Least Preferred	
Grid Connection Option 1c	Least Preferred	
Grid Connection Option 1d	Least Preferred	

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		connection alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the northern connection assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to the southern connection is more than 2km away and thus impacts on this receptor would be rated as low. ▪ The closest receptor to a substation site is VR12, which is 2.3km from Sub4a and thus would only be subjected to low levels of impact. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Options 1a, 1b, 1c or 1d and all of these alternatives are considered favourable from a visual perspective. ▪ The Option 1 alternatives are less preferred than the Option 2 and Option 3 alternatives as the route is overall much longer.
Grid Connection Option 2a	Favourable	▪ These corridor alternatives are almost identical to each other, although each one is associated with a different substation. As such, there is little difference between the alternatives from a visual perspective. ▪ Option 2a is approximately 22km in length, while Option 2b is some 2kms longer. ▪ The western sections of both these options is located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern sections however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ Much of the northern sections of these corridor alternatives is in the viewshed of the N10 receptor road, although the distance from the road (more than 5km) and the presence of the existing 400kV power lines would reduce visual impacts on passing
Grid Connection Option 2b	Favourable	

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		motorists to low. According to the visibility analysis conducted, the substation sites and the southern sections of the corridor options will be not be visible from this road. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of the northern sections of the corridor alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the northern section of the assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to a substation site is VR12, which is 2.3km from Sub4a (the Central Collector). As such this receptor would only be subjected to low levels of impact from the substation. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Options 2a or 2b and both of these alternatives are considered favourable from a visual perspective. ▪ The Option 2 alternatives are preferred over the Option 1 alternatives as the route is overall much shorter.
Grid Connection Option 3	Favourable	▪ Option is approximately 25km in length, and incorporates sections the other corridor alternatives examined above. ▪ The western section of this option is located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern section however traverses areas of higher elevation and as such power lines in these areas will be more exposed. ▪ Much of the northern section of this corridor alternative is in the viewshed of the N10 receptor road, although the distance from the road (more than 5km) and the presence of the existing 400kV power lines would reduce

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		visual impacts on passing motorists to low. According to the visibility analysis conducted, the substation sites and the southern sections of this corridor option will be not be visible from this road. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of the northern sections of the corridor alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the northern section of the assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to a substation site is VR12, which is 2.3km from both Sub4a (the Central Collector) and Sub4b. As such this receptor would only be subjected to low levels of impact from the substation. ▪ In light of the above, there are no fatal flaws associated with Grid Connection Option 3 and this alternative is considered favourable from a visual perspective. ▪ The Option 3 alternative is preferred over the Option 1 alternatives as the route is overall much shorter.
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	Preferred	▪ These corridor alternatives are almost identical to each other, although each one is associated with a different combination of substations. As such, there is little difference between the alternatives from a visual perspective. ▪ All northern connection options are between 15 and 16km approximately in length, while all southern connection alternatives are between 12 and 14km in length. ▪ Large sections of all of these corridor alternatives are located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline.
Grid Connection Option 1b	Preferred	
Grid Connection Option 1c	Preferred	
Grid Connection Option 1d	Preferred	

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		The eastern sections of both the northern and southern connections of each option do however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ There are no potentially sensitive receptor locations within 500m of any of these alternatives. The closest receptor is VR21 which is approximately 1.4km from the eastern-most section of the assessment corridor. Visual impacts affecting this receptor would be rated as moderate. ▪ The closest receptor to a substation site is VR30, which is 2.6km from Sub7b. VR28 and VR29 are both 3.2kms from Sub7b, while VR24 is 3.2km from Sub7a. Thus these receptors would only be subjected to low levels of impact resulting from the substations. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Options 1a, 1b, 1c or 1d and all of these alternatives are considered favourable from a visual perspective. ▪ The Option 1 alternatives are preferred over the Option 2 alternatives as the routes are overall much shorter and there are fewer visual receptors in close proximity.
Grid Connection Option 2a	Favourable	▪ These corridor alternatives are almost identical to each other, although each one is associated with a different combination of substations. As such, there is little difference between the alternatives from a visual perspective. ▪ All northern connection options are approximately 23km in length, while the
Grid Connection Option 2b	Favourable	
Grid Connection Option 2c	Favourable	
Grid Connection Option 2d	Favourable	

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		southern connection alternatives are between 27 and 30km in length. ▪ Large sections of all of these corridor alternatives are located on relatively flat terrain and as such the power lines would only be moderately exposed on the skyline. The eastern sections of both the northern and southern connections of each option do however traverse areas of higher elevation and as such power lines in these areas will be more exposed. ▪ There is one sensitive receptor location (SR2) and no potentially sensitive receptor locations within 500m of the northern sections of the corridor alternatives and a second sensitive receptor (SR3) only 600m from the edge of the assessment corridor. As much of the northern section of the assessment corridor is aligned adjacent to existing 400kV power lines however, visual impacts affecting these receptors would be reduced to moderate. ▪ The closest receptor to a substation site is VR12, which is 2.3km from Sub4a (the Central Collector). As such this receptor would only be subjected to low levels of impact from the substation. ▪ In light of the above, there are no fatal flaws associated with either Grid Connection Options 2a, 2b, 2c or 2d and all of these alternatives are considered favourable from a visual perspective. ▪ The Option 2 alternatives are however less preferred than the Option 1 alternatives as the routes are overall much longer and there are more visual receptors in close proximity.

7 CONCLUSION

An EIA level visual study was conducted to assess the magnitude and significance of the visual impacts associated with the development of the proposed Mooi Plaats, Wonderheuvel and Paarde Valley solar PV facilities and associated grid connection infrastructure near Noupoort and Middelburg in the Northern and Eastern Cape Provinces. Overall, sparse human habitation and the predominance of natural vegetation cover across much of the study area would give the viewer the general impression of a largely natural setting with some pastoral elements. As such, solar PV developments would alter the visual character and contrast significantly with the typical land use and/or pattern and form of human elements present across the broader study area. The level of contrast will however be reduced by the presence of the N10 national route and existing high voltage power lines in in the northern sector of the study area.

The area is not typically valued for its tourism significance and there is limited human habitation resulting in relatively few potentially sensitive receptors in the area. A total of twenty six (26) potentially sensitive receptors were identified in the combined study area, three (3) of which are considered to be sensitive receptors as they are linked to leisure/nature-based tourism activities in the area. None of the receptors are however expected to experience high levels of visual impact from any of the proposed PV facilities or the grid connection infrastructure. Although the N10 receptor road traverses the study area, motorists travelling along this route are only expected to experience moderate impacts from the proposed Mooi Plaats solar PV facility and from the grid connection infrastructure associated with all three projects.

An overall impact rating was also conducted in order to allow the visual impact to be assessed alongside other environmental parameters. The assessment revealed that impacts associated with the proposed Mooi Plaats, Wonderheuvel and Paarde Valley solar PV facilities and associated grid connection infrastructure will be of low significance during both construction and decommissioning phases.

During operation, visual impacts from all three solar PV facilities would be of medium significance with relatively few mitigation measures available to reduce the visual impact. Visual impacts associated with the grid connection infrastructure during operation would be of low significance.

Although other renewable energy developments and infrastructure projects, either proposed or in operation, were identified within a 35km radius of the Mooi Plaats, Wonderheuvel and Paarde Valley solar PV projects, it was determined that only one of these would have any significant impact on the landscape within the visual assessment zone, namely Umsobomvu WEF. This proposed WEF, in conjunction with the three proposed solar PV facilities and associated grid connection infrastructure, will alter the inherent sense of place and introduce an increasingly industrial character into a largely natural, pastoral landscape, thus giving rise to significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommendations and mitigation measures stipulated for each of these developments by the visual specialists. In light of this and the relatively low level of human habitation in the study area however, cumulative impacts have been rated as medium.

No fatal flaws were identified for any of the proposed site alternatives for laydown areas and O&M buildings for any of the PV projects. A summary of the preference ratings for each project is provided below:

- Mooi Plaats Solar PV Facility: No preference was determined for any of the laydown area and O&M building site options and all but one site was found to be favourable. The remaining option, Site Option 4 was found to be the least preferred due to its proximity to a potentially sensitive receptor and the N10 receptor road.
- Wonderheuvel Solar PV Facility: No preference was determined for any of the laydown area and O&M building site options and all but two sites were found to be favourable. The remaining options, Site Option 6 and Site Option 8 were found to be the least preferred due to their proximity to potentially sensitive receptors.
- Paarde Valley Solar PV Facility: No preference was determined for any of the laydown area and O&M building site options and all but one site was found to be favourable. The remaining option, Site Option 7 was found to be the least preferred due to its proximity to a potentially sensitive receptor.

No fatal flaws were identified for any of the grid connection infrastructure alternatives and a summary of the preference ratings for each project is provided below:

- Mooi Plaats grid connection infrastructure: No preference was determined for any of the substation sites.The Option 1 alternatives were rated as preferred due to the fact that the route is shorter and most almost entirely aligned with the existing power lines..
- Wonderheuvel grid connection infrastructure: No preference was determined for any of the substation sites and the Option 2 and Option 3 grid connection alternatives were rated as favourable, while the Option 1 alternatives were rated as least preferred. The Option 1 alternatives are less preferred than the Option 2 and Option 3 alternatives as this route is overall much longer than the others.
- Paarde Valley grid connection infrastructure: No preference was determined for any of the substation sites and the Option 1 alternatives were rated as preferred as the routes are overall much shorter and there are fewer visual receptors in close proximity.

7.1 Visual Impact Statement

It is SiVEST's opinion that the visual impacts associated with the proposed Mooi Plaats, Wonderheuvel and Paarde Valley solar PV facilities and associated grid connection infrastructure are of moderate significance. Given the low level of human habitation and the relative absence of sensitive receptors, the project is deemed acceptable from a visual impact perspective and the Environmental Authorisations (EA) should be granted for all the relevant EIA and BA applications. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

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