PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION FACILITY ON THE FARM ADAMS 328 NEAR HOTAZEL IN THE NORTHERN CAPE

For:

AURORA POWER SOLUTIONS

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIA)

NEAS Reference: DEA/EIA/0000739/2011
DEA EIA reference number: 12/12/20/2567

October 2012

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT (EIR) REPORT: PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION FACILITY ON THE FARM ADAMS 328 NEAR HOTAZEL IN THE NORTHERN CAPE

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October 2012

DEA & LEGAL REQUIREMENTS FOR SOLAR ENERGY FACILITIES: INFORMATION LIST FOR EIA PROJECTS:

1. General Site Information		
No.	**Information**	**Reference/Provided**
1.1	Description of all affected farm portions	Section 2.5 & 8.1 & Appendix 1
1.2	21 Digit Surveyor General Codes of all affected farm portions	Section 2.5
1.3	Copies of deeds of all affected farm portions	Appendix 4
1.4	Photos of areas that give a visual perspective of all parts of the site	Section 8.10, 10.3.7, Appendix 6 & Appendix 7.3
1.5	Photographs from sensitive visual receptors (Tourism routes, tourism facilities, etc.)	Section 10.3.7 & Appendix 7.3
1.6	Solar plant design specifications including: • Type of technology • Structure height • Surface area to be covered (including associated infrastructure such as roads) • Structure orientation • Laydown area dimensions (Construction period and thereafter) • Generation capacity of the facility as a whole at delivery points	Section 3 & Appendix 3
2. Site maps and GIS information		
No.	**Information**	**Reference/Provided**
2.1	All maps/information layers must also be provided in ESRI Shapefile format	Contained in the CD version of this report
2.2	All affected farm portions must be indicated	Section 2.5 & 8.1& Appendix 1
2.3	The exact site of the application must be indicated (The areas that will be occupied by the application)	Figure 11-1 & Appendix 1 &4
2.4	A status quo map/layer must be provided that includes the following: Current use of the land on site including:	Section 8, Figure 8-1 & Figure 8-2
	2.4.1 Building and other structures	Figure 8-1 & Figure 8-2
	2.4.2 Agricultural fields	N/A: None
	2.4.3 Grazing areas	Section 8.2 & Figure 8-2
	2.4.4 Natural vegetation areas (Natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of critical Biodiversity Areas and Ecological Support areas.	Figure 8-12, Figure 10-2 & Appendix 7.1 & 7.2
	2.4.5 Critically endangered and endangered vegetation areas that occur on the site	N/A; None; please refer to Sections 8.7, 10.3.2 & Appendix 7.1
	2.4.6 Bare areas which may be susceptible to soil erosion	Figure 8-12, Figure 10-2 & & Section 10.3.6 and Appendix 7.1 & 6.4

	2.4.7 Cultural historical sites and elements	Section 8.12, 10.3.5 and Appendix 7.4
	2.4.8 Rivers, streams and water courses	Section 8.8, 10.3.4
	2.4.9 Ridgeline and 20m continuous contours with height references in the GIS database	Figure 8-7
	2.4.10 Fountains, boreholes, dams (in-stream as well as off- stream) and reservoirs	Section 8.8 & 10.3.4
	2.4.11 High potential agricultural areas as defined by the Department of Agriculture, Forestry & Fisheries	N/A the site does not fall within an area which has high agricultural potential as defined by DAFF. Located in a very arid region of southern Africa, refer to Section 8.6, 10.3.6 and Appendix 7.6
	2.4.12 Buffer zones (also where it is dictated by elements outside the site): • 500m from any irrigated agricultural land • 1km from residential areas • Indicate isolated residential, tourism facilities on or within 1km of the site	No irrigated agricultural land occurs within 500 m of the site, there are no tourism facilities within close proximity to the facility. The closest residence is the farm house to the south of the study area.
	2.4.13 A slope analysis map/layer that include the following slope ranges: • Less than 8% slope • Between 8% and 12% slope • Between 12% and 14% slope • Steeper than 18% slope	Section 8.4 Figure 8-5 & Figure 8-6
	2.4.14 A map/layer that indicate locations of birds and bats including roosting and foraging areas	N/A this was not identified by the specialist as being a significant issue, please refer to section 8.7.5 &10.3.2 as well Appendix 7.1
2.5	A site development proposal map(s)/layer(s) that indicates:	Section 3, 11, Figure 3-3, Figure 11-1and Appendix 1
	2.5.1 Position of solar facility	
	2.5.2 Foundation footprint	
	2.5.3 Permanent laydown area footprint	
	2.5.4 Construction period laydown footprint	
	2.5.5 Internal road indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve	
	2.5.6 River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used	
	2.5.7 Substation(s) and transformer(s) sites including their entire footprint	
	2.5.8 Cable routes and trench dimensions (where they are not along the internal roads)	
	2.5.10 Connection routes to the	

	distribution/transmission network	
	2.5.11 Cut and fill areas along roads and at substation/ transformer sites indicating the expected volume of each cut and fill	
	2.5.12 Borrow pits	
	2.5.13 Spoil heaps (Temporary for topsoil & subsoil and permanently for excess material)	
	2.5.14 Buildings, including accommodation	

3. Regional map and GIS information

No.	Information	Reference/Provided
3.1	All maps/information layers must also be provided in ESRI Shape file format	Contained in the CD version of this report
3.2	The map/layer must cover an area of 20km around the site	Figure 8-1 & Figure 8-2
3.3	Indicate the following: • Roads including their types (tarred or gravel) • Railway lines and stations • Industrial areas • Harbours and airports • Electricity transmission and distribution lines and substations • Pipelines • Water sources to be utilized during construction and operational phases • Critical Biodiversity areas and Ecological Support area • Critically Endangered and endangered vegetation areas/agricultural fields • Irrigated areas • An indication of new roads or changes and upgrades that must be done to existing roads in order to get equipment onto the site, including cut and fill areas and crossings of rivers and streams	Figure 8-1 to Figure 8-2, this should be read in conjunction with Section 8, 10, 11 and Appendices 7.1 – 7.6.

The following amendments and additional information are required for the EIR (DEA FSR Acceptance Letter, 21/08/2012):

No.	Information	Reference/Provided
a)	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Section 3.2.3, 10 as well Appendix 8 (EMPR)
b)	The total footprint of the proposed development should be indicated. Exact locations of the solar energy facility, and associated infrastructure should be mapped at an appropriate scale.	Section 12.1311, Figure 3-3, Figure 11-1 and Appendix 1
c)	Also, it must be clearly indicated into **how many phases the project** will be developed, with how much generation capacity and footprint per phase.	Section 1, 2, 3, 11 and Appendix 1.
d)	Should a Water Use License be required, proof of application for a license needs to be submitted.	Please refer to section 3.2.4. Please note that it has been determined that there is no requirement for the submission of a WULA from the DWA or DoE for solar PV projects in the bidding phase of the IPP bidding process.
e)	Possible impacts and effects of the development on the vegetation ecology with regard to lowland-highland interface in the locality should be indicated.	Section 10.3.2 and Appendix 7.1
f)	The impacts of the proposed facility on avifauna and bats must be assessed in the E IA phase.	Not identified as being a significant issue – Refer to section 8.7.5 & 10.3.2
g)	Possible impacts and effects of the development on the surrounding industrial area.	None. The site is however located directly east of the BHP Mamatwan Manganese mine
h)	The EIR should include information on the following: • Environmental costs VS benefits of the solar energy facility activity; and • Economic viability of the facility to the surrounding area and how the local community will benefit.	Section 2.7 and 10.3.9
i)	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?	Section 3.2.4.
j)	A construction and operational phase EMP to include mitigation and monitoring measures.	Appendix 8
k)	Should blasting be required, appropriate mitigation measures should be provided.	N/A – no blasting would be required during the construction or operation phase of the development

l)	A copy of the **final** site layout plan. Existing infrastructure must be used as far as possible e.g. roads. The layout plan must indicate the following: • Solar energy facility and its associated infrastructure; • Foundation footprint; • Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); . • All existing infrastructure on the site, especially roads; • Environmental sensitive features and buffer areas. • Buildings, including accommodation; and • All "no-go" areas.	Appendix 1, Section 11 and Figure 11-1
m)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Figure 10-2
n)	A map combining the final layout plan superimposed (overlain) on the environmental sensitivity map.	Figure 11-1 & Appendix 1

1. EXECUTIVE SUMMARY

Aurora Power Solutions is proposing to develop a commercial photo-voltaic (PV) solar power plant on the farm Adams 328 which is approximately 21 km's south of Hotazel, in Northern Cape Province. The facility will be referred to as the Adams Solar PV Project Two.

The proposed project would entail three (3) development phases. The first phase would be a 19 MW facility not exceeding 20 hectares in extent, applied for under a separate basic assessment process (DEA Ref: 12/12/20/2566). Environmental Authorisation was granted to the first development phase on 10 September 2012 by the Department of environmental Affairs (DEA). Two additional phases are proposed and will consist of two 75 MW facilities (see Figure 11-1 and Appendix 1). The development phases will utilise up to 558 hectares in special extent on the farm. The envisaged combined export capacity is however expected to be 169 MW.

Solar PV is the preferred technology; however, the final choice of specific technology also influences the total generation capacity, as for example Concentrated Photo-voltaic (CPV) modules require more space than crystalline silicon modules for producing the same electricity output (Please refer to Appendix 3 for a detailed description of technology etc.). The development footprint will, however, not exceed 558 hectares; the IPP Procurement programme currently allows for a maximum export capacity of 75 MW per solar PV project per site to be submitted into any one round. Maximum Export Capacity (MEC) is by definition the contracted maximum export value (in MW) of an entire generation station in accordance with the generator's connection agreement. On the other hand generation capacity by definition is the maximum output (MW) that generating equipment can supply to system load.

The proposed Adams Solar PV Project Two requires access to the national electrical grid. The Dougnor Substation located on site does not have the capacity to accommodate additional grid access required by the PV facilities. The project company is therefore planning to construct a new substation adjacent to the development footprint of the PV facility and has been included as part of the proposed project application for environmental authorisation to the DEA.

Please also note that an amended application for environmental authorisation will be submitted to the Department of Environmental Affairs (DEA) to include the following changes:

- The current applicant "Aurora Power Solution" has established a Project Company to manage the proposed facility. The project applicant for the development will, therefore, be amended to K2012114124 (South Africa)(Pty) Ltd. (to trade as 'Adams Solar PV Project Two').
- The project scope has been expanded to include a new substation within the PV plants footprint. The reason being that the current substation on site cannot accommodate additional electrical grid access for the Adams Solar PV Project Two project.

This amendment to project scope and applicant change will be communicated to all interested and affected parties (I&Ap), please refer to section 7

The proposed project would include several, 'Listed Activities', which may not commence prior to obtaining an Environmental Authorisation in terms of Section 24 of the National

Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 R.545 and R546 of 18 June 2010, was submitted to the Competent Authority (CA), the national Department of environmental Affairs (DEA), on 17 November 2011. The application was acknowledged on 23 November 2011(Appendix 2), and issued with the project reference number **12/12/20/2567**.

The EIA was commissioned to determine the available area for construction of the PV facility, taking all environmental aspects into consideration. A preliminary site development layout plan was developed (See Figure 11-1 & Appendix 1). The plan identifies areas on the site that are considered to be viable from an environmental perspective, and where development should occur. 558 hectares of 878 hectares assessed have been proposed for authorisation.

The EIA report presents a comprehensive assessment of the anticipated environmental impacts over the full life-cycle of the proposed PV facility and the new substation on the farm Adams. Table 1-1 contains a summary of the environmental impact assessment significance rating. The project could potentially result in direct and indirect negative impacts of significance in the absence of appropriate environmental management solutions. The environmental assessment practitioner (EAP) however, believes that appropriate/feasible mitigation is readily available to the proponent that would effectively reduce the significance of potentially negative impacts to within acceptable levels. These impacts and mitigation measures that were assessed as part of this detailed Environmental impact report (EIR) was incorporated into the Environmental Management Programme Report (EMPr).

Renewable power generation has various social and environmental advantages such as:

- Clean form of energy compared to conventional coal firing methods. PV power generation does not emit any harmful pollutants to the atmosphere.
- The project has global significance as it reduces carbon dioxide released into the atmosphere
- Local communities' skills development, employment creation as well as capacity building benefits will be created by the proposed development in an area of South Africa with limited economic development opportunities

Table 1-1: Tabular Summary of Impact Assessment

Aspect	Impact Significance (No mitigation)	Impact Significance (mitigation)
Construction& Operation		
Fauna	Moderate (-)	Low (-)
Flora	Moderate (-)	Moderate (-)
Waste Generation	Low (-)	Low (-)
Ground/Surface water Quality	Moderate (-)	Low (-)
Surface Water Runoff (During construction & Operation	Low (-)	Negligible (-)
Heritage	Low (-)	Negligible (-)
Soil & Agricultural Potential		
• Impacts on current land capability/land-use	Negligible (-)	Negligible (-)
• impacts in respect of potential for alternative land-use	Negligible (-)	Negligible (-)
Visual	Moderate (-)	Moderate (-)
Traffic	Negligible (-)	Negligible (-)
Socio Economic		

• Negative impacts on Socio Economics (mainly during Construction)	Moderate (-)	Low (-)
• Positive Impact on Socio Economic	Moderate (+)	Moderate (+)

It is the EAP's opinion that the EIA process to date has been undertaken in an independent, scientifically correct manner, and in compliance with the requirements of applicable legislation. It is, therefore, recommended that the EIA Report be accepted by the Department of Environment Affairs (DEA). Furthermore, it is the EAP's opinion that the positive project impacts are deemed significant, and the negative project impacts can be mitigated to the extent that no significant, or residual, environmental damage will result from project approval. Therefore, it is recommended that the application for Environmental Authorisation be viewed favourably by the Competent Authority, provided that the proposed mitigation and conditions put forward in the EIA and associated EMPr are adhered to and made legally binding to the proponent (i.e. the Project Company).

The draft Environmental Impact Assessment Report (EIR) is being made available to registered Interested and Affected Parties and other stakeholders for review and comment from 1 October 2012 to 10 November 2012. The availability of the draft EIR and required amendments will be advertised in a local newspaper (Refer to public participation section 7).

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ABBREVIATIONS

AAA:	Astronomy Advantage Areas
AM:	After Mitigation
AIA:	Archaeological impact Assessment
APS:	Aurora Power Solutions
BAT:	Best Available Technique
BEP:	Best Environmental Practice
BID:	Background Information Document
BM:	Before Mitigation
BPEO:	Best Practicable Environmental Option
CARA	Conservation of Agricultural Resources Act
CER	Certified Emission Reduction
CO_2:	Carbon dioxide
DAFF:	Department of Agriculture, Forestry and Fisheries
DEA:	Department of Environmental Affairs
DoE	Department of Energy
DWA:	Department of Water Affairs
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr:	Environmental Management Programme Report
HIA:	Heritage Impact Assessment
IAPs:	Interested and Affected Parties
IDP:	Integrated Development Plan
IPP:	Independent Power Producer
IRP:	Integrated Resource Plan
LED	Local Economic Development
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA:	National Environmental Management Act, No. 107 of 1998
NEMA EIA Regulations:	Regulations GN R.453, R.454, 455 and R.456 (18 June 2010), as amended. promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
NHRA:	National Heritage Resources Act
NWA:	National Water Act (Act No. 36 of 1998)
PES	Present Ecological State
PoSEIA:	Plan of Study for EIA
PPP:	Public Participation Process
RDL:	Red Data Listed
SAHRA:	South African heritage resource Agency
SANBI:	South African Biodiversity Institute
SKA:	Square Kilometre Array
SR:	Scoping Report
TOPS:	Threatened Or Protected Species
VIA:	Visual Impact Assessment

2. INTRODUCTION

2.1. BACKGROUND

Aurora Power Solutions is proposing to develop a commercial photo-voltaic (PV) solar power plant on the farm Adams 328 which is approximately 21 km's south of Hotazel, in Northern Cape Province. The facility will be referred to as the Adams Solar PV Project Two.

The proposed project would entail three (3) development phases. The first phase would be a 19 MW facility not exceeding 20 hectares in extent, applied for under a separate basic assessment process (DEA Ref: 12/12/20/2566). Environmental Authorisation was granted to the first development phase on 10 September 2012 by the Department of environmental Affairs (DEA). Two additional phases are proposed under this EIA process and will consist each consist of a 75 MW facility (see Figure 11-1 and Appendix 1). The development phases will utilise 558 hectares in special extent on the farm. The envisaged combined export capacity is however expected to be up to 169 MW.

The current IPP programme allows for construction of a maximum export capacity of 75MW per site per bid round for a solar PV project. However, the available allocation will determine if the site is to be developed in phases as a reduction the maximum allocation will allow several smaller plants to be constructed, without exceeding a total development footprint of 558 hectares. Maximum Export Capacity (MEC) is by definition the contracted maximum export value (in MW) of an entire generation station in accordance with the generator's connection agreement. On the other hand generation capacity by definition is the maximum output (MW) that generating equipment can supply to system load.

The proposed Adams Solar PV Project Two requires access to the national electrical grid. The Dougnor Substation located on site does not have the capacity to accommodate additional grid access required by the PV facilities. The project company is therefore planning to construct a new substation adjacent to the development footprint of the PV facility and has been included as part of the proposed project application for environmental authorisation to the DEA.

Please also note that an amended application for environmental authorisation will be submitted to the Department of Environmental Affairs (DEA) to include the following changes:

- The current applicant "Aurora Power Solution" has established a Project Company to manage the proposed facility. The project applicant for the development will, therefore, be amended to K2012114124 (South Africa)(Pty) Ltd. (to trade as 'Adams Solar PV Project Two').
- The project scope has been expanded to include a new substation within the PV plants footprint. The reason being that the current substation on site cannot accommodate additional electrical grid access for the Adams Solar PV Project Two project.

The EIA was commissioned to determine the available area for construction of the PV facility, taking all environmental aspects into consideration. A site layout plan integrating all the relative specialist assessments was developed (See Figure 11-1 & Appendix 1). The plan identifies areas on the site that are considered to be viable from environmental perspective, and where development should occur. 558 hectares of 878 hectares assessed have been proposed for authorisation.

Renewable energy power plants in South Africa are new phenomenon, but the potential for the development of more facilities, specifically using solar power in the Northern Cape, is huge. As one can see from the national solar radiation map (Figure 2-1), the levels of solar radiation in the north-western extent of the Northern Cape are very high (>8000 Wh/m²/day). This potential for electricity generation via a renewable energy source is significant, and must be sustainably used.

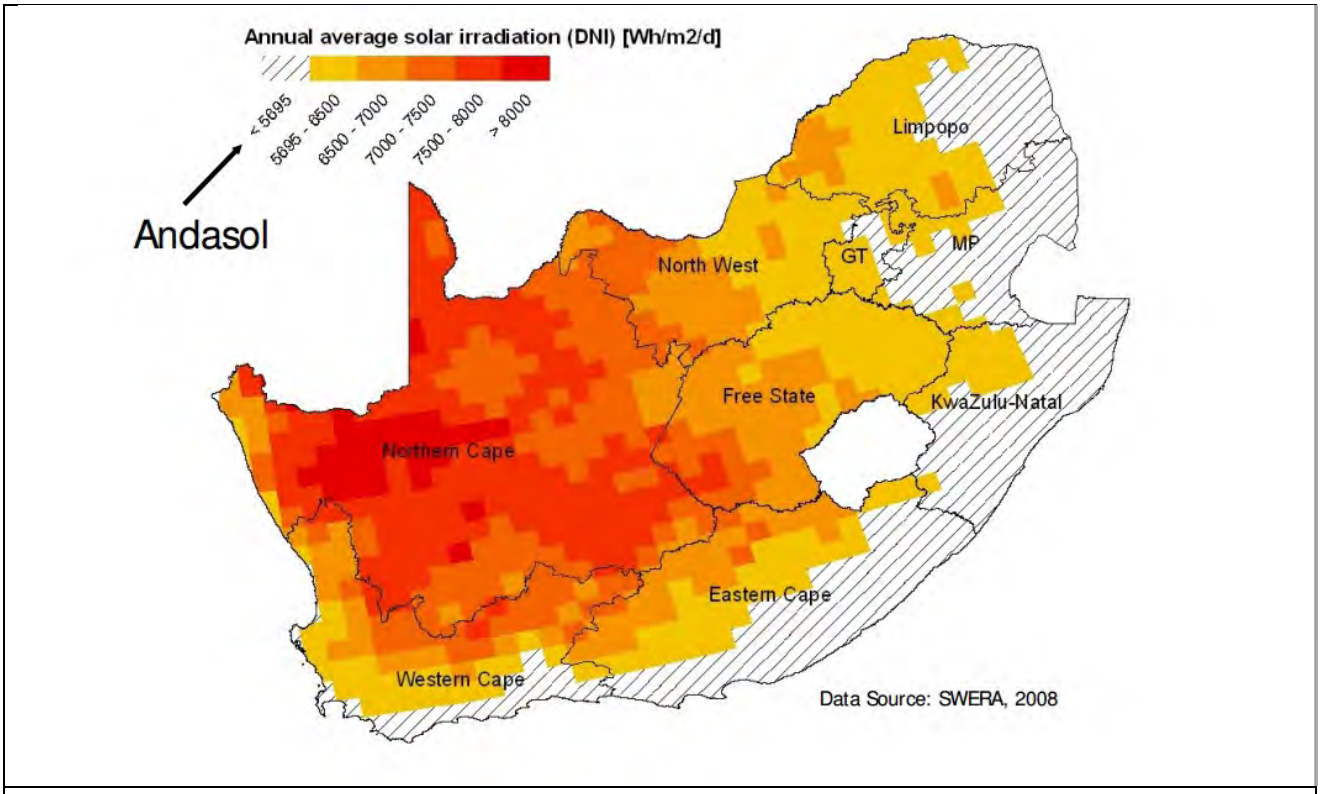

Figure 2-1: Annual Solar Radiation map (Source: SWERA, 2008)

The EIA is considered one of the early steps in evaluating the feasibility of a project of this scale. EScience Associates (ESA) has been appointed by Aurora Power Solutions (Pty) Ltd (APS) as an independent Environmental Assessment Practitioner (EAP) to conduct the scientific investigations of the EIA, and to facilitate the associated legal and administrative processes on their behalf. The main aim of the EIA is to assess the significance of potential environmental and socio-economic impacts, and to provide this information to the public and relevant Government Authorities who are responsible for making decisions on the environmental approvals that the project would require before it may commence. The key Competent Authority (CA) responsible is the National Department of Environmental Affairs (DEA).

The proposed project would include several, 'Listed Activities', which may not commence prior to obtaining an Environmental Authorisation in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 R.545 and R546 of 18 June 2010, was submitted to the Competent Authority (CA), the national Department of Environmental Affairs (DEA), on 17 November 2011. The application was acknowledged on 23 November 2011(Appendix 2), and issued with the project reference number **12/12/20/2567**.

Due to the nature and/or scale of some of the activities that would be associated with the proposed project, NEMA requires that the potential environmental impacts must be

considered, investigated, assessed and reported on to the CA through a Scoping and detailed Environmental Impact Assessment process, described in Regulations 26–35 of Government Notice R.543 (the NEMA EIA 2010 amendment Regulations), promulgated in terms of Section 24(5) of NEMA. The nature and extent of the solar facility as well the significance of potential environmental impacts associated with the proposed development (Construction, Operation and Decommissioning Phases) are reported on in the Environmental Impact Report (EIR).

The site investigated for the proposed PV power plant and new substation has been selected for, amongst others reasons, its proximity to existing electrical grid infrastructure, the location in terms of annual average direct irradiation, and its topography. Figure 2-2 below shows (in shaded black) the ideal position of solar power plants in the Northern Cape, taking into consideration annual average direct normal irradiation > 7.0 kWh/m^2/d, slope < 1%, distance to high-voltage transmission lines < 20 km, and absence of environmentally sensitive areas. The proposed site is indicated by the red dot on the map.

Although the map below indicates potential suitability for the installation of large concentrating solar thermal power plants (a different type of solar power generation technology than the proposed PV technology), the information can be applied to PV power facilities, and the site for the proposed photovoltaic solar power plant is accordingly considered to be in an ideal position to take advantage of the required environmental conditions for sustainable renewable electricity generation. The EIA-process does, however, recognize the site specific nature of environmental aspects, and a site-specific EIA was conducted.

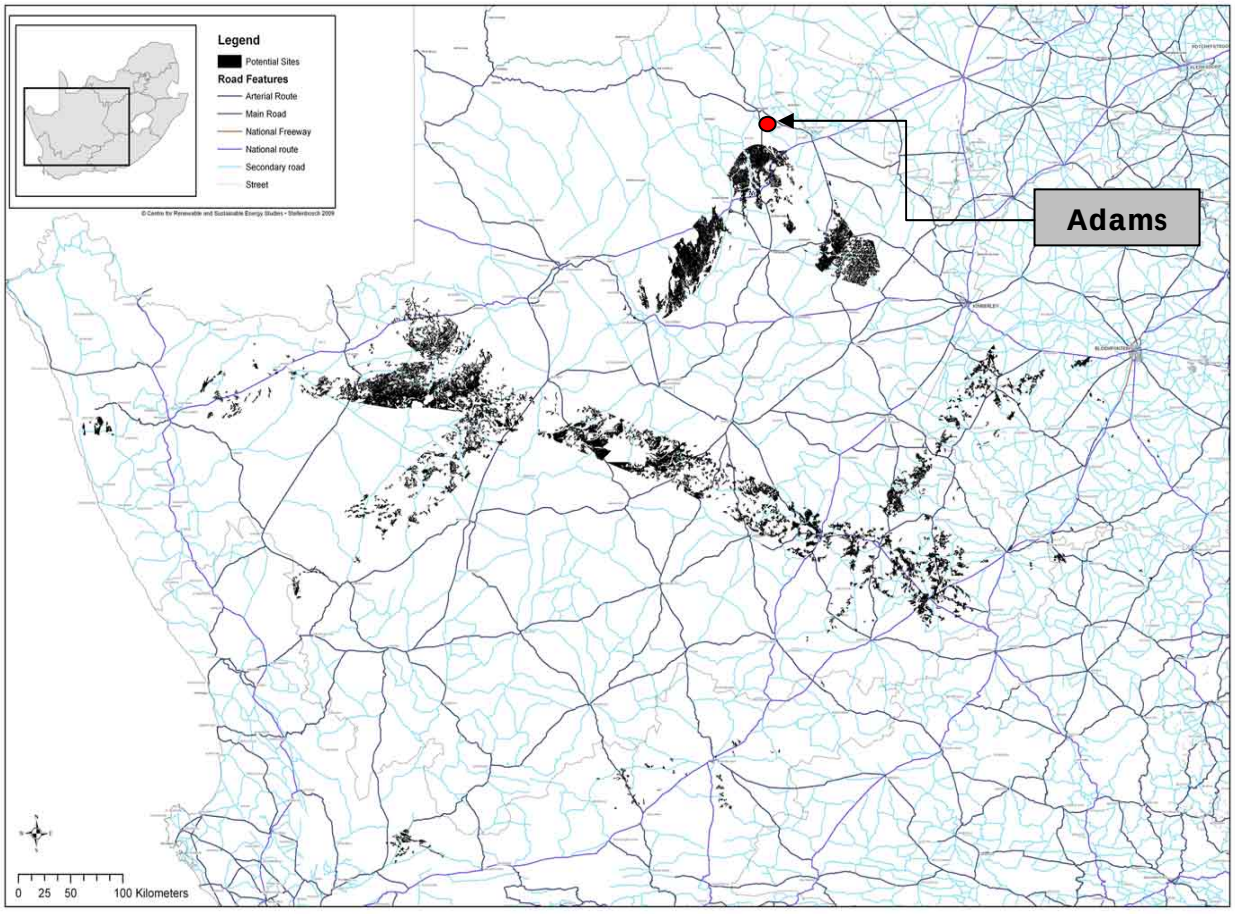

Figure 2-2: Map of South Africa indicating areas which are suitable for the installation of large concentrating solar thermal power plants. Source: http://www.crses.sun.ac.za/html/solar.htm

2.2. WHAT IS AN EIA?

An Environmental Impact Assessment (EIA) is a methodical and systematic process to identify potential positive and negative impacts on the bio-physical, socio-economic and/or cultural environment that may result from an activity (i.e. establishment and operation of a PV solar power generation facility). The minimum requirements for EIA practice in South Africa are largely prescribed in Regulations (GN. R. 543 of 18 June 2010) under the National Environmental Management Act (Act N0. 107 of 1998)[NEMA]. The 2010 NEMA EIA Regulations lay out clear enviro-legal administrative requirements for the EIA process, public participation (stakeholder engagement) and reporting alike.

An EIA in South Africa is predominantly undertaken in response to, and within the bounds of, a well-defined and robust legal framework (Aucamp, 2010). A myriad of 'environmental' Acts, Regulations, Policies and Guidelines have relevance in this regard (refer to Section 4), all of which aim at giving effect to the fundamental environmental rights enshrined upon all South African Citizens within section 24 of the constitution, 1996 (Act No. 108 of 1996)(Fugle and Rabie, 2009).

The EIA aims to ensure effective compliance and governance concerning the sustainable use of environmental resources, while simultaneously focusing on key issues such as stakeholder empowerment, and providing access to relevant and concise information to enable informed decision-making by competent authorities exercising a regulatory role in any aspect of the project. The EIA process is also used to examine alternatives and management measures to minimise negative and optimise positive impacts resulting from a project, or activity. The ultimate objectives of the EIA process are to prevent significant detrimental impact on the environment and to ensure sustainable development into the future.

An EIA should not aim to stop, hinder or obstruct development, but should rather act as a 'green-filter' to development proposals, and seeks to ensure that developments/activities proceed in an environmentally acceptable and sustainable manner (unless of course significant impact may result from an activity that truly renders the undertaking of that activity 'fatally flawed').

The EIA has to consider the different perspectives and requirements of all role players, who derive different benefits from participating in the EIA process. These include the following:

- Decision-making Authorities:
  - Enabling informed decision-making;
  - Ensuring protection of environmental quality;
  - Supporting the management, monitoring and sustainable utilisation of resources; and
  - Understanding demands on bulk services, waste disposal sites, etc.

- Project Proponents:
  - Pro-actively considering environmentally sustainable design and management principles in all that they undertake;
  - Investigating natural resource opportunities and constraints;
  - Identifying the risks and opportunities associated with environmental and operational aspects;
  - Evaluating the potential for pollution and the prevention thereof; and
  - Optimising energy, water and other resource use.

- Interested and affected parties (IAPs):
  - Providing an opportunity to be informed and give comment / express concerns;
  - Protecting environmental rights;
  - Utilising local and indigenous knowledge;
  - Increasing knowledge and environmental awareness; and
  - Informing the decision-making process.

2.3. PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

This section of the report gives a brief background of the purpose of the Environmental Impact report (EIR) as there is more often than not misinterpretation between the Scoping phase and the Environmental Impact Assessment phase of the EIA process. The Scoping and Environmental Impact Assessment (EIA) process flow diagram is presented in Figure 2-3.

The EIA process is divided into two main phases: Scoping and EIA. Scoping is a critical stage of any EIA process, and it is the initial step in involving interested and affected parties (IAPs) in environmental considerations for all stages of planning and development processes. Scoping involves the identification of various priority issues from a broad range of issues that should be addressed in the EIA, therefore scoping is the first critical step in compiling an EIA. Its main purpose is to identify the most important and significant issues that must be further investigated as part of the EIA and exclude issues that are of no concern; it therefore focuses the assessment on key issues.

Scoping focuses the EIA process on significant issues and always involves participation by interested and affected parties (government, the public, proponent and industries) in order to help identify key issues of concern. It gives IAPs an opportunity to participate in planning decisions of the development.

The above scoping process resulted in a final Scoping Report and plan of study for EIA (PoSEIA) for the competent authority. The final Scoping Report and PoSEIA were approved on 21 August 2012 by the DEA. The detailed visual, heritage, soil and biodiversity studies were then undertaken and finalised and have been made available for stakeholder review, together with this draft EIA Report and draft Environmental Management Plan (EMPr) (See Appendix 3).

This EIR therefore includes the investigation undertaken as outlined in the Scoping Report and the PoSEIA. All the relevant aspects identified in the scoping process have been investigated and assessed in detail (see Section 10 of the EIR), to determine the significance of each potential identified impact and accordingly apply relevant mitigation measures. These mitigation measures will ensure that impacts likely to occur are reduced/ eliminated as to protect the integrity of the receiving environment.

The Environmental Impact Assessment phase of the EIA process (See Figure 2-3) therefore assesses the impact of all significant impacts and alternatives on the environment in order to propose adequate mitigation measures (Aucamp, 2009).

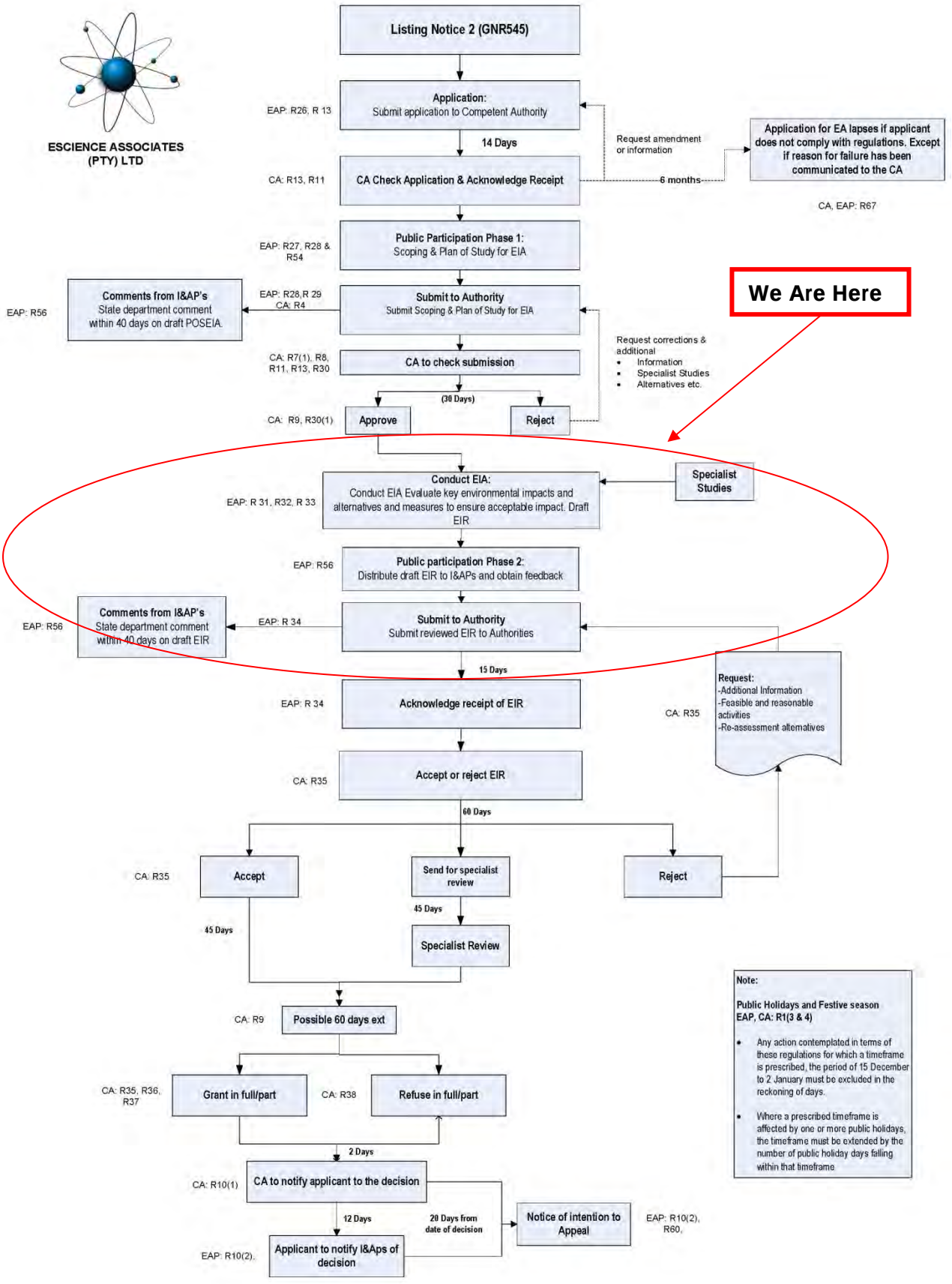

Figure 2-3: Scoping & EIA Process as prescribed by the NEMA 2010 EIA regulations (ESA, 2012)

2.4. DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

The Environmental assessment for this application was undertaken by EScience Associates (Pty) Ltd. (ESA), as independent Environmental Assessment Practitioners (EAP's) to Aurora Power Solutions (Pty) Ltd. The Environmental Impact Assessment study team was led by Mr Hanre Crous, senior environmental scientist with more than 13 years' experience in environmental management, with Roelof Letter in the EIA project management role (see Appendix 8 for relevant CVs).

Table 2-1: Details of the EAPs

Name	***Qualification***
Hanre Crous	MSc Zoology
Roelof Letter	BSc (Hons) Environmental Management

2.4.1. LIST OF SPECIALISTS AND SPECIALIST STUDIES UNDERTAKEN AS PART OF THIS EIA

A brief list of specialists and specialist studies which were undertaken are shown in Table 2-2 below:

Table 2-2: List of Specialists and Specialist Studies

	Specialist Study	***Specialists***
1	Environmental Legal Review	Hanre Crous and Roelof Letter (ESA)
2	Biodiversity/ Ecological impact assessment	Simon Todd, Simon Todd Consultancy
3	Archaeology and Heritage impact assessment	Mr Anton Pelser (Archaetnos Consultants)
4	Desktop Paleontological assessment	Bruce Rubidge; University of the Witwatersrand.
5	Visual impact assessment / GIS / 3-D visualizations	Emmanuel Tshuma (ESA) and Kotie Geldenhuys (Propaganda Studios)
6	Soil impact assessment	Bradley Thorpe and Roelof Letter (ESA) in consultation with Prof. A. Claassens (Soil science and plant nutrition consultant)
7	Cumulative impact assessment	Hanre Crous and Roelof Letter (ESA)
8	Environmental reporting, public participation, project management	Roelof Letter & Hanre Crous (ESA)

2.5. LAND, LANDOWNER DETAILS AND SURFACE RIGHTS

The EIA was undertaken on a portion of the farm Adams 328 approximately 21 km south of Hotazel on the R380 in the Northern Cape Province. Figure 2-4 indicates the area within the farm Adams which was identified as a potential location of the solar facility and that was assessed in detail as part of the Environmental Impact Assessment process, including the location of the existing Dougnor substation (see Figure 2-3). The delineated study area is 878 hectares in special extent.

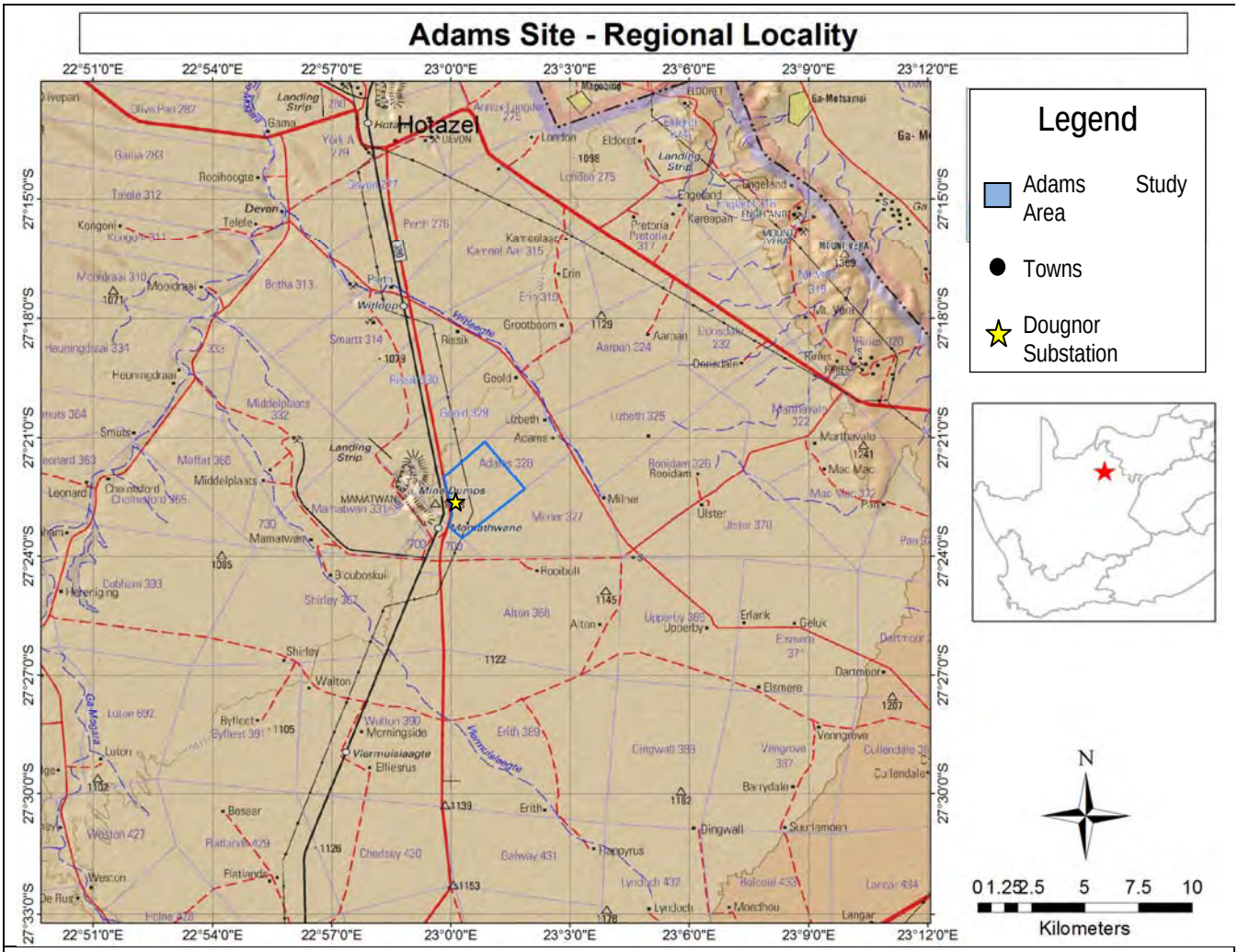

Figure 2-4: Topographical locality map of Adams farm

The project proponent is not the owner of the property, but they have entered into a lease agreement with the owners (Saltrim Ranches represented by Mr. Hendrik Venter).

Table 2-3: Details of the farm Adams 328	
Farm Portion	Owner/ contact person
Portion 0 (remaining extent) of the farm Adams No. 328 approximately 21km south of Hotazel on the R380 in Northern Cape.	Saltrim Ranches/Mr. Hendrik Venter

Table 2-4: Surveyor General 21 digit codes for farm Adams included in the EIA process:																			
Surveyor General 21 digit codes for farm Adams 328 included in the EIA process:																			
C	0	4	1	0	0	0	0	0	0	0	0	0	3	2	8	0	0	0	0	0

Table 2-5: Municipality and regional details	
District Municipality:	John Taolo Gaetsewe District Municipality
Local Municipality (LM):	Joe Morolong Local Municipality
Nearest town/city:	Hotazel

2.6. THE PROPONENT (APPLICANT)

Aurora Power Solutions (APS) is a renewable Energy and Energy Efficiency project management Company. Their main focus is on delivering long-term alternative energy solutions for industrial and commercial customers, from concept to implementation. APS focuses on developing large scale grid connected Solar Power projects to financial closure and commissioning in sub-Saharan Africa. APS's aim is to de-risk the project by performing several project development activities so as to maximise shareholder returns. These activities include:

- Site identification
- Solar Resource Measurement
- Permitting and Licensing
- Technology Assessment and design
- Project Finance
- EPC Structuring

APS has successfully developed four projects for the IPP procurement programme two of which have been given preferred bidder status and are being finalised for construction.

2.7. PROJECT MOTIVATION, NEEDS AND DESIRABILITY

The proposed activity would entail the construction of a solar power (Photovoltaic) generation facility. With populations in South Africa growing rapidly, and the need for "green" energy (such as wind and solar power) becoming more prevalent, the project aims to provide a sustainable, renewable energy resource for present and future generations. The positive aspects of using solar power far outweigh the negative compared with conventional power generation utilising fossil fuels. The proposed site will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa is proposed to be obtained from PV solar sources over the next twenty years.

A target of 10,000 GWh of renewable energy was set by the South African government for 2013, due to the high level of renewable energy potential in the country. In order to contribute towards achieving this target, to initiate the renewable energy industry in South Africa, and promote socio-economic and environmentally sustainable growth, a market mechanism needed to be established. The Independent Power Producer (IPP) Procurement Programme was introduced in 2011 for the procurement of renewable energy projects. A maximum tariff was set for each technology and developers would bid for projects and compete on a competitive price basis to obtain approval of projects from the Department of Energy.

The IPP Procurement Programme promotes the government's 10,000 GWh 2013 Renewable Energy Target and also encourages competitive markets in long term sustained growth of renewables in comparison with conventional power generation. South African electricity generation from renewable energy offers various socio-economic and environmental benefits, including:

- Increased energy security: The current electricity crisis outlines the need for more sustainable sources of electricity generations as the number of consumers increases. A grid connection with renewable energy acts as an alternative source of electricity as traditional sources become strained and more expensive.

- Resource savings: Water and natural resources can be saved by using solar technologies as conventional coal-fired power plants are major consumers of valuable natural resources.
- Pollution reduction: Major by-products of fossil fuel burning such as nitrogen, oxides and sulphur have a detrimental impact on human health though the formation of smog and cause the spread of respiratory illnesses. PV solar generation transforms solar radiation directly into electrical energy and therefore no toxic pollutants are emitted.
- Employment creation: The development, scale, installation, management and maintenance of solar facilities have significant potential for job creation in South Africa.

The activity will provide local communities in the Joe Morolong Local Municipality area with several benefits including job creation, socio-economic development and infrastructural investment into the area. Society in general will also benefit, as the proposed project will create electricity without any emissions to air, i.e. zero carbon emissions. This is in contrast to coal-fired power stations, for example, which have significant carbon emissions and require vast amounts of water for power generation. Society will be benefit as less carbon emissions means less global climate change, which means healthier and better functioning environmental ecosystems on the planet. Further to this, according to De Jong 2011, *solar development has the "potential to create sustainable employment in the Northern Cape while addressing some of the fundamental drivers of Climate Change. Being one of the pioneers of solar power in South Africa the project has the inherent role of developing solar power technology for the region. The viability and success of this project is strategic to paving the way for sustainable power technologies in this region. This is a project of strategic and national importance and capable of enhancing South Africa's position in the global technology arena while aligning the commitments made by South Africa in Copenhagen."*

3. PROJECT DESCRIPTION

3.1. PROCESS DESCRIPTION

3.1.1. PROPOSED PHOTOVOLTAIC ONSITE INFRASTRUCTURE

Photovoltaic power production has been doubling roughly every 2 years, increasing by an average of 48% each year since 2002, making it the world's fastest-growing energy technology. The volume of new grid-connected PV capacities world-wide rose from 16 GW in 2010 to 27 GW in 2011. This increased the total installed PV capacity world-wide to over 67 GW at the end of 2011. Roughly 90% of PV generating capacity consists of grid-tied electrical systems. Such installations may be ground-mounted (and sometimes integrated with farming and grazing) or built into the roof or walls of a building, known as Building Integrated Photovoltaics. Due to the growing demand for renewable energy sources, the manufacturing of solar cells and photo-voltaic modules has advanced dramatically in recent years.

Photovoltaics (PVs) are materials that convert solar radiation directly into electricity. Photovoltaic solar cells are divided into two distinct groups: Traditional crystalline silicon solar cells and thin film solar cells. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the photovoltaic effect. The crystalline silicon solar cells are made from monocrystalline or polycrystalline silicon. The thin film technologies are comprised of thinner layers of semiconductor material which are produced using a splutter process. Photovoltaic solar power plants comprise of solar modules connected together to form solar arrays for the production of electricity. Direct

current electricity is produced from the solar array which in turn is connected to inverters for conversion to alternating current. Power from the inverters is then stepped up via transformers to voltages suitable for injection into the national grid for distribution to consumers.

Solar power plants can either have fixed tilt systems or tracking systems as shown in the diagrams below. Modules in a fixed tilt system are mounted at an optimised angle facing the sun. With tracking systems, the surface of the arrays is moved to follow the sun resulting in large radiation gains. Systems can be set to track the sun's daily path and/or its annual path. Figure 3-1 below shows a typical example of a fixed tilt PV array and Figure 3-2 shows a typical example of a tracking PV array. (these are only illustrative examples of the technology).

The proposed project may potentially also use Concentrated Photovoltaic (CPV). CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so, increase the electricity generated. These CPV panels are mounted on tracking systems as to maximise the collection of energy from the sun. The concentrated light improves the efficiency of the cells and reduces the amount of expensive solar cell material needed to produce a specific amount of electricity. Some of these CPV panels can generate twice as much power per hectare in comparison with conventional solar panel technology. Certain designs of CPV use 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 4-1). CPV panels are mounted on a dual axis system and installed with tracking systems to maintain 0.8 degree angles with the sun throughout the day (Bullis, 2011).

Figure 3-1: Fixed tilt PV array (sourced http://explow.com/solar_panel)

Figure 3-2: Tracking PV array (sourced http://solarblog.ca)

Photovoltaic (PV) arrays can be up to several hundred hectares in spatial extent. The panels are mounted on metal structures that are fixed into the ground, either through a concrete foundation or a deep seated screw. Central inverters are wired to sections of the PV field, which can have a rated power of 500 kW-1250 kW each. The inverter is a pulse width mode inverter that converts DC current to AC current at grid frequency. A typical central inverter rated at 500 kW has a size of approximately 3 m x 2.5 m x 1 m and an output voltage of 480 V Alternating Current (AC).

The grid connection requires transformation of the voltage from 480 V up to between 22,000 V and 400 000 V depending on the existing infrastructure. The normal components and size of a distribution rated electrical substation is also required. Tracking Arrays (Figure 3-2) comprise of one (single axis) or two (dual –axis) motors and a sun sensor used to track the sun. The motors usually contain gears and moving parts that need greasing from time to time.

The solar power generation facility is proposed to accommodate an array of photovoltaic (PV) panels with a generation capacity of approximately 169 MW, depending on the specific technology, covering the 558 hectares identified feasible area of the site. (Refer to Sections 10 & 11). Approximately 1.5 – 2 hectares are required per MW of installed PV panels. The following infrastructure is required for the establishment of PV solar facilities:

- Foundations to support the PV panels.
- The plant consists of arrays of photovoltaic (PV) panels: The panels are placed in a number of rows with a buffer from the boundary fence and access roads in between the each row. Panels will have a junction box located below the rows

where all connections between rows meet up. Underground cables run from this box to the inverter/transformer house at 400 V-1000 V Direct Current (DC).

- Panels will be placed on a fixed rotating structure, which is done to ensure up and down movement to ensure maximum absorption of solar radiation. Each of these arrays of panels is expected to be approximately 3 m in height for fixed arrays, to 9 m for tracking systems.
- Access and inside roads/paths – An access road to the site as well internal roads between the PV arrays will need to be constructed.
- Trenching – all DC and AC wiring within the PV plant must be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass. Cable trenches will be approximately 600 mm (0.6 m) deep and 400 mm (0.4 m) wide and backfilled with sand. Manhole covers will be placed every 40 m or at each direction change. A concrete slab will be placed where vehicles pass over cable trenches.
- Inverter/transformer building-- 6 m X 3 m brick buildings located within the PV array each containing an inverter and a step up transformer will be constructed in the plant. The number of buildings will be dependent on the size of plant and inverters chosen. Alternatively a pre-packaged inverter/transformer housed in a concrete substation for outdoors can be utilised.
- Combined guard house/ control room – One (1) brick building of approximately 100 m^2 on the perimeter of the plant. Guardhouse will include a small kitchen and toilet. Building will include a storeroom for spare parts kept onsite. The control room will contain switchgear and monitoring equipment for the PV plant. The buildings will be a standard height of approximately 3 m.
- Connection to grid: The grid connection requires transformation of the voltage from 480 V to between 22,000 V and 400,000 V depending on the available infrastructure. The normal components and size of a distribution rated electrical substation will be required. A new substation would need to be constructed to accommodate the grid connection for the proposed facility as the existing Dougnor substation does not have capacity to accommodate the facility. A new 132kV line is already under construction by Eskom which passes though the site and will be used to export the power from the solar PV facility
- A small switching station for the plant will be located on the outside of the control room.

3.1.1. PROPOSED NEW SUBSTATION WITHIN THE PV DEVELOPMENT FOOTPRINT

There is a new 132kV line currently being built parallel to the existing 132kV lines by Eskom to handle increased loads in the mining area near Umtu. The proposed solar PV development intends to connect into this line that runs past the site (see Figure 3-3). The work required will be to break the 132kV line and use a loop in loop out connection, thereby creating a new substation which will form the connection node for the proposed PV development. The scope of work for the new substation will include the following and the physical footprint will not exceed 200m x 200m (4ha):

- Build Substation 200m x 200m (maximum)
- Build control room, security gates.
- Install security fence
- Add yard stone
- Loop in the 132kV feeder from the Ferrum – Umtu 132kV line
- Build 2 132kV HV Line bays
- 132kV Busbar sections (Tubular)
- Install 100MVA Transformer

- Include 132kV connection lines from the substation to the PV facility.

Eskom allows the developer to construct the substation under their self-build policy, and upon completion, the asset is ultimately transferred into the ownership of Eskom. If, in the unlikely event that Eskom insists on building the substation themselves, the approval for the substation build may need to be transferred to Eskom.

The PV development will require a facility substation on site and construction of a 132kV line from each facility to connect to the new proposed substation.

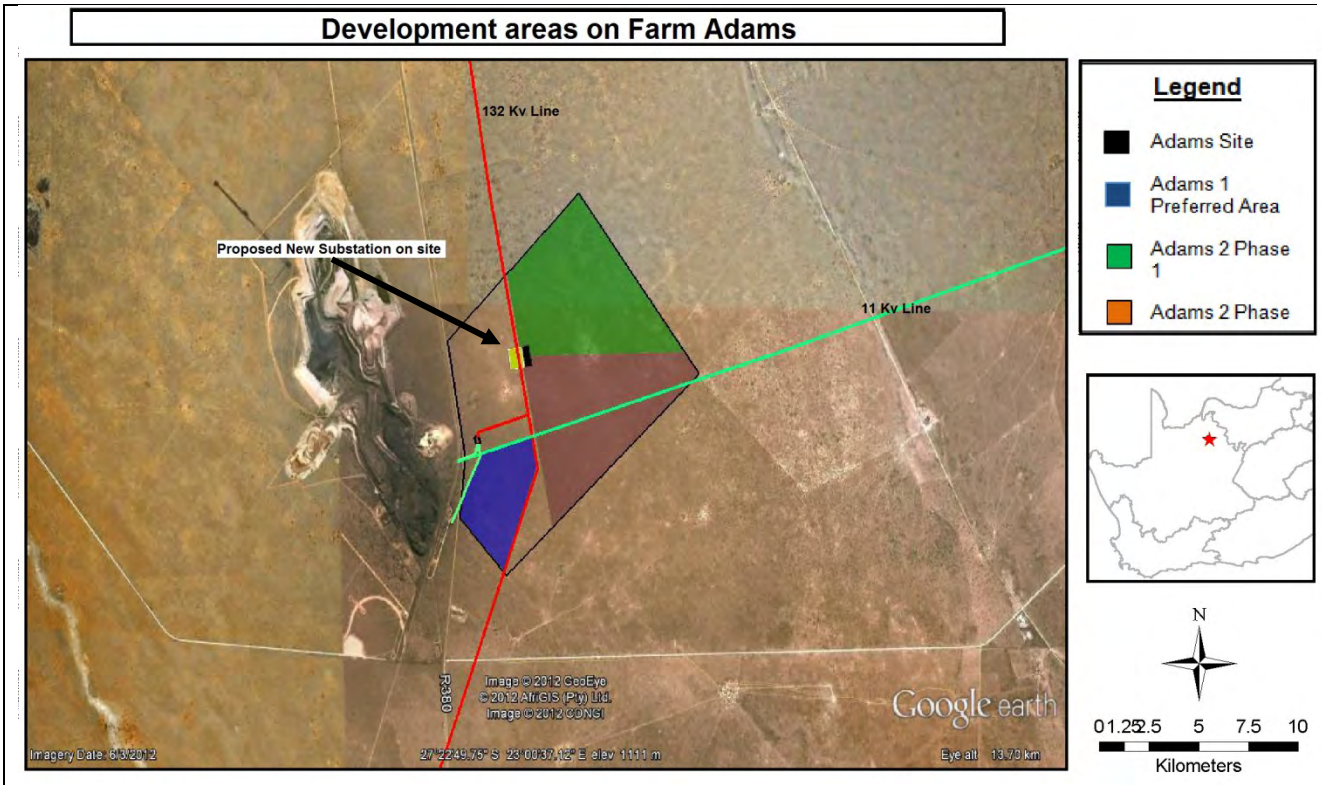

Figure 3-3: Proposed locality of the proposed substation within the farm Adams 328.as part of the subject project.

Figure 3-4: Existing Dougnor substation within the farm Adams 328.

3.2. ACTIVITIES PROPOSED DURING DEVELOPMENT STAGES OF THE PROJECT

3.2.1. CONSTRUCTION PHASE

The physical construction (footprint) of the Adams Solar PV Project Two will commence with a 75MW facility that will cover the 281 hectares identified as the phase one (1) development area including the proposed substation development footprint of four (4) hectares (See Figure 11-1). Subsequent allocations will be determined by the DoE via the IPP procurement programme, but will most likely result in a facility covering the entire identified feasible area by proceeding with Adams Solar PV Project Two Phase 2 covering a physical footprint of 281 hectares. The feasible development area was determined after all relevant specialist work and other environmental factors were considered.

There will be approximately 100 - 200 construction workers on site. The majority of the construction workers will be sourced from local communities and will be transported to the site during construction. Please refer to Section 10.3.9 for a detailed discussion regarding socio-economic issues. The typical procedures for the construction phase of the PV facility and are as follows:

- Establishment of access roads: During the construction period internal roads need to be established. There are a number of permanent roads that need to be established for operation and will be gravel based. Existing roads will be utilised as far as possible.

- Preparation of the site: Vegetation will need to be cleared for the footprint of the PV infrastructure, new substation as well as for the access roads to the site/internal roads and the laydown of the yard, etc. Topsoil stripping from the construction of access roads and infrastructure would need to be stockpiled and used to rehabilitate areas of the construction footprint.
- Transportation of equipment and components to the site: The main component of the proposed facility would be transported by road to the site. Excavators, graders, trucks and compacting equipment will need to be brought to the site.
- Establishment of workshops, temporary laydown areas and construction camps: Dedicated laydown and equipment camps will be established for the storage of all of the equipment that will be brought to the site. Fuel will be stored on-site during construction; appropriate mitigation measures must be employed to ensure no pollution occurs as a result.
- Construction of the PV array and transmission infrastructure: Two potential alternative foundations options are being considered for the facility. The PV panel array will either be excavated, or will use a ramming system for the support structure that does not require excavation. These options would however be dependent on the geotechnical condition of the ground. Concrete and aggregates would need to be brought to the site. Trenches would also need to be excavated for underground connection of the panels to the inverters and subsequently to the plant substation. Overhead transmission lines will be required or connection to the new substation. The proposed facility would require approximately 5000 m^3 per year for the duration of the construction period.
- Site rehabilitation: Removal of all construction equipment from the site and rehabilitation of areas where reasonable and practical.

3.2.2. OPERATIONAL PHASE

The PV solar facility operational lifespan is estimated at approximately 20-25 years. The typical activities during the operational phase would be as follows:

- Operation of the electrical infrastructure and PV panels: Incoming solar radiation will be converted by the PV panels into electrical energy; associated inverters will convert this electrical energy into alternating current. This alternating current will be stepped up via transformers to grid voltage and transmitted via overhead cables to the new substation. Electrical and mechanical routine maintenance will also be carried out. Regular cleaning of the panels is also required and very labour intensive.
- Cleaning of PV panels using water: The major maintenance of the PV plant is that it requires quarterly cleaning with water to remove dust from the panels. It is proposed that the groundwater will be abstracted on site for these purposes. This water will temporarily be stored in tanks on site. The option of sourcing water from a water services provider in the area is also available. The panels would need to be cleaned of dust quarterly. The water requirements for each 75MW facility would be approximately 2500 m^3 per annum.
- Site security: Security will be stationed 24 hours a day on the site. The entire development area would have to be fenced off and security cameras installed.

3.2.3. DECOMMISSIONING PHASE

The proposed PV facility is expected to be decommissioned after 20 -25 years, but the operational time could be extended if economically viable. If the economic life is extended, this would mostly involve disassembling components and installing more appropriate technologies of the time. However, if it is decided to close the facility, the site would need to be prepared to accommodate the relevant decommissioning activities.

This would most likely be followed by the disassembling of all the individual components of the entire plant. All materials that could be recycled/ reused, including the panels and support structures, would be identified and managed accordingly. All foundation materials and associated infrastructures would need to be removed and disposed of at an appropriate landfill. Once the entire facility has been removed the area should be reshaped and re-vegetated as to ensure that the environment is rehabilitated to a similar degree as before. A decommissioning and closure plan would therefore be required at end of life of the facility and approved by the DEA before commencement.

3.2.4. SERVICE AVAILABILITY

Due to the distance from the towns Hotazel and Kathu, municipal services are not directly available for the site. As around 100-200 construction workers will be stationed temporary on site during working hours and security personnel will be stationed on the site during the operational lifespan, sanitation, water, refuse and electricity facilities will be required to supplement service requirements during construction and operation. The site will be serviced as follows:

- Electricity: As the nature of the proposed facility is the generation of electricity through solar radiation, the facility requires minimal auxiliary power. During the construction, operation and decommissioning periods the electrical requirement would be supplied through auxiliary power from Eskom and diesel generators where necessary.
- Water: The construction period would be characterised with the largest consumption of water for construction, machinery and domestic use. During operation/construction water will be supplied to the site under agreements between the municipality and the project company. If insufficient water quantities are obtained from the municipality a water use licence for abstraction of groundwater would be obtained.
- Sewage: Mobile chemical toilets will be used as far as possible for the construction/operational phase. However various alternative methods do exist some which require limited amount of water such as waterless toilet systems and bio digester systems which have been investigated by the proponent. The method chosen should be done in line with the EMPr of the site, to ensure that the method employed does not cause a significant impact.
- Waste Management: During the construction/operation phase all attempts will be made by the proponent to implement the general principles of integrated waste management through the waste hierarchy. This hierarchy includes: waste minimisation, waste reduction, waste recycling and finally disposal to an approved municipal facility. The waste generated during the construction phase will be mainly packaging, general construction and domestic waste; however the majority of waste produced during operation is of domestic nature.

4. ALTERNATIVES

Alternatives were introduced into South Africa's environmental legislation to encourage project proponents to consider different ways of doing things that would have different environmental impacts, whilst still achieving the desired development goal. Going through the process of identifying and comparing alternatives will likely yield improvements to the original concept proposal. The ultimate goal of consideration of alternatives is to both reduce negative environmental impacts and to increase or introduce positive environmental impacts.

4.1. SITE ALTERNATIVES

At present there are no alternative sites being considered for this particular project, but the optimum location for placement of all components of the solar facility within the existing study area will be selected primarily on the basis of environmental considerations. Renewable energy facilities require certain natural elements to ensure proper functioning of the facility. This most often result in site alternatives not being possible. These elements include the following:

- **Topography and site slope**: The placement of the panels requires mainly flat topology with no mountains or hills in the immediate vicinity that would need excessive earthworks or cause shading issues.
- **Grid connectivity**: The site selection is restricted to areas were available electrical grid connection is available. The current site has been selected based on its close proximity to Dougnor Substation. Through consultation with Eskom, it was identified that the Dougnor substation will not have the required capacity to accommodate grid access for the 75 MW facilities. A new substation would need to be constructed for connection of the solar PV facilities to the new 132kV power line (See Appendix 1 & Figure 11-1).
- **Site Access:** The site is accessible from the R380 connecting the towns of Kathu and Hotazel.

4.2. TECHNOLOGY ALTERNATIVES

In terms of technology alternatives, it should be noted that both the proposed technology and its alternative can be implemented on site separately or in combination. The alternative technology that should be considered is Concentrated Photo-voltaic (CPV). CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so, increase the electricity generated. These CPV panels are mounted on tracking systems as to maximise the collection of energy from the sun.

The concentrated light improves the efficiency of the cells and reduces the amount of expensive solar cell materials required to produce an equivalent amount of power in a comparable PV array. In comparison to normal PV panels, certain designs of CPV use 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 4-1). These panels are all mounted on a single axis installed with tracking systems to maintain 0.8 degree angles with the sun throughout the day (Bullis, 2011). The CPV technology is more expensive, larger (8 meters high), has higher maintenance costs and requires more resources for installation compared to normal PV.

Figure 4-1: Example of Concentrated Photo-voltaic technologies (Bullis, 2011).

The materials used to construct these CPV panels are 95% recyclable due to the fact that the two main materials used are glass and aluminium (Lozanova, 2009).

Table 4-1: Comparison between PV and CPV

CPV vs. PV	
CPV	PV
Higher Efficiency	Lower Efficiency
Tracking Systems	Fixed and Tracking
Lenses/Mirrors/Panels	Panels
More Electricity	Less Electricity
Higher Maintenance Cost	Lower Maintenance Cost
Utility (Commercial)	All Markets
More Expensive than PV	Less expensive than CPV

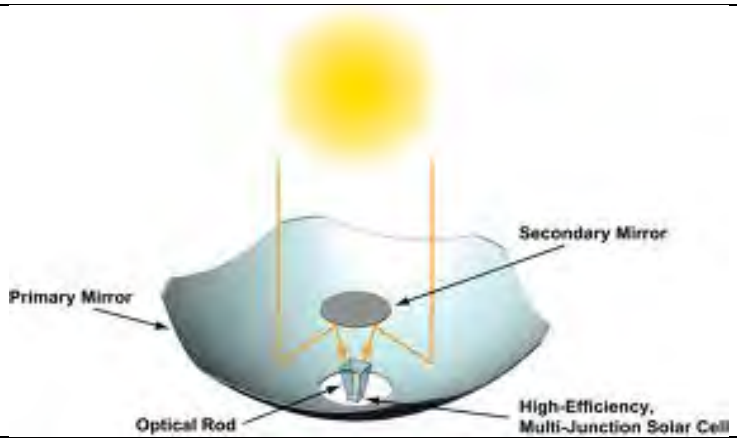

Figure 4-2: Diagram showing Concentrated Photo-voltaic technology (CPV) (Lozanova, 2009).

4.3. ALTERNATIVE GRID CONNECTIONS

Connection to the electrical grid is regulated by Eskom. The options that exist for connection to the grid are:

- Construction of an onsite switching station and the installation of a 132 kV line from the onsite station to the Dougnor or Milner substation, however these substations do not have the capacity to accommodate the proposed generation capacity of the solar PV facilities.
- A new substation would be constructed to connect the 132 kV lines from the onsite stations within the PV facility to the substation. This is the viable option.

4.4. NO-GO ALTERNATIVE

The no-go option refers to the alternative of the proposed development not going ahead at all. This alternative will avoid potentially positive and negative impacts on the environment, and the *status quo* of the area would remain. The implications of the no-go option will be evaluated as part of the EIA, focusing on comparing potential impacts from the proposed project with the *status quo*, and will be particularly relevant should it be found that detrimental impacts cannot be managed to an acceptable level.

Should this alternative be exercised the socio-economic and environmental benefits of renewable energy will not be realised. These benefits would include the following:

- Increased energy security
- Resource savings
- Exploitation of our valuable renewable energy resources
- Climate-friendly development
- Pollution reduction
- Support for international agreements
- Acceptability to society
- Employment creation

6. LEGAL AND POLICY FRAMEWORK

The following section is intended to provide an overview of all environmentally applicable legislation and associated regulatory requirements that need to be considered and addressed during the greater EIA process. The consideration of all relevant legislation will lead to improved decision making and the legally compliant commissioning of the proposed project.

6.1. CONSTITUTION OF SOUTH AFRICA

The Constitution of the Republic of South Africa (Act No. 108 of 1996) has significant implications for environmental management. The main effects are the protection of environmental and property rights, the drastic change brought about by the sections dealing with administrative law such as access to information, just administrative action and broadening of the *locus standi* of litigants.

These aspects provide general and overarching support and are of major assistance in the effective implementation of the environmental management principles and structures of the NEMA. Section 24 in the Bill of Rights of the Constitution specifically states:

- "Everyone has the right - to an environment that is not harmful to their health or well-being";
- "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."

6.2. EIA & ENVIRONMENTAL AUTHORISATION

NEMA is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in Section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legal foundation for sustainable environmental management in South Africa. NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the competent authority, in this case the DEA. Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called 2010 amendment EIA Regulations (GN R.543, R.544, R.545 and R.546; 18 June 2010).

Based on the potential significance of impacts, the Regulations identify specific activities that are either subject to a Basic Assessment process, or more comprehensive Scoping and EIA process. The proposed solar facility includes activities that require a Scoping and EIA. All activities are however included in the Scoping and EIA assessments, i.e., they are combined into a single application procedure. The activities that would be (or are likely to be) associated with the proposed solar facility are listed in Table 6-1 below. It should be noted that the two lists below are comprehensive, but some of the activities may eventually not proceed. The activities ultimately undertaken by APS will be based on the findings and recommendations of the EIA investigation and final project infrastructure design, including certain capacity thresholds and the feasibility of identified alternatives.

Table 6-1: Listed activities applied for in terms of the NEMA 2010 EIA regulations		
Listing	Activity number	Description of each listed activity
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more. *Reason: The proposed solar facility will have a power generation capacity of more than 20 MW.*
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex. *Reason: The proposed solar facility may transmit and distribute more than 275 kilovolts as they propose to connect to the proposed facility to a new substation proposed to be constructed on site.*
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply. *REASON: The proposed solar facility and new substation will be developed in phases and on completion the facility will be more than 20 hectares in spatial extent.*
Government Notice No 546 of 18 June 2010. "Listing Notice 3"	Activity 4	Road wider than 4 m with reserve less than 13.5 m *REASON: An access road to the facility is required, although the site has exiting access roads a small road would need to be constructed to the entrance of the facility.*
Government Notice No 546 of 18 June 2010. "Listing Notice 3	Activity 14	The clearance of an area of 5 ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation *REASON: The study area consists mostly of undisturbed least threatened Kathu Bushveld regional vegetation unit within the Savanna Biome*

The process of applying for Environmental Authorisation includes a requirement to conduct an initial Scoping phase, followed by a detailed EIA as part of the application process. The assessment process (Figure 2-3), aimed at identifying potential positive and negative impacts on the environment (biophysical, socio-economic, and cultural), is comprehensive and detailed in order to:

- Examine alternatives/management measures to minimise negative and optimise positive consequences;
- Prevent substantial detrimental impact to the environment;
- Improve the environmental design of the proposal;
- Ensure that resources are used efficiently; and
- Identify appropriate management measures for mitigation and the monitoring thereof.

6.3. DUTY OF CARE

The National Environmental Management Act, Act 107 of 1998, (NEMA) places a duty to care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the act states:

"28 (1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or
(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;
(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
(c) cease, modify or control any act, activity or process causing the pollution or degradation;
(d) contain or prevent the movement of pollutants or the causant of degradation;
(e) eliminate any source of the pollution or degradation; or
(f) remedy the effects of the pollution or degradation."

Consequently, in the context of this assessment, the owner/operator of the PV facility must take "reasonable steps" to prevent pollution or degradation of the environment that may result from the proposed facility and related activities. These reasonable steps include the investigation and evaluation of the potential impact and identification of means to prevent an unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

6.4. BIODIVERSITY

6.4.1. NATIONAL FORESTS ACT (ACT NO. 84 OF 1998)

There are a number of tree species that are protected according to Government Notice no. 1012 under Section 12(l)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of Section 1 5(1) of the National Forests Act, 1998 "*no person may cut, disturb,*

damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated)".

Acacia erioloba E.mey. and Acacia haematoxylon Willd were observed on the site as outlined by the specialist biodiversity assessment (Appendix 6.1). An application for a licence for the removal and/or relocation of these trees will be made with the Northern Cape: Department of Agriculture, Forestry and Fisheries (DAFF). The applicant will aim to avoid the unnecessary destruction of protected species during the detail design phase of the project. Where such avoidance may be impractical, the applicant will apply for the necessary permits to remove. The applicant will therefore make every effort to ensure that no trees are removed without the necessary permits obtained.

6.4.1. CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

As defined by the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), **conservation** is defined as: "in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources."

The objectives of the CARA, as stated in Section 2 of the Act, entitled "Objects of Act", are:

"The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants."

Furthermore, Regulation 5 of CARA entitled: "Prohibition of spreading weeds", states:
No person shall-

(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or

(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

Regulation 5 is noted, and the solar facility will strive to meet this requirement of CARA, and the management and mitigation measures to achieve this will be defined in the EIA.

Furthermore, Government Notice Regulation (GNR) 1048 of 25 May 1984 has been promulgated under the Conservation of Agricultural Resources Act (CARA). Amongst others, GNR 1048 defines the following key aspects:

"flood area: in relation to a water course, means the area which in the opinion of the executive officer is flooded by the flood water of that water course during a 1-in-10 years flood";

Utilisation and protection of vlei, marshes, water sponges and water courses

7. (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and sub regulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water

sponge or within the flood area of a water course or within 10 metres horizontally outside flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.

(2) Every land user shall remove the vegetation in a water course on his farm unit to such an extent that it will not constitute an obstruction during a flood that could cause excessive soil loss as a result of erosion through the action of water.

(3) Except on authority of a written permission by the executive officer, no land user shall-

(a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on his farm unit; or
(b) cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course.

(4) The prohibition contained in subregulation (3) shall not apply in respect of-

(a) a vlei, marsh or water sponge or a portion thereof that has already been drained or is under cultivation on the date of commencement of these regulations provided it is not done at the expense of the conservation of the natural agricultural resources; and
(b) Land within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course that is under cultivation on the date of commencement of these regulations, provided it is already protected effectively in terms of regulation 4 against excessive soil loss due to erosion through the action of water.

(5) The provisions of regulation 2 (2), (3) and (4) shall apply mutatis mutandis with regard to an application for a permission referred to in subregulation (3).

The proposed project would not impact any productive agricultural soils/ lands; there is also not a possibility that the facility would utilise vlei, marshes, water sponges or water courses as none are present.

6.4.2. NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEMBA also deals with endangered, threatened and otherwise controlled species, under the TOPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A TOPS permit is required for any activities involving any TOPS-listed species.

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. These activities may not proceed without environmental authorization. Those relevant to the current study are listed below.

6.4.3. REQUIREMENTS FOR BIODIVERSITY ASSESSMENTS

It is acknowledged that there are no national guidelines for biodiversity assessments; however, in November 2009, the Department of Agriculture and Rural Development: Directorate of Nature Conservation published the "GDARD requirements for biodiversity assessments" (Version 2). Although these guidelines are specific to the Gauteng Province, the essence of reporting on biodiversity issues and the minimum requirements for biodiversity studies can be adapted and used in any situation.

These guidelines will act as reference documentation for the reporting of biodiversity aspects on the proposed PV solar project.

6.5. NORTHERN CAPE CONSERVATION ACT (ACT NO. 9 OF 2009)

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences

19. No Person may –

(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (Schedule 2) to common (Schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under Schedule 1 or 2. Of relevance for the current development is the fact that several plant families and genera are listed in their entirety as protected, these include, inter alia *Mesembryanthemaceae*, *Amaryllidaceae*, *Apocyanceae*, *Asphodeliaceae*,

Crassulaceae, *Iridaceae* and *Euphorbia*. Although there are few species of conservation concern within these families and genera at the site, the species present within the development footprint will need to be listed with the permit application. A permit obtainable from the DENC permit office in Kimberly would be required for the site clearing. A permit would also be required to destroy or trans-located any nationally or provincially listed species from the site. A single permit, which covers all of these permitting requirements as well as meets TOPS regulations, is used in the case of this PV facility.

6.6. WATER

6.6.1. NATIONAL WATER ACT (NWA), 1998 (ACT 36 OF 1998)

The National Water Act (NWA), 1998 (Act 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected, and integrated management of water resources takes place.

In terms of Section 21 of the National Water Act, Act No. 36 of 1998 (NWA) a water use licence is required for:

a) taking water from a water resource;
b) storing water;
c) impeding or diverting the flow of water in a watercourse;
d) engaging in a stream flow reduction activity contemplated in Section 36;
e) engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1);
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 in any 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 the efficient continuation of an activity or for the safety of people; and
k) using water for recreational purposes.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (Section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns, controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

Section 19 of the NWA also places a general duty to care in so far as the pollution of water resources is concerned. This will need to be taken into consideration during the WUL application.

6.7. HERITAGE

Aspects concerning the conservation of cultural resources are dealt with mainly in two acts. These are the National Heritage Resources Act (Act 25 of 1999) and to a lesser extent, the National Environmental Management Act (Act 107 of 1998).

6.7.1. NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

According to the above-mentioned act the following are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

i. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length
ii. The construction of a bridge or similar structure exceeding 50 m in length
iii. Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof
iv. Re-zoning of a site exceeding 10 000 m^2
v. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the NHRA states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A 'structure' refers to any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

'Alter' means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;
c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or
d) bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites.
e) alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

A. ancestral graves
B. royal graves and graves of traditional leaders
C. graves of victims of conflict
D. graves designated by the Minister
E. historical graves and cemeteries
F. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
b) destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance no. 12 of 1980) (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended).

Unidentified/unknown graves are also handled as older than 60 until proven otherwise.

The entities will be classified in terms of the ranking afforded to each in the report, and the applicant will aim to minimise the impact on any identified entities throughout the detail design phase, and prior to finalising permits for destruction and/or exhumation, which will only be considered in circumstances when mitigation is impossible.

6.8. VISUAL

6.8.1. WESTERN CAPE DEPARTMENT OF AND DEVELOPMENT PLANNING: GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

A guideline document was developed by the Provincial Government of the Western Cape: Department Of Environmental Affairs and Development Planning (WCDEADP), which is entitled: "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes".

This guideline document, which deals with specialist visual input into the EIA process, has been organised into a sequence of sections, following a logical order covering the following:'

- the background and context for specialist visual input;
- the triggers and issues that determine the need for visual input;
- the type of skills and scope of visual inputs required in the EIA process;
- the methodology, information and steps required for visual input;
- and the review or evaluation of the visual assessment process.

PRINCIPLES AND CONCEPTS UNDERPINNING VISUAL INPUT

The following key principles and concepts will be considered during visual input into the EIA process (WCDEADP, 2005):

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
- The consideration of both the natural and the cultural landscape, and their inter-relatedness.
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character'.
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.

6.9. NATIONAL PLANNING AND POLICY CONTEXT ON ENERGY

6.9.1. WHITE PAPER ON THE ENERGY POLICY OF SOUTH AFRICA, 1998

The white paper on South African energy policy governs the development of the South Africa energy sector (DME, 1998). This document identifies key objectives for energy

supply such as managing energy related environmental impacts, access to affordable energy services and securing energy supply though diversity.

6.9.2. RENEWABLE ENERGY POLICY IN SOUTH AFRICA, 2003

The white paper on renewable energy (DME, 2003) supplements the energy policy and sets out the government's strategic goals, vision, policy principles and objectives implementing and promoting renewable energy in South Africa. South Africa has various sources of renewable resources, particularly solar and wind, and therefore this policy supports the rationale that from a fuel resource perspective, renewable application is proven to be the least costly, especially from an environmental and social perspective. Meeting technical and economic as well other constraints is one of the major concerns of the government policy on renewable energy.

South Africa has set a 10 year 10 000 GWH target for renewable energies by 2013 to be produced mainly from solar, wind and biomass as well small scale hydro. This amounts to approximately 4% of the country's estimated demand by 2013.

6.9.3. FINAL INTEGRATED RESOURCE PLAN, 2010 -2030

The Ministry of Energy is obligated as per the Energy Act of 2008 to publish and develop an integrated resource plan for energy. The Department of Energy (DOE) in partnership with the National Energy Regulator of South Africa (NERSA) has published the Integrated Resource Plan (IRP) for the time period 2010 to 2030. The main objective of the IRP develops an electricity investment strategy that is sustainable for the transmission infrastructure and generation capacity of South Africa for the next 20 years.

The white paper on renewable energies states that it is of global/national importance to supplement existing energy demand with renewable forms of energy in order to combat climate change. The outcome of this IRP acknowledged that coal fired power generation facilities will still be required over the next 20 years. The DOE released the final IRP in March 2011 and parliament accepted it at the end of March. In addition to all existing and committed power plants the IRP includes 6.3 GW of coal, 9.6 GW for nuclear, 17.8 GW for renewables (including 8.4 GW for solar) and 8.9 GW from other sources.

6.10. ASTRONOMY GEOGRAPHIC ADVANTAGE ACT, 2007

The objectives of the Astronomy Geographic Advantage Act are as follows:

a) to provide measures to advance astronomy and related scientific endeavours in the Republic;
b) to develop the skills, capabilities and expertise of those engaged in astronomy and related scientific endeavours in Southern Africa;
c) to identify and protect areas in which astronomy projects of national strategic importance can be undertaken;
d) to provide a framework for the establishment of a national system of astronomy advantage areas in the Republic, to ensure that the geographic areas in the Republic which are highly suitable for astronomy and related scientific endeavours due to, for example, high atmospheric transparency, low levels of light pollution, low population density or minimal radio frequency interference are protected, preserved and properly maintained;
e) to regulate activities which cause or could cause light pollution or radio frequency interference or interfere in any other way with astronomy and related scientific endeavours in those areas;
f) pursuant to Section 5, to provide for the declaration and management of astronomy advantage areas; and

g) to enable the Minister to participate in efforts to preserve the astronomy advantage of Southern Africa and to coordinate astronomy within this area.

In line with the above the MEC may declare astronomy advantage areas (AAA). The provisions provide for the minister within the act to declare any area in the Northern Cape Province as an AAA; however no such declaration may be made in respect to any area demarcated in terms of the Municipal Demarcation Act and falling within the Sol Plaatje Municipality. The entire Northern Cape province excluding Sol Plaatji Municipality was declared an astronomy advantage area within GN: 31855 (No. 82 of 2009) in terms of Astronomy Geographic Act, 2007 (Act No. 21 of 2007).

Notice of intention to declare the Karoo astronomy advantage area was published for public comment in General Notice 115 of 2009 within GN. 31855 of 2009. This general notice describes the boundaries of radio Astronomy Advantage Areas, including Karoo core radio AAA, Karoo Central radio AAA 1, Karoo Central radio AAA 2 and Karoo Central radio AAA 3

The purpose of declaring areas as astronomy advantage areas is mainly to ensure that areas suitable for astronomy and related scientific endeavours in South Africa are preserved and maintained. These areas consist of, among other things, atmospheric transparency, low levels of light pollution, low population density or minimal radio frequency interference. The AAAs also enhance and provide management to existing geographic advantage areas.

In terms of this act no person without prior permission from the delegated management authority in terms of the act, may:

1. "Enter any core astronomy advantage area
2. Reside in a core astronomy advantage area
3. Have in their possession, within a core astronomy advantage area designated by the Minister in terms of Section 7(1)(c) for radio astronomy, any interference source, mobile radio frequency interference source or short range device, unless the source or device has been turned off and, when in that state, is incapable of causing any form of radio frequency interference; and
4. Perform any other activity in a core astronomy advantage area that might be harmful to astronomy and related scientific endeavours or to the preservation of the area's astronomical advantage."

In terms of this act restrictions can also be placed on the use of radio frequency spectrums in astronomy advantage areas. Draft regulations regarding radio astronomy protection levels in astronomy advantage areas were published in GN .539 of 2011 in terms of the Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007).

6.11. OTHER RELEVANT LEGISLATION AND GUIDELINES CONSULTED

6.11.1. JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (2011/12) / SPATIAL DEVELOPMENT FRAMEWORK

A synopsis report on the 2011/12 District Municipality IDP was considered in the development of this EIA Report. The said IDP strongly outlines the need to create employment opportunities in the District. The IDP identifies a need to ensure equity in the activities of the Municipality that reflects its population demographics, both in terms of service delivery, as well as in terms of employment equity. In this regard, gender, racial and disability population demographics are important. Special interest groups, such as

youth, women and persons with disabilities must focus specifically in the strategic priorities of the Municipality.

Relevant challenges in the district are highlighted as follows (IDP Synopsis Report, 2011):

- The clear comparative disadvantage of the Joe Morolong Municipality in relation to the other municipalities in the district;
- The educational levels among the population of the district are relatively low. 27,6% of the population has no formal education, while only 67,4% has some school education. Only 1,83% of the population has some tertiary education. These statistics have obvious implications for the employment potential of the population, and therefore also for the district's local economic development and job creation initiatives.
- A total of 75% of the district's population has no recordable income. This is extremely high and puts extreme pressure on the Municipalities operating in the district. The result of such high level of unemployment is that communities cannot pay for basic services and that severe pressure is put on municipal resources due to demands for services to a poverty-stricken population.

The long term sustainability of all land development practices is identified as a key factor in the environmental and economic future of this predominantly mining and agricultural region, with specific attention needing to be given to the building of capacity amongst especially emerging land users (both miners and farmers) and the provision of a management framework to all land users within the municipality.

The following relevant principles of Spatial Development Planning, in terms of the district Spatial Development Framework (SDF), in the District were considered in the development of the EIA:

- Land use and development decisions must promote harmonious relationships between the built and natural environment;
- Land development and planning should protect natural, environmental and cultural resources;
- Land used for agricultural purposes may only be reallocated to another use where real need exists, and prime agricultural land should as far as possible remain available for production;
- Land use regulators and planning authorities must ensure that previous disadvantaged communities and areas receive benefit and opportunities flowing from land development; and
- Appropriateness of land use must be determined on the basis of its impact on society as a whole rather than only the applicant or immediate neighbours.

The proposed project is deemed to compliment the desired spatial form of the district, in that the Adams PV sites would contribute to local economic development in the area.

6.11.2. NATIONAL VELD AND FOREST FIRE ACT (ACT 101 OF 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires in terms of equipment as well as suitably trained personnel.

Although the site is arid and fires are not a regular feature of the area, the fire which had occurred prior to the site visit illustrates that sufficient biomass to carry a fire may occur

following years of above average rainfall. Therefore, precautions to limit the spread of fire and manage plant biomass at the site will be important to reduce the fire risk from within the facility or to prevent the spread of fires into the facility.

6.11.3. EQUATOR PRINCIPLES

Project financing would require the development proposal to comply with the Equator Principles. These principles are a set of international standards that are voluntarily implemented to identify, assess and manage environmental and social risks. The Equator Principles are based on the guidelines of the World Bank group of social policies of the International Finance Corporation (IFC). Once financial institutions adopt the Equator Principles they place a commitment onto themselves not to finance projects that do not comply with these principles.

The Equator Principles would be considered in monitoring and managing the project in line with these requirements. The following table represents the principles that have been considered in compiling this report.

Table 6-2: Equator Principles considered	
Principles 1: Review and Categorisation	"Category C – Projects with minimal or no social or environmental impacts."
Principles 2: Social and Environmental Assessment	This subject report is compiled to assess the environmental and social impact of the proposed development. The mitigation measures are prescribed in this report as well as in the EMPr (Appendix 7)
Principles 3: Applicable Social and environmental Standards	The following IFC performance standards are applicable to the proposed project: 1. Social and environmental Sustainability 2. Labour and Working conditions 3. Pollution prevention and abatement 4. Community health, Safety and Security 5. Land Acquisition and Involuntary Resettlement 6. Biodiversity Conservation and Sustainable Natural resource Management 7. Cultural Heritage
Principles 4: Action Plan and Management system	The EMPr should be used as the management plant to develop a site-specific Action Plan that would need to be implemented as part of the site's Environmental Management System (EMS) and implemented by the site Environmental Control Offices
Principles 5: Consultation and Disclosure	The public participation process has been and will be undertaken in line with South African legislation in terms of NEMA: EIA regulation R543.
Principles 6: Grievance Mechanism	A grievance process will be implemented by the project development company to ensure disclosure, consultation and public

Table 6-2: Equator Principles considered	
	engagements during all phases of development of the facility.
Principles 7: Independent Review	Independent review of all environmentally related aspects/documents of the proposed project lender must be undertaken.
Principle 8: Covenants	All South African legislation must be complied with by the proponent.
Principle 9: Independent Monitoring and Reporting	ECO must monitor the site to ensure independent verification of monitoring results.
Principle 10: EPFI Reporting	Annual report must be submitted to the relevant lender.

6.11.4. OCCUPATIONAL HEALTH AND SAFETY

The EIA process assesses impacts on the environment, and does not specifically focus on issues of internal health and safety, as these are regulated by other legislation such as the Occupational Health and Safety Amendment Act, Act No. 181 of 1993, (OHSA). However there are instances in which the application of health and safety regulation is relevant within the domain of impact on the environment. The Occupational Health and Safety Act (OHSA) regulations include Regulation 1179 (Hazardous Chemical Substances) and Regulation 7122 (Major Hazard Installations). A "hazardous chemical substance" is defined in Government Notice R.1179 Hazardous Chemical Substances Regulations (1995) as any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which (a) an occupational exposure limit is prescribed, or (b) an occupational exposure limit is not prescribed; but which creates a hazard to health.

In terms of Section 8(2d) of the Occupational Health and Safety Act, 1993, the employer has to establish, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business; and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons. The employer shall, furthermore, provide the necessary means to apply such precautionary measures.

A Major Hazardous Installation is defined in terms of the Occupational Health and Safety Act as an installation:

- "where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or
- where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident".

A major incident as referred to above is defined as "*an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace*". It is impossible to put a specific value to "catastrophic" because it will always differ from person to person and from place to place. However, when the outcome of a risk assessment indicates that there is a possibility that the public will be involved in an incident, then the incident can be seen as catastrophic (Department of Labour 2005). Certain substances listed in Schedule A of the General Machinery Regulations may

possibly be used or stored in quantities exceeding the stated thresholds. However due to previous experience with such this would not necessarily be the case.

6.11.5. GUIDELINES PUBLISHED IN TERMS OF NEMA EIA REGULATIONS:

- Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2066).
- Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
- Guideline 5: Assessment of alternatives and impact in support of the Environmental Impacts Assessment Regulations, 2006 (DEAT, June 2006)
- Integrated Environmental Management Information series
- South African national Biodiversity Institute (SANBI) published guidelines.

6.11.6. GUIDELINES ON THE INVOLVEMENT OF SPECIALISTS IN THE EIA PROCESS

The Western Cape Department of Environmental Affairs and Development Planning (WC DEADP) has developed policy guidelines around specialist involvement in EIA processes. The guidelines aim to improve the quality of specialist input and facilitate informed decision-making. The guidelines clarify the roles and responsibilities of all role players with regard to specialist input in the EIA process. These guidelines have been derived to help practitioners draft appropriate terms of reference for specialist input and assist role players to evaluate the appropriateness of specialist input in individual cases. Although these guidelines have been developed by the Western Cape, they can be adopted for use anywhere in the country.

Hence, the EIA process will endeavour to adhere to these set of guidelines, in order to be in line with provincial guidelines relevant to EIA's.

These guidelines include:

- Guideline for Determining the Scope of Specialist involvement in EIA processes (June 2005)
- Guideline for the Review of Specialist input in EIA processes (June 2005)
- Guideline for involving Biodiversity specialists in EIA processes (June 2005)
- Guideline for involving Heritage specialists in EIA processes (June 2005)
- Guideline for involving Visual and Aesthetic specialists in EIA processes (June 2005)
- Guideline for Environmental Management Plans
- Guideline for involving Social Assessment Specialists in EIA processes

The full versions of these reports can be downloaded from: http://www.capegateway.gov.za/eng/pubs/guides/G/103381

7. PUBLIC PARTICIPATION

7.1. INTRODUCTION

Public participation provides the opportunity for Interested and Affected Parties (IAPs) to participate on an informed basis, and to ensure that their needs and concerns are considered during the impact assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The public participation process is aimed at achieving the following:

- Provide opportunities for IAPs and the authorities to obtain clear, accurate and understandable information about the expected environmental and socio-economic impacts of the proposed development;
- Establish a formal platform for the public with the opportunity to voice their concerns and to raise questions regarding the project;
- Utilise the opportunity to formulate ways for reducing or mitigating any negative impacts of the project, and for enhancing its benefits;
- Enable project proponent to consider the needs, preferences and values of IAPs in their decisions;
- Clear up any misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- Provide a proactive indication of issues which may inhibit project progress resulting in delays, or which may result in enhanced and shared benefits; and
- Ensure transparency and accountability in decision-making.

The public participation process to date is discussed below. Refer to Appendix 3 for further detail, which includes:

- The project Background Information Document (BID);
- Proof of notifications to IAPs of the application to DEA for Environmental Authorisation;
- Proof of press advertisements and site notices;
- List of IAPs;
- Issues and Responses Report (I&RR);
- Minutes of public meetings; and
- 30 day commenting period for registered I&Ap and 40 days commenting period for key stakeholders (DAFF, DEA, DWA etc.) on draft scoping report.
- 30 day commenting period was given on the final scoping report to registered IAPs as well key stakeholders.
- 30 day commenting period for registered I&Ap and 40 days commenting period for key stakeholders (DAFF, DEA, DWA etc.) on draft EIR.
- The availability of the draft EIR as well the change to project scope in terms of extension of the Dougnor/Milner substation has been advertised in the Kalahari Bulletin.
- Proof of distribution of draft and final reports to relevant key commenting authorities

- Minutes of Authority Meeting.
- Comments and Responses Report (C&RR).

7.2. IAP NOTIFICATION & CONSULTATION TO DATE

The first step in the public participation process was to advertise the project as required by the 2010 EIA Regulations, in order to inform potential IAP's of the proposed project and EIA process. This was done by means of the following:

- A Background Information Document (BID) was compiled giving details on the applicant, the Environmental Assessment Practitioner (EAP), the scope and locality of the proposed project, the EIA process, purpose and process of public participation, and included an invitation to register as an IAP and provide comment.
- Pre-identification of interested and affected parties (IAPs), including adjacent landowners, using existing databases, and distributing the BID to these stakeholders. The BID was also sent to any other IAPs who responded to site or press notifications.
- Advertising the proposed project and associated EIA process in "The Business Day" on Wednesday 15th February 2012, "Kalahari Bulletin" on Thursday 16 February 2012, "Noothwester Messenger" on Friday 17th February 2012 as well as the "The Gemsbok" newspaper on Wednesday 17th February 2012. The advertisements indicated where written comments may be directed to and were placed in English.
- A2-size site notices were erected on the site
- The draft Scoping report was distributed to all registered IAPs for a 30 day commenting period from the 23 April 2012 to the 23 May 2012.
- The draft Scoping report was also distributed to important commenting stakeholders/authorities for a 40 day commenting period from the 16 April 2012 to the 28 May 2012.
- The final scoping report was also distributed to IAPs and commenting stakeholders/authorities for a 30 day commenting period from the 14 June 2012 to the 12 July 2012. All parties were instructed to send their comment directly to the DEA.

Proof of these advertisements, sending of the BID, proof of site notices, communications with IAP's, availability of scoping reports and others are contained in the public participation report attached as Appendix 5 to this report.

7.3. IAP NOTIFICATION & CONSULTATION FOR THE REMAINDER OF THE ASSESSMENT

- The availability of the draft EIR will be advertised in a local newspaper (Kalahari Bulletin), including the amendment to project applicant as well change in project scope to include the proposed new substation.
- The draft EIR will be distributed to all registered IAPs for a 30 day period and important commenting stakeholders/authorities for a 40 day commenting period from the 01 October 2012 to the 10 November 2012 as required in terms of section 56 (7) of the EIA regulation.

- The final EIR will also be distributed to IAPs and commenting stakeholders/authorities for a 21 day commenting period. All parties will be instructed to send their comment directly to the DEA.

7.4. EIA PUBLIC MEETING PHASE

To date no public meeting has been held regarding the proposed project. The public interest in the proposed project has been very low. If the need arises once the draft EIR has been distributed a public meeting will be held. However, to date, interest in the project has been limited.

7.5. AUTHORITIES CONSULTATION

The National Department of Environmental Affairs is the assigned competent authority for the environmental authorisation of power generation applications. All official correspondence from the DEA regarding this specific application is contained within Appendix 2 of this report. Consultation with the regulating as well as key commenting authorities has continued throughout the EIA process thus far. These include the following:

- Submission of application form for Environmental Authorisation to the Department of Environmental affairs.
- Submission of draft Scoping Report to the DEA as well key commenting authorities for a 40 day commenting period as well 30 day period to IAPs
- Submission of final Scoping report to DEA for review as well key commenting authorities for 30 day period to IAP/key commenting authorities
- Submission of draft Environmental Impact Report (EIR) for comment to DEA as well key commenting authorities for 40 day period to IAP/key commenting authorities
- A site visit was also conducted with the case office (Masina Litsoane) from DEA on the 3rd of July 2012

For the remaining EIA process, the final EIR will be submitted to the DEA after a 40 day commenting period for key commenting authorities as well a 30 day commenting period for IAP. The following key stakeholders/ authorities have been requested to provide their comment on the draft and subsequent final report (Full details contained in Appendix 5).

Table 7-1: Key commenting authorities who were sent hard and soft copies of the reports

Northern Cape Department Agriculture, Forestry and Fisheries (DAFF)	Mrs. Jacoline Mans	054 338 5909	JacolineMa@nda.agric.za
Northern Cape Department of Environment and Nature Conservation	Mr. Tshlo Makaundi	053 807 7464	tmakaudi@ncpg.gov.za
Department of Water Affairs (DWA)	Mr. A Abrahams & SR Cloete	053 830 8802 & 054 33 8500	AbrahamsA@dwa.gov.za & cloetes@dwa.gov.za
Joe Morolong Local Municipality	Ms Kgomotso Mabudi	053 773 9373	kmabudi@joemorolong.gov.za
John Taolo Gaetsewe District Municipality	Mr. Johnny Swart	053 712 8713	Swartjtaologaetsewe.gov.za

Table 7-2: Other important IAPs who received electronic copies of the reports	
National Department of Agriculture, Forestry and fisheries (DAFF)	Ms Mashudu Marubini & Ms Thoko Buthelezi
South African Heritage resource Agency (SAHRA).	Kathryn Smuts
Eskom	John Geeringh (Pr Sci Nat), KevinLeask & RonaldMarais
SKA	Dr. Adrian Tiplady

Please also refer to the public participation report (Appendix 5)

7.6. COMMENTS & ISSUES

To date very few comments or issues have been raised by any IAPs. The report will be distributed to all IAPs and comments received will be updated below. Additionally the availability of the draft EIR will be advertised in the Kalahari Bulletin, as to ensure that any additional stakeholders not identified during the initial advert and notifications are not excluded from the process.

Table 7-3: Comments from IAPs to date	
IAP & Comment	***EAP Response***
Dineo Peta (BHP Billiton): Please indicate the source of proposed water used. We already have groundwater constraints in the area.	Thank you for your response. Presently the proponent proposed to receive water from the local municipality (mostly likely the Gamagara water scheme). However if the municipality does not have the capacity to supply water requirements, a water use license will be applied for groundwater abstraction.
Jacoline Mans (NC DAFF) • DAFF is mainly concerned about potential impact on protected tree species. Please ensure that the anticipated impact (if any) on protected trees and plants are properly assessed during the EIA phase.	Your comments were noted. Part of the assessment contained in this report was the initiation of a biodiversity impact assessment by a specialist in the field. His report outlines the potential impact the proposed facility will have on the receiving environment specifically related to biodiversity (incl. trees and plants). Your concerns have been implemented as required and contained within this report and the relevant appendices attached.
SAHRA comment received on 11 June 2012 • Has no objection to project	Please refer to appendix 5
SKA comments received on 14 August 2012 • Has no objection to project	Please refer to appendix 5
Selebogo (Unknown) • Please advise on how the process will benefit the local community and who is involved from the community site to make sure that the community and local businesses benefit from the process.	The major benefit of the proposed project is that labour will be sourced from the local communities, and provide temporary employment (10-12 months). The additional power supply to the grid will likely result in more reliable and cleaner power supply to the country and consequent opportunities for business expansion. This will likely add to the economic output of the town. Permanent employment opportunities will also be created during the operational life of the facility as security guards and maintenance staff will be required. This would in return have a positive impact on the poverty levels. The facility will provide a source of sustainable income for local inhabitants. Local communities in the direct area around the facility will have a source of clean, carbon-free energy for many years to come. In addition to this, the project company plans to use a percentage of the profits from the power plant for socio-economic upliftment of the local communities. As part of the IPP programme the following thresholds are set as a minimum requirement: • Job creation - 12% from local community • Ownership - 2.5% from local community • Socio economic development - 1% of project revenue • Education and skills development • Enterprise development • Fostering rural development and involving communities Participation of HDI and marginalised regions

8. DESCRIPTION OF THE RECEIVING ENVIRONMENT

8.1. REGIONAL LOCATION

The site for the proposed facility lies within the John Taolo Gaetsewe (formerly Kgalagadi) District Municipality and within the Joe Morolong Local Municipality (formerly Moshaweng). The farm Adams 328 is located on the R380 road to Hotazel from Kathu in the Northern Cape. John Taolo Gaetsewe Municipality covers an area of approximately 27 283.17 square kilometres. The site is located directly east of the BHP Billiton Mamatwan Manganese mine and sinter plant (See Figure 8-1 & Figure 8-2)

The site co-ordinates are as follows:

Latitude:	27^0 22' 32.67" South
Longitude:	23^0 00' 50.48" East

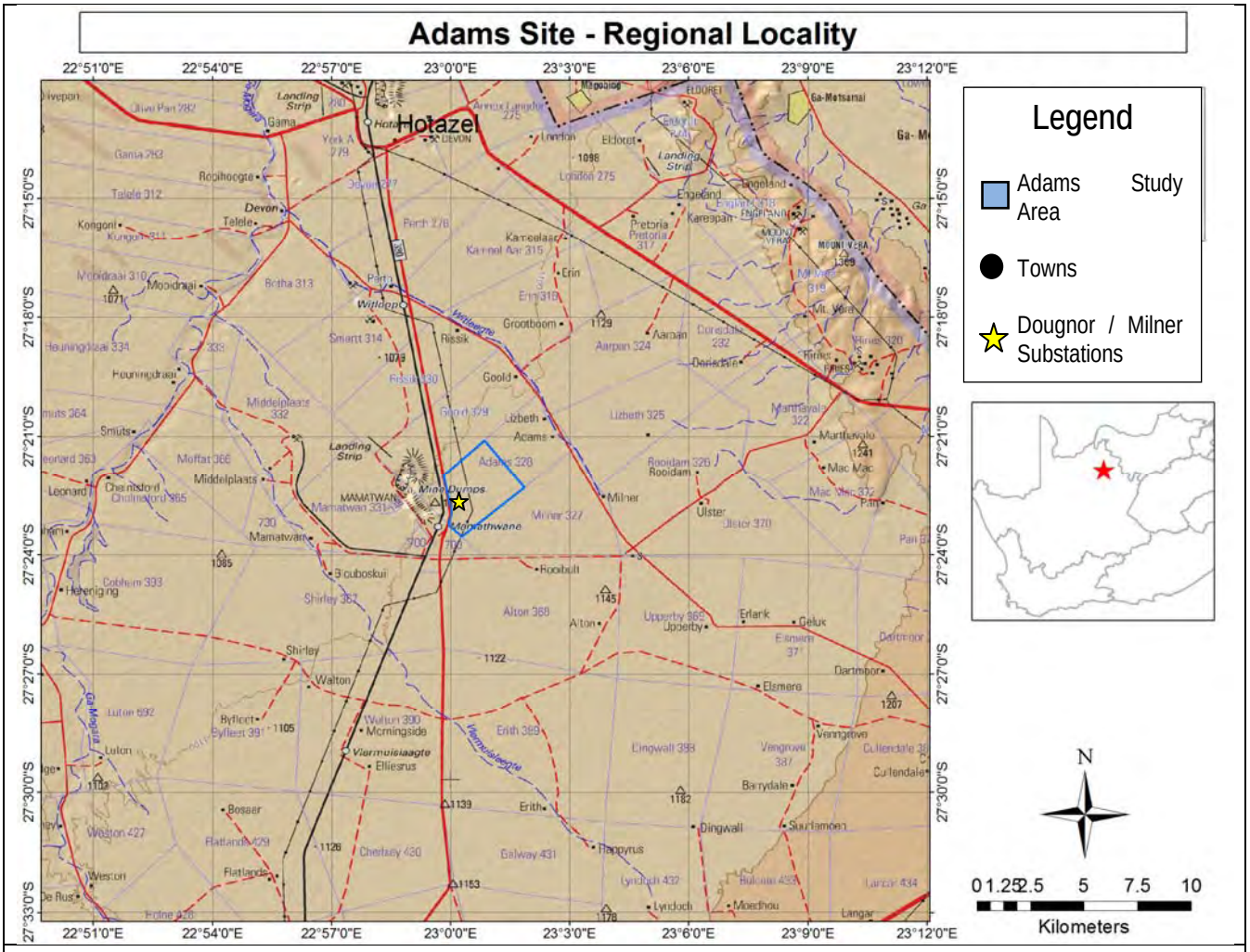

Figure 8-1: Topographical locality map of Adams farm

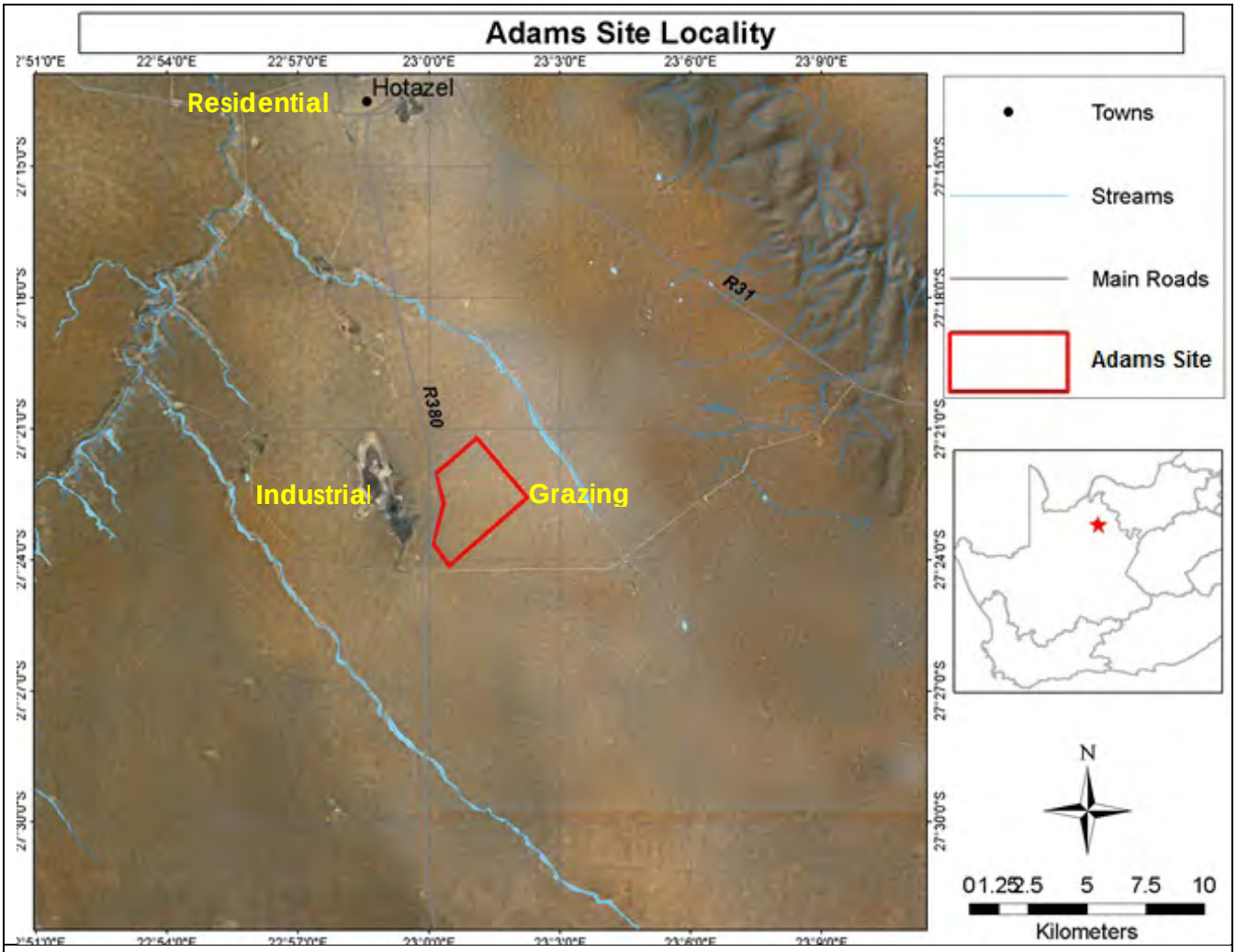

Figure 8-2: Google Earth locality map of Adams farm

8.2. LAND-USE OF THE STUDY AREA

The predominant land use activity within the study area is grazing; there is limited agricultural activity/potential in the area. This is reflected by the fact that the surrounding land usage is limited to mostly grazing, and large scale mining to the west of the R380 road. The main issues identified as issues relating to land resources in the Northern Cape Province are desertification, land degradation, land ownership and land use. The province is classified to be 30% moderately degraded and 20% of the land classified as extremely degraded, resulting in approximately 50% of the province land falling into the above categories and therefore measures must be put in place to ensure that this situation does not worsen. The Northern Cape Province is very susceptible to desertification and measures should be put in place to ensure sustainable land management.

8.3. CLIMATE

The Northern Cape region is semi-arid and receives an annual rainfall of between 250 to 500 millimetres, with the majority of rain falling in the summer months between October and March. On average the heaviest rains fall in mid- to late summer, with February and March being the wettest months of the year. Thunder storms are a common feature of the summer climate and hail may accompany summer storms.

8.3.1. TEMPERATURE

Annual average temperatures at the Adams site are in the order of 19 ºC. The average maximum temperature (experienced in December) is in the order of 33 ºC whilst the minimum temperatures (-2 ºC) occur in July.

Monthly maximum, minimum and average temperatures based on CALMET modelled data at the Assmang Black Rock Mine for 2009 approximately 24 km north of the site, presented in the figure to follow.

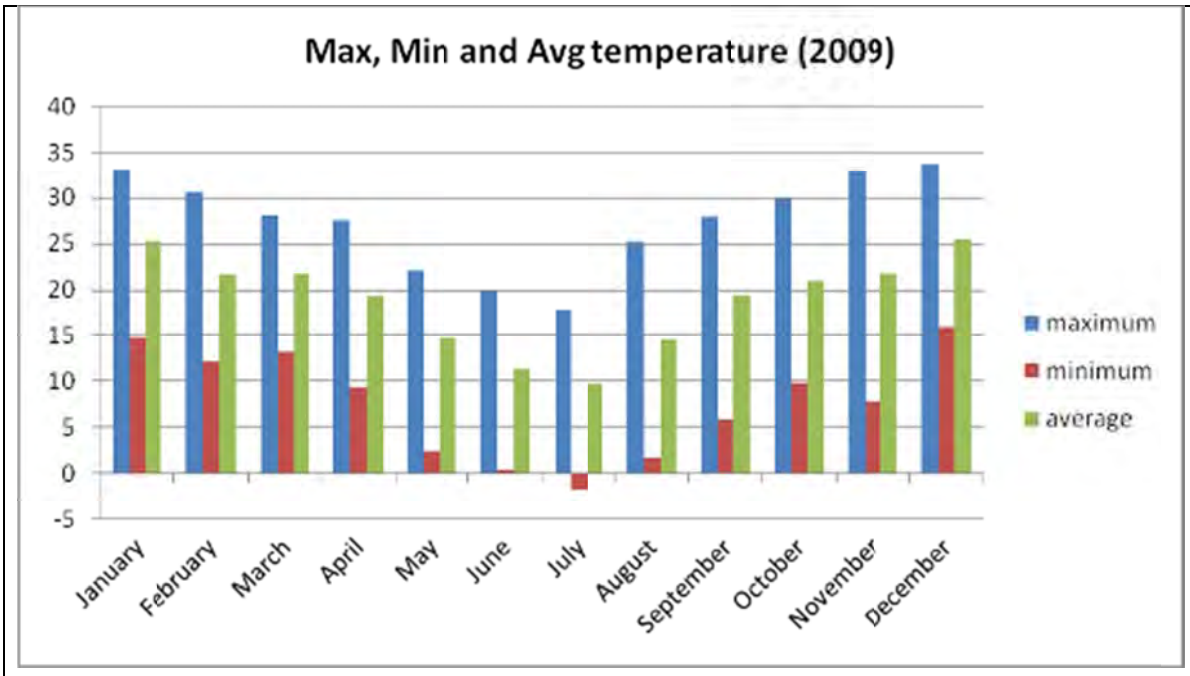

Figure 8-3: Monthly minimum, maximum and average temperature profiles at the Assmang Black Rock Mine to the north of the site based on CALMET modelled 2009 data.

8.3.2. RAINFALL

MEAN MONTHLY AND ANNUAL RAINFALL (PAST 50 YEARS)

The mean annual rainfall in the Kuruman area (42 km east of the site) is 460 millimetres, of which the majority falls in summer (Table 8-1).

Table 8-1: Rainfall Record (Average Monthly Rainfall in Millilitres)

J	F	M	A	M	J	J	A	S	O	N	D
48	111	102	50	5	7	0	1	18	29	32	54

The predicted rainfall for the quaternary catchment however is only 352 mm per annum, which is likely to be a more accurate reflection of average rainfall at the Adams site.

MAXIMUM RAINFALL INTENSITIES PER MONTH

The recorded maximum rainfall intensities (Kuruman Weather Station) are indicated in Table 8-2.

Table 8-2: Rainfall Intensity	
Duration / time period	**Rainfall (mm)**
60 minutes	56.0
24 hours	99
24 hours/50 years	92,9
24 hours/100 years storm events	104,6

8.3.3. WIND

Wind roses have been derived from CALMET modelled data for 2009 from the Assmang Black Rock Mine 27 km north of the site. The general annual wind pattern at the site is predominantly from the north easterly direction, with a pronounced westerly component. In general, wind speeds throughout the year, and within each season, vary from calm (0.5 m/s – 1.4 m/s at 6% frequency) to light (1.4 m/s – 2 m/s at 5.9% frequency) to slightly stronger and stronger gusts (>2 m/s, 88.1% frequency). There is a significant wind component directly from the north north-easterly sector throughout the year. The seasonal wind rose plots indicate the periods and wind patterns that contribute to this phenomenon and demonstrate the shifting wind pattern during the year. Even though the data was used from a site 27 km away, it is not expected to be different at the Adams site.

Wind directions vary seasonally throughout the year. In summer and spring there is a strong prevalence of westerly, west south-westerly and north-easterly winds. These are the most common directions from which winds blow; however there exists a strong prevalence from all sectors (directions) throughout these seasons. Throughout autumn and winter, winds tend to generally prevail from all sectors albeit with lower frequency. There is also a strong occurrence of winds from the north east-north sector in autumn and winter.

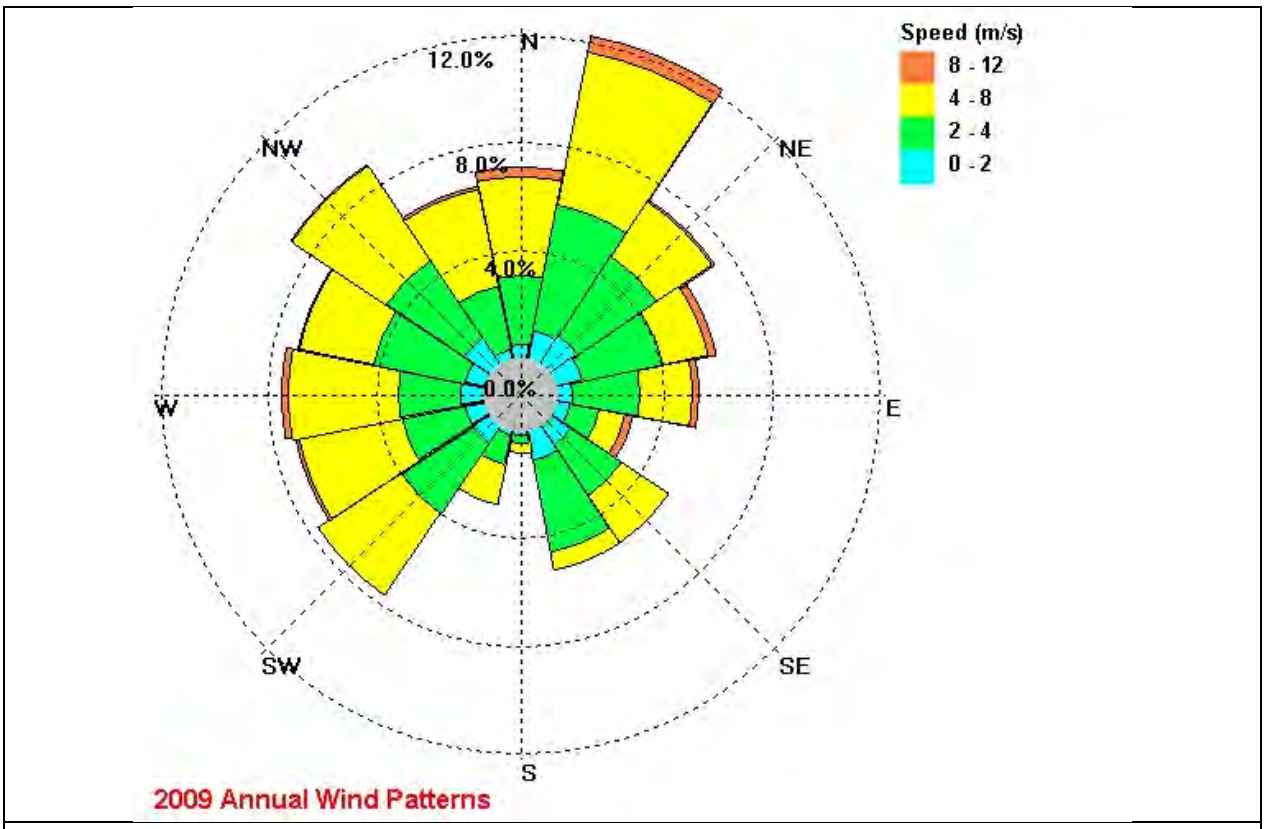

Figure 8-4 : Annual wind rose plots for the mine site produced from CALMET prognostic modelled data (2009), the data is expected to be the same on the Adams site due to their close proximity to each other.

8.4. TOPOGRAPHY

Figure 8-5 shows the regional topography of the study area as well the locations used to determine the north south and east west slope analysis. The study area is relatively flat with no major topological constraints to the proposed development. On a localised level the site is flat, with minimal change in elevation throughout with an average slope of 0.6 degrees (0.6%) (0.6˚ East West and 0.6˚ North South) (Figure 8-6 & Figure 8-5) The study area has an average elevation of 1114 mamsl. The lowest point within the study area was recorded at 1107 mamsl and highest point recorded was 1119. This indicates a height difference of 12 m. The general slope of the area is considered to be 0.6 ˚ south westerly.

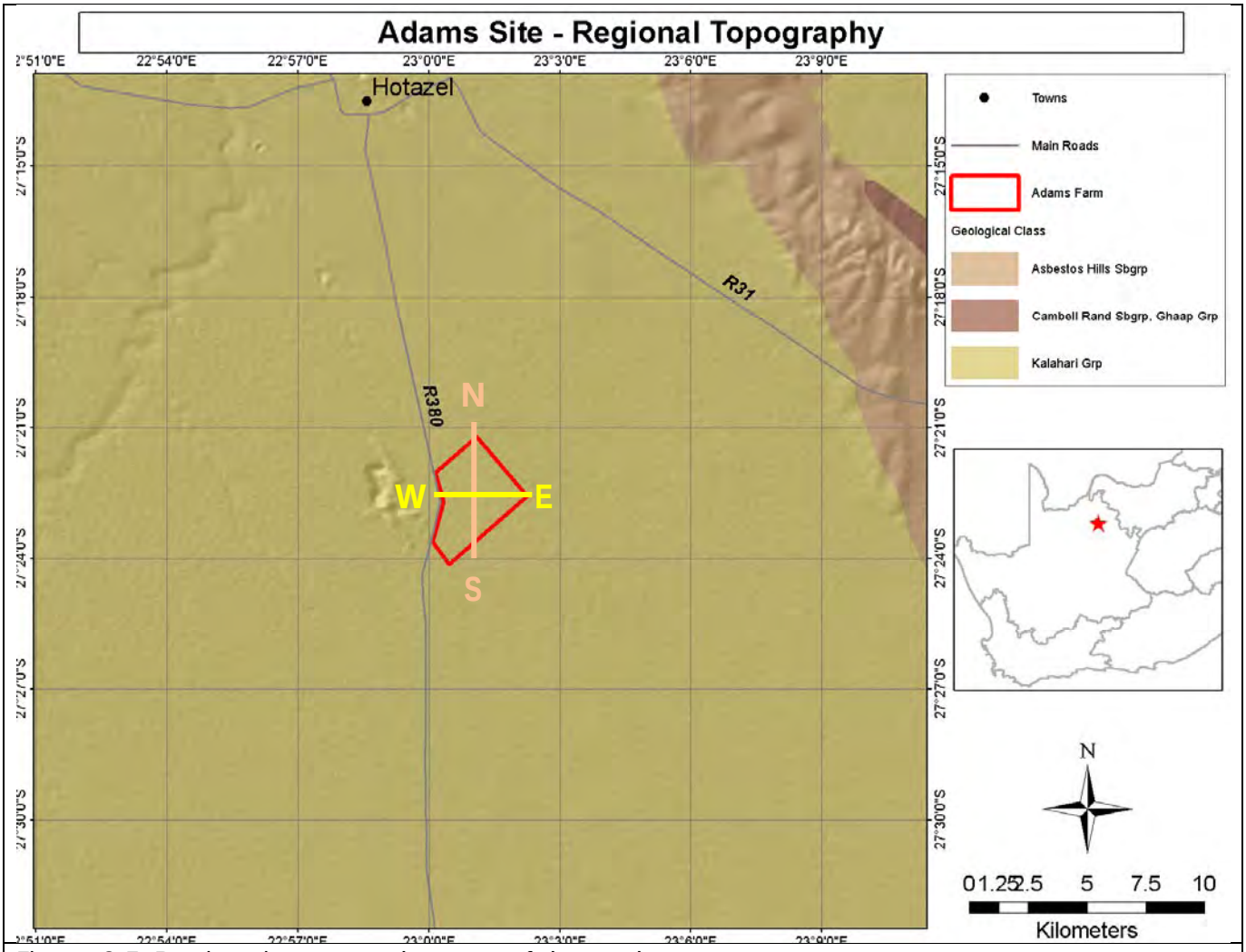

Figure 8-5: Regional topography map of the study area

North South

East West

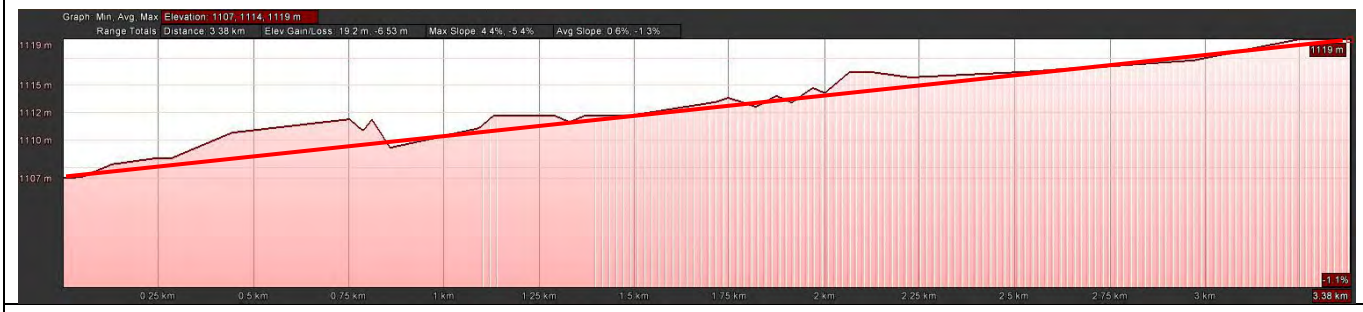

Figure 8-6: Slope analysis of the Adams farm.

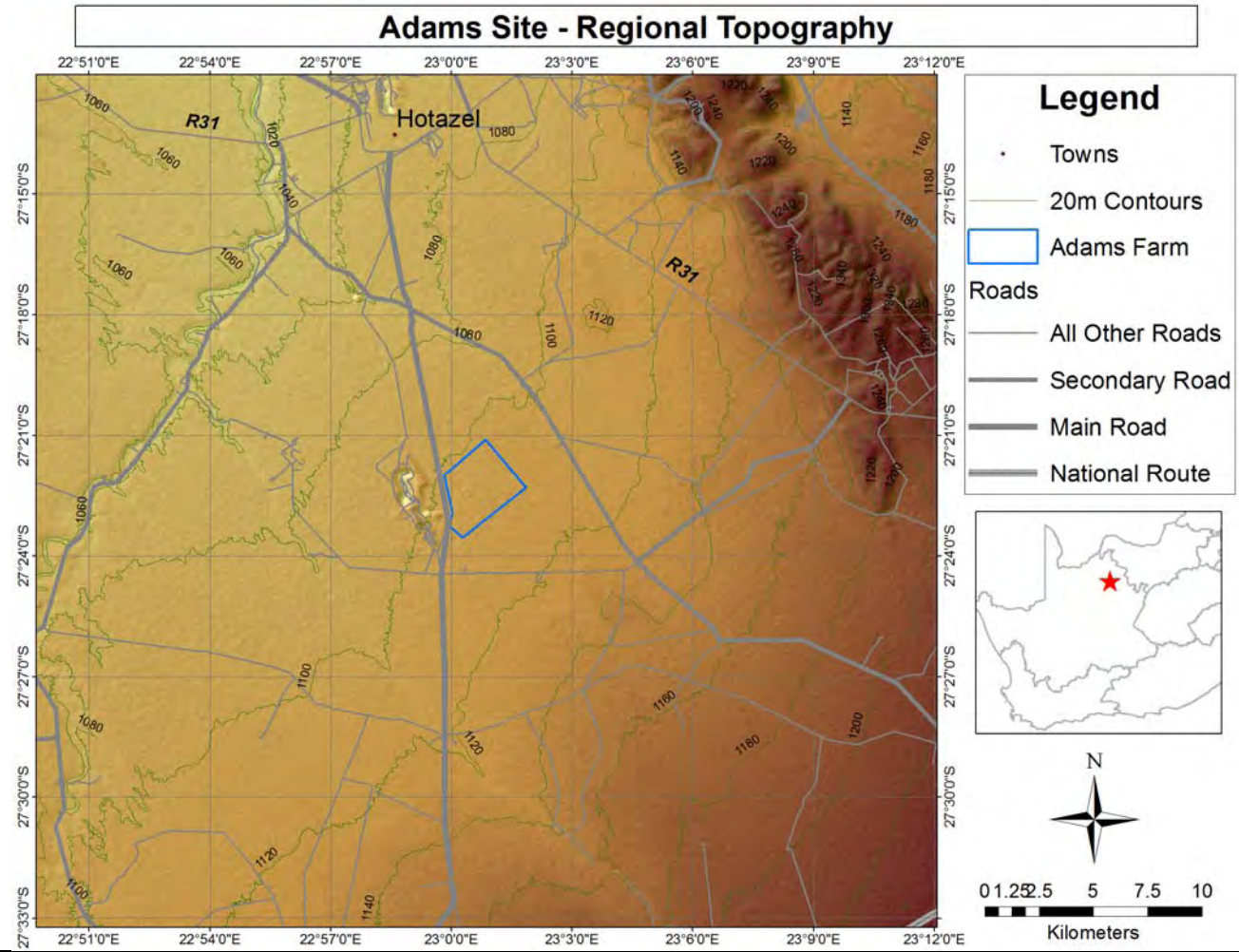

Figure 8-7: Ridgeline and 20 m continuous contours with height references in the GIS database of the Adams farm.

8.5. GEOLOGY

The Adams site is located just west of the Mamatwan Manganese mine and located on the southern tip of the Kalahari manganese field in the Griqualand West region of the Northern Cape Province. The morphology is dominated by flat plains intersected by generally N-S striking ranges of the Gamagara Ridge, Klipfontein Hills and the Asbestos Hills. These plains are characterised by thick calcretes and wind-blown Kalahari sands (Preston, 2001). Figure 8-8 and Figure 8-9 show the relative location of the site within the Griquialand west region as well the location of the Kalahari Manganese field just west of the Adams site located next to the Mamatwan mine.

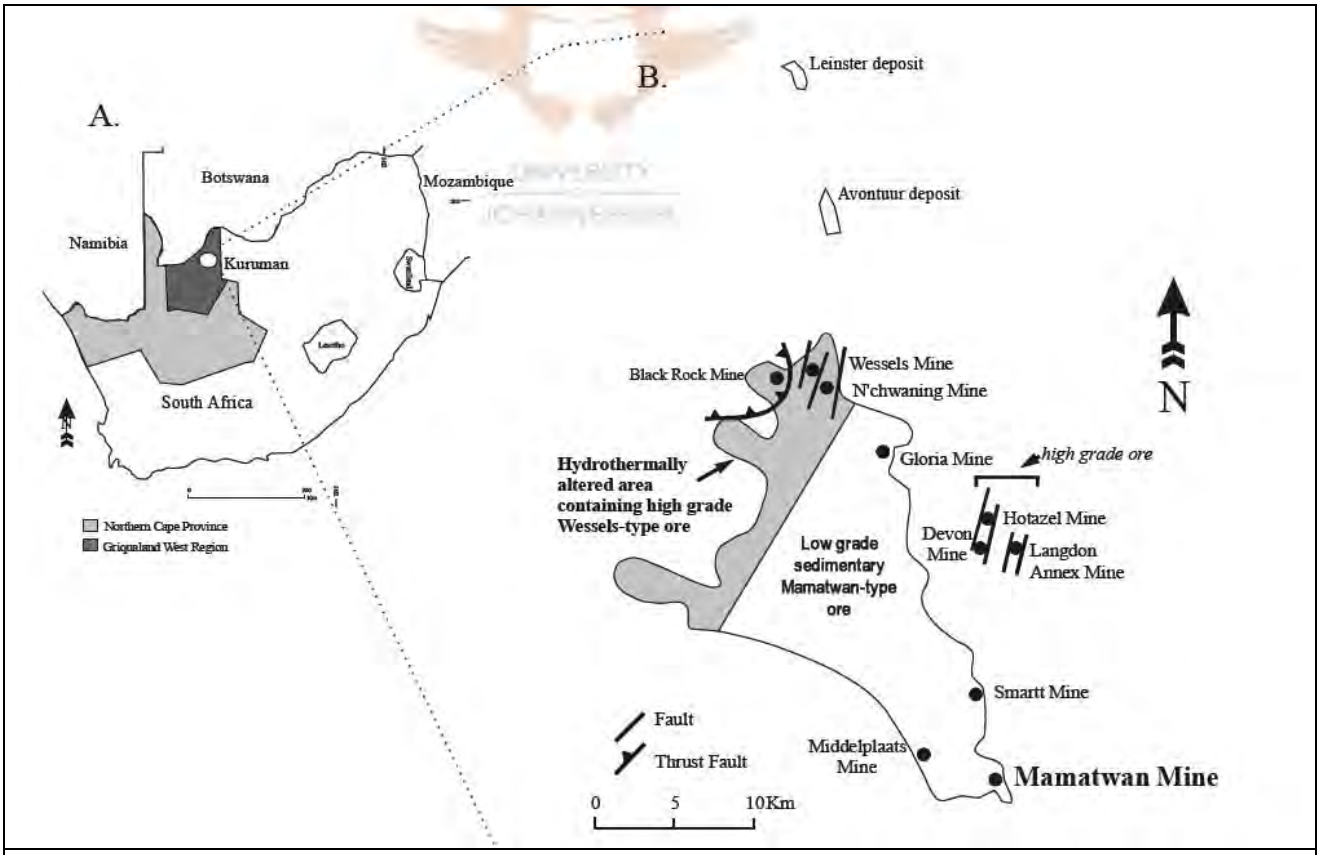

Figure 8-8: Location of the Griqualand West Region in the Northern Cape Provinces well as an enlarged view of the Kalahari Manganese field (Preston, 2001).

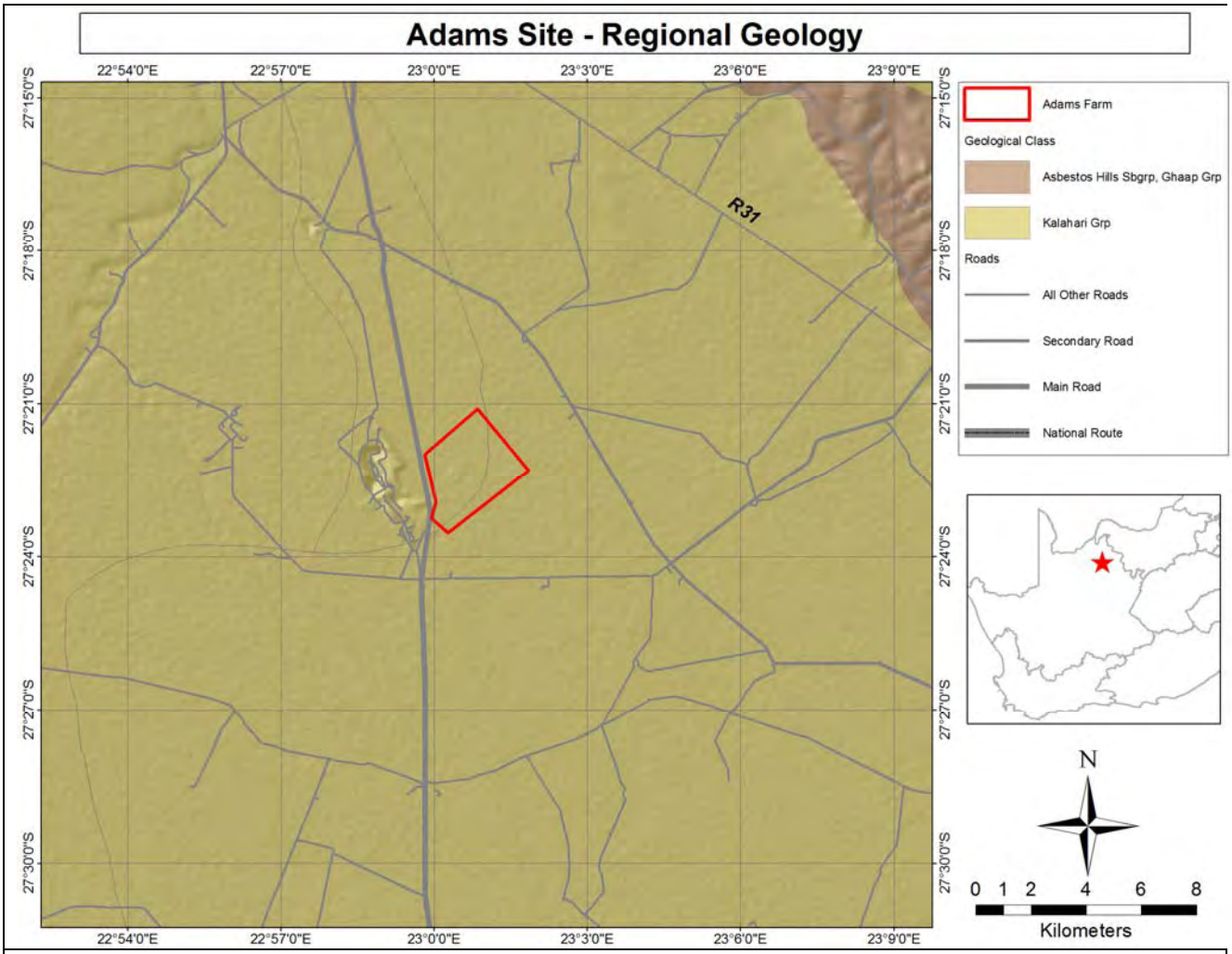

Figure 8-9: Regional Geology of the site and surrounding.

8.6. SOIL

8.6.1. LAND TYPE DATA

The farm Adams falls within the land type Ah9. The area presented by land type Ah9 has a terrain type A1. This indicate that more than 80 % of the slopes are less than 8% with a height difference of less than 30 metres between 30 and 90 metres. The terrain is flat with a distribution of the terrain units 4 and 5. Approximately 95 % of this land type presented by terrain unit 4 with slopes less than 5 %.

Land type Ah9:

Soils:

- Clovelly form covers approximately 64 % of the farm mainly on terrain unit 4. Soil texture varies from sandy to loamy sand with depths of more than 1200 mm
- Hutton soil form covers approximately 28 % of the area mainly on terrain unit 4. Soil depths of more than 1200 mm. Soils are sandy loam to sandy.
- Mispah form covers 3-4 % of the area mainly on terrain unit 5. Soil texture varies between sandy to loamy sand. Soil depth vary between 100-300 mm
- Fernwood forms cover approximately 4 % of the area mainly on terrain unit 5 and with soil depth of more than 1200 mm. Soil texture varies from sandy to loamy sand.

The area is categorised by mainly grazing mostly due to soil constraints (very sandy) and climatic conditions. The only method of crop production would be if the area can be

irrigated. This would however require large amounts of capital to implement and due to water constraints in the area, irrigation is not a viable option.

According to the 'Environmental Potential atlas for the Northern Cape- Generalised Soil Description' (Figure 8-11), the soils within the study area are considered to be red and yellow sandy soils that are well drained with high base status. The general soil depth in the area is <450 mm, with <15% clay content within the topsoil (DEA, et al., 2000).

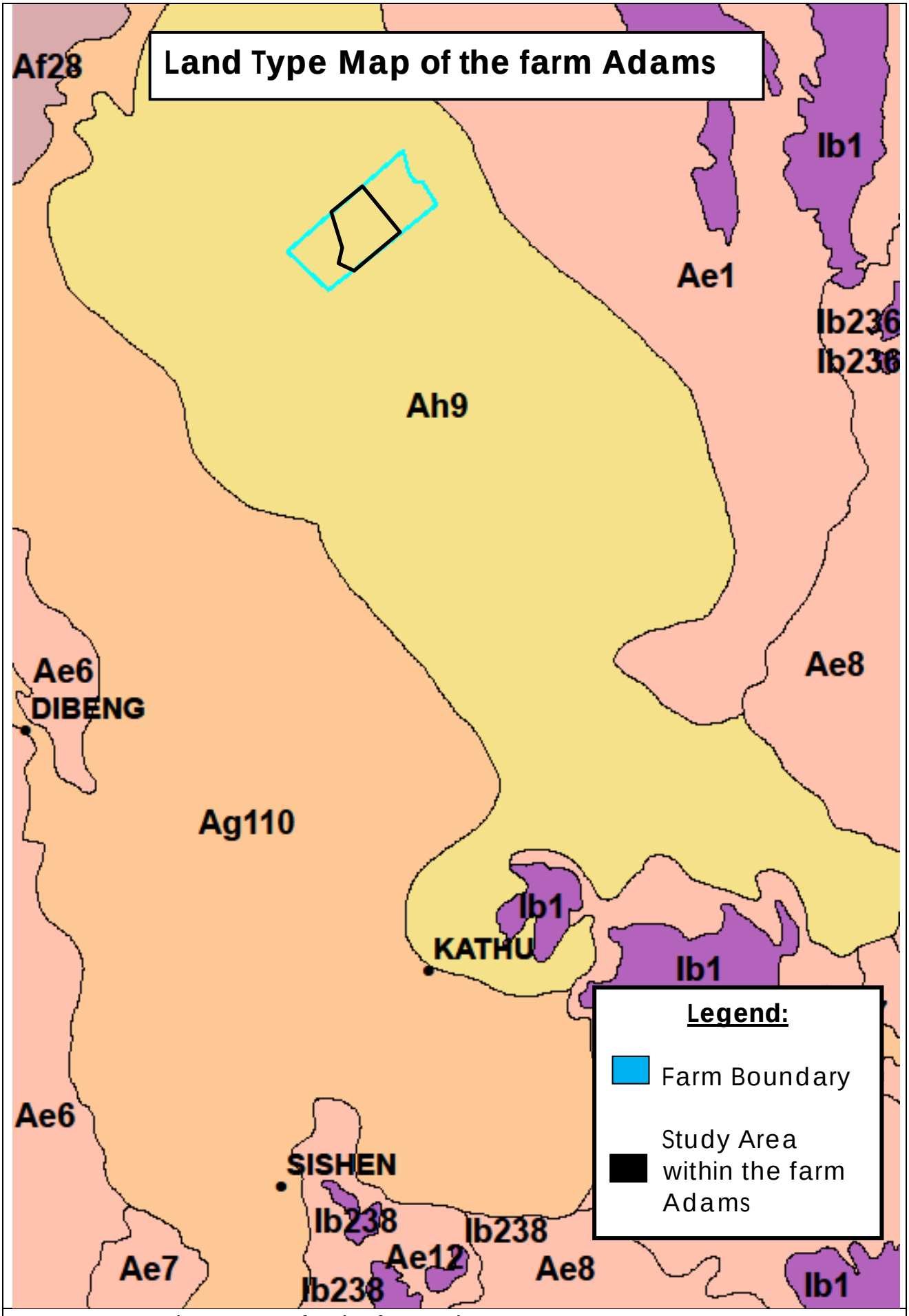

Figure 8-10: Land type map for the farm Adams

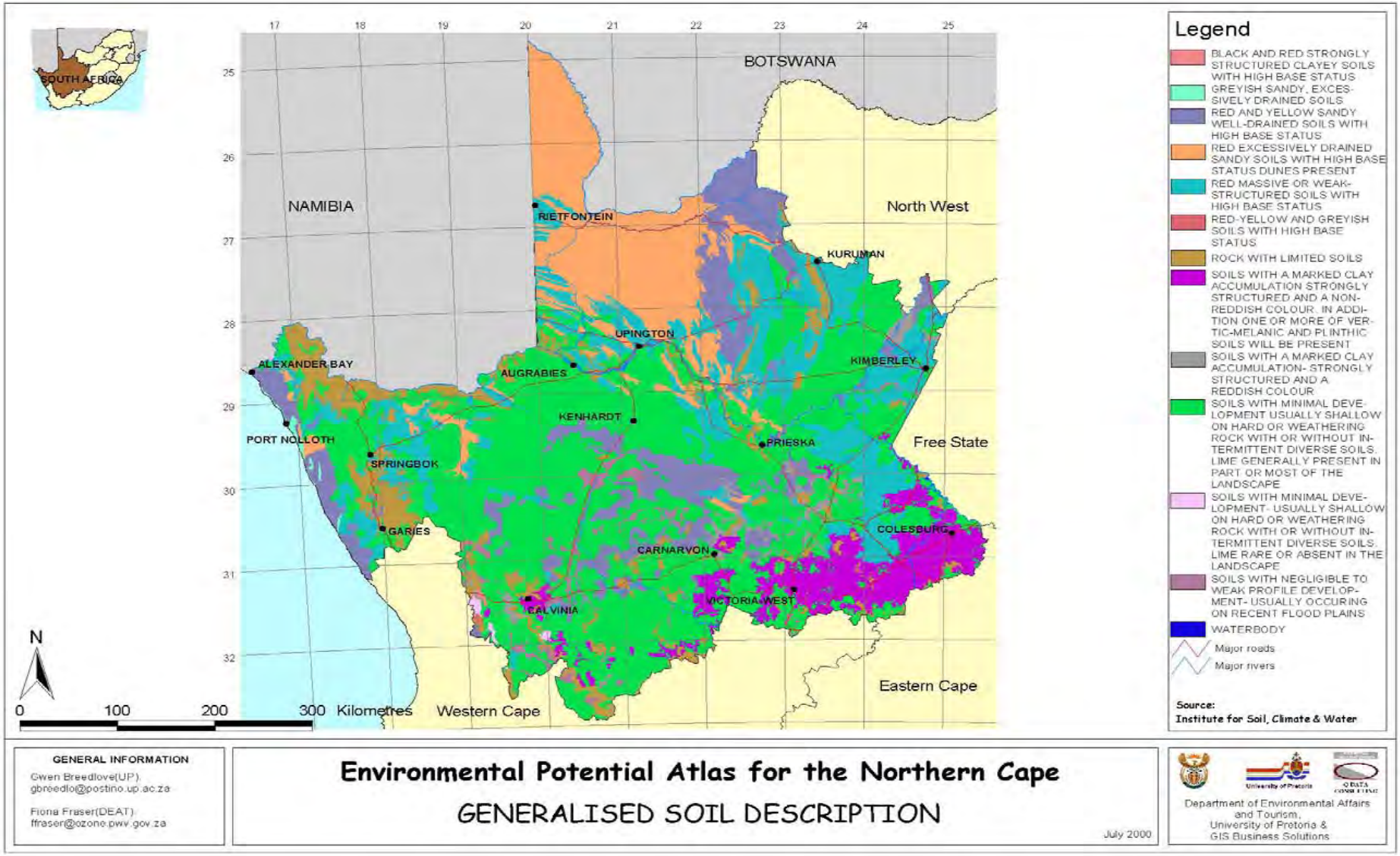

Figure 8-11: General soil description map of the Northern Cape province (http://www.environment.gov.za)

8.7. VEGETATION

Willem de Frey (EcoInfo) was appointed to conduct a baseline biodiversity assessment (refer to Appendix 7.2). Following recommendations made in this report, Simon Todd (Simon Todd Consultancy) was appointed by ESA to expedite a detailed site faunal and floral assessment (refer to Appendix 7.1) relevant to the surface area encompassed. A concise overview of the findings thereof is presented in the sections that follow.

8.7.1. BIOME

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford 1997). This assessment site falls within the *Savannah biome* (Rutherford & Westfall, 1994). The Savannah biome consists of grassland ecosystems characterised by trees sufficiently spaced so that the tree canopy does not close. This results in unbroken herbaceous layer mainly due to the open canopy allowing sufficient light to reach the ground. This herbaceous layer consists mainly of grasses.

8.7.2. VEGETATION TYPE

The site lies entirely within the Kathu Bushveld vegetation type. The vegetation unit occupies an area of 7442 km^2, mainly associated with the surface calcrete, Aeolian sand deep sandy soils of the Clovelly and Hutton soil forms. The vegetation type is classified as least threatened and remains largely intact with more than 98% still remaining in its original extent. Kathu Bushveld vegetation is poorly conserved and does not fall within any formal conservation areas. No endemic species are restricted to this vegetation type; however a number of Kalahari endemic are known to occur within the vegetation type. These include: *Acacia luederitzii* var *luederitzii*, *Anthephora argentea*, *Megaloprotachne albescens*, *Panicum kalaharense* and *Neuradopsis bechuanensis*. Other vegetation types occurring in the broad vicinity include: Gordonia Duneveld and Kuruman Thronveld.

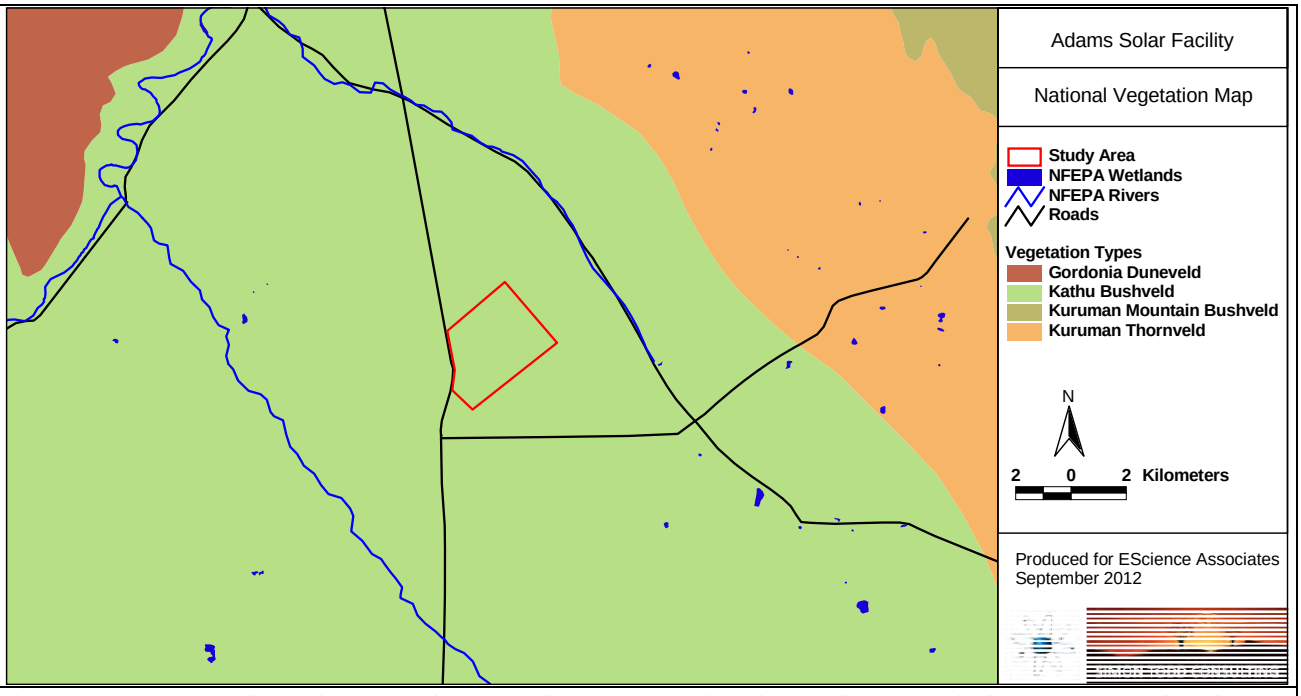

Figure 8-12: Broad-scale overview of the vegetation in and around the proposed Adams site.

8.7.3. FLORA

Variation in the composition of vegetation was observed within the study area. The density of tress was higher and grass layer was grazed out. It was identified by the specialist that there is no significant visible differences that will warranted recognition of different plant communities on site. There is little significant variation in the woody layer as well a very homogeneous substrate throughout the site. No drainage lines or other edaphic feature present on the site could lead to differentiation of the vegetation.

The site mainly consists of a tree layer consisting of: *Acacia haematoxylon*, *Acacia mellifera*, *Acacia erioloba* and *Grewia flava. The tree layer is followed by grassy understory consisting mainly of perennial grass species such as: Schmidtia pappophoroides, Aristida meridionalis, Eragrostis lehmanniana and Stipagrostis uniplumis. The following occasional shrubs species were also recorded on site: Gnidia polycephala, Hermannia tomentosa and Melolobium macrocalyx.* Other large woody species recoded mainly in localized clumps or scattered individuals include: *Searsia lancea*, *Acacia hebeclada*, *Lycium hirsutum* and *Tarchonanthus camphoratus.* Although extensive, the list may not include all species, due to the fact that a portion of the site was burned prior to the site assessment. The actual species list would have been much larger and would have included particularly under-represented species such as grasses, forbs and annuals. The specialist however indicated that even if the species list were more comprehensive it would not result in differentiation of the site in terms of sensitivity. The main reason for this is that the substrate is very homogenous, and there is limited physical basis present on which vegetation might differentiate itself.

Figure 8-13: Various examples of the landscape and vegetation of the Adams site

8.7.4. LISTED FLORAL SPECIES

A total of 458 species have been recorded within the quarter degree squares. It was indicated by the specialist that the area does not contain very high plant diversity; this low

total suggests that the area has not been very well sampled. There was only one species of conservation concern, namely *Acacia erioloba*. This species is listed as declining by the South African Red Data List of Plants (2012). Several national protected species occur at the site, including *Acacia haematoxylon* and *Acacia erioloba,* which were most dominate. *Boscia albitrunca,* although not observed on site, is also very likely to occur, as it is very widespread throughout the area.

Table 8-3: South African Red Data List of Plants (2012) that were observed or may occur at the site.

Family	Species	Status	Presence
Fabaceae	*Acacia erioloba*	Declining	Confirmed

The specialist indicated that the potential for broad scale fragmentation or loss of connectivity due to the proposed project is low.

8.7.5. FAUNAL COMMUNITIES

MAMMALS

The site falls within the distribution range of 48 terrestrial mammals, and 8 bats, indicating that the mammalian diversity at the site is potentially high. Species associated with rocky habitat are unlikely to occur on the site. Species observed at the site include Aardvark, South African Ground Squirrel, Yellow Mongoose, Cape Hare, Cape Porcupine and Steenboks.

Five terrestrial mammal species of conservation concern may occur in the area: Brown Hyena, Black- footed Cat,leopard Honey Badger and Ground Pangolin. Due to agricultural activities in the area the likelihood of leopard Honey Badger or Brown Hyena residing on site is relatively low. The habitat on site is suitable for the Black- footed Cat which favours a mix of open and more densely vegetated area. As these species are widely distributed across the arid and semi-arid region of South Africa, the limited extent of development would not amount to a significant amount of habitat loss for these species.

The farm is used mainly for livestock grazing; the abundance of larger predators namely brown Hyena and Leopard is likely to be very low as a result of persecution from farmers. The abundance of other listed species is therefore high, as the habitat is broadly suitable for all three species. The Black-footed Cat, Honey Badger and Ground Pangolin are however widely distributed across the arid and semi-arid parts of South Africa and the development of the site would not constitute significant habitat loss for these species, as a single individual has a home range far exceeding the extent of the study area. The Pangolin would potentially be most severely affected as electrocution on electrified fencing is a major cause of mortality for this species which curls up in defence in response be being shocked, often around the live wire. A complete species list likely to occur on the site has been developed (See Appendix 7.1).

The following bat species are likely to occur on the site: Cape Serotine Bat, Egyptian Free-tailed Bat, Egyptian Slit-faced Bat, Dent's Horseshoe Bat, Darling's Horseshoe Bat, and Straw-coloured fruit bat. All of these bat species are classified as being of least concern in terms on the IUCN red list categories for fauna and flora. The likelihood of them occurring in the area is reduced due to the lack of suitable habitat on site as well as the low availability of water. The proposed facility would therefore not directly affect bat communities likely to occur in the area. Please note the potential impact on bats is not considered applicable to the study area. As there are no suitable habitats located within

the study area for bat communities, the impact is not considered significant and not considered further in this assessment.

Apart from some direct loss of habitat, the development of a PV facility would potentially also disrupt the connectivity of the landscape for some fauna. However, as the facility is adjacent to the Mamatwan Mine as well as R380 road, which is fenced with mesh-fencing on both sides, the additional contribution of the facility to landscape disruption is not likely to be very large or significant given that there are extensive tracts of similar intact habitat to the east.

REPTILES

The site has a known distribution range of just over 33 reptile species and therefore the site is considered to have a low diversity in reptile community. The reptile composition at the site according to the specialist would most likely be as follows:

- Tortoise 2x
- Snakes 11x
- Lizards and skinks 13x
- Geckos 5x
- Chameleon 1x

The site is mostly characterised by species associated with wide habitat tolerance and sandy substrates. No narrow endemics or listed reptile species occur in the area. Reptile species likely to occur on the site will be largely widespread species of low conservation concern. Only a few reptile species were observed during the site investigation. The specialist indicated that the main reasons for this were the dry conditions as well as the recently burnt nature of portion of the site. Depending on the management of the vegetation within the PV areas, the impact on many reptiles may not be very high, as the panels would create suitable habitat for many geckos and arboreal species, while ground-living species would also be likely to persist provided that some vegetation cover is allowed to persist beneath the panels. The panels would also be likely to protect ground-living species from avian predators. Ultimately though, the reptile composition within the developed areas would likely represent a subset of the original reptile community of the area and certain species would benefit disproportionately.

While the development will impact the natural vegetative habitat of the site, the construction of the various infrastructural components such as the PV arrays and buildings will create additional habitat which will attract species which utilize such structures. If artificial lighting will be provided at the site at night, this would attract insects which would in turn attract geckos and other night-feeding insectivores (such as bats and solifugids) to the vicinity of the lights. In order to reduce this potential impact, the use of low-UV emitting lights, such as most LEDs, which attract significantly less insects, should be used.

AMPHIBIANS

Only about three or four of the eleven amphibian species within the known distribution range are likely to be located within the site's distribution range. There is no surface water located within the study area and no areas where water is likely to collect for prolonged time periods. As there is no surface water located within the area the only amphibian species likely to occur on the site are those capable of persisting away from perennial water. The only species of conservation concern likely to occur on site is the Giant Bullfrog. As no breeding habitat is located at or close to the development it is unlikely to significantly affect the Giant Bullfrog. The rain and sand frogs are likely to occur on the site as they are a widespread species mostly associated with sandy substrate. The site is unlikely to be of above average significance to these species. The specialist indicated

that the development would not likely have a significant impact on amphibians and therefore not considered further in this assessment.

AVIFAUNA

A detailed avifaunal assessment was undertaken by Scientific Aquatic Services in 2011 for the Assmang Black Rock Mine Operations approximately 22 km south of the Adams site. Due to the close proximity to the development the species identified in this study would be very similar to those recorded there. The following Northern Cape threatened bird species have been recorded in the vicinity of the site and very likely to occur with the site: African White-backed Vulture Cape Griffon (Cape vulture), European Roller (SAS, 2011). The following is a list of common bird species expected to occur on the site:

Cape turtle Dove (Not Threatened), Red-eyed Dove(Not Threatened), Laughing Dove (Not Threatened), Jocobin Cuckoo (Not Threatened), Barn Owl (Not Threatened), African Palm Swift (Not Threatened), Little Swift (Not Threatened), Lilac-breasted Roller (Not Threatened), Southern Yellow-billed Hornbill (Near Endemic), Pied Crow (Not Threatened), Cape Crow (Not Threatened), African Red-eyed Bulbul (Near Endemic), Kalahari Robin (Near Endemic), Cape Glossy Starling (Near Endemic), Southern Masked-Weaver (Not Threatened), Crowned Plover (Not Threatened), Cape Sparrow (Near Endemic), Groundscraper Thrush (Not Threatened), Great Sparrow (Not threatened), Yellow Wagtail (Not Threatened), Lesser grey shrike (Not Threatened), Swallow-tailede Bee-eater (Not Threatened) and Yellow Canary (Near Endemic) (SAS, 2011).

8.7.6. EXOTIC AND INVASIVE SPECIES

No alien species were observed at the site, but development would be likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion should be implemented as part of the EMPr for the development (Appendix 8).

8.8. CATCHMENT DESCRIPTION

The Adams site is located approximately 2.6 km from the eastern extent of the Witleegte River and approximately 5.3 km from the south western extent of the Vlermuisleegte River. The site falls within quaternary catchment D41K. The local topography is largely flat, dipping to the east into the Gamagara river bed. The Gamagara river catchment comprises both quaternary catchments D41k and D41J that cover an area of 8094 km^2. Within this catchment only 5182 km^2 is considered to drain to a surface drainage feature due to the flat and sandy nature of the area.

The Kuruman River is located approximately 25 km to the east, while the Gamagara River located 12 km north westerly, both rivers draining northwards of the boundary of the study area.

As the proposed solar facility would require water for cleaning purposes, the Joe Morolonog Municipality has been approached to provide water which will potentially come from the Vaal-Gamogara Water Scheme. There is also an option to abstract groundwater; however a water use licence would be required. The BHP Billition mine directly west of the site already raised concerns regarding availability of groundwater for the site. Most concerned raised on water usage of solar plants has been due to confusion between the various solar technologies. Solar PV technologies use substantially less water than solar thermal technologies. It is expected that a 75MW plant will require 2500m^3 of water per annum during the operating phase.

There is one borehole located on the old mine compound within the study area; however this borehole is not in operation presently. Water used for cattle watering is piped from a borehole on the BHB Billiton site to the Adams farm.

8.8.1. ANNUAL AVERAGE RUN OFF IN THE CATCHMENT AREA

A sizeable proportion of the Gamagara River Catchment does not yield run-off to any surface drainage feature due to the flat sandy nature of the region. The estimated run-off of quaternary catchment D21K annually is 1 mm. This effectively means that under normal circumstances, no water will flow in the Gamagara River for most of the time.

On the other hand the Kuruman River to the east of the study area starts off as a perennial river, being fed by dolomitic water from the Kuruman Eye. It soon becomes a non-perennial watercourse, as water abstracted from the stream for domestic and farming purposes and evaporation and groundwater recharge, all play a role in depleting the water flowing on the surface in the river.

As stated before the Kalahari Basin is an endorheic basin, meaning that effectively no water leaves the basin other than as evaporation. So in essence surface water rapidly becomes groundwater and stays there.

8.8.2. DRAINAGE DENSITY OF DISTURBED AREA

No streams are present within the study area. The area is largely flat. Figure 8-14 shows the relative drainage networks of the surrounding areas in proximity to the study area.

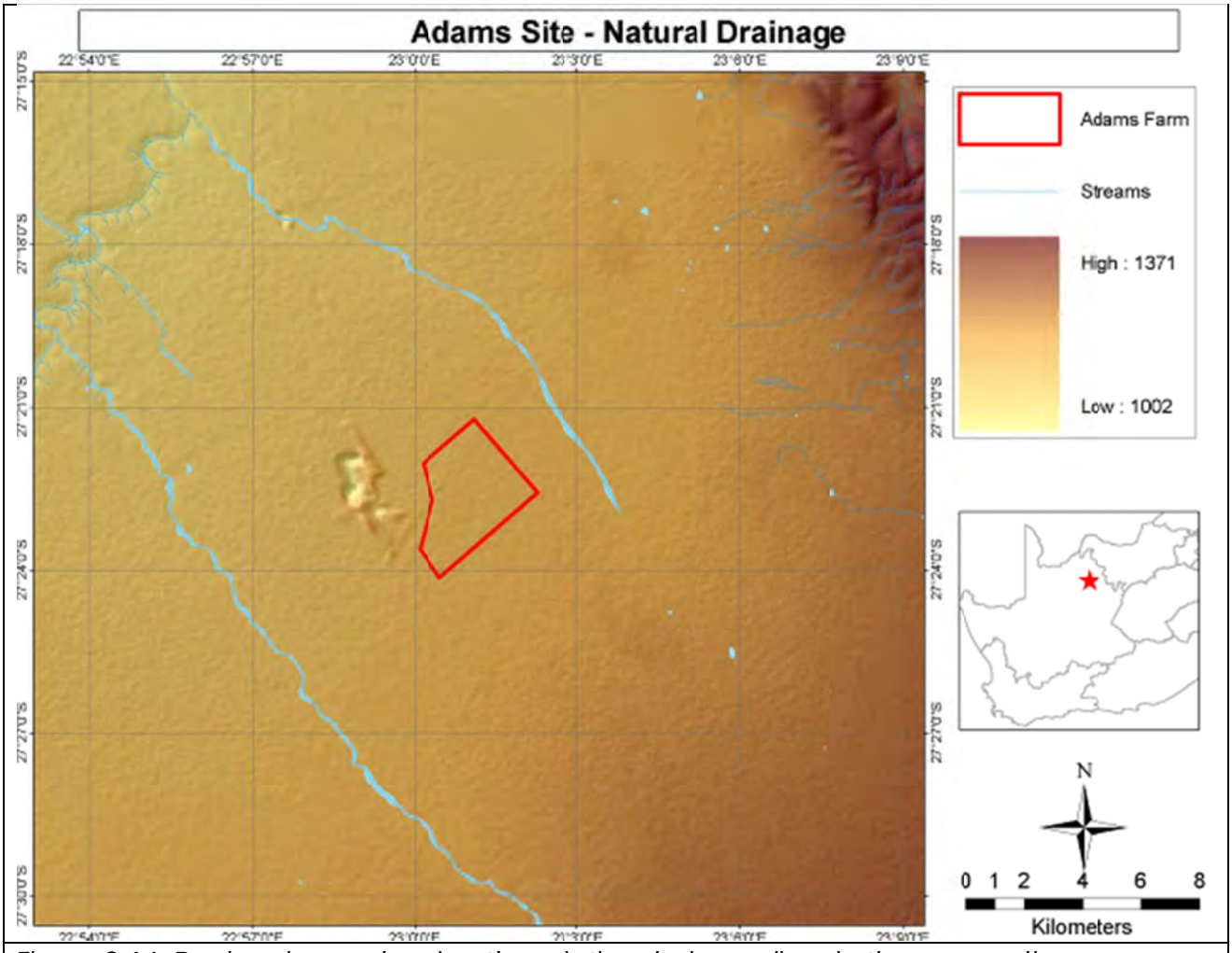

Figure 8-14: Regional map showing the relative drainage lines in the surrounding area.

8.9. NOISE

The surrounding land is largely rural in nature and base noise levels can be expected to be low. The BHP Billiton mine Mamatwan is located on the western boundary of the site; this noise source is a major contributor to the static noise levels in the area. The areas surrounding the site are mostly rural in character and contribute to low levels of background noise. The principal sources of noise are at the BHP Mamatwan sinter plant operations, and mining surface operations including ore transport by conveyor, vehicle movement of ore on the stack floors, crushing and screening of ore, road noise associated with service and labour transport and rail noise from ore trains. The proposed PV facility is not expected to increase the ambient noise levels above those already occurring within the BHP Billiton Mamatwan mining operations.

8.10. VISUAL AESTHETICS

The general appearance of the farm Adams is dominated by largely unspoilt natural woodlands vegetation on very flat ground somewhat degraded by grazing at places. The general "sense of place" (Figure 8-16) of the area is a particular kind generally unspoilt natural beauty. As the area is dominated by the open landscape the visual and aesthetic feeling of the area is pleasant. There is however some cultural modification/visual intrusion existing around the proposed site: various power lines going into the Dougnor substation as well the substation itself. A large BHP Billiton Mamatwan mining complex is situated adjacent to the development site as well an old mining compound (Figure 8-15)(Geldenhuys, 2012).

Figure 8-15: Cultural Modification & Adjacent Scenery (Geldenhuys, 2012)

Figure 8-16: Sense of place photos (Geldenhuys, 2012).

8.11. TRAFFIC

The road network around the subject Photovoltaic Power Plant is displayed in Figure 8-17 below. It consists of the Regional Road (R380) and a Divisional Road to Kuruman.

The R380 road passing the site connects the towns of Kuthu with the town of Hotazel via the R31. The divisional road to the south of the site connects the R360 with the R31 to Kuruman via Kathu.

The R380 running direcly adjacent to the west of the site is approximately 6 m wide and is located within a 34 m wide road reserve. The speed limit of the R380 is 120 km/h. The divisional road is approximately 10 m wide and located within a road reserve that varies between 30 - 40 m. The general condition of the R380 and the divisional road is good.

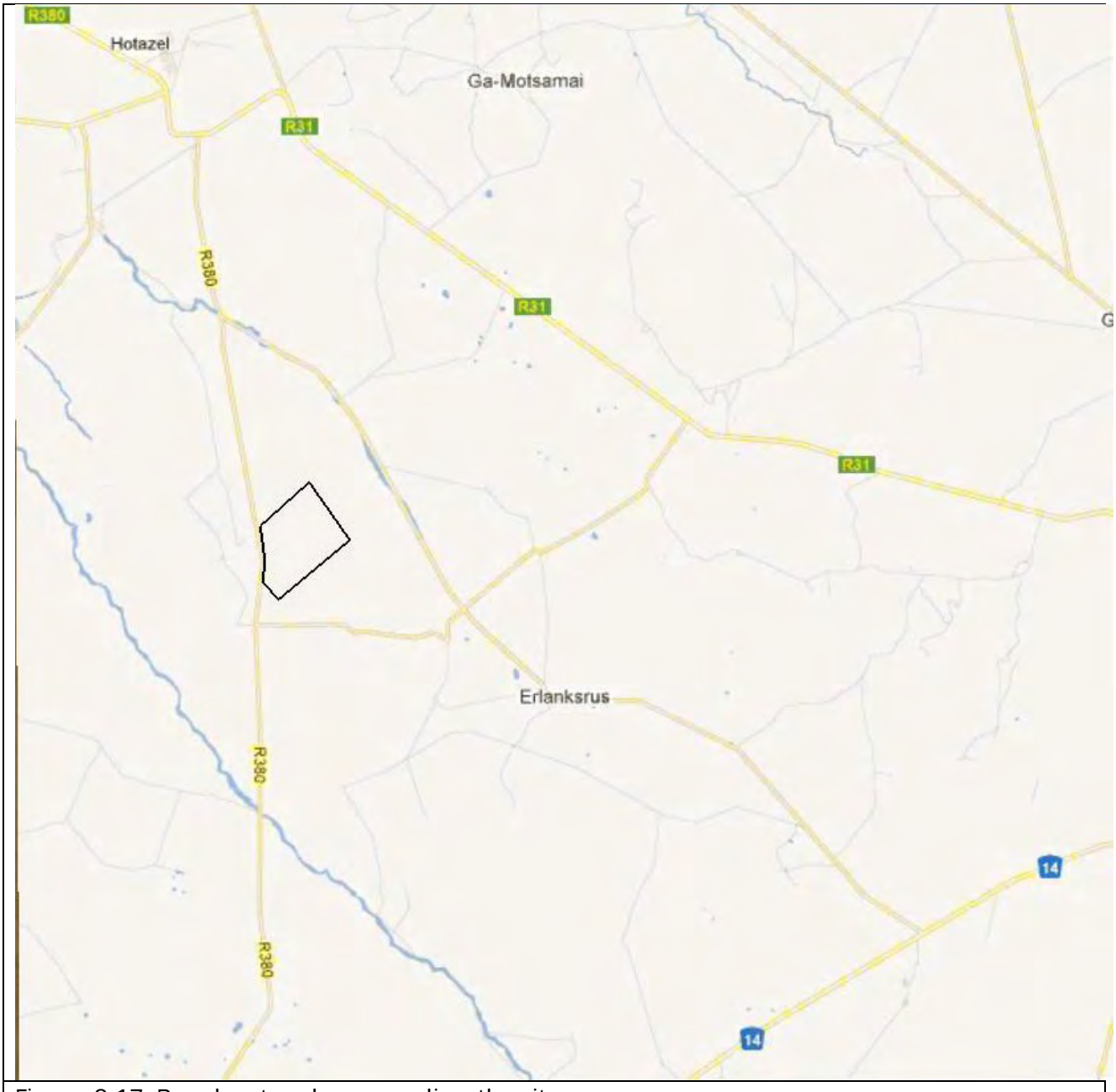

Figure 8-17: Road network surrounding the site

Figure 8-18; Visual representation of the R380 towards Hotazel. The study area is directly right (east) of the image above. To the left side of the image are the waste rock dumps of the Mamatwan mine.

Figure 8-19: Unnamed road to Kuruman, one kilometre south of the study area.

8.12. ARCHAEOLOGY, HERITAGE & CULTURE

8.12.1. STONE AGE

The Stone Age is the period in human history when stone was mainly used to produce tools (Coertze & Coertze 1996: 293). In South Africa the Stone Age can be divided in three periods is as follows (Korsman & Meyer, 1999):

Early Stone Age (ESA) 2 million – 150 000 years ago
Middle Stone Age (MSA) 150 000 – 30 000 years ago
Later Stone Age (LSA) 40 000 years ago – 1850 AD

The archaeology of the Northern Cape is rich and varied, covering long spans of human history. The Karoo is particularly bountiful. Some areas are richer than others, and not all sites are equally significant. The significance of sites encountered in the study area may be assessed against previous research in the region and subcontinent. The region's remoteness from research institutions accounts for a relative lack of archaeological research in the area. The area has probably been relatively marginal to human settlement for most of its history, yet it is in fact exceptionally rich in terms of Stone Age sites and rock art, as a relatively few but important studies have shown (Morris 2006).

Stone Age sites are known to occur in the larger geographical area, including the well-known Wonderwerk Cave in the Kuruman Hills, Tsantsabane, an ancient specularite working on the eastern side of Postmasburg, Doornfontein, another specularite working north of Beeshoek and a cluster of important Stone Age sites near Kathu. Additional specularite workings with associated Ceramic Later Stone Age material and older Fauresmith sites (early Middle Stone Age) are known from Lylyfeld, Demaneng, Mashwening, King, Rust & Vrede, Paling, Gloucester and Mount Huxley to the north. Rock engraving sites are known from Beeshoek and Bruce (Morris 2005: 3).

Studies done by Kusel (2009) and by Pelser & Van Vollenhoven (2011) at Black Rock and Gloria Mines near Hotazel, not far from the study area at Adams, did reveal a number of Early to Later Stone Age artifacts and sites in the area. A single stone tool was identified during the site assessment in 2012 (Pelser, 2012).

8.12.2. IRON AGE

The Iron Age is the name given to the period of human history when metal was mainly used to produce artifacts (Pelser, 2012). The expansion of early farmers, who, among other things, cultivated crops, raised livestock, made ceramic containers (pots), mined ore and smelted metals, occurred in this area between AD 400 and AD 1100 and brought the Early Iron Age (EIA) to South Africa. They mainly settled in semi-permanent villages

This later phase, termed the Late Iron Age (LIA), was accompanied by extensive stonewalled settlements, such as the Thlaping capital Dithakong, 40 km north of Kuruman (Pelser, 2012).

Sotho-Tswana and Nguni societies, the descendants of the LIA mixed farming communities, found the region already sparsely inhabited by the Late Stone Age (LSA) Khoisan groups, the so-called 'first people'. Most of them were eventually assimilated by LIA communities and only a few managed to survive, such as the Korana and Griqua. This period of contact is sometimes known as the Ceramic Late Stone Age and is represented by the Blinkklipkop specularite mine near Postmasburg and finds at the Kathu Pan (Pelser,

2012). The specialist assessment on site did however not find any object of features during his survey of the site.

8.12.3. HISTORICAL AGE

Factors such as population expansion, the increasing pressure on natural resources, the emergence of power blocs, attempts to control trade and penetration by Griquas, Korana and white communities from the south-west resulted in a period of instability in Southern Africa that began in the late 18th century and effectively ended with the settlement of white farmers in the interior. This period, known as the *difaqane* or *Mfecane*, also affected the Northern Cape Province, although at a relatively late stage compared to the rest of Southern Africa. Here, the period of instability, beginning in the mid-1820s, was triggered by the incursion of displaced refugees associated with the Tlokwa, Fokeng, Hlakwana and Phuting tribal groups (Pelser, 2012).

The *difaqane* coincided with the penetration of the interior of South Africa by white traders, hunters, explorers and missionaries. The first was PJ Truter's and William Somerville's journey of 1801, which reached Dithakong at Kuruman. They were followed by Cowan, Donovan, Burchell and Campbell and resulted in the establishment of a London Mission Society station near Kuruman in 1817 by James Read (Pelser, 2012).

The Great Trek of the Boers from the Cape in 1836 brought large numbers of Voortrekkers up to the borders of large regions known as Bechuanaland and Griqualand West, thereby coming into conflict with many Tswana groups and also the missionaries of the London Mission Society. The conflict between Boer and Tswana communities escalated in the 1860s and 1870s when the Korana and Griqua communities became involved and later also the British government. The conflict mainly centered on land claims by various communities. For decades the western border of the Transvaal Boer republic was not fixed. Only through arbitration (the Keate Arbitration), triggered by the discovery of gold at Tati (1866) and diamonds at Hopetown (1867) was part of the western border finally determined in 1871. Ten years later, the Pretoria Convention fixed the entire western border, thereby finally excluding Bechuanaland and Griqualand West from Boer domination (Pelser, 2012).

8.13. PALEONTOLOGICAL RESEARCH

The entire area is situated on the Cenozoic Kalahari Group comprising calcretes and eolian sands. As such there is a slight but unlikely possibility of Cenozoic fossils being present in the calcretes and unconsolidated red sands. The chances unearthing fossilised materials during the development of the proposed photovoltaic facility and associated infrastructure are extremely limited. However because all sedimentary deposits have the potential to preserve fossils it is essential that if fossilized remains of plants are animals are encountered in the process of development, a professional palaeontologist must be consulted so that the necessary rescue operations are implemented.

8.14. SOCIO-ECONOMIC BASELINE SUMMARY

8.14.1. POPULATION

The JT Gaetsewe District Municipality, within which the site is located, comprises 179 863 people and 45 040 households, thus representing 16.4% of the provincial population. Over the last decade, the size of the municipality from the population perspective has been growing at the same rate as the average growth rate observed in the rest of the Province; however it is half the rate observed in that of the country. Given the historical trend, it was estimated that by 2025, the South African population could reach 54.7 million people,

whilst the JT Gaetsewe DM's population would grow only by about 6 000 people. At the same time, it is expected that the household size in JT Gaetsewe will continue growing at a slow pace as was observed in the past ten years or so, and if this trend continues its household numbers would increase to 4.1 perons per household (Urban Econ Development, 2011).

8.14.2. ECONOMIC PROFILE

Households residing in the JT Gaetsewe District Municipality have relatively the same level of income as the average household in the Northern Cape Province, but it is significantly lower than the average household income in South Africa. This means that the Northern Cape and the JT Gaetsewe DM households do not have the same level of access to economic opportunities as the rest of South Africa.

The labour market in the primary study area comprises of 33 684 employed and 15 763 unemployed people. It has a smaller labour participation rate (47.5%) than in the rest of South Africa but a significantly lower participation rate than in the Northern Cape, which explains a lower average household income earned by JT Gaetsewe DM households versus South African households. The unemployment rate in JT Gaetsewe DM is higher than in any of the analysed areas. This, however, could be explained in terms of employment generation and the low labour participation rate. These discouraged job seekers are not considered to be economically active and are not included in the calculation of the unemployment rate. Therefore, the actual unemployment rates are deceiving and do not reflect the actual need to create new employment opportunities for people in the primary study area, as well as the rest of the country (Urban Econ Development, 2011).

Since 1996, the performance of the JT Gaetsewe DM's economy was growing on average at a faster rate than that of the country or the Province. Since 1999, however, the JT Gaetsewe DM's economy has been struggling when the Rand depreciated, experiencing a negative growth rate far below that of economies in the Northern Cape or South Africa. The JT Gaetsewe DM's economy is very sensitive to the changes on the global and regional arenas, due to the dependency of the mining sectors; its territory sector though is relatively developed but since it is reliant on the derived demand and the local disposable income, any changes in the mining sector's employment situation would have spin offs (positive or negative) in the tertiary sector(Urban Econ Development, 2011)..

The situation with housing and service delivery in the area varies. On one hand, the access to formal dwelling in the District is better than that in the rest of the country. However, it appears that an influx of people in the last few years has increased the size of informal dwellings. With respect to water and sanitation, the area shows a typical rural and per-urban profile with a significant portion of households having access to water outside their dwellings and using pit toilets (Urban Econ Development, 2011)..

Given all of the above, it can be concluded that the JT Gaetsewe DM is in need of investment to stimulate its economy and create new jobs. Ideally, such investment should focus on diversification of local economic activities to reduce the dependency on the mining sector and create new value chains within the local economy. Any new developments in the municipality also take into account the local housing and service delivery situation and, if possible, put interventions in place that would assist in improving access to formal dwellings as well as access to basic services.

8.14.3. WATER SUPPLY

All domestic water needs are sourced from the Vaal Gamagara water scheme, operated by the Sedibeng Water Board.

8.14.4. POWER SUPPLY

The mines, towns and associated villages and service infrastructure are supplied with electrical power by Eskom.

9. IMPACT ASSESSMENT METHODOLOGY

The following criteria and methodology are proposed to determine the significance of environmental impacts caused by the proposed project.

9.1. TYPE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a) Direct/Primary Impacts
   Primary impacts are caused directly by the activity and generally occur at the same time and place as the activity.
b) Indirect/Secondary Impacts
   Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.
c) Cumulative Impacts
   Cumulative impacts are those that result from the incremental impacts of the proposed activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

9.2. DETERMINING SIGNIFICANCE

The following criteria will be used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

9.2.1. NATURE

Nature (N) considers whether the impact is:
- positive [- ¼]
- negative [+1].

9.2.2. EXTENT

- Extent (E) considers whether the impact will occur:
- on site [1]
- locally: within the vicinity of the site [2]
- regionally: within the local municipality [3]
- provincially: across the province [4]
- nationally or internationally [5].

9.2.3. DURATION

Duration (D) considers whether the impact will be:
- very short term: a matter of days or less [1]
- short term: a matter of weeks to months [2]
- medium term: up to a year or two [3]
- long term: up to 10 years [4]
- very long term, or permanent: 10 years or longer [5].

9.2.4. INTENSITY

Intensity (I) considers whether the impact will be:

- negligible: there is an impact on the environment, but it is negligible, having no discernable effect [1]
- minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
- moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
- major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
- severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

9.2.5. PROBABILITY

Probability (P) considers whether the impact will be:

- unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]
- likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
- very likely: the impact will probably occur, but it is not certain [3]
- definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

9.2.6. MITIGATION OR ENHANCEMENT

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

A negative impact can be mitigated:

- unmitigated: no mitigation is possible or planned [1]
- slightly mitigated: a small reduction in the impact is likely [2]
- moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
- well mitigated: the impact can be mostly mitigated and the residual impact is negligible or minor [4]

A positive impact can be enhanced:

un-enhanced: no enhancement is possible or planned [1]

- slightly enhanced: a small enhancement in the benefit is possible [2]
- moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]
- well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

9.2.7. REVERSIBILITY

Reversibility (R) considers whether an impact is:

- irreversible: no amount of time or money will allow the impact to be substantially reversed [1]
- slightly reversible: the impact is not easy to reverse and will require much effort, taken immediately after the impact, and even then, the final result will not match the original environment prior to the impact [2]
- moderately reversible: much of the impact can be reversed, but action will have to be taken within a certain time and the amount of effort will be significant in order to achieve a fair degree of rehabilitation [3]
- mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily [4].

9.3. CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 9-1: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	**1**	**2**	**3**	**4**	**5**
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	regional	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	-
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

For a negative impact: $S = N \times (E+D) \times I \times P \div \frac{1}{2}(M+R)$; and
For a positive impact: $S = N \times (E+D) \times I \times P \times (H)$.

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

9.4. UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 9-2: Final Significance Scoring

Final score (S)	Impact significance	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMPr and managed appropriately

Table 9-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

Two examples will help illustrate this system:

SCENARIO 1 – An industrial facility proposes discharging effluent containing a high salt content into a nearby stream. These salts will cause temporary problems for the ecosystem, but are washed downstream, diluted and will have no long term effects. The short term damage to the stream can be reversed fairly easily, but only if the ecosystem has not been seriously damaged by the salts over a long time. A mitigation measure is also proposed whereby during low flow periods (dry season) a pulse of clean water is discharged into the stream after the saline effluent, diluting the salts and pushing them downstream faster, so that the salts become so dilute as to have little or no effect.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = medium = 3
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = moderate = 3
- reversibility = moderate = 3,

and therefore impact significance is:

S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+3) x 3 x 4 ÷ ½(3+3)
= 60 ÷ 3
= 20.

Note that the impact prior to mitigation is major, but that due to the mitigation and the fact that the ecosystem can recover easily from the effects of salt (high reversibility), the residual impact becomes minor/moderate.

SCENARIO 2 – The above scenario applies, except that the effluent contains metals. These metals become adsorbed onto clay and organic matter in the stream bed and are accumulative toxins within the ecosystem, getting into the food chain and concentrating

upwards into predator species. Fresh water flushing will only very slightly mitigate this and ecosystem recovery will not be easy or fast.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = very long = 5
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = slight = 2
- reversibility = slight = 2,

and therefore impact significance is:

S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+5) x 3 x 4 ÷ ½(2+2)
= 84 ÷ 2
= 42.

Note that in this case, the original impact (of the metals) is more serious than the salt, but it is the limited mitigation and reversibility that also act on the residual score and result in this score being moderate.

10. IMPACT SIGNIFICANCE ASSESSMENT/ANALYSIS

10.1. INTRODUCTION

Impact analysis is, in a sense, the core of the EIA process. It is the phase where all relevant project information that has been gathered is manipulated and distilled – *it is the Environmental Impact Assessment*. The impact analysis has two major goals, starting with listing and describing all possible environmental impacts and then proceeding to give some perspective on the relative significance of the various impacts. The predicted effects of mitigation measures also need to be factored into the impact analysis.

Environmental impact analysis needs to take cognisance of the following issues that all fall under the definition of the 'environment':

- Physical natural environment: water, land, air;
- Biological natural environment: flora, fauna, ecosystems;
- Resources: land/space, minerals, water, rights of use;
- Economic: cost, profit, distribution of income, jobs, skills, permanence;
- Human health: occupational, environmental health, pollution, safety; and
- Human cultural: religion, tradition, aesthetics, heritage, recreation.

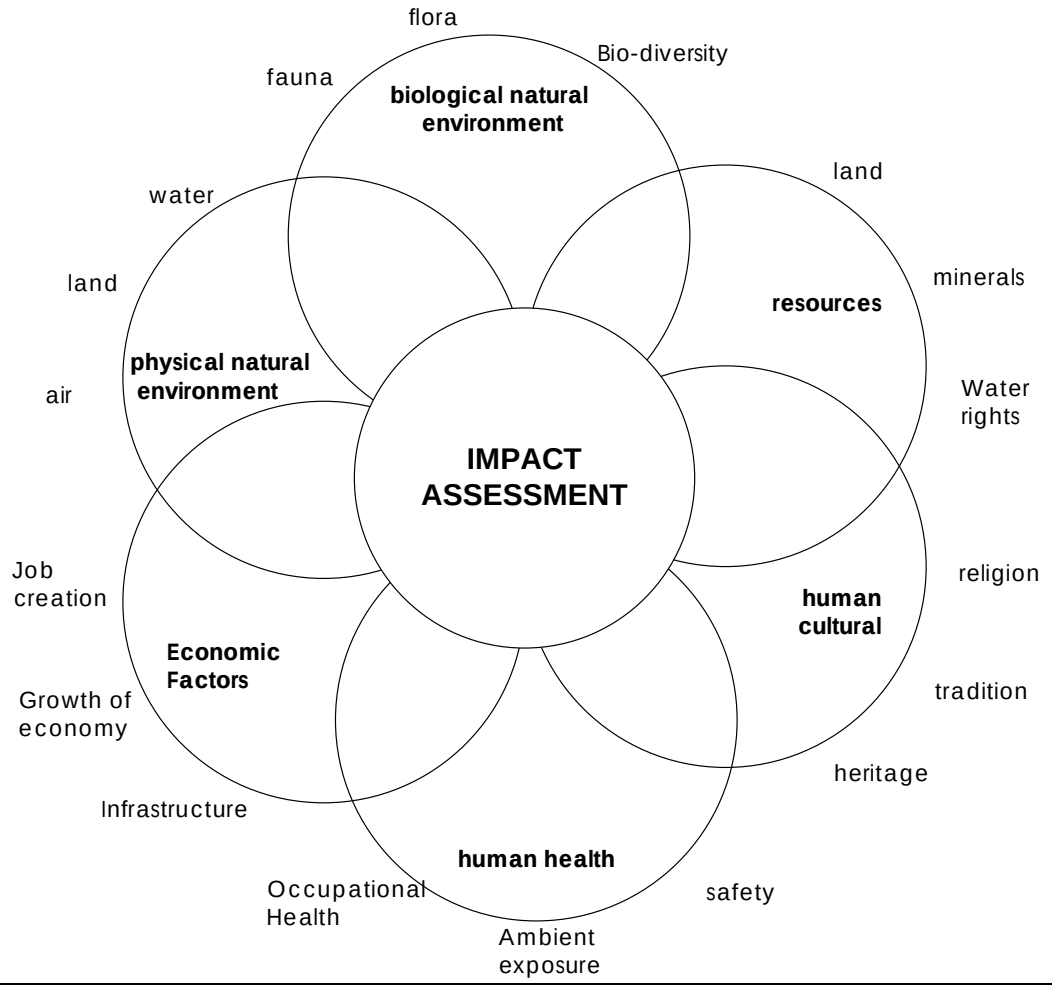

Figure 10-1: Widening environment and sustainability agenda

One needs to, however, bear in mind that the natural environment is the most threatened and irreplaceable resource upon which all the other human aspects depend.

Impact significance is semi-quantitatively assessed (Section 7.2) for relevant aspects (e.g. water, air, biodiversity, noise, visual character, heritage resources, etc.) for each respective phase of the project referred to above. In addition, a brief description of mitigation to be implemented in order to minimise the significance of the potential impacts is provided. The details of *inter alia* required mitigation, monitoring and reporting are put forward in the comprehensive Environmental Management Plan (EMP) for the project, which is annexed to this report.

The analysis of impact significance assessment for potential project impacts furthermore needs to consider impacts that may be realised through all project phases:

1. Construction:
   The significant activities associated with the construction period will be the establishment of the access road, site preparation, construction camp establishment, panel foundations and infrastructure, transportation of all materials/components to the site and finally site rehabilitation after construction has ended.

2. Operation:
   The operational phase of the facility will generate clean renewable electricity to be injected into the national grid. The site will need to have maintenance undertaken from time to time, such as washing the panels free of dust to ensure efficient operation of the facility. The substation would also require regular maintenance, which most likely to result in the generation of used transformer oil, which would need to be properly handled and disposed of.

3. Decommissioning:

   The facility is expected to have a life cycle of approximate 20-25 years; however if the facility is deemed to be economically viable the facility will remain operational beyond this point. If the facility is closed down the decommissioning will include: disassembling of the components of the facility, site preparation and finally site rehabilitation to a degree depending on the final land use of the affected area. Decommissioning by itself is therefore not assessed in detail. The reason for this is that all activities associated with the decommissioning phase are similar in nature to construction impacts; however this is adequately addressed with the EMPr (Appendix 7). The IPP Programme is designed to allow the proponent to operate the plant for a period of 20 years under a power purchase agreement. As the power plant can be operational for a longer period the economic conditions at that time will determine whether to continue with operation of the facility or decommission it. Any recyclable materials such as panels and steel structures will be sent to recycling facilities with other infrastructure disposed off in accordance with the EMPr.

10.2. ASSESSMENT APPROACH

The assessment area covers an area of 558 hectares (Figure 8-1); however only the most feasible area from an environmental and engineering point of view will be developed. The EIA has been conducted in a professional manner in line with principles of environmental management according to NEMA. To date no impacts have been identified that in the opinion of the environmental specialists result in the project being fatally flawed; the majority of the site is not considered very sensitive. The majority of the impacts identified is mainly localised to the directly affected area only.

To date no impacts have been identified that in the opinion of the environmental specialists result in the project being “fatally flawed”; however any sensitive areas that exist within the study area will be mitigated as to ensure that the impact associated by the

development of the solar facility on the farm Adams will be localised to the affected area only. These sensitive areas include:

- Ecologically sensitive areas include: The major sensitive feature on the site is the relevant abundance of the protected tree *Acacia erioloba* and *Acacia haematoxylon.* Removal permits will have to be applied for from the relevant authority
- Visual sensitive area: Only the R380 road running past the site is considered sensitive as regular commuters on the road is most likely to be directly exposed to the development, however the impact associated with regular commuters on the R380 road is considered minimal.

Taking the environmental sensitivities as well the technical preferences into consideration on the proposed site a preliminary facility layout can be developed and contained within Section 11. This layout has been produced taking all the impacts identified and assessed within this chapter into consideration to identify the area most suitable from an environmental and engineering perspective.

The feasible development area available is 558 hectares and could produce approximately 169 MW of electricity. Especially during the construction phase, the area will be disturbed due to the installation of the necessary infrastructure and foundations for the facility. The development of the proposed new substation station (Figure 3-4) was also considered in the detailed impact assessment below. The impact assessment below was mainly supplemented by specialist inputs from various fields of study and the project developer. Although large scale public notification was distributed, interest in the project was fairly limited and the only formal comment was received by the BHP Billiton mine directly west of the site which had concerns regarding the water requirements and lack of availability of groundwater.

In order to adequately assess the potential impact of the proposed development on the environment, it was required to quantify the temporarily and permanently affected areas (both linear and development areas).

10.3. CONSTRUCTION AND OPERATIONAL PHASES

10.3.1. INTRODUCTION

This phase of the project involves all those activities related to preparation of the site and subsequent construction/establishment of the various project structures and associated infrastructure thereon once prepared (e.g. vegetation stripping, topsoil stripping, earthworks/levelling/excavations/foundations, building construction and engineering services installation, etc.). It is envisaged that the construction period will last for up to 2 years. The operational life span of the facility is expected to be 20-25 years with the option to extend this period. However most likely the facility will, however, be disassembled and re-fitted with improved technology at that time or completely decommissioned. Decommissioning is not assessed as part this section due to the similarity of activities related to construction. The decommissioning activities are regarded as similar to construction activities in this particular case and addressed adequately in associated EMPr (Appendix 8).

10.3.2. FAUNA AND FLORA

INTRODUCTION

The loss of biodiversity brings significant costs through damage to the services that ecosystems provide. Biodiversity conservation efforts in South Africa are largely species, or area, based. In the former, legal protection is given to species by providing prohibitions or restrictions to listed threatened or protected species (Fuggle and Rabie, 2009). In support of the above, no person in South Africa may "*carry out a restricted activity (e.g. removes, destroy, transport or trade) involving a specimen of a listed threatened or protected species without a permit*".

Project implementation will require the stripping of large tracts of indigenous vegetation (within the 558 hectare site area) as well as up to four (4) hectares for the new substation during the construction phase for subsequent earthworks and the construction of structures and infrastructure, where the referenced structures and infrastructures relate to the proposed PV solar facility.

A specialist floral and faunal assessment was undertaken for the subject project and contained within Appendix 7. The specialists constructed a sensitivity map of the site (Figure 10-2) by integrating all existing literature and site observation of the fauna and flora communities. The sensitivity map indicates the majority of the site has a "medium sensitivity" and suitable for the location of the PV facility as well the associated new substation. The most sensitive features on site are the relevant abundance of the protected tree *Acacia erioloba* and *Acacia haematoxylon.*

These species are however widely distributed across the entire site and it would be impossible to develop the site without some impact on these species. *Acacia erioloba* density is about 5-10 trees per hectares, not considered high compared to *Acacia haematoxylon* density exceeding 100 trees per hectare. The specialist indicated that the loss of *Acacia erioloba* would be more significant than the loss of Acacia *haematoxylon.* However, overall, given that neither species are actually rare and that the affected habitat is widely available in the area, the impact on these species and their habitat is not seen as being highly significant. The site should therefore not be considered to be highly sensitive on account of the presence of these two species

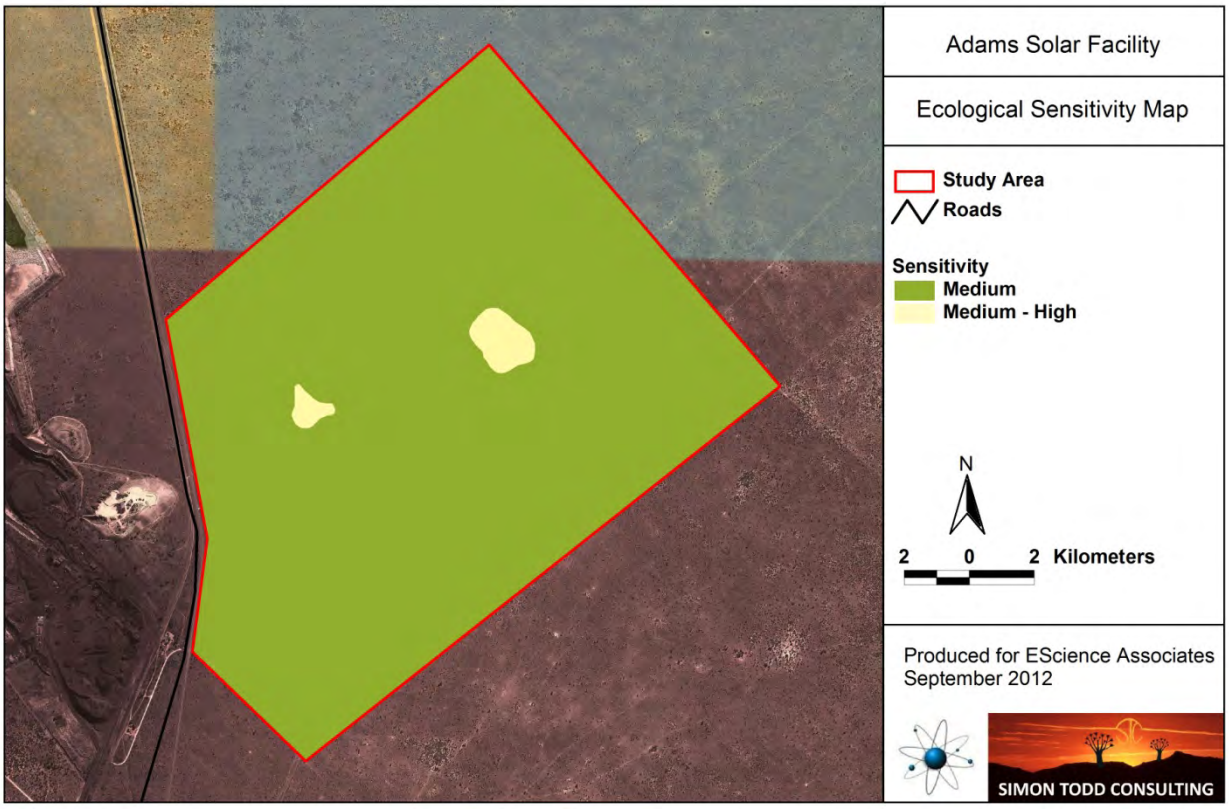

Figure 10-2: Ecological Sensitivity map of the proposed Adams PV Solar Facility

The construction/operation phase of the project will have both direct and indirect impacts on indigenous site flora and fauna, as follows:

- Construction phase:
  - Vegetation clearing for PV panel supports, roads, buildings etc. could impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
  - Increased erosion risk would be very likely to result due to the loss of plant cover and soil disturbance created during the construction phase. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems. Although the effects would probably only become apparent during the operational phase, the impact stems from the construction phase and suitable mitigation measures will also need to be applied at this stage.
  - Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.
  - Loss of connectivity & habitat fragmentation may result due to the presence of the generation infrastructure, roads, site fencing and other support infrastructure of the development.
  - Fire-related impacts (informal, unmanaged/indiscriminate, fires/burning regime by site contractors and construction personnel);
  - Soil and indigenous vegetation disturbances, leading to proliferation of alien vegetation; where such aliens would compete for space and available resources;
  - Removal/destruction of Red Data Listed (RDL) and protected floral species through site preparations (i.e. vegetation clearance);

- Operational Phase
    - The maintenance and operation activities of the facilities would generate some noise and disturbance which may deter some fauna from the area, amounting to a loss of connectivity & habitat fragmentation.
    - Maintenance activities such as vegetation clearing will impact the biodiversity of the site if not conducted in a sensitive manner.
    - Persistent avifaunal impacts would potentially result from the presence of power transmission infrastructure at the site
    - Fire related impacts (i.e. indiscriminate fires by contractors may lead to veld fires and the subsequent destruction of habitat to indigenous faunal species);

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

The proposed development will inevitably result in a loss of natural vegetation within the development footprint. The removal of some of the relatively abundant protected tree species *Acacia erioloba* and *Acacia haematoxylon* would be unavoidable and result in a loss of these species within the development footprint. These impacts can, to a large extent be mitigated to acceptable levels and included as management recommendations. The potential cumulative impact is considered relatively low on account of the small development footprint in comparison with overwhelmingly intact nature surrounding landscape. It should be noted that vegetation loss, including some protected plant species is inevitable and therefore cannot be avoided.

As the clearance of vegetation would result in loss of plant cover as well soil disturbances, it would result in a direct erosion risk. The impact would be more likely during operation as the constructed panels would increase runoff flows from the area. The specialist indicated that the erosion risk would result from wind rather than water, mainly as a result of the site topology being very flat. Cleared and exposed soil surfaces would be vulnerable to soil erosion related impacts. This impact can however be easily mitigated through regular monitoring and remedial action. The cumulative potential of the impact is considered to be very low as a result of the topology of the site. No residual impact is expected from the proposed facility through implementing appropriate erosion control measures. The construction of roads, panel foundations and the other infrastructure of the site will require a significant amount of vegetation clearing and will create a lot of disturbance at the site, leaving the soil exposed and vulnerable to erosion.

It was of specialist opinion that the site is very suitable for the development, as there are no significant ecological impacts associated with the proposed solar facility. No ecological features were deemed highly sensitive exist on site. The most significant impacts associated with the development considered are on the protected tree species *Acacia haematoxylon* and *Acacia erioloba*. However, as these species are widespread and common in the area, the impact is therefore not considered to be of high significance.

The loss of connectivity and potential for broad scape fragmentation is considered low as habitat occurring on site is widely available across an extensive area surrounding the site. The open and flat nature of the site suggests that limited ecological gradients are operating across the site in terms of broad scale processes. The potential disruption therefore of upland-lowland gradients in the area is very low and not considered a significant concern in the area. The reason for this is mainly that no topographic, diversity, physical, or climatic gradients exist in the area that might result in important broad scale ecological gradients in the area. Within the broader landscape, the Ga-Mogara River which is more than 10 km to the west of the site is a significant ecological feature that

may be important for dispersal and broad-scale ecological processes. However, the development would not have an impact on this ecosystem.

The proposed Adams PV Solar Project Two will not, from a terrestrial ecology perspective, result in any impacts which would be of conservation or ecological significance due to the lack of highly sensitive features or habitats, as well as the very homogenous nature of the site. The two recorded protected tree species are highlighted as the most significant floral features of the site. The fact that a large number of these species are present and would be affected by the development, the Northern Cape representatives of Department of Agriculture, Forestry and Fisheries may request an offset to counter this impact.

Table 10-1: Impacts on Biodiversity – Significance Rating			
Nature (N)	Negative impacts on site biological diversity		1
Extent (E)	On Site: Impact to flora will mostly be of a localised nature.		1
Duration (D)	Very long term: The impact will be largely reversed at the end of operation of the PV facility, but it may take several decades thereafter for floral species (particularly woody species) to re-establish.		5
Intensity (I)	Moderate: The disturbance to site flora will disrupt functions and processes at a localised level, thereby reducing diversity.		3
Probability (P)	Definite: Vegetation clearance is required for the establishment of site structures and supporting infrastructure.		4
Mitigation (M)	Moderately mitigated: The impact can be substantially localised though adequate monitoring and rehabilitation practices, but the residual impact will still be noticeable or significant, relative to the original impact. However implementing offset programmes would successfully trade-off the residual impact. .		3
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: Rehabilitation efforts at closure will largely reverse the impact, although this may never entirely return the site to its 'natural', pre-development, condition.		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	24
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	36
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

- In order to reduce the overall footprint of the development as well as minimise the overall disruption of ecological processes at the site, it is recommended that the current phase of development as well as any future phases are developed in contiguous blocks as close to the R380 as possible and on either side of the ESKOM power lines as the space allows.

- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. A ground layer between the panels should be left in place where possible.
- The final development area should be surveyed for species suitable for search and rescue, which should be trans-located prior to the commencement of construction.
- Minimise the development footprint so that only areas where infrastructure will be located are cleared.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and re-vegetation techniques. .
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and re-vegetation techniques.
- An environmental control officer (ECO) should oversee the rescue and relocation of all protected flora to be moved;
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Areas should be re-seeded with local indigenous species as required;
- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping;
- In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998, landowners are legally responsible for the control of invasive alien plants on their properties and it is therefore recommended that declared weed and invader species be removed from the subject property regularly as per attached EMPr (Appendix 8);
- Vehicles should be restricted to travelling only on designated roadways, in order to limit the ecological footprint of the proposed development activities;
- No fires whatsoever should be lit within the subject property;
- Impacts associated with the proposed development should not be allowed to impact on surrounding vegetation, outside the development footprint. Therefore the entire development footprint should be demarcated and no unauthorised access to these areas must be allowed.

FAUNA IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

Fauna in the direct affected area will be highly affected mainly through noise, human activity, habitat destruction, pollution and infrastructural establishment. The majority of shy and sensitive fauna will move away from the area during activities relating to construction, mainly due to human activities as well noise levels. Slow moving species such as tortoises may not be able to avoid construction activities and may be killed. Some species may also be vulnerable to illegal collection or poaching during construction as a result of large amounts of construction workers present on the site.

It is expected that these impacts discussed above can be mitigated to some extent. The direct faunal impact would largely be restricted to small amount of habitat loss within the development area not considered significant in the broader scale in relation to the distribution extent of the species. A number of mammals of conservation concern occur in the area and impacts on these species would be undesirable. The surrounding landscape

would remain mostly intact. Sufficient remaining habitat and space will be available for most species to move around the development with relative ease.

Faunal impacts relating to electrocution would be of greater potential significance in terms of the long term cumulative impact over time. Although there is a likelihood that bats could occur on the site, the direct impact associated with the development is regarded negligible. The main reason for this is lack of sufficient habitat. Suitable mitigation measures are available, such as installation of low UV lights as to not attract insects which bats feed on. A specific impact that should be avoided is the risk of electrocution on the Ground Pangolin which is vulnerable on this account.

The proposed development could result in a disturbance of the broad scale ecological process, such as migration, dispersal the ability to fauna to respond to fluctuation in climate or other conditions. The major concern in terms of the above is the fencing off of the facility. This would ultimately disrupt connectivity of the landscape and restrict movement of animals. No fauna would be able to pass through the area and could also result in species being trapped inside the facility. This can be mitigated to some extent. For example, fauna can go around the facility and those trapped should be released. However, it is considered more likely that faunal species would avoid the area regardless of management measures implemented.

Avifaunal impact associated with photovoltaic solar developments is generally considered to have minimal impact on birds, with the main concern being loss of habitat especially to threatened species. Impact can be moderately mitigated as most significant impacts associated with the development would be bird electrocution due to transmission line infrastructure. If these structures are located alongside existing lines this impact would be moderately mitigated. Impacts associated with avifauna are not considered to be significant and mainly concentrated around habitat loss and electrocution by power lines.

Table 10-2: Impacts on Fauna during construction and operation – Significance Rating		
Nature (N)	Negative impacts on site faunal diversity	1
Extent (E)	On Site: Faunal species directly within the development site would be affected, mostly by habitat fragmentation and destruction	1
Duration (D)	Very long term: The impact will be largely reversed at the end of operation of the PV facility, but it may take several years to resemble present state.	5
Intensity (I)	Moderate: The disturbance to site fauna will disrupt functions and processes at a localised level, thereby reducing diversity and habitat loss.	3
Probability (P)	Definite: Vegetation clearance is required for the establishment of site structures and supporting infrastructure. This would result in direct habitat loss to local fauna.	5
Mitigation (M)	Well mitigated: The impact can be substantially localised though adequate monitoring, relocation and rehabilitation practices, but the residual impact will still be noticeable or significant, relative to the original impact.	4
Enhancement (H)	N/A	-
Reversibility (R)	Mostly reversible: Rehabilitation efforts at closure will largely reverse the impact, although this may never entirely return the site to its 'natural', pre-development,	4

Table 10-2: Impacts on Fauna during construction and operation – Significance Rating			
	condition.		
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	18
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	29
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

- The site should not be fenced with electric fencing which is near to the ground.
- Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site.
- Fires should only be allowed within fire-safe demarcated areas.
- No fuel/wood collection should be allowed on-site.
- No dogs should be allowed on site.
- If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site.
- Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.
- Any additional power lines needed at the facility should be constructed immediately adjacent and running parallel to the existing power lines.
- Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.
- Although the facility is likely to be fenced with mesh fencing that is impermeable to most fauna, some animals may occasionally dig their way into the site or enter through gaps or gates. If such animals become trapped in the facility, they should be allowed to exit on their own and should not be unnecessarily persecuted.
- Areas of natural vegetation within the site should be managed in a manner which promotes or is at least compatible with the maintenance of biodiversity at the site.

10.3.3. CONSTRUCTION AND INSTALLATION WASTE GENERATION (CONTRIBUTION TO LANDFILL, SEWAGE, WASTE HAZ & GEN ETC.)

INTRODUCTION

Waste will be generated during the construction of the proposed project structures/infrastructure and installation of equipment. The waste would predominantly comprise of building rubble, packaging and fabrication waste. Steel and electric cabling waste is also expected from installation. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of significant quantities of general waste could indirectly impact on the operational lifespan of the

Municipal landfill facility, through the permanent occupation of remaining available space at this facility. Some hazardous waste (such as transformer liquids, used oill etc.) would be generated during the operational phase of the proposed development and would need to be properly handled and disposed of.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

The impacts will have regional extent where hazardous wastes are concerned (i.e. There is no suitably licensed hazardous landfill facility in the Northern Cape). The intensity of the impact will, however, be very low relative to cumulative national and regional waste generation volumes (general and hazardous waste generation). No hazardous materials are expected in the solar PV facility except for oils and fuel for vehicles and some from the proposed substation itself. As the waste will be taken off site weekly throughout the construction and operation phase, impacts associated with waste are not expected to be significant. However, mitigation measures would need to be implemented to ensure proper handling and storage of the waste. It is also recommended that the proponent implements the general waste management principals of in terms of waste hierarchy such as; waste reduction, reuse, recycling and finally disposal. However these aspects have been suitably addressed within the associated EMPr (Appendix 8) and would therefore ensure commitment from project developer to responsible waste management.

Dry sanitation systems or digester systems should be used as it would result in the production of dry sewage waste materials (i.t.o. dry systems). This material has very low pathogenic composition and regarded as very easily manageable and can either be:

- used to make compost (Help in rehabilitation of vegetation or used as compost in landscaping)
- Used as source of fuel
- Dispose of it on a municipal sewerage facility

Table 10-3: Impacts of Construction Waste Generation – Significance Rating			
Nature (N)	Indirect: Negative impact on landfill airspace availability		1
Extent (E)	National: Use of hazardous landfill beyond the provincial boundary		3
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to a year, or possibly two)		3
Intensity (I)	Negligible: The anticipated impact will be negligible, with no discernible effect on relative airspace availability		1
Probability (P)	Definite: The generated of waste during the construction phase is largely unavoidable (the amount generated can, however, be managed)		4
Mitigation (M)	Slightly: A small reduction in the volumes of waste generated can likely be effected during construction		2
Enhancement (H)	N/A		-
Reversibility (R)	Moderately reversible through reuse, recovery and/or recycling initiatives: Where the impact relates to contribution to landfill, any measure implemented to reuse, recover, or recycle such waste would constitute the reversal of the impact		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	9.6
Significance Rating	N x (E+D) x I x P ÷ ½(M+R)	Low	12

Table 10-3: Impacts of Construction Waste Generation – Significance Rating			
without Mitigation - Negative Impact (S)			
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

Contractors will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; such plans would need to be signed off by competent site environmental personnel/environmental control officer (ECO), prior to the start of construction activities.

All construction and installation waste will be stored temporarily in a way that protects surface and groundwater, and appropriately disposed of at the permitted municipal disposal site (where the waste in question is classified as general waste). Temporary waste storage areas will be sited under the guidance of site environmental personnel prior to the start of construction activities. Construction personnel will be trained in their correct use and the sites will be regularly inspected to ensure that they are being appropriately managed.

During construction all sewage waste should be stored in a closed system. A schedule for servicing and disposal of the sewage waste will be set forth so as not to cause unpleasant or unhygienic conditions for the site personnel by an approved service provider specializing in the maintenance and treatment/disposal of sewage waste (mainly if chemical toilet are used). The financial feasibility of using dry sanitation systems to chemical systems during construction and operation should be undertaken. If dry systems are feasible the dry sewage waste produced should be used in rehabilitation efforts.

10.3.4. SURFACE- AND GROUNDWATER QUALITY & QUANTITY

INTRODUCTION

The inappropriate storage, management and handling of fuel, oil and other potentially hazardous chemicals and substances during the construction period could result in potentially negative impacts on surface and ground water quality; where spillages of such could enter the groundwater environment in particular, through the seepage of contaminated surface run-off into the groundwater environment. Poorly maintained vehicles will impact negatively on groundwater quality. Contamination of this nature, associated with the construction phase of such a project would typically be hydrocarbon based (i.e. petrol, diesel and oil leaks and spillages to bare soil surfaces). Temporary concrete batching plants can also impact negatively on groundwater.

Poor placement and maintenance of temporary sanitary arrangements (i.e. portable toilets) can also result in detrimental impacts on water resources in one or another of the following ways (Fuggle and Rabie, 2009), depending on the nature and extent of potentially affected water resources:

- Eutrophication – referring to “the enrichment of water with nutrients, such as nitrates and phosphates, which give rise to excessive growth of aquatic algae and cyanobacteria in surface water resources in particular”;
- Nitrification – referring to “the contamination of drinking water supplies with elevated levels of nitrates; and
- Microbial contamination – referring to the contamination of drinking water supplies with harmful pathogenic agents, such as *E. coli* bacteria and other faecal coliforms.

Groundwater contamination as above would generally be restricted to the confines of the site. This impact can further be mitigated through the use of dry toilet systems on the market such as EcoSan.

In addition, during construction, temporary stockpiles of building material, excavated sand and rock, as well as waste, will be produced. It is important that these stockpiles are located in a centralised area where temporary measures such as berms will prevent sediment run-off, specifically during heavy rainfall episodes. Therefore it would be particularly important to update the storm water management plan created for the site. These particular waste streams are, however, not expected to be hazardous, or pose a contamination risk to groundwater.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

The anticipated extent of surface water run-off will be negligible. This is as a result of the sandy nature of the underlying soils; surface water will readily infiltrate soil surfaces, as opposed to travelling any significant distance at the surface. The study area is located in the arid region and no surface water exists in close proximity to the site. There are no identifiable wetlands in the study area. The topology of the area would also restrict surface flows as the general slope of the site is less than one degree.

A small amount of rain water actually ends up as runoff, therefore, the major concern regarding surface water runoff is potential erosion caused by an increase in runoff from the constructed PV panels; however through implementing appropriate measures this could be appropriately mitigated.

The project uses photovoltaic solar panels, i.e. energy from the sun will be converted into electricity by the panels directly. As this process does not involve the generation of steam, heating of liquids or other heated fluids to convert solar radiation into electricity there are no direct impacts due to the physical technological operation of the facility.

Therefore spillages of hazardous/harmful substances would not occur that could have negative impacts on the surface/groundwater water environment. Rainwater running off these panels is classified as clean water and no water contamination is expected. The major concerns regarding groundwater/surface water quality is potential groundwater contamination due to mainly hydrocarbon (during construction) and microbial (during construction and operation) contamination mainly by: inadequate storage, spillages and microbial contamination (as a result of inadequate sewage management).

Table 10-4: Impact on Ground/Surface water Quality (During construction) -Significance rating		
Nature (N)	Negative impacts of construction related Hazardous substance contamination	1
Extent (E)	Site: Within the vicinity of the development area of the study area.	2
Duration (D)	Long term: Treatment of groundwater contamination (i.e. if occurring) is a long and arduous process	4
Intensity (I)	Major: Adjacent farmers/farming communities reliant on groundwater for their livelihood only likely to happen due to spillage of oil etc.; and volumes will be very low, so doubt if it will be major. Consider scale of potential sources of pollution, and temporary nature, then reconsider	4

Table 10-4: Impact on Ground/Surface water Quality (During construction) -Significance rating			
Probability (P)	Likely: Impact likely to occur, to the extent that provisions must be made for it.		2
Mitigation (M)	Well mitigated: A comprehensive range of effective mitigation measures is readily available		4
Enhancement (H)	N/A		
Reversibility (R)	Slightly reversible: The impact is not easy to reverse once occurred and would require much effort, taking immediately after the impact.		2
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	16
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	32
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 10-5: Impacts due to Surface Water Runoff (During construction & Operation) - Significance rating			
Nature (N)	Negative impacts of construction/operation related Surface water runoff		1
Extent (E)	Site: Within the vicinity of the development area of the study area and surroundings.		1
Duration (D)	Very short terms: Only occurring during heavy rainfall periods.		5
Intensity (I)	Negligible: There's an impact on the environment, but it is negligible, having no discernible effect.		2
Probability (P)	Likely: Impact likely to occur, to the extent that provisions must be made for it.		1
Mitigation (M)	Well mitigated: The impact can be mostly mitigated and the residual impact is negligible or minor.		4
Enhancement (H)	N/A		
Reversibility (R)	Mostly Reversible: The impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	4.8
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	12
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

A comprehensive range of effective, proven mitigation measures will be implemented to ensure groundwater contamination is mitigated, which are in principle as follows:

- All hazardous substances to be stored within appropriately sized, impermeable, and roofed surfaces;
- Drip trays to be appropriately placed under vehicles that park over-night on bare soil surfaces.
- No cement mixing must be allowed to occur on bare surfaces.
- Erosion sensitive areas must be identified and regular monitoring undertaken to ensure once the impact occurs it is stabilised and rehabilitated immediately.
- Drip-trays must be placed under construction vehicles when they are not operational to capture oil leaking from the vehicles.

The various components of the power station are considered to be mostly environmentally friendly and therefore do not pose a risk to groundwater environment. The solar facility could potentially increase the amount of aquifer recharge locally. It is however recommended that the proponent make suitable provisions to investigate the potential to collect the runoff from the panels.

10.3.5. ARCHAEOLOGICAL, HERITAGE AND PALAEONTOLOGY

INTRODUCTION

An archaeological impact assessment was initiated as part of this assessment due to the potential proposed project impacts on elements of cultural/heritage importance relating primarily to the occurrence of such elements in the vicinity of the site where the Proponent proposes the establishment of a new photovoltaic solar plant. That is not to say that the potential occurrence of elements of archaeological importance underlying the remainder of the proposed development site can be ruled out; excavations required for the construction of other project elements may unearth such material.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

During the assessment only one significant site, dating to the very recent historical period, was identified and recorded in the area. A single Stone Age tool was also identified.

A single stone tool (core) was found during the assessment dating to the middle stone age. The artefact was found between the road reserve outside the farm fence and the tar road. The specialists however indicated that the significance of the find is low and no mitigation would be required. No other stone tool was found during the assessment.

The only other finds during the assessment were the remains of structures relating to mining on the farm itself. The structure was an old mining hostile abandoned in the 1970's. The specialist examined the bricks and cement and concluded that the buildings were constructed less than 60 years ago. It was also noted by the specialist that these structures had been partially/completely demolished. This site was regarded as low in significance and no mitigation would be required as the specialist documentation during the fieldwork of the area would be sufficient.

In conclusion, the specialist indicated that there would be no objections from an archaeological /heritage component as a result of the proposed development. He only highlighted the fact that if any significant archaeological/historical sites/materials are unearthed during construction a qualified archaeologist must be called in to investigate.

The chance of fossils being damaged by the proposed facility is fairly limited due to the fact that the foundations of the PV infrastructure will be mounted approximately 1 m into the ground. If fossils (fossilised remains of animals or plants) are encountered due to

proposed development a professional palaeontologist must be consulted immediately. The appropriate action will then be recommended accordingly by the professional.

It should be noted that all sedimentary deposits have the potential to preserve fossilised materials. The major concern regarding potential impacts on the heritage resource are that construction activities might result in disturbance of surfaces/underground materials containing significant artefacts and therefore resulting in the damage, alternation, destruction, collection and removal from its original position.

Table 10-6: Impacts of archaeology during construction/operation (above and below ground) – Significance Rating			
Nature (N)	Negative impacts of construction/operation related heritage on sensitive receptors		1
Extent (E)	Site: Within the vicinity of the development area of the study area.		1
Duration (D)	Permanent: Loss of archaeological material due to excavation and land clearing associated mainly with construction period.		5
Intensity (I)	Minor: Relatively significant archaeological materials found, mainly concentrated on the outcrop/ridges, however the development will avoid these areas. Therefore there will be a minor to negligible impact on archaeology of the area.		2
Probability (P)	Unlikely: The possibility of the impact occurring is very low, mainly due to the circumstances of the expansion project and experience of the appointed specialist.		1
Mitigation (M)	Well mitigated: The development has already undertaken mitigation work and it was determined that no additional mitigation would be required.		4
Enhancement (H)	N/A		
Reversibility (R)	Irreversible: Once archaeological material is lost it cannot be restored.		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	4.8
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	24
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

- The subterranean presence of archaeological and/or historical sites features or artefacts are always a distinct possibility. Care should therefore be taken during any development activities that if any of these are accidentally discovered, a qualified archaeologist be called in to investigate. In this case unmarked LSA burials are a possibility as well. The red sands are covering possible archaeological traces.
- Construction contractors should be trained to identifying relevant archaeologist materials that could potentially be found on site by a suitable qualified archaeologist.

10.3.6. SOIL AND AGRICULTURAL POTENTIAL

INTRODUCTION

A desktop soil assessment was undertaken by EScience Associates (Pty), in consultation with Prof. Andries Claassens (Soil Science and Plant Nutrition Consultant) in relation to the proposed establishment of a PV solar power plant on the farm Adams. The primary objective of the study was to determine the potential impacts of the proposed development on the land capability, land use, soils and agricultural potential of the subject site. The study details the following:

- Soil form(s) present over the site, as well as the geographic distribution thereof over the development site;
- The size of the affected farm portions encompassing the development site;
- The locality of the development site;
- Potential land use alternatives for the site in question; and
- Impacts of the proposed change in land use on land capability and agricultural potential.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

Due to the sandy to loamy soils (low water holding capacity) and climatic conditions (low rainfall) of the study area the agricultural potential is considered to be low. The cost associated to prepare the soils for crop production, install irrigation systems as well as taking into consideration the climatic conditions and water constraints would not be practical. The potential loss of grazing land is not considered to be a significant issue as the area is not supportive of high stocking rates. Stocking rates in the region are typically in the order of approximately 22-25 ha/large stock unit (LSU).

The project's impact on site soils is considered to be low, due to the erection of the PV facility. There are, however, some mitigation measures that would need to be implemented to prevent and contain erosion associated with soil disruptions during the construction phase. The impact is considered negligible when comparing it, for example, to coal mining on the Highveld which occurs on high agricultural soils and produces similar quantities of electricity (van der Waals, 2011).

Apart from the access road and construction sites where the soil (environment) may be impacted on, the proposed development should not have a major influence on the soils on the rest of the farm. For Clovelly or Hutton soil forms, the soil potential is low. The major use of the land type is therefore grazing. The nature of the underlying parent material, combined with low rainfall in the area, has led to the development of shallow soils (i.e. soils with limited pedological development); with underlying solid rock as the limiting factor to the depth thereof. Deeper soils are, however, found in the lower lying areas. The impact on the environment due to the proposed activity and the maintenance management in the area should be localized.

Soil impact would occur mostly during construction. Impact is considered mostly generic in nature. Possible impacts are described below. Table 10-7 & Table 10-8 include a description and set criteria to determine the extent/ magnitude of the impacts associated with the construction of the proposed project.

Table 10-7: Potential project impacts on current land capability/land-use (i.e. loss of extensive livestock grazing)– Significance Rating			
Nature (N)	Potentially negative impacts on land use as the area will be transformed and therefore a loss in the potential land capability for grazing.		1
Extent (E)	Site: The impact will be isolated to the development footprint.		1
Duration (D)	Very long term: The proposed facility is permanent but could be removed		5
Intensity (I)	Minor: The impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts		2
Probability (P)	Unlikely: Improbable due to low baseline agricultural/grazing potential.		1
Mitigation (M)	None: Possible disturbance will be limited to immediate surroundings.		-
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 10-8: Potential project impacts in respect of potential for alternative land-use (crop production) – Significance Rating		
Nature (N)	Potentially negative impacts from the proposed project will result in loss of area which could be used to cultivate crops.	1
Extent (E)	Site: The impact will be isolated to the development site.	1
Duration (D)	Very long term: The proposed facility is permanent but could be removed.	5
Intensity (I)	Minor: The impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts. The nature of the underlying soils is of such a nature that it does not provide for productive agriculture.	2
Probability (P)	Unlikely: Improbable due to low baseline agricultural potential.	1
Mitigation (M)	None: possible disturbance will be limited to immediate surroundings.	
Enhancement (H)	N/A	-
Reversibility (R)	Mostly reversible: the impact can mostly be reversed,	4

Table 10-8: Potential project impacts in respect of potential for alternative land-use (crop production) – Significance Rating			
	although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily ,		
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

The following recommendations must be implemented:

- Erosion must be managed though adequate control and mitigation. Early identification of erosion prone areas is essential.
- Potential impact from hydrocarbon soil contamination such vehicle oil/fuel leaks, concrete mixing and oil spillage should be prevented by providing overnight vehicle with drip trays, ensure concrete mixing does not take place on bare soils, etc.
- Ensure that soil surrounding the installed panel and associated infrastructure is rehabilitated, as well re-vegetated with indigenous seed mix where applicable.

10.3.7. VISUAL

INTRODUCTION

The specialist Visual Impact Assessment (VIA) undertaken for the project (Appendix 4) took cognisance of the following principles and concepts underpinning Visual Input, according to Guidelines for involving visual and aesthetic specialists in EIA processes:

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place;
- The consideration of both the natural and the cultural landscape and their inter-relationships;
- The identification of all scenic resources, protected areas and sites of special interest, together with their importance in the region;
- The nature and location of any cultural heritage sites, and areas of special or historical interest;
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes;
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character';
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully quality of the project.

Importantly, background research in respect of informing the legislative context of the area with respect to visual impact was undertaken and revealed that:

- No listed or proclaimed sites, such as nature reserves, biosphere reserves, proclaimed scenic routes, national parks or proclaimed view-shed protection areas were identified in proximity to the proposed development terrain; and
- No scenic routes, special areas or proclaimed heritage sites are within proximity of proposed development terrain.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

The proposed development area was deemed by the relevant specialist to have a low scenic quality, predominantly due to:

- The morphology of the development area, as well as substantial area surrounding the proposed development situated in flat plains
- No topological qualities contribute to the area's scenic quality
- Vegetation direct and adjacent to the site for development displays a typical lush characteristic.
- No complementary colours occur naturally, with a relatively diverse range of vegetation. This is mostly typical of the savannah biome. There is a marginal degree of saturation with the variety of species not adding to a wide range of colours.
- The site is located directly adjacent to the already existing Dougnor sub-station. The station comprises almost 0.53 Ha. The directly affected study area comprises mainly agricultural activities in the form of grazing, while mining activities (BHP Billiton Mamatwan Mine) occur on the western boundary of the site. This directly influences the area's sense of place.

An assessment of 'visual sensitivity' will vary with varying user types/receptors. Recreational sightseers, for example, may be highly sensitive to changes in visual quality. The development is centered around the R380 road, directly east of the BHP Billiton Mamatwan Mine and the entrances to the Eskom Dougnor sub-station; it is inferred that the predominant type of viewers will be workers in the area and local commuters travelling to Kathu, Hotazel and numerous mines in the area (such Black Rock Mine Operations). It was indicated by the relevant specialist that no significant amount of recreational viewers will be exposed to the development along the R380 road.

Using the guidelines for VIA the expected level of impact was determined. The study area was identified as being an area of low scenic quality, cultural or historical significance. It was determined by the specialist that a low visual impact is expected; however due to the distance from vantage points along the R380, the facility is anticipated to be minimally visible along the road; because of the resulting visual absorption capacity of the bushland native to the area. Because of the fact that viewer frequencies are very limited as well as somewhat obscured by exiting power infrastructure, the expected visual impact is considered minimal.

The visual impact was assessed mainly though using the following deliverables:

- Viewshed analysis (Figure 10-3): A viewshed is an area dispersed over the topography and indicating the relative positions from where the development might be visible. This was used to determine the relative vantage point from where photographic audits were conducted.
- Vantage Points (Figure 10-4) were modelled by means of photomontage, as this vantage point is where the proposed development would potentially be visible to the most viewers. These vantage points were considered the most important as most viewers travel directly past the site on the R380.

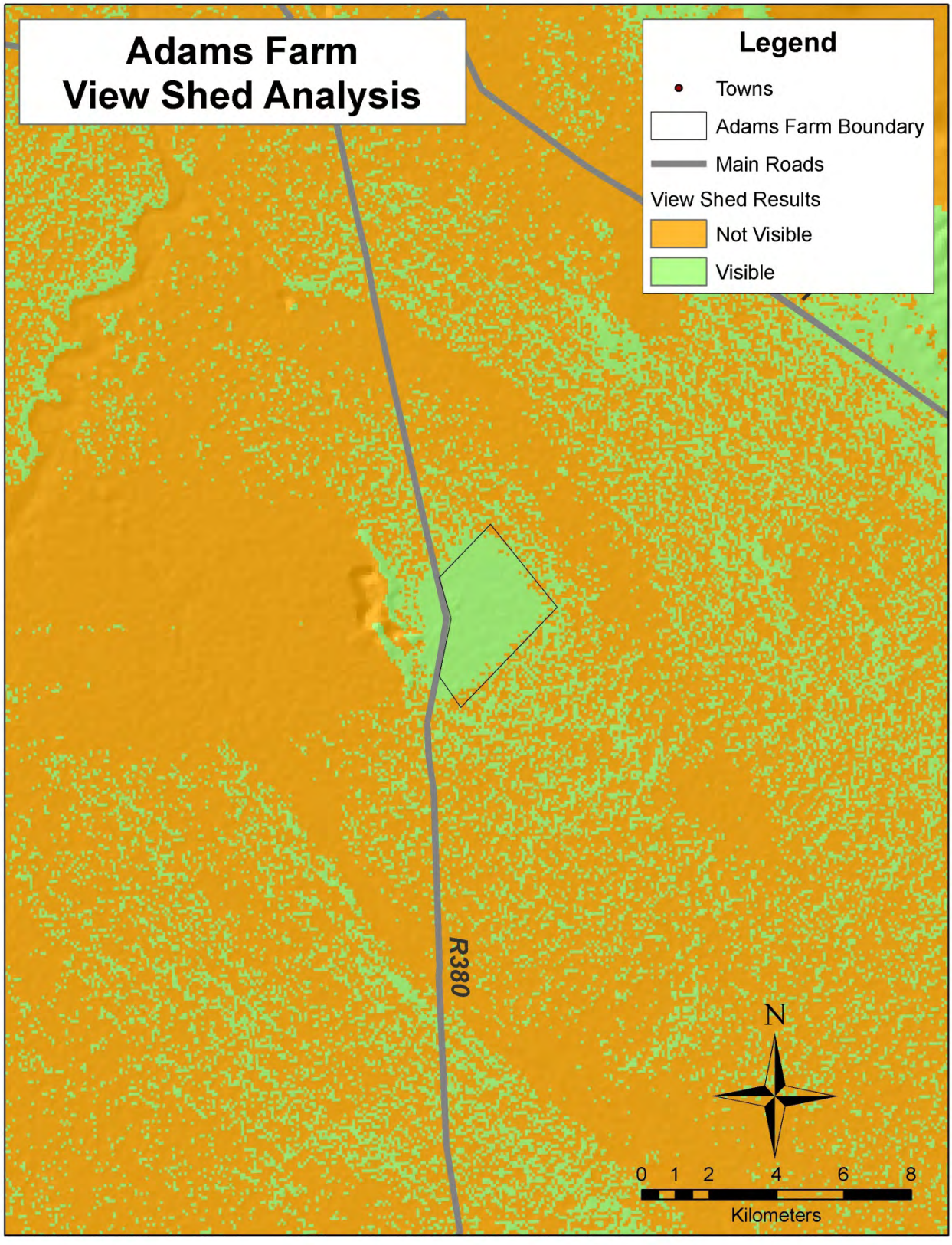

Figure 10-3: Rendered Viewshed map of the study area (ESA, 2012)

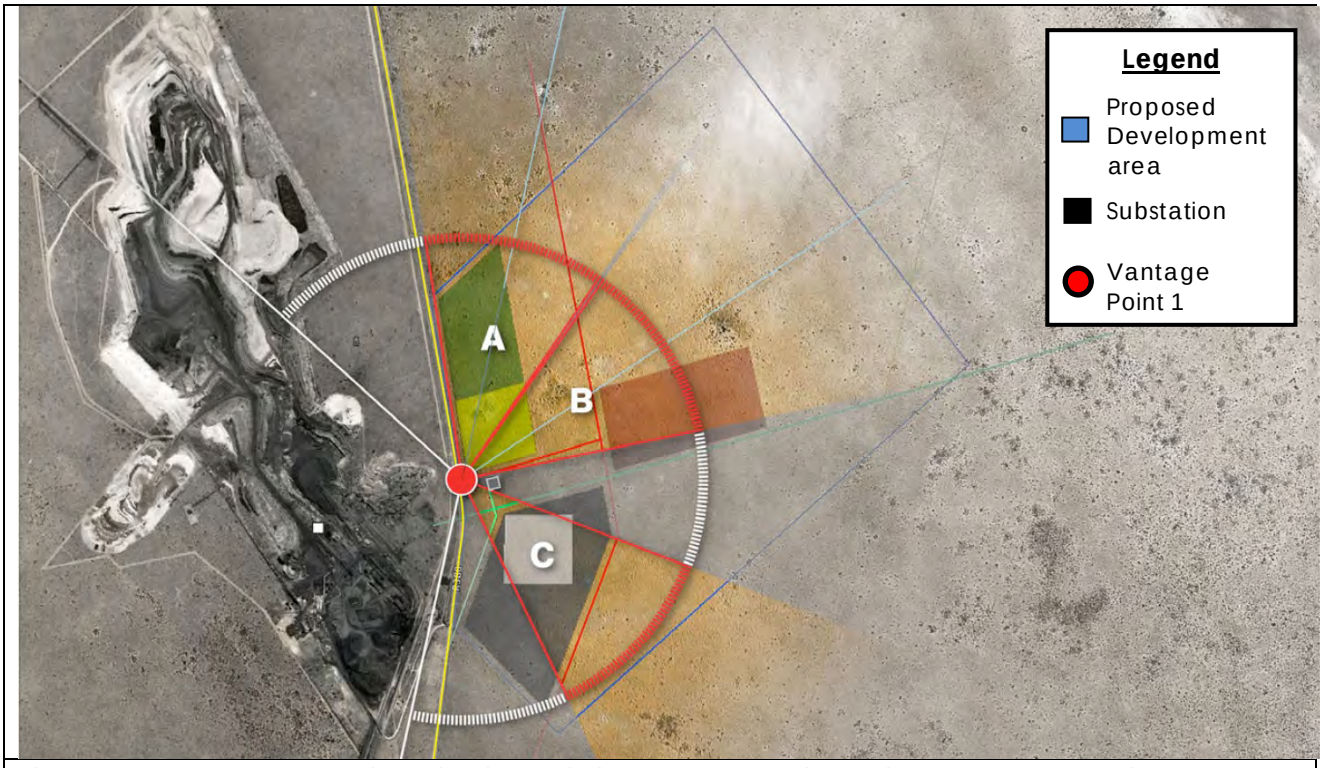

Figure 10-4: Vantage Point 1(a, b & c) (On R380 Road, at the entrance to the Dougnor Substation)

Figure 10-5: Vantage Point 2 (On R380 Road, on the far northern boundary of the Farm Adams on the R380)

Figure 10-6 provides view simulations for daytime visual quality changes anticipated from Vantage Points on visual receptors as a result of the development. The figure provides one with an idea of what the proposed project would look like from a ground level perspective if implemented.

The specialist VIA undertaken for the project concluded the following:

- "*The existing scenic quality of the area indicates low scenic quality;*
- *The level of contrast the development will have in relation to its environmental indicated a medium contrast ratio; with anticipated high compatibility with the surrounding scenery.*
- *Due to the distance from placement option 2 and 3, it is anticipated minimally visible or not visible at all.*
- *Due to its distance from vantage point 1 it is anticipated to be moderately visible*
- *The proposed development constitutes a moderate visual change rating with an anticipated 52%.*

Table 10-9: Visual and Aesthetic Impact Significance Rating			
Nature (N)	Negative impact on visual character of the area		1
Extent (E)	Locally: Within the vicinity of the site and immediate surrounds		2
Duration (D)	Life of solar facility: Approximately 25 - 30 years		5
Intensity (I)	Low: Visual and scenic resources are not affected		2
Probability (P)	Definite: Distinct possibility that the impact will occur		4
Mitigation (M)	Unmitigated: No practical mitigation possible except painting options.		1
Enhancement (H)	N/A		-
Reversibility (R)	Entirely reversible at Closure and Decommissioning of the solar facility		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	22.4
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	22.4
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

Due to the development's size, as well as its distance from identified sensitive receptors, no implementable or manageable management actions can be suggested that would be effective, other than painting auxiliary surface structures with non-reflective paint in the same hue as the colour of the soil. In terms of painting the installation in muted colours, is not recommended, since the installation's flat surfaces will serve to blend it into the landscape through reflection of the ambient sky colour. It was therefore in the opinion of the visual specialist that the proposed development can be developed without posing significant impact towards the identified sensitive receptors along the R380.

Pre Development View

Post Development View

Figure 10-6: Daytime Pre- and Post-Development View Simulations from Vantage Point 1 (placement option 1)

Pre Development View

Post Development View

Red line represents the positioning if the PV development to illustrate the degree to which the landscape obscure if from view.

Figure 10-7: Daytime Pre- and Post-Development View Simulations from Vantage Point 1 (placement option 2)

Pre Development View

Post Development View

Figure 10-8: Daytime Pre- and Post-Development View Simulations from Vantage Point 2 (placement option 1)

Pre Development View

Post Development View

Figure 10-9: Daytime Pre- and Post-Development View Simulations from Vantage Point 2 (placement option 2)

10.3.8. TRAFFIC

INTRODUCTION

Impacts associated with traffic will mostly be concentrated during the construction phase of the project. These impacts are not considered to be significant in isolation; however they become more significant in combination with surrounding development and activities. The main concern relating to traffic is as follows:

- Off-site accommodation of employees during the construction and daily transfers to the site,
- Increase in vehicular traffic mainly during the construction phase.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

The anticipated traffic volumes during the construction phase is approximately 10 light vehicles, 10 medium/light vehicle and 3 heavy vehicle daily. On average the traffic would increase daily during construction to at the most 20 vehicles. During operation the volumes of vehicles travelling to the site is expected to only increase by 6 vehicles and should be considered negligible from an environmental point of view.

The anticipated traffic load on the R380 road is significantly less that the design capacity of the road. The area is dominated by mainly mining activities, therefore the roads are characterised by heavy vehicle movement from and to these mining activities and towns. The expected impact associated with increase traffic would only be temporary of nature up to a year of two. It is however expected that during the construction period there would be an increase in vehicle movement on the R380 road to the site and therefore has the potential to cause some nuisance to regular commuters of the road. However the road has the capacity to accommodate this temporary increase in vehicular movement.

With this in mind, the traffic volumes contributed by the construction and operation phases of the Photovoltaic Power Plant on the existing traffic volumes are considered negligible.

Table 10-10: Negative impacts on increased traffic and impacts on road surfaces (mainly during Construction) - Significance Rating		
Nature (N)	Negative impact on social character of the area	1
Extent (E)	Regionally: Within the local municipality	3
Duration (D)	Medium Term: The impact will mostly be associated with the construction phase and will only be approximately up to a year or two.	3
Intensity (I)	Minor: The impact on the road surfaces alters the environment in such way that natural process or functions are hardly affected; the system does however, become more sensitive to other impacts.	2
Probability (P)	Unlikely: the probability that the impact causes significant impacts on the road surface due to increase traffic volumes is considered low. The only potential concern is of safety due to increased traffic volumes mainly during the construction phase.	1
Mitigation (M)	Well mitigated: the impact can be mostly mitigated	4
Enhancement (H)	N/A	-
Reversibility (R)	Mostly reversible: the impact can be mostly reversed, although if the duration of the impact is too long, it may	4

	make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	3
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Negligible	4.8
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

MANAGEMENT ACTIONS

No mitigation is required, however if the R380 road becomes very degraded corrective action would be required through liaison with the JT Gaetsewe District Municipality; as well as with surrounding mining activities contributing to the degradation of the road.

10.3.9. SOCIO-ECONOMICS

INTRODUCTION

With regards to the effect of social impacts due to the proposed activity, it is very important not at first glance to assume the positives outweigh the negatives, as there are various negative impacts associated with the proposed PV development that need to be incorporated in the assessment of the socio-economic environment. The following negative impacts on the socio-economic situation are associated with the proposed development:

- Influx of job seekers to the area
- Impact of heavy vehicles, including safety, dust, damage to roads and noise
- Increased risk of stock theft, damage to farming infrastructure and poaching associated with construction workers on site.
- Risk to farmers' and workers' safety and security due to presence of construction workers.
- Loss of grazing land due to the development (construction and operation)

During the operation and construction the following positive impacts are expected:

- Energy security to the country,
- Climate change: Zero carbon emissions whilst producing clean, renewable energy,
- Job creation for local communities and South Africa in general during construction and operation.

IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

- Construction:

The construction activities associated with establishment of the proposed facility will mainly be conducted by a single EPC contractor from South Africa. It is expected that approximately 100-200 construction workers will be employed. The construction phase is expected to take 2 years to complete. There will be some employment opportunities during construction - with the majority of construction labourers coming from the local areas. The opportunities available for the local communities will mostly be targeted at unemployed individuals for unskilled to semi-unskilled work, mostly due to the area's low population density, unemployment rate and low education levels. Locals with

limited skills employed only as part of the construction phase should be provided with supportive training programmes as to become eligible for higher skill positions.

Construction staff will be housed in existing facilities in the area mostly from Hotazel or Kathu; therefore no temporary accommodation on the site will occur. The construction activities of the proposed development could potentially impact on the daily movement and living patterns of the surrounding community. Due to the influx of construction workers, migrant job seekers to the area could potentially increase the incidences of livestock theft, development of informal settlements and increase criminal activity.

- Operation

The proposed operation of the PV facility does not require large numbers of employees. It is anticipated that approximately ten (10) full time employees would be required during the operational phase of the project. The majority of these employees will be responsible for the maintenance of the facility. The Adams solar project is encouraging even only on a small scale as it could potentially have quite significant economic spin offs. The operational phase of the proposed project is not expected to have any direct negative impact on the surrounding property owner's movement and daily living patterns. The operational phase of the facility consists of limited vehicle movement to and from the site with no associated health risk.

- Decommissioning

The project is planned to be decommissioned in approximately 20-25 years. It this facility is indeed decommissioned it would result in all the jobs to be lost, as well as much needed income to survive. This would also have associated indirect impacts on the local area workforce, businesses and SMMEs.

Table 10-11: Negative impacts on socio-economics (mainly during construction) - Significance Rating		
Nature (N)	Negative impact on sense of place of nearby conservation areas, influx of job seekers; increase in crime due to construction workers present on the site as well the social character of the area.	1
Extent (E)	Local: Within the vicinity of the site and immediate surroundings. Inflow of migrant job seekers	2
Duration (D)	Medium Terms: Most negative impacts on the social character of the area will be during construction phase of the development. The increase in employees to the area would have associated negative impacts as discussed above. Increase in crime etc.	3
Intensity (I)	Moderate: The social environment is altered, but function and process continue, albeit in a modified way, the system has been damaged and is no longer what it used to be, there are however still remaining functions; the system will probably decline further without positive intervention.	3
Probability (P)	Definite: Distinct possibility that the impact will occur. The proposed development will have an impact in the sense that it will change the movement and living patterns, mostly during construction. The negative impact associated with the operational phase it expected to be almost negligible.	4

Mitigation (M)	Slightly mitigated: a small reduction in the impact is likely		2
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: Once the impacts have occurred it will not be easily reversed		2
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	12
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Moderate	16
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 10-12: Positive Impact on Socio Economics of the facility- Significance Rating			
Nature (N)	Negative impact on visual character of the area		-1/4
Extent (E)	Nationally: The proposed project is of national significance as to reduce our dependence on fossil fuels, and increase power generation from renewable sources.		5
Duration (D)	Life of solar facility: Approximately 25 - 30 years		5
Intensity (I)	Minor: The solar facility on national scale has minor influence; however on a local scale it has the potential to have major contribution. On a national scale the cumulative impact in combination with all the proposed renewable plant has the potential to have a significant positive contribution to the country.		2
Probability (P)	Very Likely: The impact will probably occur but it is not certain.		3
Mitigation (M)	N/A		-
Enhancement (H)	Well-enhanced: The social benefit can be substantially enhanced to reach a far greater number of receptors. Through community development programmes, capacity building and community trust establishment etc. the positive impact can be severely enhanced on a local scale/regional scale.		4
Reversibility (R)	Moderately reversible: At Closure and Decommissioning of the solar facility the social benefits would remain, however the sustainability of the development would have not been realised.		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)		
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)		
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).	Moderate	-60

MANAGEMENT ACTIONS

It recommended that:

- Unskilled labour (local sub-contractor or directly) be employed from the surroundings of the study area as to enhance the social benefit to the local population. The proponent must verify local residence status before employment.

- The project company implements a skills transfer and capacity building programme.
- The project company should contribute to LED programmes in the local municipality.
- No informal settlements must be allowed close to the site.
- Once construction starts security personnel must be permanently stationed on site.
- Employees must be provided with sufficient ablution facilities and transport to the site.
- Construction workers and permanent employees should wear uniforms and name tags to be easily identifiable.
- During decommissioning employment opportunities should also go to local communities.

10.3.10. CUMULATIVE IMPACTS

A cumulative impact is an instance that occurs as a result of the addition of many similar smaller impacts. These smaller impacts may occur from similar or very different developments and individually they may each be within the assimilative capacity of the environment, but together they reach a threshold that then causes serious damage. At the time of writing of this EIA no other PV facility to the consultancy knowledge is proposed in closed proximity to the site. Therefore due to no facilities being currently located in close proximity to the site, there is limited potential to assess the impact in combination with similar developments, and is beyond the scope and purpose of this document.

The subject facility will definitely, in combination with the existing BHP Mamatwan Manganese mine, Dougnor substation and various transmission lines intersecting the site, add to the cumulative impact associated with these; however this impact is not in the opinion of the environmental specialist considered to be significant.

11. CONCLUSIONS AND EAP RECOMMENDATIONS

Aurora Power Solutions is proposing to develop a commercial photo-voltaic (PV) solar power plant on the farm Adams 328 which is approximately 21 km's south of Hotazel, in Northern Cape Province. The facility will be referred to as the Adams Solar PV Project Two.

The proposed project would entail three (3) development phases. The first phase would be a 19 MW facility not exceeding 20 hectares in extent, applied for under a separate basic assessment process (DEA Ref: 12/12/20/2566). Environmental Authorisation was granted to the first development phase on 10 September 2012 by the Department of environmental Affairs (DEA). Two additional phases is proposed and will consist of two 75 MW facilities (see Figure 11-1 and Appendix 1). The development phases will utilise 558 hectares in special extent on the farm. The envisaged combined export capacity is however expected to be 169 MW.

Solar PV is the preferred technology, however, the final choice of specific technology also influences the total generation capacity, as for example Concentrated Photo-voltaic (CPV) modules require more space than crystalline silicon modules for producing the same electricity output (Please refer to Appendix 3 for a detailed description of technology etc.).

The new substation was included in the project scope of this assessment as it was only recently indicated that the existing substations would not have the capacity to accommodate the generation capacity of the proposed PV facilities. However, it is believed that the impacts associated with the proposed substation on site would not result in additional impacts above those already resulting from the proposed PV development on the farm Adams. It is of specialist opinion that if all management recommendation made in this report and associated EMPr are implemented the impact would be mitigated to an acceptable level.

The environmental assessment presented a comprehensive assessment of the anticipated environmental impacts over the full life-cycle of the proposed expanded PV facility on the farm Adams. Table 11-1 contains a summary of the environmental impact assessment significance rating. The project could potentially result in direct and indirect negative impacts of significance in the absence of appropriate environmental management solutions.

The environmental assessment practitioner (EAP) however, believes that appropriate/ feasible mitigation is readily available to the proponent that would effectively reduce the significance of potentially negative impacts to within acceptable levels. These impacts and mitigation measures that were assessed as part of the detailed Environmental Impact assessment Report (EIR) have been incorporated into this draft EMPr. This draft EMPr, once approved by the DEA, will be the Adams PV Solar Project Two formal plan to manage the development and associated environment in an appropriate and responsible manner.

Renewable power generation has various social and environmental advantages such as:

- Clean form of energy compared to conventional coal firing methods. PV power generation does not emit any harmful pollutants to the atmosphere.
- The project has global significance as it reduces carbon dioxide released into the atmosphere
- Local communities' skills development, employment creation as well as capacity building benefits gets created by the proposed development in an area of South Africa with limited economic development opportunities

It is the EAP's opinion that the EIA process to date has been undertaken in an independent, scientifically correct manner, and in compliance with the requirements of applicable legislation. It is, therefore, recommended that the EIA Report be accepted by the Department of Environment Affairs (DEA). Furthermore, it is the EAP's opinion that the positive project impacts are deemed significant, and the negative project impacts can be mitigated to the extent that no significant, or residual, environmental damage will result from project approval. Therefore, it is recommended that the application for Environmental Authorisation be viewed favourably by the Competent Authority, provided that the proposed mitigation and conditions put forward in the EIA and associated EMPr are adhered to and made legally binding to the proponent (i.e. the Project Company).

The following conditions would be required within an authorisation issued:

- All mitigation measures detailed within this report, specialist reports (Appendix 7) and draft EMPr (Appendix 8) must be implemented.
- This EMPr must be made binding to the project company as well all contractors.
- All required and relevant permits must be submitted to the relevant competent authorities.
- The EMPr (Appendix 7) is seen as a living document and should be updated as determined/required.
- An Environmental Control Officer (ECO) must be appointed to monitor compliance with the attached EMPr for the entire life of the facility

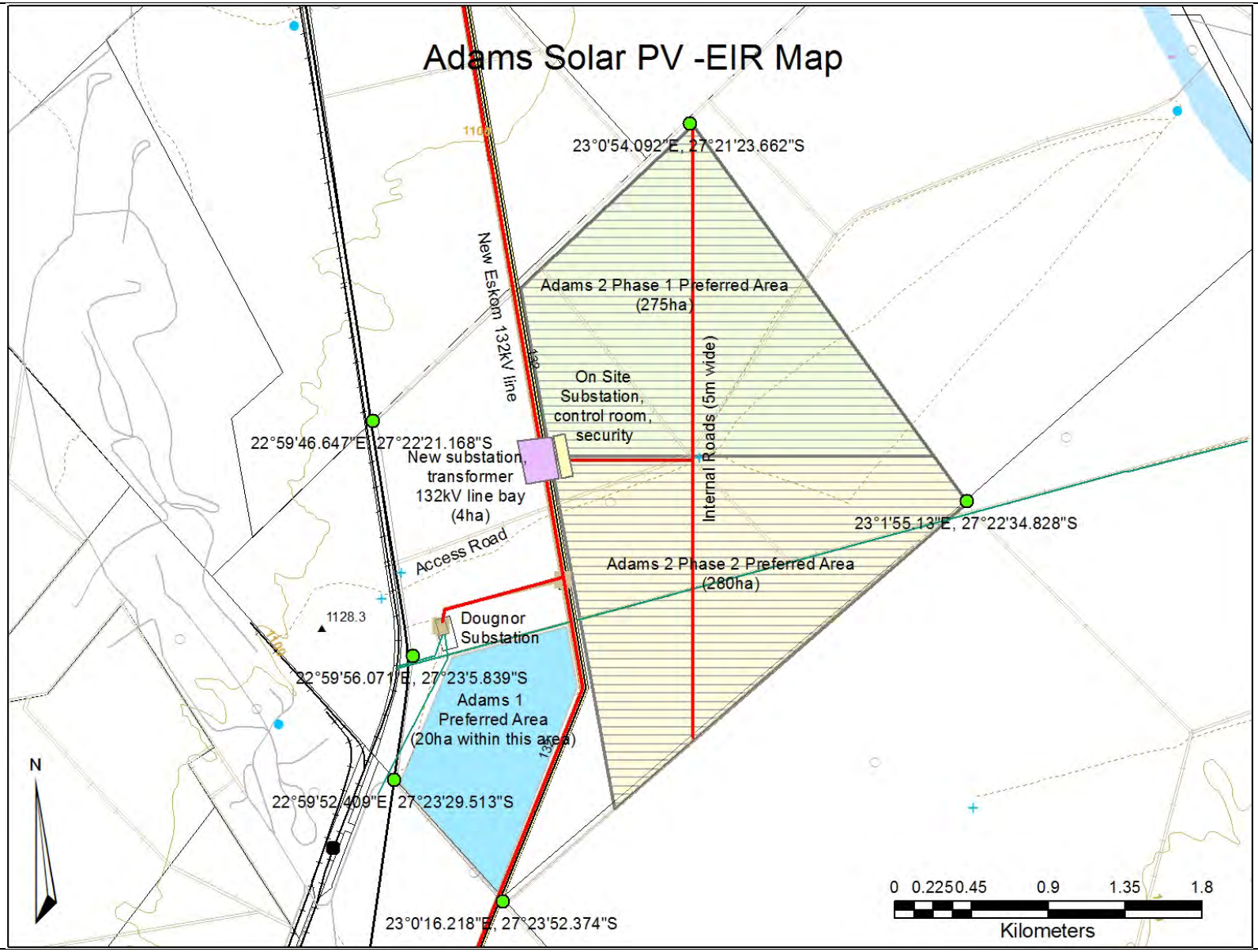

Figure 11-1: Proposed Adams PV Solar Project 1 and 2 topological layout plan.

11.1. SUMMARY OF IMPACTS

The EIA process determined the significance of each identified significant impact, the table below provides a summary of all the impacts assessed and their relative significance.

Table 11-1: Tabular Summary of Impact Assessment		
Aspect	**Impact Significance (No mitigation)**	**Impact Significance (mitigation)**
Construction& Operation		
Fauna	Moderate (-)	Low (-)
Flora	Moderate (-)	Moderate (-)
Waste Generation	Low (-)	Low (-)
Ground/Surface water Quality	Moderate (-)	Low (-)
Surface Water Runoff (During construction & Operation	Low (-)	Negligible (-)
Heritage	Low (-)	Negligible (-)
Soil & Agricultural Potential		
• Impacts on current land capability/land-use	Negligible (-)	Negligible (-)
• impacts in respect of potential for alternative land-use	Negligible (-)	Negligible (-)
Visual	Moderate (-)	Moderate (-)
Traffic	Negligible (-)	Negligible (-)
Socio Economic		
• Negative impacts on Socio Economics (mainly during Construction)	Moderate (-)	Low (-)
• Positive Impact on Socio Economic	Moderate (+)	Moderate (+)

Table 11-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMPr and managed appropriately
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed

Table 11-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

11.2. LIMITATION AND ASSUMPTIONS OF THE ASSESSMENT

The EIA was undertaken successfully; including the following limitation and assumptions

- No alternative site was assessed as part of this EIA and only the optimal generation capacity within the identified areas was determined. ‘
- The cumulative impact on similar development in the area cannot be accurately assessed as various EIA are undertaken in the area, however actual development of these facilities depend on allocation by the DoE. Information provided by APS to the EAPs was correct and valid at the time it was provided.
- Connection to the national grid is dependent on Eskom, however different options have been identified within this report, please refer to section 4.3
- A preliminary site layout has been developed. Some features may change when final designs are drawn up by the EPC contractor prior to construction.

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13. APPENDIX 1: SITE LAYOUT PLANS, LOCALITY MAPS.

14. APPENDIX 2: AUTHORITY CORRESPONDENCE

- DEA acceptance of Final Scoping Report and Plan of Study for EIA
- Application acknowledgements etc.

15. APPENDIX 3: TECHNICAL TECHNOLOGY DESCRIPTION AND POTENTIAL DESIGNS

17. APPENDIX 4: ADAMS 328, COPY OF TITLE DEEDS

18. APPENDIX 5: PUBLIC PARTICIPATION REPORT

19. APPENDIX 6: SITE PHOTO REPORT

20. APPENDIX 7: SPECIALIST ASSESSMENTS

20.1. APPENDIX 7.1: SIMON TODD BIODIVERSITY IMPACT ASSESSMENT REPORT

20.3. APPENDIX 7.2: ECOINFO BASELINE BIODIVERSITY ASSESSMENT

20.4. APPENDIX 7.3: VISUAL IMPACT ASSESSMENT REPORT

20.5. APPENDIX 7.4: HERITAGE IMPACT ASSESSMENT

20.6. APPENDIX 7.5: DESKTOP PALEONTOLOGICAL REPORT

20.7. APPENDIX 7.6: SOIL IMPACT ASSESSMENT

21. APPENDIX 8: ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

22. APPENDIX 9: CV'S OF EAPS

23. APPENDIX 10: SPECIALIST DECLARATIONS