RENOSTERBERG WIND ENERGY COMPANY (RWEC)

Proposed PV Facility

Heritage Impact Report

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Executive Summary

PGS Heritage (PGS) was appointed by Sivest Environmental Division to undertake a Heritage Impact Assessment Report (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMPr) for the Proposed Photovoltaic (PV) Facility for Renosterberg Wind Energy Company (RWEC) near De Aar, Northern Cape Province.

The field work and assessment of the impact of the proposed PV facility and power line has identified and made recommendations on the following.

Archaeological Areas

Four areas containing various Stone Age scatters were identified during the field work. The first two(**RPV1 and 3**) are all low density Stone Age (lithic) scatters occurring over large areas in extent of 7 hectares, while **RPV2** and **RPL1** are smaller and each almost 50m in diameter. The concentrations within these archaeological areas are of low density and generally of low significance, however the number and extent of the scatters in these archaeological areas give archaeological areas **RPV1** and **RPV3** a medium to high heritage significance rating and is rated as **Generally Protected A**, requiring mitigation as listed below.

1. Before construction commences all archaeological areas must be demarcated and the necessary mitigation completed as noted in points 2-6 below.
2. It is recommended that the extent of each concentration be mapped for **RPV3** as a documentation of the archaeological sequence of the development area.
3. The mapping should include a spatial layout of the concentrations
4. Surface collection and lithic analysis of the concentration with the highest density, after which the lithics are to be returned to the site.
5. The above can be done with the backing of an archaeological permit issued to a qualified archaeologist issued by SAHRA.
6. After completion of the field work and analysis an application for destruction of the sites must be lodged with SAHRA. Upon issuing of this permit construction can commence in the archaeological defined areas.
7. Monitoring of the archaeological areas during construction by a qualified archaeologist is further recommended as part of a watching brief designed for the EMP.

Cultural landscape

The landscape of the proposed development area is predominantly “platteland” and indicative of the Karoo landscape, with wide open spaces, sparse vegetation and isolated ridges and koppies adding to the character of the area. Farmsteads and small towns add to the landscape and are indicative of the human impact during the past 150 years on the landscape.

The overall impact on the cultural landscape as derived from the Visual Impact Assessment varies between the different receptors with the Bloubos dam, and Teerputs farmsteads rated as

having a moderate negative impact, while in the case of the Blaauw bosch dam farmstead receiving a low negative impact rating.

Mitigation measures will be able to reduce the impact on these farmsteads however the overall impact on the cultural landscape is still rated as moderate. It is recommended that the following measures are followed:

1. Carefully plan to reduce the construction period.
2. Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
3. Maintain a neat construction site by removing rubble and waste materials regularly.
4. Make use of existing gravel access roads where possible.
5. Ensure that dust suppression techniques are implemented on all access roads.

Palaeontology

The preferred site for the Renosterberg solar PV facility on Blaauwbosch Dam 103, to the north of the Renosterberg, is underlain by Ecca Group bedrocks mantled with a substantial thickness of superficial sediments (calcrete hardpan, surface gravels, thin soils). All these sediments are of low palaeontological sensitivity and anticipated impacts on fossil heritage here would be of low significance (Almond, 2013).

Given the low impact significance of the proposed PV solar facility development as far as palaeontological heritage is concerned, no further specialist palaeontological heritage studies or mitigation are considered necessary for this project, pending the discovery or exposure of significant new fossil remains during development.

1. During the construction phase all substantial (i.e. deep, voluminous) bedrock excavations should be monitored for fossil remains by the responsible ECO.
2. Should significant fossil remains such as vertebrate bones and teeth, shells, plant-rich fossil lenses, sizeable petrified wood specimens or dense fossil burrow assemblages be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably in situ, and alert SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) as soon as possible so that appropriate action can be taken by a professional palaeontologist at the developer's expense.
3. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy).
4. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection).

The overall impact on the heritage resources by the proposed project is seen as low through the implementation of the recommended mitigation measures.

RENOSTERBERG WIND ENERGY COMPANY (RWEC)

HERITAGE IMPACT REPORT

Contents Page

Appendices

1 INTRODUCTION

PGS Heritage (PGS) was appointed by Sivest Environmental Division to undertake a Heritage Impact Assessment Report (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMPr) for the Proposed Photovoltaic (PV) Facility for Renosterberg Wind Energy Company (RWEC) near De Aar, Northern Cape Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the impact areas identified for the EIA study. The Heritage Impact Assessment aims to inform the Environmental Impact Assessment in the development of a comprehensive Environmental Management Plan to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This Heritage Impact Report was compiled by PGS Heritage (PGS). The staff at PGS has a combined experience of nearly 60 years in the heritage consulting industry. PGS will only undertake heritage assessment work where their staff has the relevant expertise and experience to undertake that work competently. Wouter Fourie, the Principal Heritage Specialist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP). Marko Hutton, Field Archaeologist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as Field Director.

1.3 Assumptions and Limitations

Not subtracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist had been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development the procedures and requirements pertaining to graves and burials will apply as set out in this document.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA), Act 107 of 1998
- National Heritage Resources Act (NHRA), Act 25 of 1999
- Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
- Development Facilitation Act (DFA), Act 67 of 1995

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

- National Environmental Management Act (NEMA) Act 107 of 1998
    - Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    - Environmental Scoping Report (ESR) – Section (29)(1)(d)
    - Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    - Environmental Management Plan (EMPr) – Section (34)(b)
- National Heritage Resources Act (NHRA) Act 25 of 1999
    - Protection of Heritage Resources – Sections 34 to 36; and
    - Heritage Resources Management – Section 38
- Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Section 39(3)
- Development Facilitation Act (DFA) Act 67 of 1995
    - The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…” The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the

State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008):

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage".

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

Refer to for further information on the interpretation of heritage Appendix B.

1.5 Terminology

ABBREVIATIONS	DESCRIPTION
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party

LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

- **Archaeological resources**

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

- **Cultural significance**

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

- **Development**

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

- **Early Stone Age**

  The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

- **Fossil**

  Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

- **Heritage**

  That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

- **Heritage resources**

  This means any place or object of cultural significance

- **Holocene**

  The most recent geological time period which commenced 10 000 years ago.

- **Late Stone Age**

  The archaeology of the last 20 000 years associated with fully modern people.

- **Late Iron Age (Early Farming Communities)**

  The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

- **Middle Stone Age**

  The archaeology of the Stone Age between 20-300 000 years ago, associated with early modern humans.

- **Palaeontology**

  Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Location	30°25'36.17"S 23°59'3.16"E The site is 18km North of the town of De Aar and 40 km west of Philipstown in the Northern Cape
Land	8,000 Hectares of land under option, expect to subdivide areas as needed.

Figure 2 – Renosterberg PV Project locality

2.2 Technical Project Description

Refer to **Appendix C** for description of the PV technical details.

3 ARCHIVAL FINDINGS

The aim of the archival background research is to identify possible heritage resources that could be encountered during the field work. The archival research included in this report covers the larger study area and will be updated with detailed information based on discussions with the local landowners and inhabitants during the field work in the EIA phase of the HIA.

Evaluation of archaeological work completed on the Perseus Hydra Transmission line that traverses the eastern section of the study area have produced some ground thruthed information on archaeology to be expected in the study area. Further to this Archaeological Impact Assessments (AIA) and Heritage Impact Assessments (HIA) completed by Archer, Kaplan (2010), Kruger (2012), Orton (2012), PGS (2012) and Van Ryneveld (2008), has revealed a rich archaeological and historical back ground to the greater study area ranging from Earlier Stone Age (ESA) through to the Later Stone Age (LSA) and herder settlements represented by stonewalled kraals along numerous ridges throughout the study area (**Figure 3**). The colonial period is represented by abandoned and current historical farmsteads dating from the mid to late 1800's (Kruger 2012, Orton, 2012 and PGS, 2011), while remnants of stone walling and ash middens dating from the turn of the 20th Century representing the South African War (Orton, 2012 and PGS, 2012).

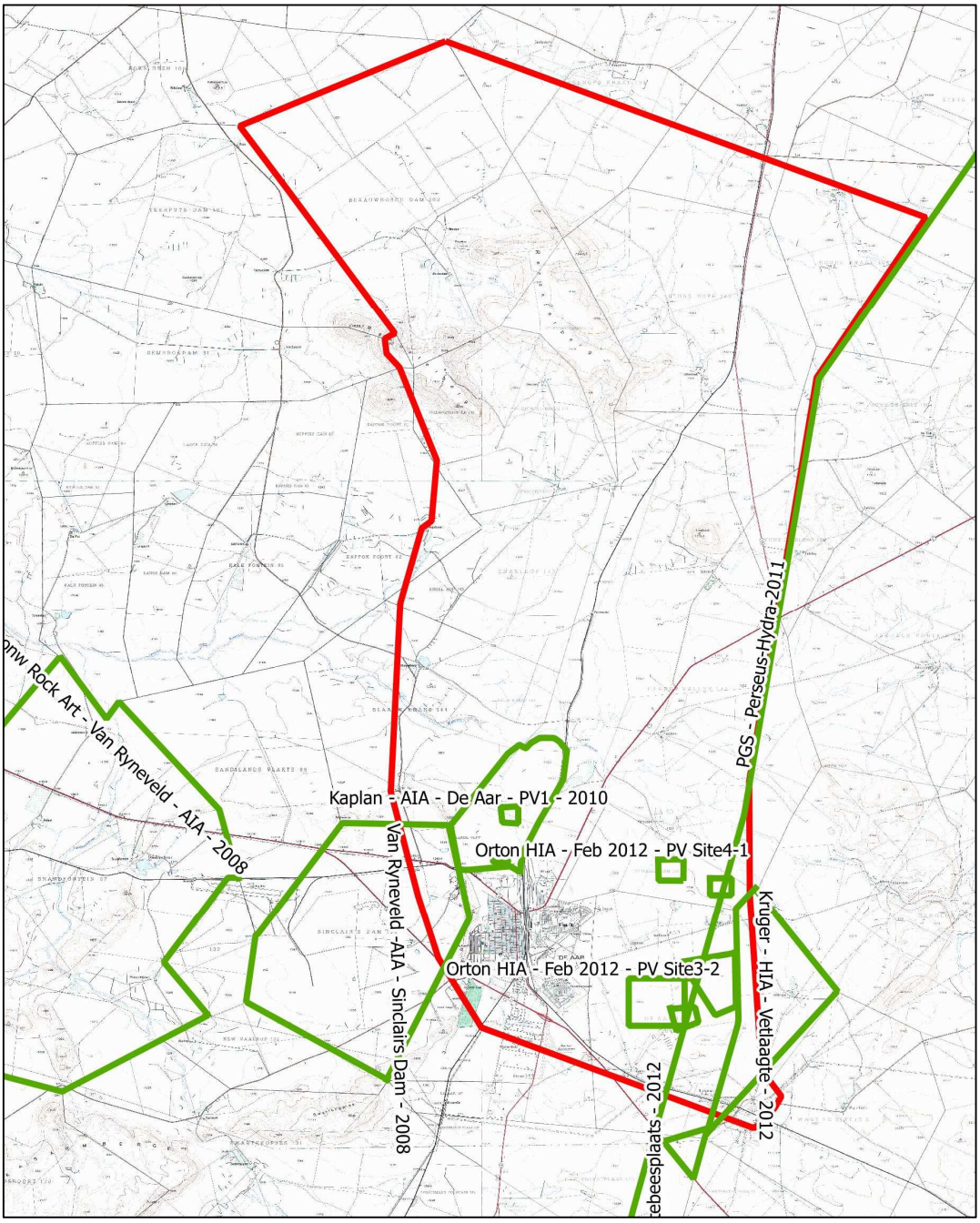


Figure 3 – The study area for this Scoping Report (red) with previous heritage studies conducted indicated (green)

Initial desktop studies completed created a map indicating that area exposed to sheet erosion produced more Stone Age finds as deflated site was exposed during erosion (**Figure 4**).

Figure 4 – The greater De Aar region indicating San Rock Art finds – Blue spot indicate areas of sheet erosion (Red outline study area) (Van Jaarsveld, 2006)

Follow up field work by PGS Heritage, have provided some valuable information on the archaeology and palaeontology in the study area where the Perseus Hydra line traverses the study area.

3.1 Archaeology

The PGS (2010) revealed numerous find spots from single low concentration Stone Age finds (**Figure 5**) in eroded areas to larger significant Middle Stone Age Scatters (**Figure 6**) in the sections of the study area impacted by the Perseus Hydra Transmission line that runs east of the Renosterberg down to De Aar.

Figure 5 – Low density scatter of MSA finds

Figure 6 – Area scattered with eroded MSA artefacts – Renosterberg in the background

3.2 Historical Context

De Aar Junction played key strategic role during the South Africa War (Anglo-Boer War) and specifically two battles: the Battle of Stormberg and the Battle of Colenso. It acted as both the supply strategic place between Cape Town and the west central regions of South Africa through the Karoo, which remained devoid of any battles during the war. It is located central western region of the country, South Africa.

The town of De Aar was established just after the South African War after two Friedlander brothers, Isaac and Wolf, surveyed the land on farm De Aar which they had purchased during the construction of a junction in the late 1800's when the railway line between Cape Town and Kimberley was built. The site for the construction of the junction was first identified in 1881 and by 1899 the Friedlander brothers were already operating a trading store and a hotel at the junction. It is during this time that they purchased the farm De Aar which the later built the town of De Aar in 1900. However, it took another 5 years after the war had ended (1902) and 6 years after the creation of the town municipality (1900) for the town to elect its first municipal mayor in 1907. The name, De Aar, means 'Artery' after the underground water supply and is the second most important South African rail junction.

3.2.1 Understanding the Importance of De Aar during the Second South Africa War

Two South African war battles become important in the history of De Aar; the Battle of Stormberg and the Battle of Colenso. The Battle of Stormberg was one of the famous encounters between the Boers and the British in the South African war. This skirmish/battle took place when the Boers were triumphant and it formed part of a chain of disasters which the British termed the 'The Black Week' (Meintjes, 1969).

The first involvements of De Aar in the war can be dated to November 1899 when the Boers moved southward from the areas of their strong hold the Orange Free State and the Transvaal. On the 1st of November 1899 a small detachment of Boers from the Orange Free State, had seized the railway bridge over the Orange River at Norvalspont. This bridge was at the time guarded by only six policemen who were quickly overcome by the Boers. On the same day Hans Swanepoel of Smithfield and Floris du Plooy of Bethulie with a combined commando of 900 men and two guns crossed the Bethulie bridges over the Orange River and headed from Naauwpoort and Stormberg (Meintjes, 1969). Up until this time the Boers are argued to have deliberately avoided and neglected to occupy some of the principal railway junctions in the Colony, notably: De Aar, Naauwpoort and Stormberg (ibid).

Idea to deliberately neglect these junctions is argued to have been aimed at offending the Schreiner Ministry based on an agreement made between Steyn and Schreiner, which Steyn withdrew in consultation with President Kruger of the Transvaal after it became apparent that the

Cape could play a significant role in the war. Steyn then issued proclamations in which parts of the British Bechuanaland and the Northern Cape were annexed to the two Boer Republics, the Transvaal and the Orange Free State. The reason behind these annexations is that, they were made to "...permit commandeering of men and supplies as well as to protect rebels who annexed territories of the Cape Colony and the Protectorate would be guilty of High Treason and perhaps be punishable by execution" (Meintjes, 1969).
When hostility between the British and the Boers across the Orange River commenced, the British had small garrisons at Stormberg Junction, Albert Road, Aliwal North, Norvalspont, Colesberg, Arundel and Naauwpoort (Meintjes, 1969). However, they had no garrison in De Aar which was one of the key strategic supply and distribution junctions. The garrisons along some of the railway line and stations were strategic as the railway lines formed an integral part of the British offensive. During the war they therefore played a significant role throughout South Africa and their disruption became a major target for the Boers; for example, during the capture of armoured train at Kraaipan by De le Ray where the first shots of the war were fired.

Stormberg Junction was chosen as a target junction of annexation, over De Aar Junction, by the Boers advancing south because of its link-up with East London and was an important strategic point for a sprung up through the Eastern Cape to Bloemfontein and Kimberley.

De Aar did, however, play a role during the war times as a stop and transfer junction with the transportation of British brigades and Naval Police from Cape Town to the central interior and for the transportation and transfer of supplies. The Naval Brigades who fought in the Stormberg skirmish pass through the large railway junction De Aar then described as a '...dreary sight of platforms and dusty trains, tin shanties and corrugated iron houses, grey boulders and ashy sky...' (Meintjes, 1969).

The De Aar junction further acted as a major stockpile for stores to be sent forward to the British forces. Doyle (1902) noted that "immense" supplies were gathered at De Aar (**Figure 7**). Danes (1903) writes, "…*De Aar was a wonderful sight in those days. Hundreds of mules and oxen were there. Countless wagons, packages and cases of food and ammunition, ambulances, hospitals, medical stores…*"

Figure 7 – Stockpiles of oats at De Aar (ca. 1900)

This stock piling was due to De Aar being a stopover and staging post for troops and supplies towards the Free State and access point from the Cape and Port Elizabeth. A large Remount Depot (Horse and Mule replenishment) was also present at De Aar, which provided much needed fresh horses and mules for the war effort (**Figure 8**).

Figure 8 – The Remount Depot Garrison at De Aar (December 1899)

Among the people of Note who passed through De Aar during the war is Winston Spencer Churchill. This is during the time when various war correspondents were travelling between the Cape, the Eastern Cape, Northern Cape and the Transvaal. It is suggested that, after staying at the Mount Nelson Hotel in Cape, Churchill travelled by rail to East London, via Matjiesfontein, De Aar, Stormberg, Molteno and Queenstown.

During the Colenso Battle, De Aar was used by the British to transfer guns between the Cape Town, the central interior and the Natal region such as, the long Tom-tom guns. The reason for this is that they were encountering hostile enemy lines along the east coast regions of the country (Martins, 1988). Nasson (1999: 135), for example, argues that "the failure of Black Week had prised things open, almost inviting a capitalizing counterstroke from some bold and resolute Boer leadership. Exposed to a broader offensive, the Cape Colony virtually asked for deeper penetration to throttle the strategic junction of De Aar, thereby severing Methuen's supply lines. On the eastern front, almost all of Natal remained under the enemy thumb, with the British confined or paralysed by the Orange Free State commandos who, in their most southerly groupings, had pegged out substantial swathe of land running down to within 120miles of the Indian Ocean".

4 POSSIBLE FINDS

Evaluation of aerial photography has indicated the whole of the study area that may be sensitive from a heritage resources perspective (**Figure 9**). Archaeological surveys and studies in the Northern Cape have shown rocky outcrops, dry river, riverbanks and confluence to be prime localities for archaeological finds and specifically Stone Age sites. Included in the archaeological timeframe is the South African War as well as colonial farmer settlements.

The aerial photography has reference the following as possible heritage sensitivity:

Drainage lines

Drainage lines, such as dry river beds, erosion dongas as well as sheet erosion has been shown to yield rich archaeological deposits due to the exposure of archaeological material as well as the fact that human settlement is drawn to water sources in arid regions (Kruger 2012; Orton 2012; PGS 2012).

Farmsteads

Most of the farmsteads in the study area date from the mid to late 1800's and are of great historical and significance r (Kruger 2012; Orton 2012; PGS 2012).

Structures

Numerous structures and outlines of man mad structures have been identified and rated as possible sensitive heritage resources from the aerial survey. Some of the early settler farmsteads

have been abandoned for close to 100 years and only the remnants of the walling, middens and paddocks remain. These sites can be of high heritage significance regions (Kruger 2012; Orton 2012; PGS 2011).

Pans

Previous research in the Northern Cape has shown that as with drainage line and rivers human occupation is drawn to pans and ephemeral water sources by the chance of water and of hunting due to the availability of game in such areas.

Ridges

Numerous ridges, koppies and mountains have been identified in the study area and AR associated with human settlement and activity. Stonewalling from herders, rock engravings and knapping sites associated with Later Stone Age manufacturing technology is known to occur in these areas (Kruger 2012; Orton 2012; PGS 2011 and 2012, Van Ryneveld 2008).

South African War

The archival research has shown that De Aar was a major staging post during the South African War. Along with the infrastructure and remnants found close to town, the railway line running northwards through the study area will have the remains of numerous blockhouses, constructed by the British Forces to protect the railway line from attack, in close vicinity.

Sensitive areas as indicated from previous HIA's

Sensitive areas as identified in previous HIA's and AIA's have been included in the mapping and are in all cases associates with one or more of the categories listed above.

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA.

- Archaeological walk through of the areas where the project will be impacting will be able to provide a detailed inventory of the heritage resources of the area;
- Palaeontological assessment of the areas and selective site visits where required by the palaeontologist – already commissioned as part of the EIA study;

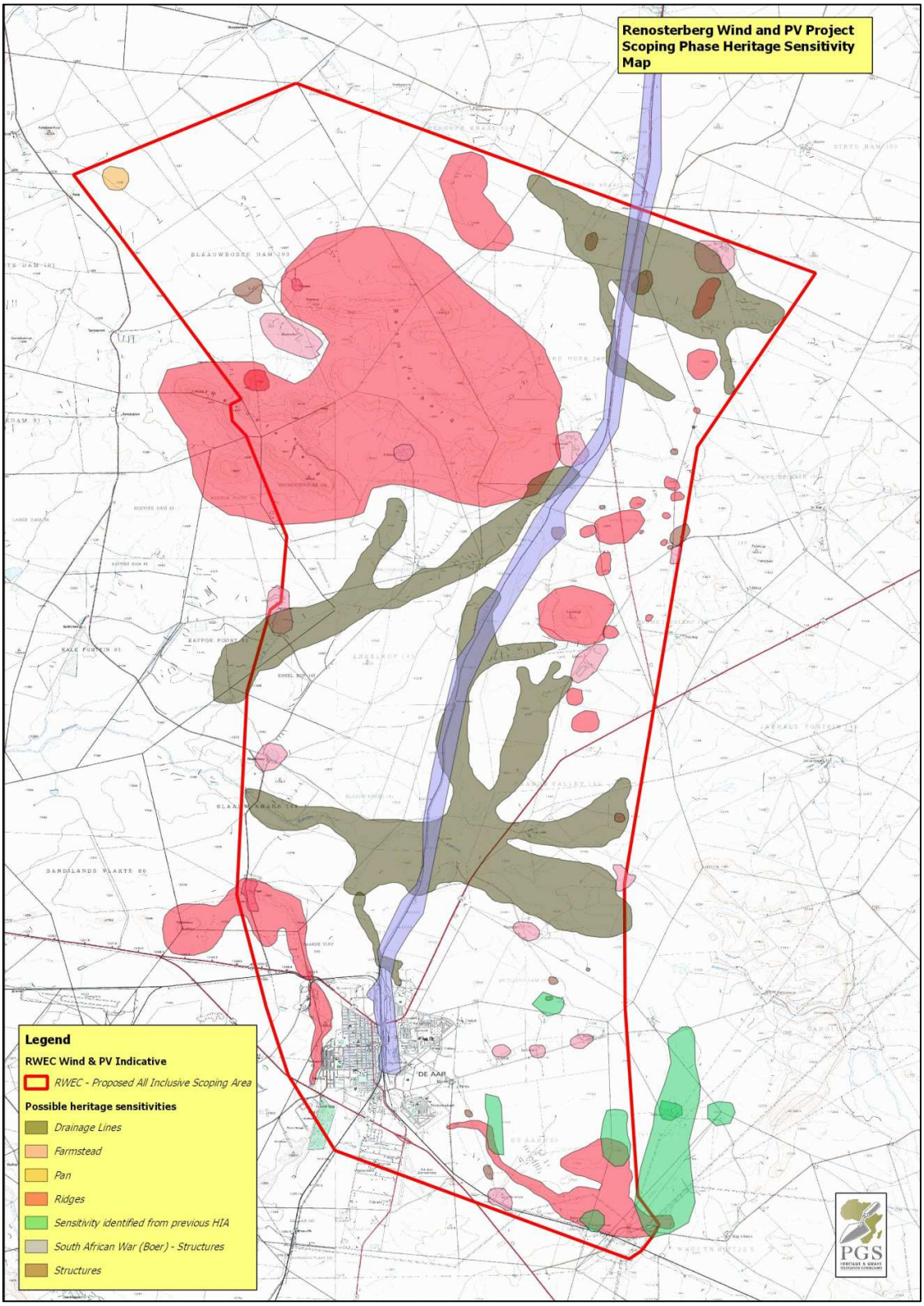


Figure 9 – Areas with possible heritage resources present

5 IMPACT ASSESSMENT

5.1 Assessment Methodology

The section below outlines the assessment methodologies utilised in the study.

This Heritage Impact Assessment (HIA) report was compiled by PGS Heritage and Grave Relocation Consultants (PGS) for the proposed. The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consisted of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site in September 2010.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by qualified archaeologists (February 2011), aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
    - Density of scatter (dispersed scatter)
        - Low - <10/50m^2
        - Medium - 10-50/50m^2
        - High - >50/50m^2
- **uniqueness** and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate pylon position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Impacts on these sites by the development will be evaluated as follows

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 1: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	-	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	-	Low Significance	Destruction

5.2 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the

process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

5.2.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 2**.

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

5.2.2 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- Rating System Used To Classify Impacts

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

Table 2: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).

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

SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

5.3 Field work findings and assessment

The footprint area for this proposed project covers approximately 250 hectares that will encompass the installation of a solar field and their associated components as well as a father 6 kilometres of power line that will link the PV substation with the Wind Farm Substation on the Renosterberg. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, a controlled-exclusive surface survey of the footprint area as well as centre line of the provided power line alignment was conducted over a period of 4 days on foot by an archaeological team of PGS. Field work was conducted in the week of 17-22 June 2013. Refer to **Appendix A** for Heritage Maps and tracklogs.

The site assessed averages at 1300 meters above mean sea level and is characterised by low density Karoo type vegetation cover, dispersed in between a high density of rock, pebble and boulder-cover over the extent of the foot print area (**Figure 11** and **Figure 11**).

Figure 10 – General view of the proposed PV Substation link alignment towards the Renosterberg

Figure 11 – General view of the proposed PV foot print area

5.3.1 Archaeological Areas

Four areas containing various Stone Age scatters were identified during the field work. The first two (**RPV1 and 3**) are all low density Stone Age (lithic) scatters occurring over large areas, with **RPV1** (**Figure 12**) and **RPV3** (**Figure 16**) being more than 7 hectares in extent. **RPV1 and 3** are characterised by small pockets of lithic concentrations. Most of these concentrations can be described as 'background scatters" or "find spots' where no context or archaeological deposit of secondary material is present. These finds spots are of low to medium density ranging between 5-10 lithics (stone artefacts) in a 100m^2. Most of these lithics are heavily weathered lithics (**Figure 13**), predominantly produced from hornfels and quartzite, with a high degree of patination visible (**Figure 15**), indicating an older age to the material. The lithics are dominated by scrapers (end and side), while some convergent points and flakes with retouch were present indicative of MSA lithics (**Figure 19**).

Site **RPV2** (**Figure 14**) and **RPL1** (**Figure 18**) are low density scatters occurring over areas of approximately 50 meters in diameter, characterised by sheet erosion exposing the lithics on the sites.

Figure 12 – General view of the area around RPV1

Figure 13 – Heavily eroded lithics found around point RPV1

Figure 14 – General view of the area around RPV2

Figure 15 – Lithics found around point RPV2

Figure 16 – General view of the area around RPV3

Figure 17 – Lithics found around point RPV3

Figure 18 – General view of the area around RPL1

Figure 19 – Lithics found around point RPL1

The scatters within archaeological areas are generally classified as having **low heritage significance and Grades as Generally Protected C**; however the extent of the areas and amount of scatters occurring within gives RPV1 and RPV3 a heritage significance rating of **medium to high and is Generally Protected A** and thus requiring mitigation before construction activities.

5.3.2 Cultural landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that are known to have added to the cultural fabric of a place or area.

The evaluation of the Cultural landscape relies heavily on the Visual Impact Assessment (VIA) completed for the project by SiVest Environmental Division (Gibb, 2013).

Gibb (2013) describes the landscape of the proposed development area as predominantly "platteland" and indicative of the Karoo landscape (**Figure 20**), with wide open spaces, sparse vegetation and isolated ridges and koppies adding to the character of the area (**Figure 21**). Farmsteads and small towns add to the landscape and are indicative of the human impact during the past 150 years on the landscape.

Figure 20 – Visual character attributed to the study area (Gibb, 2013)

Linear developments in the past 50 years include transmission and power lines varying from 32kV to the large 765kV lines, dirt roads converted to tar as well as expansion of the towns with the need for housing and infrastructure.

Figure 21 – View of the Renosterberg (Gibb, 2013)

5.3.3 Palaeontology

The palaeontological study and field work was conducted by John Almond (2013) and separately commissioned from the HIA for this project. Almond (2013) over views the palaeontology of the larger "all inclusive" study area as follows:

"The lower-lying portions of the study area for the proposed Renosterberg PV solar facility are underlain by offshore basinal to nearshore sediments of the Early to Middle Permian Ecca Group (Karoo Supergroup). These subaqueous deposits are variously assigned in this study to the Tierberg Formation or Waterford Formation and are of low to moderate palaeontological sensitivity. In the De Aar region the Ecca Group rocks are known to contain plant compressions, well-preserved petrified wood, locally abundant trace fossil assemblages (including possible large amphibian impressions) and microvertebrate remains (e.g. disarticulated teeth, scales of fish). Fieldwork shows that palaeontologically sensitive Middle Permian fluvial sediments of the Lower Beaufort Group (Adelaide Subgroup, Karoo Supergroup) are not represented within the Renosterberg core study area, contrary to the geological map. These continental rocks have recently yielded rare fossil remains of small therapsids ("mammal-like reptiles") and turtle-like

parareptiles, plus occasional fossil plants and silicified woods, in the escarpment zone to the east of De Aar. They are unlikely to be directly affected by the proposed solar facility development, with the possible exception of the alternative transmission line corridor near Hydra Substation (Alternative B); even here, anticipated impacts are slight. The Renosterberg koppies are capped by a thick sill of dolerite of the Early Jurassic Karoo Dolerite Suite and several smaller sills have intruded as well as baked the Ecca Group sediments on their slopes. The Karoo dolerites are entirely unfossiliferous and any developments situated on the Renosterberg plateau are therefore of no palaeontological significance. Much of the topographically subdued Ecca Group outcrop area surrounding the Renosterberg koppies is covered by a thin to thick (few dm to several meters) succession of Late Caenozoic (Neogene to Recent) superficial deposits such as alluvium, surface gravels, soils and well-developed calcrete hardpans. These younger rocks contain sparse, low diversity fossil assemblages such as rhizoliths (calcified plant root casts) and invertebrate burrows. Vertebrate remains (e.g. mammalian bones and teeth) might also occur here, for example within older alluvial gravels, but are probably localised and very rare.

The same limited spectrum of rock units is represented within the broader “all-inclusive” study region encompassing all the infrastructural components of the proposed Renosterberg alternative energy facility (including transmission lines, substations etc) and extending from the Renosterberg area itself southwards to De Aar and beyond. A sizeable area of Adelaide Subgroup rocks cropping out near the Eskom Hydra substation to the southeast of De Aar is of particular note.”

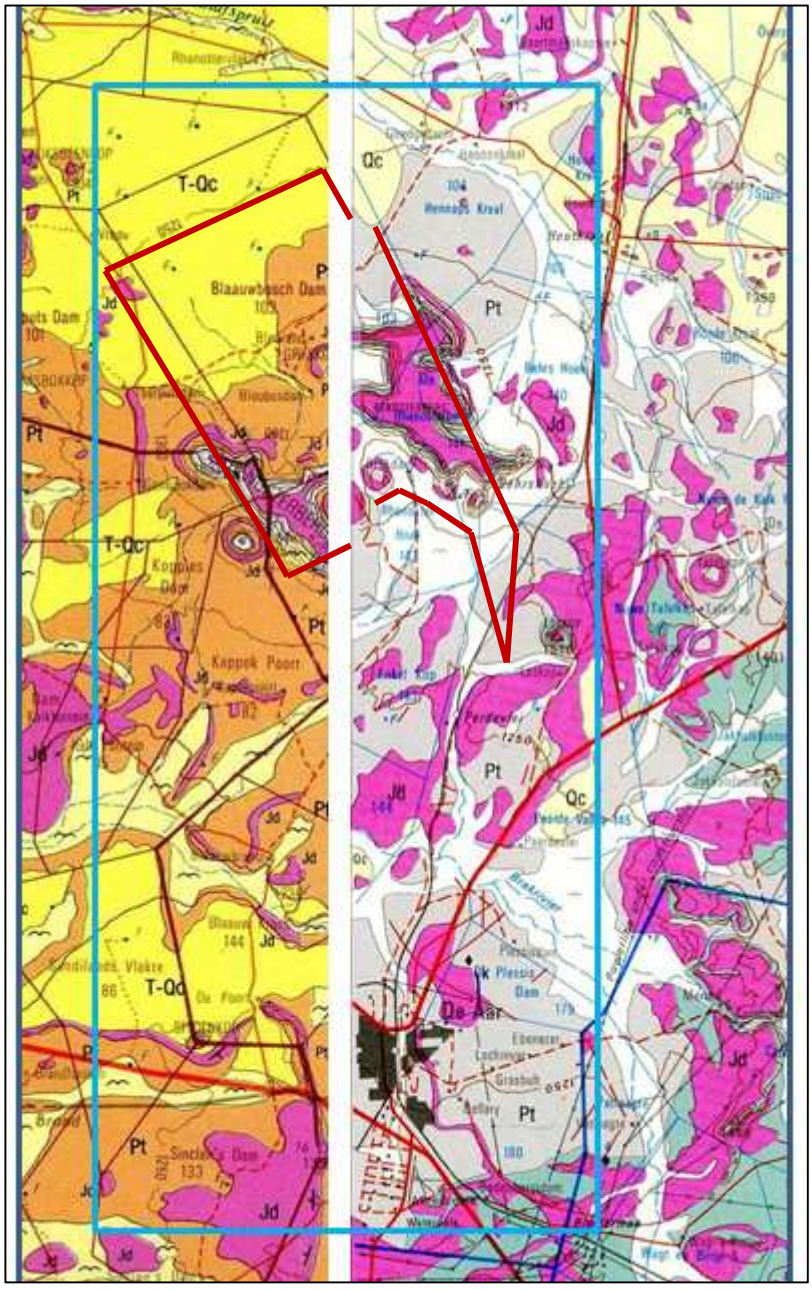


Figure 22 - Geology of the broader Renosterberg – De Aar study region (blue rectangle) abstracted from 1: 250 000 geological maps 3022 Britstown (left) and 3024 Colesberg (right) (Council for Geoscience, Pretoria). The dark red polygon outlines the land parcels around the Renosterberg within which the PV solar facility will be constructed. The major rock units mapped in this and the broader study area include: Pt (orange / grey) = Tierberg Formation (ECCA GROUP); Pa (blue-green) = Adelaide Subgroup (BEAUFORT GROUP); Jd (pink) = Karoo Dolerite Suite; T-Qc / Qc (yellow) = Late Caenozoic calcretes; Pale yellow / white = Quaternary alluvium. Of these rock units, only the Ecca and Beaufort Group rocks are of moderate to high palaeontological sensitivity. Note, however, that field studies indicate that the Ecca Group rocks in fact belong largely to the Waterford Formation while the Adelaide Subgroup is *not* represented within the core study area (Almond, 2013)

5.4 Impact Matrix

Note that the impact assessment tables all refer to impacts during construction and not operational, as the foreseen impacts on the heritage resources will primarily be during the construction phase. The only operational rating table is that for the impact on the cultural landscape in Section 5.4.3.

5.4.1 Chance finds

Table 3: Impact Assessment table for chance finds

IMPACT TABLE		
Environmental Parameter	*Discovery of previously unidentified heritage sites (archaeological, historical or grave sites)*	
Issue/Impact/Environmental Effect/Nature	*During construction activity and earthmoving archaeological material could be unearthed that was previously unidentified due to its position.*	
Extent	*In most cases confined to small areas on the site*	
Probability	*Due to the close proximity to water course, localised archaeological finds may possibly occur*	
Reversibility	*In most cases where such finds are made damaged is irreversible*	
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*	
Duration	*Permanent*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-24(Low negative)	-11 (low negative)

IMPACT TABLE	
Mitigation measures	*A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*

5.4.2 Archaeological areas

Table 4: Impact Assessment table for archaeological areas

IMPACT TABLE		
Environmental Parameter	*Identified archaeological areas*	
Issue/Impact/Environmental Effect/Nature	*The possibility of uncovering significant subsurface deposits in the identified archaeological areas are higher than in other areas*	
Extent	*In most cases confined to small areas on the site*	
Probability	*Possible impact on the cluster of archaeological areas identified*	
Reversibility	*In most cases where a site cannot be excluded and needs to be destructed the impact is irreversible*	
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*	
Duration	*Permanent*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*Low*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-32 (Medium negative)	-13 (low negative)

IMPACT TABLE	
Mitigation measures	*Mitigation measures as recommended with each identified site and,* *A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*

5.4.3 Cultural Landscape

Gibb (2103) notes that the study area represents a typical Karoo landscape and that the type of development could be considered a factor impacting negatively on the character of the landscape of the study area.

The visual sensitivity (inherent sensitivity to visual impacts) is influenced by various factors that include, but not limited to, factors such as:

- The natural character of the environment
- Aesthetic sense of place
- Irreplaceability
- Cultural or symbolic meaning
- Scenic resources, and
- Local status of the environment.

Taking the above into account Gibb (2013) rates the study area as having a moderate visual sensitivity, influenced in a large part by the scenic quality of the area. The VIA identified visual receptors within the wind farm study area and zones of visual impact in order to rate the visual impact (**Figure 23**).

Gibb (2013) further notes that, "*The solar development is likely to be perceived as a visual impact in areas that have a natural scenic quality and where tourism activities based upon the enjoyment of, or exposure to, the scenic or aesthetic character of the area are practiced. Residents and visitors to these areas may regard the solar panels to be unwelcome intrusions, which degrade the natural character and scenic beauty of the area, and which would potentially even compromise the practising of tourism activities in the area*."

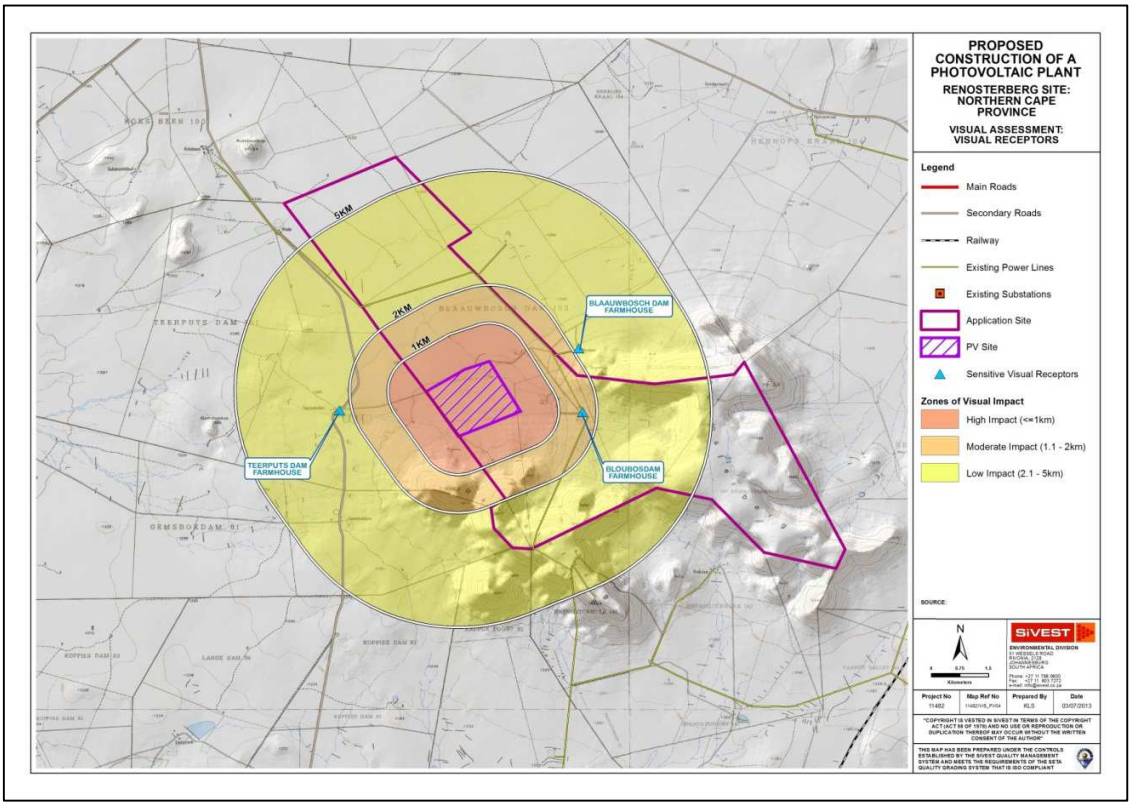


Figure 23 – Visual sensitive receptors within the study area of the PV facility (Gibb, 2103)

Most of these farmsteads are part of a working farms consisting of a main residential house, sheds, workshops and associated stock pens. The out buildings, sheds and stocks pens have retained their original function and construction, while in most cases the original main house has seen some additions over the past 60 years.

The three farmsteads closest to the proposed PV facility are rated as having an overall impact rating from the VIA (Gibb, 2013) as:

- Blaauw Bosch Dam - Low
- Bloubosdam - Medium
- Teerputs – Medium

The above rating should be read in conjunction with **Table 6 and** .

Table 5: Rating of visual impacts of the proposed PV plant during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the natural character of the

	study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local / District (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Low cumulative effects (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-20 (negative low)	-18 (negative low)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

Table 6: Impact Assessment table for cultural landscape – during the operational phase

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed PV plant could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local/district	
Probability	Definite	
Reversibility	Irreversible	
Irreplaceable loss of resources	Marginal	
Duration	Long term	
Cumulative effect	Medium cumulative effects	
Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-36 (medium negative)	-36 (medium negative)
Mitigation measures	▪ No mitigation measures exist.	

5.4.4 Palaeontology

The preferred site for the Renosterberg solar PV facility on Blaauwbosch Dam 103, to the north of the Renosterberg, is underlain by Ecca Group bedrocks mantled with a substantial thickness of superficial sediments (calcrete hardpan, surface gravels, thin soils). All these sediments are of low palaeontological sensitivity and anticipated impacts on fossil heritage here would be of low significance (Almond, 2013).

Given the low impact significance of the proposed PV solar facility development as far as palaeontological heritage is concerned, no further specialist palaeontological heritage studies or mitigation are considered necessary for this project, pending the discovery or exposure of significant new fossil remains during development.

Table 7: Impact Assessment table for palaeontology

IMPACT TABLE		
Environmental Parameter	*Impact on palaeontological resources*	
Issue/Impact/Environmental Effect/Nature	*The possibility of uncovering significant subsurface palaeontological deposits*	
Extent	*In most cases confined to small areas on the site*	
Probability	*Low probability of impact on palaeontology*	
Reversibility	*In most cases where a site cannot be excluded and needs to be destructed the impact is irreversible*	
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*	
Duration	*Permanent*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Low*	
Significance Rating	*The impact is anticipated as being low and localised*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	2	3
Duration	4	4

IMPACT TABLE		
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-16 (Medium negative)	-13 (low negative)
Mitigation measures	*Refer to Section 5.8.3*	

5.5 Confidence in Impact Assessment

It is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some heritage sites.

The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life and has been conducted as such.

5.6 Cumulative Impacts

None foreseen

5.7 Reversibility of Impacts

Although heritage resources are seen as non-renewable the mitigation of impacts on possible finds through scientific documentation will provided sufficient mitigation on the impacts on possible heritage resources.

5.8 Site specific management measures

5.8.1 Archaeological areas

1. Before construction commences all archaeological areas must be demarcated and the necessary mitigation completed as noted in points 2-6 below.
2. It is recommended that the extent of each concentration be mapped for **RPV3** as a documentation of the archaeological sequence of the development area.
3. The mapping should include a spatial layout of the concentrations
4. Surface collection and lithic analysis of the concentration with the highest density, after which the lithics are to be returned to the site.

5. The above can be done with the backing of an archaeological permit issued to a qualified archaeologist issued by SAHRA.
6. After completion of the field work and analysis an application for destruction of the sites must be lodged with SAHRA. Upon issuing of this permit construction can commence in the archaeological defined areas.
7. Monitoring of the archaeological areas during construction by a qualified archaeologist is further recommended as part of a watching brief designed for the EMP.

5.8.2 Cultural Landscape

Gibb (2013) proposes the following to limit the impact on the visual/cultural landscape during construction:

1. Carefully plan to reduce the construction period.
2. Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
3. Maintain a neat construction site by removing rubble and waste materials regularly.
4. Make use of existing gravel access roads where possible.
5. Ensure that dust suppression techniques are implemented on all access roads.

5.8.3 Palaeontology

1. During the construction phase all substantial (i.e. deep, voluminous) bedrock excavations should be monitored for fossil remains by the responsible ECO.
2. Should significant fossil remains such as vertebrate bones and teeth, shells, plant-rich fossil lenses, sizeable petrified wood specimens or dense fossil burrow assemblages be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably in situ, and alert SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) as soon as possible so that appropriate action can be taken by a professional palaeontologist at the developer's expense.
3. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy).
4. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection).

5.9 General Management guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-

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

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the South African Heritage Resources Agency (SAHRA) needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).
   This survey and evaluation must include:
   (a) The identification and mapping of all heritage resources in the area affected;
   (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Cultural Resources Act;
   (c) An assessment of the impact of the development on such heritage resources;
   (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
   (f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
   (g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
    a. Heritage;
    b. Graves;
    c. Archaeological finds; and
    d. Historical Structures.

    This module must be tailor made to include all possible finds that could be expected in that area of construction.
4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
7. After mitigation an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance is discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
9. In the event that human remains are uncovered or previously unknown graves are discovered a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA needs to be followed. This includes an extensive social consultation process.

The definition of an archaeological/palaeontological monitoring programme is a formal program of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.

The purpose of an archaeological/palaeontological monitoring programme is:

- To allow, within the resources available, the preservation by record of archaeological/palaeontological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological/palaeontological find has been made for which the resources allocated to the

watching brief itself are not sufficient to support treatment to a satisfactory and proper standard.

- A monitoring is not intended to reduce the requirement for excavation or preservation of known or inferred deposits, and it is intended to guide, not replace, any requirement for contingent excavation or preservation of possible deposits.
- The objective of the monitoring is to establish and make available information about the archaeological resource existing on a site.

Table 8: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should sit in at all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology supportive team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology supportive team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant	Client and Archaeologist	Archaeologist

authorities during each phase of development.		

5.10 All phases of the project

5.10.1 Archaeology

Based on the findings of the HIA, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions. Two courses should be organised – one aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant sites. This needs to be supervised by a qualified archaeologist. This course should be reinforced by posters reminding operators of the possibility of finding archaeological/palaeontological sites.

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making and to make the correct judgment on which actions should be taken. A responsible archaeologist/palaeontologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to sit in at relevant meetings, for example when changes in design are discussed, and notify SAHRA of these changes. The archaeologist would inspect the site and any development recurrently, with more frequent visits to the actual workface and operational areas.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMPr) of the project. Should an

archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological/palaeontological monitoring programme.

5.10.2 Graves

In the case where a grave is identified during construction the following measures must be taken.

Mitigation of graves will require a fence around the cemetery with a buffer of at least 20 meters.

If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a rescue permit must be applied for with SAHRA and the local South African Police Services must be notified of the find.

Where it is then recommended that the graves be relocated a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation
iii. Newspaper Notice indicating the intent of the relocation
iv. A permit from the local authority;
v. A permit from the Provincial Department of health;
vi. A permit from the South African Heritage Resources Agency if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. An exhumation process that will safeguard the legal implications towards the developing company;
ix. The whole process must be done by a reputable company that are well versed in relocations;
x. The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

6 CONCLUSIONS AND RECOMMENDATIONS

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The field work and assessment of the impact of the proposed PV facility and power line has identified and made recommendations on the following.

6.1 Archaeological Areas

Four areas containing various Stone Age scatters were identified during the field work. The first two(**RPV1 and 3**) are all low density Stone Age (lithic) scatters occurring over large areas in extent of 7 hectares, while **RPV2** and **RPL1** are smaller and each almost 50m in diameter. The concentrations within these archaeological areas are of low density and generally of low significance, however the number and extent of the scatters in these archaeological areas give archaeological areas **RPV1** and **RPV3** a medium to high heritage significance rating and is rated as **Generally Protected A**, requiring mitigation as listed below.

8. Before construction commences all archaeological areas must be demarcated and the necessary mitigation completed as noted in points 2-6 below.
9. It is recommended that the extent of each concentration be mapped for **RPV3** as a documentation of the archaeological sequence of the development area.
10. The mapping should include a spatial layout of the concentrations
11. Surface collection and lithic analysis of the concentration with the highest density, after which the lithics are to be returned to the site.
12. The above can be done with the backing of an archaeological permit issued to a qualified archaeologist issued by SAHRA.
13. After completion of the field work and analysis an application for destruction of the sites must be lodged with SAHRA. Upon issuing of this permit construction can commence in the archaeological defined areas.
14. Monitoring of the archaeological areas during construction by a qualified archaeologist is further recommended as part of a watching brief designed for the EMP.

6.2 Cultural landscape

The landscape of the proposed development area is predominantly “platteland” and indicative of the Karoo landscape, with wide open spaces, sparse vegetation and isolated ridges and koppies adding to the character of the area. Farmsteads and small towns add to the landscape and are indicative of the human impact during the past 150 years on the landscape.

The overall impact on the cultural landscape as derived from the Visual Impact Assessment varies between the different receptors with the Bloubos dam, and Teerputs farmsteads rated as having a moderate negative impact, while in the case of the Blaauw bosch dam farmstead receiving a low negative impact rating.

Mitigation measures will be able to reduce the impact on these farmsteads however the overall impact on the cultural landscape is still rated as moderate. It is recommended that the following measures are followed:

6. Carefully plan to reduce the construction period.
7. Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
8. Maintain a neat construction site by removing rubble and waste materials regularly.
9. Make use of existing gravel access roads where possible.
10. Ensure that dust suppression techniques are implemented on all access roads.

6.3 Palaeontology

The preferred site for the Renosterberg solar PV facility on Blaauwbosch Dam 103, to the north of the Renosterberg, is underlain by Ecca Group bedrocks mantled with a substantial thickness of superficial sediments (calcrete hardpan, surface gravels, thin soils). All these sediments are of low palaeontological sensitivity and anticipated impacts on fossil heritage here would be of low significance (Almond, 2013).

Given the low impact significance of the proposed PV solar facility development as far as palaeontological heritage is concerned, no further specialist palaeontological heritage studies or mitigation are considered necessary for this project, pending the discovery or exposure of significant new fossil remains during development.

1. During the construction phase all substantial (i.e. deep, voluminous) bedrock excavations should be monitored for fossil remains by the responsible ECO.
2. Should significant fossil remains such as vertebrate bones and teeth, shells, plant-rich fossil lenses, sizeable petrified wood specimens or dense fossil burrow assemblages be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably in situ, and alert SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) as soon as possible so that appropriate action can be taken by a professional palaeontologist at the developer's expense.
3. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy).

4. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection).

The overall impact on the heritage resources by the proposed project is seen as low through the implementation of the recommended mitigation measures.

7 REFERENCES

ALMOND, J, E. 2013. Palaeontological specialist assessment: combined desktop and field study. Proposed Renosterberg PV Solar Facility near De Aar, Northern Cape Province.

ARCHER, WILL. Undated. Archaeological Impact Assessment: proposed photovoltaic power generation facility in De Aar, Northern Cape.

BECKER, ELIZE. 2012. Phase 2 Heritage Impact Assessment De Aar Solar One Photovoltaic Power Project. Hatch Africa (Pty) Ltd

DANES, RICHARD. 1903. *Cassells's History of the Boer War, 1899-1902*. Cassell And Company, Limited London, Paris, New York & Melbourne

DOYLE, A.C. 1902. The Great Boer War.

FOURIE, WOUTER. 2008. *Archaeological Impact Assessments within South African Legislation*. South African Archaeological Bulletin 63 (187): 77–85, 2008

GIBB, A. 2013. Visual Impact Assessment Report for the proposed construction of the Renosterberg PV Facility near De Aar, Northern Cape Province of South Africa. SiVest Environmental Division

HENDERSON, ZOË. 2002. *A dated cache of ostrich egg flasks from Thomas' Farm, Northern Cape Province, South Africa*. The South African Archaeological Bulletin. Volume 57 (175).

KAPLAN, JONATHAN. 2010. Archaeological Impact Assessment for a proposed photovoltaic (PV) power generation facility in De Aar in the Northern Cape Province. Agency for Cultural Resource Management.

KENSLEY, BRIAN. 1975. Taxonomic Status of the Pygocephalomorphic Crustacea from the Dwyka 'White Band' (Permo-Carboniferous) of South Africa. Annals of the South African Museum, 67: 25-33

KRUGER, NELIUS. 2012. Archaeological Impact Assessment (AIA) of Demarcated Surface areas on the Farm Vetlaagte 4, De Aar, Northern Cape Province. AGES Gauteng

MARTIN, D. 1988. *Duelling with Long Toms: An Account of the 16th Battery Southern Division R.G. A during the Anglo-Boer War 1899-1902*. In Memorium, Henry Powell, 1877-1958.

MEINTJES, J. 1969. *Stormberg a Lost Opportunity*. Nasionale Boekhandel.

MORRIS, DAVID. 2002. *Another spouted ostrich eggshell container from the Northern Cape*. The South African Archaeological Bulletin. Volume 57 (175).

MORRIS, DAVID, 2010. Specialist input fort the Scoping Phase of the Environmental Impact Assessment for the proposed Pofadder Solar Thermal Facility, Northern Cape Province. Archaeology. McGregor Museum.

NASSON, B. 1999.*The South African War 1899-1902*. Arnold. A member of the Hodder Headline Group. London. Sydney. Auckland. Co-published in the United States of America by Oxford University Press Inx., New York.

ORTON, JAYSON. 2012. Heritage Impact Assessment for three Solar Energy Facilities at De Aar, Western Cape. ACO Associates cc

PGS HERITAGE & GRAVE RELOCATION CONSULTANTS, 2010.*Perseus Hydra Transmission Line, Archaeological Walk down*. Completed for Eskom

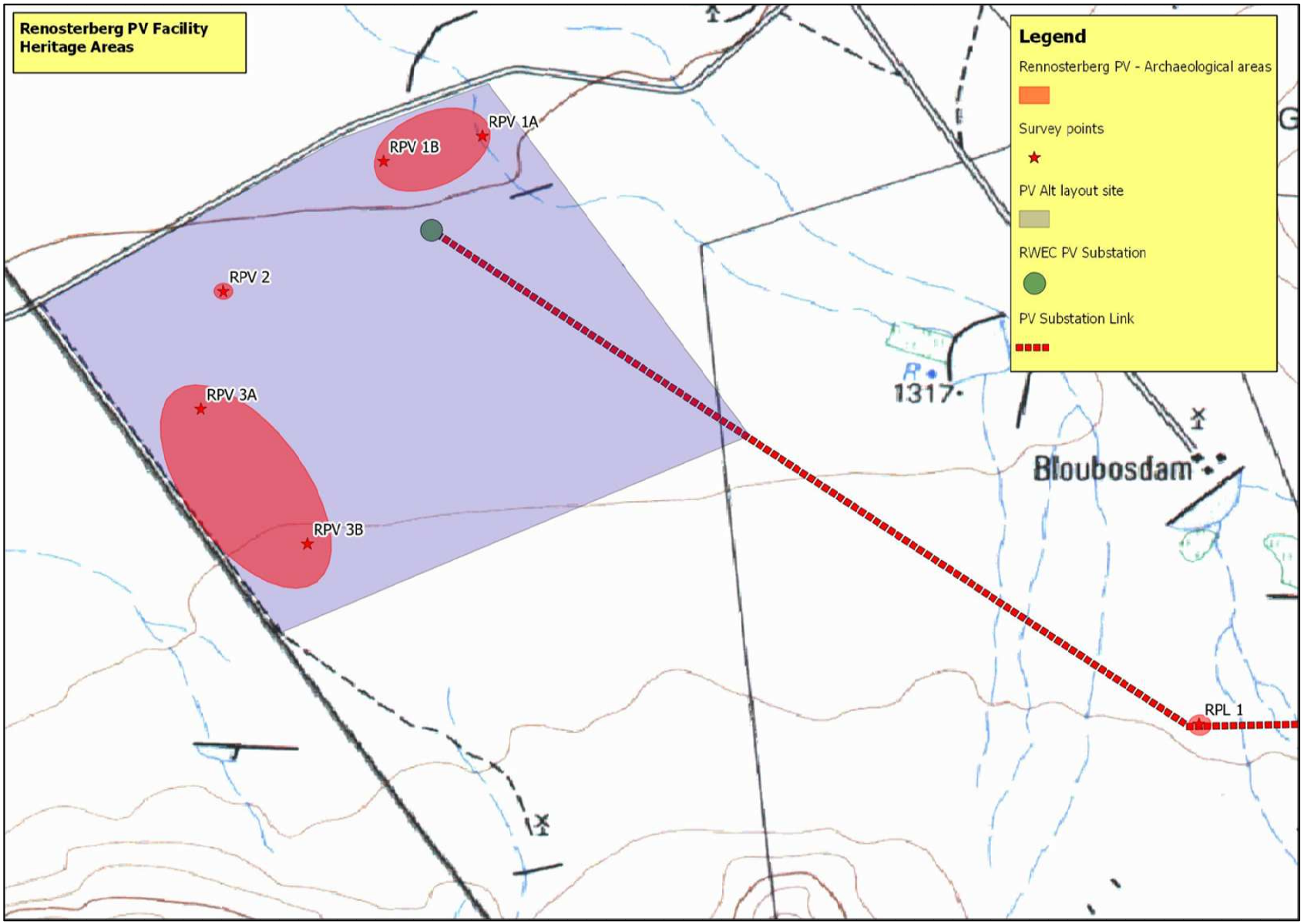
PGS HERITAGE & GRAVE RELOCATION CONSULTANTS, 2012. Concentrated Solar Project for Mainstream Renewable Power South Africa, on the farm PaardeVley 145 close to De Aar in the Northern Cape Province. SiVest Environmental Division.

VAN JAARSVELD, Albert. 2006. Hydra-Perseus and Beta-Perseus 765kv transmission power lines environmental Impact Assessment Impact on Cultural Heritage Resources. Completed for Arcus Gibb.

VAN RYNEVELD, KAREN. 2008. Archaeological Scoping - Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa. ArchaeoMaps

Appendix A

HERITAGE MAP


Renosterberg PV Facility
Heritage Areas
Legend
Rennosterberg PV - Archaeological areas
Survey points
PV Alt layout site
RWEC PV Substation
PV Substation Link
RPV 1A
RPV 1B
RPV 2
RPV 3A
RPV 3B
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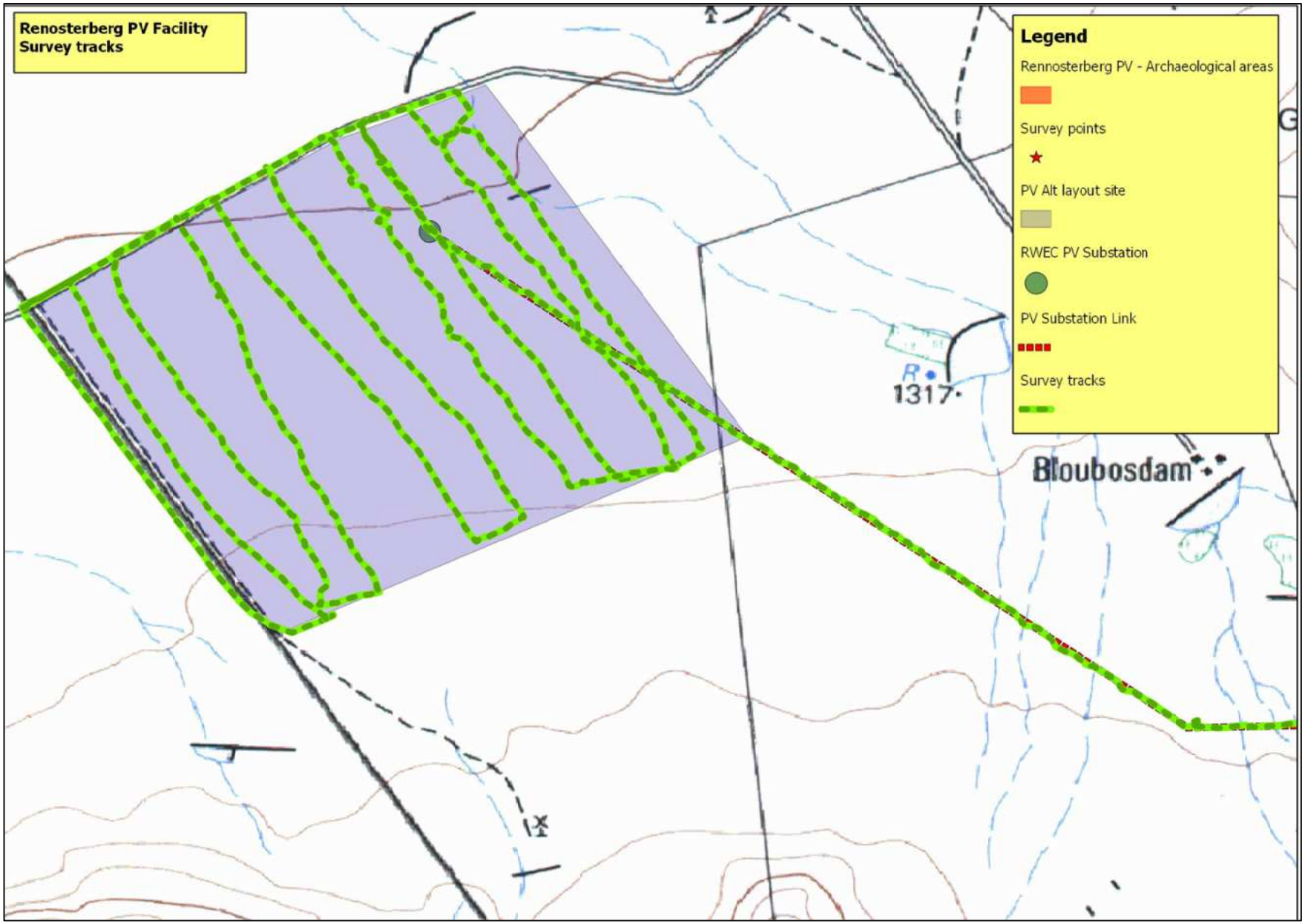
1317
Bloubosdam
RPL 1


Renosterberg PV Facility
Survey tracks
Legend
Rennosterberg PV - Archaeological areas
Survey points
PV Alt layout site
RWEC PV Substation
PV Substation Link
Survey tracks
1317
Bloubosdam

Appendix B

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

1 GENERAL PRINCIPLES

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the new legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources are integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the developer's cost. Thus, developers will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:
An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and

- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection, to all historic and pre-historic cultural remains, including graves and human remains.

2 GRAVES AND CEMETERIES

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix C

PROJECT DESCRIPTIONS

1 SOLAR PV POWER PLANT TECHNICAL DESCRIPTION

At this stage of the scoping phase, it is estimated that the proposed project will encompass the installation of a solar field and their associated components, in order to generate electricity that is to be fed into the existing Eskom grid. The solar PV power plant area will occupy an area of approximately 250 hectares. The total power generation capacity limit will ultimately depend on the size of the developable area which will be determined by environmental constraints (if any) to be identified in the EIA. It is currently envisaged that the total generation capacity will be no more than 150 Megawatts (MW). The voltage of the connection lines from the solar PV power plant substation to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom after EIA approvals have been granted. The key components of the project follow in the sub-sections below.

1.1 PV Project Components

RWEC and the IDC are proposing the establishment of a solar PV power plant on the development site near De Aar (**Figure 24**). The objective of the solar project is to generate electricity to feed into the national grid. The solar PV power plant will have a maximum capacity of 150 MW.

Figure 24: Proposed solar PV power plant application site

The project will consist of two components:

- Solar PV Power Plant
- Associated infrastructure

The solar PV power plant will consist of the following infrastructure

- Solar field
- Buildings

The section below describes the typical technical components that would be involved in the construction of the proposed infrastructure.

1.1.1 Solar field

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays would not need to be entirely cleared or graded. However, tall vegetation where present may need to be removed from the PV array area.

The solar PV panels have a variable range in size. The actual size will be determined in the final design stages of the project. The PV panels are mounted into metal frames which are usually aluminium. Concrete or screw pile foundations are commonly used to support the panel arrays. The arrays are tilted at a fixed angle (typically 25° from the horizontal plane) equivalent to the latitude at which the site is located in order to capture the most sun (Figure 25). Arrays can reach up to between 5m and 10m above ground level.

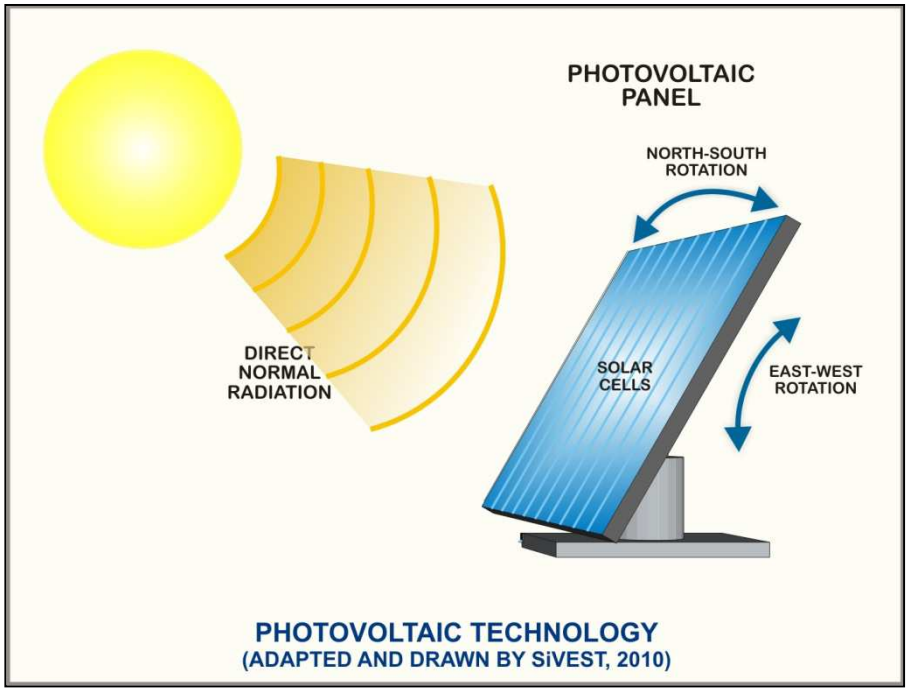


Figure 25: Illustration of how a CPV panel operates

1.1.2 Building infrastructure

The solar field will require an onsite building which will relate to the daily operation of the plant. The solar PV power plant will therefore require an administration building (office). Potential locations for the administration building will be determined at a later stage in the EIA process based on environmental constraints and design factors. The buildings will likely be a single storey building approximately 150 to 350m² which will be required to accommodate the following:

- Control room
- Workshop
- HV switchgear
- Mess Room
- Toilets
- SCADA Room
- Storeroom

1.1.3 Associated infrastructure

- Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings. In turn, the strings are connected to DC to AC inverters (Figure 26). The DC to AC inverters may be mounted on the back of the panel support substructures / frames or alternatively in a central inverter station. The strings are connected to the inverters by low voltage DC cables. Power from the inverters is collected in medium voltage transformers through AC cables. Cables are likely to have a voltage of 33 kilovolts (kV) and will be buried or pole mounted depending on the voltage level and site conditions.

The medium voltage transformers can be compact transformers distributed throughout the solar field or alternatively located in a central substation. It is likely to be a central substation in this instance. The location of the construction substation will be determined at a later stage in the EIA process based on environmental constraints and design factors.

The distribution substation will ideally be located in close proximity to the existing power lines where possible to limit impact. The substation will be a transmission substation and will include transformer bays which will contain transformer oils. Bunds will be constructed to ensure that any oil spills are suitable attenuated and not released into the environment. The substation will be securely fenced.

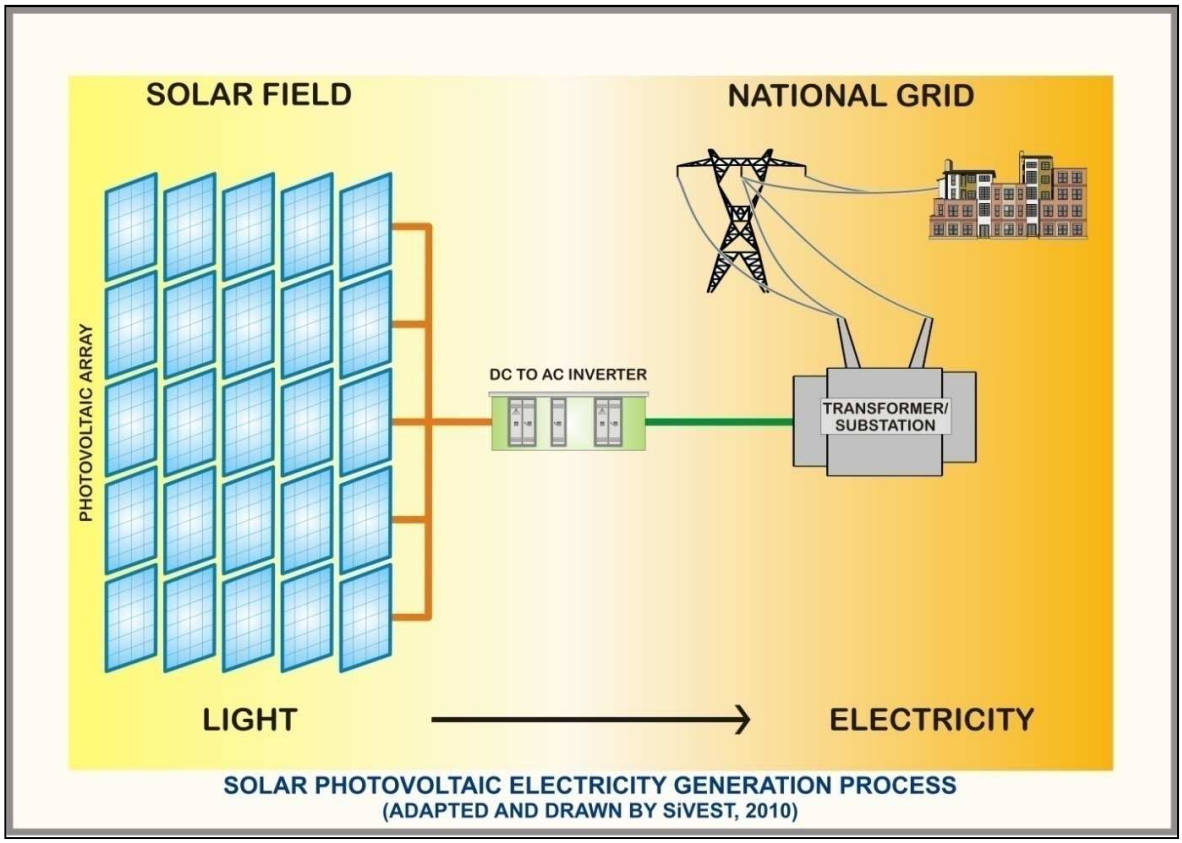


Figure 26: PV process

Where the substation is beside the line, the connection to the line will be via drop-down conductors. Where the line is remote from the substation, the connection will be by overhead line, using either pole or pylon structures depending on the voltage.

As previously mentioned, the electricity generated by the proposed PV plant is to be fed into the existing Eskom grid. The electrical connection to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom. At this stage a number of power line route alternatives have been proposed (**Figure 24**) and is further investigated in the EIA phase of the Wind Farm EIA. The proposed alternatives may either link into existing lines in which case a switchyard will also be required, or alternatively establish a completely new line that will link into an existing Eskom substation. A number of potential Eskom substation have preliminarily been identified including Behrshoek 132kV Distribution Substation, De Aar 132kV Distribution Substation, Britsville 132kV Distribution Substation and Hydra 765kv Transmission Substation.

- Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV power plant. The area may be up to approximately 80 hectares in size. However, this is likely to smaller. The location of the construction lay-down area will be determined at a later stage in the EIA process based on environmental constraints and design factors.

2 ALTERNATIVES

In terms of the EIA regulations, feasible and reasonable alternatives are required to be considered through the EIA process. Layout Alternatives and the no-go alternative were thus considered in this Final Environmental Impact Report.

The map (**Figure 27**) below illustrates the provisional solar PV power plant layout in terms of the alternatives being assessed. Layout alternatives relate mainly to the associated infrastructure at this stage of the proposed development. At this stage, grid connection alternatives are being investigated. Alternative locations for the administration building, central substation and construction lay-down area will be investigated at a later stage in the EIA process based on environmental constraints and design factors.

Figure 27: Site Layout Alternatives

As mentioned above, the option of constructing a new power line to link into an existing power line or to link to nearby Eskom substations will be assessed. As such, provisional routes are being investigated. These include PV Power Line Options 1, 2 and 3. The PV Power Line Options 1 and 2 have a number of sub-alternatives. The details pertaining to the various proposed power line routes alternatives are explored in greater detail below.

- PV Power Line Route Option 1

The PV Power Line Route Option 1 has three potential sub-alternatives (1a, 1b and 1c). PV Power Line Route Option 1a consists of establishing a direct connection approximately 15km in length routing in an easterly direction, north of the Renosterberg Plateau to the Behrshoek 132kV Distribution Substation. PV Power Line Route Option 1b follows the same path as Option 1a but routes past the Behrshoek 132kv Distribution Substation for approximately 3km linking into (Loop-in/Loop-out connection via switchyard) the existing 765kV Transmission power line running to the Hydra 765kV Transmission Substation. The total length of the alternative is approximately 18km. PV Power Line Route Option 1c likewise follows the same routes as Option 1a and 1b going north around the Renosterberg Plateau and routing to the Behrshoek 132kv Distribution Substation. However, from this point, the sub-alternative will run southwards directly to the Hydra 765kv Transmission Substation for approximately 30km in length.

- PV Power Line Route Option 2 (*Preferred alternative and studied in EIA phase*)

PV Power Line Route Option 2 has three potential sub-alternatives (2a, 2b and 2c). PV Power Line Route Option 2a is approximately 13km in length and will link via direct connection into the Behrshoek 132kv Distribution Substation. However, this particular route follows a south eastern trajectory through the Renosterberg Plateau. PV Power Line Route Option 2b equally follows the same route as Option 2a but routes past the Behrshoek 132kv Distribution Substation for approximately 3km linking into (Loop-in/Loop-out connection via switchyard) the existing 765kV Transmission power line running to the Hydra 765kV Transmission Substation. The total length of the alternative is approximately 15km. PV Power Line Route Option 2c likewise follows the same routes as Option 2a and 2b going eastwards through the Renosterberg Plateau and routing to the Behrshoek 132kv Distribution Substation. However, from this point, the sub-alternative will run southwards directly to the Hydra 765kv Transmission Substation for approximately 30km in length.

- PV Power Line Route Option 3

Finally, PV Power Line Route Option 3 routes in a north easterly fashion for approximately 4km before diverting to the east for approximately 14km making to total length of the proposed power line alternative approximately 18km. The connection will be via Loop-in/Loop-out switchyard connection to the existing 765kV power line that eventually links in the Hydra 765kV Transmission Substation near De Aar.

As a final note, it is important to point out that whilst several power line route options have preliminarily been identified, these fall within a greater ‘all inclusive scoping area’ that has been proposed for assessment to consider a wider area for potential environmental constraints. This area has been delineated to allow for flexibility in the environmental assessment process should any major constraints be identified. Therefore, the above-mentioned proposed power line routes are subject to change or be refined based on environmental constraints and design factors.

- No-go Alternative

The ‘no-go’ alternative is the option of not establishing the proposed solar PV power plant. South Africa is currently under immense pressure to provide electricity generating capacity to accommodate for the pressures which have been identified in this regard. With the current global focus on climate change, the government are under severe pressure to explore alternative energy sources in addition to coal fired power stations. Although solar power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed solar PV power plant would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project would contribute to this solution. This project will aid in achieving South Africa’s goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

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