



# PGS HERITAGE

## PROPOSED GROENHEUWEL 990 KWP SOLAR PLANT AND ASSOCIATED POWERLINE, AUGRABIES, KAI !GARIB LOCAL MUNICIPALITY, NORTHERN CAPE

### Heritage Impact Assessment

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### **Declaration of Independence**

- I, Jennifer Kitto, declare that –
- General declaration:
- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

### **Disclosure of Vested Interest**

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

**HERITAGE CONSULTANT:**

PGS Heritage (Pty) Ltd

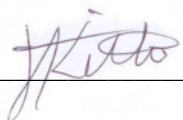
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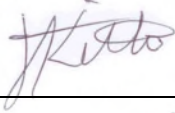

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**ACKNOWLEDGEMENT OF RECEIPT**

<b>Report Title</b>	<i>Heritage Impact Report for the Proposed Groenheuwel 990 kWp Solar Plant, Augrabies, Kai !Garib Local Municipality, Northern Cape Province</i>		
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## **EXECUTIVE SUMMARY**

PGS Heritage (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) for the construction of a proposed 990 kWp solar plant occupying an area of ~9800m<sup>2</sup> and short power line of 6.5 km, close to the town of Augrabies, within the Kai !Garib Local Municipality, Northern Cape Province.

### **Archaeology**

The archaeological resources identified within the proposed development site is a large extended area containing a Middle Stone Age surface artefact scatter. Based on findings from a range of other heritage reports in the area, this type of site is to be expected in this region.

This site is automatically protected under the heritage legislation, however, serious mitigation measures will not be required if the power line's layout is changed slightly, see below.

#### *Recommendations:*

1. Taking into account the topographical constraints, the power line must re-aligned so that it spans over the southern section of the site.
2. No pylons may be erected within the site. If this cannot be avoided, the area that will be impacted must be mitigated before construction by means of surface collection and documentation. The pylons are not large and an area of approximately 25m<sup>2</sup> will be affected during construction. The area to the south of the narrower, eastern section of the site has already been disturbed. It is recommended that, should any pylons need to be located close to the site, this area be used.
3. If access must be gained to the site, the small existing track that passes through the site must be used but only if absolutely necessary.
4. Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMPr for the construction phase of the project.
5. If any artefacts are identified during construction, the chance finds protocol must be implemented

### **Palaeontology**

The proposed development is underlain by the ancient Precambrian granite - gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province which is mantled by the overlying Gordonia Formation of the Kalahari Group. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is low and the ancient Precambrian granite -gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province is zero.

**It is therefore considered that the construction and operation of the Groenheuwel Solar Plant, in the Northern Cape is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.** Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

## **General**

In the event that additional heritage resources are discovered during site clearance, construction activities must stop, and the relevant heritage authority must be contacted in order to advise on the necessary actions to take. Generally, a qualified archaeologist or palaeontologist must be appointed to evaluate the situation and make recommendations on mitigation measures.

It is considered that the overall impact of the proposed development of the solar plant and power line on heritage resources is seen as acceptably low, after the recommended mitigation measures have been implemented. Therefore, impacts can be mitigated to acceptable levels and the project may be authorised from a heritage perspective.

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## TERMINOLOGY AND ABBREVIATIONS

### 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 and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

## **Holocene**

The most recent geological time period which commenced 20 000 years ago.

## **Late Stone Age**

The archaeology of the last 30 000 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 20 000-300 000 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.

<b>Abbreviations</b>	<b>Description</b>
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
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

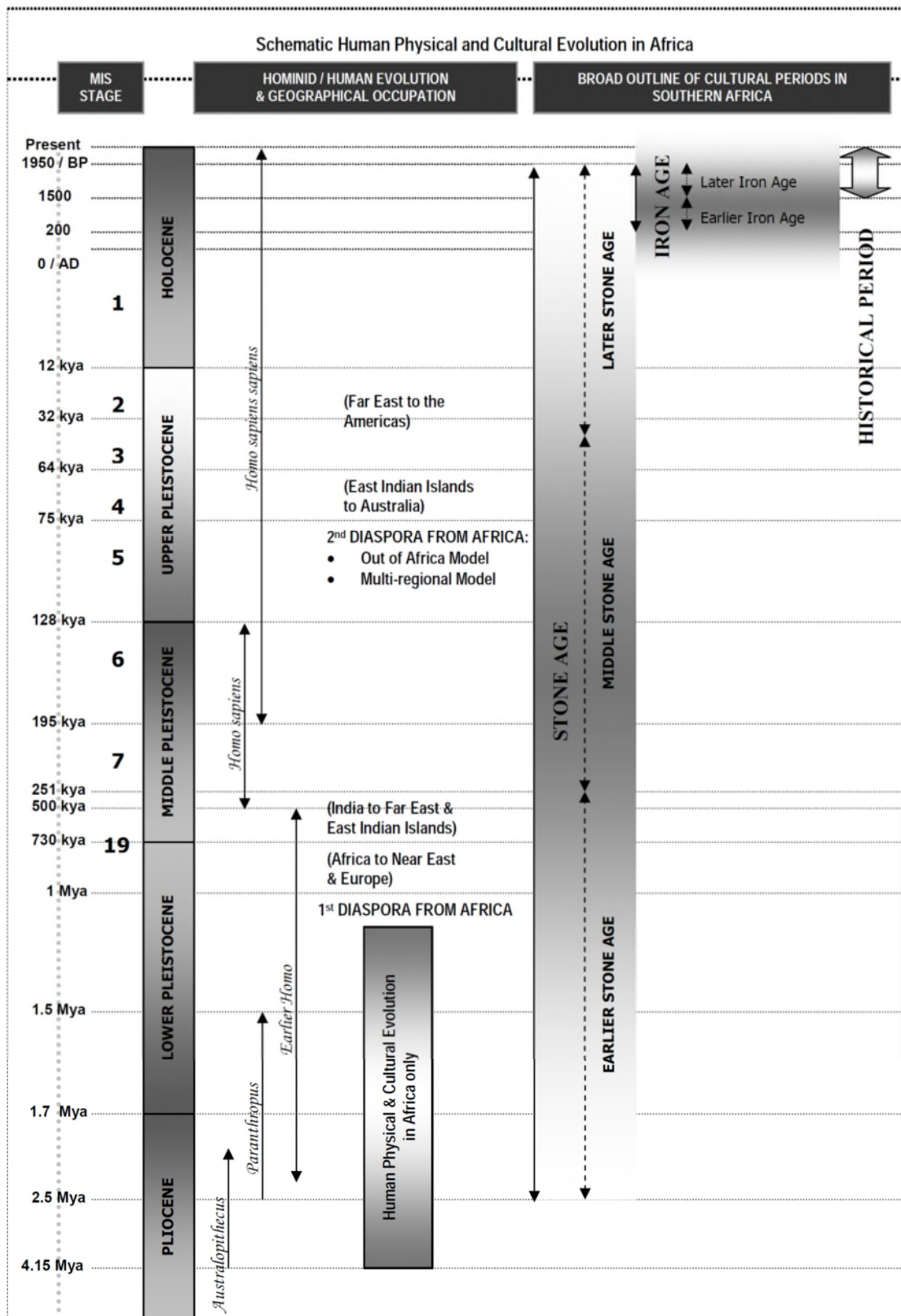


Figure 1: Human and Cultural Timeline in Africa (Morris, 2008)

## 1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) for the construction of a proposed 990kWp solar plant occupying an area of ~9800m<sup>2</sup> and power line of 6.5km, close to the town of Augrabies, within the Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**Note: The project does not trigger the requirement for an EIA process, in terms of NEMA or other similar legislation. However, it falls under s38(1) and requires a Record of Decision from the South African Heritage Resources Agency (SAHRA).**

### *Scope of Study*

The aim of the study was to identify possible heritage sites and finds that may occur in the proposed study area. The HIA aims 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).

### 1.1 Summary of Specialist Expertise

This HIA was compiled by PGS.

The staff at PGS has a combined experience of nearly 70 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Jennifer Kitto, author of this report and Heritage Specialist, has 18 years' experience in the heritage sector, a large part of which involved working for a government department responsible for administering the National Heritage Resources Act, No 25 of 1999. She is therefore well-versed in the legislative requirements of heritage management. She holds a BA in Archaeology and Social Anthropology and a BA (Hons) in Social Anthropology.

Henk Steyn, Heritage Specialist and Project Archaeologist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist with CRM accreditation. He has been involved in numerous heritage related projects since 1998.

Wouter Fourie, the Project Coordinator and Co-author, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

## 1.2 Assumptions and Limitations

Not detracting 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. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must be contacted immediately.

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 has 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.

## 1.3 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:

- i. National Environmental Management Act (NEMA), Act 107 of 1998
- ii. National Heritage Resources Act (NHRA), Act 25 of 1999
- iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
- iv. 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.

- ii. GNR 982 of 2014, as amended 2017 (Government Gazette 38282) promulgated under the (NEMA):
  - a. Basic Assessment Report (BAR) – Regulations 19 and 23
  - b. Environmental Scoping Report (ESR) – Regulation 21
  - c. Environmental Impacts Report (EIR) – Regulation 23
  - d. Environmental Management Programme (EMPr) – Regulations 19 and 23
- ii. NHRA:
  - a. Protection of Heritage Resources – Sections 34 to 36; and
  - b. Heritage Resources Management – Section 38
- iii. MPRDA Regulations of 2014:
  - a. Environmental reports to be compiled for application of mining right – Regulation 48
  - b. Contents of scoping report – Regulation 49
  - c. Contents of environmental impact assessment report – Regulation 50

- d. Environmental management programme – Regulations 51
- e. Environmental management plan – Regulation 52

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority, and that an HIA will be required if a development triggers any of the development types listed in section 38 of the NHRA. Sections 34-36 further stipulate the protections afforded to structures older than 60 years, archaeological and palaeontological sites and material and meteorites, and graves and burial grounds, as well as the process to be followed if these resources need to be disturbed.

**Note: The project does not trigger the requirement for an EIA process, in terms of NEMA or other similar legislation. However, it falls under s38(1) and requires a Record of Decision from the South African Heritage Resources Agency (SAHRA).**

## 2 TECHNICAL DETAILS OF THE PROJECT

### 2.1 Locality

The project area is located west of the town of Augrabies, within the Kai !Garib Local Municipality, Northern Cape Province. The proposed solar plant study area is situated approximately 3.5-5km immediately west of Augrabies, on the farm Groenheuwel. The property description is Remainder Erf 1300 Kakamas Suid Nedersetting, in the Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province (**Figure 2** and The study area within its local context (red lines)**Figure 3**).



Figure 2: Location of the study area (yellow arrow) within the larger region



Figure 3: The study area within its local context (red lines)

## 2.2 Technical Project Description

The project comprises the proposed construction of a 990kWp solar plant occupying an area of ~9800m<sup>2</sup> with an associated electrical private network (total distance of the line is ± 6.5 km; capacity is 22 KV and at a height of 11 meters). The proposed layout is shown in **Figure 4** and **Figure 5**.

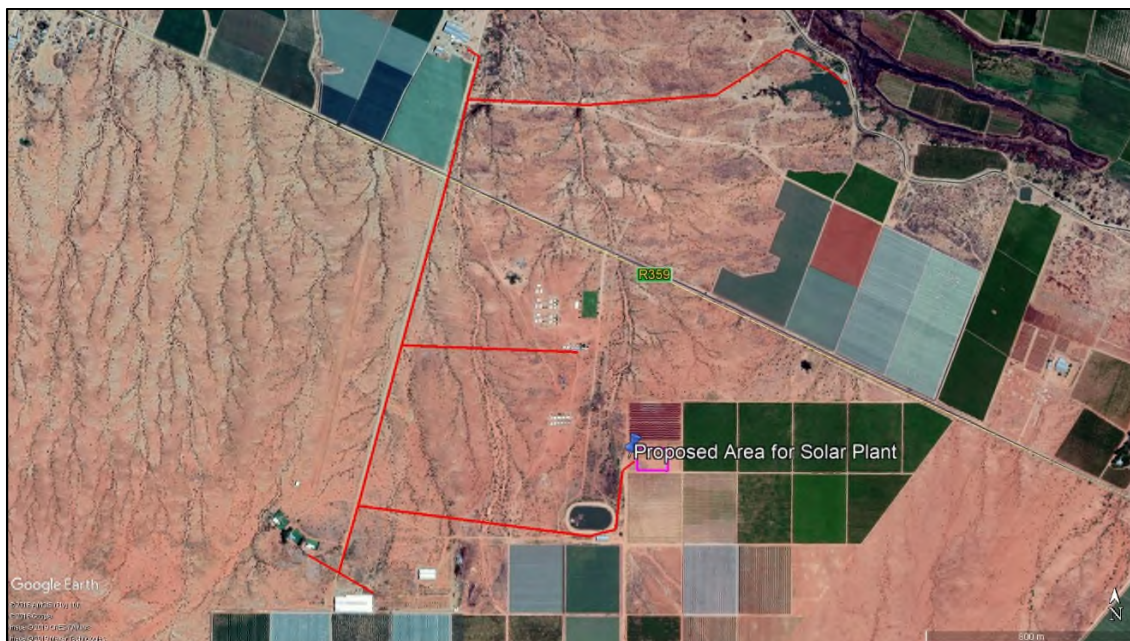


Figure 4: The project footprint overlain on Google Earth satellite imagery: red lines = powerline, pink polygon = proposed PV plant



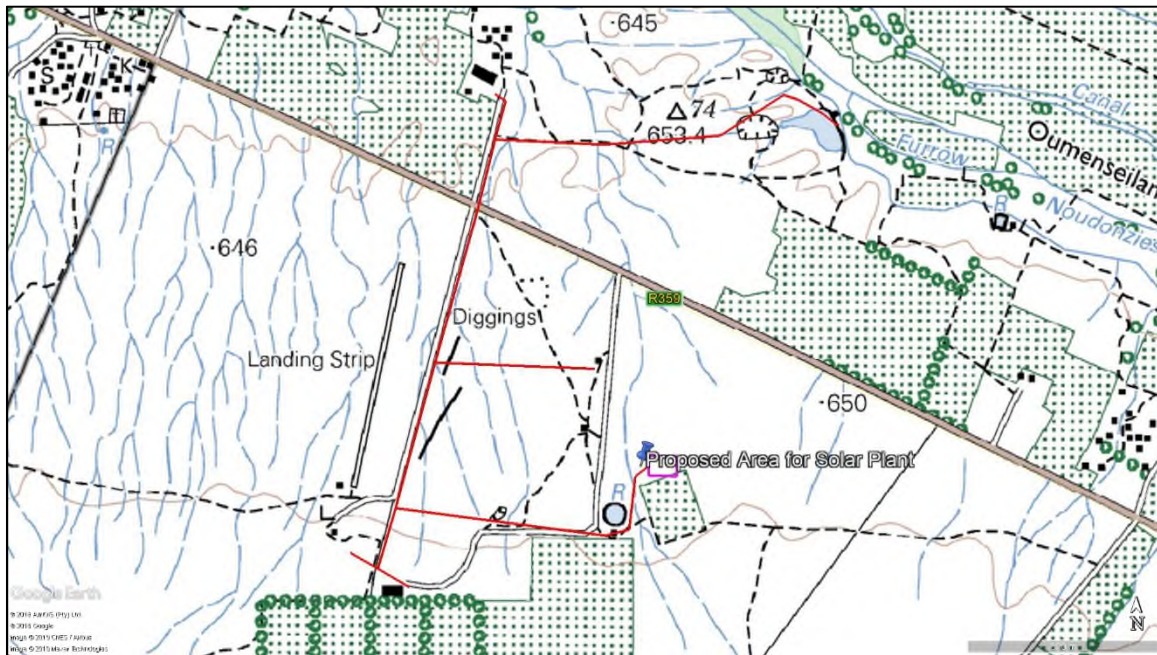


Figure 5: The project footprint overlain on most recent topographical map (2009): red lines = powerline, pink polygon = proposed PV plant

### 3 ASSESSMENT METHODOLOGY

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

#### 3.1 Methodology for Assessing Heritage Site significance

This HIA report was compiled by PGS Heritage (PGS) for the proposed Groenheuvel solar plant project. The applicable maps, tables and figures are included, as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (No. 107 of 1998). The HIA process consists of three steps:

Step I – Literature Review and initial site analysis: The background information to the field survey relies greatly on the Heritage Background Research which was undertaken through archival research and evaluation of satellite imagery and topographical maps of the study area.

Step II – Physical Survey: A physical survey was conducted by a combination of vehicle and pedestrian access through the proposed project area by one qualified archaeologist on two different occasions (11 July 2019 and 4 September 2019), aimed at locating and documenting sites falling within and adjacent to the proposed development footprint. Specific attention was

paid to the proposed infrastructures footprint areas. The two site visits were necessitated by a change in the location of the proposed PV plant.

Step III – The final step involves the recording and documentation of relevant heritage resources identified in the physical survey, the assessment of these resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

The significance of heritage sites is 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<sup>2</sup>
  - Medium - 10-50/50m<sup>2</sup>
  - High - >50/50m<sup>2</sup>
- 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 development activity 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:

### *3.1.1 Site Significance*

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The updated classification and rating system as developed by Heritage Western Cape (2016) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (Table 1).

Table 1: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by HWC. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

### 3.2 Methodology used in determining the significance of environmental impacts

The methodology used to determine the environmental impact significance was provided by Savannah Environmental, and is explained below.

#### Impact Assessment methodology:

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment must be assessed in terms of the following criteria:

- » The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- » The **duration**, wherein it will be indicated whether:
  - \* the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - \* the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - \* medium-term (5–15 years) – assigned a score of 3;
  - \* long term (> 15 years) - assigned a score of 4; or
  - \* permanent - assigned a score of 5;
- » The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- » the **status**, which will be described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated*.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts is summarised in the following table format. The rating values as per the above criteria is also included. The table is completed and associated ratings for **each** impact identified during the assessment is also included.

Example of Impact table summarising the significance of impacts (with and without mitigation) when additional impact are identified:

<b>Nature:</b> [Outline and describe fully the impact anticipated as per the assessment undertaken]		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	High (3)	Low (1)
<b>Duration</b>	Medium-term (3)	Medium-term (3)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Probability</b>	Probable (3)	Probable (3)
<b>Significance</b>	<b>Medium (36)</b>	<b>Low (24)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	Yes
<b>Can impacts be mitigated?</b>	Yes	Yes
<b>Mitigation:</b> “Mitigation”, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind.		
<b>Cumulative impacts:</b> “Cumulative Impact”, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities <sup>1</sup> .		
<b>Residual Risks:</b> “Residual Risk”, means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).		

## 4 CURRENT STATUS QUO

### 4.1 Site Description

The study area is characterised by areas of mainly flat terrain covered with red sandy soil and patches of gravels, interspersed with occasional granite outcrops. The vegetation is dominated by low growing shrubs adapted to arid and rocky conditions, with occasional patches of long grass. Overall, the site was accessible by foot and site detection visibility was good.

The proposed PV facility and associated power line will be situated on Remainder Erf 1300 Kakamas Suid Nedersetting, in the Kai !Garib Local Municipality, near Augrabies. Several farm roads and servitude gravel roads cross this property. Small areas of cultivated farmland are present within the wider area, especially closer to the Orange River.

<sup>1</sup> Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.



*Figure 6: General view of site*



*Figure 7: View of disturbed area next to dam, on proposed power line route*



*Figure 8: The main power line from the PV plant to the river will run a few meters to the right of the road in the image. The area next to the road has been disturbed by continuous maintenance*



*Figure 9: General view of PV plant area, looking west. The area has been significantly disturbed and no surface features are visible.*



*Figure 10: View of the PV plant area from the south-east*



*Figure 11: General view of PV plant area, looking east*

## 4.2 Archival findings

The archival research focused on available information sources that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying.

### 4.2.1 Previous Heritage Studies in area

A search on the South African Heritage Resources Information System (SAHRIS) has identified several Heritage Impact Assessments conducted in and around the study area. These are listed below in ascending date order:

- **Birkholtz P and Steyn H. 2001. Cultural Resource Management Plan for Augrabies Falls National Park and Surrounding Areas. SANPARKS and DANCED.** This document contains an inventory of cultural heritage sites identified within the Augrabies Falls National Park for the cultural heritage management plan. The survey recorded a large number of sites which showed that ESA, MSA and LSA sites, graves, rock art (pre- and post-colonial), historical sites and the Manie Maritz Fort are all found within and immediately adjacent to the Park. This study covered adjacent areas to the Park including the Augrabies area.
- **Beaumont, P. 2008. Phase 1 Archaeological Impact Assessment Report On Kakamas South Farm 2092 Near Augrabies, Siyanda District Municipality, Northern Cape Province.** This report was part of an EIA on Kakamas South farm 2092 for the proposed conversion of natural veld to drip - irrigated citrus groves on that property. lies -20 km north - west of Kakamas. A low density of lithics centered on the Older Gravel spread over the mid – northern sector of the property.
- **Orton J & Webley L. 2012. Heritage Impact Assessment For Proposed Hydro-Electric Facilities Near Riemvasmaak, Northern Cape. ACO Associates.** The study assessed the construction of two hydro-electric power station at one of four sites to the northeast of Augrabies Falls, in the Northern Cape Province. A wide variety of heritage resources was recorded. These included scatters of Middle (MSA), and Later Stone Age (LSA) and historical artefacts, LSA occupation sites with deposits and historical occupation sites with ruined structures and artefacts of varying age. A number of graves and many stone features that may be graves were located.
- **Van Schalkwyk, J. 2013. Cultural heritage impact assessment for The Proposed Township Development On A Section Of The Farm Kakamas Suid 28, Augrabies, Kai !Garib Municipality, Northern Cape Province.** The study was for the planned expansion of the existing township on Portion 1563 of the farm Kakamas Suid 28 in the

Kai !Garib municipal district of Northern Cape Province. A few stone tools dating to the Middle Stone Age were identified in the study area. This area is situated immediately south of the town of Augrabies, and immediately north of the R359 road.

- **Kaplan, J. 2016. Archaeological Impact Assessment Proposed vineyard development on Farm 1726 Renosterkop, Farm 1290 & Farm 1537 Augrabies Northern Cape.** The AIA was undertaken for a proposed vineyard development on Farm 1726 Renosterkop, Farm 1290 and Farm 1537 Augrabies, near Kakamas in the Northern Cape Province. The study site is located south east of the town of Augrabies. It lies directly north of the R64 and south and west of Renosterkop Peak. The Orange River borders the study site in the south and east. A relatively large number of stone tools were identified. Most of these were single, isolated finds, but dispersed (low & medium density) scatters of tools were also encountered on surface gravels below Renosterkop Peak.
- **Kaplan, J. 2017. Archaeological Impact Assessment: Proposed citrus development, Renosterkop Extension (Kakamas South Settlement No. 2185 & 2193) Augrabies, Northern Cape.** The AIA study was undertaken for a proposed citrus development on Kakamas South Settlement No. 2185 & 2193, and is located  $\pm$  2.5kms south east of Augrabies. Small numbers of stone tools were recorded, dating mostly to the Later Stone Age (LSA), with a few Middle Stone Age (MSA) flakes, were recorded during the study.

The two heritage studies located closest to the current study area (Birkholtz and Steyn 2001; Orton and Webley 2012) both recorded a large number and wide variety of sites, including scatters of Early, Middle and Later Stone Age artefacts, rock art (pre- and post-colonial), and historical structures and artefacts. A number of graves and many stone features that may be graves were also identified. The other studies mostly record the occurrence of varying numbers of stone artefacts (from isolated finds to dispersed scatters) dating to the Early (ESA), Middle (MSA) and Later (LSA) Stone Ages.

### **4.3 Archival/historical maps**

A limited number (3 editions) of historical 1:50 000 topographic maps were available for utilisation in the study. These map sheets date to 1962, 1990 and 2009 and were utilised to identify structures or graves that could possibly be older than 60 years and thus protected under Section 34 and 36 of the NHRA.



- Topographic map 2820CB – First edition 1962 map. This map is based on air photography undertaken in 1962, surveyed and drawn in 1971 by the Trigonometrical Survey Office Reprinted and published by the Government Printer in 1976 (**Figure 12**).
- Topographic map 2820CB Second edition 1990 map. This map was published by the Chief Director of Surveys and Mapping and printed by the Government Printer in 1992 (**Figure 13**).
- Topographic map 2820CB –Third edition 2009 map. This map was published and printed by the Chief Directorate: National Geo-spatial Information in 2012 (**Figure 14**).

No potential heritage features were identified in the immediate location of the study area as depicted on the topographical maps (**Figure 12 to Figure 14**). The only potential heritage feature depicted in the general area is the mission station, which is situated more than 1.5km to the north-west of the site.

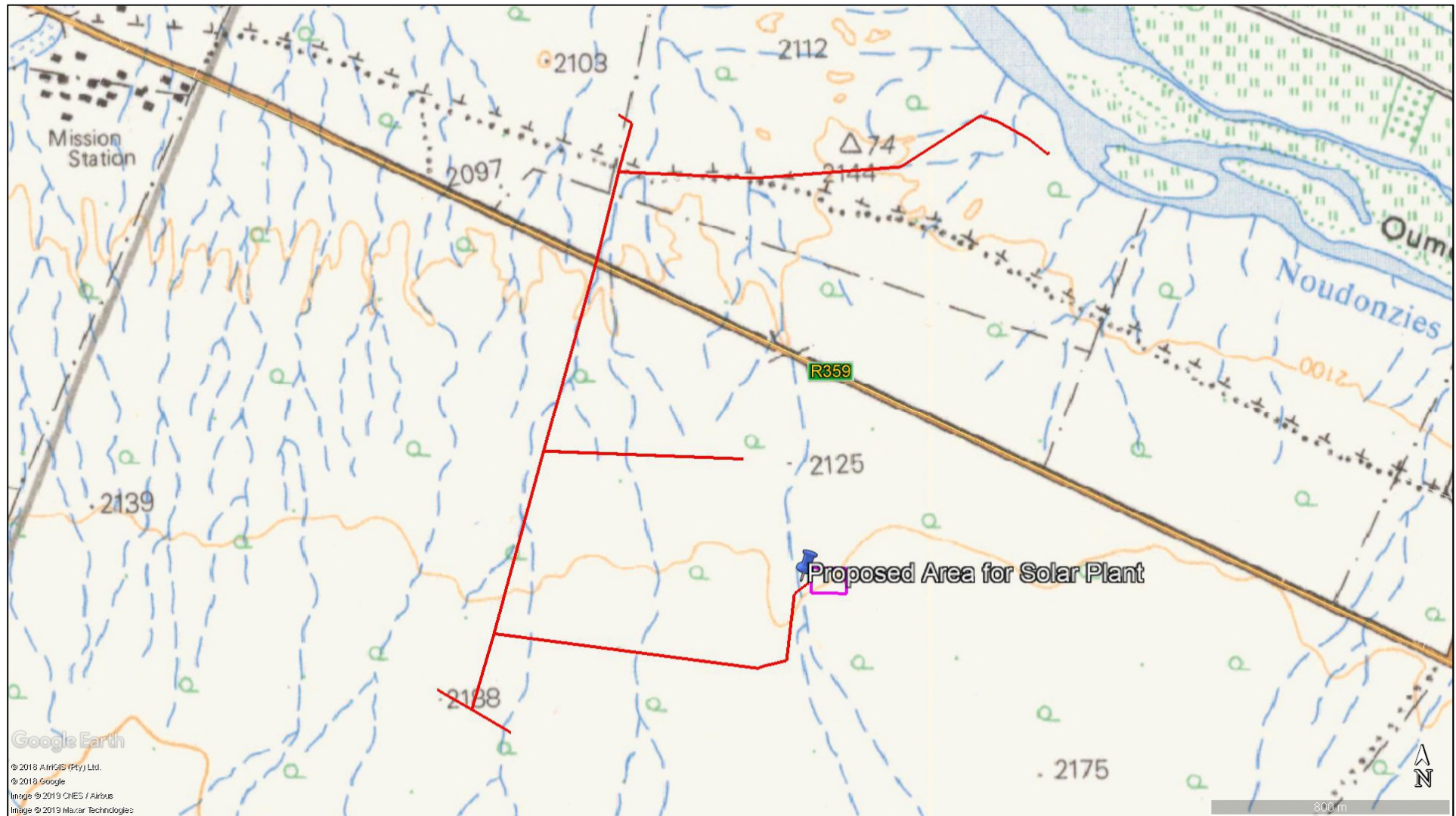


Figure 12: Enlarged section of the first edition of the topographical map sheet 2820CB 1962. The only potential heritage feature depicted is the mission station which is situated more than 1.5km to the north-west of the site. An old power line is also shown.

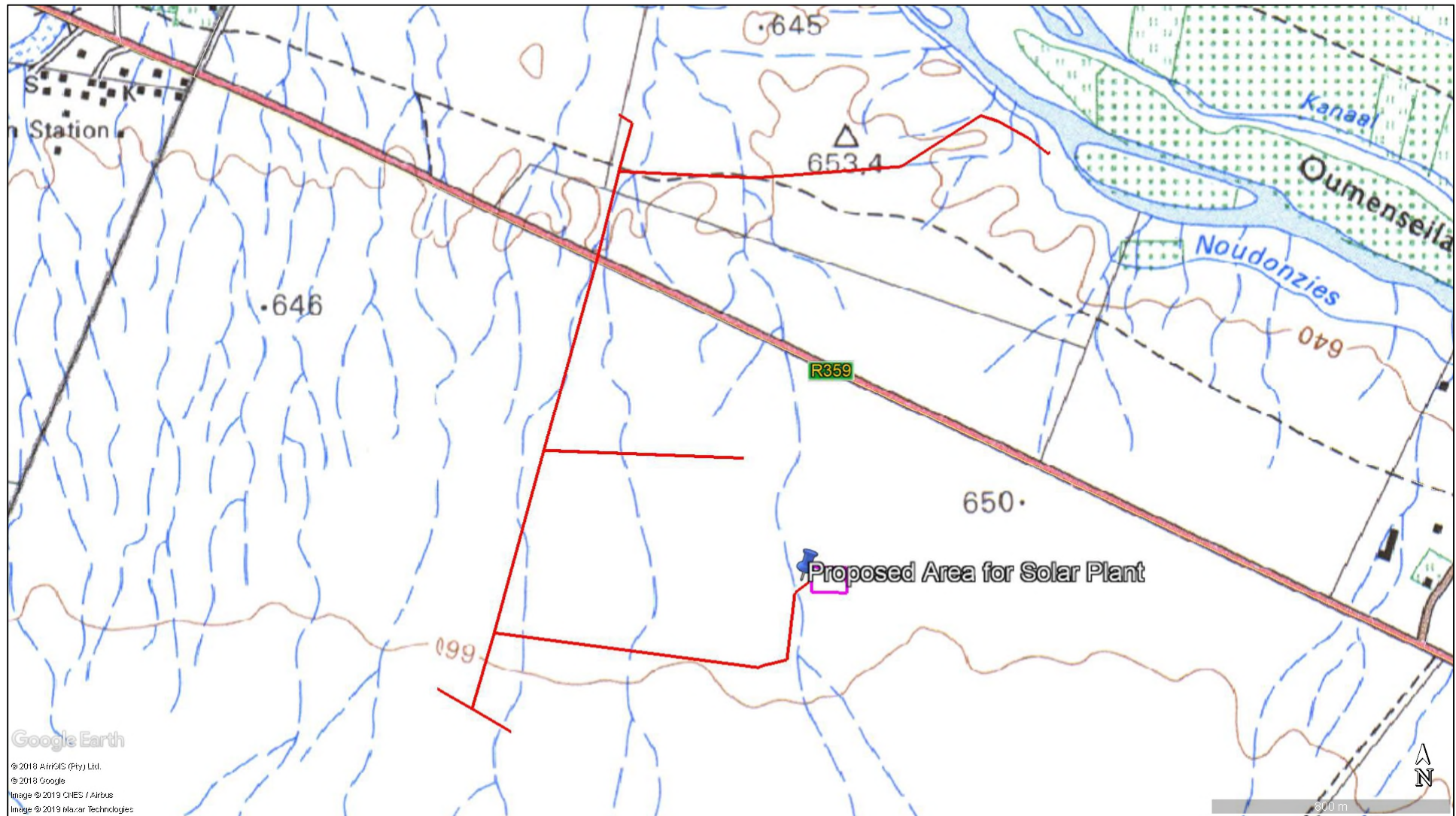


Figure 13: Enlarged section of the second edition of the topographical map sheet 2820CB 1990. The only potential heritage feature depicted is the mission station which is situated more than 1.5km to the north-west of the site.

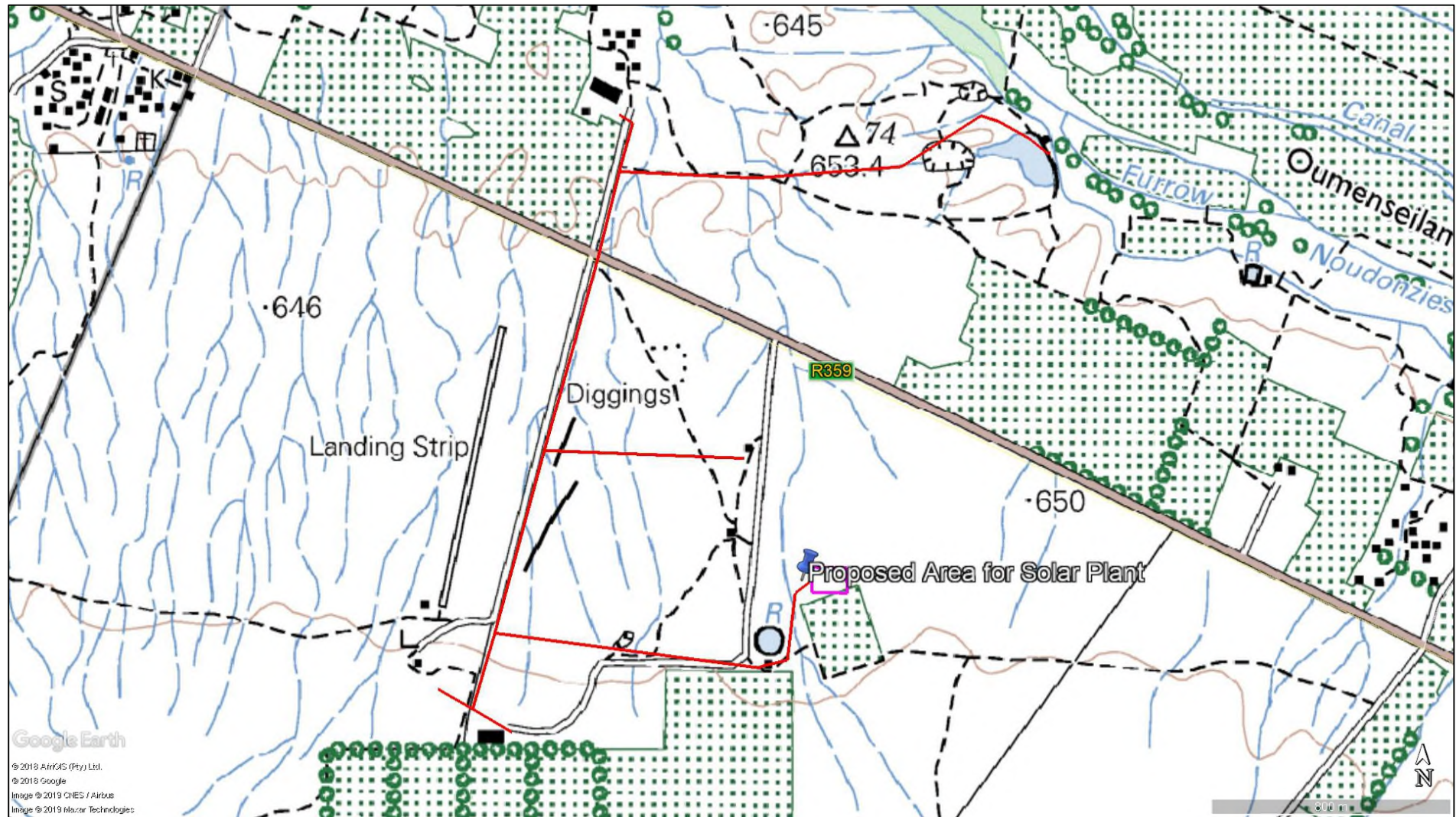


Figure 14: Enlarged section of the third edition of the topographical map sheet 2820CB 2009. This sheet shows structures which have been constructed between 1990 and 2009, as well as the mission station to the north-west of the site

#### 4.4 Archaeological background

(Note: most of the information for this section was taken from Birkholtz and Steyn 2001 and van der Ryst 2015)

The Northern Cape is an arid region with limited surface water so that archaeological remains are often found near water (Mitchell 2002) and sources of lithics that have been used to produce stone tools. Palaeo- and current river systems, springs and pans and dominant geographical landscape features such as hills or shelters are important locales within any landscape.

The region abounds with the remains of prehistoric hunting and gathering groups. Numerous archaeological sites have been recorded, researched and published through archaeological impact and heritage assessments. Stone tools mostly mark areas of prehistoric occupations and these suggest a widespread presence for tool-producing Plio-Pleistocene hominins in southern Africa (Barham and Mitchell 2008). This important part of the prehistory of southern Africa, known as the Stone Age, is chronologically divided into the Earlier, Middle and Later Stone Ages (ESA, MSA and LSA). The ESA is characterized by the use of large stone cutting tools (LCT's) (McNabb *et al.* 2004), in particular hand axes, but also cleavers and tool types such as scrapers. Following on the ESA, the MSA typologies represent greater specialization in the production of stone tools, in particular flake, blade and scraper tools and also in a more extended range of specialized, formal tools. Regional lithic style, evidence for symbolic signalling, polished bone tools, portable art and decorative items are apparent during the MSA. ESA and MSA lithics occur widespread around water sources and previously favourable land settings that are now buried. During the LSA small (microlithic) tools, bone tools and weapon armatures and a range of decorative items as well as rock art were produced. Ceramics were used and/or manufactured by hunters and Khoekhoe herders towards the terminal phases of the LSA over a period of around 2000 year. The more recent occupations of LSA groups are abundant as surface finds and in sealed deposits in shelters (Beaumont *et al.* 1995).

Differences in stone artefact assemblages have been used in attempts to discern between late-Holocene hunter-gatherer and herder sites (Parsons (2003, 2004, 2007, 2008); Lombard and Parsons 2008) but this distinction is not generally accepted. Hunter-gatherer assemblages termed Swartkop may contain grass-tempered ceramics (Beaumont and Vogel 1989). Sites with engravings, are often situated close to water sources. The Doornfontein herder sites contain ceramics that occasionally have lugs and/or spouts. Differences in the geographical spread indicate a preference for pastoral Doornfontein sites along rivers while Swartkop sites are usually found further from the river (Fauvelle-Aymar 2004). Substantial herder encampments were located along the Orange River floodplain. Hendrik Jacob Wikar during his travels in 1778 recorded the names of the various herder groups who had settlements on both sides of the river (Mossop 1935).

### *Earlier Stone Age (300 000 – 3.3 million years Before Present/BP)*

The Northern Cape Province has a well-documented Earlier Stone Age sequence, and there is evidence that the ancestors of modern humans have inhabited the areas adjoining the Orange River since the Early Stone Age (Birkholtz and Steyn 2001).

The Acheulian is a component of the Early Stone Age, which is characterised by a stone tool technology based primarily on the manufacture of bifaces, including hand-axes and cleavers (Deacon & Deacon, 1999). This technology is characterised by the presence of Large Cutting Tools (LCTs), in the form of hand axes, cleavers and occasional picks. These are tools that can either be unifacial, partly bifacial or bifacial, and they are important tools that would have been used to perform a range of subsistence based activities during the Acheulean. Occurring with these LCTs is a very important form of core production that becomes more prevalent during later periods of the Stone Age: Prepared Core Reduction. A local variant of this technology, the Victoria West Industry, has been found at Sites that have been excavated in the area, such as Olyven Kolk and Maans-Pannen to the south of the river. The Victoria West industry from other Northern Cape sites has been dated to >1 million years (Li *et al.* 2017). Early Stone Age material in primary context has been found at Ratel Draai, south-east of Upington, of which one component can tentatively be dated to the Acheulian phase of between 350 000 – 300 000 BP (Beaumont *et al.*, 1995).

### *Middle Stone Age (30 000 – 300 000 BP)*

Although substantial Middle Stone Age sites from the region are not very common, some have been found in Bushmanland and along the Orange River. Most of the sites from Bushmanland can be associated with either the MSA3 or late MSA1 phases. An MSA3 site on the farm T'Boop, near Brandvlei, has been dated to at least 37 400- 600 BP. One of the more important Middle Stone Age sites along the river is certainly that of Zoovoorbij. Although the site has a stratigraphic sequence consisting primarily of Later Stone Age levels, its lower levels have yielded very typical Middle Stone Age artefacts. Unfortunately no clear date for these lower levels could be obtained (Beaumont *et al.*, 1995).

During this period the use of prepared core reduction is extremely prevalent and this is used to increase core reduction efficiency, such that predetermined flakes and blades can be manufactured. This phase of stone tool development is associated with modern humans and complex cognition, and elsewhere in South Africa MSA sites provide some of the earliest evidence for ritual symbolism (Birkholtz and Steyn 2001).

### *Later Stone Age (30 000 BP – recent times)*

The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths.

Although very little archaeological research has taken place in the study area and environs, a synthesis of research undertaken seems to indicate that during the latter part of the Later Stone Age, the human inhabitants of the Middle Orange River consisted of two broadly defined groups, namely San hunter-gatherers and Khoi pastoralists. Whereas the hunter-gatherers appear to have inhabited the area continuously for a very long time, pastoralism only appeared on the subcontinent some 2000 years ago.

Archaeological research also indicates that since 2000 BP, the Ceramic Later Stone Age (in other words LSA sites containing potsherds or earthenware) from the region has had two distinct manifestations, called the Swartkop and Doornfontein industries. Named after a site some distance south of Kenhardt (Beaumont *et al.*, 1995), the Swartkop industry is typically located away from the river, and consists of an artefact assemblage with many formal tools (Smith, 1995). With the help of available written records, the Swartkop industry has also been linked to the /Xam, as well as the scraping technique in the production of rock art. An example of a Swartkop-related site from the vicinity of the study area is the site Droëgrond, situated some 55km southwest of Kakamas. (Beaumont *et al.*, 1995). The associated faunal evidence recovered from Droëgrond, point towards an adaptive subsistence strategy based upon the hunting of migratory herd animals (i.e. springbok and zebra) (Smith, 1995).

The Doornfontein industry sites include few formal tools, are located close to the river and can be associated with herding activities (Smith, 1995). The Doornfontein industry has been linked to the Khoi. In terms of rock art, the Doornfontein industry has been associated with the so-called pecked engravings (Beaumont *et al.*, 1995). It would appear as if the environmental conditions along the riverbanks allowed all year round habitation by herders, while the islands offered protection from stock raiders. Only during exceptional rainy periods would the herders have moved away from the river (Smith, 1995).

The available archaeological evidence relevant to the Later Stone Age, therefore seems to indicate that the first manifestation of the LSA in the region occurred some 12 000 years ago. The final phase of the Later Stone Age from the region commenced in approximately 2100 BP, with the emergence of the two ceramic LSA industries (Beaumont *et al.*, 1995).

### *Rock Art*

By the beginning of the Later Stone Age, human behaviours were undoubtedly modern (Huffman 2007). Uniquely human traits, such as rock art and purposeful burials with ornaments, became regular practice (Huffman 2007). These people were most likely the ancestors of the San, who are well known their fine-lined rock art and rock engravings. The rock art of the Northern Cape comprises paintings and, importantly, diverse categories of engravings (Morris 2012). More details on these sites in the Namaqualand region are provided below.

### *Iron Age Sequence*

Despite the widespread occurrence of the Iron Age sequence across the northern portions of South Africa, Iron Age remains south of the Orange River moving into the Northern Cape, is noticeably sparse (Humphreys 1976; Humphreys 1988). Humphreys (1976) suggests that the absence of Iron Age occupation in this part of the country is largely due to the falloff of higher rainfall isohyets in the farther south-west portion of the country. Considering that Iron Age peoples were farmers, they were greatly influenced by climatic factors and were most likely deterred by the arid conditions of the Cape (Humphreys 1976). Another possibility for their absence in the archaeological record could simply be attributed to the lack of Iron Age research conducted in this part of South Africa (Humphreys 1976).

#### **4.5 Historical background**

Although the first recorded visit by an European to the Orange River occurred in 1738, it can be assumed that European ivory hunters had been traversing the river for long before that (Penn, 1995), beginning an era of contact between Europeans (and other “foreigners”) and the Later Stone Age inhabitants of the Orange River.

The observations of these explorers seem to indicate that, at the time of the visits by Wikar and Gordon, the study area was substantially populated with both herders (i.e. Wikar’s *Namnykoa*) and foragers (i.e. the *Klaare Kraal* folk observed by Wikar). While the herders seemed to have inhabited the islands above the falls, the foragers lived in the direct vicinity of the falls. Little animosity existed between these two groups, and the only real conflict in the area came from the wars and arguments between the different herder groups, such as the *Namnykoa* and the *Gyzikoa* from further upstream. Although these *Einiqua* had some contact with the outside world (i.e. with the *Blicquoas* or BaThlaping from further north), very few outsiders entered their area and by and large they seemed to have had a peaceful, harmonious existence. From the 1780s onward, however, this situation started to change, largely due to the increasing numbers of bandits and robbers who entered the area. These robber groups preyed mercilessly on the *Einiqua* inhabitants of the Orange River, raiding their valuable livestock and causing considerable damage to them (Birkholtz and Steyn 2001).

Campbell’s observation of a few years later, that the Orange River seemed to be largely uninhabited, therefore comes as no surprise. It would seem as if the *Einiqua* inhabitants had either been killed or driven away. By the time of Thompson’s visit in 1824, some !Kora groups, originally from further east, appear to have attempted to settle in the areas left vacant by their *Einiqua* predecessors, though they were also harassed by specifically one bandit group, the Oorlams known as the Afrikaners (Birkholtz and Steyn 2001).

### **Towns**



### *Kakamas/Augrabies*

The settlement which became the town of Kakamas was established by the Dutch Reformed Church as a Labour Colony for poor whites on the farms Zoetap and Kakama. During the 1890s, locust pests, droughts and disease ravaged the areas of Namaqualand and Bushmanland, leaving many farmers bankrupt and destitute (Birkholtz and Steyn 2001; Rossouw, 1939).

The main aim of the Labour Colony was to establish an irrigation scheme along the banks of the Orange River, which would provide employment and economic benefit for the poor white inhabitants of the area. The first step in the establishment of such an irrigation scheme was the construction of canals all along the banks of the river. On 4 July 1898 work on the first canal commenced at De Neus, east of Kakamas. The poor whites from the surrounding areas undertook the work on these canals, and by doing so received a small tract of land to farm on. However, they did not receive ownership of the land, and had to rent it from the church. In 1899 the first of these plots (or “erven”) were presented to the first colonists (Anon, n.d.). When the canal reached Alheit and Marchand sometime later, the colony spread rapidly westward. By 1927 the communities of Alheit and Marchand had increased so much, that they were partitioned into a separate congregation of the church. The activities of the church included the “coloured” communities from the area as well. By 1929 two new Dutch Reformed Missions had been established, one at Perde Eiland, the other at Alheit. The church also provided for schools in Alheit and Marchand (Birkholtz and Steyn 2001).

Kakamas township was established in 1931 and came under a village management board in 1948 but only gained municipal status in 1964, after the first labour commission “colonists” had started receiving ownership of the land they had been farming on (Erasmus 2014; Raper 2004).

When the farm Rhenosterkop was acquired and divided between colonists, the Labour Colony included the whole area east of Kakamas, north and south of the river, as well as the wards of Alheit, Marchand and Perde Eiland. Rhenosterkop later came to be known as Augrabies (Birkholtz and Steyn 2001).

### *Riemvasmaak*

This village lies approx. 12km north of the Orange River and close to the Augrabies Falls National park. The village is situated in a larger area called by the same name. In the late 19th and early 20th centuries this area was inhabited by people of Xhosa, Damara and Nama ancestry as well as the descendants of local Khoe groups. However, the apartheid government, in 1973 removed those of Xhosa heritage to the Ciskei, while in 1974 the Nama and Damara were moved to northern Namibia. The remaining people were classified ‘coloured’ and allowed to live on in surrounding areas. The land was then taken over as a military training and testing ground. The site is significant in local South African history in that it was the very first land restitution case in South Africa with the decision to restore the land to its rightful owners being taken in December

1993. The community returned during early 1995 (Erasmus 2014; Hoffmann *et al.* 1995, cited in Orton and Webley 2012).

#### 4.6 Palaeontology

The proposed Groenheuwel Solar development is located in a thinly vegetated fairly flat lying terrain. The sediments are mantled by red-brown sandy soils and gravels and drained by ephemeral stream systems near the Orange River.

The proposed development is underlain by the ancient Precambrian granite-gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province, as well as the overlying Gordonia Formation of the Kalahari Group (**Figure 15**).

The ancient Precambrian granite -gneisses of the Namaqua-Natal Province are approximately 1.5 billion years old. These basement rocks are igneous in origin or highly metamorphosed (Almond & Pether 2009) and thus unfossiliferous (Cornell *et al.* 2006, Almond & Pether 2009). These rocks consist of amphibolites, gneisses, quartzites, and schists plus major granitic and gabbroic (norite) intrusions and are dated between 2050 and 1000 Ma (million years ago).

The Cenozoic Kalahari Group mantling the basement rocks, is approximately 65 – 2.5 million years old (Ma) and is the most widespread body of terrestrial sediments in southern Africa. The Cenozoic sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge *et al.*, 2006). The youngest formation of the Kalahari group is the Gordonia Formation, which is generally termed Kalahari sand, and comprises red aeolian sands that cover most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contain white to brown fine grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that show the seasonal effects of shallow saline groundwaters. Quaternary alluvium, aeolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent 1980).

The fossil assemblages of the Kalahari are generally very low in diversity and occur over a wide range and thus the palaeontological diversity of this Group is low. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. Late Cenozoic calcrete may comprise of bones, horn cores as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils, which include termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter.(Butler 2019).

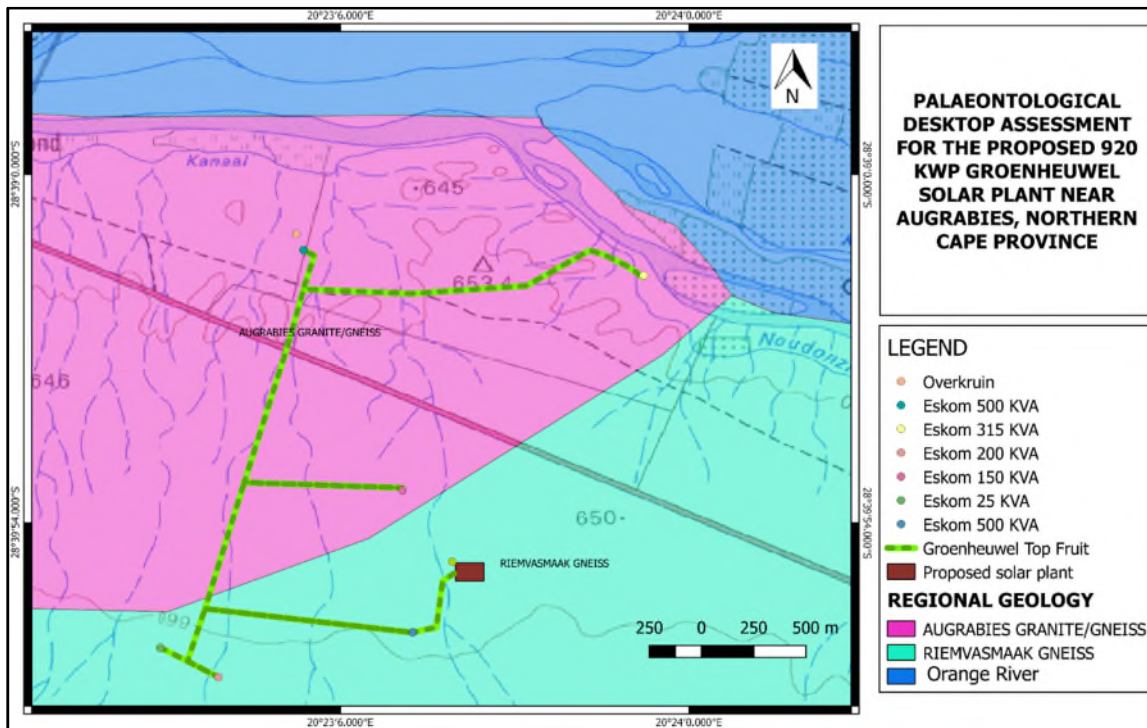


Figure 15: Surface geology of the proposed Groenheuwel Solar development near Augrabies in the Northern Cape is underlain by the Augrabies Granite Gneiss and Riemvasmaak Gneiss as well as overlying Gordonia Formation of the Kalahari Group. Map drawn by QGIS 2.18.28

According to the SAHRIS palaeosensitivity map there is zero to very little chance of finding fossils in this area (Figure 16).

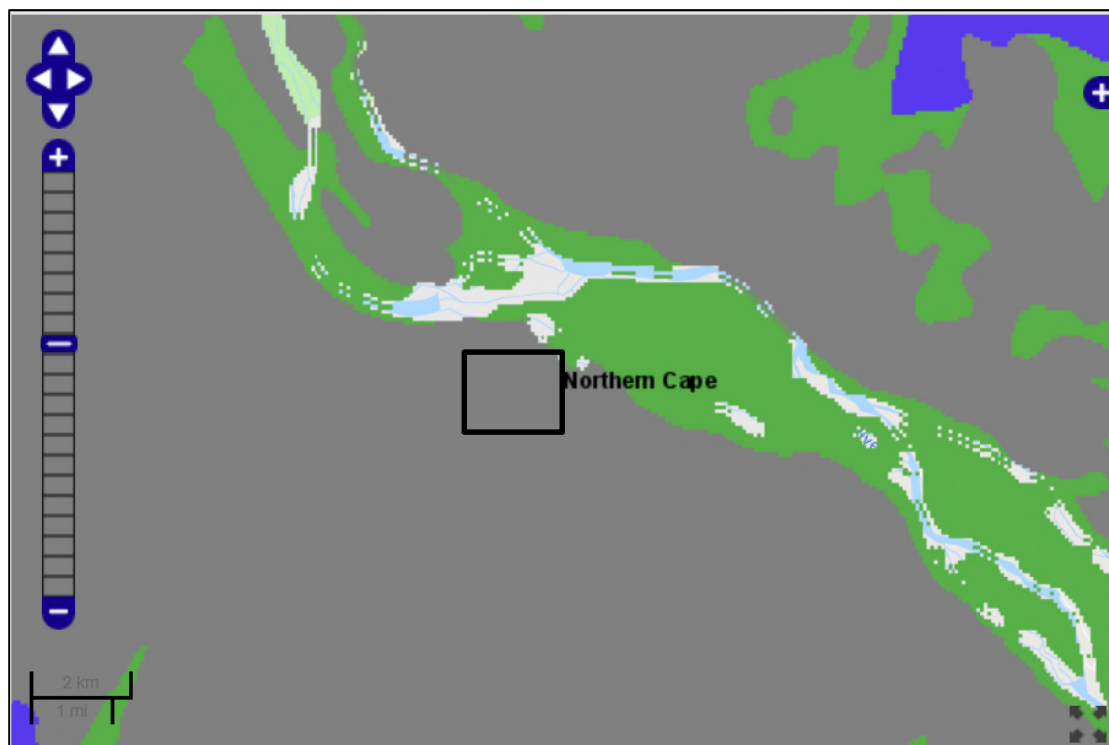


Figure 16: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the proposed development is indicated by the black polygon

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

## 5 FIELD WORK FINDINGS<sup>2</sup>

During the field work only one heritage resource site was identified. This is a large area containing a scatter of stone artefacts from the Middle Stone Age (MSA). The site has been labelled GH001. See the site description below and **Figure 17** and **Figure 18**.

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<sup>2</sup> Site in this context refers to a place where a heritage resource is located and not a proclaimed heritage site as contemplated under s27 of the NHRA.

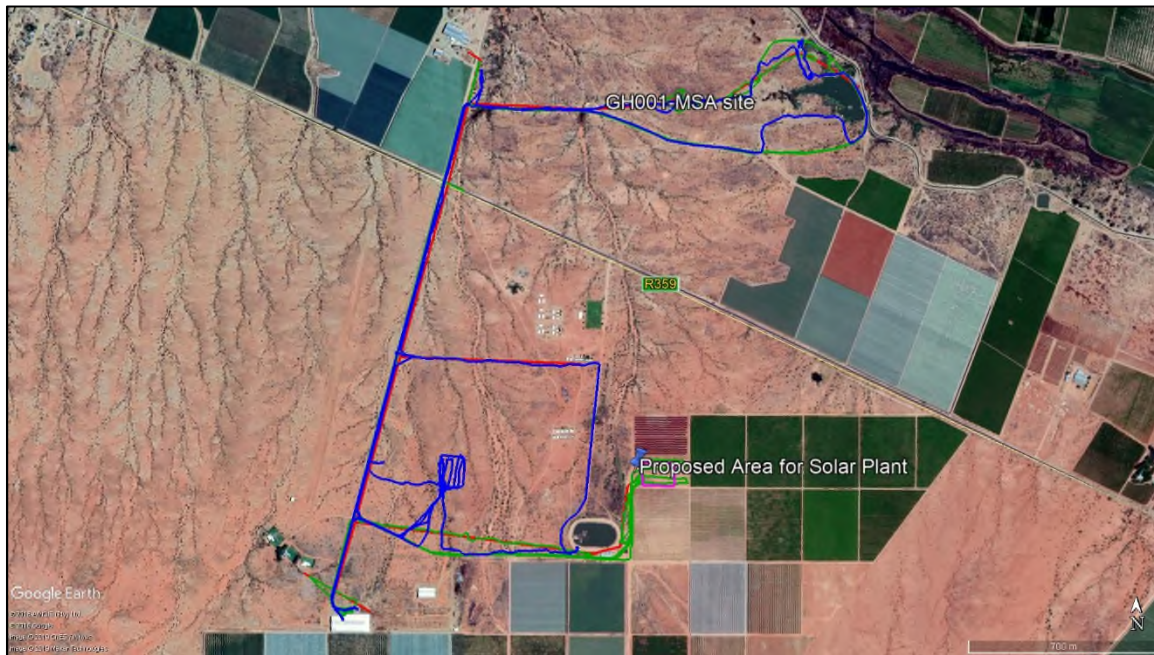


Figure 17: Tracklog of survey and location of the one heritage site identified (Site GH001-MSA site;)

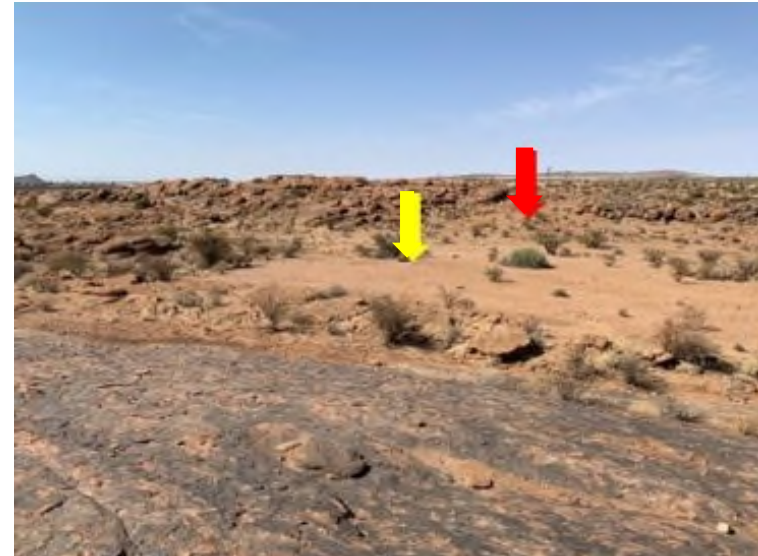


Figure 18: Image showing the extent of the heritage site identified in the area of the proposed power line (red line): Site GH001 – red shaded area)

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
<b>GH001-1</b>	S-28° 39.288'	E 20° 23.451'	<p>The site consists of a medium to high density surface scatter of MSA stone artefacts. The site extends from a narrow area between two rocky outcrops to a flat open area where the gap between the outcrops opens up. The area to the east of the site has been disturbed by earlier ground works.</p> <p>The total site extent: approx. 70m x 60m and approx. 4200m<sup>2</sup>. The (much) narrower eastern section of the site extends for about 80m to the east of the main site.</p>	Medium Significance	IIIB
<b>GH001-2</b>	S-28° 39.287'	E 20° 23.563'			



*Figure 19: Site GH001, looking north-west and showing existing track through site*



*Figure 20: Site GH001, looking south; the site is located in the flat area between ridges. It is proposed that the power line be moved from its current alignment (yellow arrow) to the foot of the ridge on the far side of the site (red arrow).*



Figure 21: Single flake (chert, siltstone/mudstone)



Figure 22: A single platform core (MSA) as well as various flakes (chert, quartz)



Figure 23: Various flakes (chert, quartz)



Figure 24: Various flakes (quartz, siltstone/mudstone)



## 6 ASSESSMENT OF HERITAGE IMPACTS

### 6.1 Impact assessment

The identified heritage resources are allocated a sensitivity buffer based on the recognised management buffers accepted by SAHRA in the past few years. No regulations in the NHRA provide guidelines on buffer zones. In the case of heritage sensitivity, a buffer of 30 – 50 meters is generally proposed. In the case of the archaeological site GH001, a buffer of 20m meters is proposed since that would both provide protection to the site and make the re-alignment of the power line possible.

The development footprint is underlain by the ancient Precambrian granite -gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province as well as the overlying Gordonia Formation of the Kalahari Group. The Palaeontological Sensitivity of the Kalahari Formation is rated as Low, while that of the Namaqua-Natal Metamorphic Province is zero. The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**. Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as having a low possibility.

#### 6.1.1 Impact assessment tables

Implementing the impact assessment methodology as supplied by Savannah the following tables provide a quantitative assessment of the impacts of the proposed development on the study area.

#### **Archaeological Site GH001**

*Table 2: Projected impact on archaeological site GH001*

<b>Nature of impact:</b> One large extended area containing a Middle Stone Age artefact scatter was identified during the survey and was rated as having medium archaeological significance. The identified area could be impacted by construction of the power line and so mitigation will be needed.		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Permanent (5)	Permanent (5)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Probability</b>	Highly Probable (4)	Improbable (2)
<b>Significance</b>	<b>48 (Medium)</b>	<b>20 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Irreversible	Irreversible

<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	Yes
<p><b>Mitigation procedure</b></p> <ol style="list-style-type: none"> <li>1. Taking into account the topographical constraints, the power line must be re-aligned so that it spans over the southern section of the site.</li> <li>2. No pylons may be erected within the site. If this cannot be avoided, the area that will be impacted must be mitigated before construction by means of surface collection and documentation. The pylons are not large and an area of approximately 25m<sup>2</sup> will be affected during construction. The area to the south of the narrower, eastern section of the site has already been disturbed. It is recommended that, should any pylons need to be located close to the site, this area be used.</li> <li>3. If access must be gained to the site, the small existing track that passes through the site must be used but only if absolutely necessary.</li> <li>4. Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMPr for the construction phase of the project.</li> <li>5. If any artefacts are identified during construction, the chance finds protocol must be implemented</li> </ol>		
<p><b>Residual Risk:</b> Loss of Archaeological Heritage</p>		
<p><b>Cumulative impacts:</b> Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is likely that the impact will result in spatial and temporal cumulative change, unless the mitigation measures are implemented.</p>		
<p><b>Residual Risks:</b> Considering the nature of the site identified in the present study, the residual risk will be minimal, if the mitigation measures are implemented.</p>		

The study has identified that the proposed development will have a Medium impact on archaeological heritage resources, if unmitigated and a Low impact if mitigation measures are implemented.

### **Palaeontological resources**

*Table 3: Projected impact on palaeontological resources of Groenheuwel Solar layout*

<p><b>Nature:</b> The excavations and clearing of vegetation during the construction phase of the Groenheuwel Solar plant and associated infrastructure will consist of digging into the superficial sediment cover and possibly the underlying deeper bedrock. These excavations will change the existing topography and may possibly destroy or even permanently close-in fossils at or below the ground surface. These fossils will then be lost for research.</p> <p>Impacts on Palaeontological Heritage are only likely to happen within <b>the construction phase</b>. No impacts are expected to occur during the operation phase or decommissioning phase.</p>
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	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long term/permanent (5)	Long term/permanent (5)
<b>Magnitude</b>	Moderate (6)	Minor (2)
<b>Probability</b>	Improbable (2)	Very Improbable (1)
<b>Significance</b>	<b>LOW (24)</b>	<b>LOW (20)</b>
<b>Status (positive or negative)</b>	Negative	Neutral
<b>Reversibility</b>	Irreversible	Irreversible
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	Yes
<p><b>Mitigation procedure</b></p> <ul style="list-style-type: none"> <li>• When a chance find is made the person must instantly stop all work near the find.</li> <li>• The site must be secured to protect it from any additional damage</li> <li>• The finder of the fossil heritage must immediately report the find to his/her direct supervisor, according to the reporting protocols instituted by the development management. The supervisor must in turn report the find to his/her manager and the EO. The EO must report the find to the relevant Authorities and a relevant palaeontologist.</li> <li>• The developer/contractor must appoint a relevant palaeontologist to investigate and access the chance find and site.</li> <li>• The palaeontologist must ensure that accurate records and documentation are kept. The documentation must start with the initial chance find report, including records of all actions taken, persons involved and contacted, comments received and findings.</li> <li>• These documents will be necessary to request authorizations and permits from the relevant Authorities to continue with the work on site</li> <li>• The reports and all other documents will be submitted to SAHRA by the palaeontologist.</li> <li>• The report will include recommendations for additional specialist work if necessary, or request approval to continue with the development.</li> <li>• When the necessary approvals have been issued, the development may carry on with the development.</li> </ul> <p>The EO will close off the chance find procedure and would be required to implement any requirements issued by the Authority and to add it to the operational management plan</p>		
<b>Residual Risk: Loss of Fossil Heritage</b>		

## 7 HERITAGE MANAGEMENT PLAN FOR IDENTIFIED HERITAGE RESOURCES

NO.	MITIGATION MEASURES	PHASE	TIMEFRAME	RESPONSIBLE PARTY FOR IMPLEMENTATION	MONITORING PARTY (FREQUENCY)	TARGET	PERFORMANCE INDICATORS (MONITORING TOOL)
<b>Identified Heritage Resources to be implemented during construction activities</b>							
<b>Palaeontology</b>	A "Chance Find Protocol" must be implemented during the proposed construction activities	Construction		Applicant EO Palaeontologist	Applicant EO	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	ECO Monthly Checklist/Report
<b>Archaeology – Site GH001</b>	The archaeological site area must be demarcated and avoided by the proposed powerline construction A "Chance Find Protocol" must be implemented during the proposed construction activities	Construction		Applicant EO Archaeologist	Applicant EO	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	ECO Monthly Checklist/Report

## 8 CONCLUSIONS AND RECOMMENDATIONS

The study identified the presence of archaeological resources and a very low probability of the presence of palaeontological resources within the study area. No burial grounds or graves or historical structures were identified.

### 8.1 Archaeology

The archaeological resources identified within the proposed development site is a large extended area containing a Middle Stone Age surface artefact scatter. Based on findings from a range of other heritage reports in the area, this type of site is to be expected in this region.

This site is automatically protected under the heritage legislation, however, serious mitigation measures will not be required if the powerline's layout is changed slightly, see below.

#### *Recommendations:*

1. Taking into account the topographical constraints, the power line must re-aligned so that it spans over the southern section of the site.
2. No pylons may be erected within the site. If this cannot be avoided, the area that will be impacted must be mitigated before construction by means of surface collection and documentation. The pylons are not large and an area of approximately 25m<sup>2</sup> will be affected during construction. The area to the south of the narrower, eastern section of the site has already been disturbed. It is recommended that, should any pylons need to be located close to the site, this area be used.
3. If access must be gained to the site, the small existing track that passes through the site must be used but only if absolutely necessary.
4. Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMP for the construction phase of the project.
5. If any artefacts are identified during construction, the chance finds protocol must be implemented

### 8.2 Palaeontology

The proposed development is underlain by the ancient Precambrian granite -gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province which is mantled by the overlying Gordonia Formation of the Kalahari Group. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is low and the ancient Precambrian granite -gneisses of the Riemvasmaak Gneiss and Augrabies Granite Gneiss of the Namaqua-Natal Province is zero.

**It is therefore considered that the construction and operation of the Groenheuwel Solar Plant, in the Northern Cape is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.** Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

### **8.3 General**

In the event that additional heritage resources are discovered during site clearance, construction activities must stop, and the relevant heritage authority must be contacted in order to advise on the necessary actions to take. Generally, a qualified archaeologist must be appointed to evaluate the situation and make recommendations on mitigation measures.

It is considered that the overall impact of the proposed development of the solar plant and power line on heritage resources is seen as acceptably low, after the recommendations have been implemented. Therefore, impacts can be mitigated to acceptable levels and the project may be authorised from a heritage perspective.

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**HENK STEYN CURRICULUM VITAE**

**Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage**

**EDUCATION**

**Name of University or Institution** : University of Pretoria  
**Degree obtained** : BA  
**Major subjects** : Archaeology, History & Cult. History  
**Year** : 1996

**Name of University or Institution** : University of Pretoria  
**Degree obtained** : BA [Hons] (Cum laude)  
**Major subjects** : Archaeology  
**Year** : 1997

**Professional Qualifications:**

Professional Archaeologist - Association of Southern African Professional Archaeologists - Professional Member

CRM Accreditation:

- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age

Treasurer of ASAPA (Association of Southern African Professional Archaeologists) from 2012 - 2017

**Languages:**

Afrikaans – First language

English – Speaking (Good) Reading (Good), Writing (Good)

**KEY QUALIFICATIONS**

Grave Relocation Management, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Business Management

**EXPERIENCE**

**Heritage Assessments**

As a heritage practitioner I have been involved with approximately 60 Heritage Impact Assessments including, but not limited to:

- Archaeological Walkdown, Hydra-Perseus Transmission line (260km), Northern Cape

Province - Eskom

- Phase 2 Heritage Impact Assessment and EMP, Gamma-Omega Transmission line (550km), Western Cape Province - Nature Conservation Corporation
- Archaeological Walk Down and EMP, Eros-Neptune Transmission Line (380km), Transkei, Eastern Cape Province – Aurecon
- Phase 2 Heritage Impact Assessment in terms of the proposed Comet Ext. 8 Development, Ekurhuleni Metropolitan Municipality – Urban Dynamics
- Heritage Impact Assessment for the proposed development of Comet Ext. 14, Ekurhuleni Metropolitan Municipality, Marsh Environmental
- Nature Conservation Corporation, Phase 2 Heritage Impact Assessment and EMP, Hydra-Perseus Transmission line (260km – selected areas), Northern Cape Province
- Heritage Assessment, Friarsdale, Northern Cape – Afrimat
- Heritage Assessments for three SCP Projects (De Aar, Kimberley, Loeriesfontein) – SiVest
- Co-Author of a Cultural Resources Management Plan for Marakele National Park.
- Co-Author of a Cultural Resources Management Plan for Augrabies National Park.

### **Grave Relocations**

As Managing Director of PGS, I have been involved in a large number of grave relocation projects, including:

- iMpunzi Division of Duiker Mining, Witbank, Relocation of 950 graves.
- University of Pretoria, Nandoni Dam Grave Relocation Project, Thohoyandou, Limpopo Province. Relocation of approximately 1,000 graves.
- Alveda Park Development, NewHco. Relocation of 114 graves.
- Tselentis Colliery, Duiker Mining. Relocation of 80 graves.
- Tselentic Colliery, Expansion of mining activities. Relocation of 15 graves.
- Abland, Proposed development of Portion 41 of the farm Wonderboom 302-JR. Relocation of 17 graves
- TCTA, VRESAP Development. Relocation of 56 graves.
- Biscuit Trading, Proposed Development of Portion 97 of the farm Knopjeslaagte 385-JR. Relocation of 5 graves.
- Savannah Country Estates, Mamelodi, Pretoria, Gauteng Province. Relocation of 7 graves.
- Atterbury Property Developments, Hartebeespoort Dam, Pretoria. Relocation of 11 graves.
- The Outpost Estate, Bela-Bela, Limpopo Province. Relocation of 78 graves.
- Nkomati Mine, Onverwacht grave relocation, near Badplaas, Mpumalanga. Relocation of 45 graves.
- Nkomati Mine, Nkomati Mine grave relocation, near Badplaas, Mpumalanga. Relocation of 60 graves.
- New Vaal Colliery, Mac West Project, Free State, Relocation of 650 graves.

- Phokathaba Platinum, Smokey Hills Mine, Maandagshoek, Burgersfort, Limpopo Province. Relocation of 11 graves.
- Martins Funerals (Randburg), Garstfontein Road grave relocation, Pretoria, Gauteng Province. Relocation of 1 grave.
- Bombela CJV, Graves affected by Gautrain Development, Midrand, Gauteng Province. Relocation of 26 graves.
- Cranbrook Properties, Motaganeng Project, Burgersfort, Limpopo Province. Relocation of 60 graves.
- Silver Glade Investments, Swavelpoort, Pretoria. Relocation of 45 graves.
- Anglo Coal (Kleinkopje Colliery), Zondagsvlei, near Ogies, Mpumalanga Province. Relocation of 110 graves.
- Anglo Coal (Kleinkopje Colliery), Kleinkopje Coppiery, Witbank, Mpumalanga Province. Relocation of 4 graves.
- Africon. Rescue excavation of 1 grave near Silvertondale, Pretoria, Gauteng Province.
- Osizweni Plaza, Newcastle, KwaZulu-Natal. Relocation of 65 graves.
- Anglo Coal, Farm Straffontein, Delmas, Mpumalanga. Relocation of 16 graves.
- Beaurivage, Relocation of 3 graves, Hartebeestpoort, North West Province.
- EIMS, Rescue excavation of 2 graves, Waltloo, Pretoria, Gauteng Province. Project Manager and Permit Holder with WC Nienaber as PI.
- Xstrata Coal, Phoenix Plant. Relocation of 1 grave.
- Xstrata Coal, ATCOM East. Relocation of 53 graves.
- AGES Environmental, Sephaku Fluoride Chemical Plant, Ekandustria, Bronkhorstspuit, Gauteng Province.
- Nkomati Mine, near Badplaas, Mpumalanga Province. Relocation of approximately 70 graves in various phases.
- SMEC South Africa/Hillary Construction (on behalf of SANRAL). Relocation of 64 graves affected by the widening of the N1 at Holfontein, Kroonstad. (Current project)
- Crystal Park Development Pty (Ltd). Rescue excavation of 17 graves exposed during construction activities. Crystal Park, Benoni (Current Project)
- Hatch-Goba, relocation of 30 graves from the Coega Industrial Development Zone, Port Elizabeth.
- Transnet, Relocation of 190 graves from the Coega Industrial Development Zone, Port Elizabeth.
- Glencore, relocation of 850 graves from the Tweefontein Optimisation Project, Ogies, Mpumalanga
- Rietvlei Mining, relocation of 59 graves near Middelburg, Mpumalanga (current project)
- Kophia Diamonds, relocation of 5 graves exposed during mining activities. Boshoff, Free State (current project).
- Estor Properties, relocation of 90 graves from The Orchards, Pretoria (current project)

**EMPLOYMENT SUMMARY**

Managing Director of PGS Heritage (Pty) Ltd 2003 - current

Director of PGS Heritage (Pty) Ltd – Lesotho

Director of PGS Heritage Africa

Shareholder in PGS Heritage Mozambique

**Countries of work experience:**

- South Africa
- Botswana

## PROFESSIONAL CURRICULUM: JENNIFER KITTO

**Name:** Jennifer Kitto  
**Profession:** Heritage Specialist  
**Date of Birth:** 1966-09-11  
**Parent Firm:** PGS Heritage (Pty) Ltd  
**Position in Firm:** Heritage Consultant  
**Years with Firm:** 8 Years  
**Years experience:** 20  
**Nationality:** South African  
**HDI Status:** White Female

### EDUCATION:

**Name of University or Institution:** Dorset Institute for Higher Education (now Bournemouth University), Poole, United Kingdom  
**Degree obtained:** :Higher National Diploma: Practical Archaeology  
**Year** :1989

**Name of University or Institution** : University of the Witwatersrand  
**Degree obtained** : BA  
**Major subjects** :Archaeology and Social Anthropology  
**Year** :1993

**Name of University or Institution** :University of the Witwatersrand  
**Degree obtained** : BA [Hons]  
**Major subjects** :Social Anthropology  
**Year** : 1994

### Professional Qualifications:

Member - Association of Southern African Professional Archaeologists – Technical Member No. 444

### Languages:

English First Language  
Afrikaans - Speaking (Fair) Reading (Fair), Writing (Fair)

### KEY QUALIFICATIONS

Cultural Resource Management and Heritage Impact Assessment Management, Historical and Archival Research, Archaeology, Anthropology, Applicable survey methods, Fieldwork and Project Management.

## **SUMMARY OF EXPERIENCE**

Specialised expertise in Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, including *inter alia* -

### **Involvement with various Heritage Impact Assessments, within South Africa, including -**

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Heritage Audits and subsequent Compilation of Heritage Management Policy for various projects

## **HERITAGE ASSESSMENT PROJECTS**

### **Below a selected list of Heritage Impact Assessments (HIA) and Heritage Audit and Management Projects completed:**

- Heritage Screening Reports for Various Road Routes: Bronkhorstspuit, Carletonville and Randfontein and Eikenhof-Vaal Dam regions, Gauteng Department of Roads and Transport, Gauteng Province
- Heritage Audit and Management Policy, Sibanye Gold, Beatrix Mining area, Lejweleputswa District Municipality, Free State Province
- Heritage Audit and Management Policy, Sibanye Gold, Kloof and Driefontein Mining areas, West Rand District Municipality, Gauteng Province
- HIA Report, Dolos-Giraffe Substation, Hopefield-Bultfontein, Free State Province
- HIA Report and Phase 2 Mitigation Report, AEL Mining Services, Decontamination of AEL Detonator Campus, Modderfontein Factory, Modderfontein, City of Johannesburg Metropolitan Municipality, Gauteng
- HIA Report, Old Rand Leases Hostel redevelopment, Fleurhof Ext 10, Roodepoort, City of Johannesburg Metropolitan Municipality, Gauteng
- HIA Report, Watershed Substation, North-West Province
- HIA Report, Solid Waste Landfill Facility, Rhodes Village, Eastern Cape
- HIA Report, Solid Waste Landfill Facility, Rossouw, Eastern Cape
- Phase 2 Mitigation Report, Cass Farmstead, Optimum Colliery, Mpumalanga
- HIA Report, Kusile Ash Disposal Facility, Witbank, Mpumalanga
- Report on Rand Steam Laundries Background History, City of Johannesburg Metropolitan Municipality, Gauteng
- New Cemetery, Barkly East, Senqu Municipality, Eastern Cape (desktop/archival research for HIA report)
- Lady Slipper Country Estates, Nelson Mandela Metro Municipality, Eastern Cape (desktop/archival research for HIA report)
- Exxaro Resources Paardeplaats Project, Belfast, Mpumalanga (field survey and archival research for HIA report)

- Copperleaf Mixed Use Development, Farm Knoppieslaagte 385/Knopjeslaagte 140, Centurion, Gauteng (field survey and archival research for HIA report)
- Isundu-Mbewu Transmission Line Project, Pietermaritzburg, Kwazulu Natal (Initial Heritage Scan (survey) for Corridor 3 Alternative 1)

## **GRAVE RELOCATION PROJECTS**

**Below, a selection of grave relocation projects involvement:**

- Mitigation Report on previous Grave Relocation and Permit applications for Test Excavation of two possible graves, Nkomati Mine, Mpumalanga
- Relocation of two graves Olievenhoutbosch, Tshwane, Gauteng (applications to SAHRA, Gauteng Dept. of Health and Local Authorities for relevant permits)
- Relocation of graves HL Hall Family, Nelspruit, Mpumalanga (applications to SAHRA, Mpumalanga Department of Health and Local Authorities for relevant permits)
- Relocation of two possible graves Noordwyk Ext 63, Midrand, Johannesburg, Gauteng (applications to SAHRA, Gauteng Dept. of Health and Local Authorities for relevant permits)
- Relocation of informal cemetery (50+) and additional unknown graves (50+) at Fleurhof Extension 5, Roodepoort, Gauteng (desktop research and applications to SAHRA, Gauteng Health Department and Local Government for relevant permits in terms of the applicable legislation)
- Relocation of informal graves (9) at Tselentis Colliery, Breyten, Mpumalanga (applications to SAHRA, Mpumalanga Department of Health and Local Authorities for relevant permits)
- Relocation of various informal cemeteries at New Largo Mine, Balmoral, Mpumalanga (as above)
- Relocation of graves at Mookodi Power Station, Vryburg, North-West Province (initial social consultation)
- Relocation of graves at Hendrina Power Station, Hendrina, Mpumalanga (social consultation, permit applications, etc)

## **EMPLOYMENT SUMMARY:**

### **Positions Held**

- 2011 – to date: Heritage Specialist - PGS Heritage (Pty) Ltd
- 2008 – 2011: Cultural Heritage Officer (National), Burial Grounds and Graves Unit: South African Heritage Resources Agency (SAHRA)
- 1998 – 2008: Cultural Heritage Officer (Provincial), Provincial Office – Gauteng: SAHRA

## WOUTER FOURIE

### Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

#### Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave “rescue” excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including -

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
- Involvement with various Heritage Impact Assessments, outside South Africa, including -
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation project in DRC

#### Key Qualifications

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

Principal Investigator - Grave Relocations

Field Director – Iron Age

Field Supervisor – Colonial Period and Stone Age

Accredited with Amafa KZN

#### Key Work Experience

2003- current - Director – Professional Grave Solutions (Pty) Ltd

2007 – 2008 - Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 - CEO– Matakoma Consultants



1998-2000 - Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng  
1997-1998 - Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique and the Democratic Republic of the Congo

## ANNEXURE B – IMPACT ASSESSMENT METHODOLOGY

The methodology used to determine the environmental impact significance was provided by Savannah Environmental, and is explained below.

### Impact Assessment methodology:

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment must be assessed in terms of the following criteria:

- » The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- » The **duration**, wherein it will be indicated whether:
  - \* the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - \* the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - \* medium-term (5–15 years) – assigned a score of 3;
  - \* long term (> 15 years) - assigned a score of 4; or
  - \* permanent - assigned a score of 5;
- » The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- » the **status**, which will be described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated*.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. The table must be completed and associated ratings for **each** impact identified during the assessment should also be included.

Example of Impact table summarising the significance of impacts (with and without mitigation) when additional impact are identified:

<b>Nature:</b> [Outline and describe fully the impact anticipated as per the assessment undertaken]		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	High (3)	Low (1)
<b>Duration</b>	Medium-term (3)	Medium-term (3)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Probability</b>	Probable (3)	Probable (3)
<b>Significance</b>	<b>Medium (36)</b>	<b>Low (24)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	Yes
<b>Can impacts be mitigated?</b>	Yes	Yes
<b>Mitigation:</b> “Mitigation”, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind.		
<b>Cumulative impacts:</b> “Cumulative Impact”, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities <sup>3</sup> .		
<b>Residual Risks:</b> “Residual Risk”, means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).		

Example of Impact table summarising the significance of impacts (with and without mitigation) when the impact has increased or decreased:

<sup>3</sup> Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.

<b>Nature of impact:</b> <b>[Outline and describe fully the impact anticipated as per the assessment undertaken]</b>				
	<b>Authorised</b>		<b>Proposed amendment</b>	
	<b>Without mitigation</b>	<b>With mitigation</b>	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Low (1)	Low (1)	Low (1)	Low (1)
<b>Duration</b>	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
<b>Magnitude</b>	Minor (2)	Minor (2)	Minor (2)	Minor (2)
<b>Probability</b>	Very improbable (1)	Very improbable (1)	Very improbable (1)	Very improbable (1)
<b>Significance</b>	<b>8 (Low)</b>	<b>8 (Low)</b>	<b>8 (Low)</b>	<b>8 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Very low	Very low	Very low	Very low
<b>Irreplaceable loss of resources?</b>	Yes	No	Yes	No
<b>Can impacts be mitigated?</b>	Yes		Yes	
<p><b>Mitigation:</b>  “Mitigation“, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.  Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind. <b><u>[Please underline all new mitigation measures which were not included in the EIA].</u></b></p>				
<p><b>Cumulative impacts:</b>  “Cumulative Impact“, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities<sup>4</sup>.</p>				
<p><b>Residual Risks:</b>  “Residual Risk“, means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).</p>				

<sup>4</sup> Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.

## APPENDIX C – DESKTOP PALAEONTOLOGICAL STUDY