Phase 1 Cultural Heritage Impact Assessment:

THE DEVELOPMENT OF THE PROPOSED KGALALELO PHOTOVOLTAIC SOLAR ENERGY PLANT NEAR OLIFANTSHOEK IN THE TSANTSABANE LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

Prepared for:

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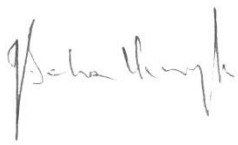
- Date: -

Copy Right:

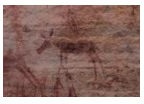
Specialist competency:

Johan A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 40 years. Originally based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape Province, Northern Cape Province, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 70 papers, most in scientifically accredited journals. During this period, he has done more than 2000 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.



J A van Schalkwyk
Heritage Consultant
January 2020





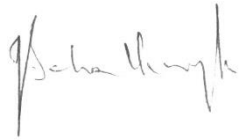


SPECIALIST DECLARATION

I, J A van Schalkwyk, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist



J A van Schalkwyk
January 2020

EXECUTIVE SUMMARY

Phase 1 Cultural Heritage Impact Assessment:
THE DEVELOPMENT OF THE PROPOSED KGALALELO PHOTOVOLTAIC SOLAR ENERGY PLANT NEAR OLIFANTSHOEK IN THE TSANTSABANE LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

Kgalalelo Solar Power Plant (RF) (Pty) Ltd is proposing the development of up to 150MW photovoltaic (PV) solar energy plant near Olifantshoek situated in the Tsantsabane Local Municipality in the Northern Cape Province.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Environamics Environmental Consultants* to conduct a cultural heritage assessment to determine if the development of the photovoltaic (PV) solar power plant and associated infrastructure would have an impact on any sites, features or objects of cultural heritage significance.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial (Stone Age) occupation. The second and much later component is a colonial (farmer) one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 100 years or less.

Identified sites

During the physical survey, the following sites, features or objects that are viewed as having cultural significance have been identified.

- (7.1.1): Some poorly formed stone tools, classified as side- and end scrapers, dating to the Middle Stone Age was identified. The material seems to originate from the other side of the farm boundary, on the farm Nokana, on what seems to have been a low outcrop of quartzite.

Impact assessment and proposed mitigation measures

Because of the low likelihood of finding further significant heritage resources in the relevant areas proposed for development and the generally low density of sites in the wider landscape the overall impacts to the heritage are expected to be of generally low significance.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

Site No.	Site type	NHRA category	Field rating	Impact rating: Before/After mitigation
7.1.1	Stone Age tools	Section 35	Medium significance – Grade IV-B	Low (16)
				Low (16)

Alternatives assessment

A preferred site as well as an alternative site were subjected to the investigation. The alternatives are rated as being either preferred, not-preferred, favourable or no preference. The possibility of a no-go alternative was also considered.

Alternative	Preference	Reason
Kgalalelo Solar Power Plant		
Preferred site	No preference	Will not impact on any known sites of cultural heritage significance.
Alternative site	No preference	Will not impact on any known sites of cultural heritage significance.
No-go alternative	No preference	This alternative would entail maintaining the current land use with no impacts on heritage resources

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	NHRA category	Field rating	Impact rating: Before/After mitigation
Archaeological sites/material	Section 35	Generally protected: Medium significance – Grade IV-B	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

Legal requirements

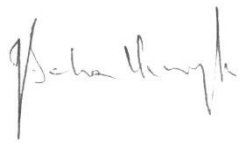
The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- As there are no areas that need to be avoided, either in the site for the solar energy facility or for the transmission line, it is recommended, from a heritage point of view, that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.



J A van Schalkwyk
Heritage Consultant
January 2020

TECHNICAL SUMMARY

Project description	
Description	Development of 115MW photovoltaic (PV) solar energy plant
Project name	Kgalalelo Solar Plant

Applicant
Kgalalelo Solar Plant (RF) (Pty) Ltd

Environmental assessors
Environamics Environmental Consultants
Ms C Otte

Property details	
Province	Northern Cape
Magisterial district	Postmasburg
Local municipality	Tsantsabane
Topo-cadastral map	2822BA
Farm name	Ruby Vale No. 266
Closest town	Olifantshoek
Coordinates	Corner points (approximate)

No	Latitude	Longitude	No	Latitude	Longitude
1	-28.21427	22.54290	2	-28.23307	22.54810
3	-28.18996	22.57035	4	-28.20317	22.54886
5	-28.20614	22.56157	6	-28.18659	22.55781
7	-28.21943	22.56157	8	-28.22866	22.53484

Development criteria in terms of Section 38(1) of the NHR Act	Yes/No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length	No
Construction of bridge or similar structure exceeding 50m in length	No
Development exceeding 5000 sq m	Yes
Development involving three or more existing erven or subdivisions	No
Development involving three or more erven or divisions that have been consolidated within past five years	No
Rezoning of site exceeding 10 000 sq m	No
Any other development category, public open space, squares, parks, recreation grounds	No

Land use	
Previous land use	Farming
Current land use	Farming

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GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Bioturbation: The burrowing by small mammals, insects and termites that disturb archaeological deposits.

Cumulative impacts: "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.

Debitage: Stone chips discarded during the manufacture of stone tools.

Factory site: A specialised archaeological site where a specific set of technological activities has taken place – usually used to describe a place where stone tools were made.

Historic Period: Since the arrival of the white settlers - c. AD 1830 - in this part of the country.

Holocene: The most recent time period, which commenced c. 10 000 years ago.

Iron Age (also referred to as **Early Farming Communities**)**:** Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Later Iron Age	AD 1300 - AD 1830

Midden: The accumulated debris resulting from human occupation of a site.

Mitigation, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

National Estate: The collective heritage assets of the Nation.

Pleistocene: Geological time period of 3 000 000 to 20 000 years ago.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 500 000 - 250 000 Before Present
Middle Stone Age	250 000 - 40-25 000 BP
Later Stone Age	40-25 000 - until c. AD 200

Tradition: As used in archaeology, it is a seriated sequence of artefact assemblages, particularly ceramics.

ACRONYMS and ABBREVIATIONS

AD	Anno Domini (the year 0)
ASAPA	Association of Southern African Professional Archaeologists

BC	Before the Birth of Christ (the year 0)
BCE	Before the Common Era (the year 0)
BP	Before Present (calculated from 1950 when radio-carbon dating was established)
CE	Common Era (the year 0)
CRM	Cultural Resources Management
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
ESA	Early Stone Age
HIA	Heritage Impact Assessment
I & AP's	Interested and Affected Parties
ICOMOS	International Council on Monuments and Sites
LIA	Late Iron Age
LSA	Later Stone Age
MIA	Middle Iron Age
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain-	
a) details of-	
i. the specialist who prepared the report; and	Front page
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page i Addendum Section 5
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5.2.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7; Figure 14
g) an identification of any areas to be avoided, including buffers;	Section 8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 14 Section 8
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
k) any mitigation measures for inclusion in the EMPr;	Section 8 & 9
l) any conditions for inclusion in the environmental authorisation;	Section 10
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion-	
i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and	Section 10
ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8, 9, 10
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	-
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	-
q) any other information requested by the competent authority.	-
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	-

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1. INTRODUCTION

1.1 Background

Kgalalelo Solar Power Plant (RF) (Pty). Ltd. is proposing the development of 115MW photovoltaic (PV) solar energy plant near Olifantshoek situated in the Tsantsabane Local Municipality in the Northern Cape Province.

The purpose of the proposed photovoltaic (PV) solar power plant will be to evacuate the generated power into the Eskom Holdings SOC Ltd (Eskom) electricity grid. If successful, the Solar Power Plant will be remunerated on a per kilowatt hour generated basis by Eskom in terms of a 20-year Power Purchase Agreement. Kgalalelo Solar Power Plants will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA). Depending on the economic conditions following the lapse of this period, the facility may either be decommissioned, or the power purchase agreement may be renegotiated and extended.

Environamics Environmental Consultants was contracted as independent environmental consultant to undertake the EIA process for the proposed photovoltaic (PV) solar power plant development.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. However, according to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Environamics Environmental Consultants* to conduct a cultural heritage assessment to determine if the development of the photovoltaic (PV) solar power plant and associated infrastructure (transmission line and access roads) would have an impact on any sites, features or objects of cultural heritage significance.

This report forms part of the Environmental Impact Assessment (EIA) as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and is intended for submission to the South African Heritage Resources Agency (SAHRA).

1.2 Terms and references

The aim of a full HIA investigation is to provide an informed heritage-related opinion about the proposed development by an appropriate heritage specialist. The objectives are to identify heritage resources (involving site inspections, existing heritage data and additional heritage specialists if necessary); assess their significances; assess alternatives in order to promote heritage conservation issues; and to assess the acceptability of the proposed development from a heritage perspective.

The result of this investigation is a heritage impact assessment report indicating the presence/ absence of heritage resources and how to manage them in the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, on condition of successful implementation of proposed mitigation measures.

1.2.1 *Scope of work*

The aim of this study is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where the photovoltaic (PV) solar power plant and associated infrastructure (transmission line and access roads) is to take place. This included:

- Conducting a desk-top investigation of the area;
- A visit to the proposed development site.

The objectives were to:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Identify any potential 'fatal flaws' related to the proposed development;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance;
- Provide guideline measures to manage any impacts that might occur during the construction phase as well as the implementation phase.

1.2.2 *Assumptions and Limitations*

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate.
- The unpredictability of buried archaeological remains.
- No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities.
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is sufficient and that it does not have to be repeated as part of the heritage impact assessment.

2. LEGISLATIVE FRAMEWORK

2.1 Background

Heritage Impact Assessments are governed by national legislation and standards and International Best Practise. These include:

- South African Legislation
    - National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA);
    - Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA);
    - National Environmental Management Act 1998 (Act No. 107 of 1998) (NEMA); and
    - National Water Act, 1998 (Act No. 36 of 1998) (NWA).
- Standards and Regulations
    - South African Heritage Resources Agency (SAHRA) Minimum Standards;
    - Association of Southern African Professional Archaeologists (ASAPA) Constitution and Code of Ethics;
    - Anthropological Association of Southern Africa Constitution and Code of Ethics.
- International Best Practise and Guidelines
    - ICOMOS Standards (Guidance on Heritage Impact Assessments for Cultural World Heritage Properties); and

- The UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (1972).

2.2 Heritage Impact Assessment Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, Section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority.

The National Heritage Resources Act (Act No. 25 of 1999, Section 38) provides guidelines for Cultural Resources Management and prospective developments:

"38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:

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

And:

"38 (3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;
(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
(c) an assessment of the impact of the development on such heritage resources;
(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
(g) plans for mitigation of any adverse effects during and after the completion of the proposed development."

3. HERITAGE RESOURCES

3.1 The National Estate

The National Heritage Resources Act (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- 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, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

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

- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix (see Section 2 of Addendum) was developed whereby the above criteria were applied for the determination of the significance of each identified site. This allowed some form of control over the application of similar values for similar identified sites.

4. PROJECT DESCRIPTION

4.1 Site location

The activities entail the development of an individual PV solar power plant and associated infrastructure on the Remaining Extent the farm Ruby Vale No. 266, Registration Division Gordonia, Northern Cape. The proposed development is located in the Northern Cape Province, in the north western interior of South Africa. The site is located approximately 35km south-southwest of the town of Olifantshoek (Fig. 1). For more information, see the Technical Summary on p. V above.

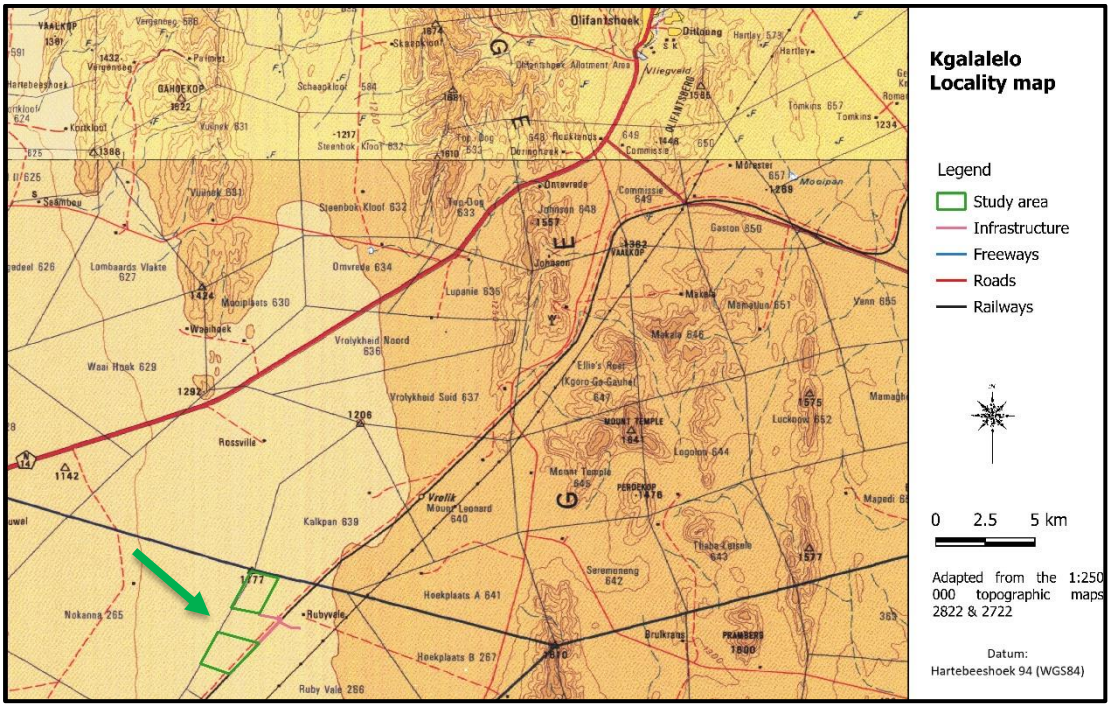

Figure 1. Location of the study area in regional context.

4.2 Development proposal

The information presented below was taken *ad verbum* from the Environamics *Background Information Document* (2019).

The projects entail the generation of up to 150MW electrical power each, through PV panels. The total footprint of each project will be approximately 300 hectares. The key components of the individual proposed projects are described below:

- PV Panel Array - To produce 115MW, each facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. Due to the fact that these projects only require ~300 hectares of land, there is scope to avoid major environmental constraints through the final design of the facilities. The PV panels will be tilted at a northern angle in order to capture the most sun.

- Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the low voltage from 480V to a medium voltage of for example 11kV, 22kV or 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is expected to be 480V and this is fed into step up transformers to a maximum voltage of 132kV. Onsite substations will be required to step the voltage up to 132kV, after which the power will be evacuated into the national grid. Since the project proponents have not yet received cost estimate letters from Eskom the exact scope of the grid connection might differ.

- Supporting Infrastructure - A control facility with basic services such as water and electricity will be constructed on each site and will have an approximate footprint 400m². Other supporting infrastructure include voltage and current regulators, and protection circuitry.

- Roads – Ready access already exists from the D 3300 and an internal site road network will be constructed to provide access to the solar field and associated infrastructure will be required. A corridor of 25m will be assessed for the location of site roads.

- Fencing - For health, safety and security reasons, the facilities will need to be fenced off from the surrounding farms.

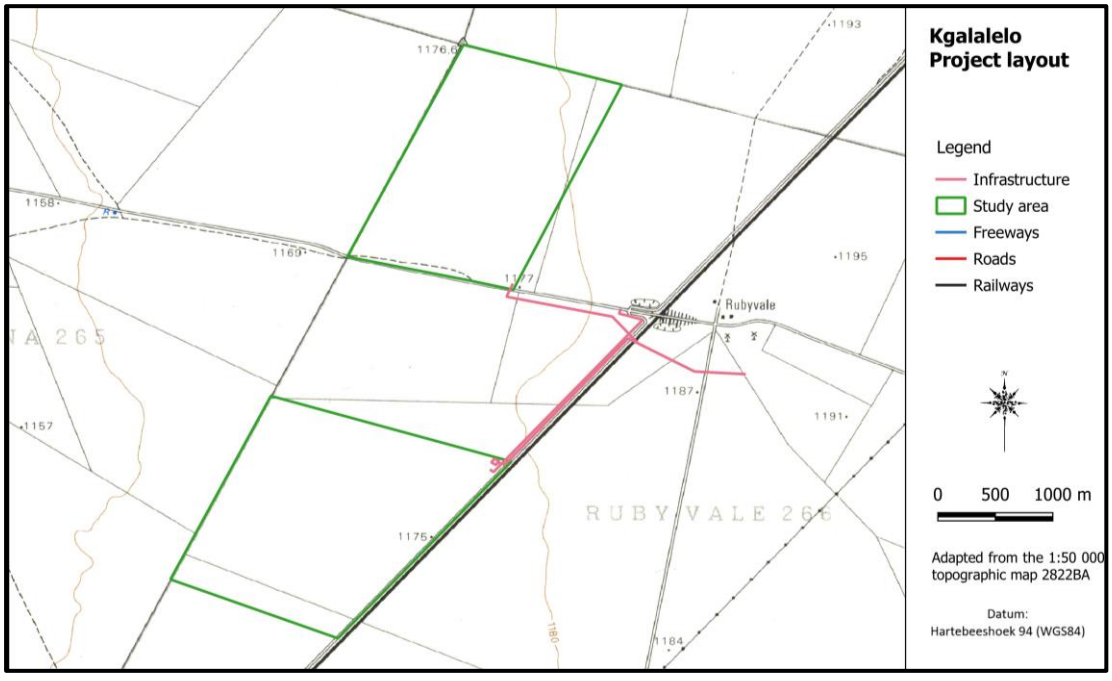

Figure 2. Layout of the project

5. STUDY APPROACH AND METHODOLOGY

5.1 Extent of the Study

This survey and impact assessment cover all facets of cultural heritage located in the study area as presented in Section 4 above and illustrated in Figure 2.

5.2 Methodology

5.2.1 *Pre-feasibility assessment*

No archaeological work has been done in the immediate vicinity of the proposed solar energy facility. The same can be said of much of the surrounding region. Existing sources, most of which dates from the last two to three decades, mostly deal with the archaeology or past events on a large, regional basis (e.g. Beaumont & Vogel 1984; Legassick 2010) whereas others deal with specific topics, also on a regional basis (Couzens 2004; S A Manganese Amcor Ltd. 1977). It is postulated that with the increase of development, e.g. more solar energy facilities, more surveys will be done which would shed light on the distant as well as the more recent past of the region.

5.2.1.1 Survey of the literature
A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted – see list of references in Section 11.

- Information on events, sites and features in the larger region were obtained from these sources.

5.2.1.2 Survey of heritage impact assessments (HIAs)
A survey of HIAs done for projects in the region by various heritage consultants was conducted with the aim of determining the heritage potential of the area – see list of references in Section 11.

- Information on sites and features in the larger region were obtained from these sources.

5.2.1.3 Data bases
The *Heritage Atlas Database,* various SAHRA databases, the *Environmental Potential Atlas*, the *Chief Surveyor General* and the *National Archives of South Africa* were consulted.

- Database surveys produced a number of sites located in the larger region of the proposed development.

5.2.1.4 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources

The results of the above investigation are presented in Figure 3 below – see list of references in Section 11 – and can be summarised as follows:

- Historic structures, inclusive of buildings and bridges, occur in a sporadic manner across the larger landscape as well as in urban centres;
- Formal burial sites occur in a number of places in town.

Based on the above assessment, the probability of cultural heritage sites, features and objects occurring in the study area is deemed to be **very low**.

Table 1: Pre-Feasibility Assessment

Category	Period	Probability	Reference
Natural			
Landscapes		None	
Early hominin	Pliocene – Lower Pleistocene		
	Early hominin	None	
Stone Age	Lower Pleistocene – Holocene		
	Early Stone Age	None	
	Middle Stone Age	Low	Heritage Atlas Database
	Later Stone Age	None	
	Rock Art	None	
Iron age	Holocene		
	Early Iron Age	None	
	Middle Iron Age	None	
	Late Iron Age	Low	Snyman (1986)
Colonial period	Holocene		
	Contact period/Early historic	Possible	Dreyer (2014); Snyman (1986)
	Recent history	Possible	Van Schalkwyk (2016a & b)
	Industrial heritage	None	

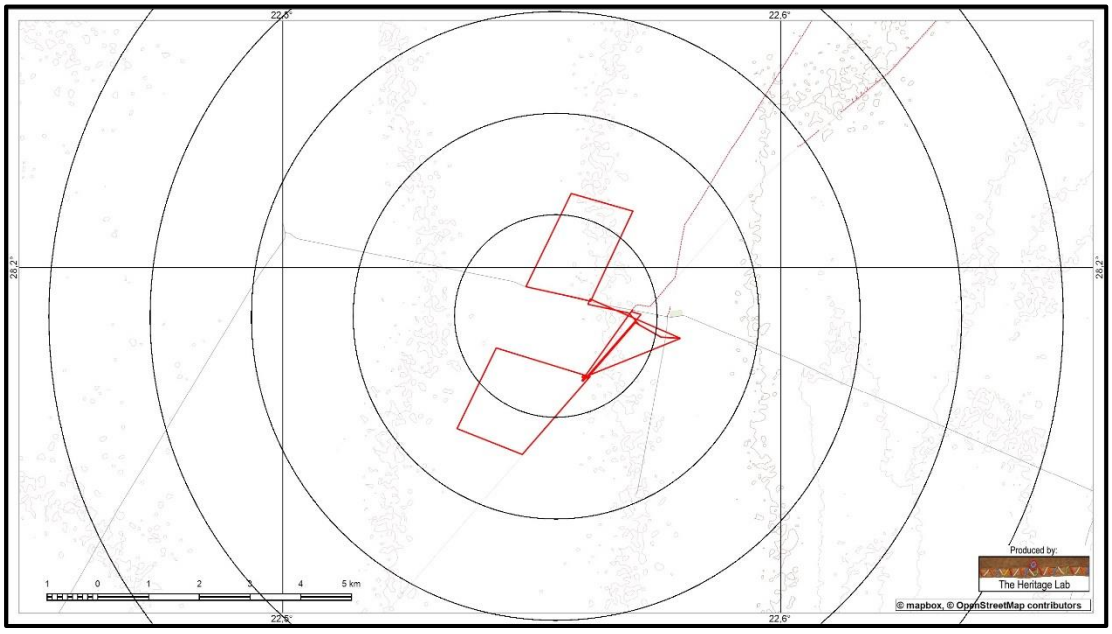

Figure 3. Location of known heritage sites and features in relation to the study area
(Circles spaced at a distance of 2km: heritage sites = coded green dots = none)

5.2.2 *Field survey*

The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible sites, objects and structures. The area that had to be investigated was identified by the *Environamics* by means of maps and .k*ml* files indicating the development area. This was loaded onto an ASUS digital device and used in Google Earth during the field survey to access the areas.

The study area was visited on 22 and 23 January 2020 and was investigated by using internal tracks to access the sites and then walking a number of transects across it – see Fig. 4 below.

- During the site visit, archaeological visibility was good due to the prolonged period of drought in the region which prevented the vegetation cover from re-growing (see Fig. 5 & 6 below).

5.2.3 *Documentation*

All sites, objects and structures that are identified are documented according to the general minimum standards accepted by the archaeological profession. Coordinates of individual localities are determined by means of the *Global Positioning System* (GPS) and plotted on a map. This information is added to the description in order to facilitate the identification of each locality. Map datum used: Hartebeeshoek 94 (WGS84).

The track log and identified sites were recorded by means of a Garmin Oregon 550 handheld GPS device. Photographic recording was done by means of a Canon EOS 550D digital camera.

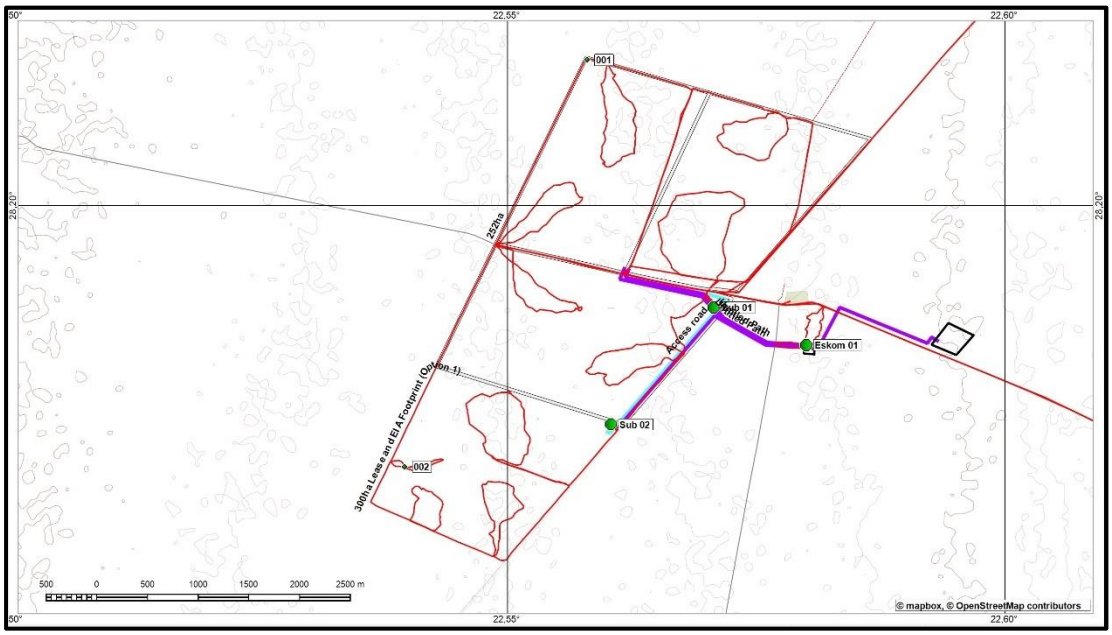

Figure 4. Map indicating the track log of the field survey.
(Please note that as Kgalalelo and Tirisano are located adjacent to each other the track log is continuous)

6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 Natural Environment

The geology of the study area is made up of superficial deposits comprising gravels, clays, sandstone, silcrete, calcrete and aeolian sand. The topography is described as plains and no rivers, outcrops or hills occur in the study area or its immediate vicinity (Fig. 5).

The original vegetation in the study area is classified as Gordonia Plains Shrubland, a savanna biome forming part of the Eastern Kalahari Bushveld Bioregion (Muncina & Rutherford 2006) (Fig. 6).

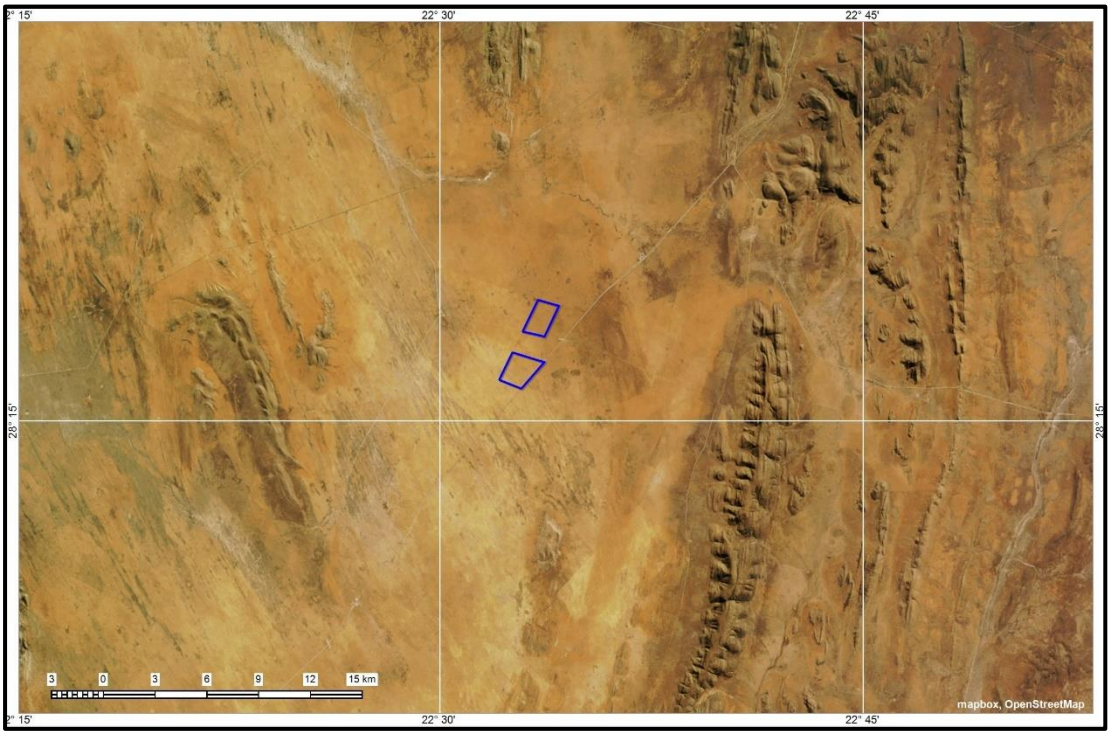

Figure 5. The topography of the larger region

Looking east

Looking south

Farming related features

Eskom substation site

Figure 6. Views over the study area

The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area (Fig. 7) has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.

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.

Figure 7. The Palaeontological sensitivity of the study areas

6.2 Cultural Landscape

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representivity.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial (Stone Age) occupation. The second and much later component is a colonial (farmer) one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 100 years or less.

6.2.1 *Stone Age*

Occupation of the region took place during the Stone Age. Most of this, however, seems to date to the Early Stone Age and centres in the areas where there are hills, e.g. to the east and south. For example,

in the vicinity of Kathu, Beaumont & Morris (1990) and Dreyer (2007) identified to occurrence of extensive Early Stone Age occupation.

Less obvious in its presence are the Later Stone Age sites, some of which are indicated by Beaumont & Vogel (1984). They equate these sites, some which occur in the larger region, with Cape Coastal pottery associated with amorphous LSA (herders) or Wilton (hunter-gatherers) in the period 100 BC to AD 1900.

6.2.3 *Iron Age*

Early Iron Age occupation did not take place in the region and seems as if the earliest people to live settled lives here were those of Tswana-speaking origin (Tlhaping and Tlharo) that settled mostly to the north and a bit to the west of Kuruman. However, they continued spreading westward and by the late 18th century some groups occupied the Langeberg region. With the annexation of the Tswana areas by the British in 1885, the area became known as British Betchuana Land. A number of reserves were set up for these people to stay in. In 1895 the Tswana-speakers rose up in resistance to the British authority as represented by the government of the Cape Colony. They were quickly subjected, and their land was taken away, divided up into farms and given out to white farmers to settle on (Snyman 1986).

6.2.3 *Historic period*

Many early explorers, hunters, traders and missionaries travelled through the area on their way to Kuruman on what was to become known as the "missionary road". Anderson, Burchell, Harris, Holub, Lichtenstein and Moffat are but a few of the better-known names to pass through here.

In 1902 Olifantshoek got its first permanent inhabitant, Edward Finnis and in 1903 Michael Colley opened a shop. The slow growth of Olifantshoek can be attributed to the fact that for many years Deben (Dibeng) was the main seat of the church in the region and local people preferred to go there.

Although prospecting for minerals, especially diamonds occurred in the area and some knowledge was available on the iron deposits, it was only during the 1940s that the extent of the iron and manganese deposits were established, This was followed by the establishment of towns such as Sishen (1952) and Kathu in 1972.

6.3 Site specific review

Although landscapes with cultural significance are not explicitly described in the NHRA, they are protected under the broad definition of the National Estate (Section 3): Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate.

The examination of historical maps and aerial photographs help us to reconstruct how the cultural landscape has changed over time as is show how humans have used the land.

As this is a very isolated region, very little information exists about it. One of the older maps of the region (Fig. 8), dating to 1914, shows an area with no development, apart from a few tracks crossing in different directions, described as "fair going", "very seldom used".

According to archival sources, see Section 11.3 below, the farm Ruby Vale was issued in 1944 by Crown Grant to a certain J.V. Kruger. However, in 1961 this grant was rescinded in Minute no. 1 731. The reason for this is not clear, but in all probability the farm was then sold as a result to somebody else.

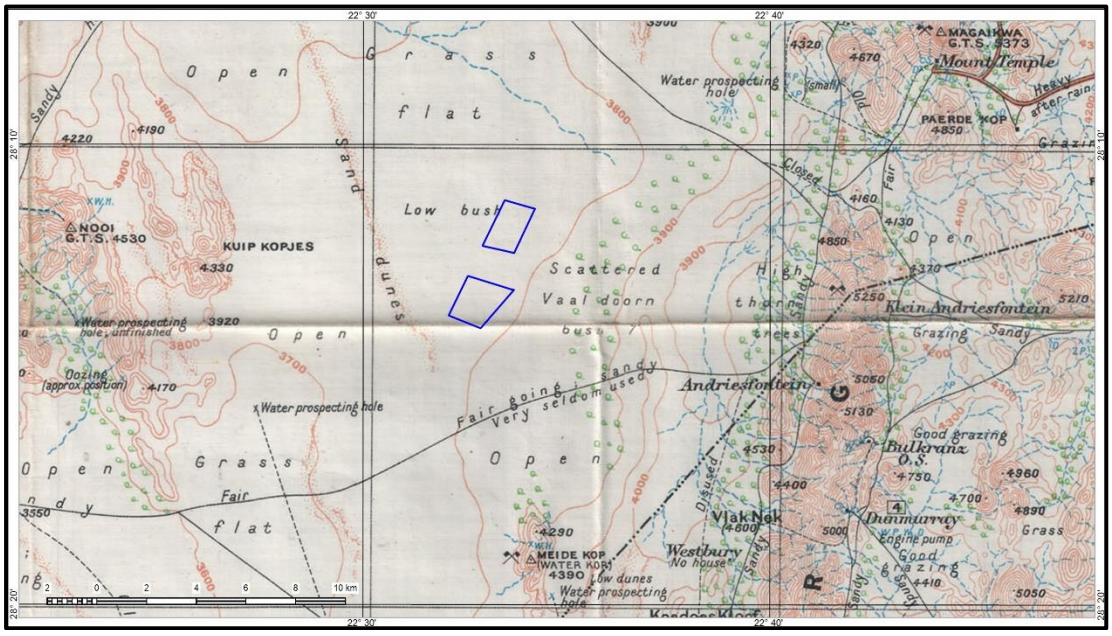

Figure 8. The study areas on the 1914 version of the 1:250 000 topographic map 'Langeberg'

Both the official aerial photograph dating to 1962 (Fig. 9) and the 1971 version of the 1:50 000 topographic map (Fig. 10) shows and landscape empty of development, apart from the Ruby Vale farmstead, fences and a road, which was re-aligned with the later construction of the Sishen-Saldanha railway line. Apart from the construction of the railway line, the situation remains the same, as can be seen on the 2019 aerial photograph (Fig. 11).

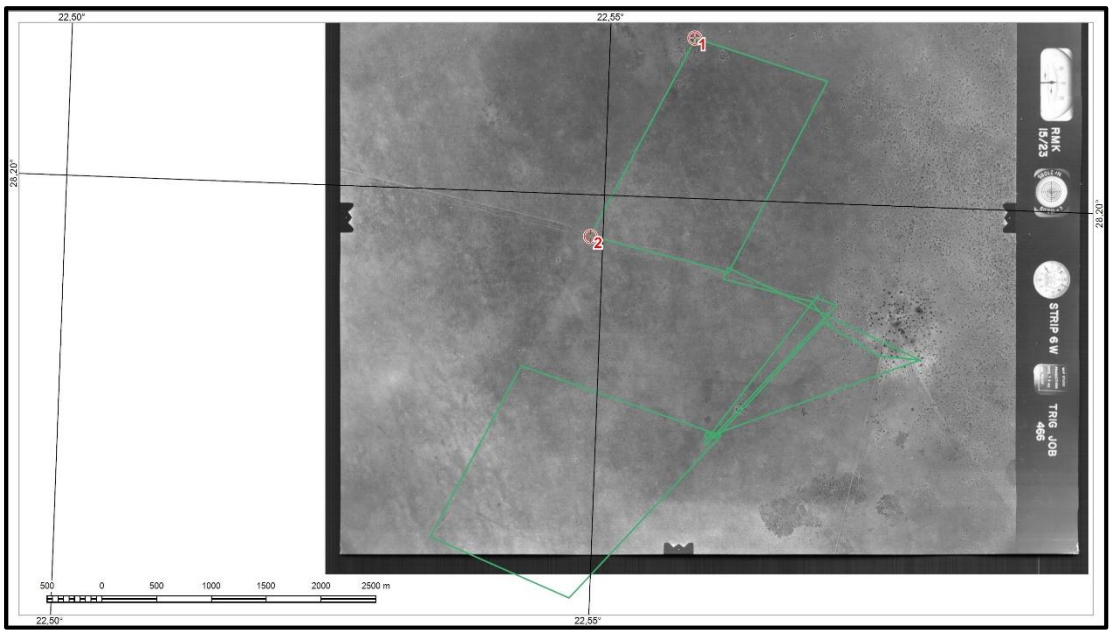

Figure 9. The study area on the 1962 version of the official aerial photograph (Photograph: 466_006_00856) (numbered red wheel-crosses = calibration points)

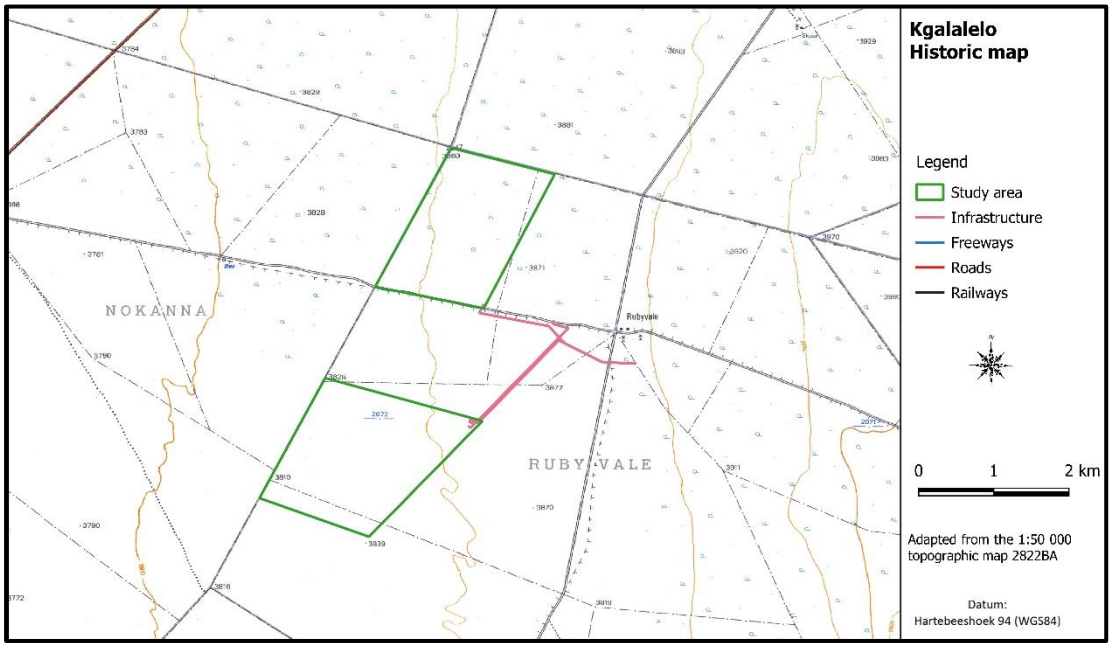

Figure 10. The study area on the 1971 version of the 1:50 000 topographic map

Figure 11. The study area on the 2019 aerial photograph
(Image: Google Earth)

7. SURVEY RESULTS

During the physical survey, the following sites, features and objects of cultural significance were identified in the study area (Fig. 12).

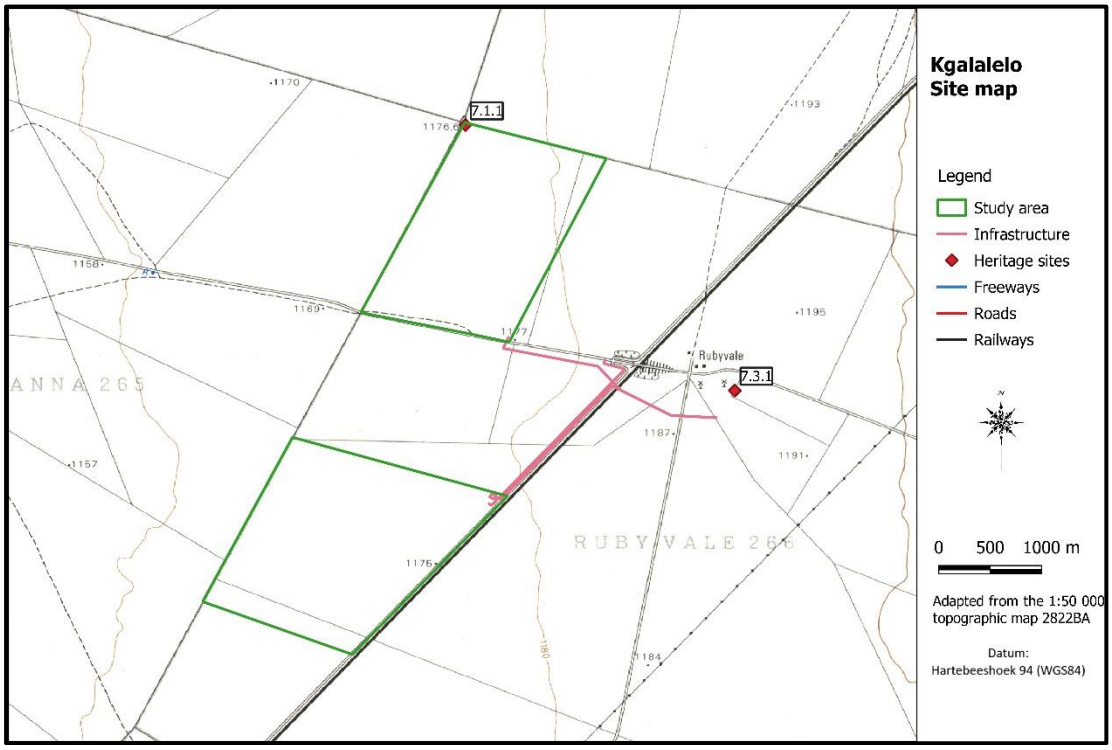

Figure 12. Location of heritage sites in the study area

7.1 Stone Age

NHRA Category	Archaeological resources – Section 35

7.1.1 Type: Surface site. **Farm**: Nokana 265. **Coordinates**: S 28,18688; E 22,55771
Description
Some poorly formed stone tools, classified as side- and end scrapers, dating to the Middle Stone Age was identified. The material seems to originate from the other side of the farm boundary, on the farm Nokana, on what seems to have been a low outcrop of quartzite. It is possible that due to the long exposure of these artefact on the surface, it was spread out over a sizable area, which allowed some to be included on the Ruby Vale side of the fence. Due to the height of the fence, it was impossible to investigate the site in more detail, but it is anticipated that there would be a good number more tools and flakes on the other side of the fence.

Significance of site/feature	Generally protected: Medium significance – Grade IV-B
Reasoned opinion: Occurrences of this type are not generally known from the region.	

Impact assessment
This site is located a few metres outside the study area on the adjacent farm and theoretically there would therefore be no impact on it by the proposed development.
Mitigation
(1) Avoidance/Preserve: Because of its location outside the project development area, it would be possible to avoid this site.

Requirements
Conservation by local authority. Sites should be mitigated before impact. Permit required from SAHRA.

References
-

The factory site

Variety of lithics found on the site

Figure 13. The area where lithics are found and some examples

7.2 Iron Age

- No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

7.3 Historic period

- (7.3.3.1) According to Mr Uys, the farm owner, oral traditional has it that some graves occur at this point. This tradition is largely based on the fact that this is one of the very few places where few large pieces of stone occur on the farm (Van Schalkwyk 2016). However, nothing definite could be identified.
    - The location of this possible feature is indicated simply because of its proximity to the power line. Fortunately, it is far away enough not to be impacted on by the proposed development.

8. IMPACT ASSESSMENT RATINGS AND MITIGATION MEASURES

8.1 Impact assessment

Heritage impacts are categorised as:

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries;
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment;
- Cumulative impacts that are combinations of the above.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development and is summarised in Table 2 below:

Table 2: Calculation of the impact on the identified heritage features

IDENTIFIED HERITAGE RESOURCE: Stone Age site 7.1.1				
Nature: Chance find Stone Age material: These features are rated to have low significance due to their low numbers as well as the fact that the area has already extensively been disturbed due to it being surface material.				
			Without mitigation	With mitigation
Extent			Local area (1)	Local area (1)
Duration			Permanent (5)	Permanent (5)
Intensity			Minor (2)	Minor (2)
Probability			Improbable (2)	Improbable (2)
Significance			Low (16)	Low (16)
Status (positive or negative)			Negative	Neutral
Reversibility			Non-reversible	Non-reversible
Irreplaceable loss of resources?			Yes	No
Can impacts be mitigated			Yes	
Mitigation: Avoidance of site				
Cumulative impact: Limited loss of similar features in the larger landscape.				
Site No.	**Site type**	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
7.1.1	Stone Age tools	Section 35	Medium significance – Grade IV-B	Low (16) Low (16)

Heritage sites	Significance of impact	Mitigation measures
Kgalalelo Solar Power Plant Transmission Line: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Kgalalelo Solar Power Plant Transmission Line: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

8.2 Alternatives assessment

For the purpose of the development of the Kgalalelo Solar Power Plant, two sites were identified: a preferred site as well as an alternative site, both of which were subjected to the heritage assessment. The alternatives are rated as being either preferred, not-preferred, favourable or no preference.

The consideration of the no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed Kgalalelo Solar Power Plant. This alternative would result in no environmental impacts on the study area or surrounding local area. Conversely, any positive community development or socio-economic benefits associated with the SPF would not be realised.

The comparative assessment is provided in Table 3 below.

Table 3: Comparative Assessment of Alternatives

Key

Not Preferred	The alternative will result in a high impact / increase the impact
Preferred	The alternative will result in a low impact / reduce the impact
Favourable	The impact will be relatively insignificant
No preference	All alternatives will result in similar impacts

Alternative	**Preference**	**Reason**
Kgalalelo Solar Power Plant		
Preferred site	No preference	Will not impact on any known sites of cultural heritage significance.
Alternative site	No preference	Will not impact on any known sites of cultural heritage significance.

Alternative	Preference	Reason
No-go alternative	No preference	This alternative would entail maintaining the current land use with no impacts on heritage resources

8.3 Cumulative assessment

The cumulative impact of the proposed Kgalalelo project is assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 60 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of six other plants and are listed in Table 4. From the map 'South African Generation Projects' (Fig. 14) below, it can be seen that the Kgalalelo project is located in an area where little such development has taken place, with the implication that the cumulative impact would be very low.

Table 4: Existing and planned alternative energy generation facilities in the larger region

Name	Nearest town	Technology	Capacity	Status
Kgalalelo	Olifantshoek	Solar PV	115MW	Proposed
Tirisano	Olifantshoek	Solar PV	115MW	Proposed
Jasper	Postmasburg	Solar PV	96MW	Fully operational
Kathu	Kathu	Solar PV	75MW	Fully operational
Lesedi	Postmasburg	Solar PV	64MW	Fully operational
Life	Olifantshoek	Solar PV	115MW	Proposed
Lutzburg	Olifantshoek	Solar PV	115MW	Proposed
Redstone	Postmasburg	Concentrated Solar Thermal	100MW	Awaiting construction

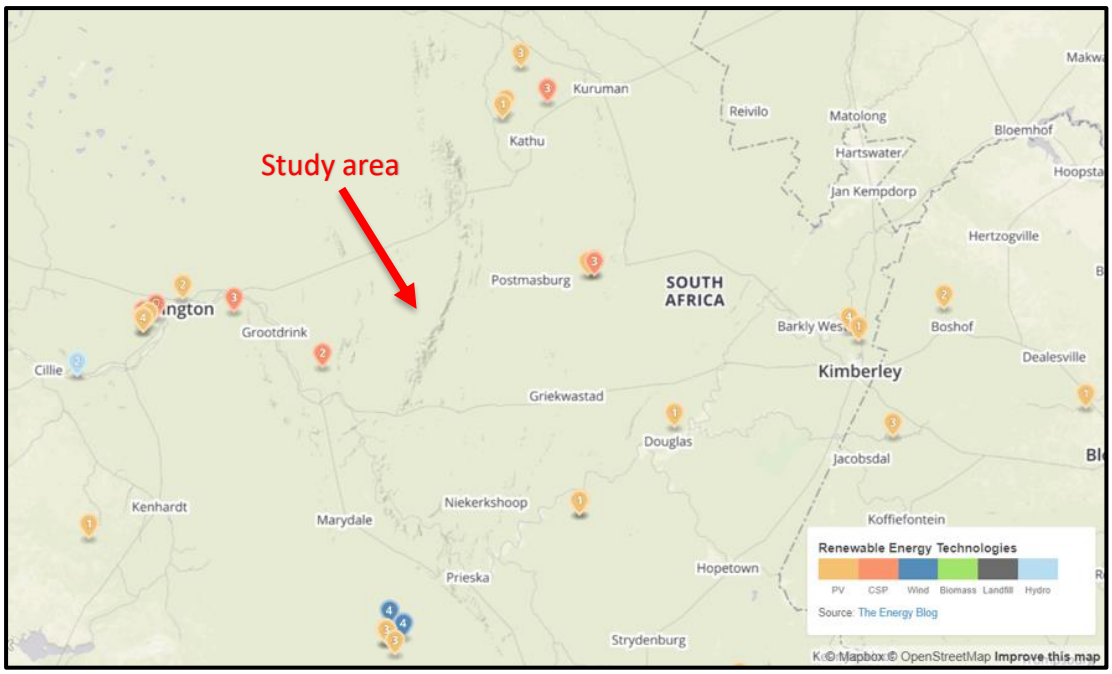

Figure 14. Map indicating the location of alternative energy generation facilities in the larger region (https://www.energy.org.za/map-south-african-generation-projects - accessed 16/01/2020)

The cultural heritage profile of the larger region is very limited. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the colonial element. This manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines. This again has the implication that the cumulative impact would be very low.

Table 5: Cumulative impact assessment summary

Nature: Loss of or damage to sites, features or objects of cultural significance			
	Without mitigation	With mitigation	
Extent	Local area (1)	Local area (1)	
Duration	Permanent (5)	Permanent (5)	
Intensity	Minor (2)	Minor (2)	
Probability	Improbable (2)	Improbable (2)	
Significance	Low (16)	Low (16)	
Status (positive or negative)	Negative	Neutral	
Reversibility	Non-reversible	Non-reversible	
Irreplaceable loss of resources?	High	Low	
Can impacts be mitigated	Yes		
Mitigation: Avoidance of site/excavation if required			
Cumulative impact: Limited loss of similar features in the larger landscape.			
Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-B	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

8.4 Mitigation measures

Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

- (7.1.1): This Middle Stone Age site is located a few metres outside the study area on the adjacent farm and theoretically there would therefore be no impact on it by the proposed development.
    - (5) No further action required.

9. MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

Sources of risk were considered with regards to development activities defined in Section 2(viii) of the NHRA that may be triggered and are summarised in Table 6A and 6B below. These issues formed the basis of the impact assessment described. The potential risks are discussed according to the various phases of the project below.

9.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

9.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

Table 6A: Construction Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure,	See discussion in Section 9.1 above	Environmental Control Officer	During construction only

e.g. access roads, water pipelines			
Monitoring	See discussion in Section 9.2 above		

Table 6B: Operation Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	It is unlikely that the negative impacts identified for pre-mitigation will occur if the recommendations are followed.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

10. CONCLUSIONS AND RECOMMENDATIONS

Kgalalelo Solar Power Plant (RF) (Pty) Ltd is proposing the development of up to 150MW photovoltaic (PV) solar energy plant near Olifantshoek situated in the Tsantsabane Local Municipality in the Northern Cape Province.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial (Stone Age) occupation. The second and much later component is a colonial (farmer) one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 100 years or less.

Identified sites

During the physical survey, the following sites, features or objects that are viewed as having cultural significance have been identified.

- (7.1.1): Some poorly formed stone tools, classified as side- and end scrapers, dating to the Middle Stone Age was identified. The material seems to originate from the other side of the farm boundary, on the farm Nokana, on what seems to have been a low outcrop of quartzite.

Impact assessment and proposed mitigation measures

Because of the low likelihood of finding further significant heritage resources in the relevant areas proposed for development and the generally low density of sites in the wider landscape the overall impacts to the heritage are expected to be of generally low significance.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

Site No.	Site type	NHRA category	Field rating	Impact rating: Before/After mitigation
7.1.1	Stone Age tools	Section 35	Medium significance – Grade IV-B	Low (16)
				Low (16)

Alternatives assessment

A preferred site as well as an alternative site were subjected to the investigation. The alternatives are rated as being either preferred, not-preferred, favourable or no preference. The possibility of a no-go alternative was also considered.

Alternative	Preference	Reason
Kgalalelo Solar Power Plant		
Preferred site	No preference	Will not impact on any known sites of cultural heritage significance.
Alternative site	No preference	Will not impact on any known sites of cultural heritage significance.
No-go alternative	No preference	This alternative would entail maintaining the current land use with no impacts on heritage resources

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	NHRA category	Field rating	Impact rating: Before/After mitigation
Archaeological sites/material	Section 35	Generally protected: Medium significance – Grade IV-B	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

Legal requirements

The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- As there are no areas that need to be avoided, either in the site for the solar energy facility or for the transmission line, it is recommended, from a heritage point of view, that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

11. REFERENCES

11.1 Data bases

Chief Surveyor General
Environmental Potential Atlas, Department of Environmental Affairs and Tourism.
Heritage Atlas Database, Pretoria
National Archives of South Africa
SAHRA Archaeology and Palaeontology Report Mapping Project (2009)
SAHRIS Database

11.2 Literature

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Beaumont, P & Morris, D (eds.) 1990. *Guide to the archaeological sites in the Northern Cape*. Kimberley: McGregor Museum.

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Orton, J. 2016. Prehistoric cultural landscapes in South Africa: a typology and discussion. *South African Archaeological Bulletin* 71:119-129.

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Snyman, P.H.R. 1987. Die rol van Sendelinge, die owerheid en ekonomiese faktore in die ontstaan van Kuruman, 1886-1913. *Contree* 22:5-14.

S A Manganese Amcor Ltd. 1977. Kalahari wealth: the story of manganese, 1926-1976. Cape Town: Purnell

Van Schalkwyk, J.A. 2016a. *Cultural heritage impact assessment for the development of the proposed Life Solar Power Plant on the remaining extent of Portion 2 of the farm Ruby Vale no. 266 registration division Gordonia, Northern Cape Province*. Pretoria: Unpublished report 2016/JvS/028.

Van Schalkwyk, J.A. 2016b. *Cultural heritage impact assessment for the development of the proposed Lutzburg Solar Power Plant on the remaining extent of Portion 2 of the farm Ruby Vale no. 266 registration division Gordonia, Northern Cape Province*. Pretoria: Unpublished report 2016/JvS/028.

11.3 Archival sources, maps and aerial photographs

1: 50 000 Topographic maps
Google Earth
Aerial Photographs: Chief Surveyor-General
Archival resources

Depot: SAB; Source: URU; Volume no: 2173; Reference 1731; Part 1; Date: 1944
Depot: SAB; Source: URU; Volume no: 4173; Reference 621; Part 1; Date: 1961

12. ADDENDUM

1. Indemnity and terms of use of this report

The findings, results, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although all possible care is taken to identify all sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. The author of this report will not be held liable for such oversights or for costs incurred as a result of such oversights.

Although the author exercises due care and diligence in rendering services and preparing documents, he accepts no liability and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

2. Assessing the significance of heritage resources and potential impacts

A system for site grading was established by the NHRA and further developed by the South African Heritage Resources Agency (SAHRA 2007) and has been approved by ASAPA for use in southern Africa and was utilised during this assessment.

2.1 *Significance of the identified heritage resources*

According to the NHRA, Section 2(vi) the **significance** of a heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. SITE EVALUATION			
1.1 Historic value			
Is it important in the community, or pattern of history			
Does it have strong or special association with the life or work of a person, group or organisation of importance in history			
Does it have significance relating to the history of slavery			
1.2 Aesthetic value			
It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group			
1.3 Scientific value			
Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage			
Is it important in demonstrating a high degree of creative or technical achievement at a particular period			
1.4 Social value			
Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons			
1.5 Rarity			
Does it possess uncommon, rare or endangered aspects of natural or cultural heritage			
1.6 Representivity			
Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects			
Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class			
Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.			
2. Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific community			
3. Field Register Rating			
1.	National/Grade 1: High significance - No alteration whatsoever without permit from SAHRA		
2.	Provincial/Grade 2: High significance - No alteration whatsoever without permit from provincial heritage authority.		
3.	Local/Grade 3A: High significance - Mitigation as part of development process not advised.		

4.	Local/Grade 3B: High significance - Could be mitigated and (part) retained as heritage register site	
5.	Generally protected 4A: High/medium significance - Should be mitigated before destruction	
6.	Generally protected 4B: Medium significance - Should be recorded before destruction	
7.	Generally protected 4C: Low significance - Requires no further recording before destruction	

2.2 *Significance of the anticipated impact on heritage resources*

All impacts identified during the HIA stage of the study will be classified in terms of their significance. Issues would be assessed in terms of the following criteria:

Nature of the impact
A description of what causes the effect, what will be affected and how it will be affected.

Extent
The physical **extent**, wherein it is indicated whether:
- 1 - The impact will be limited to the site;
- 2 - The impact will be limited to the local area;
- 3 - The impact will be limited to the region;
- 4 - The impact will be national; or
- 5 - The impact will be international.

Duration
Here it should be indicated whether the lifespan of the impact will be:
- 1 - Of a very short duration (0–1 years);
- 2 - Of a short duration (2-5 years);
- 3 - Medium-term (5–15 years);
- 4 - Long term (where the impact will persist possibly beyond the operational life of the activity); or
- 5 - Permanent (where the impact will persist indefinitely).

Magnitude (Intensity)
The magnitude of impact, quantified on a scale from 0-10, where a score is assigned:
- 0 - Small and will have no effect;
- 2 - Minor and will not result in an impact;
- 4 - Low and will cause a slight impact;
- 6 - Moderate and will result in processes continuing but in a modified way;
- 8 - High, (processes are altered to the extent that they temporarily cease); or
- 10 - Very high and results in complete destruction of patterns and permanent cessation of processes.

Probability
This describes the likelihood of the impact actually occurring and is estimated on a scale where:
- 1 - Very improbable (probably will not happen);
- 2 - Improbable (some possibility, but low likelihood);
- 3 - Probable (distinct possibility);
- 4 - Highly probable (most likely); or
- 5 - Definite (impact will occur regardless of any prevention measures).

Significance
The significance is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high:

S = (E+D+M) x P; where
S = Significance weighting

E = Extent
D = Duration
M = Magnitude
P = Probability

Significance of impact		
Points	Significant Weighting	Discussion
< 30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.
31-60 points	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.

Confidence
This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Status
- The status, which is described as either positive, negative or neutral.

Reversibility
- The degree to which the impact can be reversed.

Mitigation
- The degree to which the impact can be mitigated.

Nature:		
	Without mitigation	With mitigation
Construction Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Operation Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Reversibility		
Irreplaceable loss of resources?		
Can impacts be mitigated		

3. Mitigation measures

- *Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.*

Impacts can be managed through one or a combination of the following mitigation measures:

- Avoidance
- Investigation (archaeological)
- Rehabilitation
- Interpretation
- Memorialisation
- Enhancement (positive impacts)

For the current study, the following mitigation measures are proposed, to be implemented only if any of the identified sites or features are to be impacted on by the proposed development activities:

- (1) Avoidance/Preserve: This is viewed to be the primary form of mitigation and applies where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources. The site should be retained *in situ* and a buffer zone should be created around it, either temporary (by means of danger tape) or permanently (wire fence or built wall). Depending on the type of site, the buffer zone can vary from
    - 10 metres for a single grave, or a built structure, to
    - 50 metres where the boundaries are less obvious, e.g. a Late Iron Age site.

- (2) Archaeological investigation/Relocation of graves: This option can be implemented with additional design and construction inputs. This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated. Mitigation is to excavate the site by archaeological techniques, document the site (map and photograph) and analyse the recovered material to acceptable standards. This can only be done by a suitably qualified archaeologist.
    - This option should be implemented when it is impossible to avoid impacting on an identified site or feature.
    - This also applies for graves older than 60 years that are to be relocated. For graves younger than 60 years a permit from SAHRA is not required. However, all other legal requirements must be adhered to.
        - Impacts can be beneficial – e.g. mitigation contribute to knowledge

- (3) Rehabilitation: When features, e.g. buildings or other structures are to be re-used. Rehabilitation is considered in heritage management terms as an intervention typically involving the adding of a new heritage layer to enable a new sustainable use.
    - The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
    - Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
        - Conservation measures would be to record the buildings/structures as they are (at a particular point in time). The records and recordings would then become the 'artefacts' to be preserved and managed as heritage features or (movable) objects.
        - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (4) Mitigation is also possible with additional design and construction inputs. Although linked to the previous measure (rehabilitation) a secondary though 'indirect' conservation measure would be to use the existing architectural 'vocabulary' of the structure as guideline for any new designs.
    - The following principle should be considered: **heritage informs design**.
        - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (5) No further action required: This is applicable only where sites or features have been rated to be of such low significance that it does not warrant further documentation, as it is viewed to be fully documented after inclusion in this report.
    - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage/remains are destroyed.

4. Relocation of graves

If the graves are younger than 60 years, an undertaker can be contracted to deal with the exhumation and reburial. This will include public participation, organising cemeteries, coffins, etc. They need permits and have their own requirements that must be adhered to.

If the graves are older than 60 years old or of undetermined age, an archaeologist must be in attendance to assist with the exhumation and documentation of the graves. This is a requirement by law.

Once it has been decided to relocate particular graves, the following steps should be taken:

- Notices of the intention to relocate the graves need to be put up at the burial site for a period of 60 days. This should contain information where communities and family members can contact the developer/archaeologist/public-relations officer/undertaker. All information pertaining to the identification of the graves needs to be documented for the application of a SAHRA permit. The notices need to be in at least 3 languages, English, and two other languages. This is a requirement by law.
- Notices of the intention needs to be placed in at least two local newspapers and have the same information as the above point. This is a requirement by law.
- Local radio stations can also be used to try contact family members. This is not required by law, but is helpful in trying to contact family members.
- During this time (60 days) a suitable cemetery need to be identified close to the development area or otherwise one specified by the family of the deceased.
- An open day for family members should be arranged after the period of 60 days so that they can gather to discuss the way forward, and to sort out any problems. The developer needs to take the families requirements into account. This is a requirement by law.
- Once the 60 days has passed and all the information from the family members have been received, a permit can be requested from SAHRA. This is a requirement by law.
- Once the permit has been received, the graves may be exhumed and relocated.
- All headstones must be relocated with the graves as well as any items found in the grave.

Information needed for the SAHRA permit application

- The permit application needs to be done by an archaeologist.
- A map of the area where the graves have been located.
- A survey report of the area prepared by an archaeologist.
- All the information on the families that have identified graves.
- If graves have not been identified and there are no headstones to indicate the grave, these are then unknown graves and should be handled as if they are older than 60 years. This information also needs to be given to SAHRA.
- A letter from the landowner giving permission to the developer to exhume and relocate the graves.
- A letter from the new cemetery confirming that the graves will be reburied there.
- Details of the farm name and number, magisterial district and GPS coordinates of the gravesite.

5. Curriculum vitae

Johan Abraham van Schalkwyk

Personal particulars

Date of birth:	14 April 1952
Identity number:	520414 5099 08 4
Marital status:	Married; one daughter
Nationality:	South African

Current address: home

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Mobile: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

Qualifications

1995 DLitt et Phil (Anthropology), University of South Africa
1985 MA (Anthropology), University of Pretoria
1981 BA (Hons), Anthropology, University of Pretoria
1979 Post Graduate Diploma in Museology, University of Pretoria
1978 BA (Hons), Archaeology, University of Pretoria
1976 BA, University of Pretoria

Non-academic qualifications

12th HSRC-School in Research Methodology - July 1990
Dept. of Education and Training Management Course - June 1992
Social Assessment Professional Development Course - 1994
Integrated Environmental Management Course, UCT - 1994

Professional experience

Private Practice
2017 - current: Professional Heritage Consultant

National Museum of Cultural History
1992 - 2017: Senior researcher: Head of Department of Research. Manage an average of seven researchers in this department and supervise them in their research projects. Did various projects relating to Anthropology and Archaeology in Limpopo Province, Mpumalanga, North West Province and Gauteng. Headed the Museum's Section for Heritage Impact Assessments.
1978 - 1991: Curator of the Anthropological Department of the Museum. Carried out extensive fieldwork in both anthropology and archaeology

Department of Archaeology, University of Pretoria
1976 - 1977: Assistant researcher responsible for excavations at various sites in Limpopo Province and Mpumalanga.

Awards and grants

1. Hanisch Book Prize for the best final year Archaeology student, University of Pretoria - 1976.
2. Special merit award, National Cultural History Museum - 1986.
3. Special merit award, National Cultural History Museum - 1991.
4. Grant by the Department of Arts, Culture, Science and Technology, to visit the various African countries to study museums, sites and cultural programmes - 1993.
5. Grant by the USA National Parks Service, to visit the United States of America to study museums, sites, tourism development, cultural programmes and impact assessment programmes - 1998.
6. Grant by the USA embassy, Pretoria, under the Bi-national Commission Exchange Support Fund, to visit cultural institutions in the USA and to attend a conference in Charleston - 2000.
7. Grant by the National Research Foundation to develop a model for community-based tourism - 2001.

8. Grant by the National Research Foundation to develop a model for community-based tourism - 2013. In association with RARI, Wits University.

Publications
Published more than 70 papers, mostly in scientifically accredited journals, but also as chapters in books.

Conference Contributions
Regularly presented papers at conferences, locally as well as internationally, on various research topics, ranging in scope from archaeology, anthropological, historical, cultural historical and tourism development.

Heritage Impact Assessments
Since 1992, I have done more than 2000 Phase 1 and Phase 2 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.