SOLARESERVE (PTY) LTD

POWERLINES FOR PROPOSED ROOIPUNT SOLAR THERMAL POWER PARK PROJECT NEAR UPINGTON, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Heritage Impact Assessment

Issue Date: 22 May 2016
Revision No.: 1
Project No.: 13621

Date:	*22 05 2016*
Document Title:	Heritage Impact Assessment
Author:	*Dr Jeremy Hollmann / Wouter Fourie*
Revision Number:	*1*
Checked by:	*Shaun Taylor*
For:	*SiVEST Environmental Division*

EXECUTIVE SUMMARY

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Report (EIA) for the proposed Rooipunt Solar Thermal Power Park Project on the Farm Rooipunt 617 near Upington in ZF Mgcawu District Municipality, Northern Cape Province.

An archival and historical desktop study was undertaken which was used to compile a historical layering of the study area within its regional context. This component indicated that the landscape within which the project area is located has a rich and diverse history. The desktop assessment identified numerous heritage studies conducted within the assessment area, however none of the heritage resources identified outside of the original Rooipunt study area is of high heritage significance and no further mitigation will be required on these.

The mitigation measures as identified for the heritage resources inside the Rooipunt Solar Thermal Power Parkproject area are still valid and must be applied as per the EMP developed for the development.

These desktop studies were followed by a fieldwork component that comprised driving and walking through the study area. Only one heritage recourse (DYK001) of significance was identified in the assessment area and the required mitigation is listed below:

- Mitigation would be required if the development came closer than 50 m to the abandoned mine.
- In this case the heritage resource should be photographed and drawn to record the details of its construction before destruction.
- The documentation should be archived on SAHRIS and with the MacGregor Museum, Kimberley.

Palaeontological recommendations

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels be identified (e.g. during geotechnical investigations) within the development footprint, however, these should be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (e.g. comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed.

In all cases, whether or not a professional palaeontologist is involved in mitigation:

- The ECO responsible for the development should be aware of the possibility of important fossils being present or unearthed on site and should monitor all substantial excavations into fresh (i.e. unweathered) sedimentary bedrock for fossil remains;
- In the case of any significant fossil finds (e.g. vertebrate teeth, bones, burrows, petrified wood, calcretised termitaria) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (South African Heritage Resources Agency. Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense;
- These recommendations should be incorporated into the EMP for the solar energy facility development.
- The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere to the minimum standards for Phase 2 palaeontological studies recently published by SAHRA

The overall impact evaluation has shown that the pre-mitigation impact on heritage resources is rated as High negative, however the implementation of the recommended mitigation measures will reduce this impact to a low negative impact.

Comparative Assessment

The table below provides an assessment and rating of the preferred corridor and alignments for the project.

Rooipunt Solar Thermal Power Park Project 132kV Overhead Power Line – Comparative Assessment Table

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
POWER LINE CORRIDORS		
Corridor Option 1 (Blue)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the

Alternative	Preference	Reasons
		final alignment to avoid the identified heritage resources.
Corridor Option 2 (Orange)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.
Corridor Option 3 (Green)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.

The development of the Rooipunt Solar Thermal Power Park Project power lineand the associated infrastructure may therefore continue if the recommendations as outlined in this report are adhered to.

CONTENTS **PAGE**

LIST OF APPENDICES

1 INTRODUCTION

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Assessment Report (EIA) for the overhead power line (OHL) and associated infrastructure for the Rooipunt Solar Thermal Power Park Project on the Farm Rooipunt 617 near Upington in ZF Mgcawu District Municipality, Northern Cape Province.

1.1 Scope of the Study

The aim of the study is to identify any heritage resources that may occur within the corridors proposed for the OHL for the Rooipunt Solar Thermal Power Park Project. The HIA aims to inform the BA in the development of a comprehensive EMPr to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This HIA was compiled by PGS Heritage (PGS).

The staff at PGS has combined experience of nearly 60 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 its staff has the relevant expertise and experience to undertake that work competently.

Dr Jeremy Hollmann, archaeologist for this project, has over 20 years research and field experience. He is a member of the Association of Southern African Professional Archaeologists (ASAPA) and is accredited as a Field Director.

Wouter Fourie, Project manager for this project, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation, as well as being accredited as a Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP).

1.3 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 immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist 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 as set out below.

1.4 Legislative Context

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

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

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

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Plan (EMP) – Section (34)(b)
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    a. Section 39(3)

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…”. The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases, the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental

Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Sections of these Acts relevant to heritage (Fourie, 2008).

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

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

1.5 Terminology and Abbreviations

Archaeological resources

This includes:

i. 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;
ii. 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;
iii. 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;
iv. 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:

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

Early Stone Age

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

Fossil

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

Heritage

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

Heritage resources

This means any place or object of cultural significance

Holocene

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

Late Stone Age

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

Late Iron Age (Early Farming Communities)

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

Middle Stone Age

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

Palaeontology

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

Table 1 - Abbreviations

Abbreviations	Description
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
EMPr	Environmental Management Programme
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

Refer to **Appendix A** for further discussions on heritage management and legislative frameworks

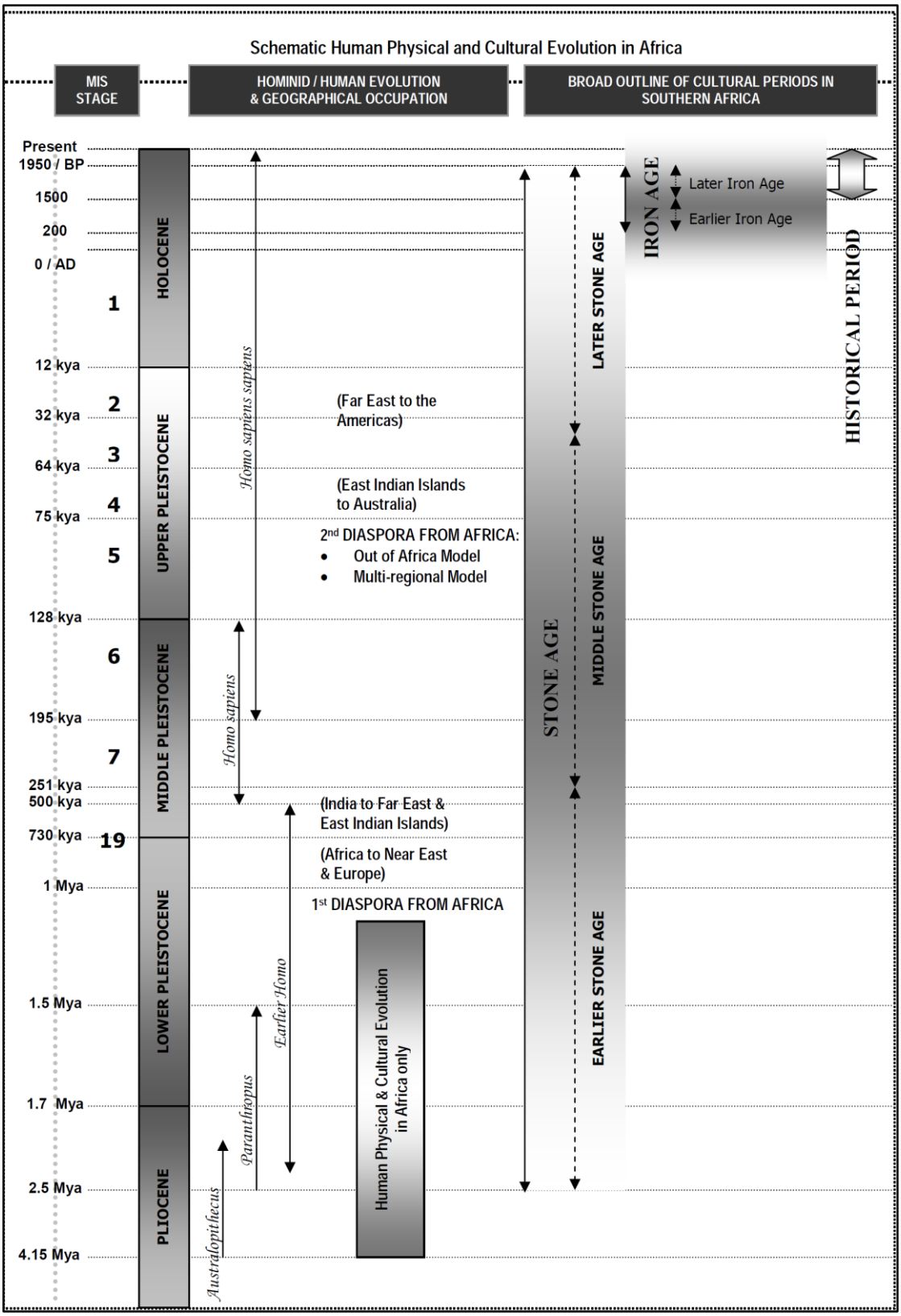


Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 OHL corridors

The project is being proposed in order to evacuate the power generated from the Rooipunt Solar Thermal Power Park Project to the national grid via the new Proposed Upington Main Transmission Substation in the Northern Cape Province. The proposed project will comprise of the following:

a. Construction of one Tern power line of up to 132kV from the proposed Rooipunt Solar Thermal Power Park Project Project. The grid connections that will be assessed include the following:
   - Corridor Option 1 = approximately 17km in length;
   - Corridor Option 2 = approximately 22km in length; and
   - Corridor Option 3 = approximately 24km in length.
b. Install 48 core optical ground wire (OPGW) on the line
c. Build 2 bay substations next to approved substations on the Rooipunt Solar Thermal Power Park Project site. Proposed substations will be approximately 100m x 100m
d. Inclusive of all cable trenches
e. Install 3 x 25m lighting/lightning masts
f. Building of an access road to substation
g. Building of a standard control room (5.5m x 12m) with top entry and cable racks. This will include a sewage system, air-conditioning and energy efficient lighting
h. Installation of a security fence with entrance gates
i. 1 x 132kV line bay and 1 x 132kV metering bay
j. Installation of a required Control Plant, AC/DC, Metering, SCADA and Telecoms
k. V drain extension of substation for drainage purposes
l. And or all extensions required (132kV yard, fencing etc.) of the connecting Eskom Assets i.e. Solar MTS

The location of the proposed substations will be adjacent to the on-site substations of the approved layout of the Rooipunt Solar Thermal Power Park Project, authorized under the EA (DEA Ref: 12/12/20//248804). The footprint of the proposed substations would be approximately 10 000m².

The power lines will consist of a series of towers located approximately 100-200m apart, depending on the terrain and soil conditions. The exact tower type to be used will be determined (based on load and other calculations) during the final design stages of the power lines. It is however likely that the bird friendly mono-pole self-supporting intermediate suspension (single steel pole) structure will be used in combination with various other structures which are usually applied as follows:

m. The mono-pole guyed intermediate suspension structures are normally installed at obvious rocky terrains, where the foundations can have a huge cost impact.
n. The mono-pole angle suspension structures are used on slight angles up to 23°.
o. The mono-pole strain structures are used as 0° in-line strainers with four diagonal stays and at angles from 1° to 110° with a variety of stay configurations to suit the specific application. The structure is also used as a terminal in situations where lines approach towards the substation feeder bay at an angle larger than 45°.

p. The H-pole structures are used for horizontal applications to cross over or under existing power lines where clearances are a problem and are used as terminal structures with an in-line approach to the substation feeder bay.

q. The 3-pole strain structures are normally used at very long spans crossing rivers, valleys, etc. These are very expensive structures, therefor it is not used very often.

The height of the single steel pole structure ranges between 18m and 26.5m in height. The exact location of the towers will also be investigated during the final design stages of the power lines.

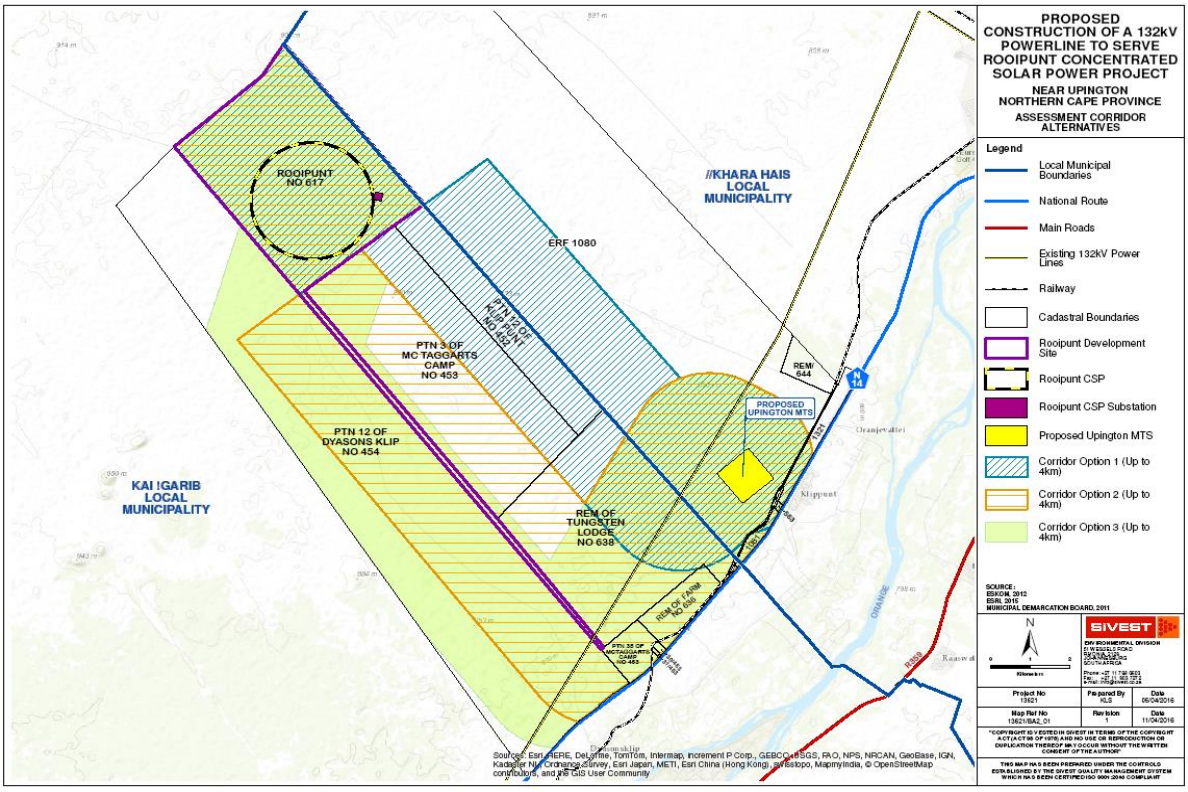


Figure 2 – Locality map of the proposed OHL corridors for the Rooipunt Solar Thermal Power Park Project (Source: SiVEST)

2.2 Site Description

Location	The proposed water supply corridors impact several farms between Upington in the east and Keimoes to the west. The affected area straddles the boundaries of the Kai !Garib and the Khara Hais Local Municipalities
Land Description	The land affected by the development includes vacant land, industrial (renewable), agricultural farming activities and residential areas.

The landscape in which the development is located falls within the Nama-Karoo biome and comprises grass and low shrubs with larger trees confined to water courses.

2.3 Technical Project Description

For the power line component, three corridors have been provided for assessment. The three corridors are up to 4km (2km either side of the centre line) wide originating from the Rooipunt Solar Thermal Power Park Project site routing to the Proposed Eskom Transmission Substation. These three corridors will serve as alternatives to each other for comparative assessment. The registered servitude width will be 31 metres (15.5 metres either side of the centre line). The three power line corridors include the following:

a. Corridor Option 1 (Blue) = approximately 17km in length;
b. Corridor Option 2 (Orange) = approximately 22km in length; and
c. Corridor Option 3 (Green) = approximately 24km in length.

The proposed power line will also include the establishment of all associated infrastructure as required (including but not limited to access roads, control rooms, security systems etc.).

2.4 ASSESSMENT METHODOLOGY

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

2.5 Methodology for Assessing Heritage Site significance

This Heritage Impact Assessment (HIA) report was compiled by PGS Heritage (PGS) for the propose overhead power line (OHL) associated with the Rooipunt CSP Project on the Farm Rooipunt 617 near Upington in ZF Mgcawu District Municipality, Northern Cape Province. The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

Step I – Literature Review: The background information to the field survey relies greatly on the Heritage Background Research.

Step II – Physical Survey: A physical survey was conducted by vehicle and on foot through the proposed project area by a qualified archaeologist, aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

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

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

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- 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:

2.5.1 Site Significance

Site significance classification standards prescribed by the SAHRA (2006) and approved by the ASAPA for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 2: Site significance classification standards as prescribed by SAHRA.

Field Rating	Grade	Significance	Recommended Mitigation
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium Significance	Recording before destruction

Generally Protected C (GP.A)	Grade 4C	Low Significance	Destruction

3 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

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

3.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 3.

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

3.2 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

3.2.1 Rating System Used To Classify Impacts

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

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

1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

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

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

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

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.

51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report.

IMPACT TABLE FORMAT		
Environmental Parameter	*A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water*	
Issue/Impact/Environmental Effect/Nature	*A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water*	
Extent	*A brief description of the area over which the impact will be expressed*	
Probability	*A brief description indicating the chances of the impact occurring*	
Reversibility	*A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity*	
Irreplaceable loss of resources	*A brief description of the degree in which irreplaceable resources are likely to be lost*	
Duration	*A brief description of the amount of time the proposed activity is likely to take to its completion*	
Cumulative effect	*A brief description of whether the impact will be exacerbated as a result of the proposed activity*	
Intensity/magnitude	*A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily*	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	*Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the*	

	mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMP.

4 BACKGROUND RESEARCH

4.1 Archaeological background

Due to the nature of the environment, stratigraphic sequences are rare in excavations, providing very little information about the chronology and lifeways of the people who lived in the region in pre-historic times. Sites usually comprise of open sites where the majority of evidence of human occupation are scatters of lithics (Beaumont et al. 1995).

4.1.1 Early Stone Age (400 000 – 2 million BP)

Human presence in the Orange River region goes back to the Early Stone Age. The Orange River area was marginal or uninhabited for much of the ESA and MSA periods, although Acheulean- era lithics such as blades and prepared cores are present. Very few formal tools such as cleavers and handaxes are found. One site with a stratigraphic sequence has been excavated 35 km southeast of Upington with Acheulean lithics much like that dated elsewhere to 350 000 - 300 000 BP (Beaumont et al. 1995).

4.1.2 Middle Stone Age (30 000 – 300 00 BP)

MSA period stone tools in this region are characterised by blades, convergent flakes and points, as well as advanced prepared cores. There are few extensive MSA sites in the region. The most significant MSA site excavated in the region is located 35 km southwest of Prieska. Here stone tools, ostrich eggshell fragments and the bones of large mammals were found at what is thought to be a base camp for ancestral modern humans. MSA lithics were also found at Zoovoorbij near Keimoes where Levallois platform preparation was used (Beaumont et al. 1995).

4.1.3 Later Stone Age (30 000 BP – recent times)

Our knowledge of the Later Stone Age in the Orange River region is far better than of earlier periods. The earlier LSA sequence is comprised of undated Oakhurst-type tools, followed by a local Wilton industry named Sprinkbokoog. This tradition is characterised by high usage of cryptocrystalline silicates, such as chalcedony, to make backed blades. Other formal tools include small scrapers, bladelets and backed blades. Springbokoog lithics are mostly dated to two periods: 4300-4200 BP and 2600-2300 BP (Beaumont et al. 1995).

Pottery was introduced into the area 2300 years ago and there are two discrete, contemporary stone tool industries associated with pottery remains: Swartkop and Doornfontein. Swartkop is likely to have

developed out of Springbokoog and is characterised by acircular blades as part of the unmodified flake component, a high proportion of backed blades, coarse undecorated pottery shards that commonly contain grass temper, and a few iron items. These sites are usually found near water sources, such as pans and springs, or on the sides of low hills. Stone circles and ovals are sometimes found at these sites and may represent the bases of dwellings. A late phase of this industry can be linked with the /Xam San who lived in the Karoo (Beaumont et al. 1995).

The Doornfontein industry is characterised by the predominance of coarse irregular flakes, frequent use of quartz as a raw material, and very little retouch. Many ceramics are found, which are amphora-like in shape with grit temper and decoration on the necks and rims. Later sites contain some large ostrich eggshell beads, iron objects, and coarser shards with grass temper. Doornfontein sites are found along the Orange River and nearby permanent water sources. This tradition may be associated with Khoekhoen groups, who probably moved into the Orange River area in approximately 2100 BP. Unfortunately, it is difficult to find sites along the river due to agricultural activities and siltation from annual flooding (Beaumont et al. 1995).

Zoovoorbij (Smith 1995) is a rare cave site a few kilometres north of the river between Keimoes and Upington. Interestingly, the occupants mined ochre at the site. The site has a few early MSA layers, characterised by large flake Levallois tools. In the above LSA layers, there were very few formal tools, some micro-blades, bone tools, ostrich eggshell artefacts, and fine grit-tempered pottery. The assemblage from nearby Renosterkop is very similar. Dates from these layers suggest LSA occupation occurred between 2800 and 3080 BP. The assemblage includes Springbokoog and Doornfontein traditions.

Several grave sites have also been excavated at different sites along the Middle Orange, marked by conical stone cairns. Skeletons were usually in a flexed position and there were very few grave goods. Interestingly, red ochre and ashes were found in several graves. A few glass trade beads were also found, dating to between the fifteenth and nineteenth century. These burials date to the historical period and are similar in style to the burial practices of recent Khoekhoen peoples (Morris 1995).

4.1.4 Rock engravings

Rock engravings are principally found in the interior of South Africa and are plentiful in the Northern Cape (Dowson 1992). However, they are concentrated in the Richtersveld to the north west, the Vaal-Harts region to the east and the Karoo south of the Orange (Morris 1988). Here, they have been associated with the /Xam San and their ancestors (Deacon 1997). Engravings are found on rocky outcrops, river beds and boulders. They are made by pecking away the surface of the rock with another rock, incising it with a sharp stone or scraping it off with another stone (Dowson 1992).

Common subjects include large game animals such as eland, rhinoceros, elephants, gemsbok, giraffe and quagga. Human figures are not commonly depicted. Therianthropes (part human, part animal figures) are sometimes depicted, as well as other non-real elements. Geometrics such as grids, zigzags, circles with rays and dots are also commonly found. Human and animal footprints are also sometimes found. Unfortunately, there are no scientific methods for securely dating engravings and research into this is still at an experimental stage (Dowson 1992).

Most engravings were made by the San and were associated with their religious beliefs and rituals. San shamans went into trance to perform certain tasks such as controlling game, protecting the group and rainmaking. Certain animals were believed to hold supernatural power and thus many of the engraved animals can be seen as both sources and symbols of supernatural power. The places where engravings were made were also sources of supernatural power, especially in rainmaking rituals. Certain geometrics such as zigzags and dots are likely to have been associated with forms called entoptics seen whilst in trance (Dowson 1992).

Some engravings–particularly those featuring nonentoptic geometrics and aprons–were probably made by Khoekhoen people. Similar motifs are found in finger painted Khoekhoen rock art sites in certain regions of the Northern Cape, especially in the Vaal-Harts region to the east. A few Khoekhoen rock art sites have been identified in the Middle Orange area. They are typified by finger paintings and roughly pecked engravings of geometrics that are located near water sources (Smith & Ouzman 2004). The complex issues of ethnicity and authorship of engravings are still being researched.

4.2 Previous studies in the area

The South Africa Heritage Information System (SAHRiS) was accessed 20 April 2016 and a list of heritage related studies was compiled as well as significant heritage resources identified during these studies:

- Van der Walt, J. 2011. Heritage Scoping Report for the proposed S Kol Photovoltaic Plant. Keimoes, Northern Cape
- Morris, D. 2013. RE Capital 3 Solar Development on the property Dyasons Klip west of Upington, Northern Cape: Archaeological Impact Assessment – proposed 'central' development footprint
- Almond, J.E. 2014. Palaeontological Heritage Basic Assessment: Desktop Study,
- Proposed RE Capital 3 Solar Development on the property Dyason's Klip near Upington, Northern Cape
- Almond, J.E. 2011. Palaeontological Heritage Basic Assessment: Desktop Study. Proposed Rooipunt Solar Power Park on Farm Rooipunt 617, near Upington, Gordonia District, Northern Cape Province
- Dreyer, C. 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Concentrated Solar Thermal Plant (CSP) At The Farms Olyvenhouts Drift, Upington, Bokpoort 390 and Tampansrus 294/295, Groblershoop, Northern Cape
- Fourie, W. 2011. Heritage Impact Assessment for the proposed Rooipunt CSP development.
- Gaigher, S. 2012. Heritage Impact Assessment for Proposed Establishment of Several Electricity Distribution Lines within the Northern Cape Province
- Durand, J.F. 2013. Palaeontological Scoping Report. Proposed solar energy facility at Tungsten Lodge near Upington, Northern Cape
- Gaigher, S. 2014 Heritage Impact assessment for the Sirius Solar Project on the Remainder of the Farm Tungsten Lodge 638

The studies identified a range of heritage resources that included archaeological (mainly Stone Age) as well as historical heritage resources (mainly associated with mining activities). These heritage resources are indicated in **Figure 3** in relation to the proposed corridors and alignments.

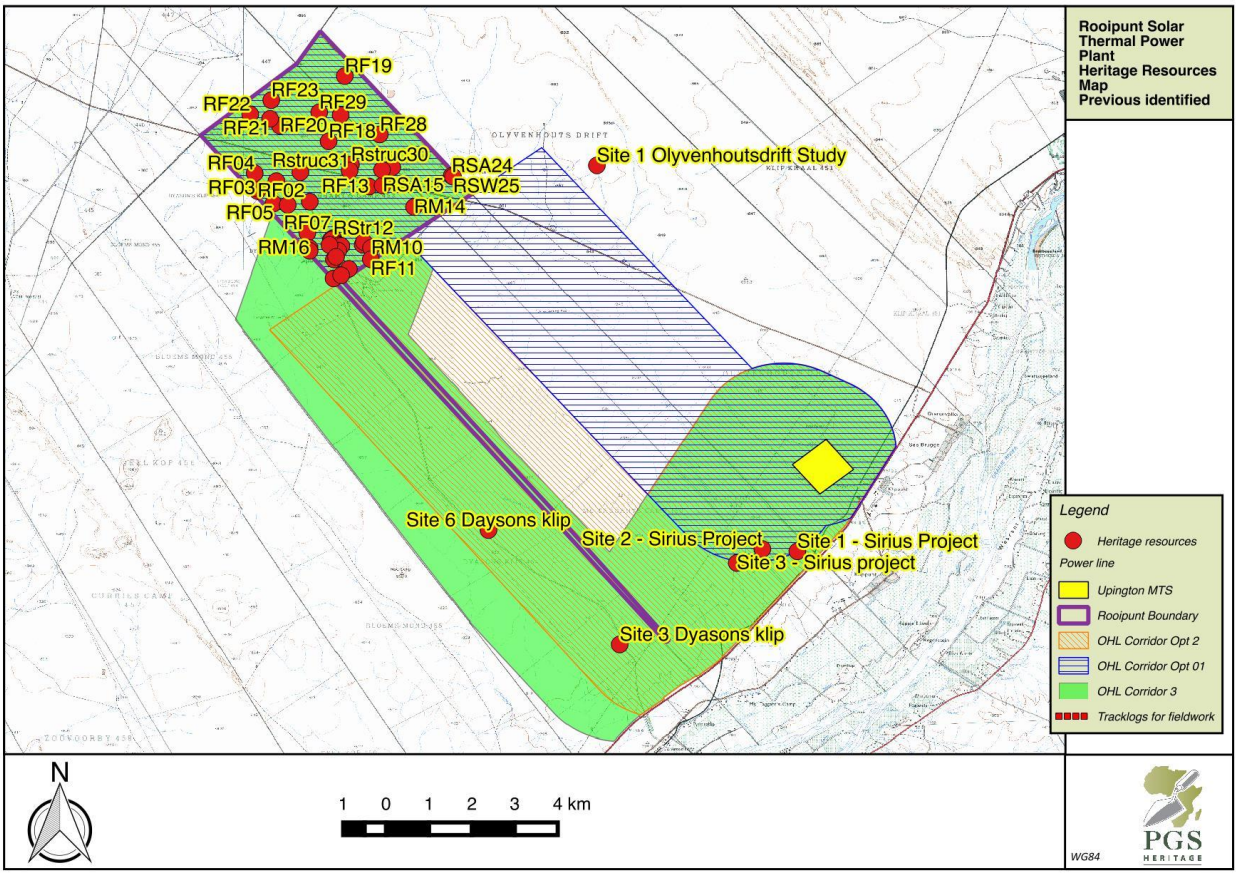


Figure 3 – Heritage resources identified during pervious studies

None of the heritage resources identified outside of the original Rooipunt study area is of high heritage significance and no further mitigation will be required on these.

4.3 Palaeontology

The study area has been covered by Dr John Almond (2011 and 2014) in two separate studies for the Rooipunt as well as the Daysons klip projects. His findings on the Palaoentological potential of the area is summarised verbatim as follows:

The study area is in part underlain by potentially fossiliferous sedimentary rocks of Late Caenozoic age assigned to the Kalahari Group. These mainly comprise Quaternary to Recent calcretes, sandy to gravelly stream alluvium and wind-blown sands. The overall impact significance of the proposed solar energy facility is likely to be LOW, however, because:

- *Much of the study area is underlain by igneous and metamorphic basement rocks (granites, gneisses etc) that are completely unfossiliferous;*

- *The overlying superficial sediments (wind-blown sands, alluvium etc) are generally of low palaeontological sensitivity;*
- *Extensive, deep excavations are unlikely to be involved in this sort of small-scale solar energy project.*

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed alternative energy development. Pending the discovery of substantial new fossil remains during construction, no further specialist palaeontological studies or mitigation for this project are considered necessary.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels be identified (e.g. during geotechnical investigations) within the development footprint, however, these should be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (e.g. comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed. (**Figure 4**)

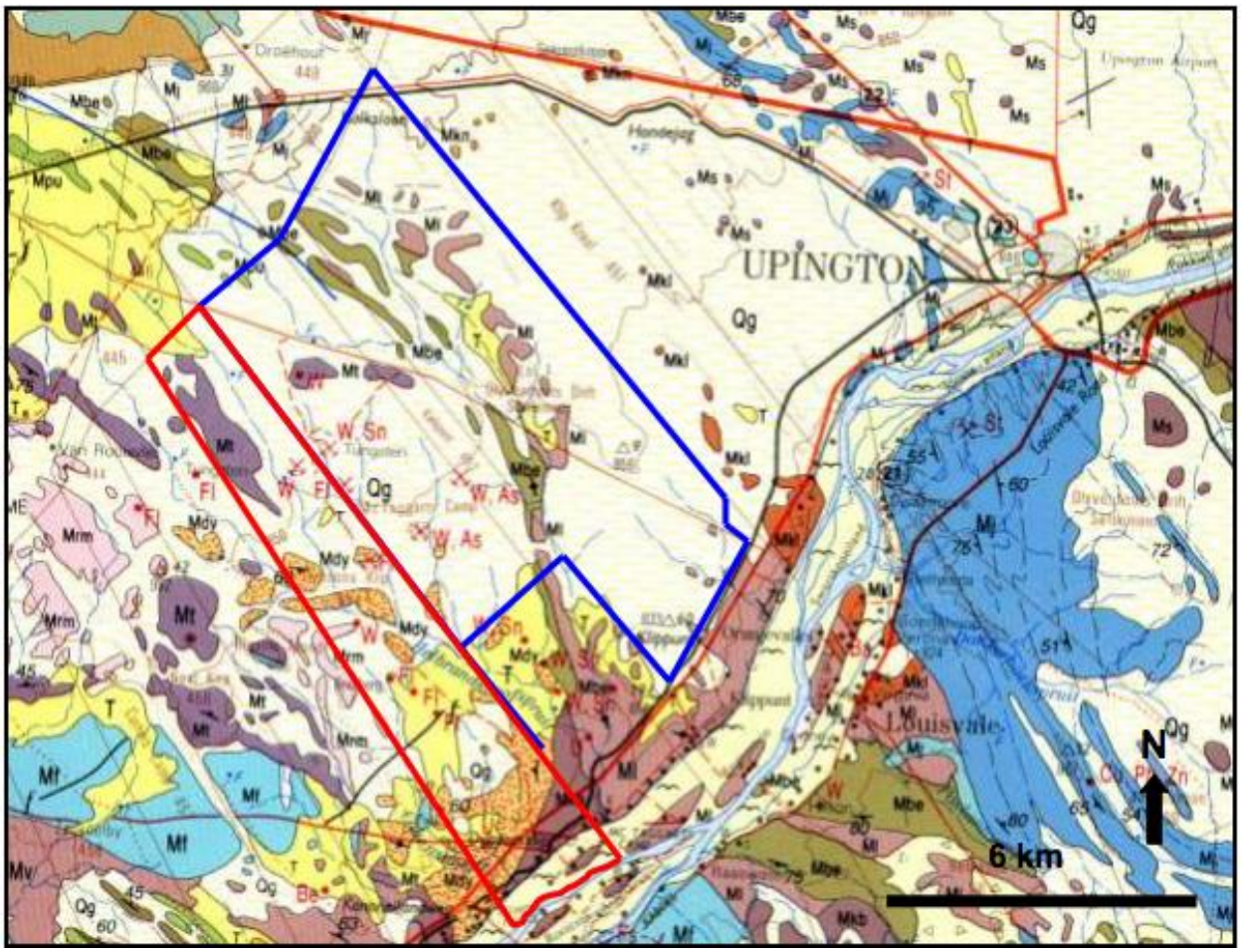


Figure 4 - Extract from 1: 250 000 geological map 2820 Upington (Council for Geoscience, Pretoria) showing the location of Dyason's Klip study area (red polygon), as well as the adjacent Rooipunt Solar Power Plant study area (blue polygon), c. 20-25 km WSW of Upington, Northern Cape Province (blue polygon). Potentially fossiliferous sedimentary rock units mapped within the study area include: Qg (white with yellow stripes) = red aeolian (windblown) sand of Gordonia Formation (Kalahari Group); T (yellow) = Late Caenozoic calcretes (Kalahari Group). The remaining area is underlain by small inliers of unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province, including a range of highly metamorphosed sediments and intrusive igneous rocks (e.g. Mdy – Dyason's Klip Gneiss, Ml – granites of Keimoes Suite, Mka – Kanoneiland Granite, Mt – Korannaland Sequence, Mrm – Riemvasmaak Gneiss). The overall palaeontological sensitivity of the entire study area is LOW. (Almond, 2014)

5 FIELDWORK FINDINGS

The corridors were surveyed by vehicle and on foot by an archaeologist. Various heritage resources were identified, their position marked using a GPS, and photographed. The findings for each of alternatives are described here.

5.1.1 DYK 001

GPS: *S 28° 30' 29.9" E 21° 01' 28.0"*

These co-ordinates mark the headgear for a mineshaft on an abandoned tungsten mine on Portion 12 of Dyason's Klip 456 (Figure 5). This structure and several other ruins, waste piles, roads and diggings cover about 3,5 ha and are the remnants of mining activity carried out between the 1940s and 1970s (Fourie 2014).

Figure 5 - Headgear at the abandoned tungsten mine on Portion 12 of Dyason's Klip 456. The mine area (about 3,5 ha) will require mitigation should development encroach closer than 50 m

The area is about 50 m from the farm track that goes along the boundary fence between Portion 12 of Dyason's Klip 456 and Portion 3 of McTaggert's Camp 453. As the mine was probably in operation from 1940 some of the mining structures are older than 60 years (Fourie 2014), and protected under Section 34 of the NHRA. The old mine is therefore rated as Grade 4B (Medium significance, recording before destruction).

Mitigation:

- Mitigation would be required if the development came closer than 50 m to the abandoned mine.
- In this case the heritage resource should be photographed and drawn to record the details of its construction before destruction.
- The documentation should be archived on SAHRIS and with the MacGregor Museum, Kimberley.

6 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

6.1 Assessment

The methodology utilised in the identification and classification of finds between find spots and sites enable a clear distinction between groupings.

It must be kept in mind that the fieldwork could in no way identify all archaeological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering other Stone Age archaeological site is extremely high.

The following set of tables provide an assessment of the impact on heritage resources within the development foot print

Table 3 - Rating of Impacts – Chance finds

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified heritage resources. As well as the impact on the identified archaeological sites*
Extent	*Will impact on the footprint area of the development*
Probability	*The fieldwork has shown that such a predicted impact will definitely occur*
Reversibility	*Due to the nature of archaeological sites the impact is seen as irreversible, however mitigation could enable the collection of enough information to preserve the data from such a site*
Irreplaceable loss of resources	*The development could lead to significant losses in unidentified and unmitigated site*
Duration	*The impact on heritage resources such as archaeological sites will be permanent*
Cumulative effect	*As the type of development impact on a large area, and other similar development in the area will also impact on archaeological sites the cumulative*

	impact is seen as having a medium negative impact.	
Intensity/magnitude	*The large scale impact on archaeological sites and will require mitigation work.*	
Significance Rating	*The overall significance rating for the impact on heritage resources is seen as high pre-mitigation. This can be attributed to the very definite possibility of encountering more archaeological sites as shown through fieldwork. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	2
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	4	1
Significance rating	-68 (negative High Impact)	-8 (low negative)
Mitigation measures	*Monitoring during construction by an archaeologist* *Mitigation through archaeological excavations and collection* *Walkdown of final power line route*	

The overall impact evaluation has shown that the pre-mitigation impact on heritage resources is rated as High negative, however the implementation of the recommended mitigation measures will reduce this impact to a low negative impact.

6.2 Cumulative impacts

An evaluation of the possible cumulative impacts from the combined solar projects in the area on heritage resources has shown that the biggest envisaged impact could be on the graves of this proposed development

Though with the implementation of mitigation measures these impacts could be mitigated

6.3 Impact Summary

Table 4 provides a summary of the projected impact rating for this project on heritage resources.

Table 4: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	68		8	
			Negative high Impact		Positive Low Impact

6.4 Rooipunt Solar Thermal Power Park Project 132kV Overhead Power Line – Comparative Assessment Table

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
POWER LINE CORRIDORS		
Corridor Option 1 (Blue)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.
Corridor Option 2 (Orange)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.
Corridor Option 3 (Green)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.

7 MANAGEMENT GUIDELINE

7.1 Heritage Management Plan for EMP implementation

No.	Mitigation Measures	Phase	Timeframe	Responsible Party For Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)	Cost
A	Include section on possible heritage finds in induction prior to construction activities take place	Planning /Pre-Construction	Prior to construction	Applicant ECO Heritage Specialist	ECO (Monthly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	No legal directives Legal compliance audit scores (Legal register) (ECO Monthly Checklist/Report)	**R5 000**
B	Implement chance find procedures in case where possible heritage finds area made	Construction	During construction	Applicant ECO Heritage Specialist	ECO (weekly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	ECO Monthly Checklist/Report	**Possibly R10 000**
C	Implement walk down of final alignment on power line alignment	Pre-Construction	Pre-Construction	Applicant ECO Heritage Specialist	Once off	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	Completion and development of mitigation measures	**R40 000**

8 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

Only one heritage recourse (DYK001) of significance was identified in the assessment area and the required mitigation is listed below:

- Mitigation would be required if the development came closer than 50 m to the abandoned mine.
- In this case the heritage resource should be photographed and drawn to record the details of its construction before destruction.
- The documentation should be archived on SAHRIS and with the MacGregor Museum, Kimberley.

9 CONCLUSIONS

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Report (EIA) for the proposed Rooipunt Solar Thermal Power Park Project on the Farm Rooipunt 617 near Upington in ZF Mgcawu District Municipality, Northern Cape Province.

An archival and historical desktop study was undertaken which was used to compile a historical layering of the study area within its regional context. This component indicated that the landscape within which the project area is located has a rich and diverse history. The desktop assessment identified numerous heritage studies conducted within the assessment area, however none of the heritage resources identified outside of the original Rooipunt study area is of high heritage significance and no further mitigation will be required on these.

The mitigation measures as identified for the heritage resources inside the Rooipunt Solar Thermal Power Park Project area are still valid and must be applied as per the EMP developed for the development.

These desktop studies were followed by a fieldwork component that comprised driving and walking through the study area. Only one heritage recourse (DYK001) of significance was identified in the assessment area and the required mitigation is listed below:

- Mitigation would be required if the development came closer than 50 m to the abandoned mine.
- In this case the heritage resource should be photographed and drawn to record the details of its construction before destruction.
- The documentation should be archived on SAHRIS and with the MacGregor Museum, Kimberley.

9.1 Palaeontological recommendations

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels be identified (e.g. during geotechnical investigations) within the development footprint, however, these should

be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (e.g. comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed.

In all cases, whether or not a professional palaeontologist is involved in mitigation:

- The ECO responsible for the development should be aware of the possibility of important fossils being present or unearthed on site and should monitor all substantial excavations into fresh (i.e. unweathered) sedimentary bedrock for fossil remains;
- In the case of any significant fossil finds (e.g. vertebrate teeth, bones, burrows, petrified wood, calcretised termitaria) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (South African Heritage Resources Agency. Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense;
- These recommendations should be incorporated into the EMP for the solar energy facility development.
- The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere to the minimum standards for Phase 2 palaeontological studies recently published by SAHRA

The overall impact evaluation has shown that the pre-mitigation impact on heritage resources is rated as High negative, however the implementation of the recommended mitigation measures will reduce this impact to a low negative impact.

9.2 Comparative Assessment

The table below provides an assessment and rating of the preferred corridor and alignments for the project.

13621 Rooipunt CSP 132kV Overhead Power Line – Comparative Assessment Table Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
POWER LINE CORRIDORS		
Corridor Option 1 (Blue)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.
Corridor Option 2 (Orange)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.
Corridor Option 3 (Green)	No preference	No heritage resources of high significance were identified along the proposed corridor. The width of the corridor makes it possible to design the final alignment to avoid the identified heritage resources.

The development of the Rooipunt Solar Thermal Power Park Project and the associated infrastructure may therefore continue if the recommendations as outlined in this report are adhered to.

10 REFERENCES

ALMOND, J.E. 2014. Palaeontological Heritage Basic Assessment: Desktop Study,

ALMOND, J.E. 2011. Palaeontological Heritage Basic Assessment: Desktop Study. Proposed Rooipunt Solar Power Park on Farm Rooipunt 617, near Upington, Gordonia District, Northern Cape Province

BEAUMONT, P.B., SMITH, A.B., AND VOGEL, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier p236-264. Cape Town: UCT Press.

DEACON, J. 1997. 'My heart stands in the hill': rock engravings in the Northern Cape. Kronos 24: 18-29.

DOWSON, T.N. 1992. The rock engravings of southern Africa. Johannesburg: Witwatersrand University Press.

DREYER, C. 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Concentrated Solar Thermal Plant (CSP) At The Farms Olyvenhouts Drift, Upington, Bokpoort 390 and Tampansrus 294/295, Groblershoop, Northern Cape

DURAND, J.F. 2013. Palaeontological Scoping Report. Proposed solar energy facility at Tungsten Lodge near Upington, Northern Cape

FOURIE, W. 2014. Proposed Rooipunt Solar Power Park near Upington, KAI !GARIB Municiaplity, Northern Cape Province.Heritage Impact Assessment

GAIGHER, S. 2012. Heritage Impact Assessment for Proposed Establishment of Several Electricity Distribution Lines within the Northern Cape Province

GAIGHER, S. 2014 Heritage Impact assessment for the Sirius Solar Project on the Remainder of the Farm Tungsten Lodge 638

MORRIS, A.G. 1995. The Einiqua: an analysis of the Kakamas burials. A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier p110-164. Cape Town: UCT Press.

MORRIS, D. 1988. Engraved in place and time: a review of variability in the rock art of the Northern Cape and Karoo. South African Archaeological Bulletin 43: 109-121.

MORRIS, D. 2013. RE Capital 3 Solar Development on the property Dyasons Klip west of Upington, Northern Cape: Archaeological Impact Assessment – proposed 'central' development footprint

Proposed RE Capital 3 Solar Development on the property Dyason's Klip near Upington, Northern Cape

SMITH, A.B. 1995. Archaeological observations along the Orange River and its hinterland. A. B. Smith (ed.). Einiqualand: studies of the Orange River Frontier p263-300. Cape Town: UCT Press.

SMITH, B.W.S. and Ouzman, S. 2004. Taking stock: identifying Khoekhoen herder rock art in southern Africa. Current Anthropology 45(4): 499-526.

VAN DER WALT, J. 2011. Heritage Scoping Report for the proposed S Kol Photovoltaic Plant. Keimoes, Northern Cape

Appendix A

HERITAGE MANAGEMENT GUIDELINES

1 HERITAGE MANAGEMENT GUIDELINES

1.1 General Management Guidelines

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

(a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

- (i) exceeding 5 000 m^2 in extent; or
- (ii) involving three or more existing erven or subdivisions thereof; or
- (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA.SAHRA;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

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

2. If a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA) and or the Association of Professional Heritage Practitioners (APHP).

This survey and evaluation must include:

(a) The identification and mapping of all heritage resources in the area affected;

(b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;

(c) An assessment of the impact of the development on such heritage resources;

(d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the **SHEQ training** given to contractors involved in surface earthmoving activities. These sections must include basic information on:

   a) Heritage;
   b) Graves;
   c) Palaeontology;
   d) Archaeological finds; and
   e) Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

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

The purpose of an archaeological/palaeontological monitoring programme[1] is:

[1] The definition of an archaeological/palaeontological monitoring programme is a formal program of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified

- To allow, within the resources available, the preservation by recording of archaeological/palaeontological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological/palaeontological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard.
- A monitoring programme is not intended to reduce the requirement for excavation or preservation of known or inferred deposits, and it is intended to guide, not replace, any requirement for contingent excavation or preservation of possible deposits.
- The objective of the monitoring programme is to establish and make available information about the archaeological resource existing on a site.

PGS can be contacted on the way forward in this regard.

Table 5: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage.	The client	Environmental Consultancy and the Archaeologist,

area or site on land, in the inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.

(i.e. integrate the archaeological components into the employee induction course).		
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

1.2 All phases of the project

1.2.1 Archaeology

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

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

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

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

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Programme (EMPr) of the project. Should an archaeological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery.

SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist available to do such work.

1.2.2 Procedure

In the case where archaeological finds are identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological finds, a buffer of at least 20 meters should be implemented.
- If archaeological finds are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find.
- If the evaluation of the finds require further documentation and mitigation such as excavations, surface collections and/or in situ documentation, a permit must be applied from SAHRA.
- This documentation and mitigation must conform to the guidelines and requirements of SAHRA and international accepted standards and must include as a minimum:
    - *Non-technical summary*
      This should outline in plain, non-technical language the principal reason for the work, its objectives and main results. It should include reference to authorship and commissioning body.

    - *Introductory statements*
      These could include acknowledgements, circumstances of the project such as planning background, the archaeological background, an outline nature of work, the site description (including size, geology and topography, location), when the project was undertaken and by whom.

- *Aims and objectives*
  These should reflect or reiterate the aims set out in the project design or specification.

- *Methodology*
  The methods used, including the detail of any variation to the agreed project design or specification should be set out carefully, and explained as appropriate. These should be set out as a series of summary statements, organised clearly in relation to the methods used, and describing structural data, associated finds and/or environmental data recovered. Descriptive material should be clearly separated from interpretative statements. Technical terminology (including dating or period references) should be explained where necessary if the report is aimed at a largely non-archaeological audience. The results should be amplified where necessary by the use of drawings and photographs; and by supporting data contained in appendices (below).

- *Conclusions*
  It is appropriate to include a section, which sums up and interprets the results and puts them into context (local, national or otherwise). Other elements should include a confidence rating on techniques used, or on limitations imposed by particular factors (eg weather or problems of access).

- Archive location
  The final destination of the archive (records and finds) should be noted in the report.

- *Appendices*
  These should contain essential technical and supporting detail, including for example lists of artefacts and contexts or details of measurements, gazetteers etc. It may also be appropriate to include the project design or specification for ease of reference.

- *Illustrations*
  Most reports will need the inclusion of one or more illustrations for clarity; as a minimum a location plan should be included. Any plans or sections should be clearly numbered and easily referenced to the National Grid and related to the specified area.

- *References and bibliography*
  A list of all sources used should be appended to the report.

- *Other*
  Contents list, disclaimers.

1.2.3 Procedure for discovery of human remains / graves

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

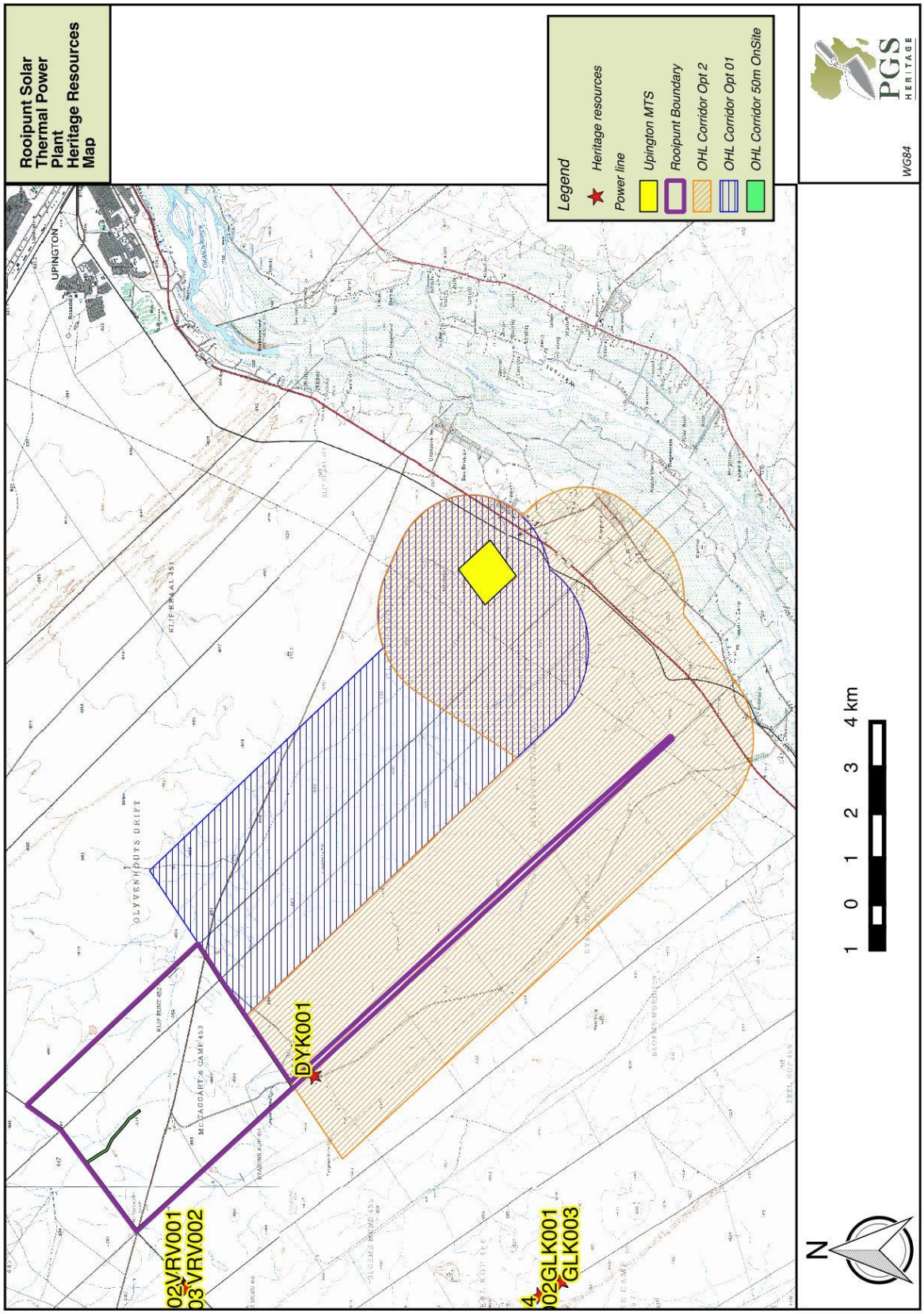
- Upon the accidental discovery of graves, a buffer of at least 20 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA and other relevant authorities. The local South African Police Services must immediately be notified of the find.
- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

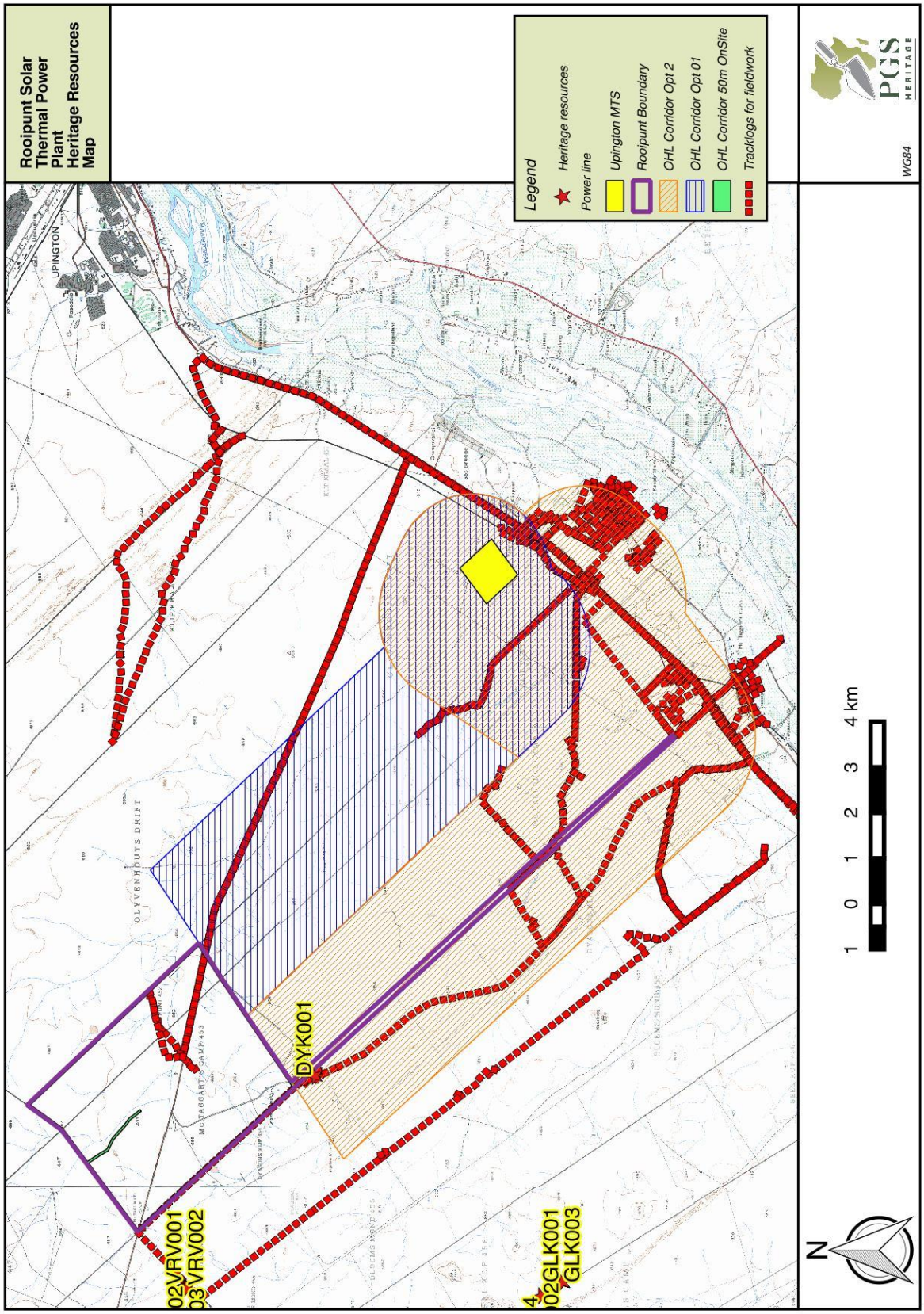
The grave relocation process must include:

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

Appendix B

HERITAGE MAP WITH SURVEY TRACK LOG


Rooipunt Solar Thermal Power Plant Heritage Resources Map
Legend
Heritage resources
Power line
Upington MTS
Rooipunt Boundary
OHL Corridor Opt 2
OHL Corridor Opt 01
OHL Corridor 50m OnSite
PGS HERITAGE
WG84
UPINGTON
OLYVENHOUTS DRIFT
KLIP RIVER 451
MOSAGGART'S CAMP 453
DYK001
02VRV001
03VRV002
4
02GLK001
GLK003
1 0 1 2 3 4 km
N


Rooipunt Solar Thermal Power Plant Heritage Resources Map
Legend
Heritage resources
Power line
Upington MTS
Rooipunt Boundary
OHL Corridor Opt 2
OHL Corridor Opt 01
OHL Corridor 50m OnSite
Tracklogs for fieldwork
PGS HERITAGE
WG84
UPINGTON
OLYVENHOUTS DRIFT
MOSTAGGART
DYK001
02VRV001
03VRV002
4
02GLK001
GLK003
N
1 0 1 2 3 4 km