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PROPOSED CONSTRUCTION OF A 132KV POWER LINE AND ASSOCIATED INFRASTRUCTURE FOR THE EVACUATION OF POWER FROM THE PROPOSED KALKAAR CONCENTRATING SOLAR THERMAL POWER PROJECT ON THE REMAINDER OF PORTION 1 OF THE FARM KALKAAR 389 NEAR JACOBSDAL, FREE STATE AND NORTHERN CAPE PROVINCES

Heritage Impact Assessment

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For:	*SiVEST Environmental Division*

EXECUTIVE SUMMARY

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Assessment Report (BAR) for the Proposed Construction of a 132kV Power Line and Associated Infrastructure for the evacuation of power from the Proposed Kalkaar Concentrating Solar Thermal Power Project on the Remainder of Portion 1 of the Farm Kalkaar 389 near Jacobsdal, Free State and Northern Cape Provinces (the **CSP Project Site'**).

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.

These desktop studies were followed by a fieldwork component that comprised driving and walking through the study area. A total of 27 occurrences of heritage resources were identified within Corridor 2 Alternative 1. Fourteen of these would require mitigation before exhumation (graves) or destruction (historical structures) if development were to come within 20 m. Site Kal1 and Kal2 must be avoided with a 50 meter buffer. Thirteen occurrences of heritage resources have high significance and should not be disturbed by development within 20 m.

It is likely that further survey work in the study area will uncover additional heritage resources, especially graves, ruins and rock art sites on hilltops.

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.

The CSP Project footprint is completely underlain by lower Permian sediments of the Ecca Group of the Karoo Basin (White Hill and Prince Albert Formations), Late Permian Volksrust Formation, and the Karoo Dolerite Suite and Quaternary deposits. The CSP Project footprint as a whole is a fairly flat lying terrain with grassy vegetation cover in places as well as a few thorn trees. The Karoo dolerite Suite is unfossiliferous and the sensitivity in the Quaternary sediments is low. Although the palaeontological sensitivity of the Whitehill, Prince Albert and Volksrust Formations is rated as high to very high, scarcity of fossil-bearing sediments and lack of exposure at the proposed sites indicate that the impact on palaeontological material is negligible and regarded as insignificant."

Comparative Assessment

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

CSP Project – 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		
Kalkaar Solar Thermal Power Project to Corridor 1 Jacobsdal Link	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts. The fossil heritage in the development area is low/ negligible. Formations include: Prince Albert , White Hill and Volksrust Formations and Quaternary sediments
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 1	Not Preferred	Corridor 2 has a large amount of heritage resources that was identified as well as the possible palaeontological significance of large areas of this alignment makes it less favourable that the other two alignments. The fossil heritage in the development area is low/ negligible. Formations include: Prince Albert, White Hill and Volksrust Formations, dolerite and Quaternary sediments.
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 2	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts. The fossil heritage in the development area is low/negligible Formations include

Alternative	Preference	Reasons
		Prince Albert; Volksrust Formations and Karoo Dolerite

The development of the CSP Project may therefore continue if the recommendations as outlined in this report are adhered to.

CONTENTS **PAGE**

1 INTRODUCTION 8

1.1 Scope of the Study 8

1.2 Specialist Qualifications 8

1.3 Assumptions and Limitations 9

1.4 Legislative Context 9

1.5 Terminology and Abbreviations 10

2 TECHNICAL DETAILS OF THE PROJECT 14

2.1 Site Description 15

2.2 Technical Project Description 15

3.1 Methodology for Assessing Heritage Site significance 16

4 Environmental impact assessment methodology 17

4.1 Determination of Significance of Impacts 17

4.2 Impact Rating System 18

5.1 Palaeontology 28

6 FIELDWORK FINDINGS 28

6.1 Focussed fieldwork on possible heritage sensitive areas from the desktop assessment 29

6.2 Site Kal1 and Kal2 30

6.3 Site BEZ 001: 32

6.4 Site BEZ 002: 33

6.5 Site KLP 001: 34

6.6 Site KLP 002 35

6.7 Site KLP 003 36

6.8 Site KLP 004 37

6.9 Site KLP 005 38

6.10 Site KLP 006 39

6.11 Site KLP 007 40

6.12 Site KLP 008 41

6.13 Site KLP 009 42

6.14 Site KLP 010 43

6.15 Site KLP 011 44

6.16 Site KLP 012 45

6.17 Site KLP 013.....46
6.18 Site JDX 001.....47
6.19 Site JDX 002.....48
6.20 Site JDX 003.....49
6.21 Site JDX 004.....50
6.22 Site JDX 005.....51
6.23 Site JDX 006.....52
6.24 Site JDX 007.....53
6.25 Site JDX 008.....54
6.26 Site JDX 009.....55
6.27 Site JDX 010.....56
6.28 Site JDX 011.....56
6.29 Site JDX 012.....57
7 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES..... 57
7.1 Assessment.....58
7.2 Cumulative impacts.....64
7.3 Impact Summary.....64
7.4 Kalkaar Solar Thermal Power Project Powerline – Comparative Assessment Table65
8 Management Guideline..... 67
8.1 Heritage Management Plan for EMP implementation.....67
9 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS..... 68
10 CONCLUSIONS..... 69
10.1 Comparative Assessment.....69
11 REFERENCES..... 71
12 HERITAGE MANAGEMENT GUIDELINES 74
12.2 All phases of the project.....77

LIST OF APPENDICES

A Heritage Management Guidelines
B Heritage Map and Survey Tracklog

1 INTRODUCTION

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Assessment Report (BAR) for the proposed 132kV Power Line and associated infrastructure (the '**Power line Project**') for the evacuation of power from the proposed Kalkaar Concentrating Solar Thermal Power Project (the "**CSP Project**") on the Remainder of Portion 1 of the Farm Kalkaar 389 near Jacobsdal in the Free State Province and Northern Cape Provinces (the **CSP Project Site'**).

1.1 Scope of the Study

The overall aim of the study is to identify any heritage resources that may occur within the corridors proposed for powerline routes for the CSP Project. The HIA aims to inform the Basic Assessment (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
DWA	Department of Water Affairs
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

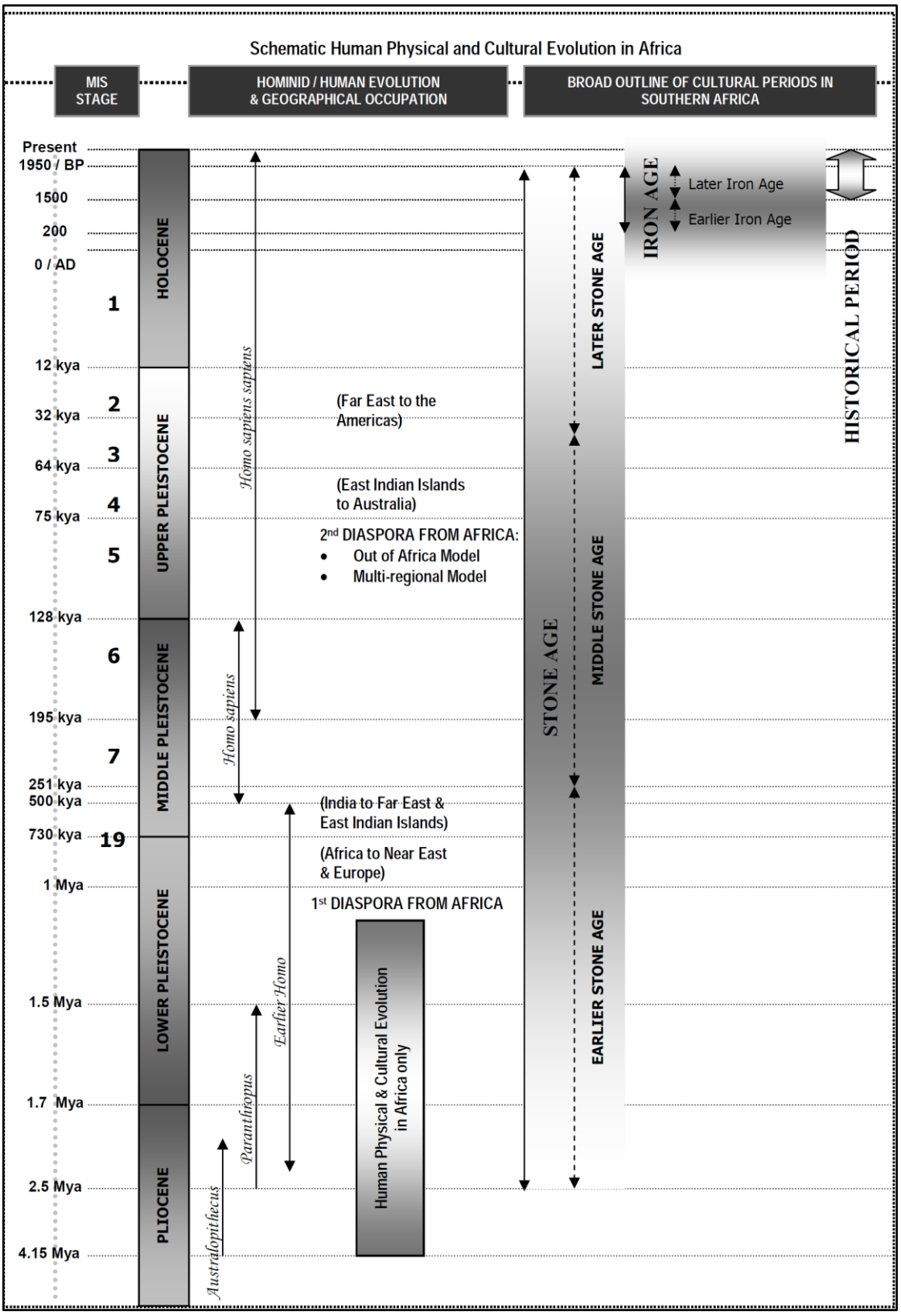

Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

The Project is being proposed in order to evacuate the power generated at the CSP Project to the national grid. The preferred evacuation point for the electricity generated by the CSP Project is from the Jacobsdal Substation via the Project Substation (which is situated on the CSP Project Site) and terminating at the Kimberley Distribution Substation ('**KDS**') to Boundary Substation near Kimberley. As such, in order to evacuate the electricity generated by the CSP Project, this environmental authorisation process was undertaken to assess the environmental feasibility of the proposed Power line Project to the aforementioned interconnection point. Importantly, it must be noted that the grid connection solution proposed for the CSP Project will only be finalised by Eskom at the Budget Quote stage of Eskom's Load and Demand Network Integration Studies. The preliminary Load and Demand Network Integration Studies have however shown that Eskom may require that the CSP Project is to evacuate power not only via the KDS to the Boundary Substation but also to the Jacobsdal Substation.

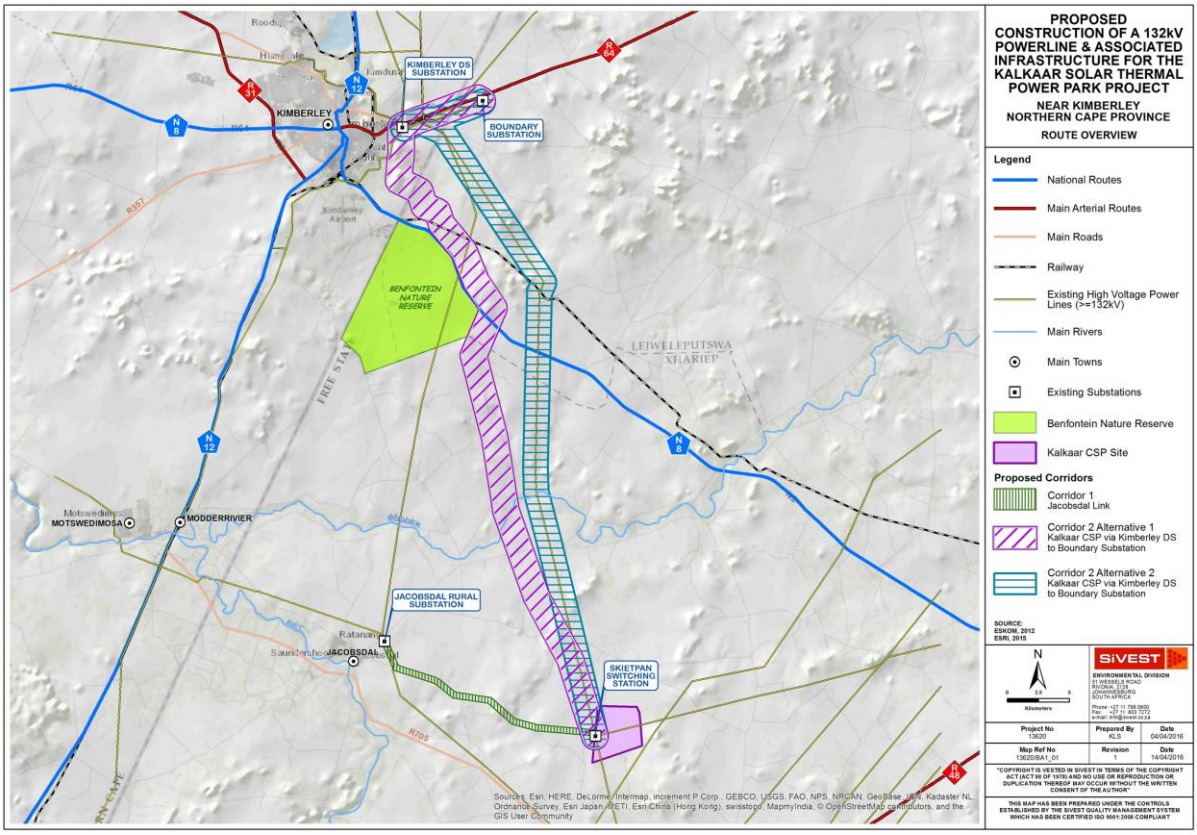

Figure 2 – Locality map of the proposed powerline corridors for the Kalkaar Solar Thermal Power Project (Source: SiVEST)

2.1 Site Description

Location	The proposed Power line Project study area is located primarily within the Free State Province, with a relatively small portion cited in the Northern Cape Province near Kimberley. The proposed Power line Project traverse the Lejweleputswa District Municipality in the Free State Province and the Frances Baard District Municipality in the Northern Cape Province. More specifically, the proposed Power line Project traverse into the Tokologo and Letsemeng Local Municipalities in the Free State Province and the Sol Plaatje Local Municipality in the Northern Cape Province. Land uses for the Power line Project encompasses mainly mining, industrial (renewable), agricultural farming activities and urban as well as residential areas.

2.2 Technical Project Description

Three power line corridors were assessed. Two of the three corridors are up to 2km (1km either side of the centre line) wide originating from the CSP Project Site routing via the KDS to the Boundary Substation. The aforementioned two corridors will serve as alternatives to each other for the comparative assessment. An additional corridor of 500m in width (250m either side of the centre line) is required for the CSP Project interconnection solution, from the Jacobsdal Substation to the CSP Project Site before evacuating the power to the Boundary-Kimberley substations. This route is not subject to an alternative assessment, but environmental considerations will be applied to determine the alignment best suited to the receiving environment within this corridor.

Eskom dictates the size of the servitude and there is a possibility that larger servitudes will be required. However, at this stage, it is anticipated that the registered servitude width will be 31 metres (15.5 metres either side of the centre line) or unless otherwise required by Eskom.

The three power line corridors include the following:

- Corridor 1 (Green) – Jacobsdal Substation – CSP Project Site (approximately 19km in length); ***This corridor is needed to complete the interconnection solution using Corridor 2 to evacuate the power to the KDS and Boundary Substations***.
- Corridor 2 Alternative 1 (Purple) – CSP Project Site via KDS to Boundary Substation (approximately 61km in length); and
- Corridor 2 Alternative 2 (Turquoise) – CSP Project Site via KDS to Boundary Substation (approximately 62km in length).

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

3 ASSESSMENT METHODOLOGY

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

3.1 Methodology for Assessing Heritage Site significance

This Heritage Impact Assessment (HIA) report was compiled by PGS Heritage (PGS) for the Power line Project. 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:

3.1.1 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

4 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.

4.1 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.

4.2 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.

4.2.1 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.*

5 BACKGROUND RESEARCH

The aim of the archival background research is to identify possible heritage resources that could be encountered during fieldwork, as summarised in **Table 3**.

Table 3 - Summary of History of the Jacobsdal Area

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA). The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as Oldowan which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago. No recorded sites were located during the desktop study.
250 000 to 40 000 years ago	The Middle Stone Age (MSA). The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. It is associated with flakes, points and blades manufactured by means of the prepared core technique. No recorded sites were located during the desktop study.
40 000 years ago to the historic past	The Later Stone Age is the third phase in South Africa's Stone Age history. It is associated with an abundance of very small stone artefacts (microliths). The Later Stone Age is also associated with rock engravings and rock paintings. Rock engravings are known from the wider vicinity of the study area (Bergh, 1998). Burkitt (1928) mentions two Late Stone Age sites on the farm Brakfontein, 24km from Fauresmith on the Koffiefontein Road: one yielded Smithfield lithics and the other yielded Fauresmith lithics. A site with engravings is mentioned on a koppie called Afvallingskop, located on the road from Koffiefontein to Jacobsdal, just outside Koffiefontein. This koppie had many boulders strewn over the flat top which had been engraved.
AD 200 - 900	Early Iron Age (EIA). No recorded sites were located during the desktop study.
AD 900 - 1300	Middle Iron Age (MIA). No recorded sites were located during the desktop study.
AD 1300 - 1840	Late Iron Age (LIA).

	A specific type of settlement known as “Type R” settlements is limited to the Riet River between Kalkfontein Dam in the east and the hilly country around the village of Plooysburg in the west, a distance of some 130 km. Maggs (1971) has identified a large number, consisting of at least 78 settlement units, in the eastern half of this area between Kalkfontein Dam and the town of Jacobsdal. From here there is a gap of about 50 km until the settlement at Driekops Eiland is reached. In this area north and west of Plooysburg are an additional six or more settlement units. (Maggs, 1971)
AD 1859	Historical period. The town of Jacobsdal derives its name from Christoffel Jacobs who made a portion of his farm Kalkfontein available for the establishment of the town. The layout of the town commenced in 1859 and the town obtained municipal status in 1860. The Riet River irrigation settlement starts about 3 km west of the town and extends 15 km upstream to the confluence of the Riet and Modder Rivers (Webley & Orton, 2012). Several provincial heritage sites are located in and around the town of Jacobsdal, as recorded on the SAHRA database SAHRIS. These include the following: Magersfontein Burgher Memorial, on the farm Magersfontein 219; Anglo-Boer War Blockhouse, on the road to Paardeberg; Nederduitse Gereformeerde Church, Andries Pretorius Street; Jacobsdal (SAHRIS)
1899-1902 South Africa War	Jacobsdal saw a great deal of military action during the Second Anglo-Boer War of 1899-1902 because it was close to the strategic towns of Kimberley and Mafeking. The wounded from the battles of Belmont/Graspan, Modder River, Magersfontein and Paardeberg were all nursed in the town. There are a number of important memorials and buildings in town, including the Burger Monument in front of the Dutch Reformed Church, erected in memory of the deceased at the Battle of Roodelaagte (or Graspan) on 25 November.1899. The town also has a cairn memorial erected by the Boers of Jacobsdal in November 1899 before departing for the battle of Graspan. The Dutch Reformed Church, consecrated in 1879 and enlarged in 1930, was used as a hospital during the Anglo Boer War. The oldest grave in the Jacobsdal Cemetary dates from 1859. British War graves and monuments can be found dating from the Anglo Boer War (1899 - 1902) (Webley & Orton, 2012). The Battles of Modder River and Magersfontein both occurred in late 1899. The battle of Modder River was an immediate precursor to the battle of Magersfontein in relation to the Boer siege of Kimberley. The Boers had dug themselves in on the Northern bank of the Modder River close to its confluence with the Riet. However, the Commonwealth forces eventually forced the Boers to retreat after an intense artillery fire. Notwithstanding, the Boers held up the British advance for 10 days and entrenched themselves at a series of low dolerite hills called Magersfontein The site of the Battle of Modder River is marked by a Commonwealth War Graves cemetery (Hart, 2003)

	At Magersfontein, the Boers in their trenches at the base of the hills opened fire on the British forces at a range of 400m. The result was some 700 Commonwealth troop fatalities. After two days of fierce fighting, the British Forces retreated to Modder River camp to await reinforcements before attempting to reach Kimberly. Magersfontein was a huge shock for the Commonwealth army. Today Magersfontein battle site is one of the best preserved (Hart, 2003). The town of Jacobsdal played a key role in most of these engagements, being at first the Boer headquarters and later taken over by the British for the same purpose (Hart, 2003)

The following heritage sites were identified in and around Jacobsdal from the Letsemeng Local Municipality web-site:
http://www.letsemeng.gov.za/index.php/council/76-uncategorised/58-jacobsdal

- *British Block House (Fort)*
  The blockhouse with its unique architecture was built in 1900 on the road to Paardeberg. It was declared a national monument in 1983.
- *Burger Monument*
  In front of the Dutch Reformed Church - erected in memory of the deceased at the Battle of Roodelaagte 25.11.1899 under command of D.S. Lubbe.
- *Cairn - Heap of stones (Klipstapel)*
  It was erected by the Boers from Jacobsdal in November 1899 before departing for the battle of Roodelaagte (Graspan). Each boer engraved his name on a stone and these stones were used to build the monument. The monument can be reached by a walking trail from the Agricultural School.
- *Dutch Reformed Church*
  Consecrated in 1879 and enlarged in 1930, was used as a hospital during the Anglo Boer War - now a national monument. A Bullet hole in the front door is evidence of the many skirmishes which took place between Boer and Brit in the area.
- *Jacobsdal Cemetery (at the end of De Villiers St)*
  The oldest grave date from 1859. British War graves and monuments can be found dating from the Anglo Boer War (1899 - 1902). Some "Boers" that fought the Magersfontein battle were reburied at Magersfontein which included Commandant D.S. Lubbe's grave (1923).
- *Jacobs Farmhouse*
  It is the first dwelling that was built in the area where Jacobsdal is today. It was built by Mr C.J. Jacobs. The house is situated in Sarel Cilliers St next to First National Bank.
- *Magersfontein Battlefield & Museum*
  20 km North-west of Jacobsdal.
- *Old Market Square*

The market square was where the city hall is today and it was used as a British soldier's lager. A big battle took place on 25 October 1900. Boers fired at the British from behind a stone wall which still stands today.

- *Paardeberg (18 - 27 February 1900)*
  By means of a wide flanking movement to avoid the Boers at Magersfontein, Lord Roberts succeeded in relieving Kimberley on 15 February 1900. Due to his precarious position, Cronje was forced to fall back to Bloemfontein along the Modder River. He was denied crossing Vendusiedrif due to the British onslaught with the result that the Boers entrenched themselves on both sides of the river. 40000 British troops supported by 100 guns besieged the small Boer force of 4000 men, women and children. After 10 days of continuous bombardment, the Boer force surrendered on 27 February 1900. Majuba was at last revenged.
- *"Tuishuis"*
  The old fashioned dwelling, still with its original wallpaper, was used during religious ceremonies. It is situated directly opposite the southern entrance of the Dutch Reformed Church.

Further to the above, a large scale study conducted as part of the renewable energy development zones (CSIR, 2013) identified areas of heritage sensitivity that could be of significance for developments in the area between Jacobsdal and Kimberley. These sensitivities include, watercourses and pans, ridges, battlefields and blockhouses as well as palaeontological sensitive areas.

Significant sensitive areas situated inside or just bordering some of the proposed alignments area the old Kimberley cemetery on the outskirts of Kimberley but just inside the Corridor 2 Alternative 1 (purple corridor – **Figure 3**). During the Siege of Kimberley, the Boer forces had numerous fortifications around the town. Three such area has been demarcated from historical maps, and occur in the northern sections of both Corridor 2 Alternative 1 (purple corridor) and 2 (blue corridor).

Two block house alignments central to securing the Kimberley and larger Free State are during the South African War crosses both alignments; the Kimberley Boshoff line in the north and the Modderrivier to Krugersdrift line in the south.

A few ridges that are usually associated with archaeological remains such as engraving have also been demarcated in the southern section of both alignments.

Field investigations of the above mentioned areas area discussed in Section 6.1 of this report.

Studie completed in the general study area:

Morris, D. 2014. Proposed Blackwood Solara Energy Facility on portion 1 of Padamsfontein 1593, south east of Kimberley.
Rossouw, L. 2013. Phase 1 Palaeontological Impact Assessment on portion 1 of Padamsfontein 1593, south east of Kimberley.
Morris, D. 2014. Proposed Boundary Solar Energy Facility on the farm Kareeboom 1716, east of Kimberley.

Rossouw, L. 2014. Phase 1 Palaeontological Impact Assessment for the Proposed Boundary Solar Energy Facility on the farm Kareeboom 1716, east of Kimberley.

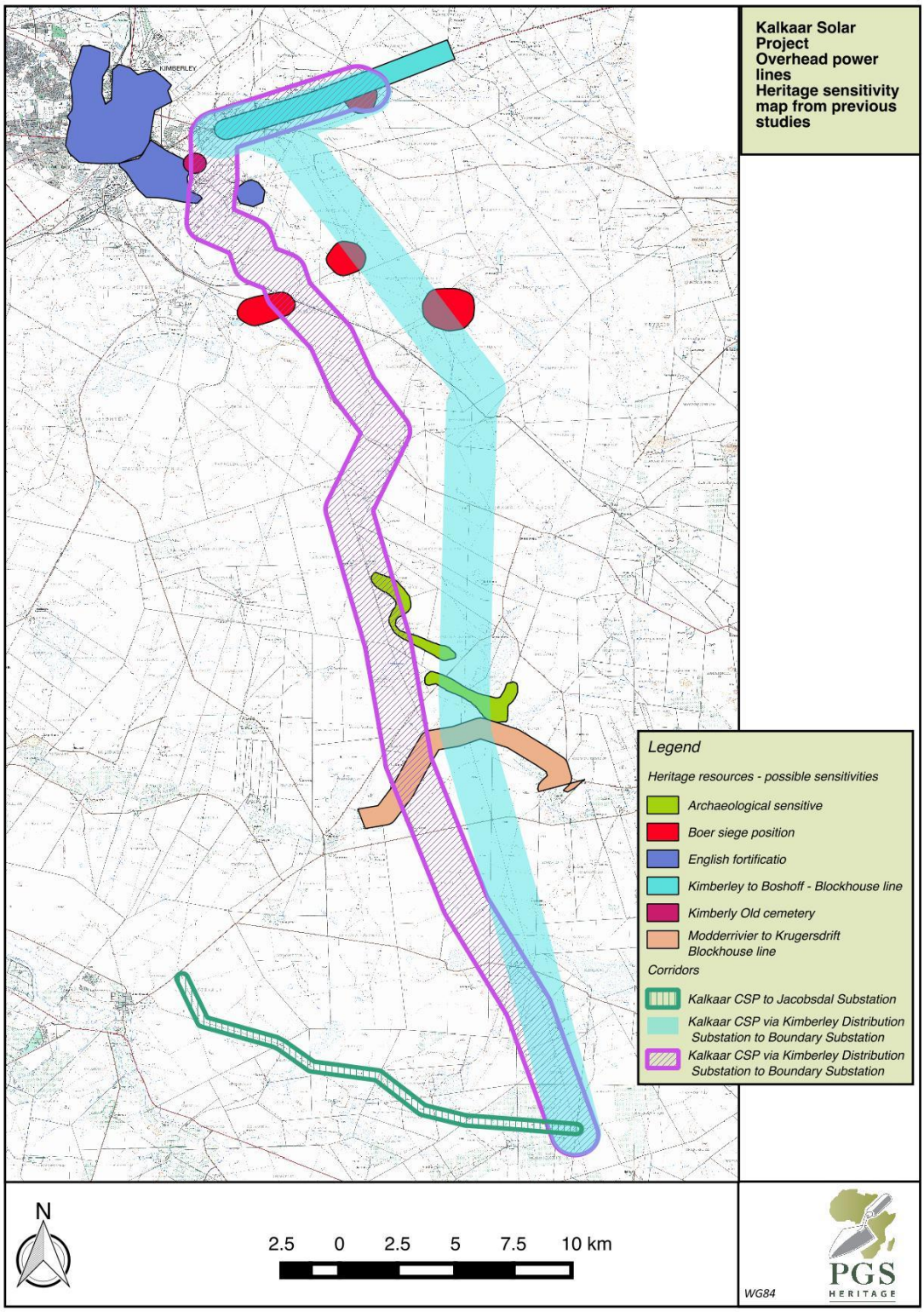

Figure 3 – Heritage sensitive areas from previous studies

5.1 Palaeontology

Ms. Elize Butler (2016) completed a Paleontological Impact Assessment (PIA). A summary of the findings is included below.

" *The development footprint is completely underlain by lower Permian sediments of the Ecca Group of the Karoo Basin (White Hill and Prince Albert Formations), Late Permian Volksrust Formation, and the Karoo Dolerite Suite and Quaternary deposits. The development footprint as a whole is a fairly flat lying terrain with grassy vegetation cover in places as well as a few thorn trees. The Karoo dolerite Suite is unfossiliferous and the sensitivity in the Quaternary sediments is low. Although the palaeontological sensitivity of the Whitehill, Prince Albert and Volksrust Formations is rated as high to very high, scarcity of fossil-bearing sediments and lack of exposure at the proposed sites indicate that the impact on palaeontological material is negligible and regarded as insignificant*." (Butler, 2016)

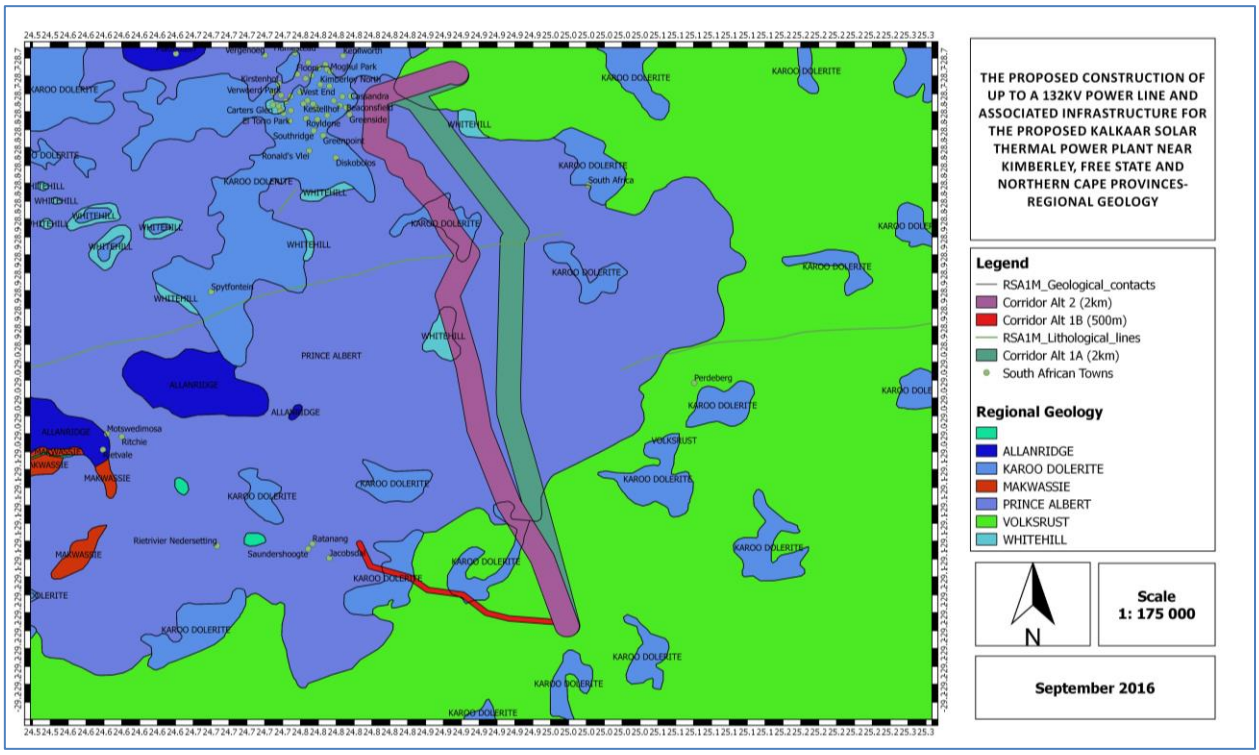

Figure 4 – The surface geology of the Power line Project (Butler, 2016)

6 FIELDWORK FINDINGS

Fieldwork was carried out by an archaeologist who drove and walked along the proposed corridors to locate heritage resources and to identify other likely places where heritage resources might be found. Surveys were carried out along the length of all three corridors. The area is rich in historical and archaeological sites that occur within and around the proposed powerline route corridors (e.g. **Figure 5** and **4**).

Figure 5 – Drawer full of Early and Middle Stone Age stone artefacts collected on the farm Rooifontein No 211 (Ptn 1) over the years by Mr J. Reichert and family

Figure 6 – Eroded area on Chavonne No 364 that has a large scatter of Middle Stone Age artefacts. The area is just outside the 500 m wide Corridor 1 Jacobsdal Link

6.1 Focussed fieldwork on possible heritage sensitive areas from the desktop assessment

As indicated in Section 5, some significant sensitive areas are situated inside or just bordering some of the proposed alignments area the old Kimberley cemetery on the outskirts of Kimberley but just inside the Corridor 2 Alternative 1 (purple corridor – **Figure 3**). During the Siege of Kimberley, the Boer forces had

numerous fortifications around the town. Three such area has been demarcated from historical maps, and occur in the northern sections of both Corridor 2 Alternative 1 (purple corridor) and 2 (blue corridor).

Two block house alignments central to securing the Kimberley and larger Free State are during the South African War crosses both alignments; the Kimberley Boshoff line in the north and the Modderrivier to Krugersdrift line in the south.

A few ridges that are usually associated with archaeological remains such as engraving have also been demarcated in the southern section of both alignments.

Additional fieldwork was conducted in August 2016 to assess some of these areas as part of the HIA update. **Table 4** indicates the areas surveyed and the findings.

Table 4 - Surveyed sensitive areas

Area	Survey status	Findings
Kimberley historic cemetery	Surveyed in August 2016	Historic Jewish cemetery identified and discussed in this report as **Kal1** and **Kal 2**. (Section 6.2)
Possible Boer Siege fortifications	Additional areas not previously surveyed were assessed.	No fortifications found.
Blockhouse line on Modder Rivier	Was assed during original survey.	No fortifications found.
Blockhouse line Kimberley to Boshoff	Assessed and surveyed during August 2016.	No fortifications found.

6.2 Site Kal1 and Kal2

GPS: S 28° 45' 23.5" E 24° 48' 18.1" – Kal1

GPS: S 28° 45' 18.4" E 24° 48' 20.3"" – Kal1

The site was accessed with the help of security of the De Beers mining company. The resource consists of the remains of the historic Jewish cemetery dating from the late 1800s to early 1900s. The cemetery is about 6 hectares in size. It is no longer in use and not maintained.

A small ruin that was most probably a small chapel or sinagoge is also present on the site. The site does have a berm around the southern and western sections.

Figure 7 – General view of the cemetery

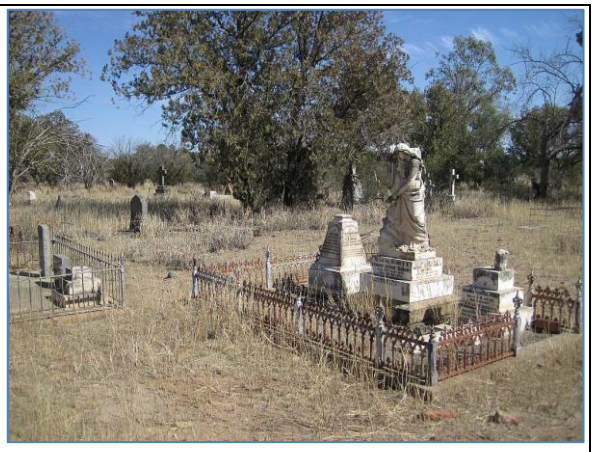

Figure 8 – General view of the cemetery

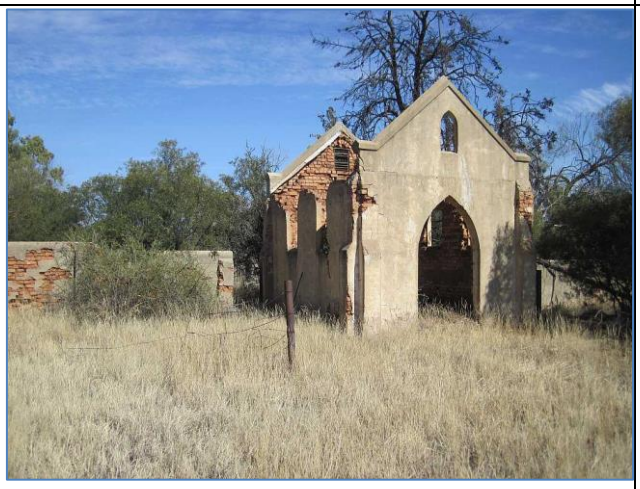

Figure 9 – View of chapel ruin

The site is rated as Grade 3A (Conservation; Mitigation not advised) the site is associated with the history of Kimberley and will have a strong link to some prominent figure of the diamond rush era. A distance of at least 50 m should be maintained from any development associated with the project.

Mitigation:

- Development should be limited to 50 m from the graveyard.

The following sites were recorded during the survey. They occur mainly in the Corridor 2 Alternative 1 corridor north and south of the Modder River.

6.3 Site BEZ 001:

GPS: S 29° 00' 49.6" E 24° 54' 25.2"

This is a graveyard on Bezuidenhoutskraal No 53 on the northern bank of the Modder River. There are currently eight graves, including a single fenced grave with headstone. The rest currently have no headstones, but are decorated with mugs that perhaps were used as vases filled with flowers to place on the grave. The graveyard is still in use.

The site is rated as Grade 3A (Conservation; Mitigation not advised) because the graveyard is still in use. A distance of at least 20 m should be maintained from any development associated with the project.

Mitigation:

- Mitigation is not advised. Development should be limited to 20 m from the graveyard.

Figure 10 – Site BEZ 001 is a graveyard that is still in use. It is recommended that any development within 20 m of the graveyard be avoided

6.4 Site BEZ 002:

GPS: S 29° 00' 49.0" E 24° 54' 25.7"

This is a second graveyard on Bezuidenhoutskraal No 53. It is about five meters east of BEZ 001; it is neglected and overgrown and it was not possible to determine how many graves are located here (but there at least six burials).

The site is rated as Grade 4A (high/medium significance). Mitigation would therefore be required if the powerlines or associated structures or roads to encroach upon the graveyard.

Mitigation:

- The process of grave relocation—negotiations with relatives, notifications, permits, identification of an acceptable alternative site for reburial, exhumation and reburial-- would need to be followed.

Figure 11 – Site BEZ 002 is a neglected graveyard, probably no longer in use

6.5 Site KLP 001:

GPS: S 29° 02' 49.4" E 24° 53' 42.9"

This is a graveyard of about 400 square metres in area on Klipdrift no 20 Rem. It is very neglected and overgrown by trees. There are at least five burials with headstones. Three of the burials date to the early 20th century (1907, 1908, 1930). There is also at least one burial without a headstone, marked with packed stones.

The site is rated as Grade 4A (high/medium significance). Mitigation would therefore be required if the powerlines or associated structures or roads to encroach upon the graveyard.

Mitigation:

- The process of grave relocation—negotiations with relatives, notifications, permits, identification of an acceptable alternative site for reburial, exhumation and reburial-- would need to be followed.

Figure 12 – Overgrown graveyard (Site KLP 001)

6.6 Site KLP 002

GPS: S 29° 02' 52.1" E 24° 53' 27.6"

This is a graveyard that currently comprises about 14 graves in area of 0,168 ha. The graveyard is still in use.

The site is rated as Grade 3A (Conservation; Mitigation not advised) because it is still in use.

Mitigation:

- Mitigation is not advised, development should be limited to 20 m from the graveyard.

Figure 13 – Graveyard that is still in use (Site KLP 002). It is recommended that the graveyard be conserved and that no development take place closer than 20 m to the site

6.7 Site KLP 003

GPS: S 29° 03' 02.1" E 24° 53' 51.2"

These are the remains of a kraal built of stone, about 5 m by 3 m, on Klipdrift No 20 Rem. The walls are no longer standing.

The site is rated as Grade 4C (medium significance).

Mitigation:

- The site should be recorded before destruction.

Figure 14 – The remains of a kraal built of stone (Site KLP 003)

6.8 Site KLP 004

GPS: S 29° 03' 02.0" E 24° 53' 52.4"

These are the remains of a kraal built of stone, about 5 m by 3 m, on Klipdrift No 20 Rem. The walls are no longer standing.

The site is rated as Grade 4C (medium significance).

Mitigation:

- The site should be recorded before destruction.

Figure 15 – Remains of a kraal (Site KLP 004)

6.9 Site KLP 005

GPS: S 29° 03' 02.1" E 24° 53' 51.4"

These are the remains of a walled building about 2 m by 2 m on Klipdrift No 20 Rem. Only the foundations remain.

The site is rated as Grade 4C (medium significance).

Mitigation:

- The site should be recorded before destruction.

Figure 16 – Remains of walled structure broken down to its foundations (KLP 005)

6.10 Site KLP 006

GPS: S 29° 03' 01.0" E 24° 53' 54.4"

Remains of an old disused rubbish heap, now flattened, on Klipdrift No 20 Rem.

The site is rated as Grade 4B (medium significance).

Mitigation:

- The site should be recorded before destruction.

Figure 17 – Possible ceiling fixture found on ash heap on Rem of Klipdrift No 20 (KLP 006)

6.11 Site KLP 007

GPS: S 29° 02' 49.2" E 24° 54' 02.3"

Heavily patinated pecked engraving of unidentified motif on dolerite boulder on Klipdrift No 20 Rem. There is also some heavily patinated scratching over a portion of the pecked engraving.

The site is rated as Grade 3A (high/medium significance). Mitigation is not advised,

Mitigation:

- Mitigation not advised. Development should be limited to 20 m from the engraved boulder.

Figure 18 – Engraved dolerite boulder (Site KLP 007)

6.12 Site KLP 008

GPS: S 29° 02' 50.1" E 24° 54' 02.4"

A flat area about 9 by 10 m built against a small hill covered with dolerite boulders and enclosed by two rows of large dolerite boulders that meet at right angles. These are identified as the remains of kraal walls.

The site is rated as Grade 4B (medium significance).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- The site should be recorded before destruction.

Figure 19 – Outline of a rectangular kraal structure (KLP 008)

6.13 Site KLP 009

GPS: S 29° 02' 50.1" E 24° 54' 02.4"

A circular area on top of a low rise; the area is about 5 m wide that has been cleared of most of the boulders in order to create an enclosure.

The site is rated as Grade 4B (medium significance).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- The site should be recorded before destruction.

Figure 20 – Circular enclosure on low rise (KLP 009)

6.14 Site KLP 010

GPS: S 29° 03' 54.7" E 24° 55' 36.4"

Rectangular structure on Klipdrift No 20 Ptn 1 with internal dividing wall in the middle, constructed using roughly dressed locally occurring white stone blocks. The structure may be the remains of two kraals dating to the nineteenth century. It is within about 10 m of the ruins of farmhouse built of the same material. The kraals are probably part of a 19th century homestead

The site is rated as Grade 4A (high/medium significance, mitigation required).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- Research needs to be done into the historical significance of the kraals and the other structures that comprise the homestead.
- The homestead should be mapped, laser-scanned and photographed. The documentation should be archived where it is accessible to the public.

Figure 21 – Possible kraals built of locally sourced, roughly dressed stone (KLP 010)

6.15 Site KLP 011

GPS: S 29° 03' 53.6" E 24° 55' 33.9"

Circular arrangement of roughly dressed white stones about 1 m in diameter on Klipdrift No 20 Ptn 1. The structure is part of a cluster of structures that probably comprise a 19th century homestead.

The structure is rated 4A (high/medium significance, mitigation required).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- Research needs to be done into the historical significance of this circular structure and the other structures that comprise the homestead.
- The homestead should be mapped, laser-scanned and photographed. The documentation should be archived where it is accessible to the public.

Figure 22 – Circular structure of stones (KLP 011)

6.16 Site KLP 012

GPS: S 29° 03' 54.4" E 24° 55' 33.4"

Ruin of a house on Klipdrift No 20 Ptn 1. The house is in ruins but the layout is still visible and some of the walls are still standing. The house probably dates from the nineteenth century and is associated with a possible kraal (KLP 010), a circular structure (KLP 011) and a spring that has been dug open (KLP 013).

The structure is rated 4A (high/medium significance, mitigation required).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- Research needs to be done into the historical significance of this house and the other structures that comprise the homestead.
- The homestead should be mapped, laser-scanned and photographed. The documentation should be archived where it is accessible to the public.

Figure 23 – Ruined house possibly 19th century, built of local stone (KLP 012)

6.17 Site KLP 013

GPS: S 29° 04' 08.9" E 24° 55' 31.5"

A spring that has been dug open so that the water is accessible (Klipdrift No 20 Ptn 1).

The structure is rated 4A (high/medium significance, mitigation required).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- Research needs to be done into the historical significance of this house and the other structures that comprise the homestead.
- The homestead should be mapped, laser-scanned and photographed. The documentation should be archived where it is accessible to the public.

Figure 24 – Spring that has been dug open (KLP 013). It is probably part of the nearby homestead (KLP 010-012)

6.18 Site JDX 001

GPS: S 28° 58' 50.8" E 24° 53' 59.6"

Graves on Judex No 240, in the *Beeskamp* on top of a hill. One grave that is bordered with cement bricks contains two burials according to the headstones (Maria and Waylit Mokweni died 1997 and 1987 respectively). There is at least one other grave, without a headstone, to the right.

The site is rated as Grade 4A (high/medium significance). Mitigation would therefore be required if the powerlines or associated structures or roads encroach closer than 20 m upon the graveyard.

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- The process of grave relocation—negotiations with relatives, notifications, permits, identification of an acceptable alternative site for reburial, exhumation and reburial-- would need to be followed.

Figure 25 – Graves on Judex No 240 (JDX 001)

6.19 Site JDX 002

GPS: S 28° 58' 51.2" E 24° 53' 54.9"

Circular enclosures made on the northern side of a hill by clearing away boulders and leaving behind a ring of boulders. May have been used as a camp and/or a small kraal.

The site is rated as Grade 4B (medium significance).

Mitigation:

- It is advised that the alignment of the OHL be kept at least 50 meters away from this site. If not possible the following mitigation will be required:
- The site should be recorded before destruction.

Figure 26 – Circular enclosure of dolerite hilltop (JDX 002)

6.20 Site JDX 003

GPS: S 28° 58' 51.2" E 24° 53' 54.9"

Two scraped engravings on a rock; at right is an ostrich, at left an unidentified animal with four legs (perhaps an elephant. On the farm Judex No 240, in the *Beeskamp*.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 27 – Two scraped engravings: an ostrich at right. Unknown animal at left (JDX 003)

6.21 Site JDX 004

GPS: S 28° 58' 52.2" E 24° 53' 54.5"

An engraved dolerite boulder with at least five circular motifs about 50 mm in diameter towards the top of the rock and a pecked right-facing four-legged animal with horns lower down on the rock. In the *Beeskamp* on Judex No 240.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 28 -- Engraved dolerite boulder with at least five circular motifs and a pecked right-facing four-legged animal with horns (JDX 004)

6.22 Site JDX 005

GPS: S 28° 59' 15.7" E 24° 53' 17.0"

Scraped engraving of a right-facing eland on dolerite boulder on a small hill overlooking a pan in the *Boskamp* on Judex No 240.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 29 -- Scraped engraving of a right-facing eland (JDX 005)

6.23 Site JDX 006

GPS: S 28° 59' 13.1" E 24° 53' 16.3"

Engraved boulder on the same small hill in the *Boskamp* as JDX 005, on Judex No 240. On one side of the boulder there is a patinated scraped engraving of a left-facing, small and slender species of antelope with a pair of short wavy horns. On top of the boulder is a much more noticeable scraped image of a left-facing four-legged animal, perhaps an antelope, but with curious and unrealistically splayed hooves.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 30 – Engraving of a possible antelope with curious and unrealistically splayed hooves (JDX 006)

6.24 Site JDX 007

GPS: S 28° 59' 13.1" E 24° 53' 16.4"

Scraped engraving of left-facing rhinoceros (perhaps a black rhino) and two anthropomorphic figures on the same small hill in the *Boskamp* on Judex No 240 as JDX 005 and 006.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 31 – Engraving of a rhinoceros (JDX 007)

6.25 Site JDX 008

GPS: S 28° 59' 13.2" E 24° 53' 16.6"

Scraped engraving of an anthropomorph on a dolerite boulder on the same small hill in the *Boskamp* on Judex No 240 as JDX 005, 006 and 007.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 32 – Scraped engraving of dancing anthropomorph (JDX 008)

6.26 Site JDX 009

GPS: S 28° 59' 12.9" E 24° 53' 16.3"

Pecked engraving of an elliptical outline with a short straight line on either end; on the same small hill in the *Boskamp* on Judex No 240 as JDX 006, 007, and 008.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 33 – Engraving of an elliptical shape with two short, straight lines at either end (JDX 009)

6.27 Site JDX 010

GPS: S 28° 59' 13."2 E 24° 53' 16.6"
Scraped engraving of anthropomorph on dolerite boulder on the same hill in the *Boskamp* on Judex No 240 as JDX 006, 007, 008, and 009.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

6.28 Site JDX 011

GPS: S 28° 58' 59.1" E 24° 53' 38.3"

Scraped engraving of a left-facing eland on a dolerite boulder on a small hill in the Boskamp.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 34 – Engraving of an eland (JDX 011)

6.29 Site JDX 012

GPS: S 28° 58' 59.0" E 24° 53' 38.5"

Scraped engraving of a right-facing eland on a dolerite boulder on a small hill in the *Boskamp* on Judex No 240. This engraving is three metres east of JDX 012, also an eland engraving.

The engraved boulder is rated as Grade 3A (high significance, mitigation not advised).

Mitigation:

- Mitigation not advised. Development should be restricted to 20 m from the engraved boulder.

Figure 35 – Engraving of an eland (JDX 012)

7 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

Altogether, 27 heritage resources were identified along Corridor 2 Alternative 1. These comprise graves, historical ruins (houses, kraals and associated infrastructure), archaeological resources (artefacts and rock art). It is therefore inevitable that more heritage resources will be found within the corridors. It is recommended that graveyards still in use and all the hilltops with rock art are should be avoided; a 20 m limit on development around these sites should be observed. Other structures require documentation before

destruction can be permitted. Currently, the corridor most impacted by the presence of heritage resources in those parts of Corridor 2 Alternative 1 north and south of the Modder River.

7.1 Assessment

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 sites (including rock engravings on hilltops), historical structures and graves is extremely high. If development can stay 20 m away from graveyards that are currently in use and avoid crossing hilltops where engravings are concentrated impact of development will be considerably decreased.

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

Table 5 - 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 powerline route*	

Table 6 - Rating of Impacts – Rock Engravings

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified engravings. As well as the impact on the identified engraving 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 engraving 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 engraving sites the cumulative impact is seen as having a medium negative impact.
Intensity/magnitude	*The large scale impact on engraving 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 powerline route*	

Table 7 - Rating of Impacts – cemeteries and graves

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified graves and cemeteries. 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 graves and cemeteries 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 graves and cemeteries 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 graves and cemeteries 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 graves and cemeteries 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 powerline route* *Keep at least a 20 meter buffer away from all cemeteries and a 50 meter buffer from Kal1.*	

Table 8 - Rating of Impacts – Palaeontology

IMPACT TABLE	
Environmental Parameter	*Impact on the Palaeontology Heritage (fossils) of the development footprint*

Issue/Impact/Environmental Effect/Nature (E)	The excavations and site clearance during the construction phase will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. This impact is likely to occur only during the construction phase. No impacts are expected to occur during the operation phase.
Extent	Corridor 1: Kalkaar CSP to Jacobsdal Substation (approximately 20km in length); Corridor 2 Alternative 1: Kalkaar CSP via Kimberley Distribution Substation to Boundary Substation (approximately 62km in length); and Corridor 2 Alternative 2: Kalkaar CSP via Kimberley Distribution Substation to Boundary Substation (approximately 62km in length
Probability	During the site visit to the development area no fossils were detected. Although the sensitivity of the Formations a considered to be high to very high. The probability of significant impacts on palaeontological heritage during the construction phase is low.
Reversibility	Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category
Irreplaceable loss of resources	Stratigraphic and geographical distribution of fossils within the relevant formations (see findings) has been documented in the literature. During a field assessment fossils were not detected on the development footprint, but the possibility that these fossils actually could occur is a possibility (windblown aeolian deposits). By taking a precautionary approach, a significant loss of fossil resources is expected.

Duration	The expected duration of the impact is assessed as potentially permanent to **long term**. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**	
Cumulative effect	Low Cumulative Impact The cumulative effect of the development area within the proposed location is considered to be low	
Intensity/magnitude	Probable significant impacts on palaeontological heritage during the construction phase are high, but the intensity of the impact on fossil heritage is rated as low	
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	2	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	4	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-20 (high negative)	-6 (low negative)
Mitigation measures	Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but *before* the ground is levelled for construction Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category.	

	Not deemed necessary unless fossils are uncovered during the construction phase.

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.

7.2 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 and engravings of this proposed development. Most heritage resources are point specific and in general impacts are found to be localised and impacting on the specific resource in a development. As such the cumulative impact on archaeological and historical heritage resources area deemed to be low.

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

7.3 Impact Summary

Table 9 provides a summary of the projected impact rating for this project on heritage resources.

Table 9: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Palaeontological resources	Impact during construction	20	Negative high Impact	6	Positive Low Impact
Graves and Cemeteries	Impact during construction	68	Negative high Impact	8	Positive Low Impact
Engravings	Impact during construction	68	Negative high Impact	8	Positive Low Impact
Chance finds	Impact during construction	68	Negative high Impact	8	Positive Low Impact

7.4 Kalkaar Solar Thermal Power Project Powerline – 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		
Kalkaar Solar Thermal Power Project to Corridor 1 Jacobsdal Link	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts. The fossil heritage in the development area is low/ negligible. Formations include: Prince Albert , White Hill and Volksrust Formations and Quaternary sediments
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 1	Not Preferred	Corridor 2 has a large amount of heritage resources that was identified as well as the possible palaeontological significance of large areas of this alignment makes it less favourable that the other two alignments. The fossil heritage in the development area is low/ negligible. Formations include: Prince Albert, White Hill and Volksrust Formations, dolerite and Quaternary sediments.
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 2	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts. The fossil heritage in the development area is low/negligible

Alternative	Preference	Reasons
		Formations include Prince Albert; Volksrust Formations and Karoo Dolerite

8 MANAGEMENT GUIDELINE

8.1 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	**R80 000**

9 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

Fifteen instances of Grade 3A rated heritage resources were identified along Corridor 2 Alternative 1 and Corridor 2 Alternative 2 respectively. These sites should be protected from development. Two of them are cemeteries that are still being used (BEZ 001 and KLP 002). The other ten sites (KLP 007, JDX 003-012) are engraved boulders on a range of dolerite hills on Rem of Klipdrift No 20 and Judex No 240 respectively. It is recommended that development be kept 20 m away from these sites.

Fourteen instances of the heritage resources identified in this study may be mitigated if necessary. These include graves and historical structures on Rem of Klipdrift No 20, Ptn 1 of Klipdrift No 20 and Bezuidenhoutskraal No 53, all of which occur within Corridor 2, just north and south of the Modder River. Mitigation can be avoided by keeping development 20 m away from these sites. Site Kal1/2 (the old Jewish cemetery) should be avoided with at least a 50 meter buffer around the site.

It is likely that more heritage resources will identified within Corridor 2 Alternative 1. It is already known that artefacts occur on the farm Rooifontein No 211 (Ptn 1) and the farms Olifantsfontein No 1719, Rem of Susanna No 197, and Olifantskop No 1720 are known to have rock art sites on the hilltops (see below).

No heritage resources were identified with Corridor 1 Jacobsdal link, although they were found just outside the corridor. The occurrence of heritage resources in such close proximity to the corridor could suggest there is a high likelihood of encountering heritage resources within the corridor.

Discussion with Dr David Morris (April 11 2016), archaeologist at the McGregor Museum yielded information about the presence of engraved boulders on the hilltops on Olifantsfontein No 1719, Rem of Susanna No 197, and Olifantskop No 1720, areas between the two corridors but closer to corridor 1A. It is likely that other hilltops will also yield engravings. Because the significance of engravings is closely linked to their situation in the landscape it is recommended that proposed development avoids all such rock art sites by 20 m.

It is also likely that more graves and archaeological material will come to light in future investigations. It is therefore imperative that plans for the powerlines take these resources into consideration so as to avoid completely sensitive heritage resources such as rock art sites and graveyards and minimize the necessity for mitigation.

Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but before the ground is levelled for construction.

Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie

within the beneficial category. *Not deemed necessary unless fossils are uncovered during the construction phase.*

10 CONCLUSIONS

PGS Heritage was appointed by SIVEST to undertake a Heritage Impact Assessment (HIA) that forms part of the BAR for the Power line Project.

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.

These desktop studies were followed by a fieldwork component that comprised driving and walking through the study area. A total of 27 occurrences of heritage resources were identified within Corridor 2 Alternative 1. Fourteen of these would require mitigation before exhumation (graves) or destruction (historical structures) if development were to come within 20 m. Site Kal1/2 must be avoided with a 50 meter buffer. Thirteen occurrences of heritage resources have high significance and should not be disturbed by development within 20 m.

It is likely that further survey work in the study area will uncover additional heritage resources, especially graves, ruins and rock art sites on hilltops.

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.

The development footprint is completely underlain by lower Permian sediments of the Ecca Group of the Karoo Basin (White Hill and Prince Albert Formations), Late Permian Volksrust Formation, and the Karoo Dolerite Suite and Quaternary deposits. The development footprint as a whole is a fairly flat lying terrain with grassy vegetation cover in places as well as a few thorn trees. The Karoo dolerite Suite is unfossiliferous and the sensitivity in the Quaternary sediments is low. Although the palaeontological sensitivity of the Whitehill, Prince Albert and Volksrust Formations is rated as high to very high, scarcity of fossil-bearing sediments and lack of exposure at the proposed sites indicate that the impact on palaeontological material is negligible and regarded as insignificant."

10.1 Comparative Assessment

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

Power Line Project – 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 1 (Green) – Kalkaar CSP to Jacobsdal Substation	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts.
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 1	Not Preferred	Corridor 2 Alternative 1 has a large amount of heritage resources that was identified as well as the possible palaeontological significance of large areas of this alignment makes it less favourable that the other two alignments.
Kalkaar Solar Thermal Power Project via Kimberley DS to Boundary Substation Corridor 2 Alternative 2	Favourable	Low impact on heritage resources foreseen and appropriate mitigation measures could address envisaged impacts.

The development of the Kalkaar 132kV powerline and the associated infrastructure may therefore continue if the recommendations as outlined in this report are adhered to.

11 REFERENCES

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Appendix A

HERITAGE MANAGEMENT GUIDELINES

12 HERITAGE MANAGEMENT GUIDELINES

12.1 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:

- 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 10: 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

[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 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.

Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into the employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

12.2 All phases of the project

12.2.1 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.

12.2.2 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.

12.2.3 Procedure for discovery of human remains / graves

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

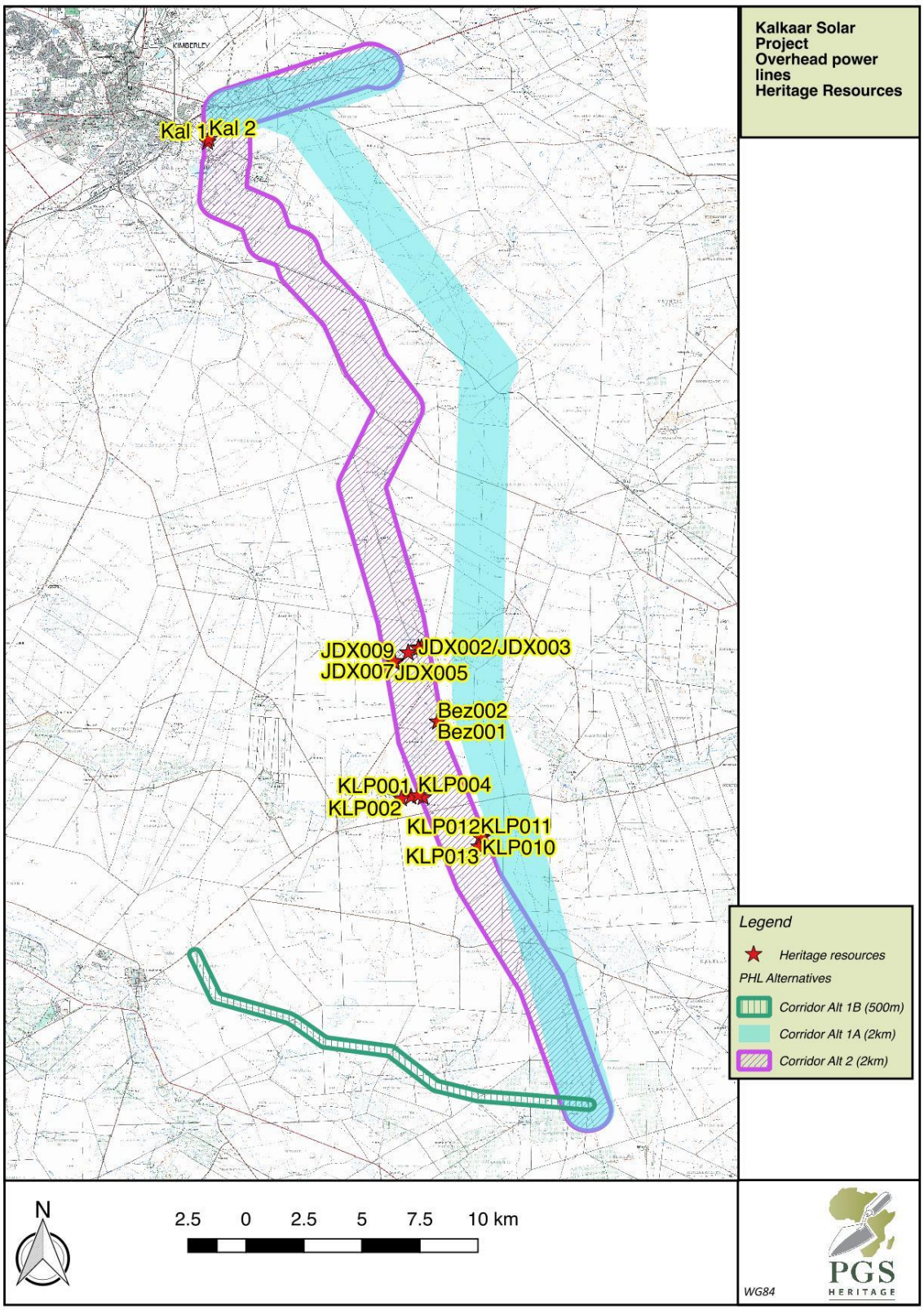
- Upon the accidental discovery of graves, a buffer of at least 20 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied 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.

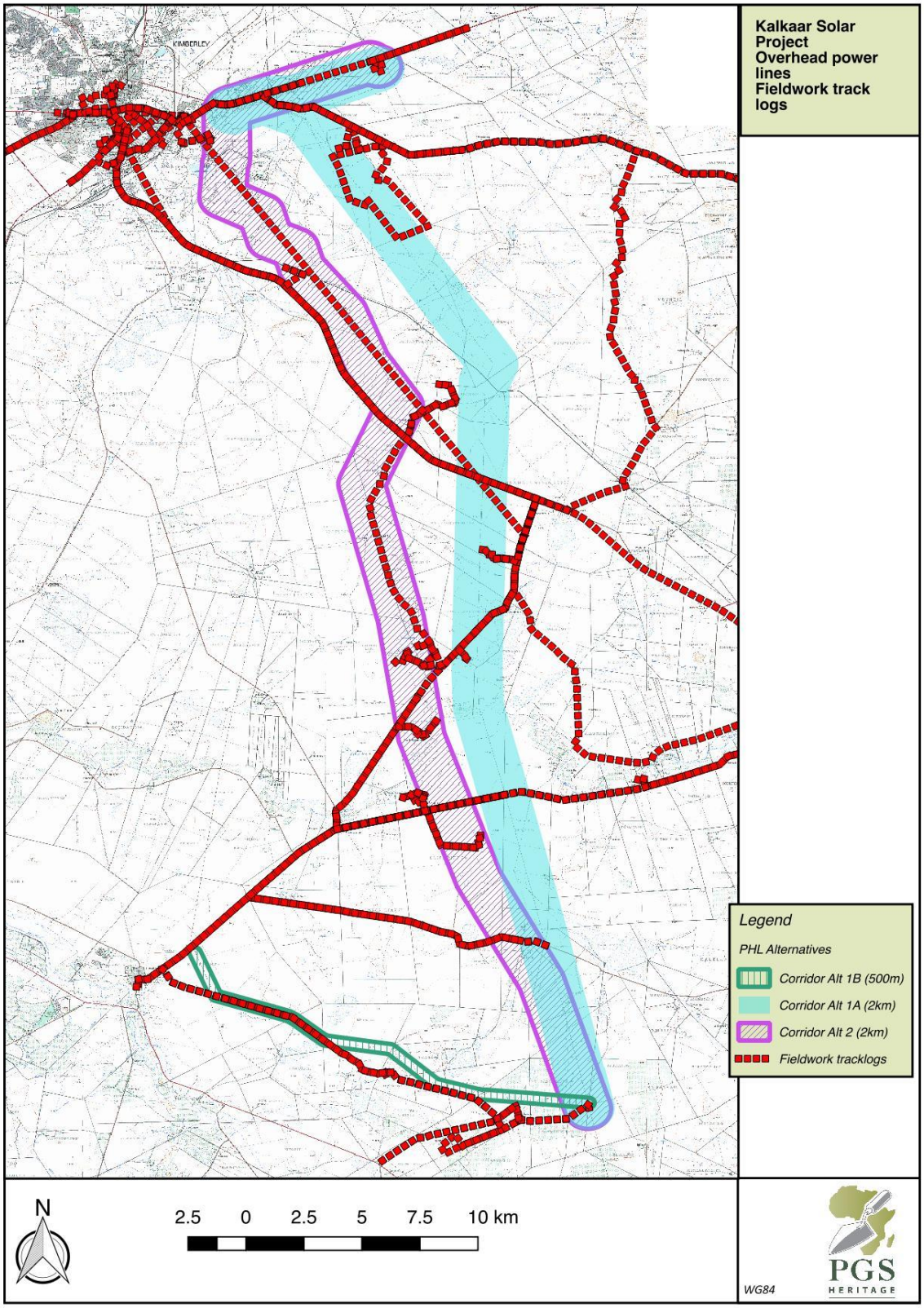
The grave relocation process must include:

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


Kalkaar Solar Project
Overhead power lines
Heritage Resources
Kal 1
Kal 2
JDX009
JDX002/JDX003
JDX007
JDX005
Bez002
Bez001
KLP001
KLP004
KLP002
KLP012
KLP011
KLP013
KLP010
Legend
Heritage resources
PHL Alternatives
Corridor Alt 1B (500m)
Corridor Alt 1A (2km)
Corridor Alt 2 (2km)
N
2.5 0 2.5 5 7.5 10 km
WG84
PGS HERITAGE


Kalkaar Solar Project
Overhead power lines
Fieldwork track logs
KIMBERLEY
Legend
PHL Alternatives
Corridor Alt 1B (500m)
Corridor Alt 1A (2km)
Corridor Alt 2 (2km)
Fieldwork tracklogs
N
2.5 0 2.5 5 7.5 10 km
WG84
PGS
HERITAGE