BIOTHERM ENERGY (PTY) LTD

SENDAWO POWERLINE ALTERNATIVES – SENDAWO PROJECTS

Heritage Impact Assessment

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Executive Summary

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact Assessment that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of powerline between the Sendawo PV site and the Mookodi substation near Vryburg, North West Province.

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

The Heritage Impact Assessment has shown that the proposed powerline alternatives have heritage resources present on the property. This has been confirmed through a field survey, archival research and evaluation of aerial photography of the sites.

1.1. Heritage Resources

During the fieldwork 2 archaeological findspots were identified of which both were representing the Earlier and Middle Stone Age. Both findspots have low heritage significance and will require no further mitigation.

1.2. Palaeontological Resources

The fieldwork findings have shown that a small part of the study area is characterised by the presence of significant Stromatolites and that stromatolites are present in almost all the dolomite boulders on site. Some areas have possible remains of cave breccia but no in situ outcrops were recorded.

1.3. Impact Summary

Table 1provides a summary of the projected impact rating for this project on heritage resources.

Table 1: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	28		10	
			Negative medium Impact		Positive Low Impact
Palaeontological Resources – Route 2A		-34	Medium Negative	26	Low Positive

Palaeontological Resources – Route 2B		-34	Medium negative	26	Low Positive

1.4. Comparative Assessment

The two Alternative alignments both cross over the area where the two archaeological findspots were identified. Both alternative will have an equally low impact on the findspots and as such no preference for either of the alignments exist.

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 LINES		
Power Line Corridor Alternative 2A	No Preference	Although stromatolites are present they are small and mostly associated with boulders on site
Power Line Corridor Alternative 2B	No Preference	Although stromatolites are present they are small and mostly associated with boulders on site

The overall impact on heritage resources is seen as acceptable and the proposed mitigation measures to be incorporated in the EMP will provided the necessary actions to address any impacts on heritage resources.

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HERITAGE IMPACT REPORT

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1. INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact Assessment that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of powerline between the Sendawo PV site and the Mookodi substation near Vryburg, North West Province.

1.1. Scope of the Study

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

1.2. Specialist Qualifications

PGS Heritage (PGS) compiled this Heritage Scoping Report.

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

Jessica Angel, the Archaeologist for the project, holds a Masters degree in Archaeology and is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA).

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 fieldwork undertaken, it is necessary to realise that the heritage sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the 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.

The survey was conducted over 2 days over the extent of the total footprint and power line areas. It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Sendawo power line alternatives is an area of 2.42 square kilometres for Alternative 2A and 3.1 square kilometres Alternative 2B

A total of 2 sites, which can be considered archaeological, were logged. Both these sites relate to the Stone Age.

1.4. Legislative Context

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

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

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

a) 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)
b) 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
c) 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 and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, and MPRDA 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).

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

1.5. Terminology

Table 2: Terminology

Acronyms	***Description***
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community

SAHRA	South African Heritage Resources Agency

Archaeological resources

This includes:

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

Cultural significance

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

Development

This means any,

- physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:
- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age, between 700 000 and 2500 000 years ago.

Middle Stone Age

The archaeology of the Stone Age between 30-300 000 years ago, associated with early modern humans.

Late Stone Age
The archaeology of the last 30 000 years, associated with fully modern people.

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.

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.

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

Iron Age
The archaeology of the last 1000 years up to the 1800s, associated with people who carried out iron working and farming activities such as herding and agriculture.

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.
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.

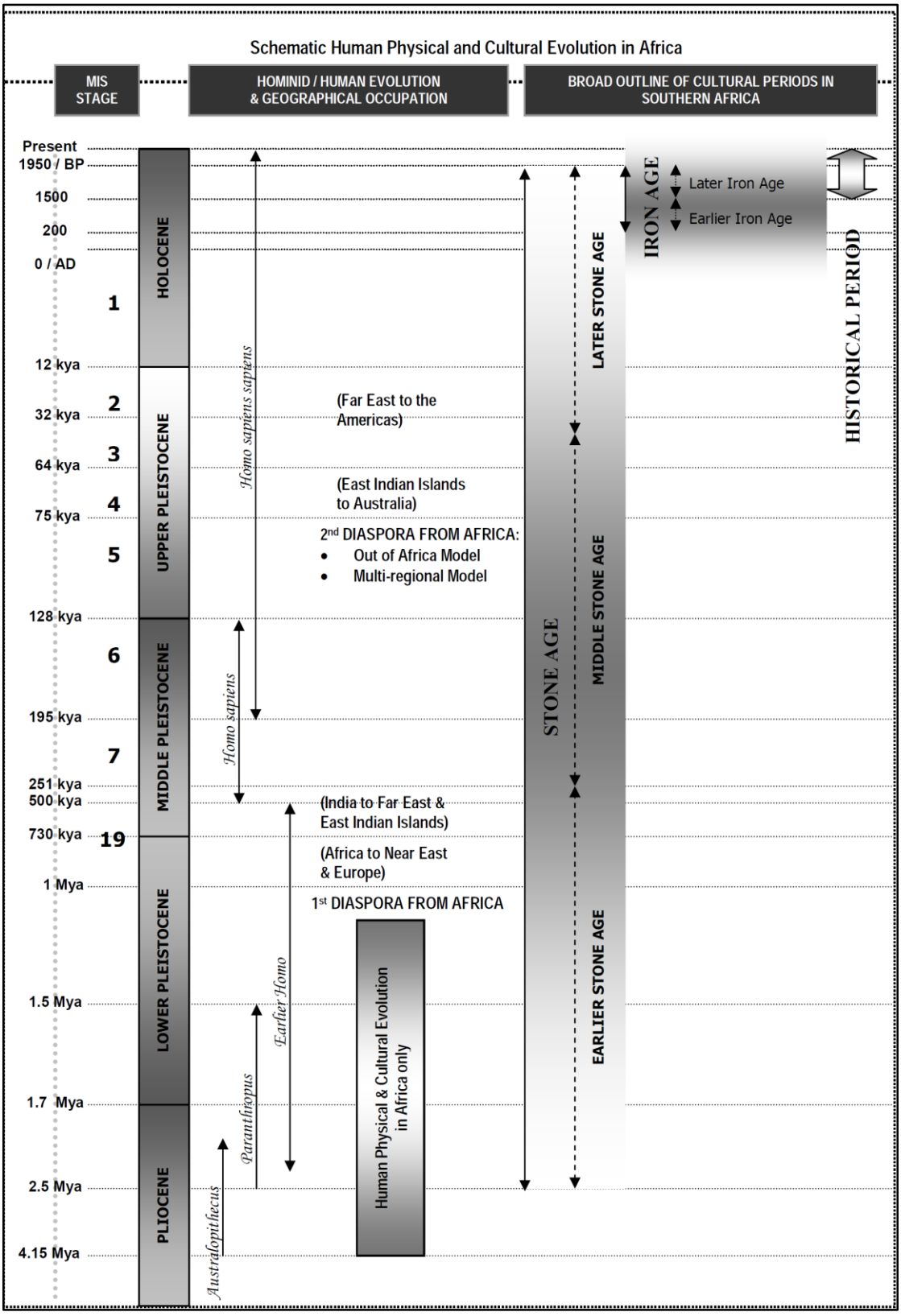

Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

2. TECHNICAL DETAILS OF THE PROJECT

2.1. Site Location and Description

Sendawo Solar PV will be located approximately 10km south of Vryburg, in the Dr Ruth Segomotsi Mompati District of the North West Province. (Figure 2).

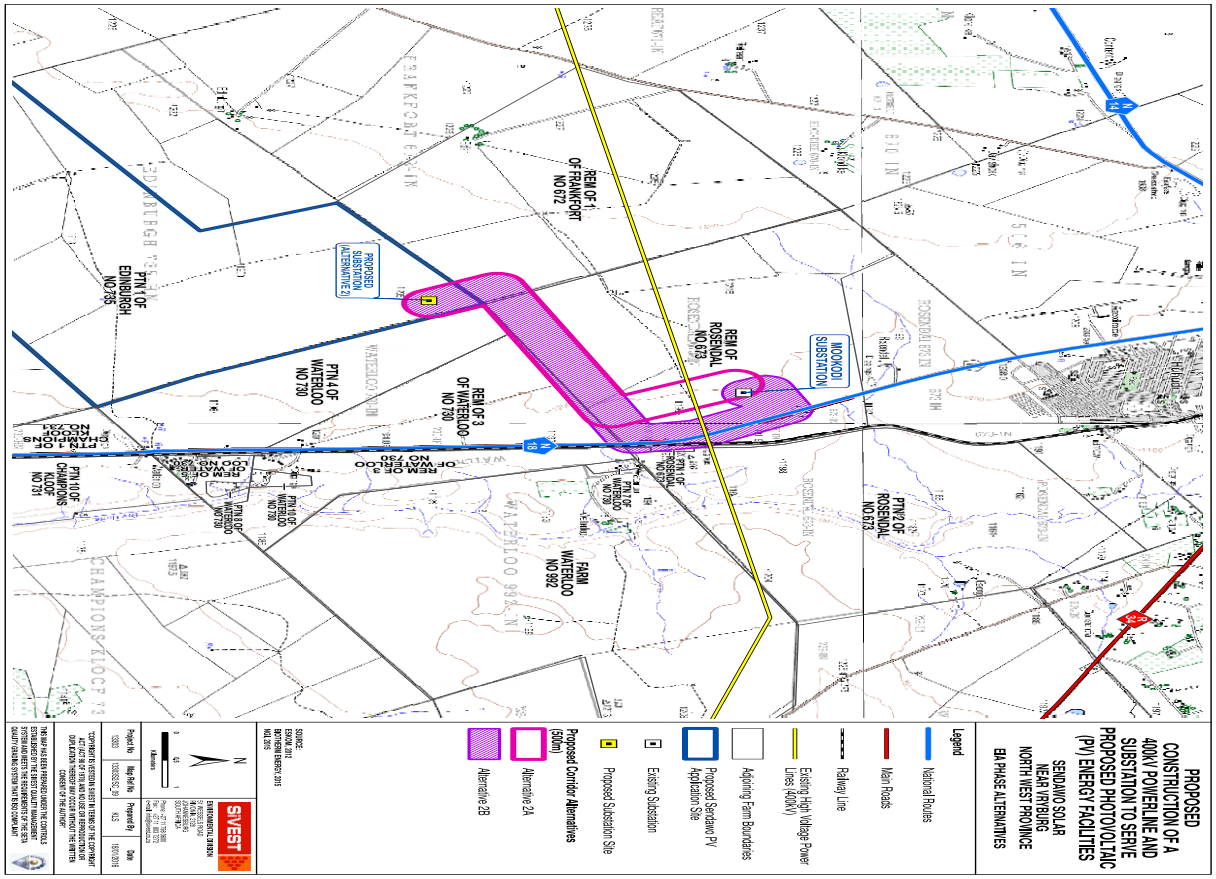

Figure 2 – Sendawo Solar Locality

The application site is approximately 1700ha however the buildable area will be significantly smaller than this and will be determined by sensitive areas identified during the Scoping Phase of the EIA. Sendawo Solar will consist of three (3) 75MW solar PV facilities, namely Sendawo Solar 1, Sendawo Solar 2 and Sendawo Solar 3. Additionally, 132kV power lines will connect the PV facilities to the proposed Sendawo substation. **The said power lines are the subject of this report.**

3. ASSESSMENT METHODOLOGY

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

3.1. Methodology for Assessing Heritage Site significance

PGS compiled this Heritage Assessment Document as part of the Heritage Impact Assessment (HIA) report for the proposed power line for the Sendawo Solar facilities. 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:

3.1.1. Scoping Phase

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

3.1.2. Impact Assessment Phase

Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by a qualified archaeologist, which 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.

Appendix B, outlines the Plan of study for the Heritage Impact Assessment process, while **Appendix C** provides the guidelines for the impact assessment evaluation that will be done during the EIA phase of the project.

4. BACKGROUND RESEARCH

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an Internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

4.1. Archival findings

4.1.1.Overview of the archaeological fabric of the study area and surroundings

A small number of archaeological and heritage contract projects have been undertaken in the general surroundings of the study area. Of the three heritage studies located in this area, two were undertaken for proposed photovoltaic solar farms and one for an extension to an existing base metal mine. No purely academic archaeological research appears to have taken place in the direct vicinity

of the study area, with the nearest known research locality the Taung Skull World Heritage Site situated 18.4 km south-east of the present study area. It is important to note that the information listed here does not necessarily represent all the previous archaeological work undertaken in the vicinity of the study area. The second source is information from reports that were accessed from the SAHRA electronic database known as SAHRIS, and which for the most part came about due to the requirement for archaeological and heritage impact assessments to be undertaken for mining (and other development) activities.

4.1.2. Archaeological Sites as Revealed Through a Study of Published Literature

The following sites were identified by studying archaeological journals and books. The sites are grouped according to their respective farm names. At the end of each description the approximate distance between the site and the present study area is provided. No information could however be obtained with regard to any archaeological research that was undertaken in close proximity to the study area. In the surrounding landscape the following archaeological sites are known:

Taung

In 1924 Raymond Dart identified the skull of an infant gracile australopithecine from a limestone quarry near Taung. While numerous fossils have been recovered from the same quarry, the skull of the Taung Child is the only hominin remains recovered from this site. Taung is one of only three localities in South Africa where fossil evidence for early hominins were ever recovered, the other two being the Cradle of Humankind (with sites such as Sterkfontein and Kromdraai) and Makapansgat (Mitchell, 2002). The Taung Skull World Heritage Site is located 70 km south of the present study area.

Harts River Valley Survey Project

In 1989 the University of the Witwatersrand was commissioned to conduct an archaeological survey of a section of the Harts River valley that was scheduled to be flooded by the proposed construction of the Taung Dam. A total of 28 Stone Age and three pastoralist sites were identified during the survey. Of the 38 identified Stone Age sites, a total of 11 could be associated with the Early Stone Age.

The best-preserved sites identified during the survey were excavated in 1992, including two of the Early Stone Age sites namely 2724DB3 and 2724DB4. Incidentally, the research undertaken at these two sites has provided valuable insight into the Acheulean archaeology of South Africa. In the words of Prof. Kathleen Kuman (2001:20), the "...Harts Valley project provides further documentation for the South African part of this picture of technological continuity and the origins of prepared core technology within the Acheulean".

Seven rock art sites were also identified in the footprint area of the proposed Taung Dam. These seven sites comprise finger paintings of geometric patterns as well as one site which contains paintings of "...riders on horseback...riders on horseback chasing an elephant...and two geometric patterns" (Dowson et.al., 1992:28).

If any of these sites identified before the construction of the Taung Dam still exists, they would be located roughly 60 km south east of the present study area.

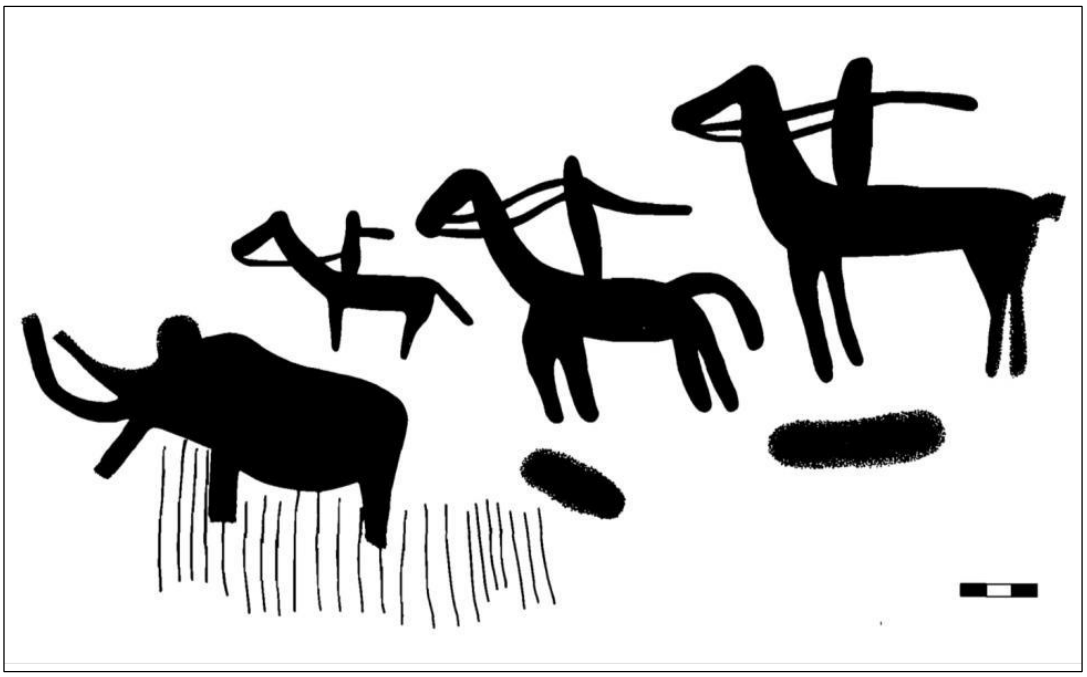

Figure 3 – Tracing of one of the rock art panels at a site located roughly 40 km east of the present study area (Dowson, et.al., 1992: 29).

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

Table 3: Summary of History of Lichtenburg Town and Surrounding Area

DATE	DESCRIPTION
2.5 million to 250,000 years ago	The Earlier Stone Age (ESA) 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 Acheulean and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulean phase dates back to approximately 1.5 million years ago. A total of 11 Early Stone Age sites with Acheulean lithics have been recorded in the Harts River valley, immediately east of the town of Taung and roughly 60 km east of the present study area (Kuman, 2001).
250,000 to 40,000 years ago	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.
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), with one known site located at Dinkweneng (roughly 43 km east of the study area). Furthermore, a Low Density Surface Scatter of Later Stone Age material was identified at the Pering Mine (approximately 60 km south-west of the study area) (Birkholtz, 2011).
Early 1600s	The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Daniëlskuil) (Snyman, 1986).
c. 1770	The Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the study area during this time.
Early 1800s	After the threat of the Kora became less intensive the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis there during the 1820s (Snyman, 1986). During this time German-born deserter Jan Bloem and his followers established themselves at Lekatlong (Legassick, 2010).
1833	Hurutshe refugees established themselves at Taungs (Legassick, 2010). The present-day town of Taung is roughly 40 km due-south of the study area.
1834	Mahura and his Thlaping followers moved from the vicinity of Kuruman to Taungs. Apart from the 1,500 individuals that followed Mahura to Taungs, the settlement of Taungs at the time also included some 2,000 Hurutshe, the Kora leader Mosweu Taaibosch and his followers as well as some 1,500 Maidi (Legassick, 2010).
November 1840	Gasibonwe, the son of Mothibi, attacked Mahura's cattle posts at Taungs and further afield. His aim was to degenerate Mahura's rule and to achieve supremacy over all the Thlaping (Legassick, 2010).
22 April 1842	A treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed upon boundary closest to the study area ran from Daniëlskuil to Boetsap, which meant that the

	study area was defined as part of this treaty as forming part of Thlaping land (Legassick, 2010). This boundary was very similar to an earlier one that was thought to have been agreed to during the 1820s as a boundary between the Griqua and the Thlaping (Legassick, 2010).
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River in the vicinity of the confluence of the Vaal and Harts Rivers (Van Staden, 1983). This resulted in large numbers of fortune seekers streaming into the area from overseas, which would have had a profound impact on the social-dynamics of the landscape.
27 October 1871	The area located in the triangle formed by the Orange and Vaal Rivers was proclaimed as British Territory and named Griqualand West. This proclamation came as a result of ownership disputes between the Griqua, the Boer Republic of the Orange Free State and the Boer Republic of the Zuid-Afrikaansche Republiek in terms of the newly discovered diamond diggings (www. wikipedia.com).
1879	After Barend Barends was defeated by the Khumalo Ndebele of Mzilikazi, Boetsap was occupied by two shopkeepers, Hunter and Tasker.
1882-1885	The Boer Republic of Stellaland existed during this time in the general area of the Vryburg district. Stellaland had its roots in the conflict between Mankurwane's Tlhaping and Mosweu's Kora over land. Both sides used white mercenaries who as part of their remuneration were to receive farms. Almost 300 Boers joined the side of Mosweu in this war and on 26 July 1882 Mankurwane sued for peace. As a result of the peace agreement a portion of land was set aside for the mercenaries. From September 1882 the capital of Stellaland was being laid out and named Vryburg. On 6 August 1883 the Republic of Stellaland was proclaimed. However, the republic seized to exist when Sir Charles Warren proclaimed the Bechuanaland Protectorate on 30 September 1885 (Bergh, 1999). The Taungs area, including the farm Brakfontein, was located just outside the southern boundary of Stellaland.
30 September 1885	Sir Charles Warren proclaims British Bechuanaland. This proclaimed area included the study area (www.wikipedia.com).
1895	British Bechuanaland was incorporated into the Cape of Good Hope (www.wikipedia.com). The study area now fell within the Cape of Good Hope. In the same year the Kaukwe Native Reserve was established in accordance with British Bechuanaland Proclamation No. 220 (Breutz, 1986). This reserve is located 60km south-west of the present study area
1904	Reverend William Charles Willoughby and his wife Bessie arrives in the vicinity of the current study area with the aim of assisting the

	Batswana to establish a school in Bechuanaland. After several attempts the Institution was finally established at Tiger Kloof. http://www.tigerkloof.com/index.php/about-us/history

4.1.3.Findings of the background research

The pre-history of the area is evident through the presence of numerous farms with rock engravings, including Verdwaal Vlakte, Bernauw, Schatkist, Wonderfontein and Kinderdam (Van Schalkwyk, 2012; Morris, 1998).

The numerous dry pans in the northern section of the study area also increase the probability of finding Stone Age Sites associated with hunter gatherer subsistence.

Heritage Resources associated with the South African War can be traced through the presence of blockhouse lines between Taung and Vryburg and onwards towards Madibogo, as well as the Vryburg concentration camp situated on the Vryburg Allotment area that is now part of the Leon Taljaard Nature Reserve to the north west of Vryburg.

Other areas of significance identified are the Devondale Mission (*circa* pre-1900), Tiger Kloof Institute (*circa* 1904) as well as the farmstead of the first and only president, Gerrit Jacobus van Niekerk, of the republic of Stellaland on the farm Niekerksrus. some 36 kilometres northwest of Vryburg.

4.1.4.Themes identified during the research were

- Palaeontology
- Pre-colonial archaeology and early inhabitants – especially associated with inland water in the arid regions of South Africa
- Early Colonial History and settlement
- Routes and transport
- Military history
- Town and village formation

4.2. Palaeontology

The palaeontological resources in the Vryburg area have received very little scientific attention. To a great extent they can only be inferred from the rock units represented there on geological maps. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps, however.

Stromatolitic carbonate rocks (limestones, dolomites) of Early Precambrian (Archaean) age in outcrops of the Ventersdorp Group (Kameeldorns, Rietgat and Bothaville Formations) as well as the lower part of the Transvaal Supergroup (Ghaap Group, Vryburg Formation & Schmidtsdrift Subgroup, including the Boomplaas Formation). In the Vryburg area and further south towards Taung these include some of the oldest (> 2.5 billion years) and best-preserved stromatolites (fossil microbial mounds) known from this period;

Stromatolites are recorded from the dolomite layers. Highly fossiliferous Caenozoic cave breccias are also known to occur within the dolomite layers, but are not mapped individually. These fossiliferous deposits often contain more recent mammal and hominid fossils, e.g. in the Cradle of Humankind."

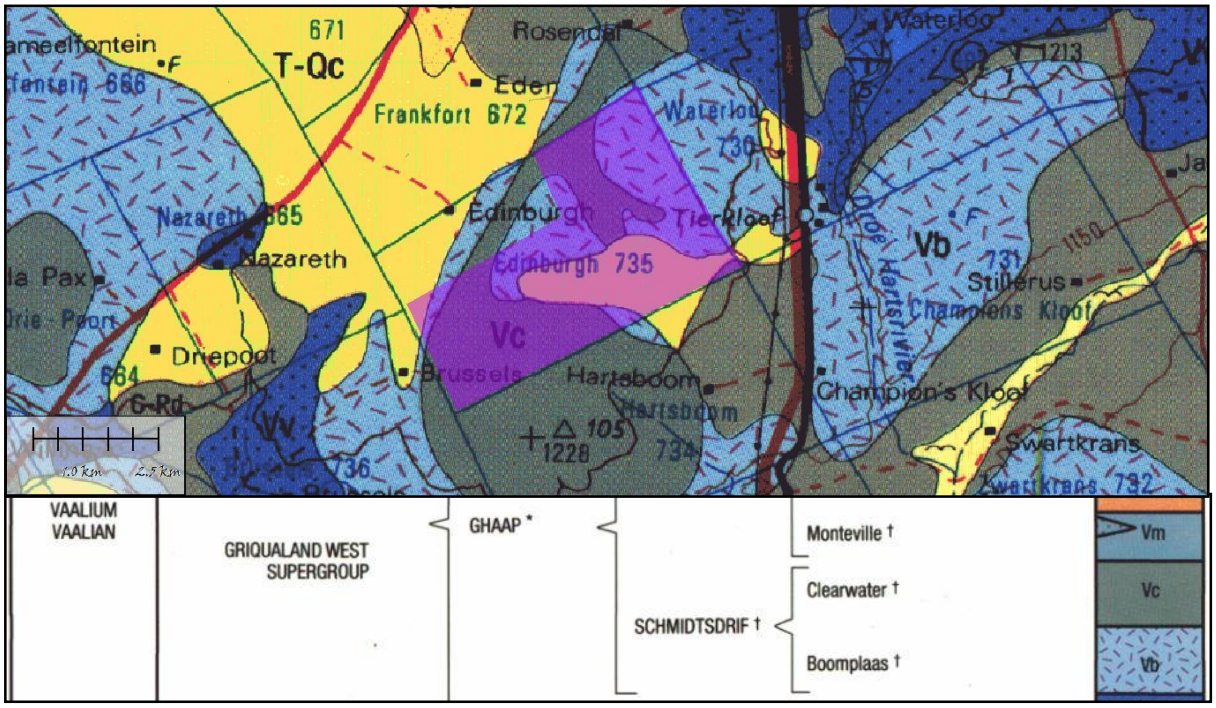

Figure 4: The study area is underlain by rocks of the Boomplaas (Vb) and Clearwater (Vc) Formations of the Ghaap Group, and calcrete (T-Qc)

4.2.1.Findings from the studies

Through the analysis of the aerial photographs and available maps of the study area no obvious heritage sensitive areas were identified inside the study area. Some rocky outcrops that could possibly contain rock engravings and open air stone age sites have been identified as possible heritage sensitive areas.

4.3. Cumulative impacts

An evaluation of the possible cumulative impacts from the combined solar projects in the area (Table 2 and **Figure 5**) on heritage resources has shown that the biggest envisaged impact could be on the palaeontological heritage of the area with the Rosendal and Waterloo solar facilities just east and north east of the of this proposed development increasing the possibility of impacts on the breccias that could occur in the area.

Though with the implementation of mitigation measures these impacts could be transformed into a positive impact through the discovery of previously unknown fossils and the subsequent study of such fossil finds adding to the academic knowledge of the palaeontological resources of the study area.

Table 4: Renewable energy developments proposed within a 25km radius from the Sendawo PV application site

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Tiger Kloof Solar PV energy facility	14/12/16/3/3/2/535	Scoping and EIA processes underway.	Kabi Solar (Pty) Ltd	75MW	Portions 3 & 4 of the Farm Waterloo 730
Sediba Power Plant 75MW PV Solar Facility and associated infrastructure	14/12/16/3/3/2/390	Environmental authorisation received	Sediba Power Plant (Pty) Ltd	75MW	A portion of the remaining extent of the Farm Rosendal 673
Waterloo Solar Park	14/12/16/3/3/2/308	Environmental authorisation received and preferred bidder status (REIPPP window 4).	DPS79 Solar Energy (Pty) Ltd	75MW	Southern portion of the Farm Waterloo 992
Cronos Energy Renewable Energy Generation Project	14/12/16/3/3/2/750	Environmental authorisation received	Cronos Energy (Pty) Ltd	75MW	Remainder of the Farm Elma No 575
75MW Carocraft PV Solar Park and associated infrastructure	14/12/16/3/3/2/374	Environmental authorisation received 29 June 2013. Amended to 75MW on 4 April 2014.	Carocraft (Pty) Ltd	75MW	Portion 1 and the Remainder of the Farm Weltevrede 681
Expansion of the Carocraft Solar Park	14/12/16/3/3/2/699	Scoping and EIA processes underway.	Carocraft (Pty) Ltd	75MW	Southern side of the Remainder of the Farm Weltevrede 681
Woodhouse Solar 1 PV Facility	TBC	Scoping and EIA processes underway.	Genesis Woodhouse Solar 1 (Pty) Ltd	100MW	Remaining extent of the Farm Woodhouse 729

Woodhouse Solar 2 PV Facility	TBC	Scoping and EIA processes underway..	Genesis Woodhouse Solar 2 (Pty) Ltd	100MW	Remaining extent of the Farm Woodhouse 729

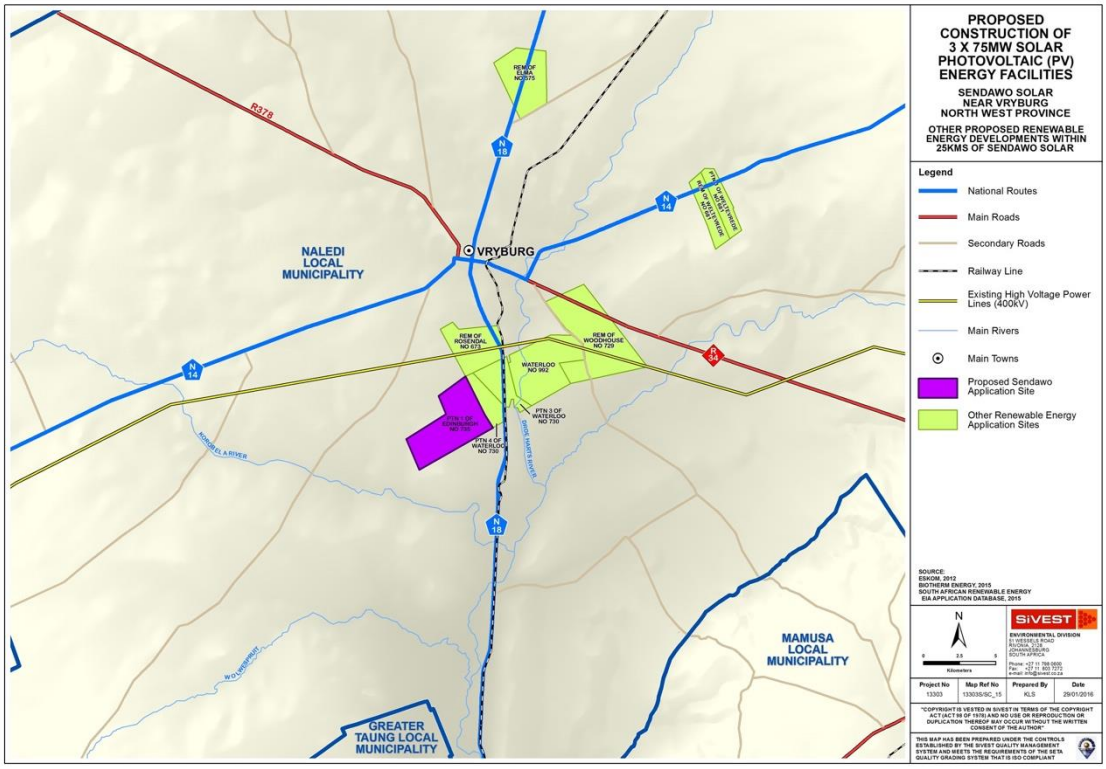

Figure 5 - Geographical position of renewable energy developments proposed within a 20km radius from the proposed Sendawo PV application site

Figure 6 provides and illustration of the possible impact areas to be associated with the proposed PV facilities at Sendawo. The following impacts and possible mitigation associated with this project can be listed as:

- Impacts on palaeontology – ***monitoring during construction where needed. Controlled collection of fossils***;
- Impact on unidentified graves – demarcation and protection where possible. Relocation of graves should only be considered as last resort and under strict permitting conditions.

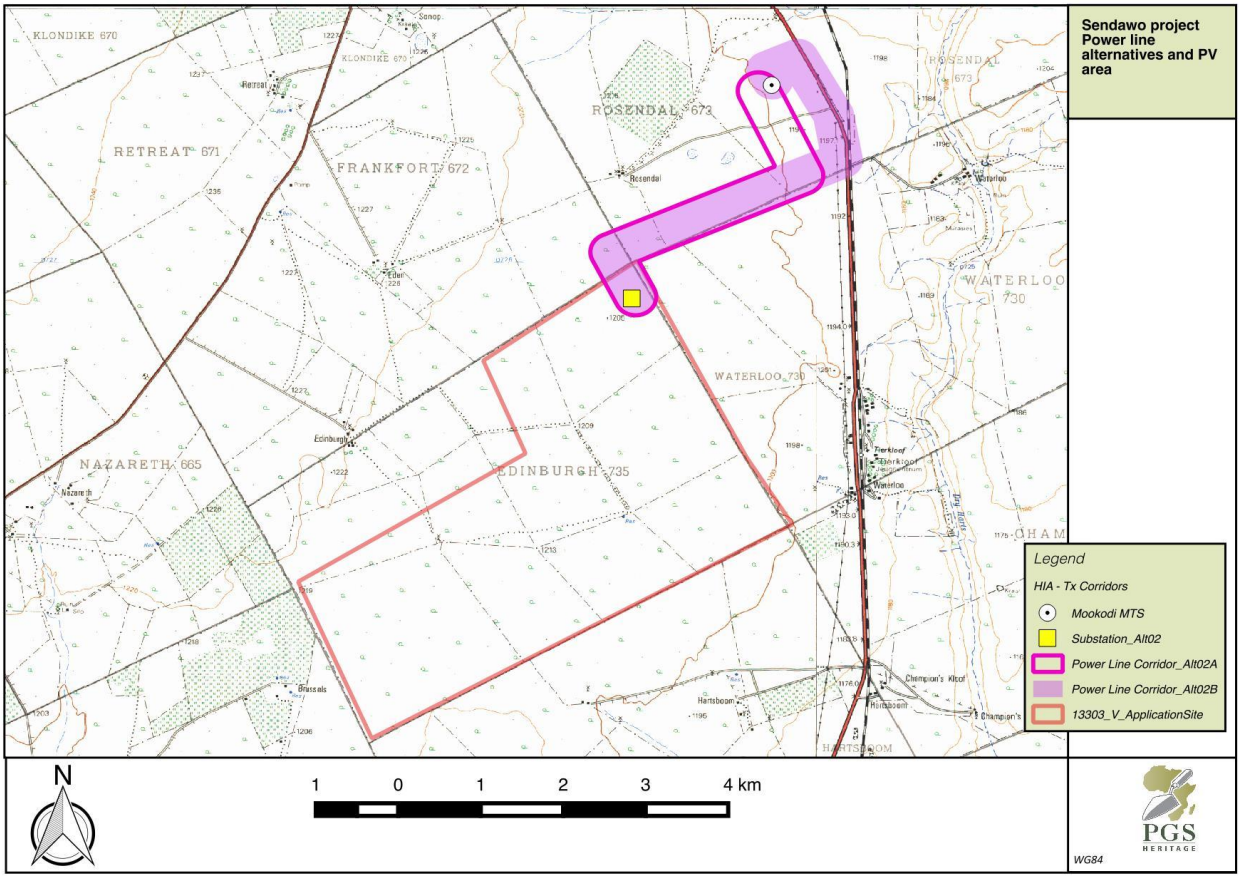

Figure 6 - Combined project options for the Sendawo PV facilities

4.4. Impact Assessment

4.4.1.Field work findings

Fieldwork was conducted on the application site of the Sendawo Alternative power lines from 3-4 December 2015. The methodology focused of a tracked walkthrough of the foot print areas of proposed PV project application area (**Figure 7**). An accredited professional archaeologist, Miss Jessica Angel, completed the fieldwork. The fieldwork was done on foot and by vehicle.

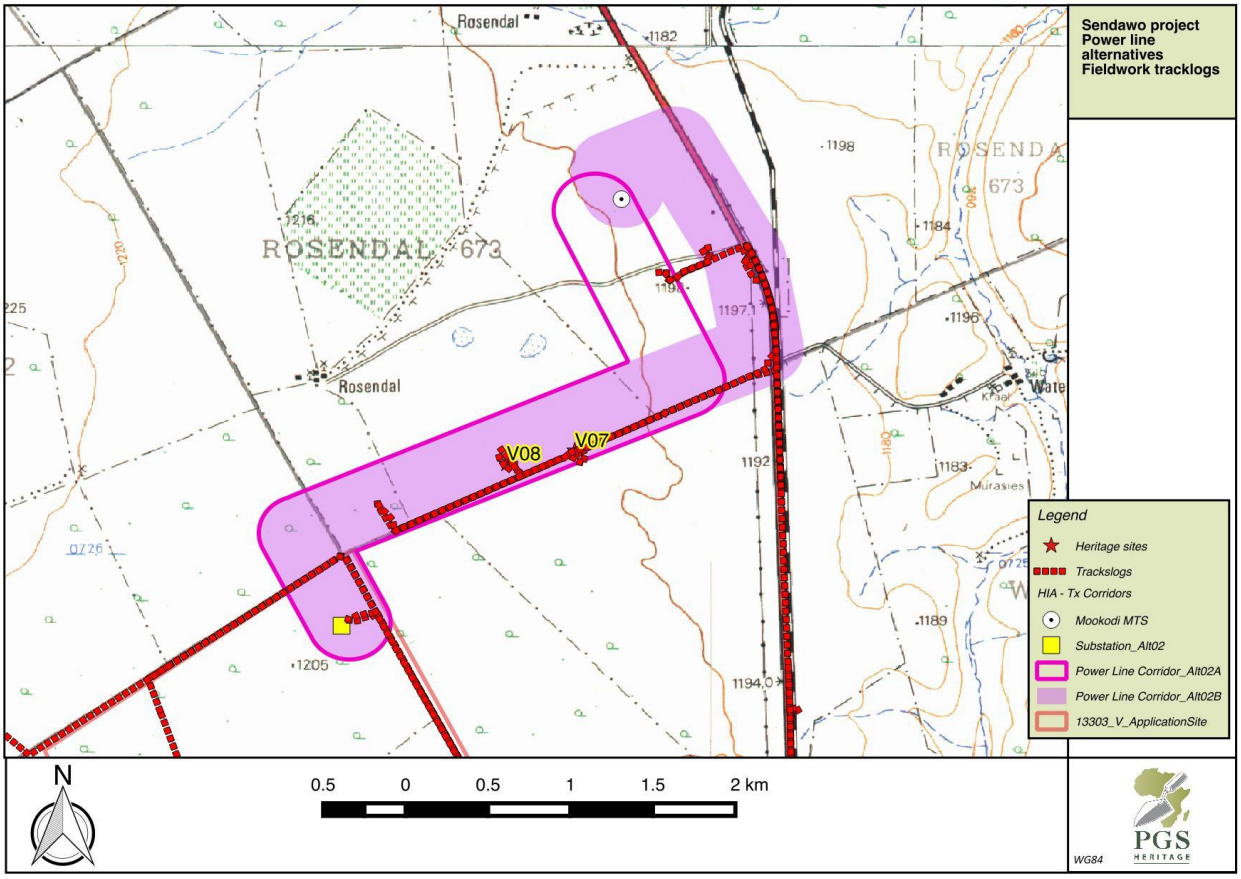

Figure 7 – Project layout with tracklogs

It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Sendawo power line alternatives is an area of 2.42 square kilometres for Alternative 2A and 3.1 square kilometres Alternative 2B

A total of 2 sites (find spots), which can be considered archaeological, were logged. Both these sites relate to the Stone Age.

The numerous Stone Age artefacts (lithics) occurring over the extent of the area, required a refinement of the methodology and the defining of what constitutes an archaeological site as appose to a findspot.

It was decided to use the density of lithics present on the ground to be the guiding rule towards elaborating on a findspot and defining it as an archaeological site. A find spot was classified as and area containing a density of more than 10 lithics per square meter, while a density of or than 20 lithics per square meter was deemed to be the trigger mechanism for converting a find spot to an archaeological site.

4.4.2.Description of area

The study area and surrounds is characterised by low vegetation growth dispersed over fairly flat terrain The vegetation in the area falls under the Savanna Biome and more specifically in the Ghaap Plateau Vaalbosveld Group. Dominating the surface area are vast exposed pebble layers usually associated with low rises in the landscape. Drainage lines and flat surface are characterised by red sand cover in between the exposed pebble layers.

Figure 8 – View of general area. This photo was taken at the proposed Sendawo substation site

Figure 10 – General view of the area, Dried pan where V07 was located

Figure 9 – Mookodi substation

Figure 11 **– General vegetation at the southern most end of the power line alternatives**

4.4.3.Heritage Resources

The sites varied from Middle Stone Age (MSA) scatters consisting of flakes and some cores manufactured from coarse-grained quartzite material; Early Stones Age (ESA) lithics consisting of cores and a hand axe with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops. Most of the lithics were either rolled or heavily weathered with patination evident on many of the lithics.

Find spots **V07** and **V08** have a low significance, however the possibility of subsurface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.

Figure 12 – View of pan at site V07

Figure 13 – View of site V08

Figure 14 – Site V07, MSA core (quartzite)

Figure 15 – V08, ESA hand axe (highly weathered) and MSA core.

Table 5 : Sites – Application footprint

Site number	Type	Longitude	Latitude	Description	Heritage Significance
V07	MSA site	S27° 01' 30.8"	E24° 44' 28.8"	Low density scatter of MSA lithics over an area of approximately 50 $m^{2.}$ The site is characterised by a large pebble concentration within a dry pan.	Grade 3C
V08	ESA/MSA site	S27° 01' 33.7"	E24° 44' 13.8"	Low density scatter of MSA and ESA material The site is characterised by the typical Savanna Biome and more specifically in the Ghaap Plateau Vaalbosveld Group the size of the site is about 130 $m^{2.}$	Grade 3C

4.4.4.Palaeontological Resources

During the fieldwork it was observed that most of the areas have little outcrop but an area at GPS stations 0482 to 0562 has significant outcrops of dolomite with both stromatolites and possible cave breccia (Table 6) (Groenewald, 2016).

The fieldwork findings have shown that a small part of the study area is characterised by the presence of significant Stromatolites and that stromatolites are present in almost all the dolomite boulders on site. Some areas have possible remains of cave breccia but no in situ outcrops were recorded.

Table 6: Photographic observations during fieldwork session (See Figure 10)

Photo	GPS station no (Fig. 16) and coordinates	Description	Picture
1	(0592) -27° 02' 02.7" 24° 43' 43.1"	Deeper red sandy soils in possibly Tertiary Aged river bed. outcrops are mostly shale and quartzite outcrops with minor stromatolitic dolomites	
2	(0602) -27° 01' 53.9" 24° 43' 38.0"	Deep red soils on shale and quartzite with minor dolomites, no fossils observed	
3	(0612) -27° 01' 57.5" 24° 43' 31.9"	Shallow sandy soils on shale and quartzites with minor dolomite. No fossils observed.	

4	(0752) -27° 00' 28.2" 24° 44' 53.1"	Deeper sandy soils, windblown sand on shale and quartzites, minor dolomite and no significant fossils observed	
5	(0762) -27° 00' 28.2" 24° 44' 53.1"	Sandy soil on quartzite and shale, no fossils observed	
6	(0772) -27° 01' 11.9" 24° 45' 13.0"	Shale, quartzite and minor dolomite. No fossils observed	
7	(0782) -27° 00' 53.8" 24° 44' 27.8"	Deep windblown sand on quartzite, shale and minor dolomite. No fossils expected, no fossils observed.	

8	(0792) -27° 00' 53.8" 24° 44' 27.8"	Deep sandy soils on windblown sand covering shale, quartzite and minor dolomite. No fossils observed	
9	(0802) -27° 00' 51.9" 24° 45' 09.7"	Interbedded shale,quartzite, shale and dolomite with thin windblown sand cover. No significant stromatolites or other fossils observed	
10	(0802) -27° 00' 51.9" 24° 45' 09.7"	Deep windblown sand with quarry into interbedded quartzite, shale and lava. Very few fossils expected in outcrops and no fossils observed	

The fieldwork findings have shown that a small part of the study area is characterised by the presence of significant Stromatolites and that stromatolites are present in almost all the dolomite boulders on site. Some areas have possible remains of cave breccia but no in situ outcrops were recorded (Figure 17).

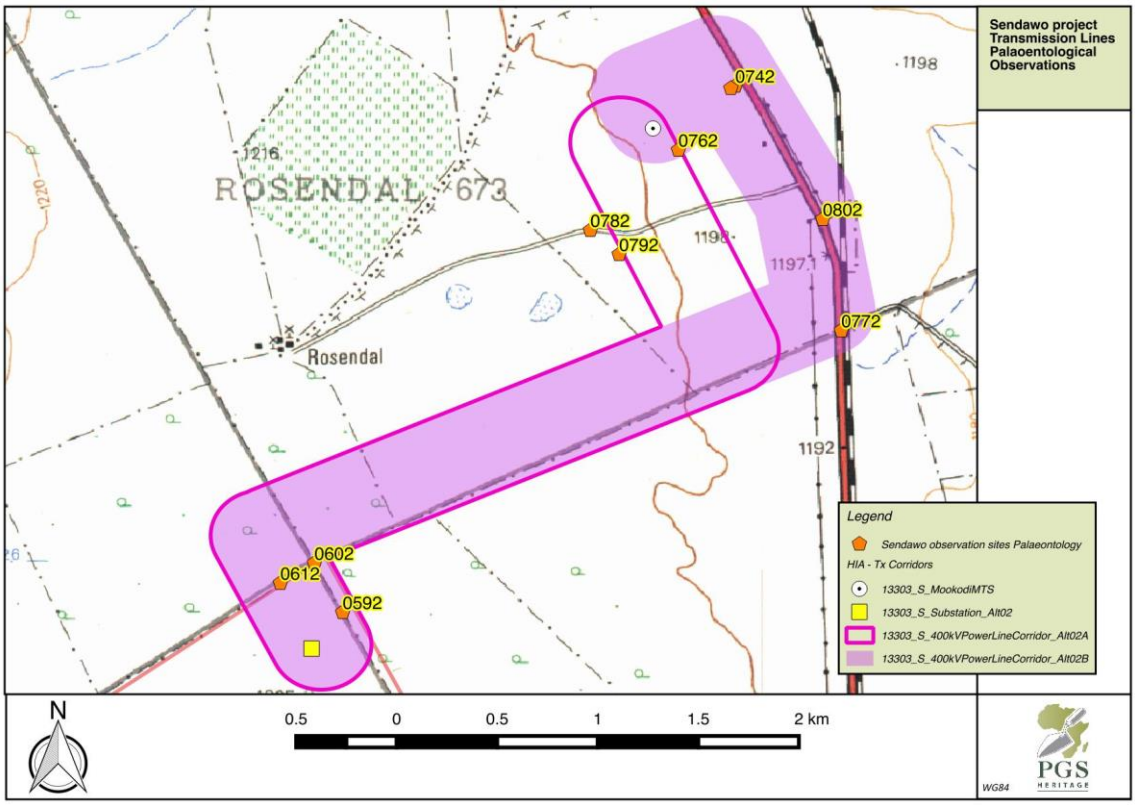

Figure 16 - Photographic observation points correlating with Table 6

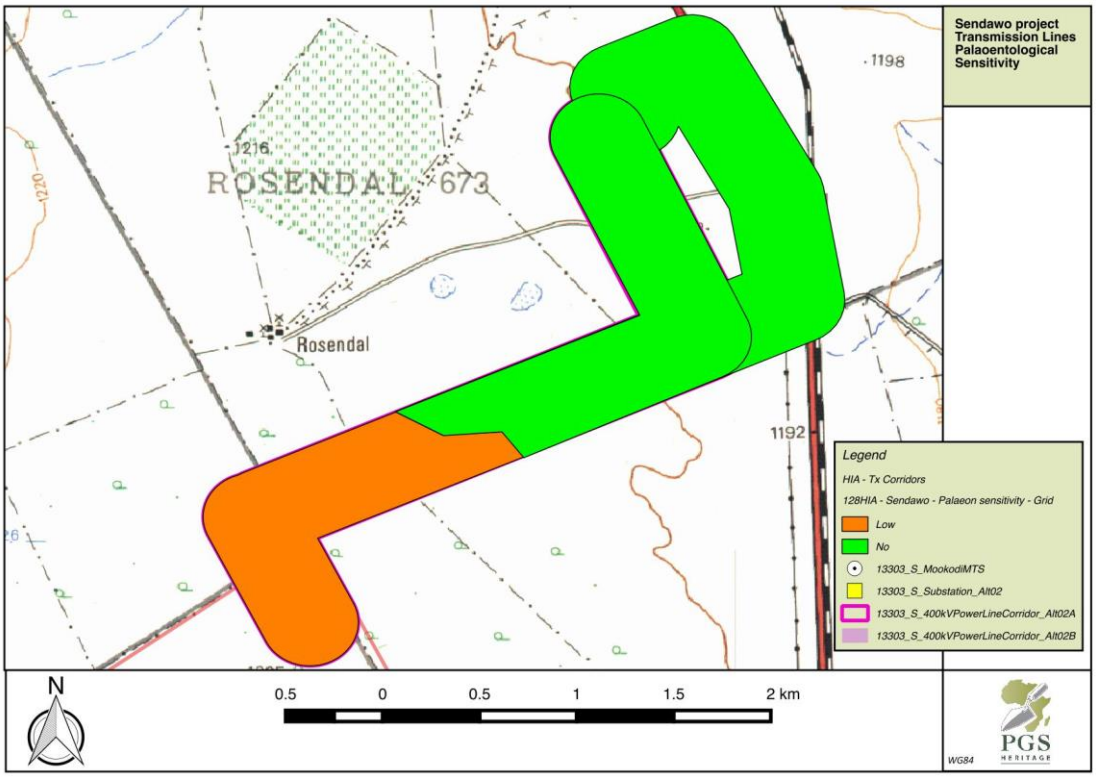

Figure 17 - Palaeontological sensitivity (less important stromatolites in dolomite boulders and minor outcrop in orange area, and no fossils observed in green area)

4.5. Assessment

4.5.1.Heritage Resources

The fieldwork findings have shown that the study area is characterised by a background scatter of Stone Age artefact. The methodology utilised in the identification and classification of finds between find spots and sites enable a clear distinction between groupings.

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

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

Table 7 Rating of Impacts – Chance finds

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified heritage resources and specifically Stone Age archaeological sites. 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	3	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (negative Medium Impact)	-10 (low negative)
Mitigation measures	*Monitoring during construction by an archaeologist* *Mitigation through archaeological excavations and collection* *Walkdown of final power line route*	

4.5.2.Palaeontological Resources

The fieldwork findings have shown that a small part of the study area is characterised by the presence of significant Stromatolites and that stromatolites are present in almost all the dolomite boulders on site. Some areas have possible remains of cave breccia but no in situ outcrops were recorded.

It must be kept in mind that the fieldwork could in no way identify all palaeontological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering possible cave breccias during geotechnical investigation is relatively high.

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

Table 8: Rating of Impacts on Palaeontology - Alternative route 2A and 2B

IMPACT TABLE	
Environmental Parameter	*Palaeontological Resources*
Issue/Impact/Environmental Effect/Nature	*The presence of previously unidentified Palaeontological heritage resources and specifically Palaeontological sites as well as the impact on the identified palaeontological sites*
Extent	*Will impact on the footprint area of the development but will have a significant impact on the National Heritage database*
Probability	*The fieldwork has shown that such a predicted impact could occur*
Reversibility	*Due to the nature of palaeontological sites the impact is seen as irreversible, however mitigation could enable the exclusion of a small area to preserve the highly sensitive sites and 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 sites. Fossils can never be replaced*
Duration	*The impact on heritage resources such as palaeontological sites will be permanent unless mitigated*
Cumulative effect	*As the type of development impact on a large area, and other similar development in the area will also impact on palaeontological sites the cumulative impact is seen as having a major negative impact.*
Intensity/magnitude	*The impact on palaeontological sites will require mitigation*
Significance Rating	*The overall significance rating for the impact on heritage resources is seen as low negative pre-mitigation for both alternatives. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating or even significant positive rating.*

Impact Assessment for Alternative Route 2A and 2B		
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	-34 (medium negative)	26 (low positive)
Mitigation measures	*Monitoring during construction by palaeontologist if fossils are exposed during excavation of more than 1.5m of soil cover*	

4.6. 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 palaeontological heritage of the area of this proposed development increasing the possibility of impacts on the breccias that could occur in the area.

The need for the implementation of the recommended mitigation measures is of great importance and must be seen in the context of the large areas to be impacted by the construction activity. By implementing the mitigation measures the cumulative effect will be reduce from a Very High Negative to a High Positive impact rating.

Though with the implementation of mitigation measures these impacts could be transformed into a positive impact through the discovery of previously unknown fossils and the subsequent study of such fossil finds adding to the academic knowledge of the palaeontological resources of the study area.

4.7. 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
Heritage resources	Impact during construction	28		10	
			Negative medium Impact		Positive Low Impact
Palaeontological Resources – Route 1A		-34	Medium Negative	26	Low Positive
Palaeontological Resources – Route 2A		-34	Medium negative	26	Low Positive

4.8. Comparative Assessment for Sendawo solar

The two Alternative alignments both cross over the area where the two archaeological findspots were identified. Both alternative will have an equally low impact on the findspots and as such no preference for either of the alignments exist.

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 LINES		
Power Line Corridor Alternative 2A	No preference	Although stromatolites are present they are small and mostly associated with boulders on site
Power Line Corridor Alternative 2B	No preference	Although stromatolites are present they are small and mostly associated with boulders on site

5. MANAGEMENT GUIDELINE

5.1. 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 – Refer to Section 9 of this report	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)		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		Completion and development of mitigation measures	**R30 000**
D	Monitoring of construction activities by palaeontologist if indicated after completion of geotechnical report	Construction	During construction	Applicant ECO Palaeontologist	Palaeontologist (Initial 2-day site visit. Then Fortnightly during construction)		Palaeontologist Monthly Checklist/Report	**Monthly R40-50 000**

6. HERITAGE MANAGEMENT GUIDELINES

6.1. 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 or a provincial heritage resources authority;
   (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
   (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

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

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

   This survey and evaluation must include:
   (a) The identification and mapping of all heritage resources in the area affected;
   (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National 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. Archaeological finds; and
   d. Historical Structures.

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

   Possible finds include:
   a. Open air Stone Age scatters, disturbed during vegetation clearing. This will include stone tools.
   b. Palaeontological deposits such as bone, and teeth in fluvial riverbank deposits.
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.

Table 10: Roles and responsibilities of archaeological and heritage management when heritage resources are discovered during operations

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites, when discovered.	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 (when discovered). The client with the specialist needs to agree on the scope and activities to be performed	The client	Environmental Consultancy and the Archaeologist
When a specialist/archaeologist has been appointed for mitigation work on discovered heritage resources, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

6.2. All phases of the project

6.2.1.Archaeology

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area.

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 phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

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

In the case where archaeological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological material, a buffer of at least 20 meters should be implemented.
- If archaeological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the material permit must be applied for from SAHRA under Section 35 of the NHRA.

6.2.2.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 50 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 (Section 36 of the NHRA) and other relevant authorities (National Health Act and its regulations). 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.

7. CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact Assessment that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of powerline between the Sendawo PV site and the Mookodi substation near Vryburg, North West Province.

The Heritage Impact Assessment has shown that the proposed powerline alternatives have heritage resources present on the property. This has been confirmed through a field survey, archival research and evaluation of aerial photography of the sites.

7.1. Heritage Resources

During the fieldwork 2 archaeological findspots were identified of which both were representing the Earlier and Middle Stone Age. Both findspots have low heritage significance and will require no further mitigation.

7.2. Palaeontological Resources

The fieldwork findings have shown that a small part of the study area is characterised by the presence of significant Stromatolites and that stromatolites are present in almost all the dolomite boulders on site. Some areas have possible remains of cave breccia but no in situ outcrops were recorded.

7.3. Impact Summary

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

Table 11: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	28		10	
			Negative medium Impact		Positive Low Impact
Palaeontological Resources – Route 2A		-34	Medium Negative	26	Low Positive
Palaeontological Resources – Route 2B		-34	Medium negative	26	Low Positive

7.4. Comparative Assessment

The two Alternative alignments both cross over the area where the two archaeological findspots were identified. Both alternative will have an equally low impact on the findspots and as such no preference for either of the alignments exist.

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 LINES		
Power Line Corridor Alternative 2A	No Preference	Although stromatolites are present they are small and mostly associated with boulders on site
Power Line Corridor Alternative 2B	No Preference	Although stromatolites are present they are small and mostly associated with boulders on site

The overall impact on heritage resources is seen as acceptable and the proposed mitigation measures to be incorporated in the EMP will provided the necessary actions to address any impacts on heritage resources.

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8.4. Historic Topographic Maps

One of the historic topographic maps used in this report was obtained from the National Archives and the other from the digital resources of the William Cullen Library, Historical Papers, Early Maps collection.

8.5. Google Earth

All the aerial depictions and overlays used in this report are from Google Earth.

Appendix A

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

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

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

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

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

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

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

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

3.2 Graves and cemeteries

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

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

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

Appendix B

Heritage Assessment Methodology

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

The Heritage Impact Assessment (HIA) report to be compiled by PGS Heritage (PGS) for the proposed Tlisitseng Solar projects will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consists of three steps:

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

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

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

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

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

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

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

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- Site Significance

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

Table 12: 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

Appendix C

Impact Assessment Methodology to be utilised during EIA phase

Methodology for Impact Assessment

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

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 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.

Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

- Rating System Used To Classify Impacts

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

Table 13: Description

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

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

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

SIGNIFICANCE

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

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

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

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The 2010 regulations also specify that alternatives must be compared in terms of impact assessment.

Appendix C

Heritage Maps