



**PROPOSED 10 MW SOLAR PHOTOVOLTAIC FARM
THABA-SIONE,
NORTHWEST PROVINCE**

Heritage Impact Assessment

Version 1.0

DEA Reference: 14/12/16/3/3/1/500

24 May 2013

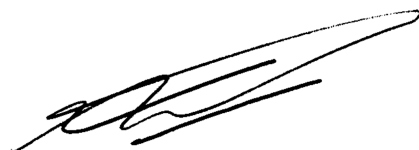
ACKNOWLEDGEMENT OF RECEIPT

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Report Title	<i>Heritage Impact Assessment for the Proposed 10 Mw Solar Photovoltaic Farm, Thaba-Sione, Northwest Province</i>		
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Reviewed			

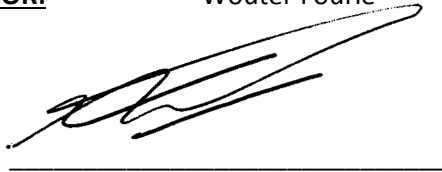
Declaration of Independence

The report has been compiled by PGS Heritage, an appointed Heritage Specialist for Environmental Impact Management Services (Pty) Ltd (EIMS). The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment Process.

ARCHAEOLOGICAL CONSULTANT: PGS Heritage

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A handwritten signature in black ink, appearing to read 'Wouter Fourie', is written over a horizontal line. The signature is stylized and cursive.

Executive Summary

PGS Heritage (PGS) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS), to undertake a Heritage Impact Assessment for the development of a 20Ha PV Solar facility close to Thaba-sione on the Khunana Location 4 IO, 11 kilometres north west of Kraaipan, North West Province.

During the survey 3 point specific heritage sites and 3 areas of possible heritage significance were found, while areas of possible heritage sensitivity were also identified. The following management is recommended:

Heritage Structures

- No further mitigation or permitting required – excluding burials
- The remaining structures must be evaluated during social consultation for the possible presence of infant burials.
- If it is found to contain infant burials the procedures as describe for grave relocation must be followed.

Stone Age Sites

- Archaeological collection permit in terms of Section 35 of the NHRA will be required if the site are to be impacted by the development and mitigation must be implemented.
- Phase 2 Archaeological Mitigation – To entail surface collection with surface distribution documentation
- After which the developer can apply for a destruction permit with the backing of the Phase 2 Archaeological Report.

Stone Age sensitive areas

As the Stone Age sensitive areas are located on the southern and eastern boundaries of the proposed development, it is recommended that the layout be adjusted to exclude these sensitive areas. If not possible to realign the development, monitoring during construction will be required by a qualified archaeologist (Refer to Appendix B).

Graves

If further investigation during the recommended mitigation measures for heritage structures indicates the presence of graves, the following management measures are recommended:

1. Adjust the development layout and demarcate site with at least a 10 meter buffer.
2. It is further recommended that in the event that the cemeteries cannot be incorporated in to the development the graves be relocated after a full grave relocation process that includes comprehensive social consultation. The grave relocation process must include:
 - 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;
 - Site notices indicating the intent of the relocation
 - Newspaper Notice indicating the intent of the relocation
 - A permit from the local authority;
 - A permit from the Provincial Department of health;
 - 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;
 - An exhumation process that keeps the dignity of the remains and family intact;
 - An exhumation process that will safeguard the legal implications towards the developer;
 - The whole process must be done by a reputable company that are well versed in relocations;
 - The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

Cultural landscape

The recommendation made in the Visual Impact Assessment needs to be implemented to minimise the visual impact on the landscape, where possible.

General recommendation

Further to these recommendations, the general Heritage Management Guidelines in Section 5 need to be incorporated into the EMP for the project.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels

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1. INTRODUCTION

PGS Heritage (PGS) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS), to undertake a Heritage Impact Assessment for the development of a 20Ha PV Solar facility close to Thaba-sione on the Khunana Location 4 IO, 10 kilometres North-West of Kraaipan, North West Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area. The Heritage Impact Assessment aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the identified 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 Heritage Impact Report was compiled by PGS Heritage (PGS).

The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS's staff has extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where their staff has the relevant expertise and experience to undertake that work competently.

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

Dr Gideon Groenewald has a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

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 and the current dense vegetation cover in some areas. As such, should any heritage features and/or objects not included in the present inventory be located or observed, an archaeologists must be contacted immediately.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time as the archaeologist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply.

1.4 Legislative Framework

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. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- iv. Development Facilitation Act (DFA) Act 67 of 1995

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

- i. National Environmental Management Act (NEMA) Act 107 of 1998 as promulgated in the Regulations.
 - a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
 - b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
 - c. Environmental Impacts 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. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002

- a. Section 39(3)
- iv. Development Facilitation Act (DFA) Act 67 of 1995
 - a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

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 NEMA (No 107 of 1998) states that an integrated environmental management plan should (23:2 (b)), “...identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”. In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive legally compatible HIA report is compiled. The heritage impact assessment criteria are described in more detail in **Appendix C**.

Table 1: Abbreviations

<i>Acronyms</i>	<i>Description</i>
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
ESA	Early Stone Age
GIS	Geographic Information System
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
NID	Notice of Intent to develop
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

1.5 TERMS & DEFINITIONS (taken from the National Heritage Resources Act, No 25 of 1999 – Section 2. Definitions)

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 400 000 and 2500 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 30 000 years, associated with fully modern people.

Late Iron Age (Early Farming Communities)

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.

Middle Stone Age

The archaeology of the Stone Age between 30-300 000 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.

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

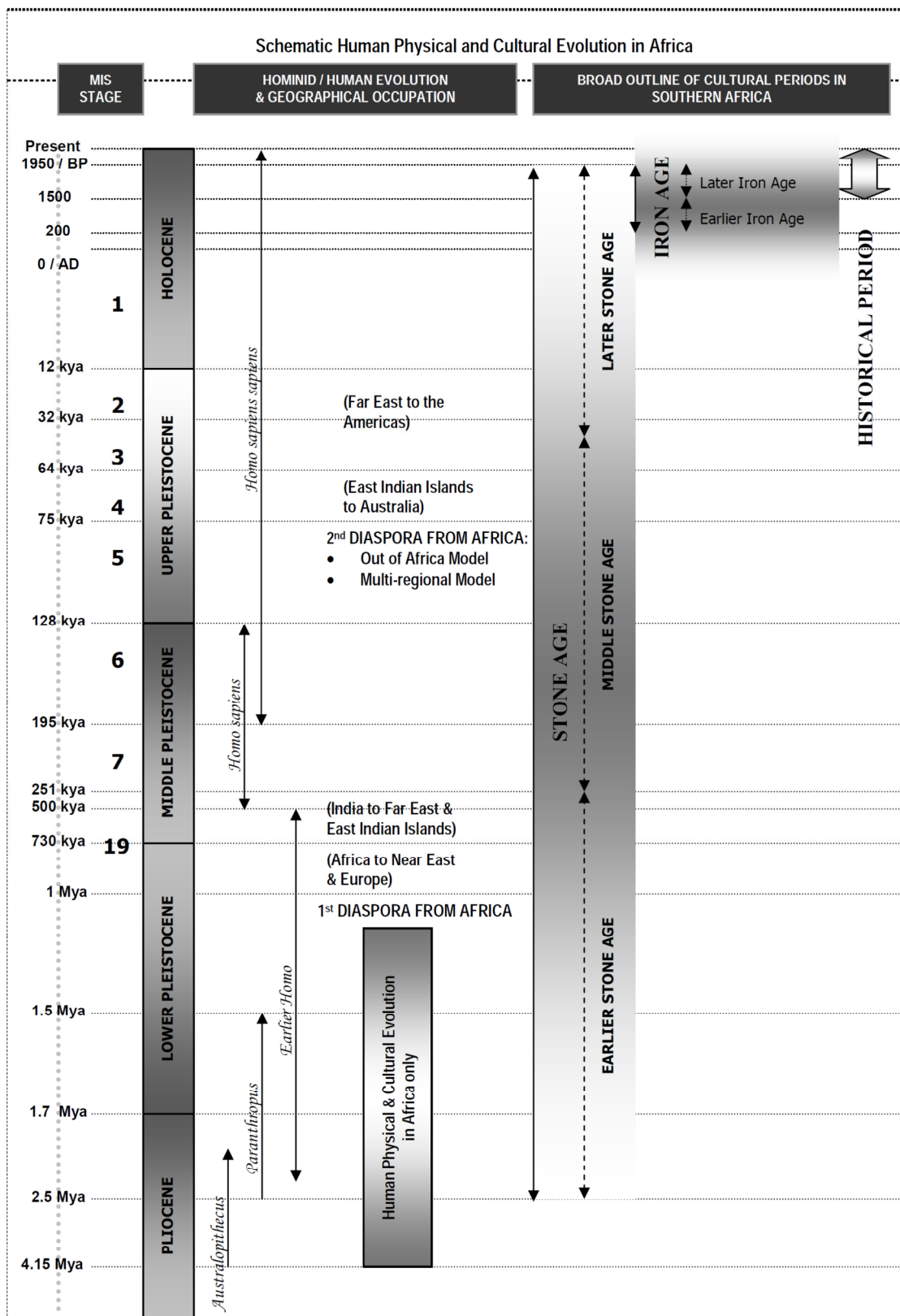


Figure 1 - Human and Cultural Time line in Africa (Morris, 2008)

2. TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location

Location	<p>GPS S26.35211 E25.40500</p> <p>The site is located some 40 kilometres northwest of the town of Delareyville, just 2 kilometres west of the Thaba-sione settlement on the Khunana Location 4 IO, 11 kilometres north west of Kraaipan, North West Province (Figure 2). The development will entail the construction of a Solar Photovoltaic farm, with a capacity of generating 10 Mega Watts.</p>
Land	20 Hectares of land under option
Land Description	The land is not currently utilised and consists of previously ploughed fields with secondary grass cover.

2.2 Site Description

The site is located some 40 kilometres northwest of the town of Delareyville, just 2 kilometres west of the Thaba-sione settlement (**Figure 2**). The property is to be utilised for the construction of a solar photovoltaic farm, with a capacity of generating 10 mega watts. This will entail the transformation of rural land to be used by an independent power producer (IPP). Eskom will provide the connection to bulk supply distribution lines.

In order to create a clear understanding of the project, the section below briefly describes the components that together make up a PV facility. PV technology employs solar panels composed of a number of solar cells containing a photovoltaic material (in this case, crystalline silicon). These panels are then linked together to form arrays, generating large amounts of direct current (DC) electricity. The electricity generated from the facility will be fed directly into the ESKOM grid after it has been converted from DC to Alternating Current (AC) electricity by an on-site substation. Eskom will provide to overhead power lines to link the PV facility to the ESKOM grid. At present however, ESKOM will only design the layout and construct the required infrastructure once the bid has been approved.

PV technology consists of the following components:

1. **PV Cell** - A basic photovoltaic device, which generates electricity when exposed to solar radiation. All photovoltaic cells produce DC electricity.

2. **PV Module or Panel** - The smallest complete assembly of interconnected photovoltaic cells. In the case of crystalline silicon cells, the cells are connected and compressed between a transparent layer and a backing material. The modules are typically mounted in a lightweight aluminium frame. Panels will be spaced 0.8 m apart. (Panel dimensions Length = 1.56 m, Width = 1.04 m, total area = 1.63 m²)
3. **Photovoltaic Array** - A mechanically integrated assembly of modules and panels together with support structure (typically attached to a frame with a concrete mounting) to form a DC power producing unit. An array will occupy 8.84 ha.
4. **Connection to Array Enclosures**
The electricity generated from the solar modules will be transferred to array enclosures. These enclosures function to combine the power transmitted by numerous solar modules and enable its transmission via two DC cables to inverters/transformers.
5. **Wiring to Central Inverters/Transformers**
Array enclosures are wired to central inverters/transformer enclosures, where DC needs to be converted to AC to allow for linking up the ESKOM grid. The central inverters/transformers function to convert DC electricity to AC electricity at grid frequency.
6. **Connection to the Grid**
A substation is required to combine the electricity generated from the numerous arrays, and feed this electricity into the ESKOM grid. The substation (13 m x 3 m in size) will be constructed to ESKOM specification, and will step up the voltage from 480V (central invertors and transformers) to 33 kV to allow for feeding into the overhead power lines. The 33 kV lines are typically 10-13 m high.

The length of the power line connection from the PV facility substation is dependent on EKSOM and their preference of infrastructure design. Once the REBID bid has been successful, ESKOM will construct the necessary bulk electricity lines to connect the PV facility with the grid.

Construction activities will be limited to inside the 19.5 ha footprint. The construction phase will consist of three separate phases that will take up to a maximum of 18 months to complete.

1. Preparing the site for solar steel structures;
2. Delivering and installing solar panels; and
3. Testing prior to commissioning of the PV system.

Construction and establishment of the facility will entail the following:

1. **Site Clearing and Preparation** - Clearing and levelling of the site will have to take place prior to construction. Topsoil will be removed and stockpiled, and the site will be compacted. The area is considered natural with very limited disturbance, thus the facility location will have an

impact on flora and fauna (Refer to specialist ecological report). The site is relatively flat, thus requiring minimal levelling.

2. **Access roads** - Existing roads will be used where possible, however a new access track will have to be created to link the facility with the existing road.
3. **Trenching** – Cabling sleeves will be installed at a minimum depth of 800 mm below ground level and warning tape placed on top, before the trench is covered with soil.
4. **Transportation and Installation of PV Panels into an Array** - Panels will be transported to the site in a standard shipping container carried by a truck. 70 containers are required for the system. Panels will be mounted on the racking system which is attached to the ground mounted steel structures. The racking and mounting systems will also be pre-fab construction. The racking system will be mounted in the soil with concrete foundations.

3. HERITAGE ISSUES AND POTENTIAL IMPACTS

3.1 Cartographic and Archival Information

The archival research focused on available information sources (historical maps, literature survey, etc.) that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying of the current study area.

The archaeological and historical literature search provided the following information, which has been compiled into an overview of the significant archaeological and historical sites and events relevant to the study area and surrounding landscape.

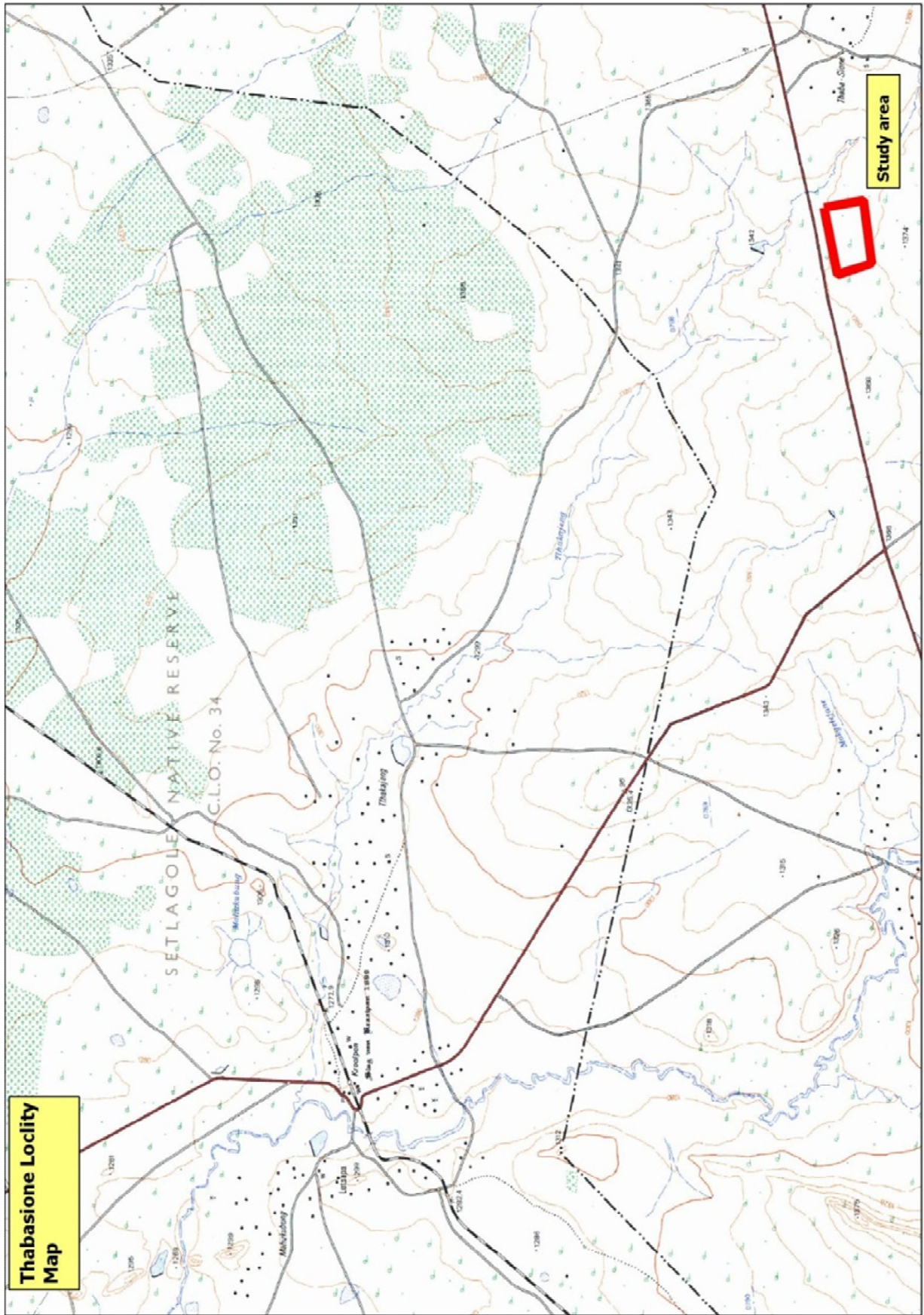


Figure 2 - Locality Map of the Study Area

DATE	DESCRIPTION
2.5 million to 250,000 years ago	<p>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 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. The rock engraving site at Bosworth Farm, near Klerksdorp also contains many stone artefacts (lithics) which date to over one million years ago (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites).</p>
250,000 to 40,000 years ago	<p>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 sites are known in the vicinity of the study area</p>
40,000 years ago to the historic past	<p>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). See below for two well-known sites in the greater vicinity of the study area (Thaba Sione and Bosworth Farm).</p>
Rock Art	<p>Thaba Sione: this site is located in the middle of Thaba Sione town, some 60km south-west of Mmabatho. The site contains over 559 engravings located on rocks and boulders. The engravings are dominated by depictions of rhinoceros – some have been rubbed smooth. There are also buffalo, eland, shamanic human figures, wildebeest and a rare lizard. The site is still important today to local Tswana people and is used by the Zion Christian Church as a rain-making centre. (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites)</p> <p>Bosworth Farm: this site is located some 22km north-west of Klerksdorp on the Bosworth Farm property. It is a large site with over 400 San and Khoe (herder) rock engravings. There many depictions of human figures as well as animals: a charging rhinoceros, a large elephant, a flight of birds. There are also many geometric motifs. The site also has many stone artefacts (lithics) which date to over one million years ago. Bosworth is one of South Africa's 12 Rock Art sites formally protected under the national heritage Resources Act (25 of 1999). (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites)</p>

DATE	DESCRIPTION
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 (Danielskuil) (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 themselves on a permanent basis there during the 1820s (Snyman, 1986). During this time a German-born deserter and his followers established themselves at Lekatlong, roughly 80km south of the present study area (Legassick, 2010).
1820s	Barend Barends and his followers moved from their settlement at Danielskuil to Boetsap. Boetsap is roughly 60km south-east of the study area. During the same time Thlaping ruler Mothibi, the brother of Mahura, settled in the vicinity of Boetsap before moving to Griquatown (Legassick, 2010).
1833	Hurutshe refugees established themselves at Taungs (Legassick, 2010). The present-day town of Taung is roughly 50km south-east 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 Maudi (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 (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).

DATE	DESCRIPTION
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.
1882-1885	The Boer republic of Stellaland existed during this time. 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 laid out and named Vryburg. On 6 August 1883 the Republic of Stellaland was proclaimed. However, the republic ceased to exist when Sir Charles Warren proclaimed the Bechuanaland Protectorate on 30 September 1885 (Bergh, 1999).
12 October 1899	<p>The Thabasione area is historically known for the Battle of Kraaipan (11 kilometres to the northwest) that took place on this day. A Boer commando under Gen Del la Rey attacked a fortified train the "Mosquito" just south of the Kraaipan Station, and so doing fired the first shots of the South African War (Breytenbach, 1978).</p> <p>A contemporary account provides the following details:</p> <p>"General De la Rey had started from Cronje's laager with two hundred Lichtenburghers before artillery had arrived from Pretoria, in order to be over the border at midnight, and was to await the arrival of Captain Van der Merwe with guns before engaging any force he might locate between Vryburg and Mafeking. On reaching the railway station at Kraaipan he found that the English outposts at that place had retired on seeing the approach of the Boers. De la Rey, in awaiting the arrival of Van der Merwe, tore up the railway going south to Kimberley, and cut the telegraph wires.</p> <p>De la Rey's scouts soon discovered an armored train steaming from the south towards the railway station. This mobile fort consisted of an engine and two trucks lined with bullet-proof armor sheeting, and was armed with a Maxim and two mountain guns. The "fort" bore down upon the station at Kraaipan during the evening of the 13th of October and the engine and trucks capsized on reaching the derailed spot." (Davitt, 1902; http://www.angloboerwar.com/books/37-davitt-boer-fight-for-freedom/839-davitt-chapter-ix-kraaipan)</p>

Palaeontology

A palaeontological impact assessment (PIA) was commissioned by PGS Heritage from Dr Gideon Groenewald (**Appendix E**). This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

The findings of the PIA report were as follows:

The study area is mainly underlain by Radian aged metamorphic and volcanic rocks of the Ventersdorp Supergroup). The upper Ventersdorp succession (“Pniel Sequence”) also comprises a variety of sediments - mainly siliciclastics such as conglomerates and quartzite, comprising the Bothaville and Allanridge Formations. In the western part of the study area the Radian aged rocks are overlain by Quaternary Aeolian sand deposits. Conical stromatolites have been described from sequences in the Bothaville Formation.

The upper Ventersdorp succession (“Pniel Sequence”) also comprises a variety of sediments – mainly siliciclastics such as conglomerates and quartzites eroded from the mountainous uplands, but with some conical stromatolites (Bothaville Formation) – followed by a final pulse of volcanic lavas (Allanridge Formation) where no fossils are expected to occur.

Following the desktop survey, the study area is underlain by Radian aged metamorphic and volcanic rocks, as well as Quaternary Aeolian deposits. Due to the small extent of the outcrops of the Bothaville Formation, it is unlikely that the development in this region will lead to adverse impacts on the palaeontological heritage of the study area.

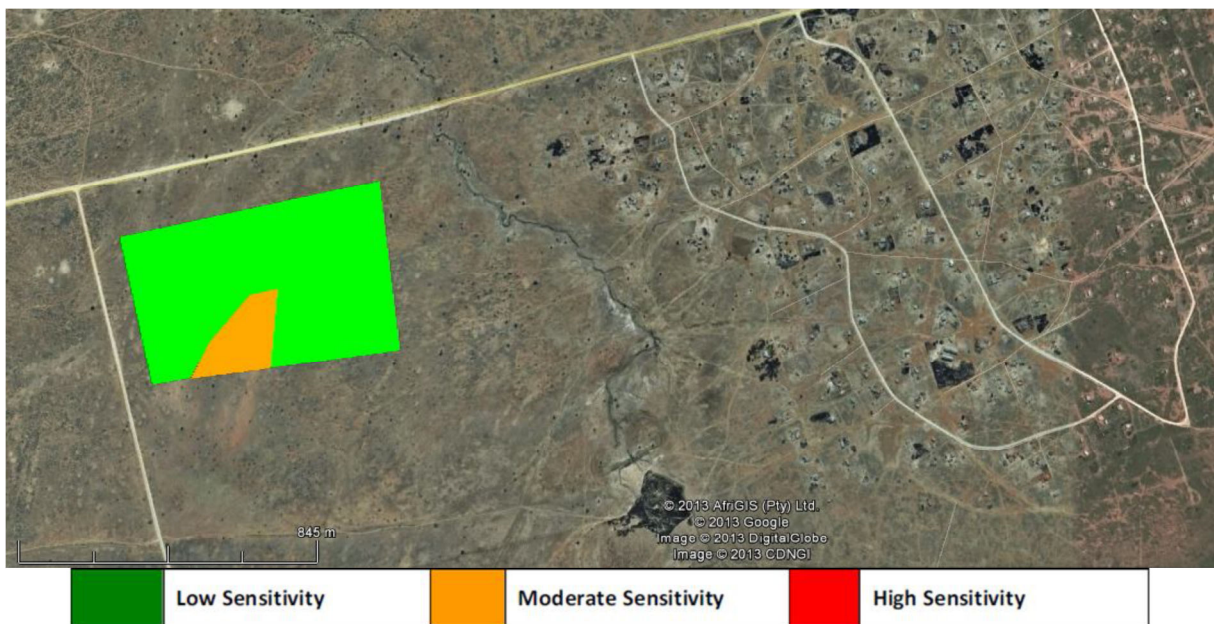


Figure 3 - Image showing the palaeosensitivity of the study area

Recommendation:

It is recommended that the Developer and the ECO responsible for the project be made aware of the possible occurrence of stromatolite structures in the Bothaville Formation. If stromatolites are present, a trained palaeontologist must be appointed to record the finds.

4. FINDINGS OF THE HERITAGE IMPACT ASSESSMENT SURVEY

Methodology

The site was evaluated during a day's field work. The site was surveyed through a selective walkthrough method to identify possible heritage resources in the demarcated study area. The terrain was found to be heavily over grazed with dense vegetation in the south east of the site. A controlled-exclusive surface survey by foot was conducted. GPS co-ordinates were taken and the identified sites were recorded photographically.



Figure 4 – General view of study area

4.1 Findings of survey

During the survey 3 point specific heritage sites and 3 areas of possible heritage significance were found - .

Table 2: Site List

SITE	DETAIL	COORDINATES	MITIGATION
TBS001	Medium to high density Early Stone Age Lithics scattered over an area of approximately 20x20m. Situated in area of rocky outcrop. Error! Reference source not found.-Error! Reference source not found.	S26.35676 E25.39848	<ul style="list-style-type: none"> • Destruction permits in terms of Sections 34 -36 of the NHRA will be required if the site is to be impacted by the development • Phase 2 collect material to determine distribution through mapping and on site analysis of material,
TBS002	Low to medium density Early Stone Age Lithics scattered over an area of approximately 20x20m. Error! Reference source not found.	S26.35648 E25.40110	<ul style="list-style-type: none"> • Destruction permit in terms of Sections 34 -36 of the NHRA will be required if the site is to be impacted by the development • Phase 2 collect material to determine distribution through mapping and on site analysis of material,
TBS003	Single square stone foundation. 3x2 metres in diameter. Error! Reference source not found.	S26.35374 E25.40445	The structure must be evaluated during social consultation for the possible presence of infant burials.
TBS004	Rocky outcrop with visible MSA/LSA flaking from mother rock. Error! Reference source not found.	S26.35283 E25.40262	Monitoring during construction
TBS005	Single rock packed structure – Possible grave. Error! Reference source not found.	S26.35332 E25.40395	Investigate presence of grave
TBS006	Rocky outcrop with visible MSA/LSA flaking from mother rock. Error! Reference source not found. - Error! Reference source not found.	S26.35211 E25.40500	Monitoring during construction

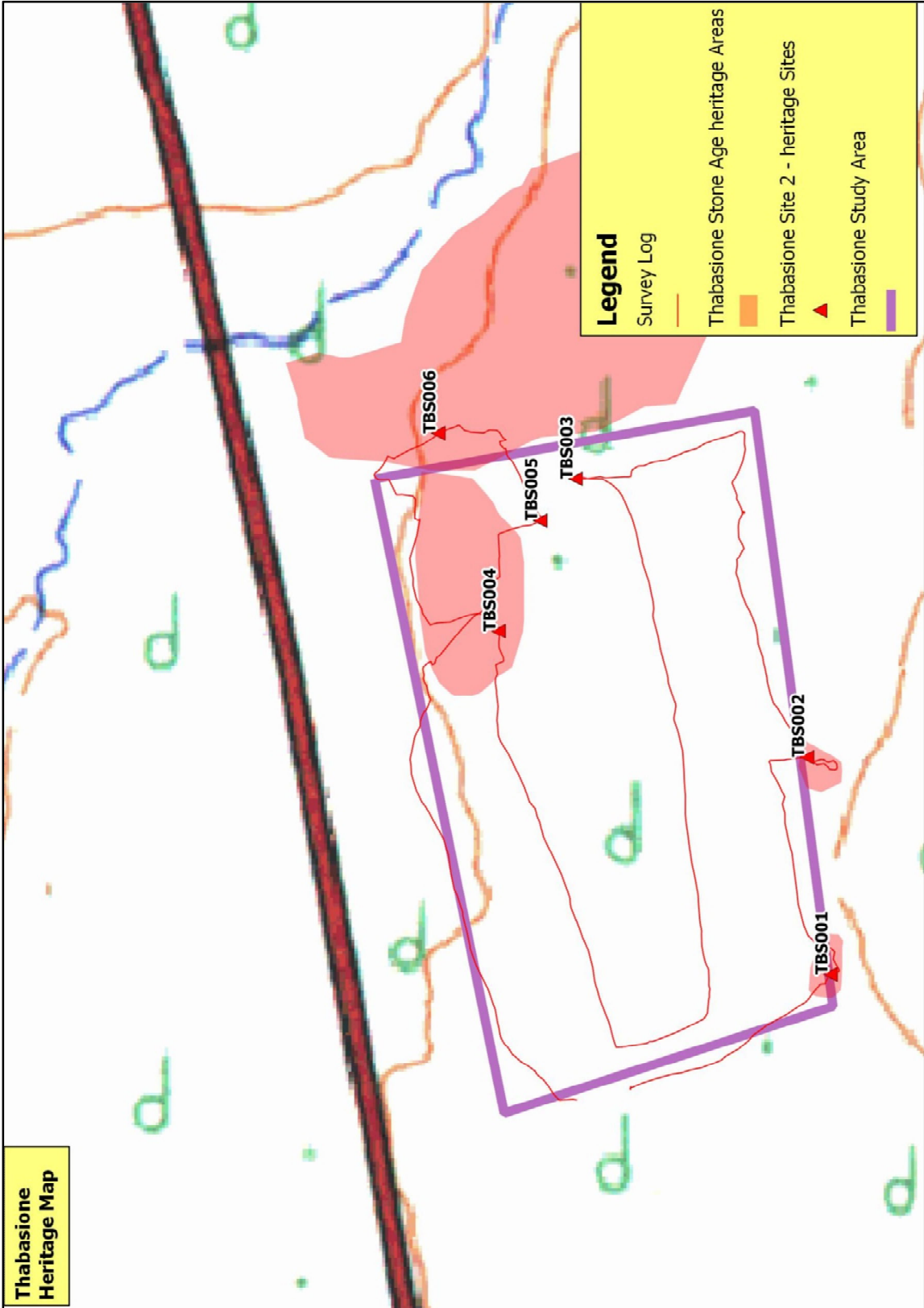


Figure 5 – Heritage map with site distribution



Figure 6 - View of area and TBS001 in fore ground



Figure 7 – ESA flakes and incomplete handaxe flakes at TBS001



Figure 8 – general view of TBS002 with rocky outcrop



Figure 9 – ESA cores and MSA flakes at TBS002



Figure 10 – Square stone structure at TBS003



Figure 12 – Flaking from “mother material” close to TBS004



Figure 11 – Flaking from “mother material” close to
TBS006



Figure 13 – Possible grave at TBS005



Figure 14 – Flaking from “mother material” close to
TBS006



Figure 15 – Flaking from “mother material” close to
TBS004

4.1.1 Graves and Structures

Through experience of similar sites and the knowledge of cultural customs and traditions it is known that stillborn babies and deceased infants occasionally were buried within the occupational settlement of African Rural Communities. These children were sometimes buried underneath the floors and walls of houses and huts. These burials were not marked, but were known to the immediate family.

Customs and traditions like these were common in the rural African communities during the earlier parts of the 20th century. It is therefore not only possible, but rather likely, that some of these structures may be on top of some of these infant remains.

Impact Evaluation:

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Moderate	Grade GP.B	Possible	Permanent	B

4.1.2 Cultural Landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that are known to have added to the cultural fabric of a place or area.

The Thaba-Sione site is situated in on a sparsely vegetated plane, with a flat topography. Although the site is not situated close to roads that can be seen as of scenic nature, the site will have a substantive impact on the rural landscape in changing it to an industrial area. The impact on the cultural landscape is seen as of medium negative significance, however the economic and possible change to the living conditions to the surrounding settlements needs to be considered as a positive.

The recommendation made in the Visual Impact Assessment needs to be implemented to minimise the visual impact on the landscape, where possible.

5. RECOMMENDATIONS

During the survey 3 point specific heritage sites and 3 areas of possible heritage significance were found, while areas of possible heritage sensitivity were also identified. The following management is recommended:

Heritage Structures

- No further mitigation or permitting required – excluding burials
- The remaining structures must be evaluated during social consultation for the possible presence of infant burials.
- If it is found to contain infant burials the procedures as describe for grave relocation must be followed.

Stone Age Sites

- Archaeological collection permit in terms of Section 35 of the NHRA will be required if the site are to be impacted by the development and mitigation must be implemented.
- Phase 2 Archaeological Mitigation – To entail surface collection with surface distribution documentation
- After which the developer can apply for a destruction permit with the backing of the Phase 2 Archaeological Report.

Stone Age sensitive areas

As the Stone Age sensitive areas are located on the southern and eastern boundaries of the proposed development, it is recommended that the layout be adjusted to exclude these sensitive areas. If not possible to realign the development, monitoring during construction will be required by a qualified archaeologist (Refer to Appendix B).

Graves

If further investigation during the recommended mitigation measures for heritage structures indicates the presence of graves, the following management measures are recommended:

3. Adjust the development layout and demarcate site with at least a 10 meter buffer.
4. It is further recommended that in the event that the cemeteries cannot be incorporated in to the development the graves be relocated after a full grave relocation process that includes comprehensive social consultation. The grave relocation process must include:
 - 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;
 - Site notices indicating the intent of the relocation
 - Newspaper Notice indicating the intent of the relocation
 - A permit from the local authority;
 - A permit from the Provincial Department of health;
 - 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;
 - An exhumation process that keeps the dignity of the remains and family intact;
 - An exhumation process that will safeguard the legal implications towards the developer;
 - The whole process must be done by a reputable company that are well versed in relocations;
 - The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

Cultural landscape

The recommendation made in the Visual Impact Assessment needs to be implemented to minimise the visual impact on the landscape, where possible.

General recommendation

Further to these recommendations, the general Heritage Management Guidelines in Section 5 need to be incorporated into the EMP for the project.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels.

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 m² 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 m² 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 South African Heritage Resources Agency (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.
 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 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.

Archaeological Monitoring

The definition of an archaeological 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.

The purpose of an archaeological monitoring programme is:

- To allow, within the resources available, the preservation by recording of archaeological 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 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 3: Roles and responsibilities of archaeological and heritage management

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

6.2 All phases of the project

6.2.1 *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 needs to be supervised by a qualified archaeologist. This course should be reinforced by posters reminding operators of the possibility of finding archaeological sites.

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.

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 recognize any significant material being unearthed, and to make the correct judgment on which actions should be taken. A responsible archaeologist/palaeontologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to sit in at 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 workforce 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 Plan (EMP) 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. This provision can be made in an archaeological monitoring programme.

6.2.2 Graves

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

- Mitigation of graves will require a fence around the cemetery with a buffer of at least 20 meters.
- 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 rescue permit must be applied for with SAHRA and the local South African Police Services must be notified of the find.
- Where it is then 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.

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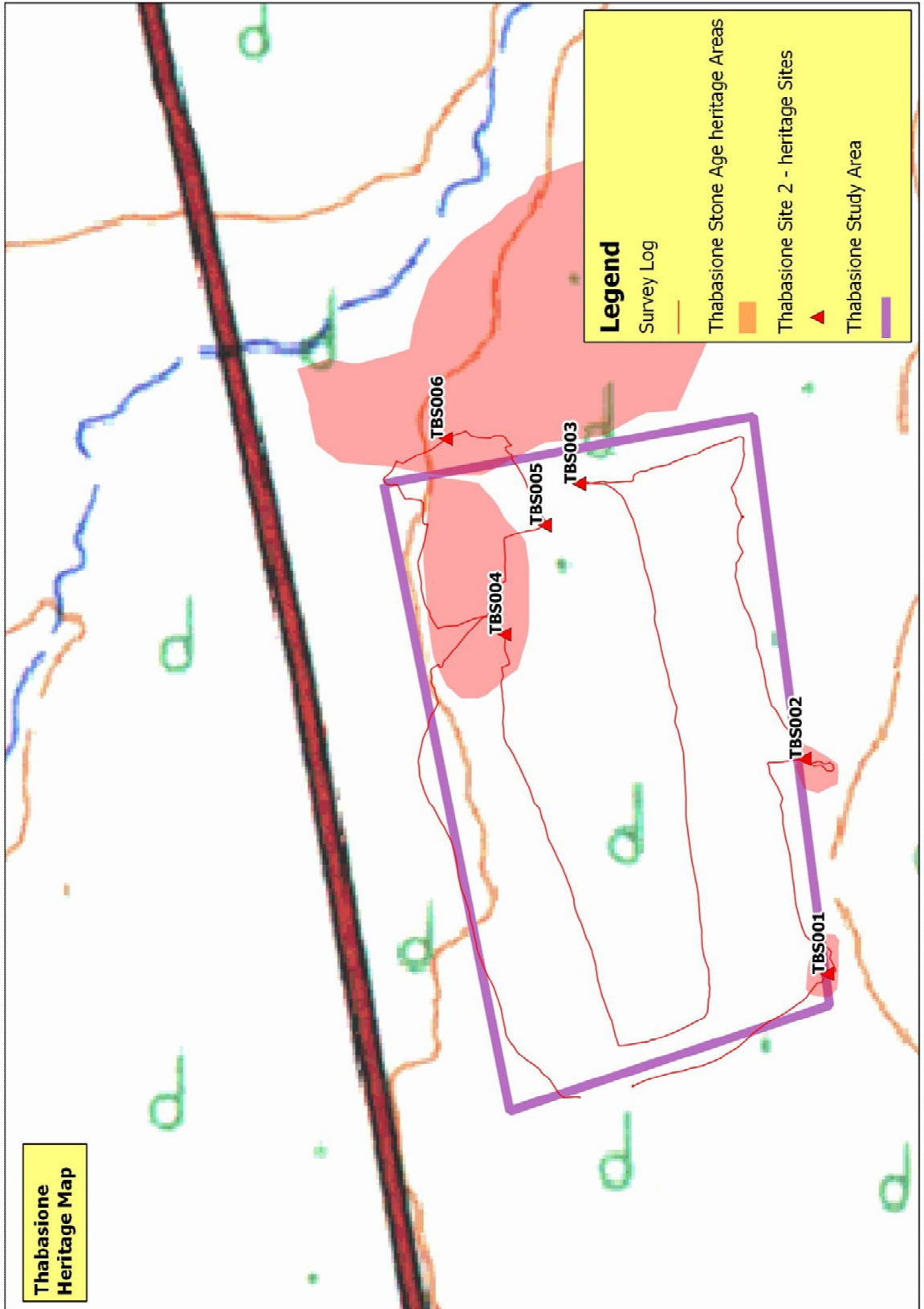
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**APPENDIX A
HERITAGE MAP**



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 construction company's cost. Thus, the construction company 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 administered by a local authority. Graves in the category located inside a formal cemetery administered 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 C
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 and Grave Relocation Consultants (PGS) for the proposed Project has assess the heritage resources found on site. This report contains 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 consisted of three steps:

Step I – Literature Review: The background information to the field survey leaned greatly on the initial desktop research completed by PGS Heritage for this report.

Step II – Physical Survey: A physical survey was conducted by vehicle and on foot through the proposed project area by a qualified archaeologist and experienced staff, 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 - <10/50m²
 - 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 mitigation
- D - Preserve site, or extensive data collection and mapping of the site; and
- E - Preserve site

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 1: 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)	-	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	-	Low Significance	Destruction

Impact Rating

VERY HIGH

These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.

Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.

Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with a VERY HIGH significance.

HIGH

These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.

Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.

Example: The change to soil conditions will impact the natural system, and the impact on affected parties (in this case people growing crops on the soil) would be HIGH.

MODERATE

These impacts will usually result in medium- to long-term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial.

Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.

Example: The provision of a clinic in a rural area would result in a benefit of MODERATE significance.

LOW

These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.

Example: The temporary change in the water table of a wetland habitat, as these systems is adapted to fluctuating water levels.

Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.

NO SIGNIFICANCE

There are no primary or secondary effects at all that are important to scientists or the public.

Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.

Certainty

DEFINITE: More than 90% sure of a particular fact. Substantial supportive data exists to verify the assessment.

PROBABLE: Over 70% certainty of a particular fact, or of the likelihood of an impact occurring.

POSSIBLE: Only over 40% certainty of a particular fact or of the likelihood of an impact occurring.

UNSURE: Less than 40% certainty of a particular fact or likelihood of an impact occurring.

Duration

SHORT TERM: 0 to 5 years

MEDIUM: 6 to 20 years

LONG TERM: more than 20 years

DEMOLISHED: site will be demolished or is already demolished

An example of a ratings table:

Impact Grading

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Moderate	Grade GP.C	Possible	Permanent	C

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE
DEVELOPMENT OF A PHOTOVOLTAIC POWER FACILITY
NEAR THE THABA-SIONE SETTLEMENT IN THE
TSWAING LOCAL MUNICIPALITY, NGAKA MODIRI
MOLEMA DISTRICT MUNICIPALITY IN THE NORTH
WEST PROVINCE**

For:

HIA CONSULTANTS



DATE: 23 May 2013

By

GIDEON GROENEWALD

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed developments of a photovoltaic facility near the Thaba-sione settlement in the Tswaing Local Municipality, Ngaka Modiri Molema District Municipality in the North West Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

The project entails the development of a 20ha Solar Photovoltaic farm. The study area is located 40 kilometres northwest of the town of Delareyville just 2 kilometres west of the Thaba-sione settlement, on the Khunana Location 4 IO, 10 kilometres north west of Kraaipan in the North West Province.

The study area is mainly underlain by Radian aged metamorphic and volcanic rocks of the Ventersdorp Supergroup (Figure 3.1). The upper Ventersdorp succession (“Pniel Sequence”) also comprises a variety of sediments - mainly siliciclastics such as conglomerates and quartzite, comprising the Bothaville and Allanridge Formations. In the western part of the study area the Radian aged rocks are overlain by Quaternary Aeolian sand deposits.

Conical stromatolites have been described from sequences in the Bothaville Formation.

The upper Ventersdorp succession (“Pniel Sequence”) also comprises a variety of sediments - mainly siliciclastics such as conglomerates and quartzites eroded from the mountainous uplands, but with some conical stromatolites (Bothaville Formation) – followed by a final pulse of volcanic lavas (Allanridge Formation) where no fossils are expected to occur.

Following the desktop survey, the study area is underlain by Radian aged metamorphic and volcanic rocks, as well as Quaternary Aeolian deposits. Due to the small extent of the outcrops of the Bothaville Formation, it is unlikely that the development in this region will lead to adverse impacts on the palaeontological heritage of the study area.

Recommendation:

It is recommended that the Developer and the ECO responsible for the project be made aware of the possible occurrence of stromatolite structures in the Bothaville Formation. If stromatolites are present, a trained palaeontologist must be appointed to record the finds.

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1. INTRODUCTION

1.1 Background

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed developments of a photovoltaic facility near the Thaba-sione settlement in the Tswaing Local Municipality, Ngaka Modiri Molema District Municipality in the North West Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2 Aims and Methodology

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where a negligible impact on the fossil heritage is likely. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

1.3 Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc).

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project entails the development of a 20ha Solar Photovoltaic farm. The study area is located 40 kilometres northwest of the town of Delareyville just 2 kilometres west of the Thaba-sione settlement, on the Khunana Location 4 IO, 10 kilometres north west of Kraaipan in the North West Province.



Figure 0.1 Google image showing the location of the study area

3. GEOLOGY

The study area is mainly underlain by Radian aged metamorphic and volcanic rocks of the Ventersdorp Supergroup (Figure 3.1). The upper Ventersdorp succession ("Pniel Sequence") also comprises a variety of sediments - mainly siliciclastics such as conglomerates and quartzites

3.1 Bothaville Formation (Rbt):

The Bothaville Formation consists of quartzite, greywacke and conglomerate with subordinate chemical sedimentation recorded in the sequence.

3.2 Allanridge Formation (Ra):

The Allanridge Formation consists predominantly of basaltic amygdaloidal lava, agglomerate and tuff.

3.3 Quaternary deposits (Qw):

Undifferentiated Aeolian deposits

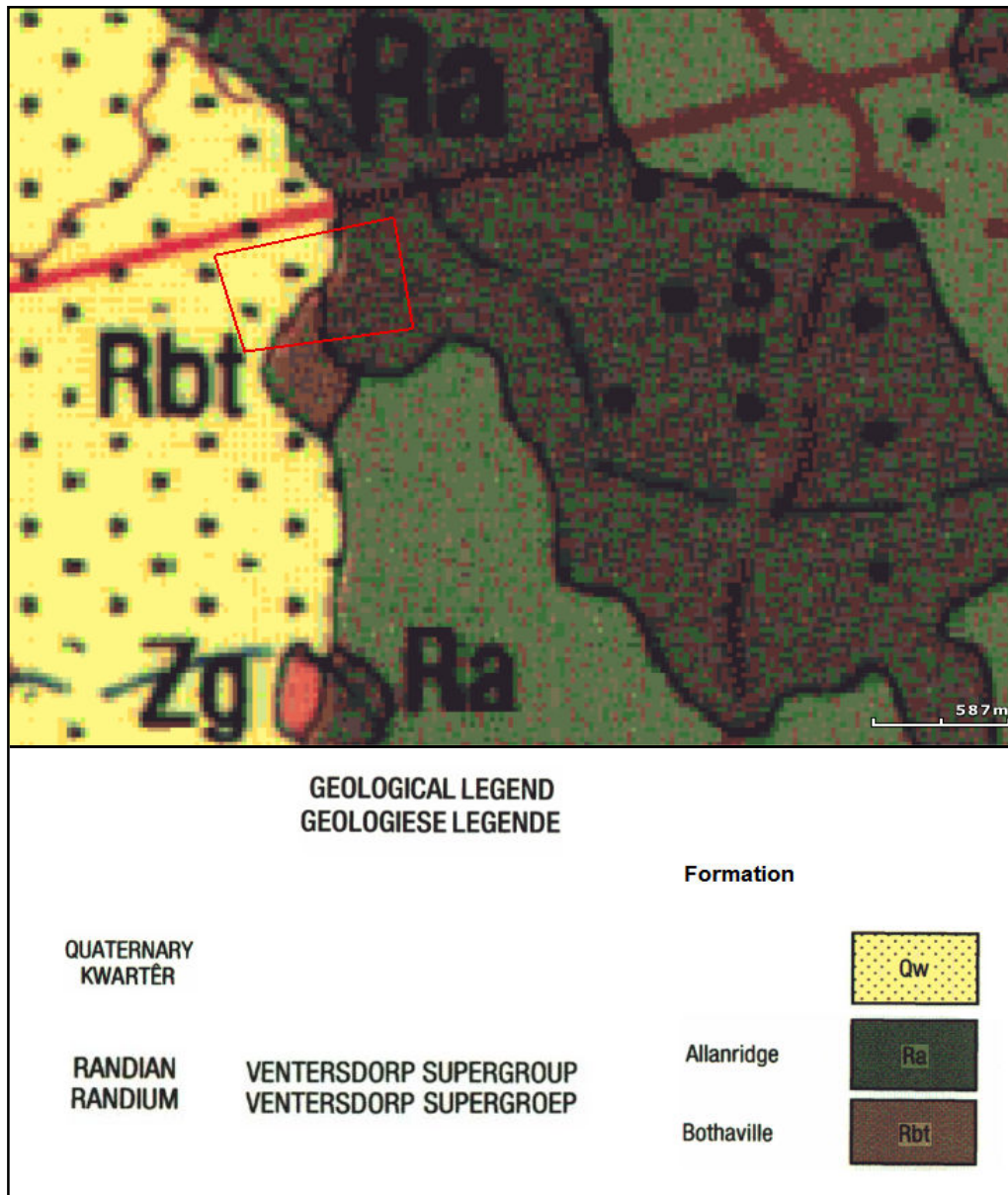


Figure 0.2 Geological map of the study area (1:250 000 2624 Vryburg)

4. PALAEOONTOLOGY OF THE AREA

4.1 The Bothaville Formation

Conical stromatolites have been described from sequences in the Bothaville Formation.

4.2 The Allanridge Formation

Due to the volcanic nature of the Allanridge Formation it will not contain fossils.

4.3 Quaternary deposits

No fossils have been described from the Quaternary Aeolian deposits in this region.

5. PALAEOLOGICAL SENSITIVITY

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself.

The upper Ventersdorp succession (“Pniel Sequence”) also comprises a variety of sediments - mainly siliciclastics such as conglomerates and quartzites eroded from the mountainous uplands, but with some conical stromatolites (Bothaville Formation) – followed by a final pulse of volcanic lavas (Allanridge Formation) where no fossils are expected to occur.

The Bothaville Formation will have a moderate sensitivity for palaeontological heritage if the conical stromatolites are present in the study area. The outcrop of Bothaville Formation rocks are limited to a small area in the development area (Figure 5.1).

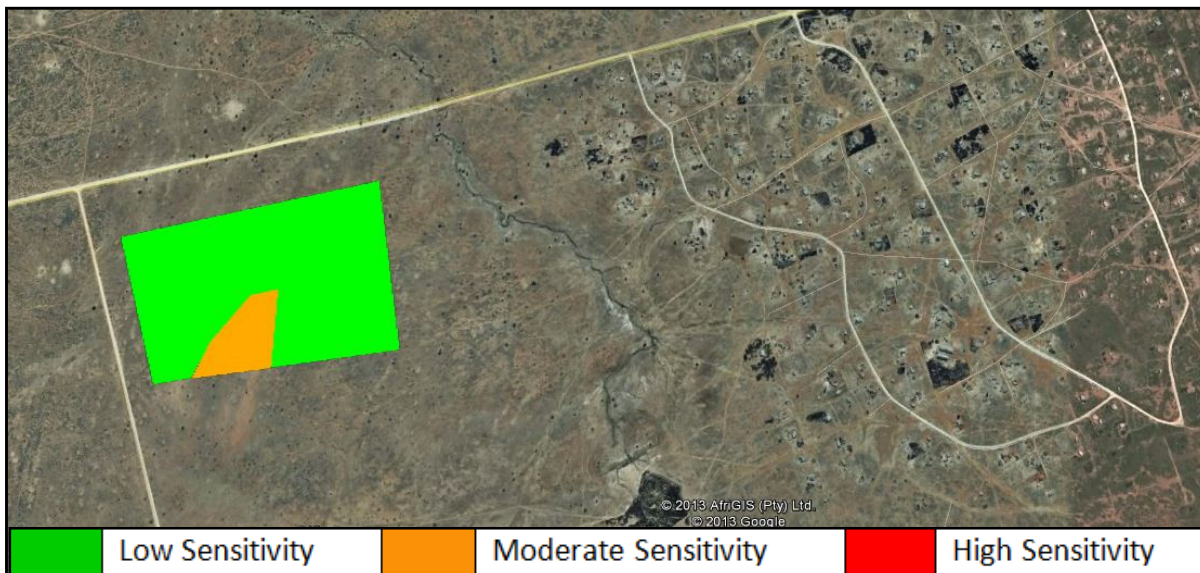


Figure 0.3 Image showing the palaeosensitivity of the study area

6. CONCLUSION AND RECOMMENDATIONS

Following the desktop survey, the study area is underlain by Radian aged metamorphic and volcanic rocks, as well as Quaternary Aeolian deposits. Due to the small extent of the outcrops of the Bothaville Formation, it is unlikely that the development in this region will lead to adverse impacts on the palaeontological heritage of the study area.

Recommendation:

It is recommended that the Developer and the ECO responsible for the project be made aware of the possible occurrence of stromatolite structures in the Bothaville Formation. If stromatolites are present, a trained palaeontologist must be appointed to record the structures.

7. REFERENCES

Johnson MR, Anhauser CR and Thomas RJ. 2009. The Geology of South Africa. Geological Society of South Africa.

8. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

9. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Dr Gideon Groenewald
Geologist