NOKUKHANYA ENERGY (PTY) LTD

Nokukhanya Solar Facility
Heritage Impact Assessment Report

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Executive Summary

PGS Heritage (PGS) was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Solar Project for Nokukhanya Energy (Pty) Ltd (hereafter referred to as Nokukhanya), on the farm Kikvorschfontein 57 JS, close to Dennilton in the Limpopo Province.

The initial Heritage Scoping Report (HSR) has shown that the proposed Nokukhanya site to be developed as a Solar Energy Facility may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

The historical significance of the region with regards to the Ndebele and the proclamation of the KwaNdebele homeland have been described in the background research. The presence of Late Iron Age (LIA) stone walling, on the south western boundary the study area, as well as the numerous historical ruins of African homesteads necessitate extensive fieldwork to evaluate and recommend the necessary mitigation measures, where required.

The development of the PV facility near Dennilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.

A total of 14 heritage sites were identified, of which 13 are located within the development boundary and the 14th a cemetery located on the eastern boundary just of the current access road.

The mitigation measures proposed is a follows:

Archaeological Sites

1. *Monitor find spot areas if construction is going to take place through them.*
2. *A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.*
3. *If archaeological remains are discovered a permit as issued by the South African Heritage Resources Agency under Section 35 of the National Heritage Resources Act will be required to mitigate the finds. Such a mitigation process can take up to 4 months to finalise.*
4. *If the sites are to be avoided an archaeologist should assist with the demarcation and a 10 meter perimeter should then be kept around each site.*

Historical sites

1. *Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted;*

2. *If it is found that there are burials associated with the ruins, a grave relocation process must be initiated. Which must include permit applications to the relevant authorities. Thus will include the Local Municipality, Provincial Health Department and the South African Heritage Resources Agency. Such a mitigation process can take up to 6 months to finalise.*
3. *An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures.*
4. If the sites are to be avoided an archaeologist should assist with the demarcation and a 10 meter perimeter should then be kept around each site.

Cemetery

The cemetery needs to be fenced and a 20m safety buffer needs to included in side the development footprint to ensure protection of the cemetery.

Comparative Assessment of Alternatives

Key

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

Alternative	Preference	Reasons
SOLAR PANEL ARRAY LAYOUT		
Alternative 1	Preferred	Both show minimal impact on heritage resources
Alternative 2	Preferred	Both show minimal impact on heritage resources
SUBSTATION AND ASSOCIATED BUILDINGS		
Substation and OM Alternative 1 (south-west)	Not preferred	Does not impact on heritage resources
Substation and OM Alternative 2 (north)	Not preferred	Impacts on NK02 and NK03 which are still in use
Substation and OM Alternative 3 (south-east)	Preferred	Does not impact on heritage resources
LAYDOWN AREAS		
Laydown Alternative 1	Preferred	Does not impact on heritage resources
Laydown Alternative 2	Preferred	Does not impact on heritage resources

By implementing the recommended mitigation measures the impact on the identified heritage resources is rated as low.

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HERITAGE REPORT

Contents Page

Appendices

1 INTRODUCTION

PGS Heritage (PGS) was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Solar Project for Nokukhanya Energy (Pty) Ltd (hereafter referred to as Nokukhanya), on the farm Kikvorschfontein 57 JS, close to Dennilton in the Limpopo 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 (HA) 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 Impact Assessment (HIA).

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 HIA processes and will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

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

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries

as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

1.4 Legislative Context

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

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

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

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

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…" The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources 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, MPRDA and the DFA legislation. In the latter cases, the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Sections of these Acts relevant to heritage (Fourie, 2008).

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

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

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

Table 1: Terminology

Acronyms	***Description***
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
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
PGS	PGS Heritage
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:

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

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

Development
This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

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

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

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

Heritage

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

Heritage resources
This means any place or object of cultural significance, such as the caves with archaeological deposits identified close to both development sites for this study.

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

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

Late Iron Age (Early Farming Communities)
The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

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

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

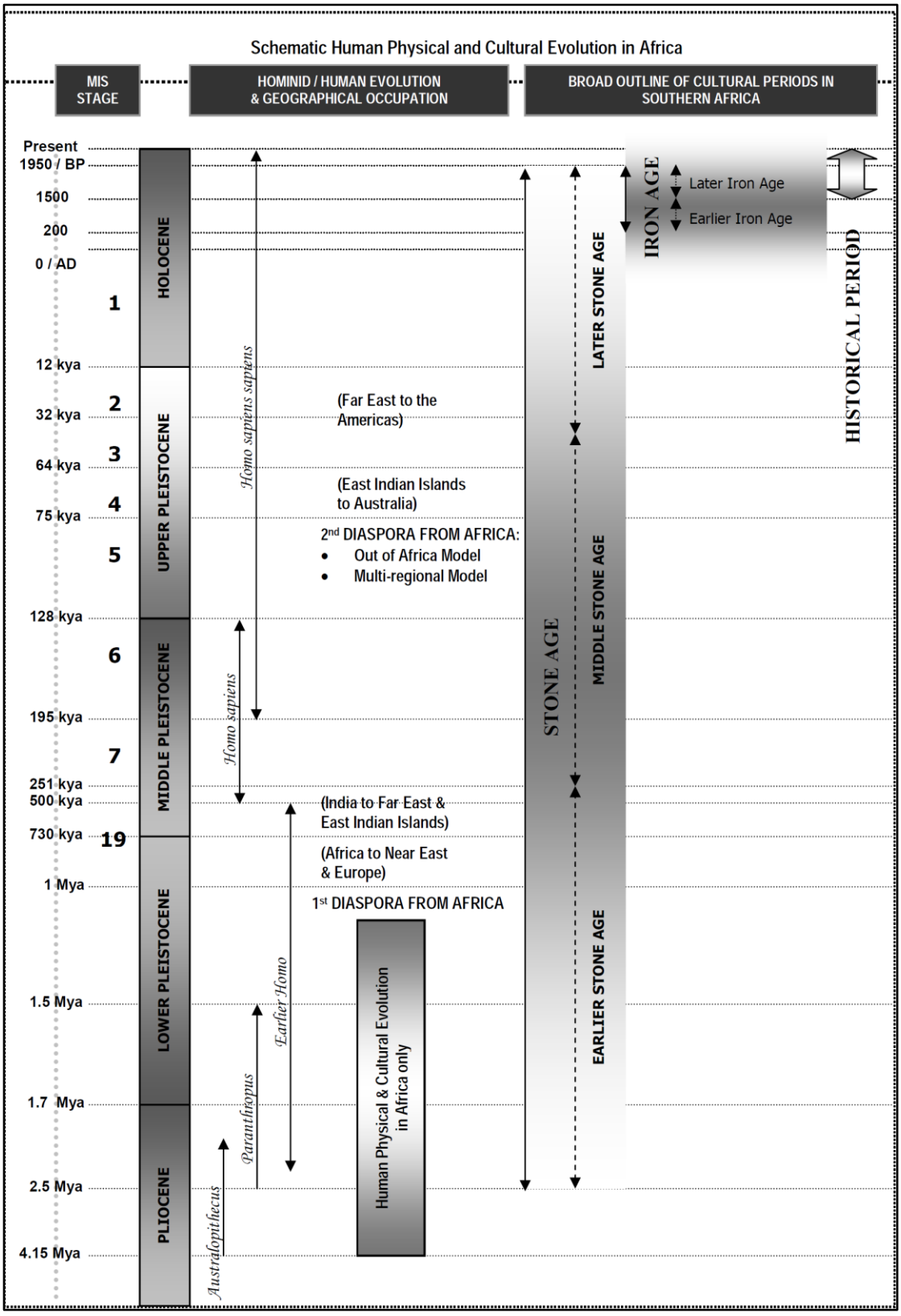


Figure 1: Human and Cultural Timeline in Africa (Morris, 2013)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Table 2: Nokukhanya land description

Location	S25 18 25.0 E29 08 09.1 The land is 28km southwest of Groblersdal in the Limpopo Province
Land	176 Hectares of land under option.

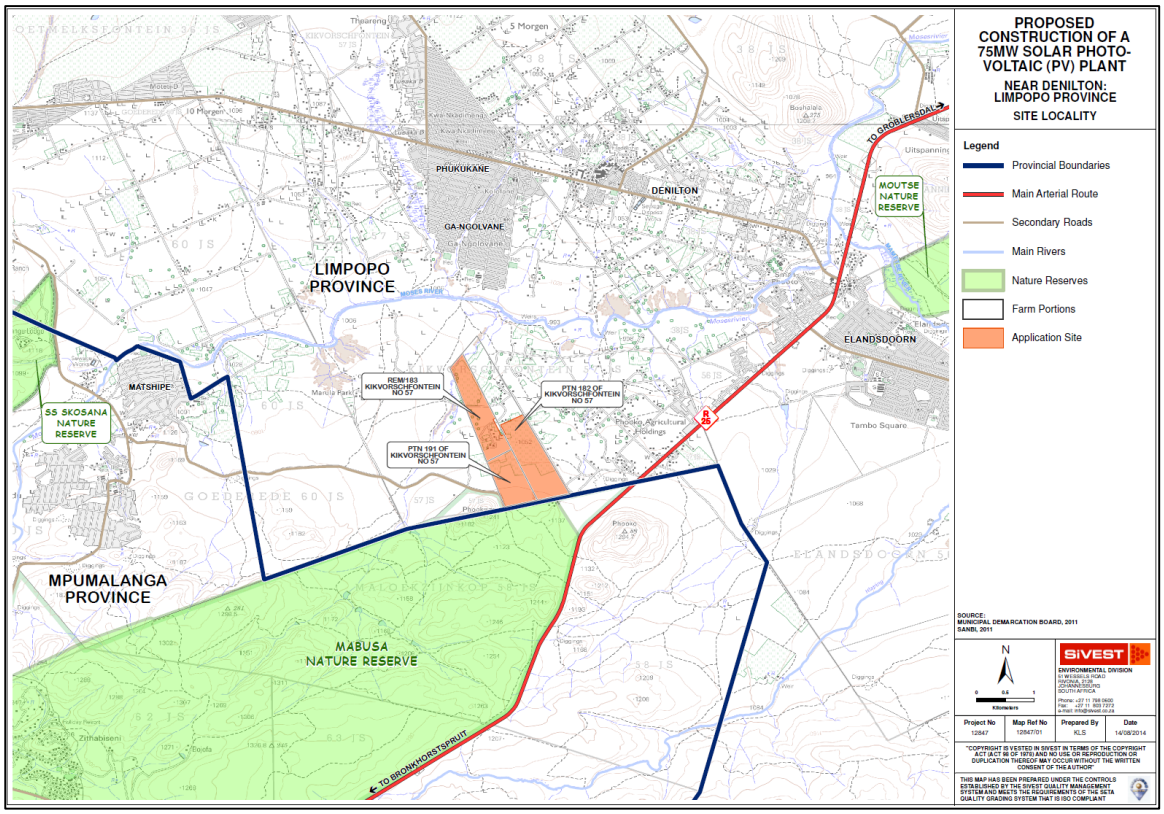


Figure 2: Nokukhanya Locality

2.2 Technical Project Description

The proposed development will entail the construction of a 75MW solar photovoltaic plant near Dennilton. The study area is located in the Limpopo Province within the Elias Motsoaledi Local Municipality.

The proposed project would comprise of the following:

- Approximately 342 000 solar PV panels with a total generation capacity of 75MW;
- Panels will be arranged in section sizes of approximately 40m x 5m and installed on racks made of aluminium or steel;
- DC-AC current inverters and transformers;
- Underground cabling/overhead power lines;
- Solar resource measuring stations, including 10m high meteorological masts;
- A 132kV switching station at the Nokukhanya PV plant;
- 4x132kV feeder bays at the switching station at the Nokukhanya PV plant;
- Loop In Loop Out of the Kwaggafontein-Dennilton 132kV feeder;
- Construction of 2x132kV 3km Kingbird lines to the Nokukhanya switching station from the Kwaggafontein- Dennilton 132kV feeder;
- Installation of VT's at the Kwaggafontein substation and Dennilton substation;
- A lay-down area for the temporary storage of materials during the construction activities;
- Upgrading access roads, where necessary;
- Construction of a car park and fencing around the project; and
- Administration and warehouse buildings.

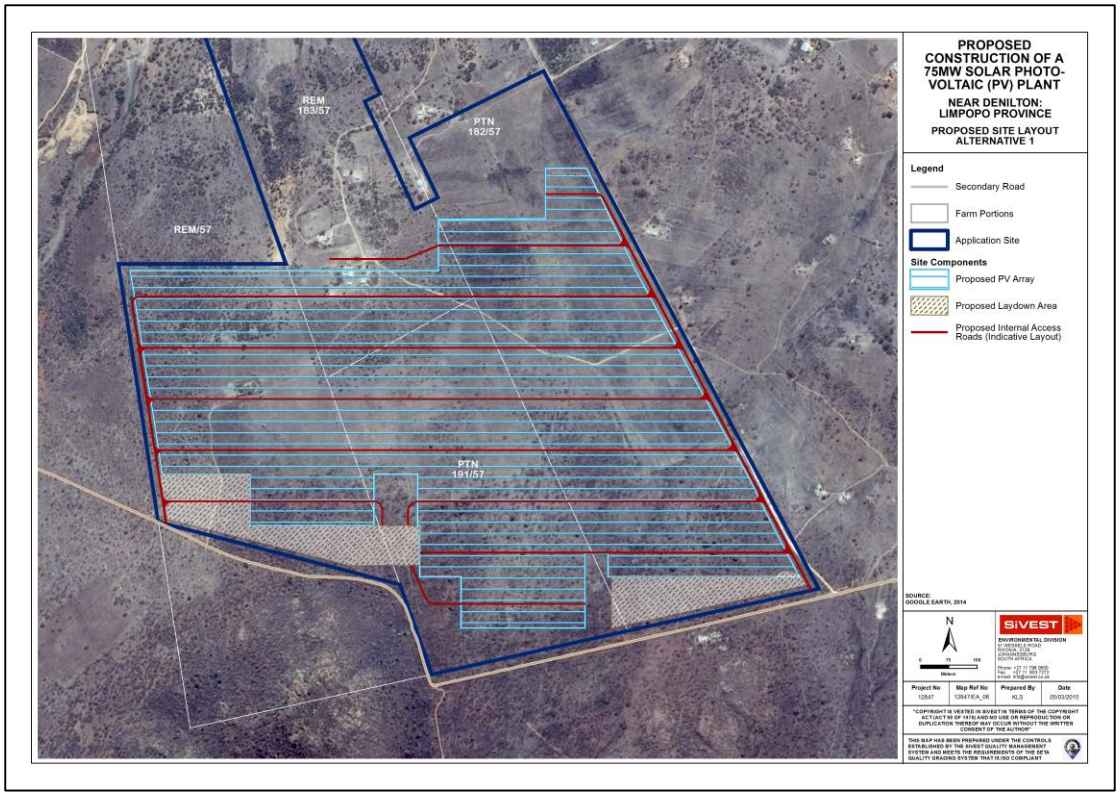


Figure 3: Nokukhanya – Proposed Alternative Layout 1

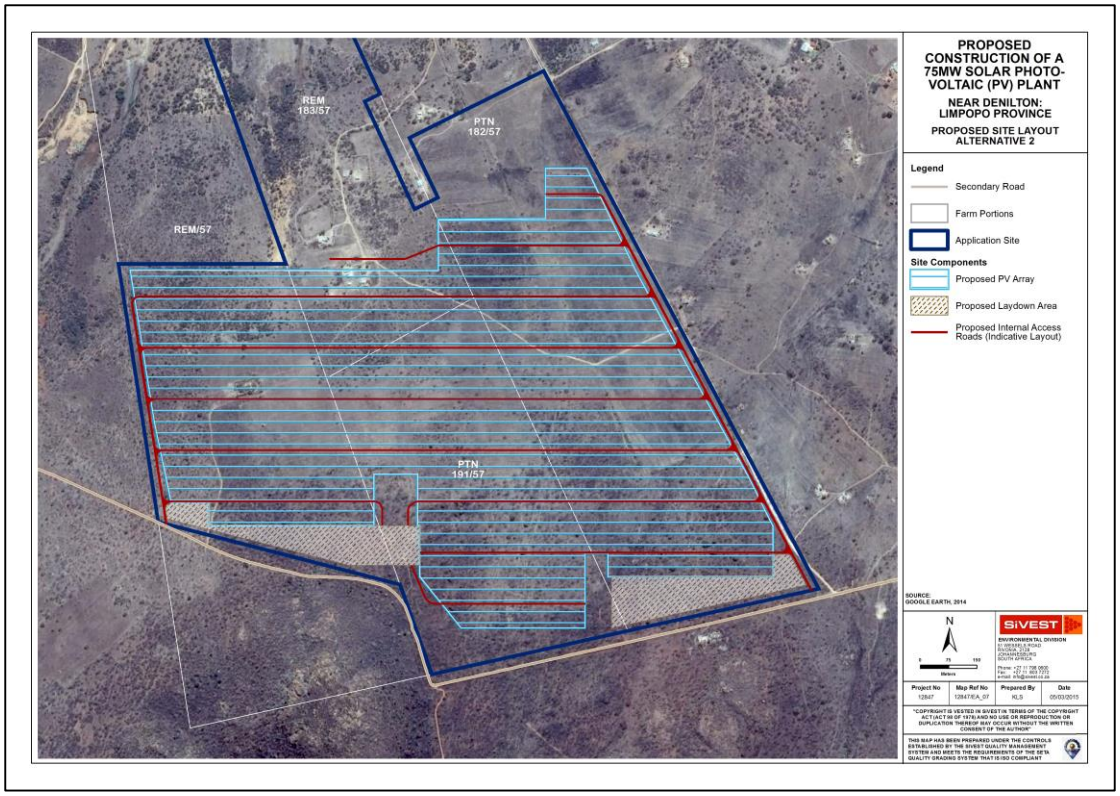


Figure 4: Nokukhanya – Layout Alternative 2

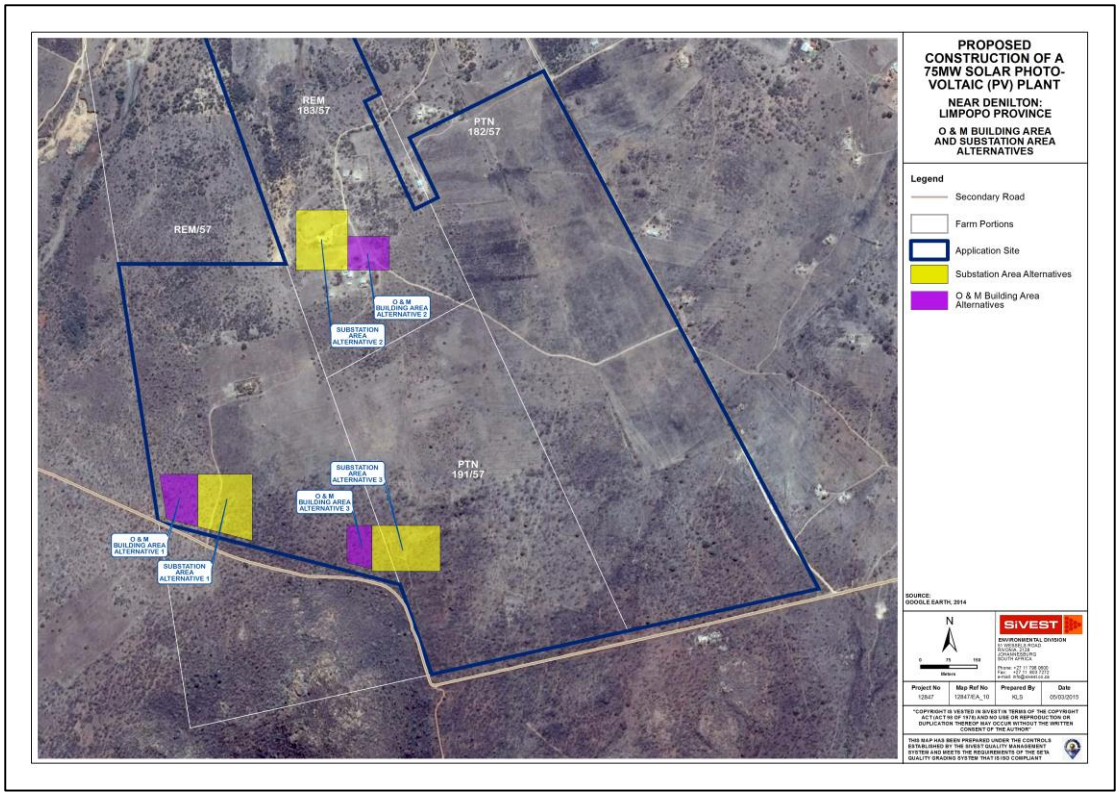


Figure 5: Operations, Maintenance and substation alternatives

3 ASSESSMENT METHODOLOGY

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

3.1 Methodology for Assessing Heritage Site significance

PGS Heritage (PGS) compiled the Heritage Impact Assessment (HIA) report for the proposed Nokukhanya Solar Facility. 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 followed 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 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. No heritage studies

4.1.1 Findings from the studies

A single exemption application done by Roodt in 2006 was identified close to the study area. The study did not include any background research and no heritage resources were identified during the field work.

Roodt, F. 2006. *Phase 1 Heritage Resources Impact Assessment (Scoping & Evaluation), Ntwane/Elandsdoorn, Groblersdal, Mpumalanga. Letter of recommendation for exemption*. Completed for AGES Environmental.

4.2 General background to study area

4.2.1 Stone Age

The Stone Age can be roughly divided into three

Earlier Stone Age (400 000 – 2 million Before Present/BP)
Middle Stone Age (30 000 – 300 000 BP)
Later Stone Age (30 000 BP – recent times)

4.2.2 Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the Pre-Historic and Historic periods. It can be divided into three distinct periods:

The Early Iron Age: Most of the first millennium AD.
The Middle Iron Age: 10th to 13th centuries AD
The Late Iron Age: 14th century to colonial period.

The Iron Age is characterised by the ability of these early people to manipulate and work Iron ore into implements that assisted them in creating a favourable environment to make a better living. Iron is a very hard metal to work with compared to gold and copper that have lower melting temperatures and therefore are easier to forge. A drawback of gold and copper are the occurrence of ore, which is relatively limited compared to iron.

In Africa, we proceeded technologically directly from the Stone Age in to the Iron Age whereas in Eurasia there was a prolonged Copper and Bronze Age preceding the Iron Age. In southern Africa, metallurgical techniques made their first appearance in a rather advanced state that permitted the smelting of Copper and Iron directly after a Stone Age economic way of live.

This scenario provides a strong argument that metallurgical technology was introduced from elsewhere and did not develop locally. To effectively smelt iron oxide, ore by reduction requires a temperature of at least 1100°C that is 400°C below the metals melting point. To obtain a temperature this high was probably unattainable in ancient furnaces. But the prolonged heating of ore in contact with abundant charcoal, needed to obtain a sufficiently high temperature for the reduction of the oxide ores, enable the iron to obtain enough carbon to make it mild steel. If this mild steel was repeatedly heated and hammered during the forge process, it will harden.

4.2.3 Early Iron Age

Early in the first millennium AD, there seem to be a significant change in the archaeological record of the greater part of eastern and southern Africa lying between the equator and Natal. This change is marked by the appearance of a characteristic ceramic style that belongs to a single stylistic tradition. These Early Iron Age people practised a mixed farming economy and had the technology to work metals like iron and copper.

A meaningful interpretation of the Early Iron Age has been hampered by the uneven distribution of research conducted so far; this can be partly attributed to the poor preservation of these early sites.

Linguistic and archaeological research has developed a model of Bantu distribution from Central Africa down towards Southern Africa from around 1000 BC to 500 AD. This movement has resulted in the current tribal distribution as known today (**Figure 6**).

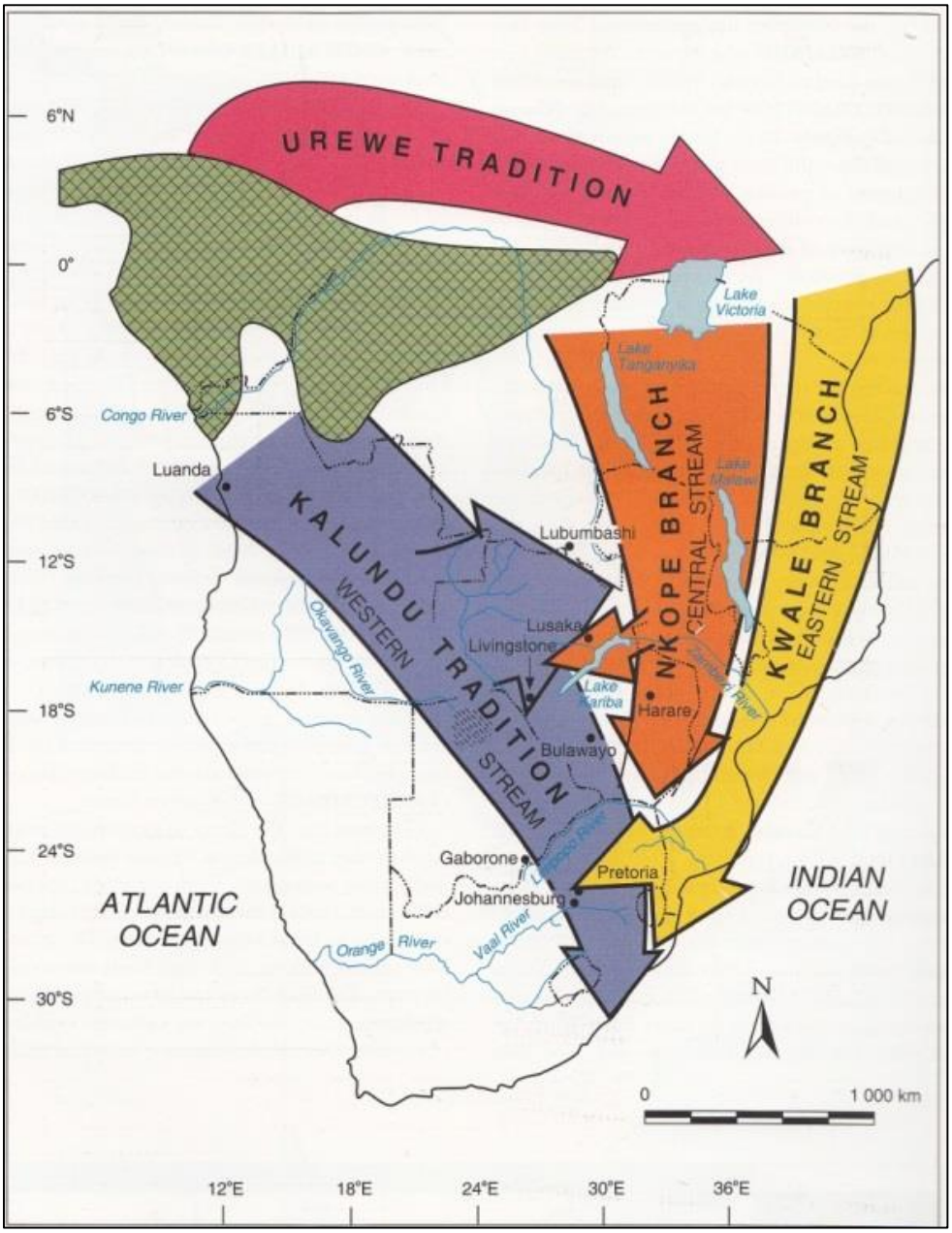


Figure 6: Map of Western and Eastern Bantu movements from the Central Lakes area (Huffman, 2007)

4.2.4 Later Iron Age – early Farming Communities

Later Iron Age (LIA), also referred to as early farming communities, starts around 1500 AD and continues up to 1840 with the start of colonialisation of the South African interior. One of the main features of the LIA is the remnants of stone walled settlements scattered over large area of southern Africa. These stone walled settlements and characterised by a specific type of layout referred to as the Central Cattle Pattern (CCP). The CCP refer to a settlement pattern where animal enclosures forma circle around a central open space or cattle are kept in a central kraal around which the development of settlements are done (Huffman, 2007).

There are numerous differences in layout of these stone walled settlements which researchers use to assign cultural affinities and/ or associated temporal scales. The main types are Moorpark Cluster (Moore park/Melora/KwaMaza walling; Nguni, 1500-1600AD), Ntsuanatsatsi Cluster (Types N/V/ Klipriviersberg/Molokwane/Badfontein/Type Z/B/ Thukela and Doornspruit type walling), and Zimbabwe Patterns (Khami and great Zimbabwe) (Huffman, 2007).

4.2.5 Anthropology of area

The study area falls within an area proclaimed as a homeland to the Ndebele, by the pre-1994 government as KwaNdebele. The inhabitants of this area are predominantly associated with the Southern Ndebele.

Three main groups of Ndebele people are recognised in southern Africa:

- The Southern Transvaal Ndebele (now Gauteng and Mpumalanga)
- The Northern Transvaal Ndebele (now Limpopo Province) around the towns of Mokopane (Potgietersrus) and Polokwane (Pietersburg).
- The Ndebele people of Zimbabwe, who were called the Matabele by the British (Coetzee, 1980; De Beer, 1986; Fourie, 1921)

The Southern Transvaal Ndebele (Southern Ndebele) is divided into three kin groups, namely the Ndzundza, the Manala and the Hwaduba (Jonas, 1989). The origins of the southern Ndebele starts with Mafana and Mhlanga (1557 AD-1587 AD) ruling at a place called Emhlangeni (close to Randfontein) after which they moved under Mhlanga to KwaMnyamana, near Bon Accord. Mhlanga was then succeeded by Musi (1666 AD). Musi had five or six sons: Manala, Masombuka, Ndzundza, Mathombeni and Dhlomu (Nelson, 2008; Jonas, 1989). Jonas (1989) indicates that a war of succession broke out between Manala and Ndundza and Ndzundza and his followers fled east wards through the Bronkhorstspruit, Witbank and Middelburg areas before settling in the Stoffberg area. Massie (1905) however maintains that the tribe divided in to four groups; Manala (settling in the Pretoria area), Kekaan (settling in the Soutpansberg, Waterberg and Pretoria area), M'Hwaduba (settling the Pretoria area) and Ndzundza (also known as the Mapoch tribe, settling in the eastern Transvaal (Mpumalanga) and Pretoria area).

Estimated date	Related groups	Main groups	Neighbours	Place of residence
c. 1480s-500s AD	Sotho, Tswana and Tsonga	Nguni, Mafana and Mhlanga	Khoisan	Crossing Zambezi from central Africa
	Southern Nguni	Nguni	Khoisan	East coast of South Africa
	Tonga Nguni	eMbó	Khoisan and Tsonga	uBombo
c. 1600s-1630 AD	Ndwandwe, Tonga, Ngwane, Mkize and Dlamini	Hlubi	Khoisan and Sotho	Lundini/Drakensberg
c. 1648-1666 AD	N.Tvl. Ndebele and Hlubi	S.Tvl. Ndebele, Mhlanga and Musi	Hurutse, Kwena and kgatla	Emhlangeni and Wonderboom area
c. 1670s AD	Manala, Hwaduba and Kekaan	Ndzundza (sons: Mrhetsha, Magobholi and Bongwe	Pedi, Koni, baTau, Mongatane, baPai, baKopa, Kutswe, Pulane, maTebele and Ndwandwe	Lower Steelpoort river (Stofberg)
c. 1675 AD		Bongwe (sons: Sindeni, Mahlangu, Phaswana and Maridili)		KwaMaza (Bothasberg)
c. 1819 AD		Somdeyi		Esikhunjini (Bothasberg)
c. 1835 AD		Mabhogo	Pedi, Swazi, Missionaries, British and Boers	KoNomtjarhelo (Steenkampsberg)
c. 1883-1923 AD		Mahlangu	Sotho, Pedi, Boers/farmers and city dwellers	Boer farms, KwaNdebele and Weltevreden farm
c. 1930s AD		Mayisha Cornelis Mapog		Scattered throughout Mpumalanga and Gauteng

Figure 7 – Origins and settlement areas of the Ndzundza (Nelson, 2008)

The dispersal of the Ndzundza Ndebele to the Steelpoort and KwaNdebele in 1883, was preceded by numerous movements and resettlements due to political and socio-economic circumstances during the preceding 150 years (Nelson, 2008). This is depicted in **Figure 7**, indicating dates, correlating with tribal groupings, neighbours and places of residence. The important settlement sites taken from **Figure 7**, are Lower Steelpoort, KwaMaza, Eskikhujini, KoNomtjarhelo, KwaNdebele and Weltevreden farm (Loskop Dam reserve).

The most significant of the above mentioned sites, also having the final part in the scattering of the Ndebele, is KoNomtjarhelo. KoNomtjarhelo was the royal kraal of Mabogho of the Ndzundza clan and was laid out as settlement and military fortress around 1830. The Ndzundza maintained a fragile peace with the colonial forces of the ZAR up until 1882, when Nyabela, the successor of Mabhogo, provided shelter for the Pedi chief, Mampuru and his men. Mampuru murdered his half-brother Sekhukhune in 1882, resulting in the then ZAR sending gen. Piet Joubert and a commando to arrest Mampuru and end the uprising that ensued the murder of Sekhukhune (Saks, 2008)

The ZAR forces laid siege to KoNomtjarhelo for 8 months after which Nyabela and 8000 of his subject surrendered. Mampuru was sentenced to death and hanged on 22 November1883 in Pretoria.

The Ndzundza was dispersed to Boer farms in different districts of the ZAR to work for 5 years as indentured labour. KoNomtjarhelo and surrounds were subdivided and given as reward to Boer commando members that participated in the siege. After the release of Nyabela in 1898 he settled with some of his subjects at KwaMkhina (close to Derdepoort in Pretoria) (Van Jaarsveld, 1986)

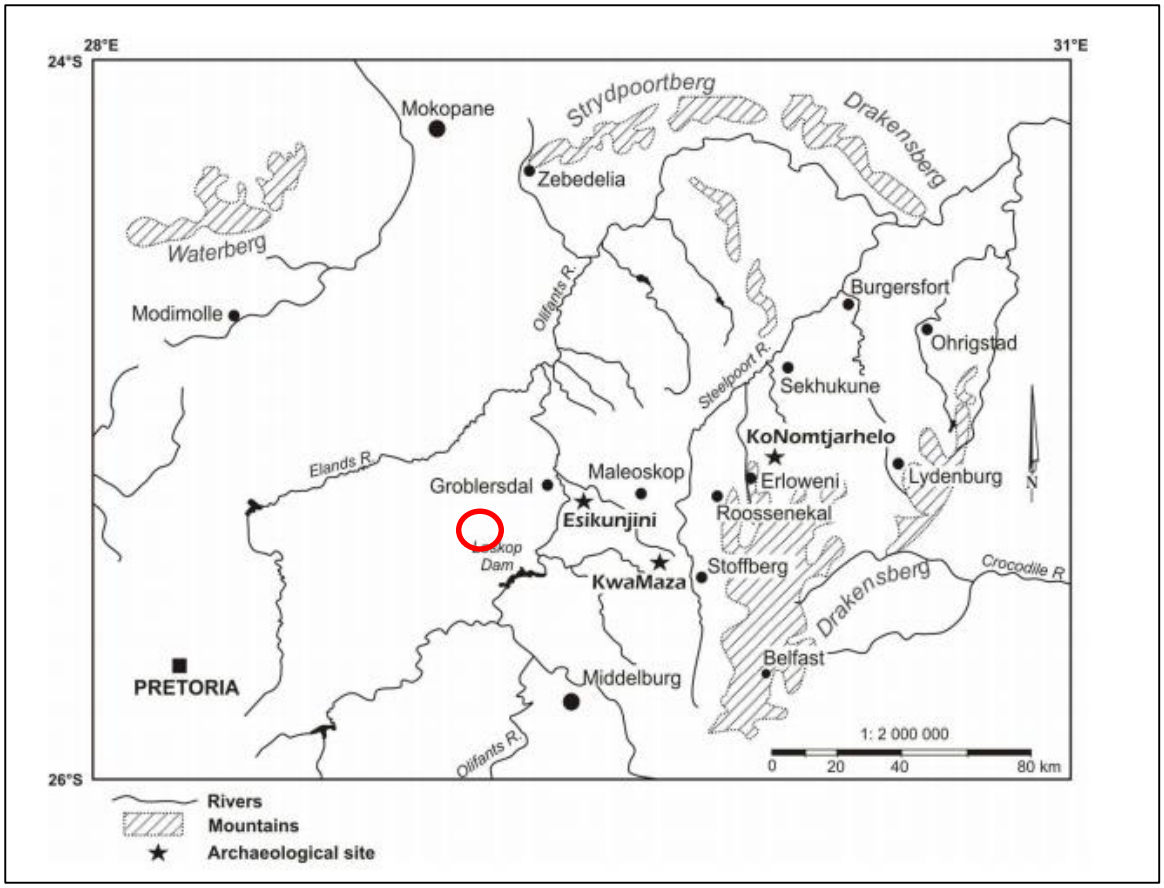


Figure 8: Site as indicated in Figure 4 (Nelson, 2008) (Study area indicated in red)

4.2.6 Recent history

KwaNdebele

Since the scattering of the Ndzundza, the Ndebele people work towards the establishment of a self-governing area (Phatlane, 1998). This former Bantustan was given self-governing status on 1 April 1981 by the pre-1994 government under the name KwaNdebele. This former homeland was re-integrated in to South Africa on 27 April 1994.

4.2.7 Historical structures and history

Four areas of possible historical settlements have been identified in the study area and will be assessed during the field work of the HIA.

4.2.8 Historical Maps

Historical maps of the study area consulted were the First edition 1:50 000 topo cadastral map – 2529AC dated 1966 and surveyed in 1965.

The map provides interesting information on the historic layout of the farm and corroboration of the data on farms sales in the area.

- **First Edition 1:50 000 – 2529AC map (1962)**

  Evaluation of the map (**Figure 9)** indicates the presence of on cluster of structures in the central part of the study area and two separate settlement units in the southern sections of the study area (all circled in red).

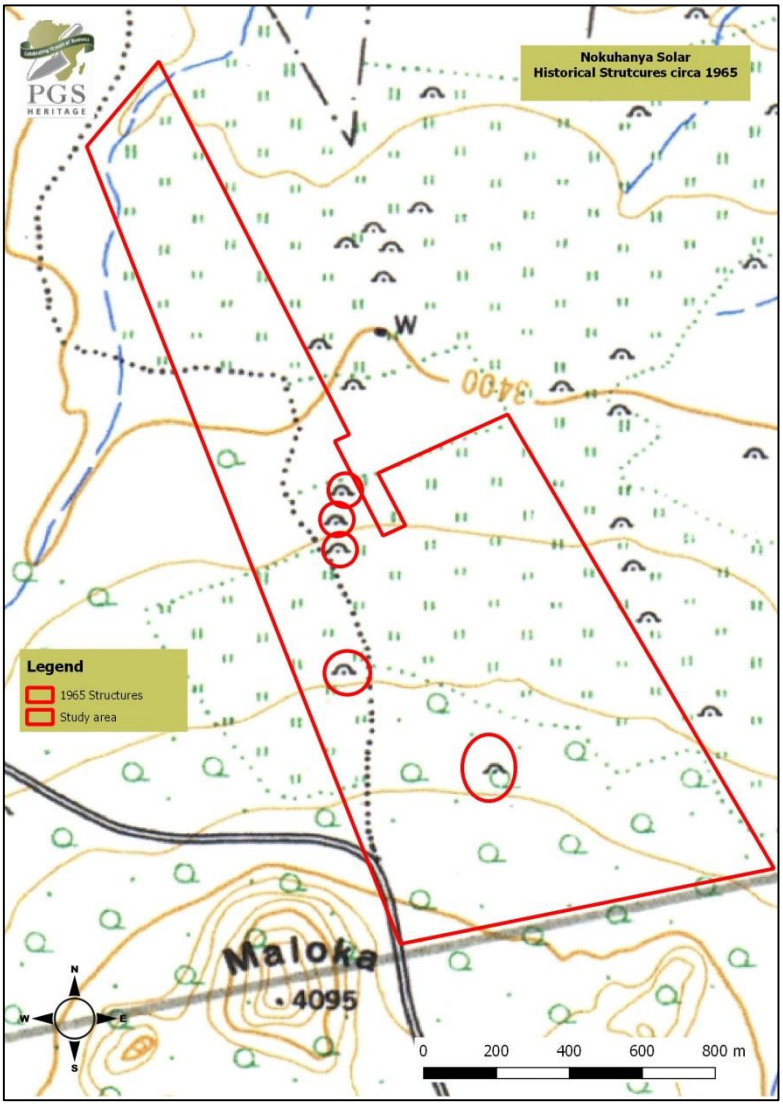


Figure 9: Structures dating to 1965 as demarcated on the 1966 topographical map

4.3 Palaeontology

The Study area is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. This unit consists of grey to pink coarse-grained granite becoming red, medium grained near the top (Geological Survey 1978).

Due to the age and igneous nature of the Nebo Granite, no fossils will occur and a Low Palaeontological sensitivity

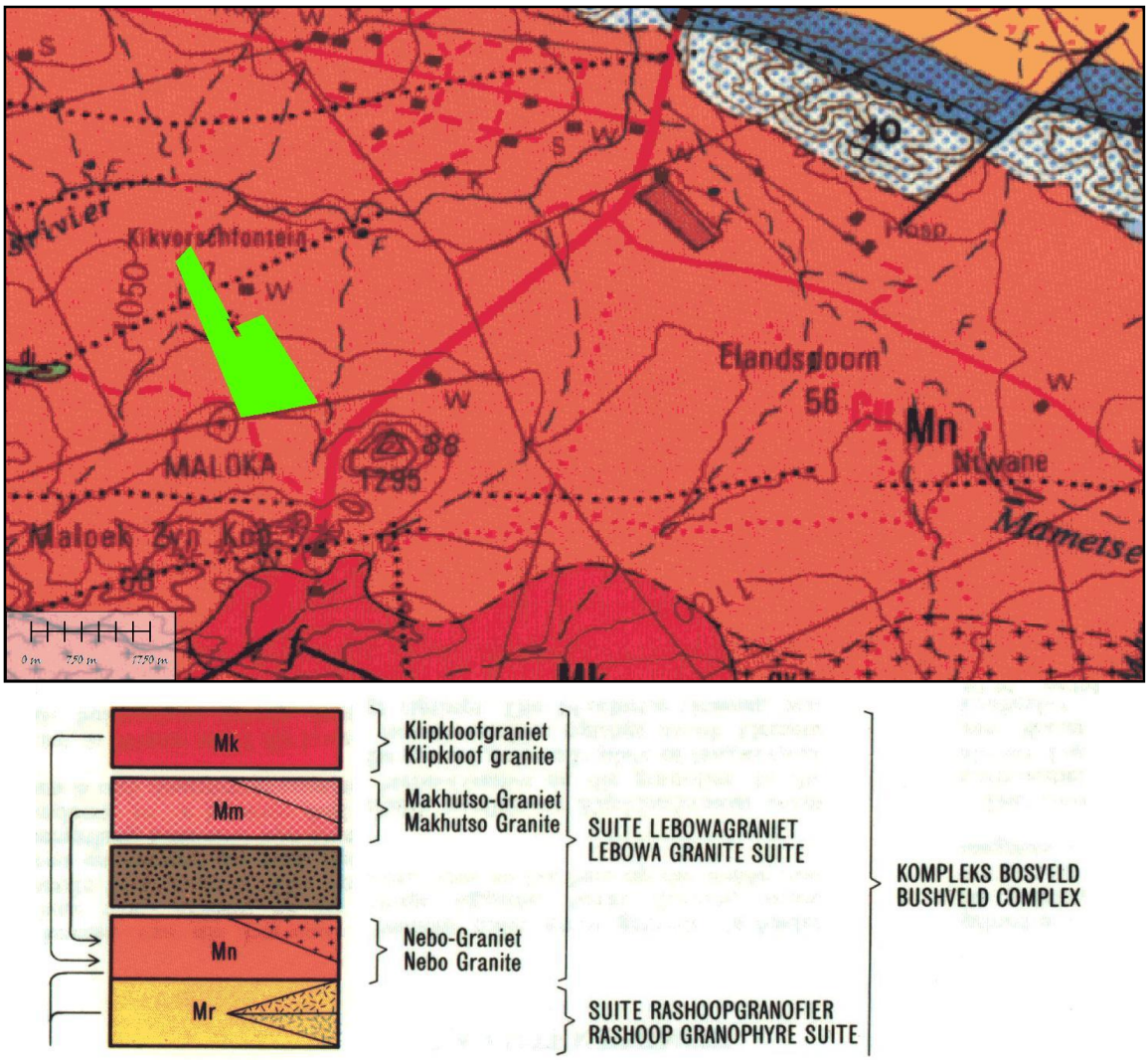


Figure 10: Geology of the study area

4.3.1 Possible finds

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (**Figure 12**). The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 3**.

Table 3: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
River drainages	LSA and MSA scatters
Ridges	Iron Age stone walling
Farmsteads	Historical material/cemeteries
Labourer housing	Historical material/cemeteries/still born burials (Cocks, et al, 2006)

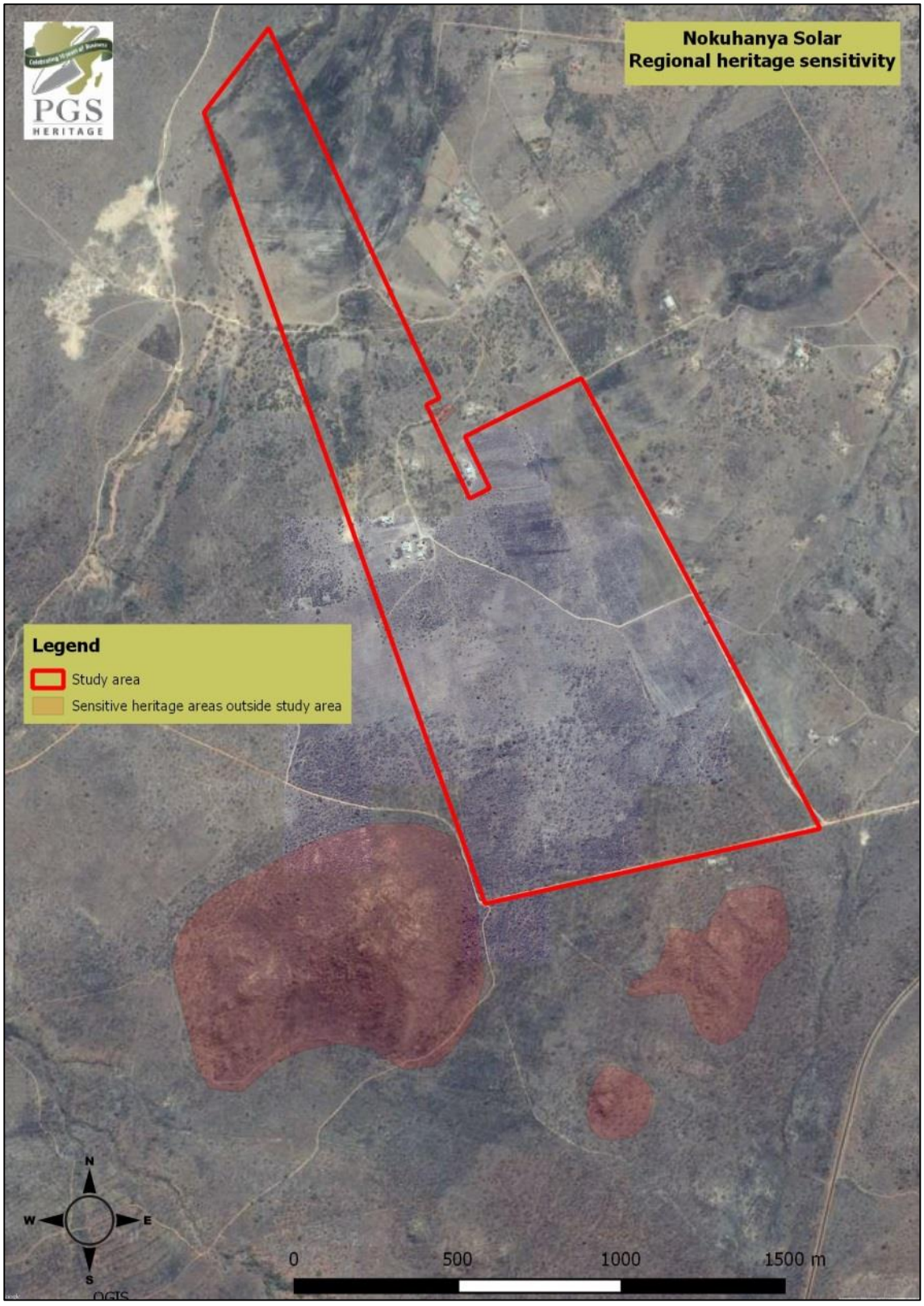


Figure 11: Heritage sensitivities outside study area

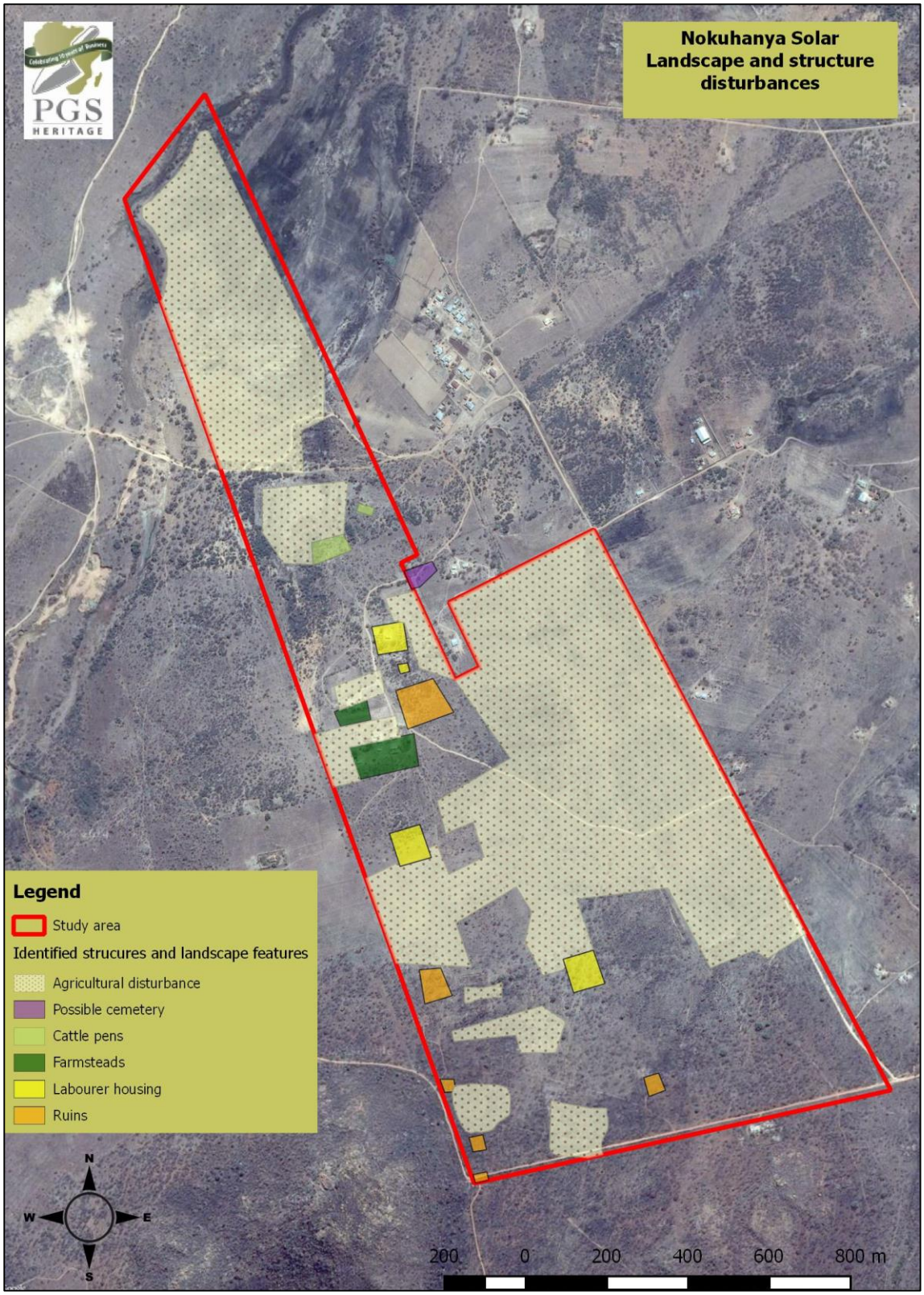


Figure 12: Structures and cultural disturbances in study area

Analysis of the area around the study area has shown a large LIA stone walled site situated on the hill (Phookwane Hill) just southwest of the study area (**Figure 13**), at this stage no reference

to any archaeological sites could be found in literature and will be followed up with further research during the EIA phase.

The layout of the stone walling shows resemblance to stone walled layout of other Ndebele sites such as KwMaza (**Figure 14**).

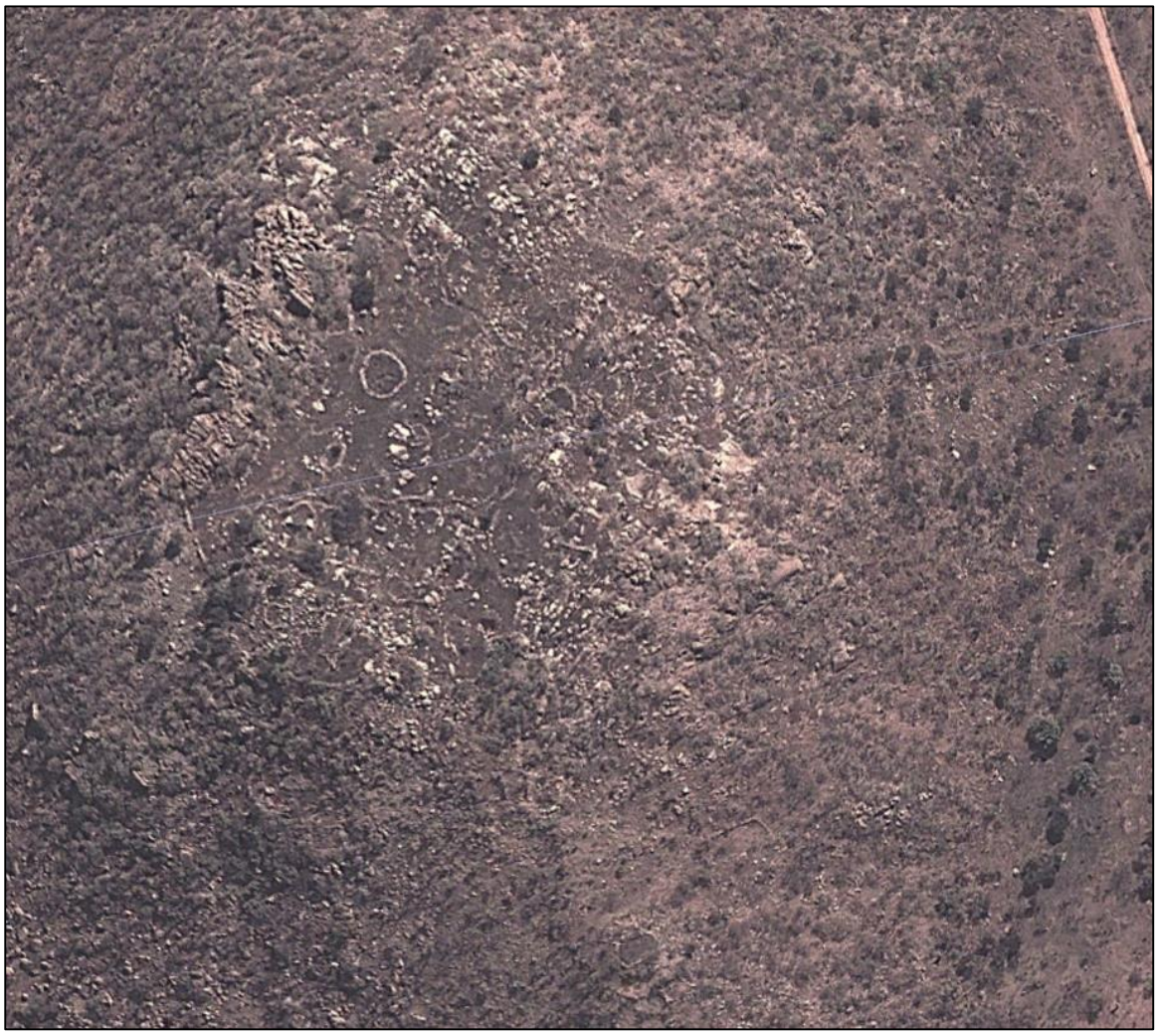


Figure 13: Phookwane Hill (Maloka Hill) just south west of the study area

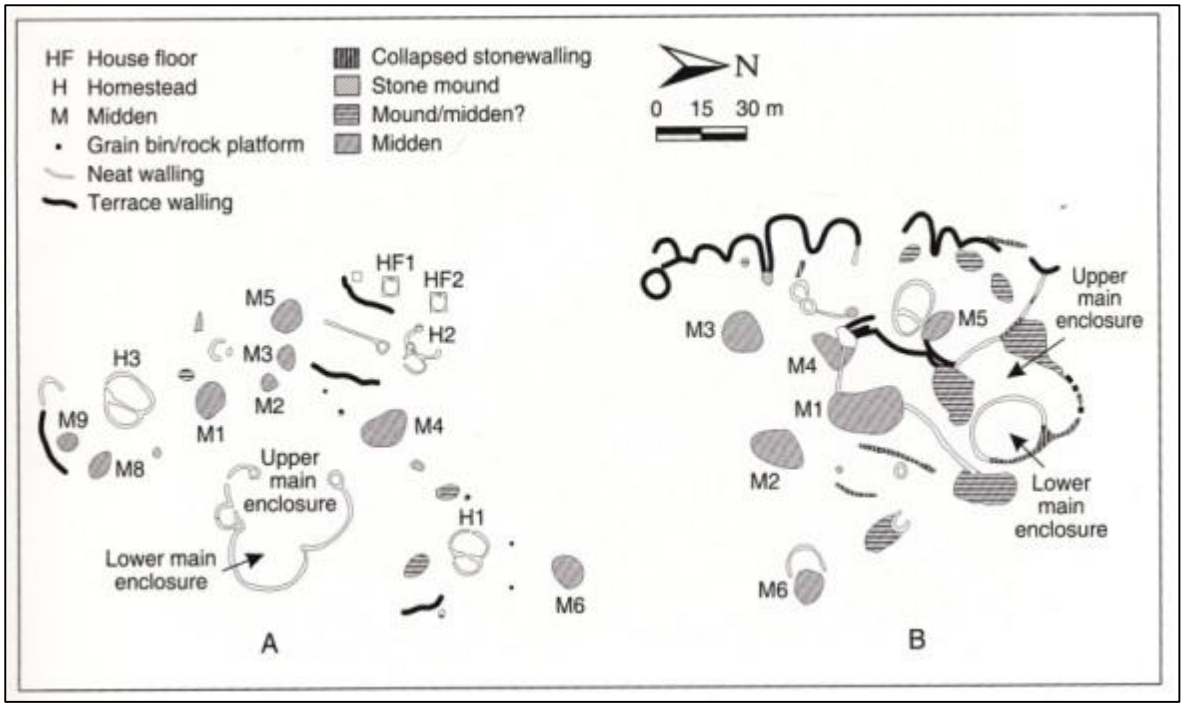


Figure 14: Stone walled layout of the LIA site of KwaMaza (Huffman, 2007)

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA.

- Archaeological walk through of the areas where the project will be impacting;

4.4 Environmental Issues and Potential Impacts as identified during the Scoping Phase

ISSUE	Impact on archaeological sites
DISCUSSION	As seen from the archival work and discussion in Section 4.3.1 the possibility of archaeological finds are possible in the study area. Linked with the LIA stone walled sites just outside of the study area the need for a field survey must be stressed.
EXISTING IMPACT	None known
PREDICTED IMPACT	Unidentified archaeological sites and the discovery of such sites during construction can seriously hamper construction timelines. Field work can thus provide valuable information on such site in the study area and provide timeous management of such site through realignment of development or mitigation of such sites where needed.
EIA INVESTIGATION REQUIRED	Archaeological walk down of the study area
CUMULATIVE EFFECT	None foreseen at this stage.

ISSUE	Impact on palaeontological sites
DISCUSSION	No palaeontological sensitivity due to the age and igneous nature of the geology
EXISTING IMPACT	No impact
PREDICTED IMPACT	No further impacts
EIA INVESTIGATION REQUIRED	No
CUMULATIVE EFFECT	None foreseen.

ISSUE	Impact on historical sites
DISCUSSION	As seen from the archival work and discussion in section 4.3.1 the possibility of historical finds have been identified as being high and thus further field work is required to develop a comprehensive Heritage Management Plan.
EXISTING IMPACT	Old ruins identified in the study area are being degraded by natural weathering.
PREDICTED IMPACT	Unidentified historical structure and the discovery of such structures during construction can seriously hamper construction timelines. Field work can thus provide valuable information on such site in the study area and provide timeous management of such site through realignment of development or mitigation of such sites where needed.
EIA INVESTIGATION REQUIRED	Archaeological walk down of impact areas will identify possible impacted sites
CUMULATIVE EFFECT	None foreseen at this stage.

ISSUE	Impact on graves and cemeteries site
DISCUSSION	The existence of graves and cemeteries has not been verified during the archival research. The existence of still born burials at historical African houses cannot be excluded. The possibility of a cemetery on the central eastern boundary of the site needs to be investigated. It has however been found that such structures are rarely noted in maps and documents and can only really be identified during field work.
EXISTING IMPACT	None known

PREDICTED IMPACT	Unidentified graves and cemeteries and the discovery of such structures during construction can seriously hamper construction timelines. In the event that these graves and cemeteries could not be avoided a grave relocation proses needs to be started. Such a process impacts on the spiritual and social fabric of the next of kin and associated communities. Field work can thus provide valuable information on such site in the study area and provide timeous management of such site through realignment of development or relocation of such sites where needed.
EIA INVESTIGATION REQUIRED	Archaeological walk down of impact areas will identify possible impacted sites
CUMULATIVE EFFECT	None foreseen at this stage.

Figure 15 provides a delineation of heritage sensitivity of areas within the study area. Notably previously ploughed fields area given low heritage sensitivity, while ruins and African labourer housing is given a high rating due to the possibility of still-born burials. Note that no area has been graded as a no-go.

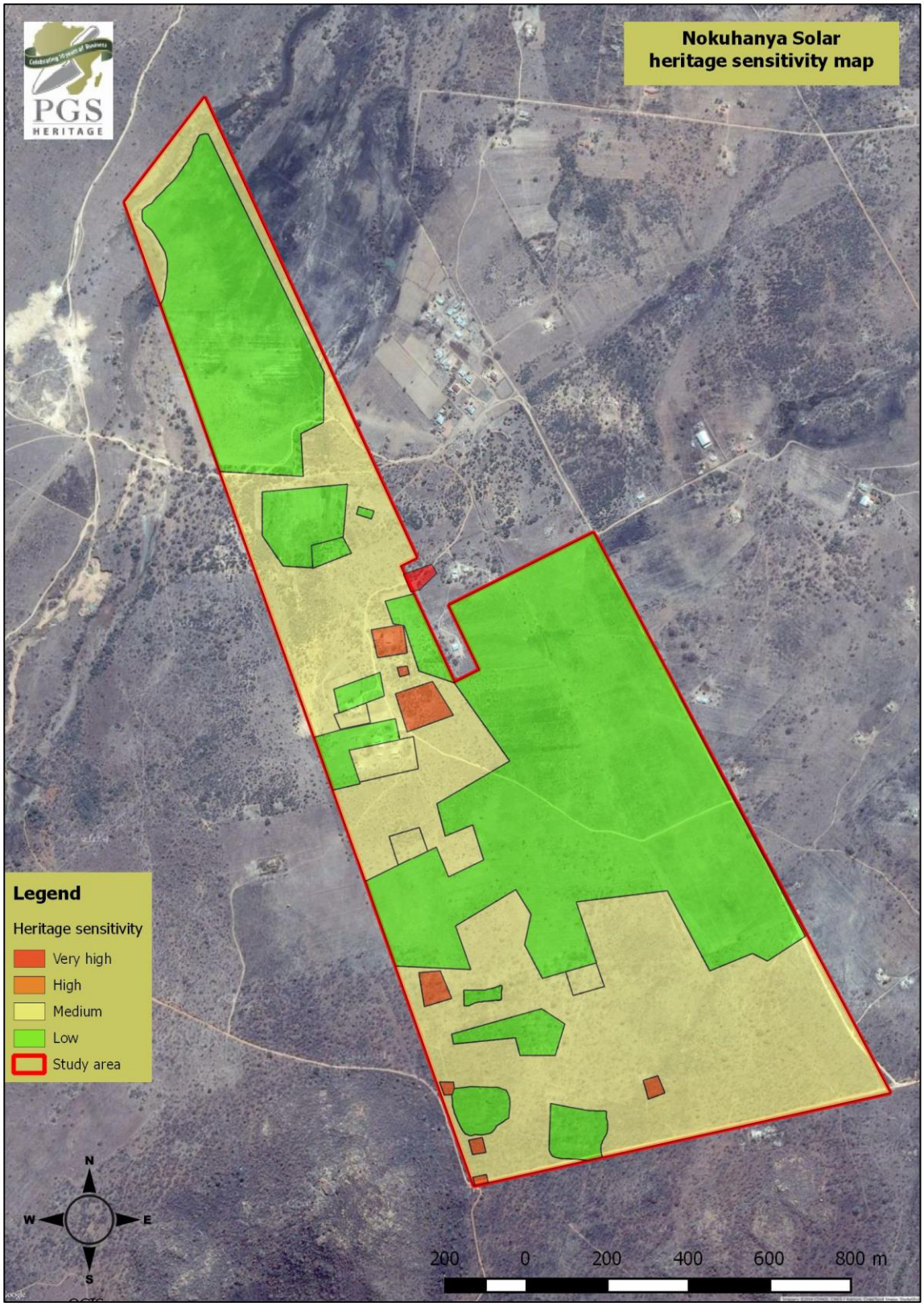


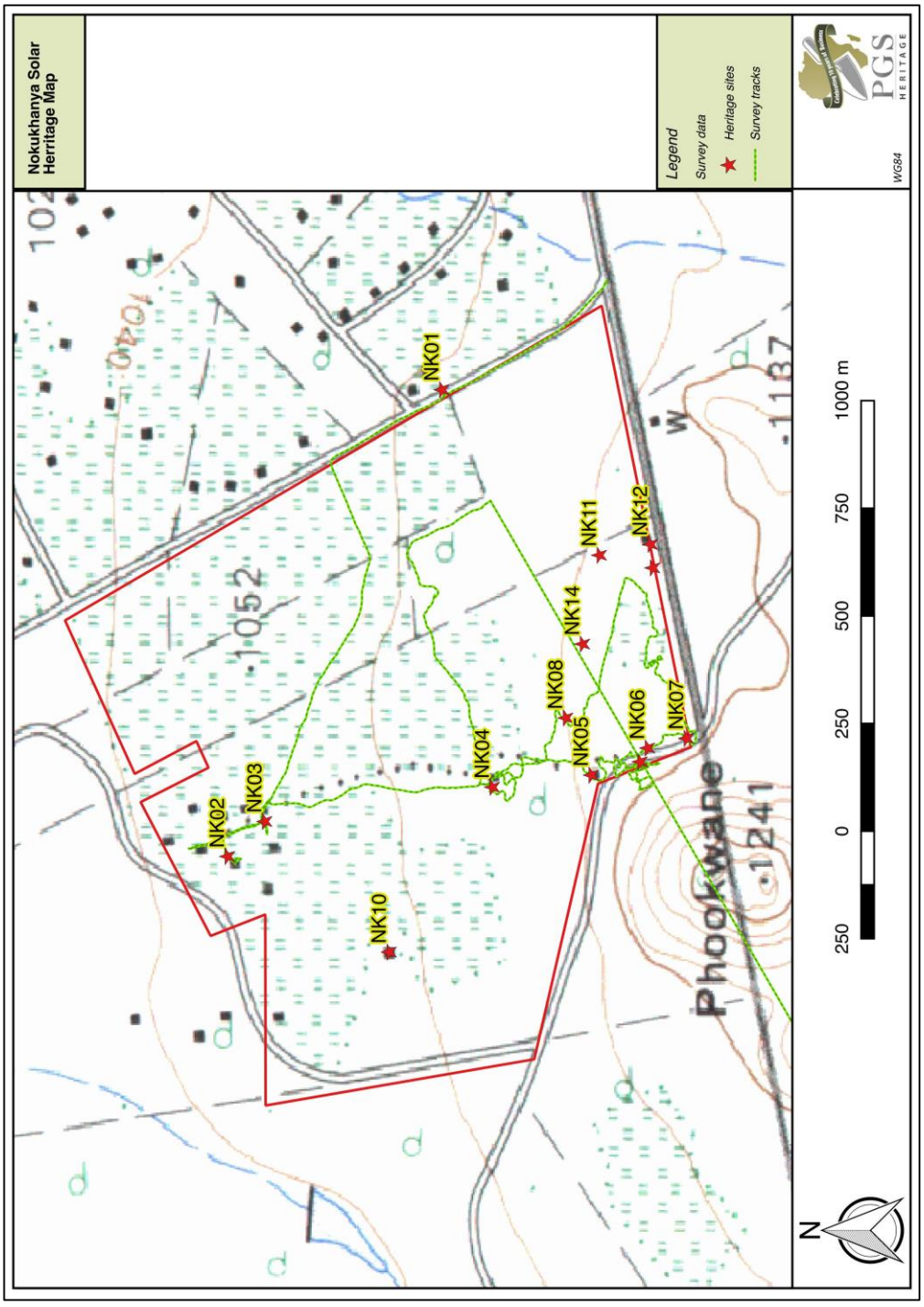
Figure 15: Heritage sensitivity map

5 FIELD WORK FINDINGS

5.1 Methodology

A selective survey of the study area was conducted on 9 February 2015. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, an archaeologist of PGS conducted a vehicle and foot-survey that covered the study area. The fieldwork was logged with a GPS to provide a background of the areas covered (**Figure 16**).

Figure 16: Heritage distribution map including fieldwork tracklog



The study area is characterised by dense mopaniveld (**Figure 18)** over large parts of the study area, while section are only grass land where historical agriculture took place (**Figure 17**).

Figure 17: Disturbed grass land in between wooded areas

Figure 18: View of Phookwane hill just south of the study area

The fieldwork identified 14 heritage finds. The following sections list and describe the finds and sites.

5.2 Sites

5.2.1 Archaeological

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK09	E29.133	S25.308	Site	Iron Age pottery scatter	Low	4B

A low-density scatter of potsherds and some iron slag (**NK09**) was found to be concentrated just east of the road that runs between Phookwane hill and the south-western boundary of the study area. Although the finds were sporadic, it must be seen as significant if the position of the archaeological site on Phookwane hill is taken in to account. The site extent over and are of 50x50 meters

Mitigation

Monitoring by and archaeologist will be required during construction.

Figure 19: View of area where pottery and slag was found

5.2.2 Cemetery

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK01	E29.1417	S25.3040	Site	Cemetery containing 11 -12 graves	High	3A

NK01 is s cemetery situated just outside the development area on the eastern side of the current access road to the property. The site consist of a cemetery with 11 possibly 12 graves of the Malibe/Malebe/Malabye family. The grave date between 1969 and 2013, with all having granite headstones and dressing (Figure 20).

Figure 20: View of the partially fenced cemetery

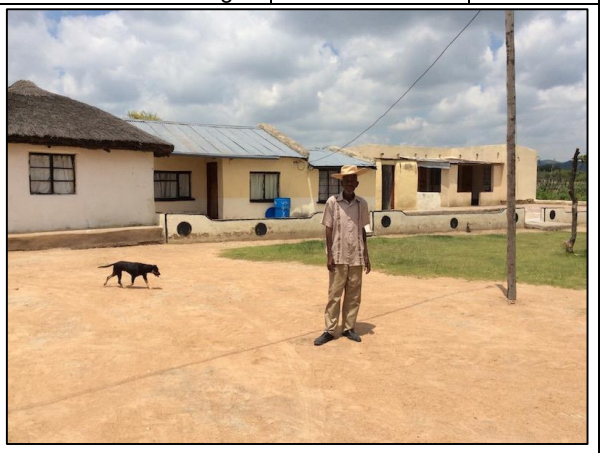
5.2.3 Historical

Ten heritage sites (**Table 4**) of historical significance were identified during the fieldwork. The twelve sites are all homestead consisting of one to three multi room mud brick structures. Two of the homesteads (**NK02** and **NK03**) are still utilised and is very well kept and in good condition. The remaining eight sites are all ruined and of low heritage value.

During the field work only on person was found at home (**NK02**). Mr Simon Mabilane indicated that he has been residing on the property for the last 30 years. He also indicated that he was only aware of one cemetery (**NK01**)

Although Mr Mbilane gave no indication of other graves or burials, ethnographical evidence (Cocks, et al., 2006) and personal experience over years of fieldwork has indicated that the possibility of stillborn burials in and around African homesteads does occur.

Table 4: Historical Sites

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK02-03	E29.1310	S25.2991	Site	Homestead with extended outbuildings	Medium	4A
 **Figure 21: View of main house façade (NK03)**				 **Figure 22: Homestead with Mr Simon Mabilane (NK02)**		
NK04	E29.1326	S25.3052	Site	Ruined African homestead	Low	4B
 **Figure 23: Northern façade of mud brick ruin**				 **Figure 24: painted motif on wall**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK05	E29.1328	S25.3075	Site	Ruined African homestead	Low	4B

Figure 25: Northern façade of mud brick ruin

Figure 26: Back porch of ruin

NK06	E29.1335	S25.3088	Site	Ruined African homestead	Low	4B

Figure 27: mud foundation of ruin visible

NK07	E29.1337	S25.3097	Site	Ruined African homestead	Low	4B

Figure 28: Granite monument in the memory of AJ Nel (one of the previous owners of the farm)

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK08	E29.1342	S25.30693	Site	Ruined African homestead	Low	4B

Figure 29: Remains of mud brick structure

NK10	E29.1288	S25.3028	Site	Ruined homestead	Low	4B

Figure 30: Ruin of farm house in western section of study area

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK11	E29.1379	S25.3077	Site	Ruined African homestead	Low	4B

Figure 31: Low mud walls just visible in grass

NK12	E29.13820	S25.30889	Site	Ruined African homestead	Low	4B

Figure 32: Remains of mud brick walls on southern boundary of study area

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK13	E29.1376	S25.3089	Site	Ruined African homestead	Low	4B

Figure 33: Remains of large mud brick house

NK14	E29.1359	S25.3073	Site	Ruined African homestead	Low	4B

6 IMPACT ASSESSMENT

The impact rating and analysis was done based on the methodology as explained and summarised in **Appendix C** of this report. The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage sites and thus the reduction of impacts at an early design phase. Analysis of the impact matrix tables will reflect this.

6.1 Impact matrix

Table 5: Impact rating - Palaeontology

IMPACT TABLE		
Environmental Parameter	*No palaeontological sensitive rock formations*	
Issue/Impact/Environmental Effect/Nature	*Due to the age and igneous nature of the Nebo Granite, no fossils will occur and a Low Palaeontological sensitivity*	
Extent	*Localised*	
Probability	*Low probability of encountering fossils exist*	
Reversibility	*Fossils are none renewable.*	
Irreplaceable loss of resources	*Low probability due to geology*	
Duration	*The loss of the fossil record will be permanent*	
Cumulative effect	*Low cumulative impact over the site*	
Intensity/magnitude	*Magnitude of the impact pre-mitigation is rated as low*	
Significance Rating		
	Alternative 1	**Alternative 2**
	Pre-mitigation impact rating	
Extent	1	1
Probability	1	1
Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
	Post mitigation impact rating	
Extent	1	1
Probability	1	1

Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	*None required*	

Table 6: Impact rating – Archaeological Sites

IMPACT TABLE		
Environmental Parameter	*Possible Iron Age remains in south western corner of the development area*	
Issue/Impact/Environmental Effect/Nature	*A low density scatter of pottery fragments and iron slag is present in the area of NK09. Construction could unearth sub-surface deposits*	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Archaeological sites are irreplaceable*	
Duration	*Permanent*	
Cumulative effect	*Low*	
Intensity/magnitude	*Low*	
Significance Rating		
	Alternative 1	**Alternative 2**
	Pre-mitigation impact rating	
Extent	1	1
Probability	2	2
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-16 (low negative)	-16 (low negative)
	Post mitigation impact rating	
Extent	1	1
Probability	1	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-15 (low negative)	-15 (low negative)
Mitigation measures	*1. Monitoring by and archaeologist will be required during construction.*	

Table 7: Impact rating – Historical/Recent history

IMPACT TABLE		
Environmental Parameter	*Homesteads*	
Issue/Impact/Environmental Effect/Nature	*The structures and homesteads have a low heritage significance however the possibility of stillborn burials at these sites does pose a possible impact.*	
Extent	*Site*	
Probability	*Low*	
Reversibility	*Low*	
Irreplaceable loss of resources	*Loss of human remains is irreplaceable*	
Duration	*Permanent*	
Cumulative effect	*Low*	
Intensity/magnitude	*High*	
Significance Rating		
	Alternative 1	**Alternative 2**
	Pre-mitigation impact rating	
Extent	1	1
Probability	2	2
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	-48 (medium negative)	-48 (medium negative)
	Post mitigation impact rating	
Extent	1	1
Probability	1	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-15 (low negative)	-15 (low negative)
Mitigation measures	1. *Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted;*	

	2. *If it is found that there are burials associated with the ruins, a grave relocation process must be initiated.* 3. *An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures.*

Table 8: Impact rating – cemetery

IMPACT TABLE		
Environmental Parameter	*Impact on cemetery outside development area*	
Issue/Impact/Environmental Effect/Nature	*The cemetery is situated on the eastern border of the property and could be affected by construction.*	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Heritage resources are non-renewable.*	
Irreplaceable loss of resources	*The graves in the cemetery is irreplaceable*	
Duration	*Short*	
Cumulative effect	*Low*	
Intensity/magnitude	*Low*	
Significance Rating		
	Alternative 1	**Alternative 2**
	Pre-mitigation impact rating	
Extent	1	1
Probability	2	2
Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	3
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-11 (low negative)
	Post mitigation impact rating	
Extent	1	1
Probability	1	1
Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	3

Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	1. *The cemetery needs to be fenced and a 20m safety buffer needs to included in side the development foot print to ensure protection of the cemetery.*	

6.2 Confidence in Impact Assessment

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 heritage sites.

The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life and has been conducted as such.

6.3 Cumulative Impacts

None foreseen

6.4 Reversibility of Impacts

Although heritage resources are seen as non-renewable the mitigation of impacts on possible finds through scientific documentation will provided sufficient mitigation on the impacts on possible heritage resources.

6.5 Comparative Assessment of Alternatives

The comparative assessment of the alternatives have shown that an overall low impact on heritage is foreseen, as most of the heritage sites identified fall outside the proposed alternative foot prints.

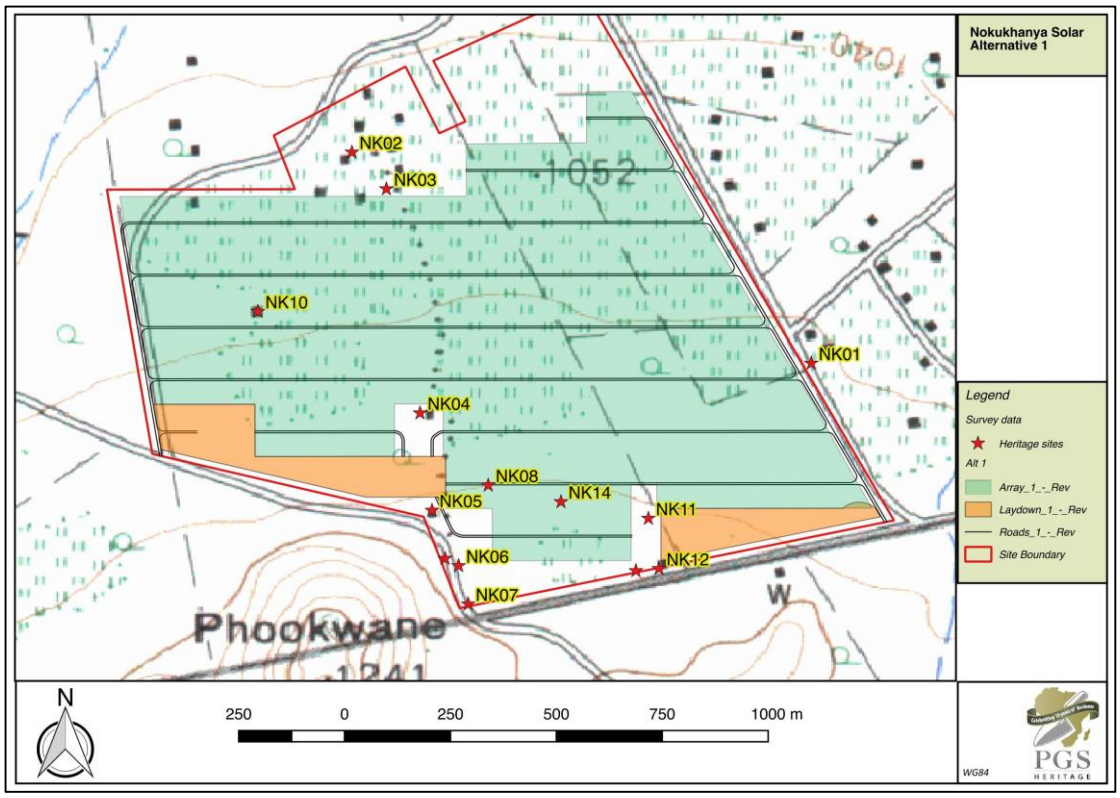


Figure 34: Alternative 1 with heritage resources

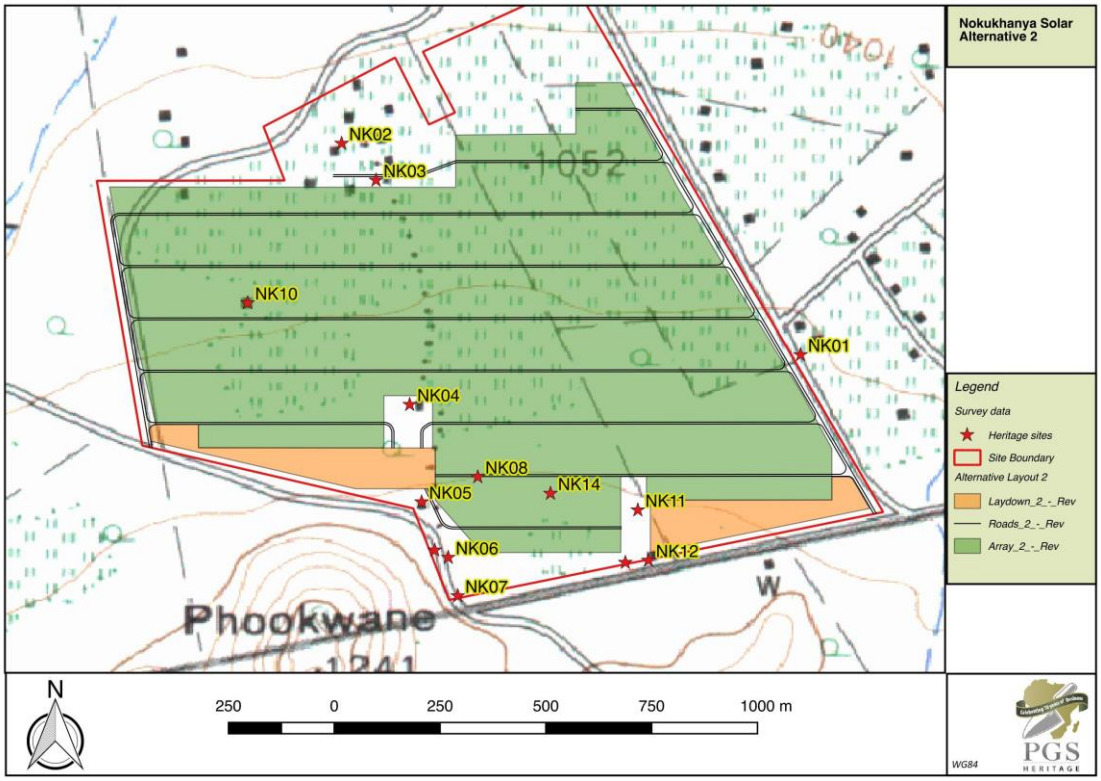


Figure 35: Alternative 2 with heritage resources

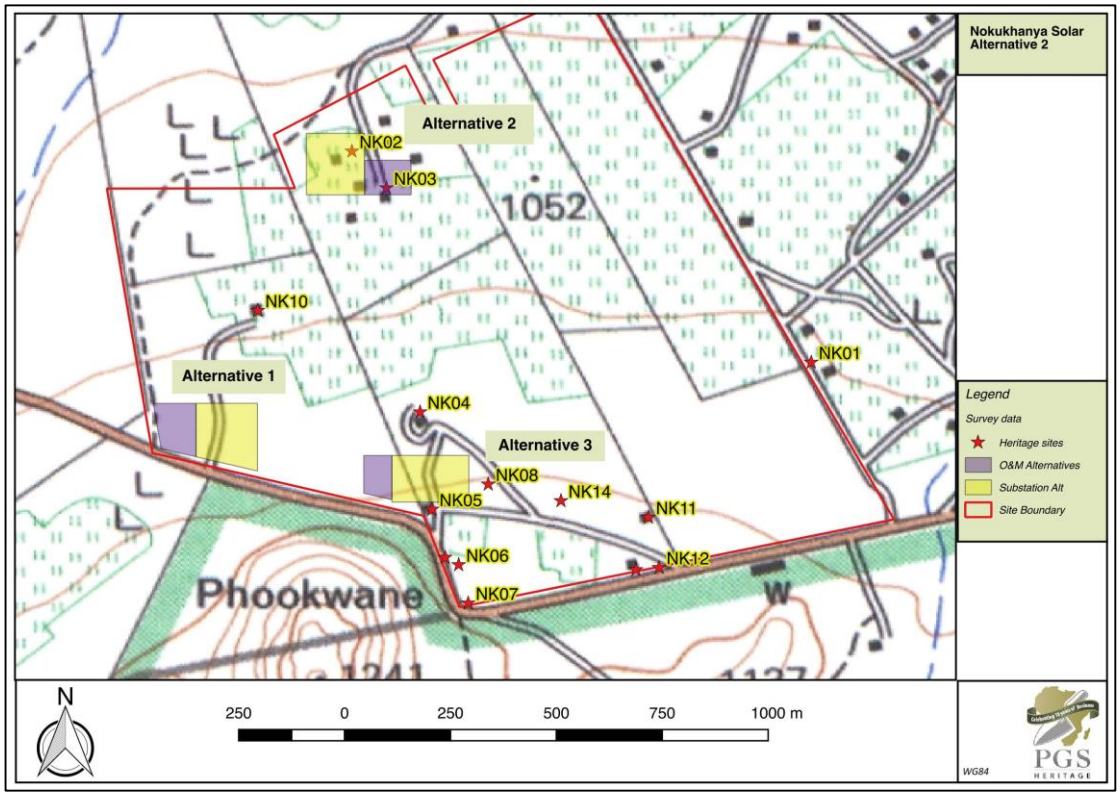


Figure 36: Operations, Maintenance and Substation alternatives with heritage resources

6.5.1 Solar Array layout

Both alternatives impact directly on only 3 low significance heritage site and as such will have the same impact.

6.5.2 Substation and associated building

The substation and OM position of Alternative 1 will impact on sites **NK02** and **NK03** and will most probably lead to the destruction of the two inhabited homesteads. Where Alternative 2 and Alternative 3 will not impact on any heritage features.

Table 9: Comparative Assessment of Alternatives

Key

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

Alternative	Preference	Reasons
SOLAR PANEL ARRAY LAYOUT		
Alternative 1	Preferred	Both show minimal impact on heritage resources
Alternative 2	Preferred	Both show minimal impact on heritage resources
SUBSTATION AND ASSOCIATED BUILDINGS		
Substation and OM Alternative 1 (south-west)	Not preferred	Does not impact on heritage resources
Substation and OM Alternative 2 (north)	Not preferred	Impacts on NK02 and NK03 which are still in use
Substation and OM Alternative 3 (south-east)	Preferred	Does not impact on heritage resources
LAYDOWN AREAS		
Laydown Alternative 1	Preferred	Does not impact on heritage resources
Laydown Alternative 2	Preferred	Does not impact on heritage resources

7 CONCLUSIONS AND RECOMMENDATIONS

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

The initial Heritage Scoping Report (HSR) has shown that the proposed Nokukhanya site to be developed as a Solar Energy Facility may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

The historical significance of the region with regards to the Ndebele and the proclamation of the KwaNdebele homeland have been described in the background research. The presence of Late Iron Age (LIA) stone walling, on the south western boundary the study area, as well as the numerous historical ruins of African homesteads necessitate extensive fieldwork to evaluate and recommend the necessary mitigation measures, where required.

The development of the PV facility near Dennilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.

A total of 14 heritage sites were identified, of which 13 are located within the development boundary and the 14th a cemetery located on the eastern boundary just of the current access road.

The mitigation measures proposed is a follows:

7.1 Archaeological Sites

1. *Monitor find spot areas if construction is going to take place through them.*
2. *A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.*
3. *If archaeological remains are discovered a permit as issued by the South African Heritage Resources Agency under Section 35 of the National Heritage Resources Act will be required to mitigate the finds. Such a mitigation process can take up to 4 months to finalise.*
4. If the sites are to be avoided an archaeologist should assist with the demarcation and a 10 meter perimeter should then be kept around each site.

7.2 Historical sites

1. *Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted;*
2. *If it is found that there are burials associated with the ruins, a grave relocation process must be initiated. Which must include permit applications to the relevant authorities. Thus will include the Local Municipality, Provincial Health Department and the South African Heritage Resources Agency. Such a mitigation process can take up to 6 months to finalise.*
3. *An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures.*
4. If the sites are to be avoided an archaeologist should assist with the demarcation and a 10 meter perimeter should then be kept around each site.

7.3 Cemetery

The cemetery needs to be fenced and a 20m safety buffer needs to included in side the development footprint to ensure protection of the cemetery.

By implementing the recommended mitigation measures the impact on the identified heritage resources is rated as low.

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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 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 (PGS) for the proposed Dwarsrug WEF 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

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 10: 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 calculated as shown in **Error! Reference source not found.**.

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 11: 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 D

Palaeontological Desktop Assessment

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED

For:

HIA CONSULTANTS

DATE: 26 August 2014

By

GIDEON GROENEWALD

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PSG Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of a 75 MW PV facility and associated infrastructure near Dennilton, Elias Motsoaledi Local Municipality, Limpopo Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of theSouth 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.

The proposed development will entail the construction of a 75MW solar photovoltaic plant near Dennilton within the Elias Motsoaledi Local Municipality, Limpopo Province. The proposed project would comprise of the following:

- Approximately 342 000 solar PV panels with a total generation capacity of 75MW;
- Panels will be arranged in section sizes of approximately 40m x 5m and installed on racks made of aluminium or steel;
- DC-AC current inverters and transformers;
- Underground cabling/overhead power lines;
- Solar resource measuring stations, including 10m high meteorological masts;
- A 132kV switching station at the Nokukhanya PV plant;
- 4x132kV feeder bays at the switching station at the Nokukhanya PV plant;
- Loop In Loop Out of the Kwaggafontein-Dennilton 132kV feeder;
- Construction of 2x132kV 3km Kingbird lines to the Nokukhanya switching station from the Kwaggafontein- Dennilton 132kV feeder;
- Installation of VTs at the Kwaggafontein substation and Dennilton substation;
- A lay-down area for the temporary storage of materials during the construction activities;
- Upgrading access roads;
- Construction of a car park and fencing around the project; and
- Administration and warehouse buildings

The development of the PV facility near Denilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and a Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 Background

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of a 75 MW PV facility and associated infrastructure near Dennilton, Elias Motsoaledi Local Municipality, Limpopo 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 developmentfootprint 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 weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed development will entail the construction of a 75MW solar photovoltaic plant near Dennilton within the Elias Motsoaledi Local Municipality, Limpopo Province. The proposed project would comprise of the following:

- Approximately 342 000 solar PV panels with a total generation capacity of 75MW;
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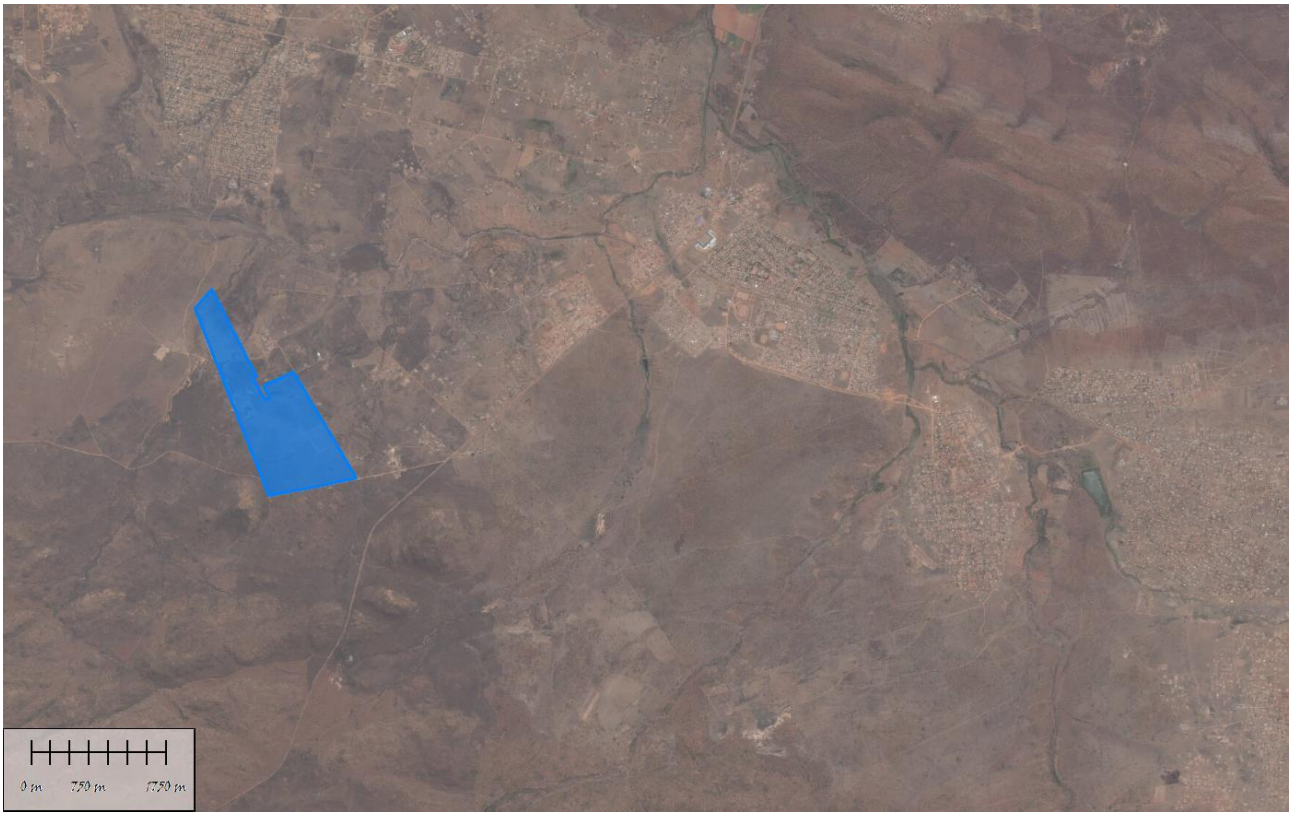

Figure 0.1 Locality of the proposed development

3 GEOLOGY

Nebo Granite (Mn)

The Study area is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. This unit consists of grey to pink coarse grained granite becoming red, medium grained near the top (Geological Survey 1978).

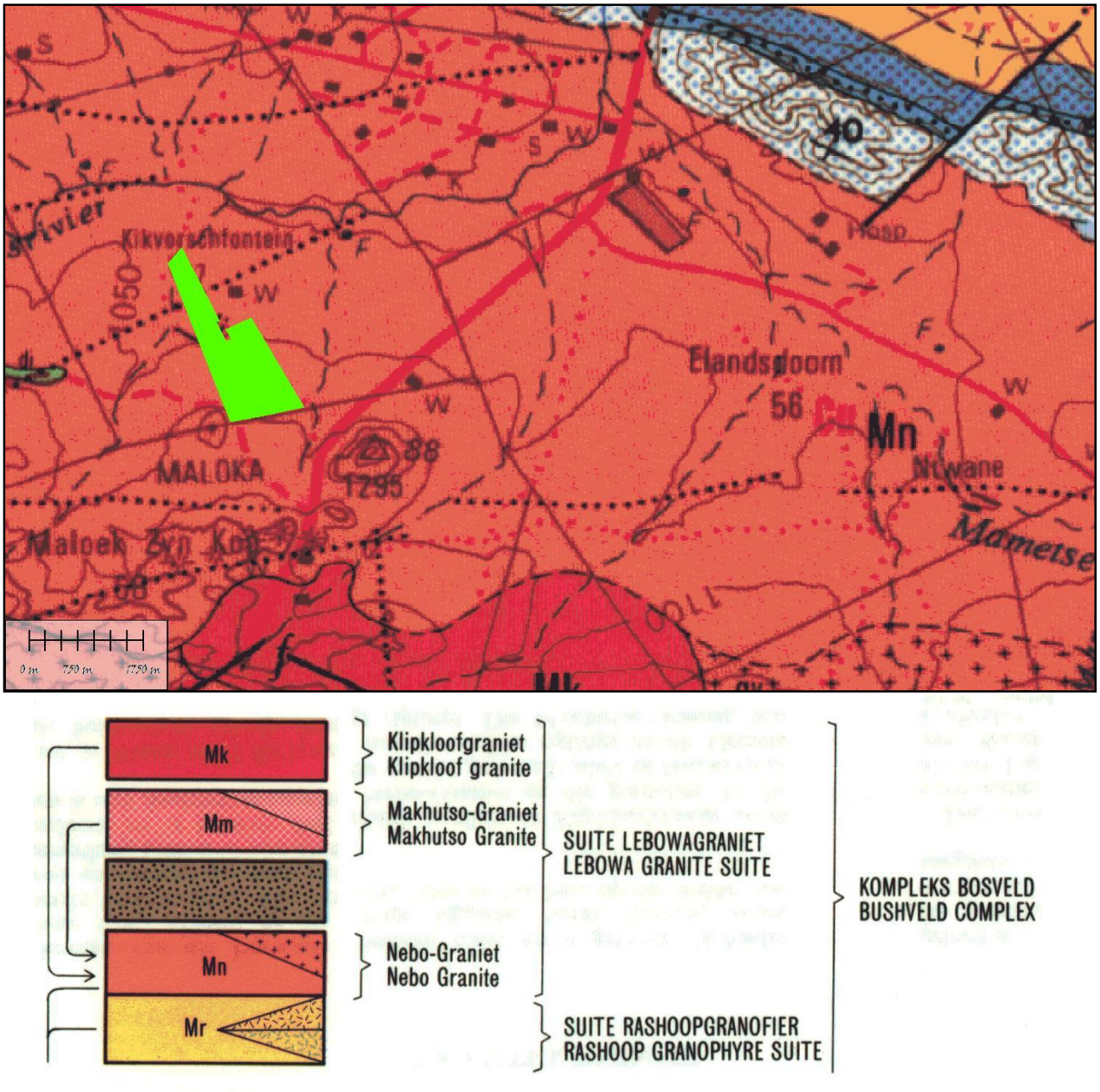

Figure 0.2Geology of the study area

4 PALAEONTOLOGY OF THE AREA

Nebo Granite (Mn)

Due to the age and igneous nature, no fossils are expected in this formation.

5 PALAEONTOLOGICAL 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.

Due to the age and igneous nature of the Nebo Granite, no fossils will occur and a Low Palaeontological sensitivity is allocated as shown in Figure 5.1.

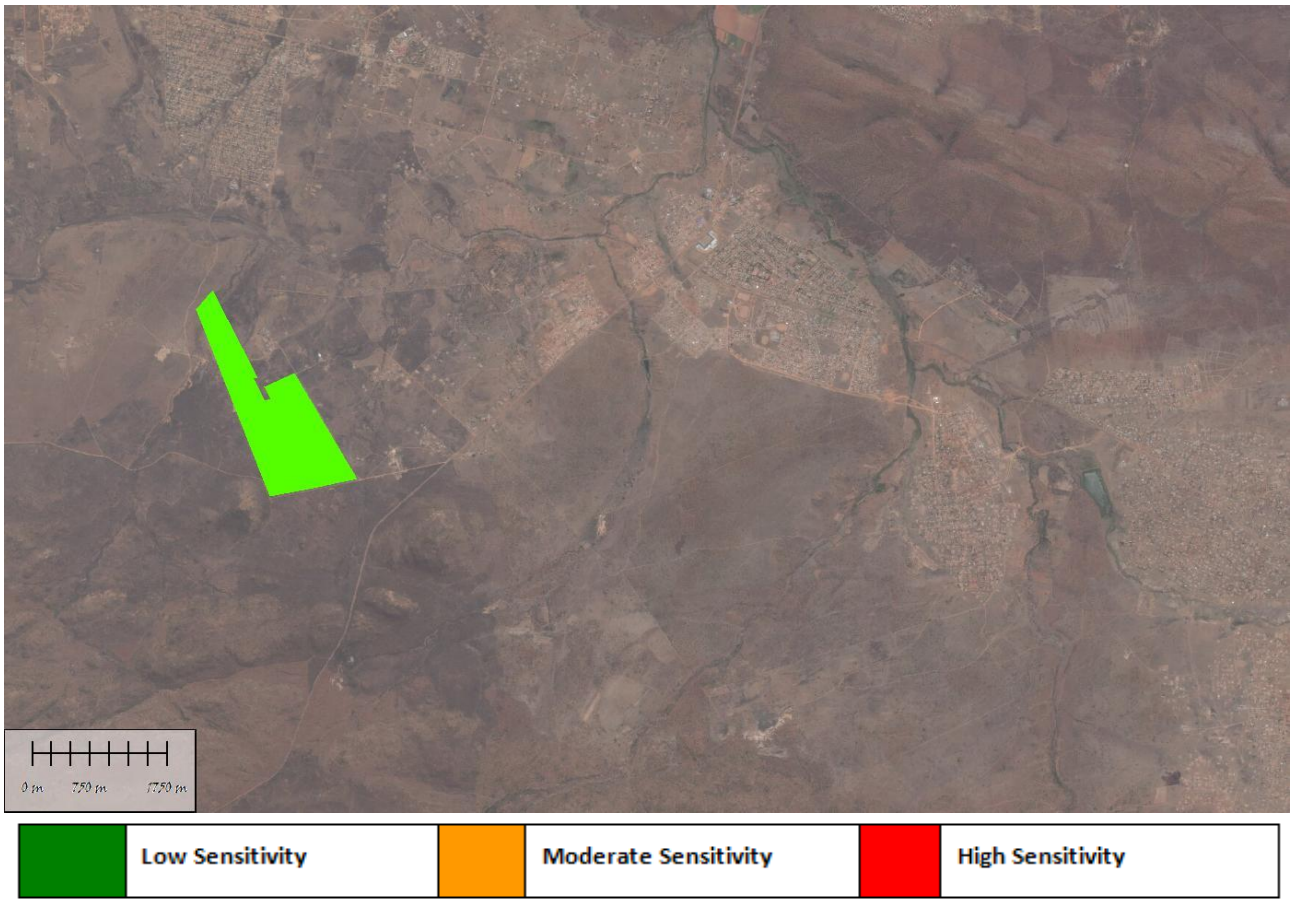

Figure 0.3 Palaeosensitivity of the area

6 CONCLUSION AND RECOMMENDATIONS

The development of the PV facility near Denilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and a Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.

7 REFERENCES

Geological Survey of South Africa. 1978. 2528 Pretoria 1:250 000 Geological Map. Government Printer, Pretoria.

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