MASHALA RESOURCES: LEIDEN COLLIERY PROJECT

HERITAGE STUDY: IMPACT ASSESSMENT REPORT

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FOR

ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PTY) LTD

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DECLARATION OF INDEPENDENCE AND SUMMARY OF EXPERTISE

The report has been compiled by PGS Heritage, an appointed Heritage Specialist for Environmental Impact Management Services (Ltd). 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.

HERITAGE CONSULTANT: PGS Heritage

CONTACT PERSON: Polke Birkholtz

SIGNATURE: 

Polke D. Birkholtz, the project manager and archaeologist, has a BA Honours (cum laude) in Archaeology from the University of Pretoria (1997) and has been actively involved in the heritage industry since that year. He has been responsible for managing and undertaking in excess of 175 heritage and archaeological impact assessments across South Africa and is well versed in the applicable legislation as it relates to heritage in South Africa. Polke Birkholtz has also managed and conducted a number of Phase 2 mitigation projects, including archival and historical research on various projects across the country, archaeological excavations on Late Iron Age sites in Gauteng, Mpumalanga and the Limpopo as well as archaeological excavations on historic sites in Gauteng, Free State and the Northern Cape. He has also managed and conducted a large number of grave relocation projects in Gauteng, Mpumalanga, North West Province, Limpopo and the Free State. Polke Birkholtz is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a professional archaeologist and is a member of the Cultural Resource Management (CRM) Section of ASAPA.

Dr Gideon Groenewald, who conducted the palaeontological desktop study, 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).

EXECUTIVE SUMMARY

PGS Heritage was appointed by Environmental Impact Management Services (Ltd) (EIMS) to undertake a Heritage Impact Assessment Report for the proposed Leiden Colliery. The study area is located 13.8km south of Sheepmoor, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.

The purpose of the Heritage Impact Assessment report is to assess the impacts of a proposed development on the identified heritage resources. This is important because heritage resources are protected in terms of the National Heritage Resources Act, No 25 of 1999, (NHRA) from *inter alia*, destruction or damage, excavation or removal, or other disturbance, without a permit from the responsible heritage resources authority. The National Heritage Resources Act, No 25 of 1999, (NHRA) states that heritage resources are unique and non-renewable and, as such, any impact on such resources must be seen as significant (NHRA, section 5(1)(a)). The NHRA specifically protects certain categories of heritage resources, i.e.: structures, archaeological and paleontological (including meteorological) sites and material and graves and burial grounds (NHRA, sections 34, 35 and 36). Furthermore, Section 38 of the NHRA provides for and regulates the compilation of impact assessment reports of heritage resources that may be affected by construction or development activities.

This Heritage Impact Assessment was preceded by a Heritage Scoping Report which has shown that the study area and surrounding areas have a historical and archaeological history and that there is potential for archaeological and historical sites and material to exist within the study area. The initial research has also identified specific possible heritage sensitive areas within the study area that would require further investigation during the HIA/EIA phase, depending of course on the exact location of the final development footprint to be assessed as part of the Heritage Impact Assessment. A site visit was also undertaken during the Heritage Scoping Study which identified a total of nine sites comprising six cemeteries, one historic farmstead, one historic rock engraving site as well as one abandoned historic farm worker homestead.

As part of this study three development alternatives were assessed and compared, namely Alternative 1 (No Go), Alternative 2 (Maximum Mine Production) and Alternative 3 (Sensitivity Planning Approach). While Alternative 1 will entail the least impact on heritage resources, of the two development alternatives Alternative 3 was calculated to have a lower impact significance in terms of heritage than what Alternative 2 was calculated to have. Hence, Alternative 2 was calculated to be the preferred option.

The placement of the final development footprint area on the landscape by EIMS in consultation with Mashala Resources was undertaken in cognisance of the results of the Heritage Scoping Study as well as the other specialist studies. As a result none of the sites identified during the Heritage Scoping Study were located in the development footprint area. As the Heritage Scoping Study comprised a desktop study and brief site visit, the first component of

this Heritage Impact Assessment was to conduct a physical walkthrough of the development footprint area. Despite an intensive walkthrough undertaken by an experienced fieldwork team, no heritage sites were identified.

As no heritage sites were identified within the development footprint area, no impacts on tangible heritage sites such as historic structures, archaeological sites and graves and cemeteries are expected. The only identified impacts would be on palaeontology and on the remote potential presence of stillborn babies in proximity to the development area.

Palaeontology

A palaeontological desktop study was undertaken by Dr. Gideon Groenewald during the Heritage Scoping Study. A copy of this report can be found in Annexure C. According to the report the study area is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite. The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material. Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area. Dolerite will not contain any fossils because of its igneous nature and the small area along the South-western edge underlain by dolerite has thus been allocated a Low palaeontological sensitivity. The following mitigation measures are required: (a) the developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material; (b) the developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation and (c) the developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University (Groenewald, 2013).

In Chapter 8 the impact on palaeontology is identified as an environmental sensitivity, whereas Chapter 9 identifies it as an environmental constraint. The impact of the proposed development on palaeontology in terms of three different alternatives is assessed in Chapter 10 and mitigation measures and an action plan to mitigate the impact on palaeontology is outlined in Chapters 11 and 12 respectively.

Stillborn Babies

During the desktop study a black homestead was found to be depicted in proximity to the proposed development area on a topographical map that was compiled in 1985 and printed in 1990. From past experience it is know that

the possibility exists for stillborn babies to be associated with especially older black homesteads. Although the black homestead is depicted roughly 20m from the south-western end of the proposed development area, the possibility still exists for the homestead to be located much closer and even within the proposed development area. This is due to the fact that although the development area was intensively covered during the archaeological walkthroughs, large sections of the development area had been impacted upon by forestry activities which may have made the identification of the remains of such a homestead near impossible. Although the possibility for stillborn babies to be located within the development area can be seen as slim, this possibility still exists and was assessed as part of this study.

In Chapter 8 the impact on possible stillborn babies is identified as an environmental sensitivity, whereas Chapter 9 identifies it as an environmental constraint. The impact of the proposed development on the possible presence of stillborn babies was assessed in terms of three different alternatives in Chapter 10. The required mitigation measures and an action plan to mitigate this impact are outlined in Chapters 11 and 12 respectively.

On the condition that the recommendations made in this report are adhered to, no heritage reasons can be given for the project not to continue.

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ANNEXURES

1. INTRODUCTION

PGS Heritage was appointed by Environmental Impact Management Services (Ltd) (EIMS) to undertake a Heritage Impact Assessment Report for the proposed Leiden Colliery. The study area is located 13.8km south of Sheepmoor, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.

2. SCOPE OF WORK

2.1 Overview of the Scope of Work

PGS Heritage was appointed by EIMS to undertake a Heritage Impact Assessment (HIA). The aims of the study are to identify heritage sites and finds that occur in the proposed development area as well as to assess the impact of the proposed development on these identified heritage sites. 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).

The scope of work for the Heritage Impact Assessment Phase of the project can be itemised as follows:

- Update of Baseline Information as determined post Scoping Phase;
- A detailed Heritage Impact Assessment based on the proposed activities and the alternatives identified during scoping. Impacts must be calculated for each phase of the project and these phases shall be classified as:
    - Planning and Design;
    - Construction;
    - Operation;
    - Decommissioning;
    - Rehabilitation and Closure.
- Identification and description of site sensitivities (if none, motivate why not);
- Identification and description of site constraints (if none, motivate why not);
- Identified potential impacts must be evaluated in accordance with the agreed methodology to determine significance. Identified potential impacts (cumulative, direct and indirect) must be quantified (where possible) and fully described for each feasible alternative utilising the EIMS Impact Assessment template provided by EIMS.
- Residual and latent impacts after mitigation must be evaluated (in accordance with the assessment methodology described above) that actual implemented results can be measured against those predicted;

- Comparative assessment of the identified alternatives;
- Each specialist will be required to contribute to the preparation of a detailed site specific EMP relating to the specific field of expertise and impacts identified;
- Provide detailed mitigation / management measures for the management of the identified impacts for inclusion in the EMP. The mitigation / management measures must be presented in a tabulated format for each phase of the project and must include:
    - Detailed description of mitigation measures or management options;
    - Roles and Responsibilities for Implementation;
    - Timeframes for implementation;
    - Means of measuring successful implementation (Targets & Performance Indicators).
- Compilation of an Action Plan for Implementation of the recommended mitigation measures. This plan must, at a minimum, include the following:
    - Management Actions for Implementation;
    - Responsibilities for Implementation, Monitoring and Review;
    - Timeframes for implementation;
    - Means of measuring successful implementation (Targets & Performance Indicators).
- Proposed heritage monitoring program. This plan shall, at a minimum, include the following:
    - Conceptual management strategy (Principles & Objectives);
    - Baseline data;
    - Recommended Data collection/sampling;
    - Recommended Methods and materials;
    - Applicable Parameters & Standards;
    - Recommended Timeframes & Responsibilities for Implementation where appropriate;
    - Recommended Targets and Key Performance Indicators;
    - Recommended Data Interpretation, Trending and Analysis;
    - Recommended Reporting;
    - Recommendations for audit and review.
- Any other Recommendations;
- Identify any gaps in knowledge, data or information;
    - Report on the adequacy of predictive methods utilised
    - Report on the adequacy of underlying assumptions;
    - Report on uncertainties in the information provided.
- Anticipated costs to implement mitigation measures and recommendations suggested; and
- Attendance at two open days for presentation of the findings of the study to I&AP's.

2.2 Definition of Study Area for Scope of Work

Three development alternatives were assessed as part of this study, namely Alternative 1 (No Go), Alternative 2 (Maximum Mine Production) and Alternative 3 (Sensitive Planning Approach). As the No Go alternative does not constitute any development, it does not have a defined study area. The study areas for the Maximum Mine Production alternative as well as the Sensitive Planning Approach (Alternative 3) only differ in terms of the addition of a section of land (roughly 10.8 hectares in extent) that was added to the study area for the Sensitive Planning Approach (roughly 34.2 hectares in extent). These two study areas are defined in detail below.

It must be noted that the preferred alternative would be Alternative 3. As a result intensive fieldwork was only undertaken of the study area of this alternative, with only a quick scan undertaken of the additional section forming part of the study area for Alternative 2. The calculations undertaken as part of this study have also revealed that in terms of the comparison of heritage impact significance, Alternative 3 is preferred above Alternative 2.

DEFINITION OF STUDY AREA FOR ALTERNATIVE 2 (MAXIMUM MINE PRODUCTION)		
Coordinates **Infrastructure and Opencast**	S 26° 51’ 41.5” E 30° 18’ 52.0” S 26° 52’ 06.3” E 30° 18’ 52.0” S 26° 51’ 58.9” E 30° 18’ 32.7”	S 26° 51’ 54.6” E 30° 18’ 26.6” S 26° 51’ 45.6” E 30° 18’ 38.6”
Coordinates **Additional Opencast Area**	S 26° 52’ 00.0” E 30° 18’ 11.4” S 26° 52’ 01.2” E 30° 18’ 12.9” S 26° 52’ 03.3” E 30° 18’ 13.7” S 26° 52’ 05.7” E 30° 18’ 16.0” S 26° 52’ 02.6” E 30° 18’ 21.3” S 26° 52’ 02.0” E 30° 18’ 25.0”	S 26° 51’ 59.2” E 30° 18’ 32.8” S 26° 51’ 54.6” E 30° 18’ 26.3” S 26° 51’ 54.8” E 30° 18’ 23.8” S 26° 51’ 55.1” E 30° 18’ 21.4” S 26° 51’ 56.9” E 30° 18’ 17.1” S 26° 51’ 58.5” E 30° 18’ 14.4”
Property	Section of the Remainder of the farm Leiden 340 IT, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.	
Location	The study area is located 16.4km to the south of Sheepmoor and is 13.7km south-west of Panbult. It is located on the eastern boundary of the farm Leiden 340 IT.	
Extent	The extent of the study area for Alternative 2 is roughly 45 hectares.	
Land Description	The northern and southern sections of the property are currently used for forestry, with medium sized fir tree plantations observed here. With the exception of a river which passes through the southern end of the property, the remainder of the study area contains the sawn off tree stumps of a former plantation with no recent forestry activities taking place in these sections.	

DEFINITION OF STUDY AREA FOR ALTERNATIVE 3 (SENSITIVITY PLANNING APPROACH)		
Coordinates	S 26° 51’ 41.5” E 30° 18’ 52.0” S 26° 52’ 06.3” E 30° 18’ 52.0” S 26° 51’ 58.9” E 30° 18’ 32.7”	S 26° 51’ 54.6” E 30° 18’ 26.6” S 26° 51’ 45.6” E 30° 18’ 38.6”
Property	Section of the Remainder of the farm Leiden 340 IT, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.	
Location	The study area is located 16.4km to the south of Sheepmoor and is 13.7km south-west of Panbult. It is located on the eastern boundary of the farm Leiden 340 IT.	
Extent	The extent of the study area is roughly 34.2 hectares.	
Land Description	The northern and north-western sections of the property are currently used for forestry, with medium sized fir tree plantations observed here. The remainder of the study area contains the sawn off tree stumps of a former plantation with no recent forestry activities taking place in these sections.	

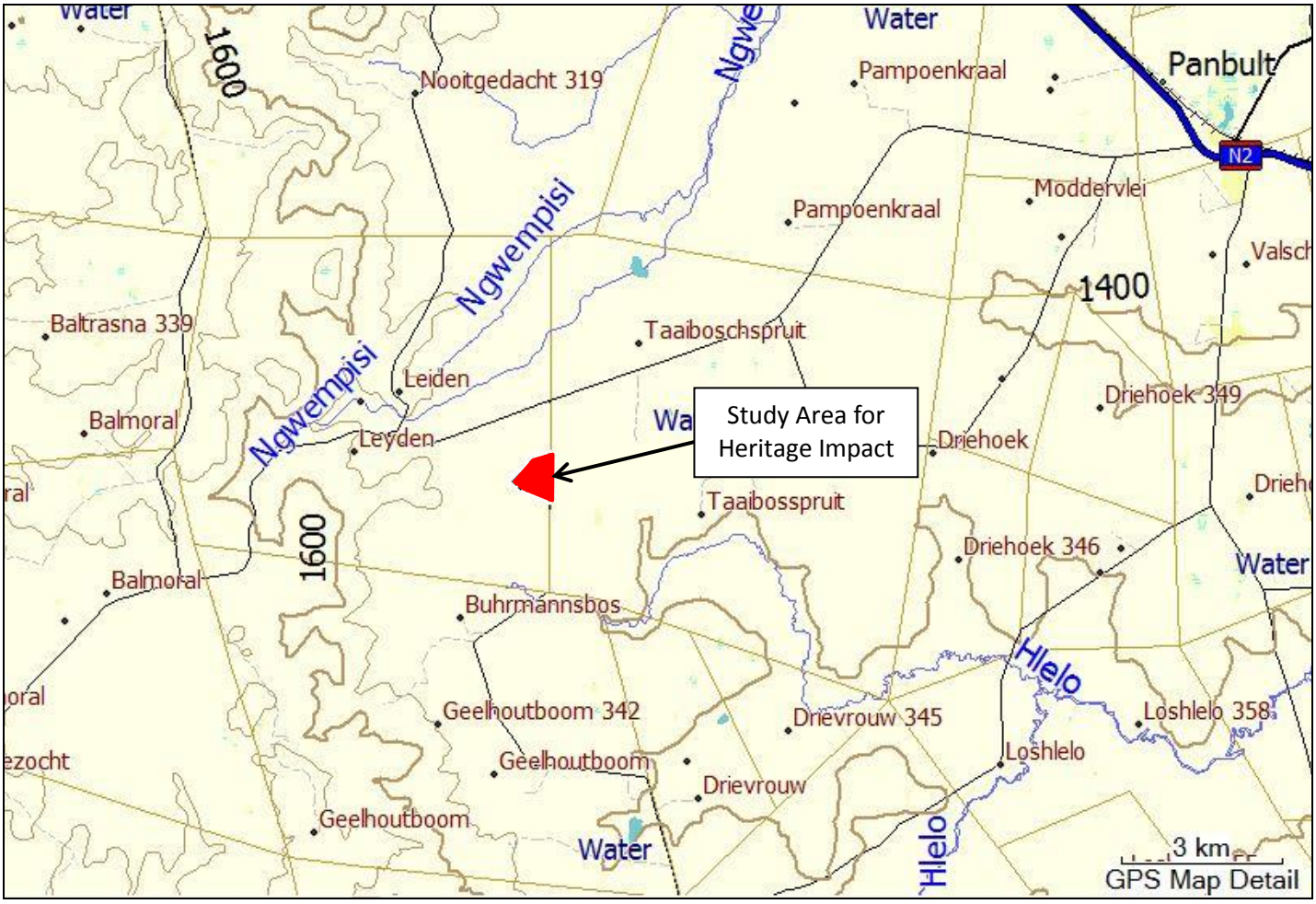

Figure 1 – The study area of Alternative 3 within its regional context

3. METHODOLOGY

3.1 General Methodology

PGS Heritage was appointed by Environmental Impact Management Services (EIMS) to undertake a Heritage Impact Assessment (HIA) which forms part of the Environmental Impact Assessment (EIA) for the proposed Leiden Colliery on a Section of the Remainder of the farm Leiden 340 IT, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998).

As mentioned elsewhere, this Heritage Impact Assessment followed on a Heritage Scoping Study undertaken for the entire property known as the Remainder of the farm Leiden 340 IT. The final development area was established by EIMS and the client in cognizance of the findings of the various specialist scoping studies, including the Heritage Scoping Assessment undertaken by PGS Heritage.

Once the development area for the proposed Leiden Colliery had been finalised and with the desktop studies already completed as part of the Heritage Scoping Study, the methodology for the Heritage Impact Assessment Study comprised the following:

- To conduct an intensive walkthrough of the development area to identify any heritage sites located there.
- To compile the findings of the Heritage Scoping Study and findings of the heritage walkthrough into a single report during which an assessment of the impact of the proposed development on the identified heritage sites can be made and mitigation measures provided.

In practical terms the HIA process consisted of three steps:

Step I – Desktop Studies: The information assimilated during the Heritage Scoping Study was collated and applied in terms of the present study area.

Step II – Physical Survey: A physical survey was conducted over the course of one day namely Thursday, 17 July 2014. The survey was undertaken by a team comprising a professional archaeologist (Polke Birkholtz) and field assistant (Derrick James). The fieldwork was undertaken on foot. It must be noted that intensive fieldwork was only undertaken on the study area of Alternative 3, with the additional area represented in Alternative 2 only briefly scanned during the Heritage Scoping Phase as well as during the day spent on fieldwork.

Step III – Report: The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources regarding the heritage impact assessment criteria and report writing, including mapping and recommendations.

The methodology used in this study to assess heritage site significance can be found in Annexure A whereas the methodology used to assess the impact significance is outlined in Annexure B.

3.2 Terminology/Abbreviations

Table 1- Abbreviations

ACRONYMS	*DESCRIPTION*
AIA	**Archaeological Impact Assessment**
ASAPA	**Association of South African Professional Archaeologists**
CRM	**Cultural Resources Management**
DEA	**Department of Environmental Affairs**
DWA	**Department**: **Water Affairs**
DMR	**Department of Mineral Resources**
ECO	**Environmental Control Officer**
EIA practitioner	**Environmental Impact Assessment Practitioner**
EIA	**Environmental Impact Assessment**
EMPR	**Environmental Management Programme Report**
ESA	**Early Stone Age**
GPS	**Global Positioning System**
HIA	**Heritage Impact Assessment**
HIR	**Heritage Impact Report**
HSR	**Heritage Scoping Report**
I&AP	**Interested & Affected Party**
LSA	**Later Stone Age**
LIA	**Late Iron Age**
MSA	**Middle Stone Age**
MIA	**Middle Iron Age**
NEMA	**National Environmental Management Act**
NHRA	**National Heritage Resources Act**
PHRA	**Provincial Heritage Resources Authority**

PSSA	**Palaeontological Society of South Africa**
RoD	**Record of Decision**
SADC	**Southern African Development Community**
SAHRA	**South African Heritage Resources Agency**

The following definitions are taken from the National Heritage Resources Act, no 25 of 1999 (NHRA, section 2):

Archaeological resources

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.

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 the 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

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.

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.

4. LEGISLATIVE AND POLICY FRAMEWORK

4.1 Legislative Overview

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:
   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 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 Section of these Acts relevant to heritage (Fourie, 2008b):

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 (Fourie, 2008b).

MPRDA defines 'environment' as it is in the NEMA and therefore acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the National Heritage Resources Act that are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities (Fourie, 2008b).

In accordance with the legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive and legally compatible HSR report is compiled.

The heritage impact assessment criteria to be utilised in the HIR are described in more detail in ***Annexure A***; while the Environmental Impact Scoring criteria to be utilised in the HIR, are provided in ***Annexure B***.

5. TECHNICAL DETAILS OF THE PROJECT

The Leiden Project is a project of Mashala Resources who proposes the establishment of the Leiden Colliery on the Remainder of the farm Leiden 340 IT. The project is currently in the Environmental Authorisation stage. The proposed mining development will comprise the following:

- Opencast Mining Areas
- Stockpile / Highwall Entrance
- Highwall / Stockpile
- Carbonatious Stockpile
- Conveyor
- Coal Stockpile
- Soil Berms
- Pollution Control Dam
- Storm Water Dam
- Storm Water Drain
- Offices
- Change Room / Change House
- Workshop Store
- Building
- Security Building
- Sewage Treatment
- Wash Bay
- Access Roads
- Parking
- Break Test Ramp

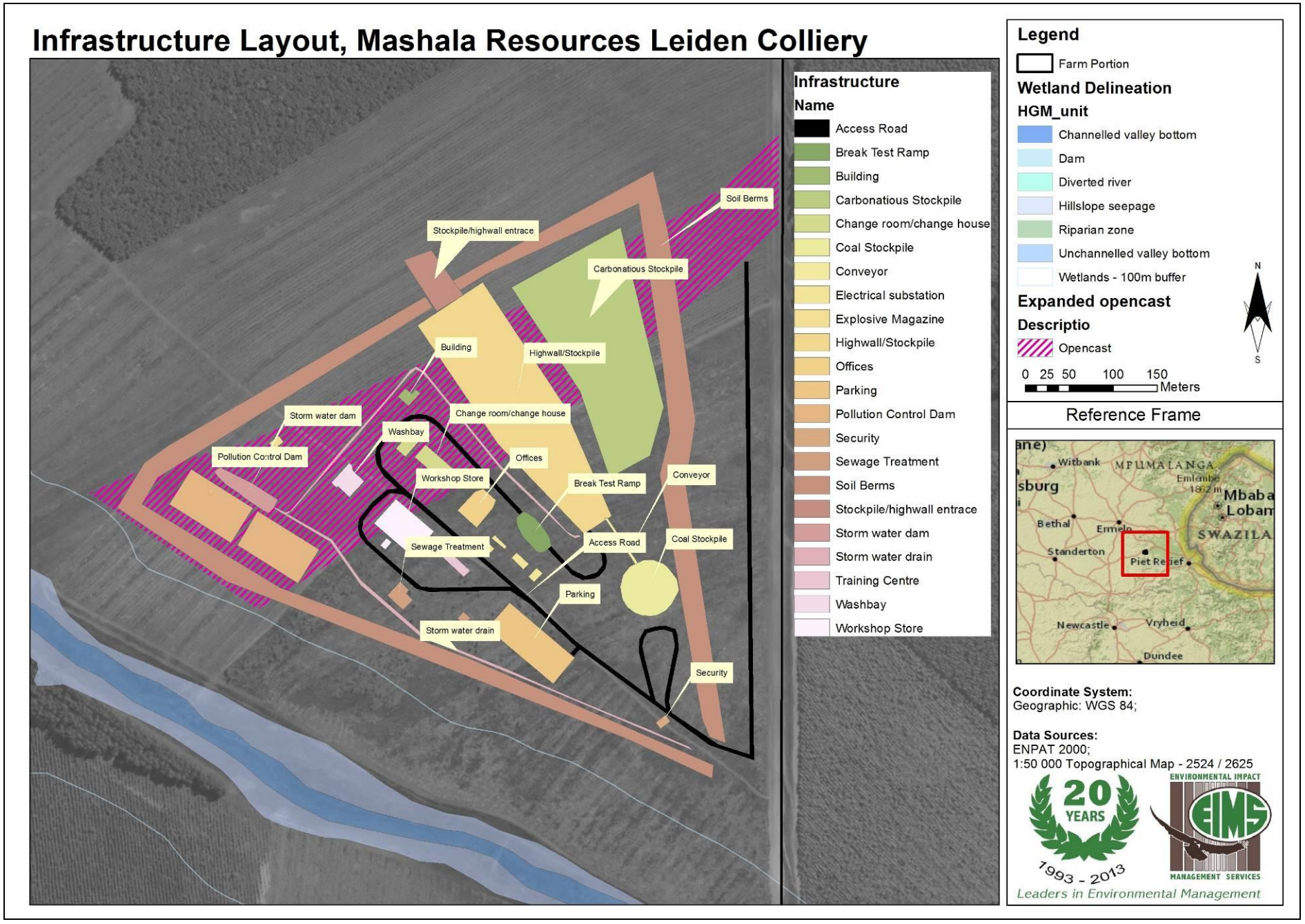

Figure 2 – Development layout plan for the proposed Leiden Colliery. The plan was supplied by EIMS and represents the study area for Alternative 3 only.

6. GENERAL BACKGROUND TO THE STUDY AREA AND SURROUNDING LANDSCAPE

6.1 Historical and Archaeological Overview of the Study Area and Surrounding Landscape

The province of Mpumalanga is known to be rich in archaeological sites that tell the story of humans and their predecessors in the region going back some 1.7 million years (Delius & Hay, 2009). The archaeological history of the area can broadly be divided into a Stone Age, Iron Age and Historic Period. Both the Stone and Iron Ages form part of what is referred to as the Pre-Colonial Period (Prehistoric Period) whereas the Historic Period is referred to as the Colonial Period (Historic Period) (refer **Figure 3**). Although this area would have been well suited for human habitation over the last 1.7 million years, very little information is known about especially the archaeological history of the area. This can likely be attributed to a lack of research focus over the last five decades or more.

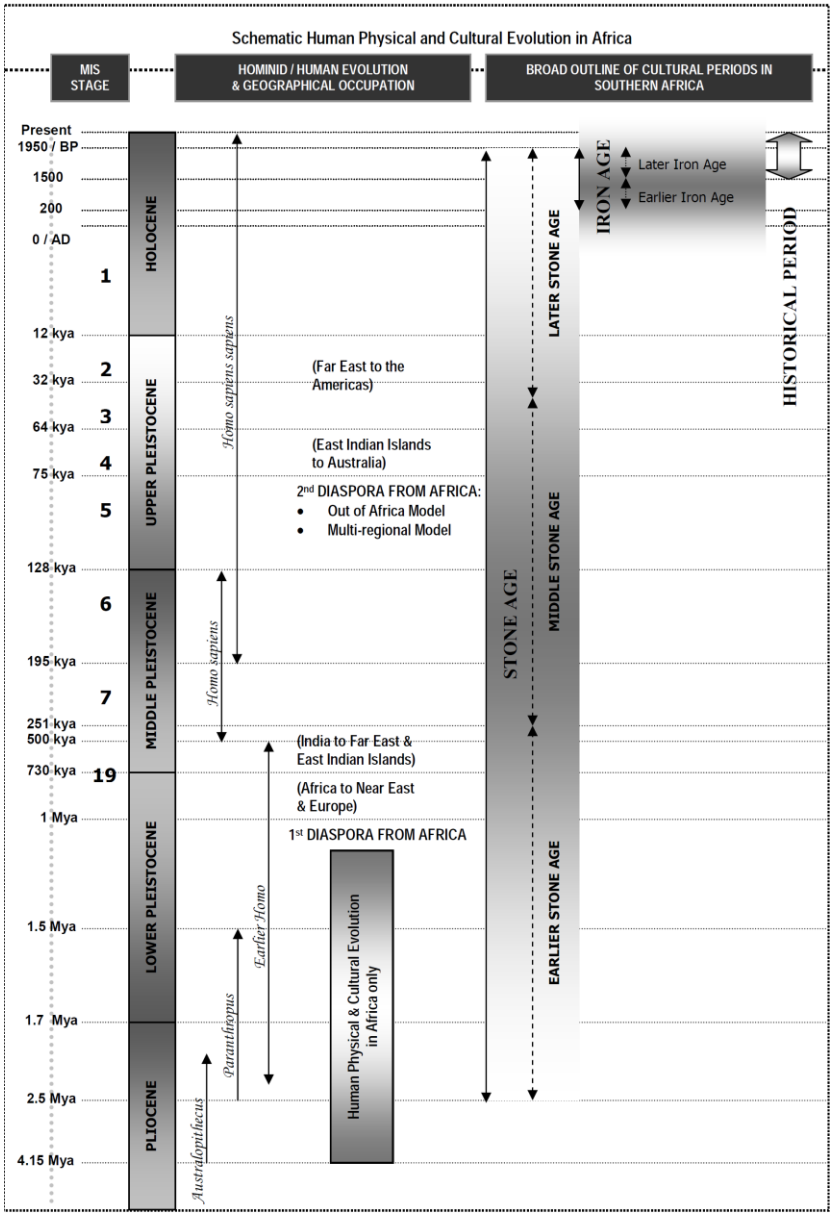

Figure 3 – Human and Cultural Time line in Africa (Morris, 2008)

Table 2- Archaeological and Historical Overview of the Study Area and Surrounding Landscape

DATE	DESCRIPTION
2.5 million to 250 000 years ago	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 is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago. No Early Stone Age sites are known from the study area or direct vicinity. However, this is likely rather due to lack of research focus in this area than an absence of such sites.
250 000 to 40 000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique. No Middle Stone Age sites are known from the study area or direct vicinity. However, this is likely rather due to lack of research focus in this area than an absence of such sites.
40 000 years ago to the historic past	The Later Stone Age is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. A single Later Stone Age lithic was observed roughly 3.3km south-west of the present study area during the Heritage Scoping Study. Furthermore, the surrounding landscape is well suited for Later Stone Age sites due to the many shelters and overhangs located in the sandstone cliffs of this landscape. Such a known site is located on the farm Welgelen 322 IT, situated 30.6km north-west of the present study area.
AD 200 – AD 900	The earliest phase in the Iron Age history of Southern African is known as the Early Iron Age. According to the distribution maps published by Huffman (2007) the only possible presence of Early Iron Age sites in the study area and surrounding landscape would be in the form of the so-called Silver Leaves facies of the Kwale Branch of the Urewe Tradition. This facies is dated to between AD 280 and AD 450. The key features on the decorated ceramics of the Silver Leaves facies comprise multiple facets in the first position (Huffman, 2007).
AD 900 – AD 1300	The second phase in the Iron Age history of Southern Africa is known as the Middle Iron Age. No sites from the Middle Iron Age are known from the study area and surrounding landscape.
Ad 1300 – AD 1850	The third and final phase in the Iron Age history of Southern Africa is known as the Late Iron Age. This period in the Iron Age history of South Africa is associated with the Nguni and Sotho-Tswana speaking people (Huffman, 2007). Bergh (1999) identifies two main Late Iron Age groups within the wider vicinity of the study area, namely the Phuthing and the Khumalo Ndebele (Matabele). Lombard (1980) also mentions a Late Iron Age group he refers to as the Nhlapo people and indicates that when the first white people came to stay in the Ermelo district they already found the Nhlapo people in the vicinity of Maviristad. As mentioned elsewhere, the farm Mavieriestad 321 IT is located some 10.9km north-west of the study area. During these later stages of the Late Iron Age the area under discussion fell under the sphere of influence of the Swazi.

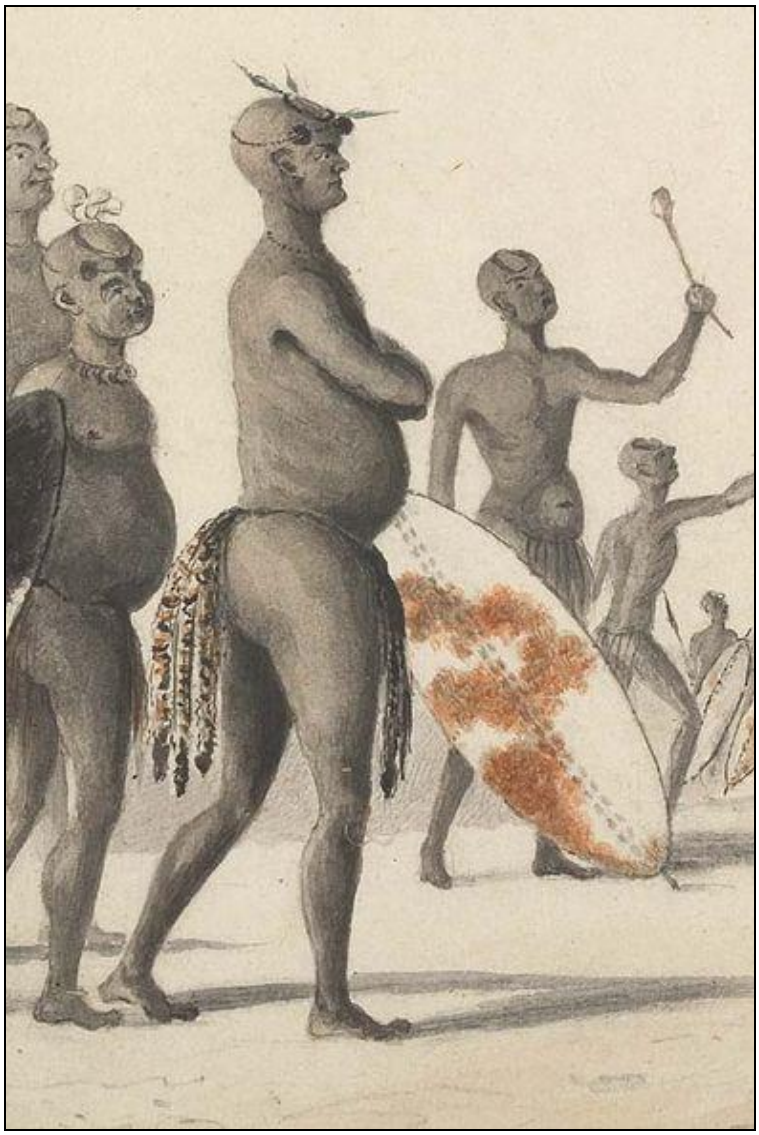

Figure 4

King Mzilikazi of the Matabele. This illustration was made by Captain Cornwallis Harris in c. 1838 (www.sahistory.org.za).

1836	The first Voortrekker parties started crossing over the Vaal River.
1845	The district of Lydenburg was established (Bergh, 1999). The study area fell within this district at the time.
Before c. 1855	Before this time, a chief by the name of Mlambo (son of Magonondo) and his Nhlapo Clan were settled "...*at the source of the Ngwempisi river at the foot of the Ntabande mountain*..." (Matsebula, 1972). Although the Ntabande Mountain could not be identified, the remainder of this description of the locality of the settlement of Nhlapo indicate that the area referred to must either be located within the farm Leiden or very close to it. After the death of Mlambo Nhlapo shortly before c. 1855 a dispute arose between his two sons Mhlangala and Bashele over the chieftainship. When Bashele realised that he was about to lose the conflict he called on the protection of the Swazi King Mswati who sent out a regiment to protect Bashele. According to this version of events Mhlangala was killed and Bashele was installed as chief under King Mswati (Matsebula, 1972). Myburgh (1956) provides a slightly different version of events which he recorded from community elders during his research into the oral histories of the tribes of the Carolina District. He also refers to the dispute between the two sons of Mlambo Nhlapo over his chieftainship but indicates that the sons' names were Mhlangala and Gama. In this version of events Gama realised that he was losing the war with his brother and asked the Zulu King Mpande for assistance.

	King Mpande however referred him to the Swazi King Mswati who in turn ordered his elite iNyatsi regiment to assist Gama. Mhlangala's settlement on the farm Mavieriestad 321 IT was attacked by both Gama and the iNyatsi regiment which resulted in Mhlangala deciding to flee. It is worth noting that the farm Maveriestad 321 IT is located 10.9km north-west of the present study area. From this point on two versions of events exist. According to the Nhlapo the Swazi regiment was halted in their pursuit of Mhlangala by the appearance of a lightning strike. However, according to the Swazi oral histories the iNyatsi regiment met up with the men of Mhlangala on the eMsobotjeni Mountain on the farm Sobbeken 390 IT (located 18km south-east of the present study area). However, their attack was restricted by a severe snow storm which allowed Mhlangala and his followers to flee. They eventually settled in the Mlambo area of present day Lesotho (Myburgh, 1956).
November 1859	The town of Marthinus Wesselstroom in the district of Wakkerstroom was formally established. The town later became known as Wakkerstroom as well (Hofmeyr et.al., 2009). Wakkerstroom is located 56.4km south-west of the study area. Although the study area initially fell within Lydenburg, changed made to the boundaries of the Districts of Lydenburg and Wakkerstroom during 1867 resulted in the study area falling within the District of Wakkerstroom (Bergh, 1999).
Early 1860s	During the early 1860s the first Voortrekker families started establishing themselves in the general vicinity of the study area including Hendrik Teodor Bührmann, Nicolaas Jacobus Breytenbach and F.P. van Rhede van Oudtshoorn (Lombard, 1980).
1867	Although the study area fell within the District of Lydenburg during the period 1845 to 1867, this year saw a number of changes made to the southern boundary of the Lydenburg District and the northern boundary of the Wakkerstroom District which resulted in the study area now falling within the Wakkerstroom District (Bergh, 1999).
2 July 1868	The farm Leiden was inspected for the first time on this day by F.P. van Rhede van Oudtshoorn and was transferred to its first owner Hendrik Teodor Bührmann on 3 August 1869. Bürhmann was born in Amsterdam, Netherlands on 17 March 1822 and moved to the Boer republic of Lydenburg in 1848 where he worked as magistrate's clerk and magistrate of Lydenburg and was also member of the Volksraad of Lydenburg. In 1865 he moved to the Highveld and established himself on the farm De Emigratie, roughly 18.9km north-west of the present study area. Bührmann passed away on 12 May 1890 (Lombard, 1980).
2 December 1879	The farm was transferred from H.T. Bührmann to Marthinus Jacobus Johannes Oosthuizen.
12 February 1880	The town of Ermelo was officially proclaimed by the administrator of the Transvaal William Owen Lanyon (Lombard, 1980). Ermelo is located 50km north-west of the study area.
26 October 1882	The district of Ermelo was officially proclaimed (Bergh, 1999). The study area still fell within the Wakkerstroom District but the farm Leiden appears to have been located on the boundary between this and the District of Ermelo. Interestingly, an archival document was found in the National Archives which comprises a letter dated 28 September 1886 written by one M. Oosthuizen requesting that his farm Leiden should fall under the District of Ermelo (SS, R5055/86). From the archival research it is known that one Marthinus Jacobus Johannes Oosthuizen owned the farm Leiden between 1872 and 1896. It is therefore evident that at the time the farm did not fall within the Ermelo District but that the owner wanted it to fall under that district. However, the farm remained under Wakkerstroom.
5 November 1896	The farm was transferred from M.J.J. Oosthuizen to Daniel Abraham Groenewald.

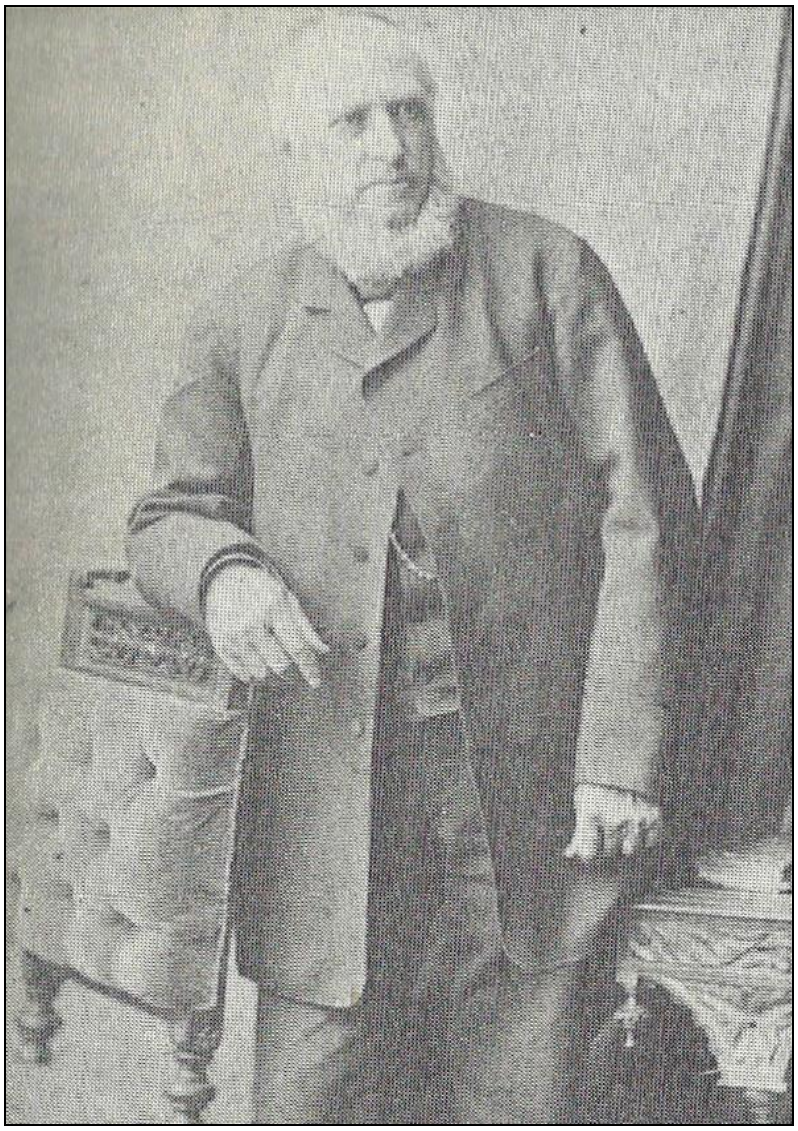

Figure 5

Contemporary studio photograph of Hendrik Teodor Bührmann. On 3 August 1869, Bührmann became the first registered owner of the farm Leiden (Lombard, 1980:7)

1899 - 1902	The South African War took place during this time. Although no battles or skirmishes from this war are known for the study area and no direct association between the war and the farm Leiden could be found, a reference to a skirmish on the farm Rotterdam on 3 January 1902 was found. Although other farms by that name are known from the Free State as well as the Western Cape, a strong likelihood exists for the Rotterdam farm referred to being the farm Rotterdam 323 IT located directly north-west of Leiden. From the surrounding landscape it is known that some events associated with the war years took place on the farm De Emigratie. The farm was owned by the Bürhmann family and is located 18.9km north-west of the study area. For example, on 10 May 1901 a council of war took place on De Emigratie to discuss the situation that the Zuid Afrikaansche Republiek found itself in (Fourie, n.d.).
1912	One of the founding members of the South African Native Congress (later the African National Congress) Pixley ka Izaka Seme established the Native Farmers Association of Africa (NFAA) which aim was to acquire land for Black farmers. In the same year the NFAA purchased three farms for this purpose namely Driefontein, Daggakraal and Driepan (Delius, 2007). Of these three properties, the farm Driefontein 388 IT is situated the closest to the study area and is located 12km to the south-east.

1924 - 1924	The town of Sheepmoor appears to have been established during this time.
23 March 1928	The farm Leiden was transferred from D.A. Groenewald to Jozua Joubert Scheepers.
2 September 1932	The farm Leiden was subdivided for the first time and was divided into three sections with a one third portion being transferred from J.J. Scheepers to Daniel Jacobus Elardus Scheepers, Jozua Joubert Scheepers (jnr.) and Gerhardus Francois Scheepers respectively.
1944	Portion 1 of the farm was transferred from G.F. Scheepers and two others to Ernst Heinrich Wilhelm Eggers and Hermann Wilhelm Frederich Eggers.
1945	During this year Portion 2 of the farm was transferred from D.J.E. Scheepers and two others to Helgaard Muller. At the same time the remaining extent of the farm was transferred from D.J. E. Scheepers and two others to Hellenius Le Roux Van Niekerk and Thomas William Joyce. This remaining extent is the portion of the farm comprising the present study area. It seems likely that Mr. Van Niekerk who is the current owner of the portion of the farm under discussion, is the direct descendant of Hellenius Le Roux van Niekerk.
1965 - 1985	In 1965 the Driefontein community was declared a so-called “black spot” by the Apartheid government which meant that the authorities intended to remove the residents of this community to respective homelands. While very little was intitially done by the government to implement these measures, the early 1980s saw increasing pressures placed on the Driefontein community climaxing in the death of community leader and staunch opponent of the proposed removal, Saul Mkhize. His funeral at Driefontein on 16 April 1983 was attended by more than 2,000 people representing various anti-Apartheid organisations. In October 1985 the government decided not to proceed with the planned removal.

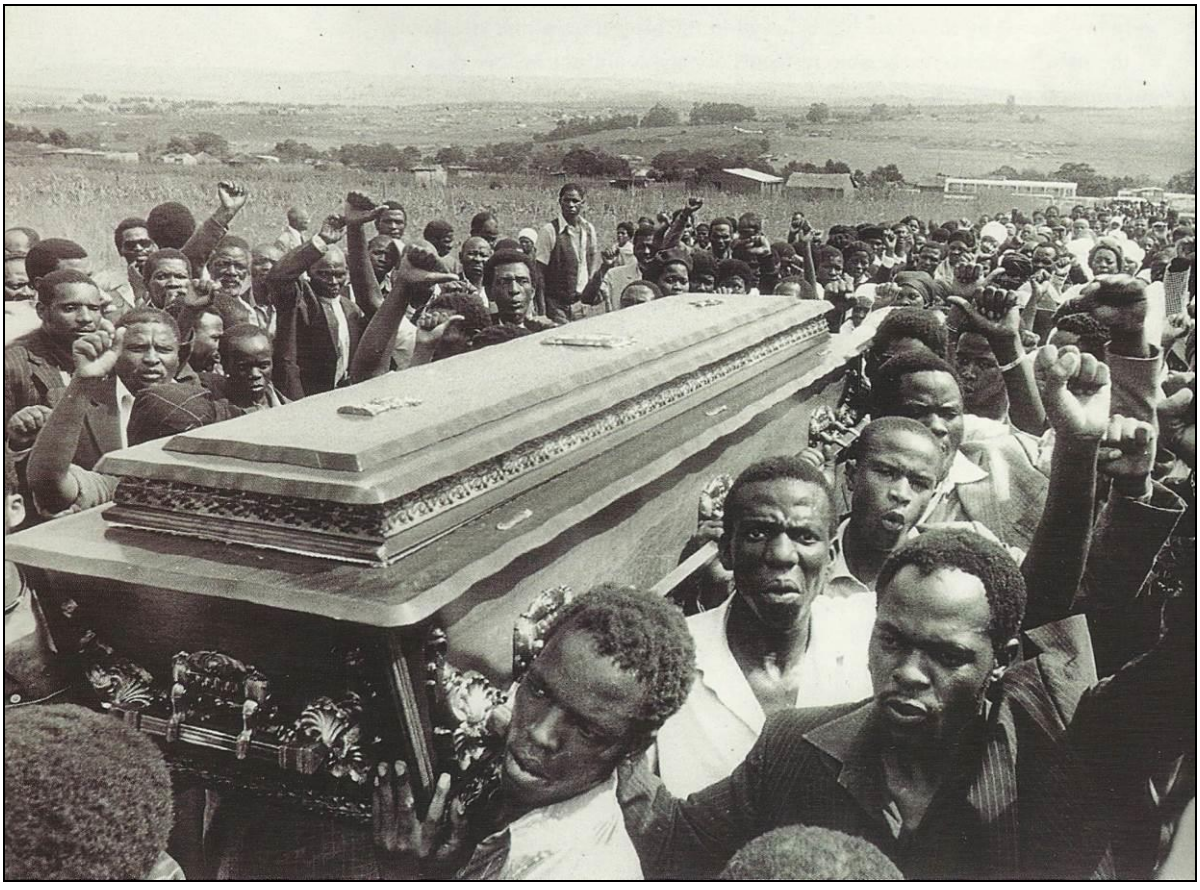

Figure 6 – The funeral of Saul Mkhize on 16 April 1983 at Driefontein (Delius, 2007:283).

6.2 Examination of Archival and Historical Maps

An investigation of available historical maps formed part of the process to identify the known heritage resources from within the study area. The two maps assessed as part of this study will be individually discussed below.

6.2.1 First Edition of the 2630CD Topographical Sheet

The image depicted below is from the First Edition of the 2630CD Topographical Sheet that was based on aerial photography undertaken in 1963 and was surveyed and drawn in 1971.

It is evident from the map that the entire study area at the time was covered by a plantation. Furthermore, no heritage sites or features are depicted within the study area on the map.

6.2.2 Second Edition of the 2630CD Topographical Sheet

The image depicted below is from the Second Edition of the 2630CD Topographical Sheet that was compiled in 1985 and printed in 1990.

One black homestead is depicted just outside of the south-western corner of the study area. This feature reflects a homestead of black residents of the study area who would in all likelihood have been farm workers. As the homestead is not depicted on the first edition and only appears for the first time on the second edition, the suggestion is that the homestead was established between 1971 and 1985.

Table 3- List of coordinates for features depicted on 1985 map.

FEATURE NUMBER	DESCRIPTION	COORDINATES
Feature 1	Black Homestead	S 26° 51’ 55.6” E 30° 18’ 26.9”

No evidence for this homestead could be identified in the field. Apart from the fact that the homestead is shown to be located just outside of the proposed development area, a new fir tree plantation was established in this area after the compilation of the 1985 map and as part of the planting and maintenance of the new plantation the area has been ripped with forestry machinery.

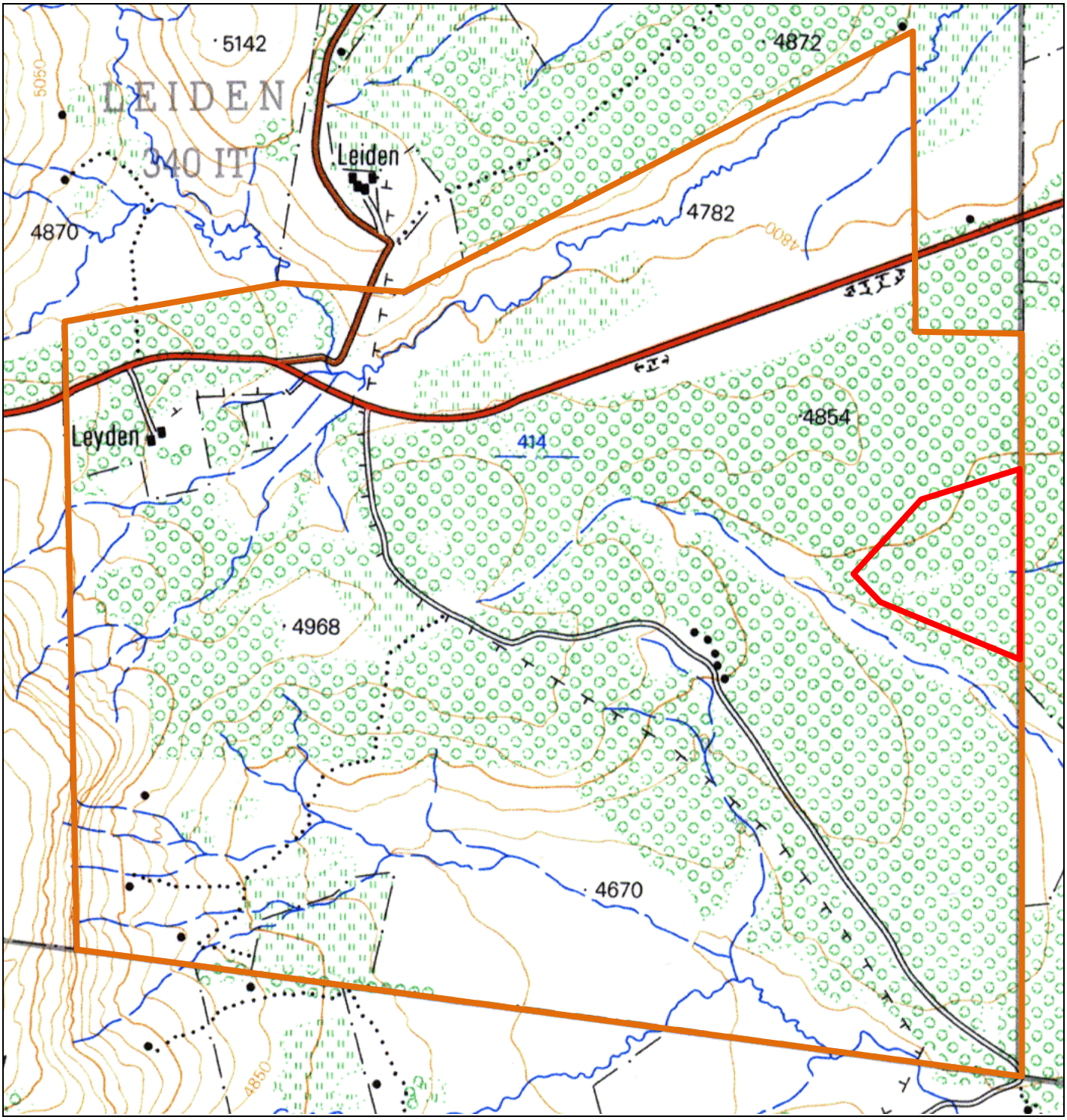

Figure 7–Section of the First Edition of the 2630CD topographical sheet. This particular sheet was based on aerial photography undertaken in 1963 and was surveyed and printed in 1971. The boundaries of the original study area applicable to the heritage scoping study are marked in brown, with the mining development area depicted in red.

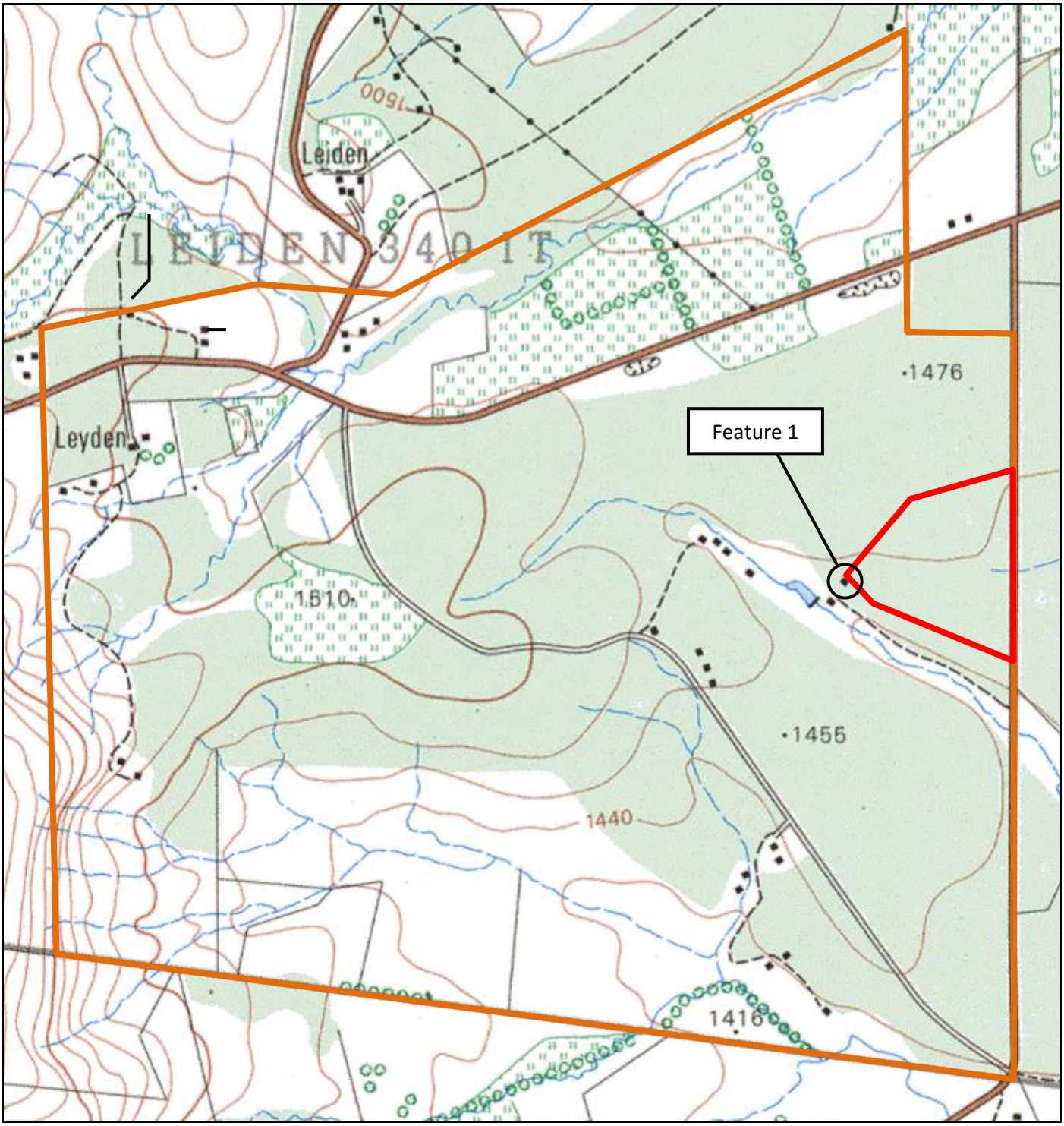

Figure 8–The Remainder of the farm Leiden 340IT as depicted on the Second Edition of the 2630CD topographical sheet. This particular sheet was compiled in 1985 and was printed by the Government Printer in 1990. The purple markers indicate the position of farmsteads and the red markers black homesteads.

6.3 Previous Archaeological and Heritage Research undertaken within the Study Area

As far as could be established, no known archaeological or heritage research has ever been undertaken within the study area or the farm Leiden 340 IT as a whole. The South African Heritage Resources Information System (SAHRIS) contains no information on previous reports, permit applications and the like with regard to this farm.

As mentioned elsewhere in the report, the study area is located in a landscape which would have been suitable for pre-colonial settlement i.e. during the Stone and Iron Ages of South Africa's history. However, known archaeological sites in this landscape are few and far between and no pre-colonial archaeological sites are known for the study area. This can likely be more attributed to a lack of research focus in this area than necessarily a lack of sites.

A number of archaeological and heritage assessments have been undertaken in the general vicinity of the study area. The typical heritage sites identified in these reports comprise cemeteries and farm buildings.

One reasonably well known archaeological site from the wider vicinity of the study area is a Later Stone Age site with associated paintings located on the farm Welgelegen 322 IT, situated 30.6km north-west of the present study area.

6.4 Archival Research in terms of the Study Area

Although research was undertaken at the National Archives in Pretoria, the only aspects of note that were identified there comprise the early farm ownership history as well as the letter by the second registered owner of the farm Marthinus Jacobus Johannes Oosthuizen dated 28 September 1886 for the farm to fall under the Ermelo District (SS, R5055/86). These aspects are discussed in more detail in the historic overview provided above.

6.5 Palaeontological Desktop Study

As part of the Heritage Scoping Study, PGS Heritage commissioned Dr. Gideon Groenewald to undertake a desktop survey to assess the potential palaeontological impact of mining development on the farm Leiden 340 IT. Refer Annexure C for a copy of the report.

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 below.

The following colour coding method is used in Dr. Groenewald's report to classify a development area's palaeontological impact and respective sensitivities.

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

The study area for the Heritage Scoping Assessment (which included the present proposed development footprint area as well) is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite.

The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material.

Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area. Dolerite will not contain any fossils because of its igneous nature and the small area along the south-western edge of the original study area is underlain by dolerite and has thus been allocated a low palaeontological sensitivity.

The following recommendations are made:

- The developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material.
- The developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation.
- The developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University.

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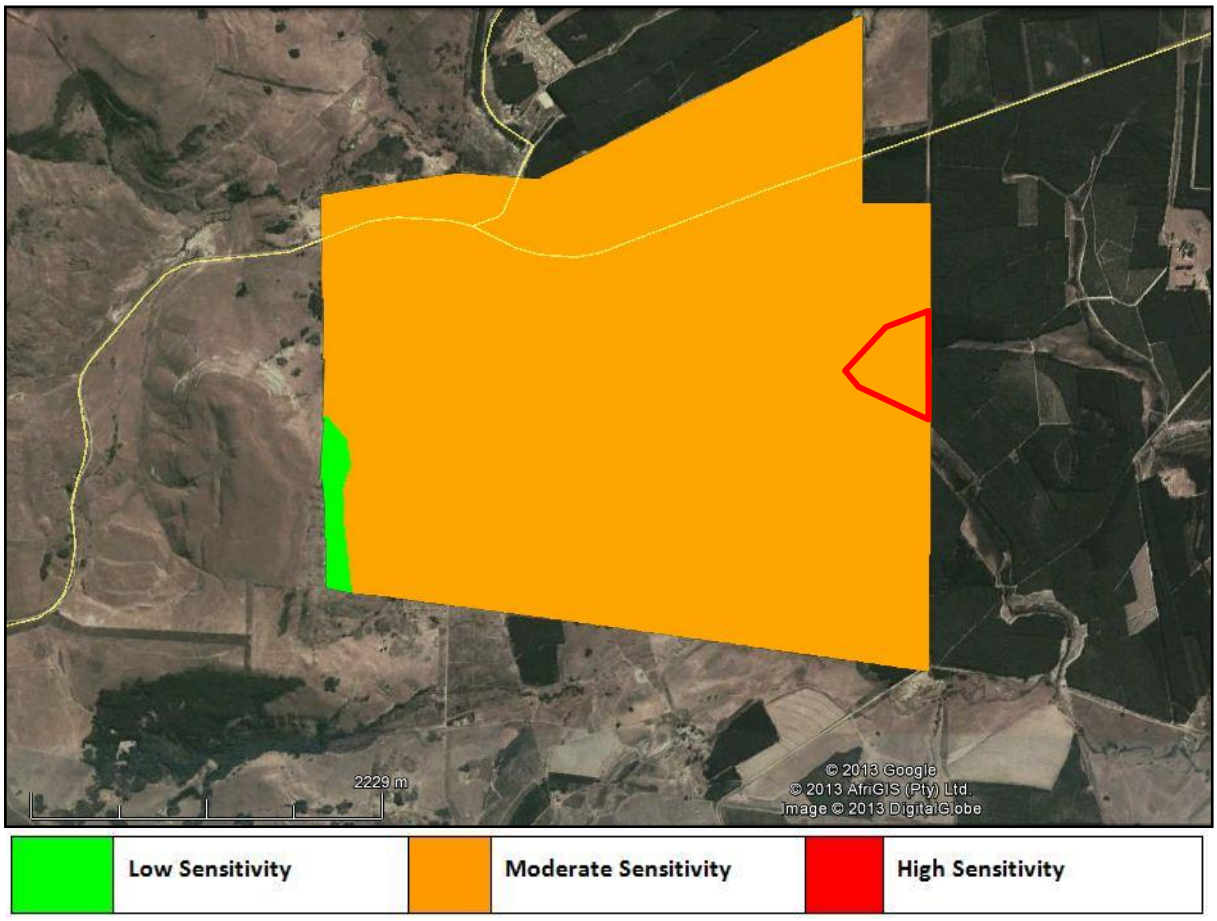

Figure 9–Depiction of the palaeontological sensitivity of the original study area assessed during the Heritage Scoping Study. The development footprint assessed for this Heritage Impact Assessment is shown in red.

7. BASELINE RECEIVING ENVIRONMENT

The baseline receiving environment can be described as almost entirely disturbed by present and past forestry activities. Medium sized fir tree plantations are located on the development area's northern and north-western sections whereas the remainder of the study area contains sawn off tree stumps of a former plantation with no recent forestry activities taking place in these sections.

From a topographic perspective the study area is reasonably flat with an increased slope down toward an intermittent stream which passes roughly 176m to the south of the southern boundary of the present study area.

A number of farm roads pass through the study area. What is believed to be a provincial gravel road defines the eastern boundary of the site and provides direct access to it.

Figure 10 – The proposed development area comprising the study area of Alternative 3.

8. SITE SENSITIVITIES

8.1 Introduction

The site sensitivities is derived from a Heritage Scoping Study undertaken of the Remainder of the farm Leiden 340 IT as well as a systematic walkthrough of the study area that was undertaken during the Heritage Impact Assessment.

8.2 Heritage Sites identified within the Development Footprint Area

During the Heritage Impact Assessment an intensive walkthrough of the proposed development area was undertaken. The aim of the walkthrough was to identify any heritage sites located within the development area. The walkthrough was conducted on Thursday, 17 July 2014 by a fieldwork team comprising an archaeologist (Polke Birkholtz) and one field assistant (Derrick James) . Both members of the fieldwork team were equipped with a hand-held GPS, and an overlay was created of their recorded track logs and the development layout plan.

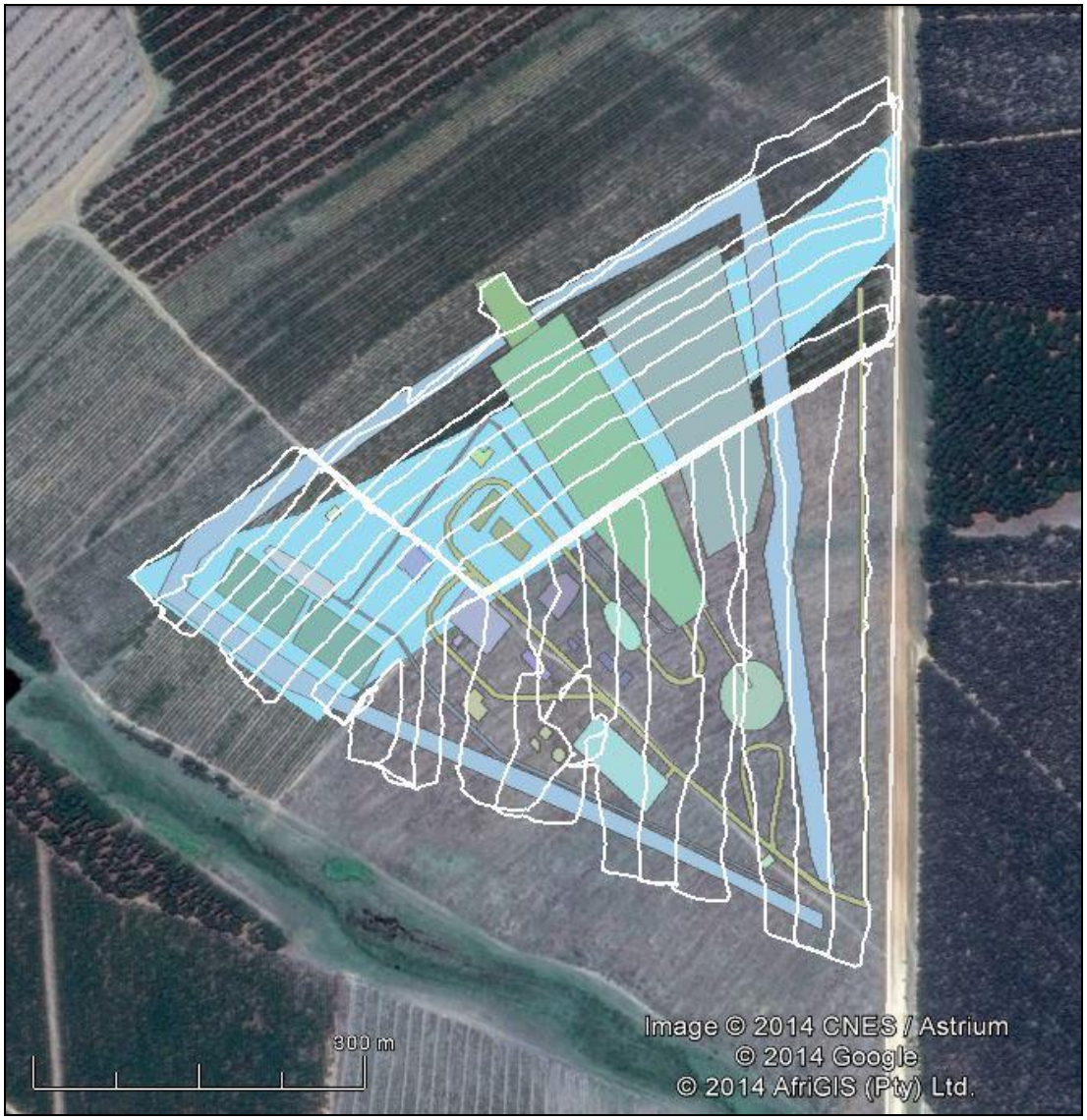

Figure 11 – The track logs recorded for during the fieldwork.

During the fieldwork it was found that large sections of the development area had been disturbed by the establishment of plantations. Despite an intensive walkthrough of the development area, **no heritage sites were identified.**

At the time of the fieldwork the brother of the landowner, Mr. Ettienne van Niekerk, was met. Mr. Van Niekerk had grown up on the property and still farms the land. He was asked if he knew of any graves or cemeteries within the development area and he indicated that he did not (Van Niekerk, pers. comm.).

Figure 12 (above)

General view of a section of the study area on its eastern end showing the remains of a former plantation.

Figure 13 (left)

This photograph was taken near the western end of the study area and depicts the fir tree plantation characterising this end of the site.

8.3 Heritage Sites identified outside of the Development Footprint Area

During the Heritage Scoping Study undertaken of the entire property known as the Remainder of the farm Leiden 340 IT, a total of nine heritage sites were identified. These nine sites comprise six cemeteries, one historic farmstead, one historic farm worker dwelling and one historic rock engraving. None of these sites are in any way close to the present study area, with the site that is closest to the development area situated roughly 1.3km away. As a result, no impacts from the proposed mining development are expected on these identified heritage sites.

The table below provides the details of the nine identified heritage sites whereas the diagram further down provides a geographic perspective of the proposed development area in relation to the heritage sites that were identified during the Heritage Scoping Study.

Table 4- List of heritage sites identified during the Heritage Scoping Assessment with coordinates, a short description for each as well as the respective distances between the development area and the identified sites.

SITE	COORDINATES	DESCRIPTION	DISTANCE FROM DEVELOPMENT AREA
SITE 1	S 26° 52’ 01.7” E 30° 17’ 41.9”	Cemetery with approximately 54 graves	The site is located 1.3km west by south-west of the development area.
SITE 2	S 26° 52’ 13.6” E 30° 16’ 33.2”	Historic engravings	The site is located 3.2km south-west of the development area.
SITE 3	S 26° 52’ 21.0” E 30° 16’ 39.9”	Historic farm worker homestead	The site is located 3km south-west of the development area.
SITE 4	S 26° 52’ 44.1” E 30° 18’ 16.8”	Cemetery with approximately six graves	The site is located 1.5km south by south-west of the development area.
SITE 5	S 26° 51’ 16.9” E 30° 17’ 16.0”	Cemetery with approximately 16 graves	The site is located 2.3km north-west of the development area.
SITE 6	S 26° 51’ 22.8” E 30° 16’ 49.9”	Cemetery with approximately seven graves	The site is located 2.8km north-west of the development area.
SITE 7	S 26° 51’ 21.5” E 30° 16’ 47.4”	Cemetery with one possible grave	The site is located 2.9km north-west of the development area.
SITE 8	S 26° 51’ 20.3” E 30° 16’ 39.8”	Cemetery with approximately five graves	The site is located 3.1km north-west of the development area.
SITE 9	S 26° 51’ 36.1” E 30° 16’ 41.0”	Historic farmstead	The site is located 3km north-west of the development area.

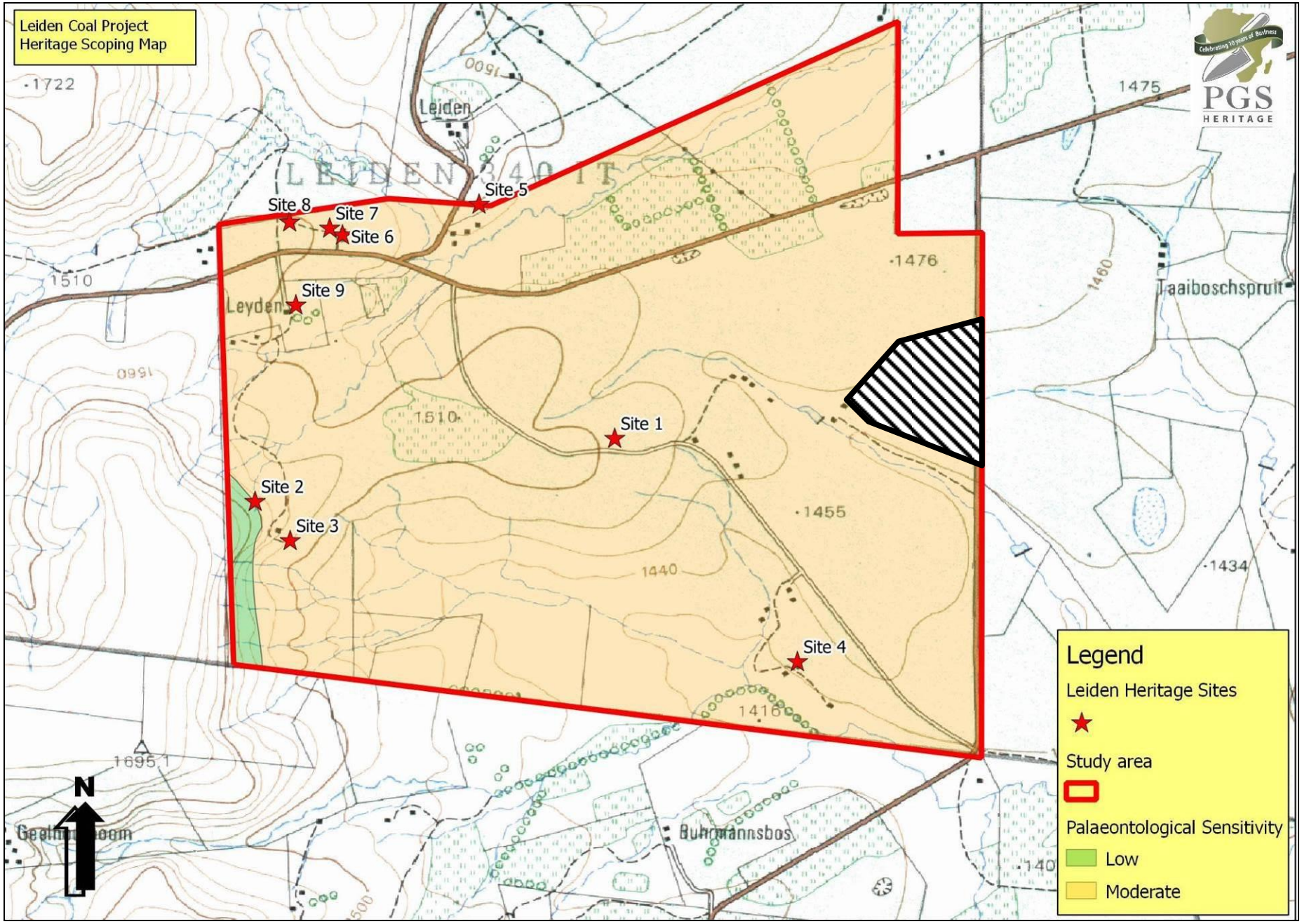

Figure 14 – Heritage sites identified on the Remainder of the farm Leiden 340 IT during the Heritage Scoping Phase. The red line depicts the boundary of the Scoping Level study area whereas the black shaded area reflects the proposed development area assessed for this Heritage Impact Assessment.

8.4 Heritage Sensitivities identified during Desktop Studies

8.4.1 Palaeontological Sensitivity

As indicated above, a palaeontological desktop study was undertaken of the Remainder of the farm Leiden 340 IT during the Heritage Scoping Study by Dr. Gideon Groenewald. Refer Annexure C for a copy of the report.

The desktop study found that the study area (including the present proposed development footprint area) is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite.

The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material.

Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area. Dolerite will not contain any fossils because of its igneous nature and the small area along the south-western edge of the original study area is underlain by dolerite and has thus been allocated a low palaeontological sensitivity.

The following recommendations are made:

- The developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material.
- The developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation.
- The developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University.

8.4.2 Black Homestead

The second edition of the 2630CD topographical sheet that was compiled in 1985 and printed in 1990 depicts a black homestead in close proximity to the south-western corner of the proposed development area. As this homestead is not depicted on the first edition of the same topographical sheet that was surveyed and printed in 1971, the suggestion is that the homestead was established between 1971 and 1985.

Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads and aspecially along the sides of the parents' dwelling. This seems to be especially true for older sites, but sites occupied during the 1970s and the 1980s are also associated with this cultural aspect. As this site was abandoned some time ago, no direct information with regards to the presence (or not) of stillborn graves are currently available.

Based on information that is presently available, the homestead is located roughly 20m outside of the development footprint. However, due to potential slight inaccuracies on the original map as well as the calculations and overlays undertaken for the present study, it is always possible that the homestead is located within the study area. Although no evidence for the homestead remains were found during the archaeological walkthrough, the fact that large sections of the site had been disturbed by forestry activities would make any identification of the tangible remains of such a homestead very difficult.

The estimated position of the homestead is presently located in an area which had been utilised for forestry. As a result it is highly likely for the homestead to have been destroyed as part of these activities.

Figure 15–The approximate position of the Black Homestead in relation to the footprint area of Alternative 3.

9. SITE CONSTRAINTS

From the site sensitivities highlighted above it is evident that the following site constraints can be identified for the present development area:

- Palaeontology

  The entire development area can be classified as of Moderate Palaeontological Sensitivity.

- Black Homestead

  A slight possibility exists for stillborn babies to be located in close proximity to the south-western corner of the development area.

10. IMPACT ASSESSMENT

10.1 Introduction

Three development alternatives exist for the proposed Leiden Colliery. These three alternatives are the following:

- **Alternative 1: No Go Alternative**

  This alternative will imply that no development takes place and that the environment remains unchanged and unaltered. ***For this alternative the assumption is that no heritage resources will be impacted on. As a result no further evaluation of impacts will be done for this alternative.***

- **Alternative 2: Maximum Mine Production**

  This alternative entails a mine plan which is designed to represent the maximum potential production of the mine. While the infrastructure component for this mining design will be the same as in Alternative 3, the opencast area will be much larger. As a result the development footprint will be more extensive.

- **Alternative 3: Sensitivity Planning Approach**

  This alternative entails a mine design which acknowledges the presence of site sensitivities and site constrains. Within this alternative the footprint area is kept to the absolute minimum. While the infrastructure component will be the same as in Alternative 2, the opencast area will be much smaller.

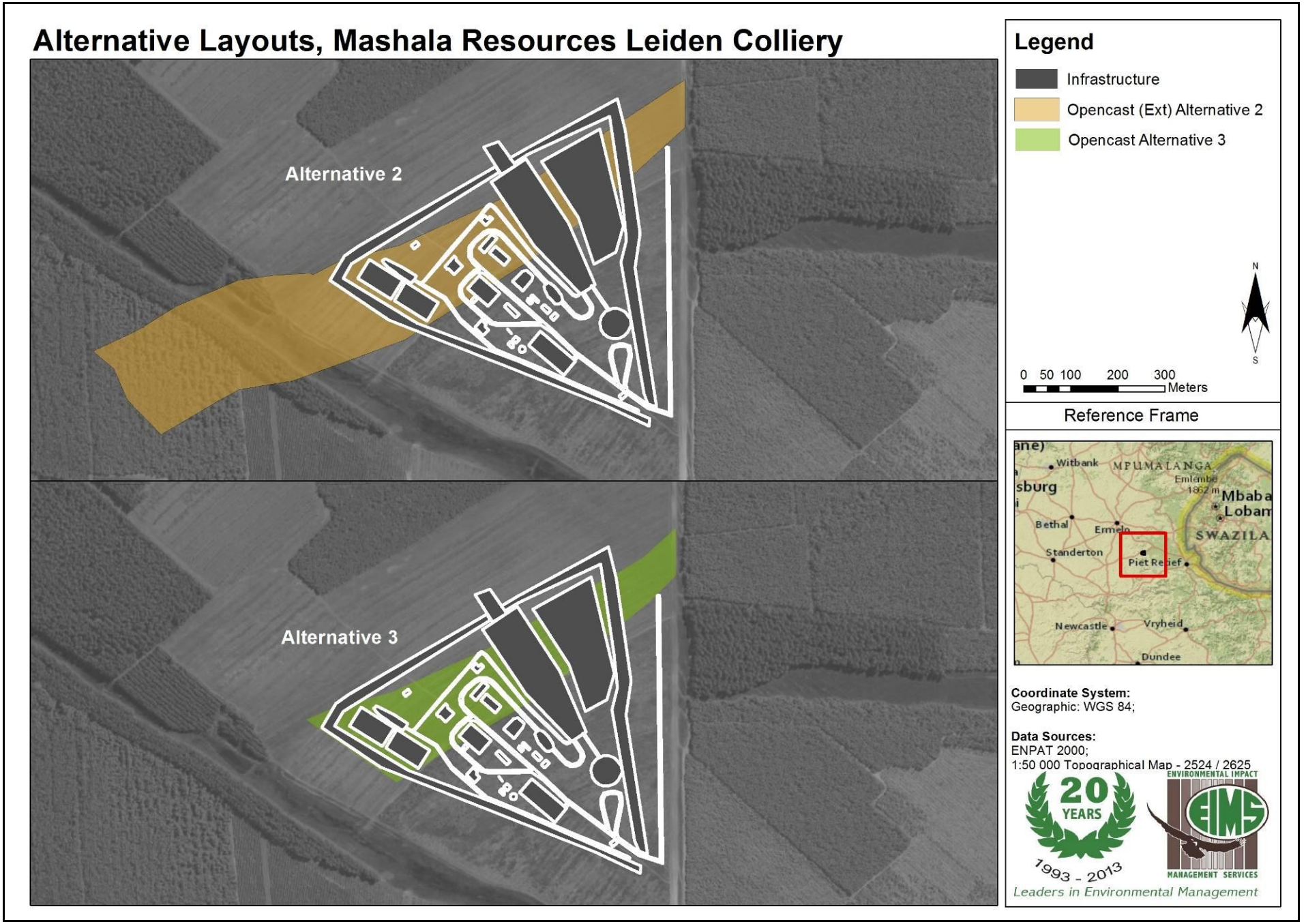

Figure 16 – Development layout plans depicting the mining footprint areas for Alternatives 2 and 3. The plan was supplied by EIMS.

10.2 Impact Assessment in terms of Alternative 2 Maximum Mine Production

The following two site sensitivities in terms of the footprint area associated with this alternative can be identified, namely the impact on palaeontology as well as the possible impact on stillborn babies.

10.2.1 Palaeontological Sensitivity

10.2.1.1 Discussion

As indicated above, a palaeontological desktop study was undertaken of the Remainder of the farm Leiden 340 IT during the Heritage Scoping Study by Dr. Gideon Groenewald. Refer Annexure C for a copy of the report. The desktop study found that the study area (including the development footprint area of Alternative 2) is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite.

The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material. Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area.

The fossil coal floras of South Africa are of international interest and represent an important part of our local heritage. Any loss of this heritage due to mining or construction is permanent, and should be regarded as a highly significant negative impact. However, the discovery of fossils during excavation followed by effective mitigation in collaboration with a palaeontologist, would result in the curation of new and important fossil material. As a result the development could potentially have a positive, beneficial impact on South Africa's palaeontological heritage.

10.2.1.2 Assessment

Any destruction of fossils is a permanent negative impact and must be regarded as potentially a high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a serious loss in terms of our understanding of historical biodiversity.

This assessment holds true during both the construction and operational phases of this alternative.

Refer to Table 5 for the impact evaluation on palaeontological resources in terms of the Maximum Mine Production Alternative.

Table 5– Impact table: Damage/Destruction of Palaeontological Resources – Maximum Mine Production - Construction and Operational Phases

Impact Name:	*Impact on Palaeontological Resources*		
Phase:	*Construction and Operational Phase*		
Alternative:	*Alternative 2: Maximum Mine Production*		
Description of Impact:	*During the construction and operational phases of the mining project, impacts can occur to the palaeontological resources prevalent in the Vryheid Formation.*		
Environmental Risk			
Attribute	**Pre-mitigation**	**Post-mitigation**	
Nature of Impact	-1	-1	
Extent of Impact	3	3	
Duration of Impact	5	5	
Magnitude of Impact	4	2	
Reversibility of Impact	5	3	
Probability	4	3	
Environmental Risk (Pre-mitigation)			**-17**
Environmental Risk (Post-mitigation)			**-9.75**
Degree of confidence in impact prediction:			Medium
Recommended Mitigation Measures			
• *The developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material.* • *The developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation.* • *The developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University.*			
Impact Prioritisation			
Public Response			1
The public response is not known, but expected to be low.			
Cumulative Impacts			2
The potential to impact negatively on plant fossils will remain as long as mining continues to expose and destroy fossiliferous strata. The mining of coal is by definition the mining of fossil plant material.			
Degree of potential irreplaceable loss of resources			3
In palaeontological terms any destruction of fossils is a permanent negative impact and must be regarded as potentially high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a heavy loss in terms of our understanding of historical biodiversity.			
Prioritisation Factor			1.5
FINAL SIGNIFICANCE			**-14.63**

10.2.2 Impact on Stillborn Babies

10.2.2.1 Discussion

The second edition of the 2630CD topographical sheet that was compiled in 1985 and printed in 1990 depicts two black homesteads within the extended opencast area of this alternative. As these homesteads are not depicted on the first edition of the same topographical sheet that was surveyed and printed in 1971, the suggestion is that these homestead were established between 1971 and 1985. Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads and aspecially along the sides of the parents' dwelling. This seems to be especially true for older sites, but sites occupied during the 1970s and the 1980s are also associated with this cultural aspect. As these sites were abandoned some time ago, no direct information with regards to the presence (or not) of stillborn graves are currently available.

The estimated positions of the two homesteads are presently located in an area which had been utilised for forestry. As a result it is highly likely for the homestead to have been destroyed as part of these activities.

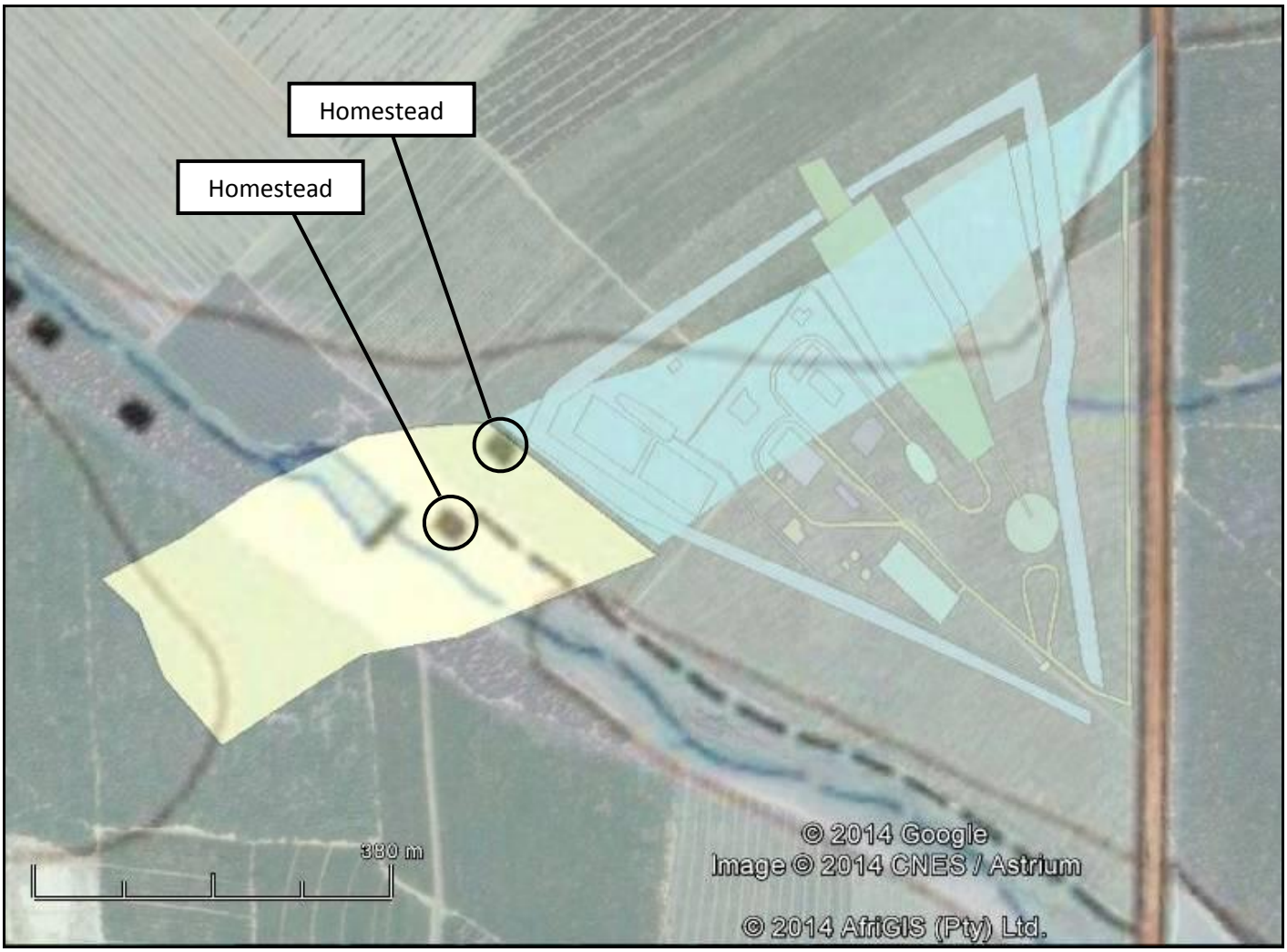

Figure 17–Overlay of the mine footprint for Alternative 2 and the topographic map depicting the two homesteads.

10.2.2.2 Assessment

Any destruction of graves is a permanent negative impact and must be regarded as potentially a high impact significance. The legal, ethical and financial implications of the destruction of graves could be severe. ***This assessment holds true during both the construction and operational phases of this alternative.*** Refer to Table 6 for the impact evaluation on the possible presence of stillborn graves in terms of the Maximum Mine Production Alternative.

Table 6– Impact table: Damage/Destruction to Possible Stillborn Graves – Maximum Mine Production - Construction and Operational Phases

Impact Name:	*Impact on Possible Presence of Stillborn Graves*		
Phase:	*Construction and Operational Phase*		
Alternative:	*Alternative 2: Maximum Mine Production*		
Description of Impact:	*During the construction and operational phases of the mining project, impacts can occur to stillborn babies which may be buried in association with a number of homesteads depicted on the topographical map within the maximum mine footprint.*		
Environmental Risk			
Attribute	**Pre-mitigation**	**Post-mitigation**	
Nature of Impact	-1	-1	
Extent of Impact	4	3	
Duration of Impact	5	3	
Magnitude of Impact	4	2	
Reversibility of Impact	5	5	
Probability	3	2	
Environmental Risk (Pre-mitigation)			**-13.50**
Environmental Risk (Post-mitigation)			**-6.50**
Degree of confidence in impact prediction:			Medium
Recommended Mitigation Measures			
• *An archaeological watching brief must be implemented whereby all excavations and mining development in the positions from within the mining footprint areas where black homesteads are depicted on the available maps must be monitored by a professional archaeologist during the construction and operational phases of the project.*			
Impact Prioritisation			
Public Response			3
The public response is not known, but with the much higher potential of stillborn babies being buried within the mining footprint, a high level public response can be expected.			
Cumulative Impacts			2
The potential for mining to impact negatively on stillborn graves remain high as these graves were seldom marked on the surface. If the presence of a black homestead was not identified at an early stage, with the necessary mitigation measures implemented, many such stillborn graves may potentially be destroyed by mining activities.			
Degree of potential irreplaceable loss of resources			3
Any destruction of graves is a permanent negative impact and must be regarded as potentially high impact significance. The potential legal, ethical and financial implications associated with the destruction of graves can prove irreversible.			
Prioritisation Factor			1.83
FINAL SIGNIFICANCE			**-11.92**

10.3 Impact Assessment in terms of Alternative 3 Sensitivity Planning Approach

The following two site sensitivities in terms of the footprint area associated with this alternative can be identified, namely the impact on palaeontology as well as the possible impact on stillborn babies.

10.3.1 Palaeontological Sensitivity

10.3.1.1 Discussion

As indicated above, a palaeontological desktop study was undertaken of the Remainder of the farm Leiden 340 IT during the Heritage Scoping Study by Dr. Gideon Groenewald. Refer Annexure C for a copy of the report. The desktop study found that the study area (including the development footprint area of Alternative 3) is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite.

The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material. Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area.

The fossil coal floras of South Africa are of international interest and represent an important part of our local heritage. Any loss of this heritage due to mining or construction is permanent, and should be regarded as a highly significant negative impact. However, the discovery of fossils during excavation followed by effective mitigation in collaboration with a palaeontologist, would result in the curation of new and important fossil material. As a result the development could potentially have a positive, beneficial impact on South Africa's palaeontological heritage.

10.3.1.2 Assessment

Any destruction of fossils is a permanent negative impact and must be regarded as a potentially high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a serious loss in terms of our understanding of historical biodiversity.

This assessment holds true during both the construction and operational phases of this alternative.

Refer to Table 7 for the impact evaluation on palaeontological resources in terms of the Maximum Mine Production Alternative.

Table 7– Impact table: Damage/Destruction of Palaeontological Resources - Sensitivity Planning Approach - Construction and Operational Phases

Impact Name:	*Impact on Palaeontological Resources*		
Phase:	*Construction and Operational Phase*		
Alternative:	*Alternative 3: Sensitivity Planning Approach*		
Description of Impact:	*During the construction and operational phases of the mining project, impacts can occur to the palaeontological resources prevalent in the Vryheid Formation.*		
Environmental Risk			
Attribute	**Pre-mitigation**	**Post-mitigation**	
Nature of Impact	-1	-1	
Extent of Impact	2	2	
Duration of Impact	5	5	
Magnitude of Impact	4	2	
Reversibility of Impact	5	3	
Probability	4	3	
Environmental Risk (Pre-mitigation)			**-16**
Environmental Risk (Post-mitigation)			**-9**
Degree of confidence in impact prediction:			Medium
Recommended Mitigation Measures			
• *The developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material.* • *The developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation.* • *The developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University.*			
Impact Prioritisation			
Public Response			1
The public response is not known, but expected to be low.			
Cumulative Impacts			2
The potential to impact negatively on plant fossils will remain as long as mining continues to expose and destroy fossiliferous strata. The mining of coal is by definition the mining of fossil plant material.			
Degree of potential irreplaceable loss of resources			3
In palaeontological terms any destruction of fossils is a permanent negative impact and must be regarded as potentially high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a heavy loss in terms of our understanding of historical biodiversity.			
Prioritisation Factor			1.5
FINAL SIGNIFICANCE			**-13.5**

10.3.2 Impact on Stillborn Babies

10.4.2.1 Discussion

The second edition of the 2630CD topographical sheet that was compiled in 1985 and printed in 1990 depicts a black homestead in close proximity to the south-western corner of the proposed development area. As this homestead is not depicted on the first edition of the same topographical sheet that was surveyed and printed in 1971, the suggestion is that the homestead was established between 1971 and 1985.

Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads and aspecially along the sides of the parents' dwelling. This seems to be especially true for older sites, but sites occupied during the 1970s and the 1980s are also associated with this cultural aspect. As this site was abandoned some time ago, no direct information with regards to the presence (or not) of stillborn graves are currently available.

Based on information that is presently available, the homestead is located roughly 20m outside of the development footprint. However, due to potential slight inaccuracies on the original map as well as the calculations and overlays undertaken for the present study, it is always possible that the homestead is located within the study area.

The estimated position of the homestead is presently located in an area which had been utilised for forestry. As a result it is highly likely for the homestead to have been destroyed as part of these activities. It is also important to note that the presence of the graves of stillborn babies in association with this former homestead is of course not presently known and is highlighted here as a potential risk.

10.4.2.2 Assessment

Any destruction of graves is a permanent negative impact and must be regarded as a potentially high impact significance. The legal, ethical and financial implications of the destruction of graves could be severe.

This assessment holds true during both the construction and operational phases of this alternative.

Refer to Table 8 for the impact evaluation on palaeontological resources in terms of the Sensitivity Planning Alternative.

Table 8– Impact table: Damage/Destruction to Stillborn Graves - Sensitivity Planning Approach - Construction and Operational Phases

Impact Name:	*Impact on Possible Presence of Stillborn Graves*		
Phase:	*Construction and Operational Phase*		
Alternative:	*Alternative 3: Sensitivity Planning Approach*		
Description of Impact:	*During the construction and operational phases of the mining project, impacts can occur to stillborn babies which may be buried in association with a homestead which is depicted on a topographical map roughly 20m outside of the development footprint.*		
Environmental Risk			
Attribute	**Pre-mitigation**	**Post-mitigation**	
Nature of Impact	-1	-1	
Extent of Impact	4	3	
Duration of Impact	5	3	
Magnitude of Impact	4	2	
Reversibility of Impact	5	5	
Probability	2	1	
Environmental Risk (Pre-mitigation)			**-9.00**
Environmental Risk (Post-mitigation)			**-3.25**
Degree of confidence in impact prediction:			Medium
Recommended Mitigation Measures			
An archaeological watching brief must be implemented whereby all excavations in the extreme south-western corner of the development footprint must be monitored by a professional archaeologist during the construction and operational phases of the project.			
Impact Prioritisation			
Public Response			2
The public response is not known, but should a stillborn baby indeed be associated with the homestead depicted on the topographical map, a medium level public response can be expected.			
Cumulative Impacts			2
The potential for mining to impact negatively on stillborn graves remain high as these graves were seldom marked on the surface. If the presence of a black homestead was not identified at an early stage, with the necessary mitigation measures implemented, many such stillborn graves may potentially be destroyed by mining activities.			
Degree of potential irreplaceable loss of resources			3
Any destruction of graves is a permanent negative impact and must be regarded as potentially high impact significance. The potential legal, ethical and financial implications associated with the destruction of graves can prove irreversible.			
Prioritisation Factor			1.67
FINAL SIGNIFICANCE			**-5.42**

10.4 Impact Comparison between different Alternatives

If a comparison is drawn between the three different mining development alternatives, it is clear that three different impact levels can be ascribed to the three alternatives. Of the three, the No Go Option (Alternative 1) will have the least impact on heritage resources. This is due to the fact that in this alternative no mining development will take place. With no mining development taking place no mining-related impacts on the area's heritage resources will take place.

The Maximum Mine Production Option (Alternative 2) will entail the most extensive mining footprint and as a result will represent the alternative with the highest potential impact on the heritage resources from the area. Two potential impacts have been identified namely the impact of this mining alternative on palaeontology as well as its potential impact on stillborn babies which may be associated with two black homesteads depicted on a historic topographic map. While a moderate negative impact significance of -14.63 has been calculated for the impact of this alternative on palaeontology, a moderate negative impact significance of -11.92 has been calculated in terms of the potential impact of the implementation of this development alternative on stillborn babies which may be associated with the two former homesteads.

Alternative 3 Sensitivity Planning Approach will have a smaller footprint area designed in such a way to lessen the impact of the proposed development on the environmental sensitivities and constraints identified within the landscape. While a moderate negative impact significance of -13.50 has been calculated for the impact of this alternative on palaeontology, a low negative impact significance of -5.42 has been calculated in terms of the potential impact of the implementation of this development alternative on stillborn babies which may be associated with a former homestead situated in close proximity to the development area.

It is therefore evident that although very little difference in impact significance could be calculated for the two alternatives in terms of the impact on palaeontology, the potential impact on possible stillborn babies associated with former homesteads in this area is significantly less in terms of the Sensitivity Planning Approach than what it is in terms of the Maximum Mine Production Alternative.

Table 9- Comparison of Impact Significance between the Development Alternatives

COMPARISON OF IMPACT SIGNIFICANCE BETWEEN THE ALTERNATIVES			
Alternative 2: Maximum Mine Production		**Alternative 3: Sensitivity Planning Approach**	
Impact on Palaeontology	-14.63	Impact on Palaeontology	-13.5
Potential Impact on Stillborn Babies	-11.92	Potential Impact on Stillborn Babies	-5.42

11. MITIGATION MEASURES SUGGESTED

11.1 Introduction

As indicated above, the alternative with the least impact on heritage is the Sensitivity Planning Approach (Alternative 3). This is also the preferred alternative and represents the mine design for the proposed Leiden Colliery. In this section the mitigation measures to be followed to minimize the impact of the proposed development on heritage will be outlined and discussed.

11.2 Suggested Measures to Mitigate the impact of the Proposed Development on Palaeontology

11.2.1 General Recommendations

The following recommendations are made in the palaeontological desktop study undertaken by Dr. Gideon Groenewald:

- The developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material.
- The developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation.
- The developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University.

In the section that follows the proposed methodology for mitigating the impact on palaeontology that was compiled by Dr. Gideon Groenewald will be provided.

11.2.2 Proposed Methodology for Recovering Fossils

It is suggested that an effort is made to record well-preserved remains of plant fossils from exposed fossil-bearing shale layers that are interbedded within the coal beds. It is unlikely that fossils will be observed during active mining operations, mainly due to the fact that the rocks will be covered in dust and fossils will only be visible after exposure to the elements for a certain period of time. The practical way of finding fossils will be to inspect the exposed shale beds and other shale scree that is produced by the mining operation. It is not practical for the professional palaeontologist to be on site all the time and it is proposed that a dedicated member of the staff of the mining company be trained to do preliminary investigations of the shale beds on a continuous basis and report any finds to the ECO who will then inform the palaeontologist of the find and decide on possible site visits to inspect the finds.

In principle, the strategy during mitigation is to “rescue” the fossil material as quickly as possible. The strategy to be adopted depends on the nature of the occurrence, particularly the density of the fossils. The methods of collection would depend on the preservation or fragility of the fossils and whether in loose or in lithified sediment.

11.2.3 Mitigation of Mining Impact on Palaeontological Resources

It is proposed that the appointed palaeontologist, in consultation with the mining company, develop a long-term strategy for the recovery of significant fossils during the mining operation. As part of such a strategy the palaeontologist will have to:

- Initially, and at least for the first three months of operation, visit the mine at least once every two weeks to ensure recording of all significant fossil strata
- Determine a long-term strategy and budget for the recording of significant fossils

11.2.3.1 Mitigation Measures Normally Required

1. Mitigation of palaeontological material must begin as soon as possible. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.
2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the BPI for Palaeontology WITS University.
3. Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

11.2.3.2 Functional Responsibilities of the Mining Company

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the mining operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the mine areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the mine area or crushers.

3. Facilitate systematic recording of the stratigraphic and palaeoenvironmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, by providing aid in the surveying of positions.
4. Provide safe storage for fossil material found routinely during mining operations by mine personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities for a work area for sorting, labelling and boxing/bagging samples.
6. Costs of basic curation and storage in the sample archive at the BPI for Palaeontology, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

11.2.3.3 Documentary Record of Palaeontological Occurrences

The mine will make the mining plan available to the appointed specialist, in which the following information will be indicated on the plan by the mine in conjunction with the appointed specialist:

1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the mining period
2. Locations of samples and measured sections will be pegged and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally.

11.2.3.4 Functional Responsibilities of Appointed Palaeontologist

1. Establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata at the BPI Palaeontology at WITS University.
2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations.
3. On the basis of the above, and evaluation during the early stages of mine development, develop, in collaboration with the mine management, more detailed practical strategies to deal with the fossils encountered routinely during mining, as well as the strategies for major finds.
4. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the ECO and environmental staff by the appointed specialist.
5. Respond to significant finds and undertake appropriate mitigation.
6. Initially, for the first three months of operation, at least two weekly visits to “touch base” with the monitoring progress, process and document interim “normal” finds and to undertake an inspection and documentation of new mine faces. A strategy for further visits during the life of the mine must then be determined.

7. Transport of material from the mine to the BPI Palaeontology, WITS University.
8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at BPI Palaeontology and the South African Heritage Resources Authority (SAHRA). It must fulfil the reporting standards and data requirements of these bodies.
9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

11.2.3.5 Exposure of Palaeontological Material

In the event of mining exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil plant find, the following procedure must be adhered to:

- The appointed specialist or alternates (SAHRA, BPI WITS University) must be notified by the responsible officer (e.g. the ECO or mine geologist), of major or unusual discoveries during mining, found by the mine geologist or other personnel.
- Should a major in situ occurrence be exposed, mining will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the BPI Palaeontology WITS University, or its designated contractor, have had reasonable opportunity to investigate the find. Such work will be at the expense of the mining company.

11.3 Suggested Measures to Mitigate the impact of the Proposed Development on Stillborn Babies

11.3.1 General Recommendations

As mentioned above the potential impact exists for stillborn babies to have been associated with a black homestead that is depicted on the second edition of the 2630CD topographical sheet in close proximity to (but outside of) the proposed mining development footprint. While it is important to note that no evidence for the presence of such stillborn baby graves in this area exists, the potential for such graves to be associated with the former black homestead located here does exist. To mitigate the impact of the proposed mining development on this potential risk, the following recommendations are made:

- An archaeological watching brief must be implemented whereby all excavations in the extreme south-western corner of the development footprint must be monitored by a professional archaeologist during the construction and operational phases of the project. **It must be noted that once this entire area has been disturbed by excavations or mining activities with the watching brief for this disturbance completed, no further monitoring would be required.**

- The area within which all excavations must be monitored by a professional archaeologist is referred to as a red zone in this report. This area is defined by the following coordinates:

    - S 26° 51’ 54.5”
      E 30° 18’ 26.6”

    - S 26° 51’ 53.8”
      E 30° 18’ 28.2”

    - S 26° 51’ 56.5”
      E 30° 18’ 29.5”

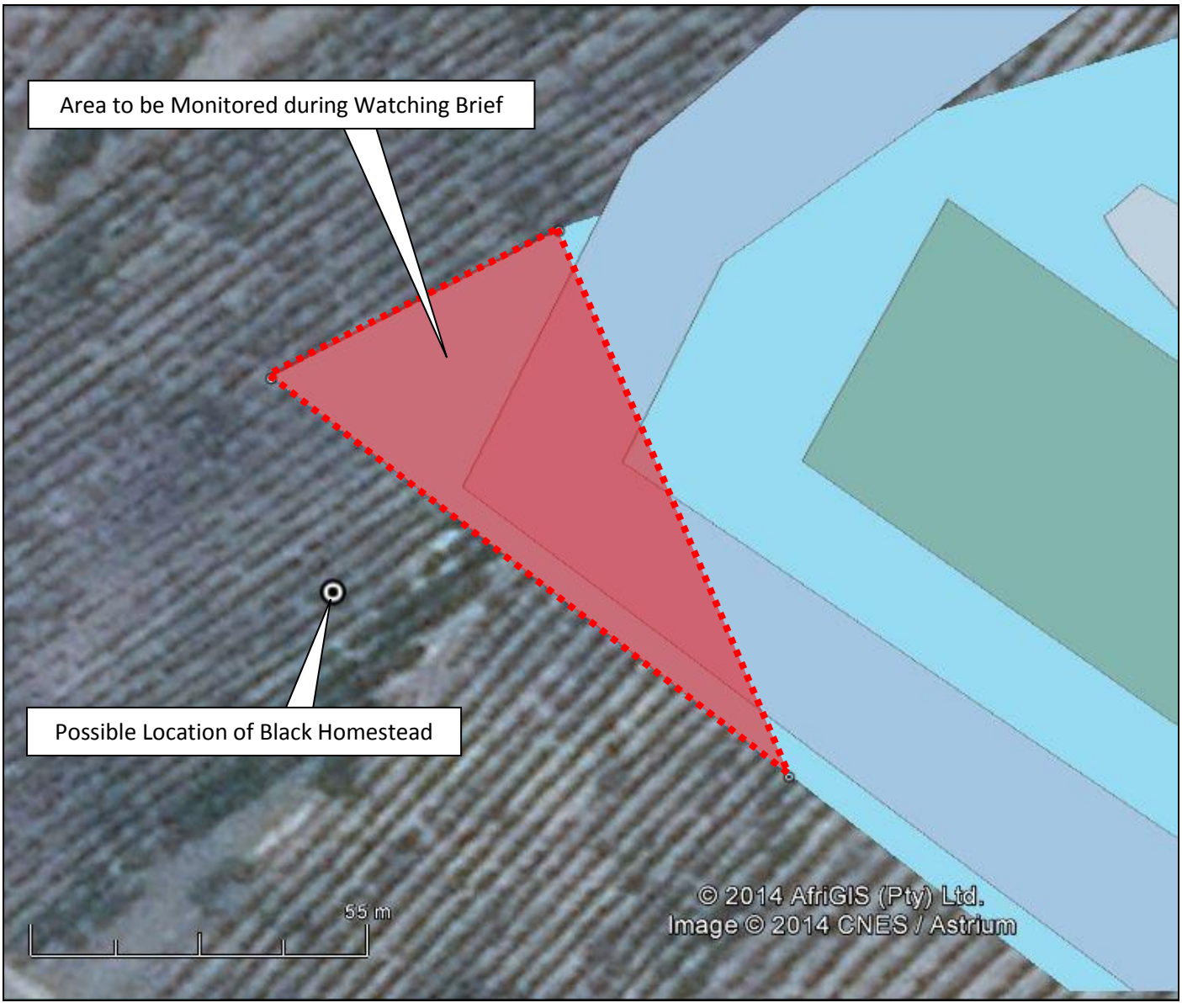

Figure 18–This image depicts the approximate position of the Black Homestead in relation to the development footprint area as well as the area which has to be monitored during the archaeological watching brief.

11.3.2 Mitigation of Mining Impact on Possible Stillborn Graves

11.3.2.1 Mitigation Measures Required

The following general mitigation measures must be undertaken:

1. The mitigation of the potential impact of the proposed mining development on the possible presence of stillborn babies will be undertaken by means of archaeological monitoring by a professional archaeologist.
2. The archaeologist will be present during any excavations or disturbances in the previously defined area.

The outcomes of this mitigation exist, namely that no evidence for graves are found and secondly that evidence for graves are found. In the first instance no further mitigation measures would be required. However, if evidence of a grave is found, the following measures would apply:

1. Should any evidence for graves be found (i.e. coffin remains, clothing, skeletal remains etc.) all mining activities in that specific area will have to be halted and a buffer area around it kept clear of any further mining activities until such time that the newly discovered grave has been excavated.
2. A rescue permit application will follow and once the permit is received the newly discovered grave will be excavated and curate at a registered mortuary.
3. Social consultation will then be undertaken to attempt to identify the next of kin for the grave.
4. Once the social consultation has been completed, the grave will be reburied in a municipal cemetery of the family's choosing and in the case of no identified family the closest municipal cemetery to the grave will be utilised for reburial.

11.2.3.2 Functional Responsibilities of the Mining Company

1. Appoint at their cost a professional archaeologist to undertake the monitoring.
2. Ensure that the archaeologist is informed at least two weeks beforehand that the defined area on the south-western corner of the development footprint will be accessed for mining or excavations activities.
3. Should evidence for a grave be found, the mining company will have to stop all mining activities in the area demarcated by the archaeologist and appoint an experienced grave relocation company to undertake the relevant mitigation measures as outlined above.

11.2.3.3 Functional Responsibilities of the Responsible Archaeologist

1. To conduct the archaeological monitoring in the previously defined area.

2. Identify any evidence for graves and should such evidence be found demarcate such areas.
3. Ensure that the mine manager is immediately informed of the discovery of a grave.
4. Provide the mining company with guidance on the future steps to be followed in the mitigation of the grave.
5. Provide a report on the archaeological monitoring whether evidence for a grave is found or not.

11.4 Summary of Mitigation Measures

11.4.1 Mitigation Measures for Palaeontology

The first mitigation measures required to minimise the impact of the proposed development on palaeontology, is outlined in table form below. It is important to note that the measures outlined here only include the early steps in the entire process. The details of exactly how the the fossils will be identified and the steps required after that will be outlined in the palaeontological plan required under measure 2A below. It must therefore be noted that all of the the steps outlined in the table must be undertaken, with further steps outlined in the detailed plan. Such measures would include the timing of excavation and destruction permits, the conservation measures required once fossils have been identified and the like.

11.4.2 Mitigation Measures for Potential Stillborn Babies

The mitigation measures required in terms of the potential impact on stillborn babies are outlined below. Please note that the information contained in the table below only outlined the required mitigation measures up to the point that a discovery of suspected human remains are safely demarcated from further disturbance. The exact mitigation measures to be followed after this point will be provided by the archaeologist who made the discovery and as indicated will depend on the conditions of the site and the characteristics of the discovery. The required mitigation measures would likely be a rescue permit application to SAHRA, the physical excavation of the suspected grave, analysis of suspected human remains and if confirmed as human the curation of excavated human remains in a registered mortuary, followed by a social consultation process. Once the social consultation process has been completed to the satisfaction of SAHRA the remains can be reburied in a municipal cemetery.

12. ACTION PLAN FOR IMPLEMENTATION

12.1 Basic Principles of the Action Plan

The action plan to mitigate identified development impacts is based on the following overriding principles:

- The minimisation of the disturbance of the proposed mining activities to the palaeontology of the area

- The minimisation of the disturbance of the proposed mining activities to stillborn babies which potentially may be located there.

12.2 Management Measures and Mechanisms

The management measures and mechanisms required in terms of achieving the principle of minimizing the impact of the proposed mining development on palaeontology, are as follows:

- A palaeontological monitoring procedure will be required to monitor mining activities with the aim of identifying fossils before they are destroyed. The identification of significant fossils can then be suitably mitigated before such fossils are destroyed by the mining activities. This process will be managed and driven by the appointed palaeontologist and will be supported by the Environmental Control Officer and dedicated staff member of the mine who will be made responsible for palaeontology. During the first three months of the project implementation, the palaeontologist will undertake a monitoring visit once every two weeks whereas the dedicated staff member who would have been trained to undertake the monitoring, will conduct daily on-site monitoring.
- With assistance provided by the mine, the palaeontologist will submit a destruction permit application to SAHRA which would allow for the destruction of fossils during mining as well as the rescue excavation of exposed and significant fossils which have been identified during the monitoring process.

The management measures and mechanisms required in terms of achieving the principle of minimizing the impact of the proposed mining development on stillborn babies are as follows:

- An archaeological watching brief must be implemented whereby an archaeologist monitors any disturbance to an area which had been defined above. Any identification of graves can then be immediately acted upon and suitably mitigated.

12.3 Required Actions

The individual actions required to implement the mitigation of the impact of the proposed mining development on palaeontology and potentially on stillborn babies, are outlined in **Table 12** below.

Table 10- Initial Mitigation Measures required for Palaeontology

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
1. Immediate Mitigation in terms of Palaeontology							
A	The Applicant together with the ECO shall identify a suitably qualified palaeontologist to assist in conducting the mitigation of the mining impact on the palaeontological resources of the study area. Once identified this individual or company must be appointed.	Planning	Immediate action that needs to be undertaken well in advance of construction	Applicant ECO	ECO (Monthly)	The appointed palaeontologist would direct the way in which the impact on palaeontology can be mitigated.	(ECO Monthly Checklist/Report)
2. Priority Mitigation Measures after appointment of Palaeontologist							
A	A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples must be developed in collaboration with the BPI for Palaeontology WITS University.	Planning	Priority action to follow on appointment of palaeontologist. Must be undertaken well in advance of construction	Appointed Palaeontologist ECO	ECO Applicant	To compile a plan to outline in detail the mitigation of palaeontology affected by the proposed colliery.	(ECO Monthly Checklist/Report)
B	The appointed palaeontologist must present the mitigation plan to the ECO, Mine Manager and dedicated member of the mine staff who will be responsible for palaeontology.	Planning	Priority action after completion of previous action. Must be undertaken well in advance of construction.	Appointed Palaeontologist ECO	ECO Applicant	To present the detailed palaeontological mitigation plan to representatives of the mine and ECO.	(ECO Monthly Checklist/Report)
C	The appointed palaeontologist must conduct training with a dedicated	Planning	To be undertaken	Appointed Palaeontologist	ECO	To train a dedicated staff	(ECO Monthly Checklist/Report)

	member of the staff of the mining company as well as the ECO to do preliminary investigations of the shale beds on a continuous basis and report any finds to the ECO who will then inform the palaeontologist of the find and decide on possible site visits to inspect the finds.		well ahead of the start of the Construction Phase.	ECO	Applicant	member in order to assist with the assessment of shale beds and report any finds to the ECO.	
3. Priority Mitigation Measures after appointment of Palaeontologist							
A	A preliminary site visit must be undertaken by the palaeontologist and ECO to allow for the familiarisation of the study area and project by the specialist.	Construction	Within two weeks after start of the Construction Phase	Appointed Palaeontologist ECO	ECO Applicant	To allow the specialist to familiarise him/her with the study area and details of the project.	(ECO Monthly Checklist/Report)
B	The appointed palaeontologist must conduct site visits to the mine during the first three months of operation. The frequency of these site visits will be once every two weeks.	Construction and Mining	First three months of operation	Appointed Palaeontologist ECO Applicant	ECO Applicant	To "touch base" with the monitoring progress, process and document interim "normal" finds and to undertake an inspection and documentation of new mine faces. A strategy for further visits during the life of the mine must then be determined.	(ECO Monthly Checklist/Report)

Table 11- Mitigation Measures required for Potential Presence of Stillborn Babies

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
1. Immediate Mitigation in terms of Stillborn Babies							
A	The Applicant together with the ECO shall identify a suitably qualified archaeologist to assist in conducting the mitigation. Once identified this individual or company must be appointed.	Planning	Immediate action that needs to be undertaken well in advance of construction	Applicant ECO	ECO (Monthly)	The appointed archaeologist would direct the way in which the potential impact on stillborn babies can be mitigated.	(ECO Monthly Checklist/Report)
2. Priority Mitigation Measures after appointment of Archaeologist							
A	Demarcation of red zone (see above) on mine plans as well as on the ground.	Planning	Priority action to follow on appointment of archaeologist. Must be undertaken well in advance of construction	ECO	ECO Applicant	To ensure that the red zone indicated above will be mitigated in the correct manner.	(ECO Monthly Checklist/Report)
3. Archaeological Watching Brief							
A	The appointed archaeologist must be notified in writing of any planned excavation or disturbance to either a section or the entire red zone defined above. This written notification must be sent at least two weeks in advance of planned action.	Construction and Mining Phases	Two weeks ahead of planned action.	ECO	ECO Applicant	To ensure that the appointed archaeoloigist is informed of any planned disturbance to the red zone.	(ECO Monthly Checklist/Report) Specialist Report

B	The appointed archaeologist must undertake an archaeological watching brief during the excavations or disturbances to the defined red zone. This watching brief will comprise a fieldwork team consisting of one archaeologist and one archaeological field assistant conducting intensive on-site walkthroughs and assessments throughout the excavation and disturbances.	Construction and Mining Phases	On pre-scheduled day(s) when the excavations and/or disturbances to the red zone will take place.	Archaeologist ECO	Archaeologist ECO Applicant	To identify any evidence for human remains or graves.	(ECO Monthly Checklist/Report) Specialist Report
C	The appointed archaeologist must compile a watching brief report with photographs providing the findings of the watching brief.	Construction and Mining Phases	Two weeks after completion of watching brief.	Archaeologist ECO	Archaeologist ECO Applicant	To provide written feedback on the watching brief.	(ECO Monthly Checklist/Report) Specialist Report
4. Mitigation Measures Required should Suspected Evidence for Human Remains or Graves be Identified during Watching Brief							
A	Should suspected evidence for graves or human remains be identified during the watching brief, the archaeologist must immediately inform the ECO who in turn must inform the Mine SHEQ Manager immediately.	Construction and Mining Phases	Immediately after discovery of suspected evidence of human remains or graves.	Archaeologist ECO	Archaeologist ECO Applicant	To ensure that the ECO and Mine SHEQ Manager immediately becomes aware of the potential discovery of graves.	(ECO Monthly Checklist/Report) Specialist Report
B	The archaeologist, with assistance provided by the ECO and Mine SHEQ Manager, must demarcate an area around the suspected position of a grave that must be kept clear of any further disturbance, excavation or mining activities until such time that the archaeologist provides written permission for the demarcation to be lifted and the demarcated area to be	Construction and Mining Phases	Immediately after ECO and Mine SHEQ Manager are on site.	Archaeologist ECO Mine SHEQ Manager	Archaeologist ECO Applicant	To ensure that the suspected grave is not further damaged or destroyed until mitigation measures can be undertaken.	(ECO Monthly Checklist/Report) Specialist Report

	impacted upon.						
C	The archaeologist will provide the ECO with the mitigation measures that will be required from this point onward. The exact mitigation measures to be followed would depend on the characteristics of the discovery and conditions of the site. These measures may include a rescue permit application to SAHRA, the physical excavation of the suspected grave, analysis of suspected human remains and if confirmed as human the curation of excavated human remains in a registered mortuary followed by a social consultation process. Once the social consultation process has been completed to the satisfaction of SAHRA the remains can be reburied in a municipal cemetery.	Construction and Mining Phases	Immediately after demarcation of suspected human remains.	Archaeologist	Archaeologist ECO Applicant	To outline the exact mitigation measures required.	(ECO Monthly Checklist/Report) Specialist Report

Table 12- Action Plan for Implementation

ACTION PLAN				
Phase	**Management Action**	**Timeframe for Implementation**	**Responsible Party for Implementation (Frequency)**	**Responsible Party for Monitoring/Audit/Review (Frequency)**
Planning	Identify and appoint suitably qualified palaeontologist.	Immediate action	Applicant ECO	ECO (Monthly)
Planning	Identify and appoint suitably qualified	Immediate action	Applicant	ECO (Monthly)

	archaeologist.		ECO	
Planning	Development of a detailed plan to outline systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples in collaboration with the BPI for Palaeontology WITS University.	Four weeks after appointment of palaeontologist and well ahead of commencement of construction phase.	Palaeontologist	ECO (Monthly)
Planning	The appointed palaeontologist must present the mitigation plan to the ECO, Mine Manager and dedicated member of the mine staff who will be responsible for palaeontology.	Two weeks after submission of final plan in electronic format to ECO and Mine Manager and at least four weeks before the commencement of construction.	Palaeontologist	ECO (Monthly)
Planning	The appointed palaeontologist must conduct training with a dedicated member of the staff of the mining company as well as the ECO to do preliminary investigations of the shale beds on a continuous basis and report any finds to the ECO who will then inform the palaeontologist of the find and decide on possible site visits to inspect the finds.	At least two weeks before commencement of construction.	Palaeontologist	ECO (Monthly)
Planning	Demarcation of red zone (see above) on the mine plans and also physically on the ground. The physical demarcation must be maintained throughout the project until such time that the archaeologist provides written permission for the demarcation to be removed.	Two weeks before the commencement of the construction phase.	ECO	ECO (Monthly)
Construction	A preliminary site visit must be undertaken by the palaeontologist, ECO and dedicated staff member tasked with palaeontology to allow for the	Two weeks after the commencement of the construction phase.	ECO Palaeontologist	ECO (Monthly)

	familiarisation of the study area and project by the specialist.		Dedicated Staff Member	
Construction and Mining	The appointed palaeontologist must conduct site visits to the mine during the first three months of operation. The frequency of these site visits will be once every two weeks.	During the first three months of the construction and operational cycle.	Palaeontologist Dedicated Staff Member ECO	ECO (Monthly)
Construction and Mining	The appointed archaeologist must be notified in writing of any planned excavation or disturbance to either a section or the entire red zone defined above. This written notification must be sent at least two weeks in advance of planned action.	At least two weeks in advance of planned disturbance to red zone.	ECO	ECO (Monthly)
Construction and Mining	The appointed archaeologist must undertake an archaeological watching brief during the excavations or disturbances to the defined red zone. This watching brief will comprise a fieldwork team consisting of one archaeologist and one archaeological field assistant conducting intensive on-site walkthroughs and assessments throughout the excavation and disturbances.	On the pre-scheduled day(s)	Archaeologist	Watching Brief Report ECO (Monthly)
Construction and Mining	The appointed archaeologist must compile a watching brief report with photographs providing the findings of the watching brief.	One week after watching brief.	Archaeologist	Watching Brief Report ECO (Monthly)

13. CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage was appointed by Environmental Impact Management Services (Ltd) (EIMS) to undertake a Heritage Impact Assessment Report for the proposed Leiden Colliery. The study area is located 13.8km south of Sheepmoor, Mkhondo Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.

The purpose of the Heritage Impact Assessment report is to assess the impacts of a proposed development on the identified heritage resources. This is important because heritage resources are protected in terms of the National Heritage Resources Act, No 25 of 1999, (NHRA) from *inter alia*, destruction or damage, excavation or removal, or other disturbance, without a permit from the responsible heritage resources authority. The National Heritage Resources Act, No 25 of 1999, (NHRA) states that heritage resources are unique and non-renewable and, as such, any impact on such resources must be seen as significant (NHRA, section 5(1)(a)). The NHRA specifically protects certain categories of heritage resources, i.e.: structures, archaeological and paleontological (including meteorological) sites and material and graves and burial grounds (NHRA, sections 34, 35 and 36). Furthermore, Section 38 of the NHRA provides for and regulates the compilation of impact assessment reports of heritage resources that may be affected by construction or development activities.

This Heritage Impact Assessment was preceded by a Heritage Scoping Report which has shown that the study area and surrounding areas have a historical and archaeological history and that there is potential for archaeological and historical sites and material to exist within the study area. The initial research has also identified specific possible heritage sensitive areas within the study area that would require further investigation during the HIA/EIA phase, depending of course on the exact location of the final development footprint to be assessed as part of the Heritage Impact Assessment. A site visit was also undertaken during the Heritage Scoping Study which identified a total of nine sites comprising six cemeteries, one historic farmstead, one historic rock engraving site as well as one abandoned historic farm worker homestead.

As part of this study three development alternatives were assessed and compared, namely Alternative 1 (No Go), Alternative 2 (Maximum Mine Production) and Alternative 3 (Sensitivity Planning Approach). While Alternative 1 will entail the least impact on heritage resources, of the two development alternatives Alternative 3 was calculated to have a lower impact significance in terms of heritage than what Alternative 2 was calculated to have. Hence, Alternative 2 was calculated to be the preferred option.

The placement of the final development footprint area on the landscape by EIMS in consultation with Mashala Resources was undertaken in cognisance of the results of the Heritage Scoping Study as well as the other specialist

studies. As a result none of the sites identified during the Heritage Scoping Study were located in the development footprint area. As the Heritage Scoping Study comprised a desktop study and brief site visit, the first component of this Heritage Impact Assessment was to conduct a physical walkthrough of the development footprint area. Despite an intensive walkthrough undertaken by an experienced fieldwork team, no heritage sites were identified.

As no heritage sites were identified within the development footprint area, no impacts on tangible heritage sites such as historic structures, archaeological sites and graves and cemeteries are expected. The only identified impact would be on palaeontology and on the remote potential presence of stillborn babies in proximity to the development area.

Palaeontology

A palaeontological desktop study was undertaken by Dr. Gideon Groenewald during the Heritage Scoping Study. A copy of this report can be found in Annexure C. According to the report the study area is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite. The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material. Due to the fact that the Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that fossils will be observed before the mining takes place. For this reason a moderate palaeontological sensitivity is allocated to the larger portion of the study area. Dolerite will not contain any fossils because of its igneous nature and the small area along the South-western edge underlain by dolerite has thus been allocated a Low palaeontological sensitivity. The following mitigation measures are required: (a) the developer and the ECO of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material; (b) the developer must apply for a collection and destruction permit for plant fossils encountered during the mining operation and (c) the developer must employ a qualified palaeontologist to visit the present mining operations to record any fossils. The palaeontologist will look out for exceptionally well preserved fossils and collect representative samples of these fossils for further study at an appropriate institute such as the Bernard Price Institute for Palaeontology at WITS University (Groenewald, 2013).

In Chapter 8 the impact on palaeontology is identified as an environmental sensitivity, whereas Chapter 9 identifies it as an environmental constraint. The impact of the proposed development on palaeontology in terms of three different alternatives is assessed in Chapter 10 and mitigation measures and an action plan to mitigate the impact on palaeontology is outlined in Chapters 11 and 12 respectively.

Stillborn Babies

During the desktop study a black homestead was found to be depicted in proximity to the proposed development area on a topographical map that was compiled in 1985 and printed in 1990. From past experience it is know that the possibility exists for stillborn babies to be associated with especially older black homesteads. Although the black homestead is depicted roughly 20m from the south-western end of the proposed development area, the possibility still exists for the homestead to be located much closer and even within the proposed development area. This is due to the fact that although the development area was intensively covered during the archaeological walkthroughs, large sections of the development area had been impacted upon by forestry activities which may have made the identification of the remains of such a homestead near impossible. Although the possibility for stillborn babies to be located within the development area can be seen as slim, this possibility still exists and was assessed as part of this study.

In Chapter 8 the impact on possible stillborn babies is identified as an environmental sensitivity, whereas Chapter 9 identifies it as an environmental constraint. The impact of the proposed development on the possible presence of stillborn babies was assessed in terms of three different alternatives in Chapter 10. The required mitigation measures and an action plan to mitigate this impact are outlined in Chapters 11 and 12 respectively.

On the condition that the recommendations made in this report are adhered to, no heritage reasons can be given for the project not to continue.

14. ASSUMPTION AND LIMITATIONS

The following assumptions and limitations can be identified:

- The exact way in which the proposed mining (i.e. opencast or high wall mining) will be undertaken is presently unknown. However, for the purposes of this report it was assumed that opencast mining would take place.
- The potential presence of stillborn babies in proximity to the development area was primarily based on the indication of a black homestead on an old topographic map in proximity to the development area as well as the previous experience of the staff at PGS Heritage which suggests the potential for stillborn babies to be associated with older black homesteads. This potential presence of stillborn babies within the development area is however remote but needed to be raised in this report.
- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage sites identified during the desktop study and fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.

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Archival References

SS, R5055/86

Historic Topographic Maps

All the historic topographic maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

Google Earth

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

Internet References

www.sahistory.org.za
www.wikipedia.org

ANNEXURE A

HERITAGE ASSESSMENT METHODOLOGY

The significance of heritage sites is 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, will be used for the purpose of this report.

Table 13: 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.C)	Grade 4C	Low Significance	Destruction

ANNEXURE B

THE SIGNIFICANCE RATING SCALES USED IN THIS REPORT

Method of Assessing Impacts:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact. For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R)}{4} \times N$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 14:

Table 14: Criteria for determination of impact consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),

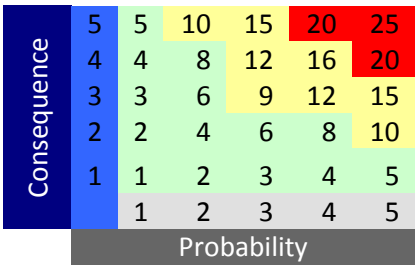
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 15.

Table 15: Probability scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows: ER= C x P



The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 16.

Table 16: Significance classes.

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/ mitigated.

Impact Prioritisation

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented in Section 0 it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority / significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 17: Criteria for the determination of prioritisation.

Public response (PR)	Low (1)	Not raised as a concern by the I&AP's
	Medium (2)	Issue/ impact raised by the I&AP's
	High (3)	Significant and meaningful response from the I&AP's
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 17. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (refer to Table 18).

Table 18: Determination of prioritisation factor.

Priority	Ranking	Prioritisation Factor
= 3	Low	1
3 > 9	Medium	1.5
= 9	High	2

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Environmental Significance Rating	
Value	**Description**
< 9	Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥9; <17	Medium (i.e. where the impact could influence the decision to develop in the area),
≥ 17	High (i.e. where the impact must have an influence on the decision process to develop in the area).

ANNEXURE C

PALAEONTOLOGICAL DESKTOP STUDY