Heritage Impact Assessment for the Cluster 2 Seismic Survey investigations by Tetra4/Renergen Ltd., on multiple farm portions. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province.

Heritage Impact Assessment

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REVISION HISTORY

Version	Issue Date	Description of Changes
01	31/01/2026	First draft

Specialist Declaration for assessments undertaken for application for authorisation in terms of the National Environmental Management Act (Act 107 of 1998) as amended and the Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) as amended

I, Alexander Andreou declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998) as amended, when applying for environmental authorisation which were promulgated in Government Notice 320 (Government Gazette 43110, 20 March 2020) and in Government Notice 1150 (Government Gazette 43855, 30 October 2020).
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
- any decision to be taken with respect to the application by the competent authority; and;
- the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of the Environmental Impact Assessment Regulations (Government Notice R982, Government Gazette 38282, 4 December 2014) as amended and is punishable in terms of section 24F of the National Environmental Management Act (Act 107 of 1998).
- I will take into account, to the extent possible, the matters listed in section 38 of the National Heritage Resources Act (Act 25 of 1999) when preparing the application and any report relating to the application.

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd

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SIGNATURE: 

ACKNOWLEDGEMENT OF RECEIPT

Report Title	Heritage Impact Assessment for the Cluster 2 Seismic Survey investigations by Tetra4/Renergen Ltd., on multiple farm portions. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province.		
Control	**Name**	**Signature**	**Designation**
Author	Dr Alexander Andreou		**PGS Heritage** - Heritage Advisory Unit Manager and Senior Heritage Specialist
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This Heritage Impact Assessment report has been compiled considering the Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended by Government Notice 326 (Government Gazette 40772, 7 April 2017) requirements for specialist reports as indicated in the table below:

Requirements Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Page iii of Report – Contact details and company
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to Appendix B
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page iii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	N/A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4.2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	EIMS Impact Methodology
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4.2 and section 5
(g) An identification of any areas to be avoided, including buffers	Section 2
(h) A map superimposing the activity, including the associated structures and infrastructure on the environmental sensitivities of the site, including areas to be avoided, including buffers;	Section 2
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 5
(k) Any mitigation measures for inclusion in the Environmental Management Program	Section 6
(l) Any conditions for inclusion in the Environmental Assessment	Section 6
(m) Any monitoring requirements for inclusion in the Environmental Management Program or Environmental Assessment	Section 6
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Sections 7
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the Environmental Management Program, and where applicable, the closure plan	Section 7
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Informal consultation in fieldwork.
(p) A summary and copies if any comments that were received during any consultation process	To be supplied by EIMS
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	No protocols or minimum standards for HIA or PIA

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by Environmental Impact Management Services (Pty) Ltd.to undertake a Heritage Impact Assessment that forms part of the Phase 2 Seismic Survey investigations by Tetra4/Renergen Ltd., on multiple farm portions. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province.

A standalone Palaeontological Desktop Assessment was conducted by PGS Heritage (Pty) Ltd; **942HIA-002**.

During the study, a total of 22 heritage sites and 28 features were identified. These consist of six historical homesteads (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); five metal objects (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**); 12 recent structures (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**) , one ceramic surface scatter (**T_BD_1**); and one grave (**T_BV_1**).

Historical Homesteads/Structures

Of the six historical homesteads/structures identified on site, (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); all were predominantly foundation remnants or had >5% ex situ. All were graded as **NCW** with **zero-low local significance**.

Recent Structures

12 recent structures were identified on site, all were predominantly foundation remnants or had >5% ex situ (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**); all of which were graded as **NCW** with **zero local significance**.

Archaeological/Historical Material

There were five metal objects, predominantly industrial machinery remnants and oil/water drums (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**), graded **NCW** with **low local significance**, and one ceramic surface scatter (**T_BD_1**) of famille-bleu polychrome ceramic sherds, graded **NCW** with **low local significance**.

Burial Grounds and Graves

A single illegibly marked grave was identified (**T_BV_1**), and graded as **Grade IIIA**, with **high significance**. It should be noted that the landowner advised of another grave within the vicinity, but was not forthcoming with a precise bearing, and the receiving environment was incredibly overgrown and impassable.

Palaeontology

The proposed development is underlain by Quaternary alluvium, Superficial sands, the Jurassic dolerite of the Karoo Igneous Province, as well as the Adelaide Subgroup of the Karoo Supergroup. According to the

PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Quaternary sediments is Moderate (green), that of the Karoo Igneous Suite is Zero (grey), while that of the Adelaide Subgroup (Beaufort Group) is Very High (red).

Although the SAHRIS PalaeoMap indicates that the study area falls within a zone of Very High Palaeontological Sensitivity, the significance of potential impacts associated with the proposed survey is assessed as Very Low, owing to the non-invasive nature of the activities. As no vegetation clearance or subsurface disturbance will occur, the proposed survey is not expected to result in any direct impacts on palaeontological heritage resources.

Should any fossil material be encountered during any phase of the project, whether exposed at surface or during unforeseen ground-disturbing activities, the Chance Find Protocol must be implemented immediately by the Environmental Control Officer (ECO) or the responsible site manager. All fossil discoveries must be protected in situ and reported to the South African Heritage Resources Agency (SAHRA) to ensure that appropriate recording and, where necessary, collection can be undertaken by a qualified palaeontologist.

These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the Tetra4 Seismic Survey Project, as well as included as conditions for Environmental Authorisation.

Mitigation measures

Mitigation measures are described in **Table 10**.

Conclusion

It is the combined considered opinion of the heritage specialists that the proposed project will have no direct impact on any known cultural heritage resources. With the implementation of recommended mitigation measures in case of a chance find, the overall impact on heritage resources will be reduced to acceptable levels during the activities of the project.

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ABBREVIATIONS AND TERMINOLOGY

Abbreviations	Description
AD	Anno Domini
AIA	Archaeological Impact Assessment
APHP	Association of Professional Heritage Practitioners
ASAPA	Association of South African Professional Archaeologists
BA	Basic Assessment
BGG	Burial Ground and Graves
CFP	Chance Finds Procedure
CRM	Cultural Resource Management
CVs	Curriculum Vitae
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorization
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
EMPr	Environmental Management Program
ESA	Early Stone Age
ESRI	Environmental Systems Research Institute
GN 320	Government Notice 320 (Government Gazette 43110, 20 March 2020)
GN 326	Government Notice 326 (Government Gazette 40772, 7 April 2017)
GN 982	Government Notice 982 (Government Gazette 38282, 4 December 2014)
GPS	Global Positioning System
HIA	Heritage Impact Assessment
KNARIA	KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No. 5 of 2018)
IAIAsa	International Association for Impact Assessment
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
NCW	Not Conservation Worthy
NEMA	National Environmental Management Act (Act 107 of 1998) as amended
NHRA	National Heritage Resources Act (Act 25 of 1999) as amended
PDA	Paleontological Desktop Assessment
PGS	PGS Heritage (Pty) Ltd
PIA	Paleontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PR	Prospecting Right
PSSA	Palaeontological Society of South Africa
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures,
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10 m of such representation,
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritime Zones Act (Act 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which the South African Heritage Resources Agency considers to be worthy of conservation,
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

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

Development

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

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

Early Stone Age

The archaeology of the earlier stone age between 700 000 and 2 500 000 years ago (Refer **Figure 1**).

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 (Act 25 of 1999) as amended.

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under section 3 of the National Heritage Resources Act (Act 25 of 1999) as amended,

- places, buildings, structures and equipment of cultural significance,
- places to which oral traditions are attached, or which are associated with living heritage,
- historical settlements and townscapes,
- landscapes and natural features of cultural significance,
- geological sites of scientific or cultural importance,
- archaeological and palaeontological sites,
- graves and burial grounds and
- sites of significance relating to the history of slavery in South Africa.

Holocene

The most recent geological time period which commenced 12 000 years ago (Refer **Figure 1**).

Late Stone Age

The archaeology of the later stone age associated with fully modern people during the last 30 000 years (Refer **Figure 1**).

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with settled lifeways, iron-working and farming activities such as herding and agriculture (Refer **Figure 1**).

Middle Stone Age

The archaeology of the middle stone age between 30 000-300 000 years ago, associated with early modern humans (Refer **Figure 1**).

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.

Tracklogs

Movements during field survey documented by means of Global Positioning System.

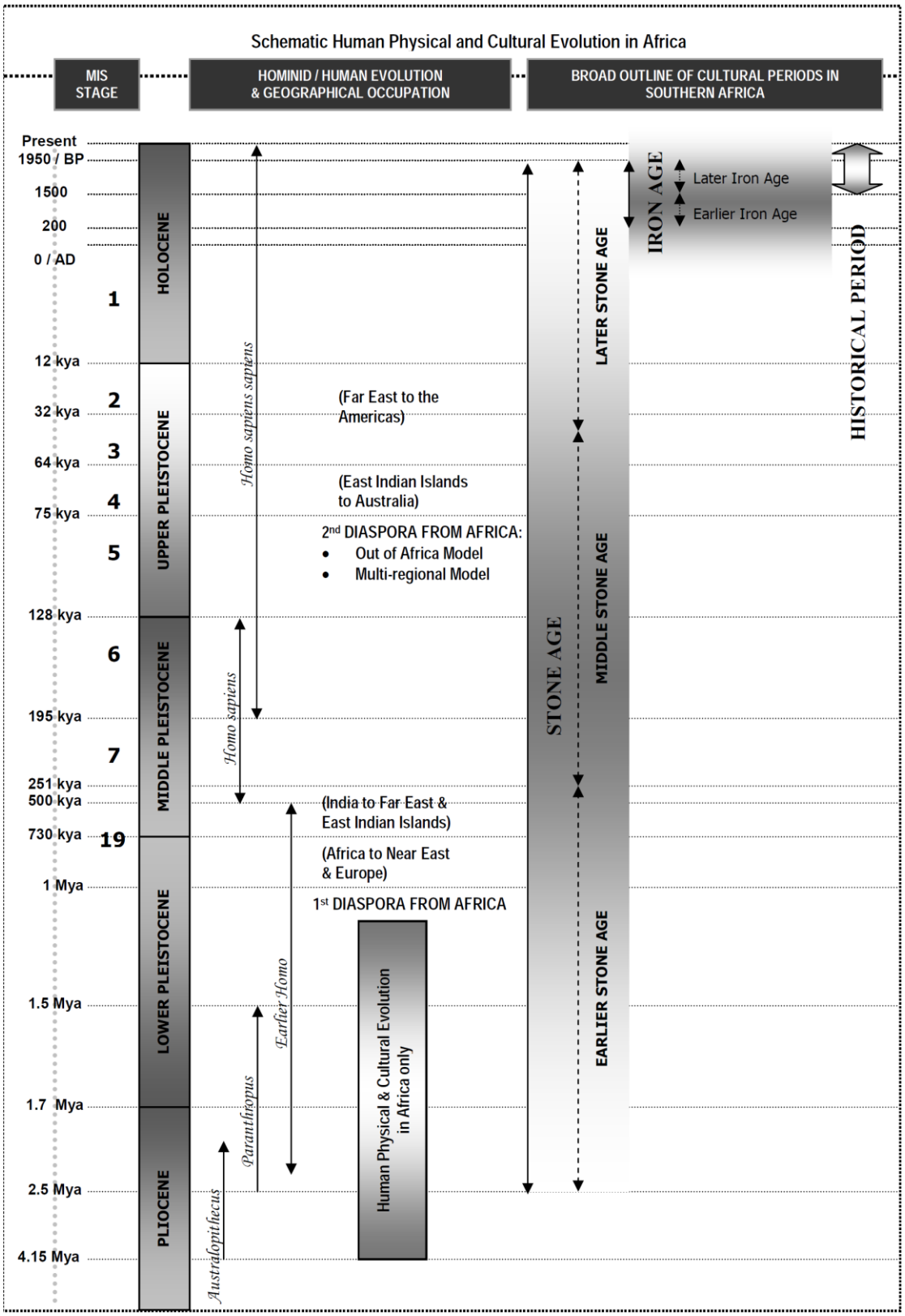

Figure 1 – Human and Cultural Timeline in Africa.

1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by Environmental Impact Management Services (Pty) Ltd. (EIMS) to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Authorisation application, Phase 2 Seismic Survey investigations by Tetra4/Renergen Ltd., on multiple farm portions. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province.

1.1 Scope of the Study

The aim of the study is to identify heritage sites and finds that may occur in the proposed project area. The HIA aims to inform the Environmental Authorisation (EA) to assist the developer in managing the discovered heritage resources in a responsible manner, to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act (25 of 1999) as amended (NHRA).

1.2 Specialist Qualifications

This HIA report was compiled by PGS.

The staff at PGS has a combined experience of over 100 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Alexander Andreou, Heritage Advisory Unit Manager, wields over a decade of transdisciplinary experience within the heritage resources management sector. He specialises in spatial biographies and urban archaeology. He holds an MPhil in Conservation of the Built Environment from the University of Cape Town, and a PhD in Development Studies, in the sub-field of Critical Architecture and Urbanism from the University of Pretoria. He is a registered member of the Association of Professional Heritage Practitioners (APHP), Association of Southern African Professional Archaeologists (APHP), The Historical Association of South Africa (HASA), and The International Association for Impact Assessment (IAIAsa).

Wouter Fourie, Principal Heritage Specialist, brings over 27 years of expertise in heritage resource management and has been a specialist consultant on numerous high-profile projects across Southern Africa, focusing on tailored heritage solutions for the mining, water, and oil and gas sectors. He holds a BA (Honours) (Cum Laude) in Archaeology from the University of Pretoria and an MPhil in the Conservation of the Built Environment from the University of Cape Town. Accredited as a Professional Heritage Practitioner by the Association of Professional Heritage Practitioners (APHP), he is also recognised as a Professional Archaeologist by the Association of Southern African Professional Archaeologists (ASAPA). He holds CRM grading as a Principal Investigator in Grave Relocations, Iron Age and Stone Age archaeology and as a Field Director in Colonial Period Archaeology. Notably, Wouter is the first chair of ASAPA elected from the Cultural Resource Management (CRM) industry.

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, amongst others the subterranean nature of some archaeological sites and existing vegetation cover. However, most of the study area was accessible for the fieldwork survey.

Fieldwork was also focussed on areas that were not previously disturbed by farming/construction/mining, thus concentrating on areas with the highest potential to yield indications of the possible presence of heritage resources.

Therefore, should any heritage features and/or objects be located or observed outside the identified heritage sensitive areas during construction activities, a heritage specialist must be contacted immediately. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time as the heritage specialist has been able to make an assessment of the significance of the site (or material) in question. This also applies to Burial Grounds and Graves (BGG). If any BGG are located or observed during the course of the development, the procedures and requirements pertaining to BGG will apply as set out below.

1.4 Legislative Context

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

- Government Notice 320 (Government Gazette 43110, 20 March 2020) (GN 320) - general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified,
- EIA Regulations (Government Notice 982 (Government Gazette 38282, 4 December 2014)) Appendix 6 (GN 982) as amended by GN 517 of 11 June 2021 (Government Gazette 444701, 11 June 2021) (GN 517),
- NHRA.

1.4.1 Government Notice 320 (Government Gazette 43110, 20 March 2020)

Although minimum standards for Archaeological Impact Assessment (AIA) (2007) and Paleontological Impact Assessment (PIA) (2012) were published by the South African Heritage Resources Agency (SAHRA), GN 320 requires sensitivity verification for a site, for which no specific assessment protocol related to any

theme has been identified, on the national web based environmental screening tool. The requirements for GN 320 are listed in **Table 1** and the applicable section in this report noted.

Table 1: Reporting requirements for GN 320.

GN 320	**Relevant section in report**	**Where not applicable in this report**
2.2 (a) a desktop analysis, using satellite imagery;	**section 4**	
2.2 (b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.	**section 4.2**	
2.3(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web-based environmental screening tool;	**section 4.1**	
2.3(b) contains motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity;	**section 4.2**	

1.4.2 Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended by Government Notice 517 (Government Gazette 444701, 11 June 2021) requirements

This HIA report has been compiled considering the GN 326 and 517 Appendix 6 requirements for specialist reports.

1.4.3 Heritage screening - Department of Forestry, Fisheries and the Environment

A heritage screening was conducted by means of the Department of Forestry, Fisheries and the Environment (DFFE) National Web-based Environmental Screening Tool as required by GN 982**.**

DFFE issued guidelines in April 2025 concerning the application of the screening tool in relation to cultural heritage, archaeology, and palaeontological themes. The guidelines indicate that the "theme layer represents a limited number of known" heritage and palaeontological resources. These resources are widely distributed and may be present at any development site within South Africa. The guidelines state the following in terms of -

- HIA "*Therefore, a Heritage Impact Assessment (HIA) must be undertaken for all developments, irrespective of the sensitivity shown on the archaeological and cultural heritage theme layer*"
- PIA "*Therefore, a Palaeontological Impact Assessments (PIAs)* [sic] *must be undertaken for all developments as per the PalaeoSensitivity Map provided on* [South African Heritage Resources Information System] *SAHRIS, irrespective of the sensitivity shown on the palaeontology theme layer."*

The guidelines further stipulate the requirements for both an HIA and PIA must:

HIA	PIA
▪ meet the requirements of section 38(3) of the NHRA or section 41(1) of the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No. 5 of 2018) (KNARIA), should the development be in KwaZulu-Natal (KZN); ▪ must be undertaken by a qualified heritage specialist; ▪ be undertaken in line with GN 326 Appendix 6; and ▪ for HIA submitted to SAHRA the report must also comply with the requirements of the "2007 Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports", accessible at https://sahris.sahra.org.za.	▪ meet the requirements of section 38(3) of the NHRA or section 41(1) of the KNARIA should the development be in KZN; ▪ must be undertaken by a qualified palaeontological specialist; ▪ be undertaken in line with GN 326 Appendix 6; and ▪ for PIA submitted to SAHRA, the report must comply with the requirements of the "2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments" [sic], accessible at https://sahris.sahra.org.za.

According to the heritage screening report, the project area has a Low Heritage Sensitivity (

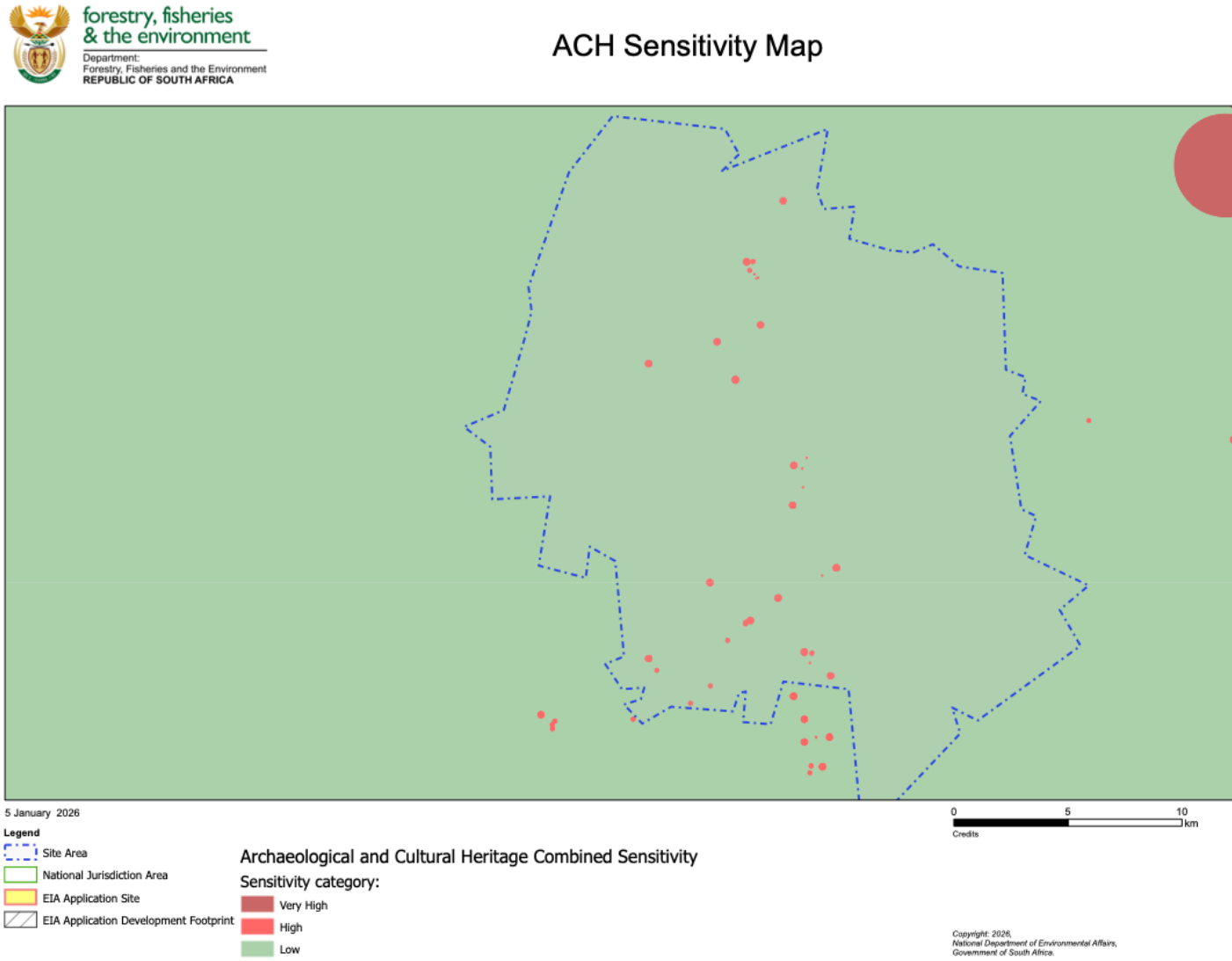

Figure 25 – DFFE Screening map indicating a **low** sensitivity rating for archaeology and heritage.). The fieldwork is in agreement with the screening tool as no heritage resources were located within the study area.

1.4.4 National Heritage Resources Act (Act 25 of 1999) as amended

- Protection of Heritage Resources – sections 34 to 36; and
- Heritage Resources Management – section 38.

The NHRA is utilised as the basis for the identification, evaluation, and management of heritage resources and in the case of Cultural Resources Management (CRM) those resources specifically impacted on by development as stipulated in section 38 of the NHRA. This study falls under section 38(8) and requires comment from the relevant heritage resources authority.

Section 24(2) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA) requires environmental authorisation from the environmental authority for certain activities that have been identified

and must undergo an EIA or BA process. Similarly, section 38 of the NHRA lists specific development activities that require notice to the heritage resources authority to determine if an HIA process is necessary. Approval from the heritage authority is mandatory before proceeding with the development activities.

To avoid redundancy and facilitate co-ordination between NEMA and NHRA requirements, section 38(8) of the NHRA states that if the development activities listed in section 38(1) require an EIA under NEMA; a separate HIA and approval from the heritage resources authority are unnecessary. However, the environmental authority must ensure that the heritage resources authority's requirements for HIA are fulfilled and that its comments and recommendations are considered before granting environmental authorisation.

Therefore, if a NEMA EIA is required for the development activities listed under section 38 of the NHRA, separate HIA and EIA processes may not be followed, and different decisions may not be issued under NHRA and NEMA. The EIA process will be followed, and if the heritage resources authority requires a HIA, it must be conducted as one of the EIA specialist studies.

The environmental authority must ensure that the heritage resources authority's requirements for the assessment are met. A separate heritage approval may not be issued, but the environmental authority must consider the heritage resources authority's comments and recommendations before granting or refusing environmental authorisation.

It must, however, be noted that if no environmental process is required, but the proposed development still triggers the requirements for an HIA under section 38(1) of the NHRA, SAHRA or the relevant provincial heritage authority will be the authorising authority. This entity could then require a full HIA, taking into account the requirements for public participation and stakeholder engagement as stipulated by the regulations of the NHRA.

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Locality

The project area spans ~27 500 ha across multiple Farms within Ward 36 of the Matjhabeng Local Municipality, under the jurisdiction of the Lejweleputswa District Municipality. The site boundary is approximately 9,75km south of Welkom, 4,86km east of Virgina, and 16km north of Theunisen in the Free State Province of South Africa (**Figure 4**).

2.2 Technical Project Description

2.2.1 Project description[1]

The Cluster 2 EA authorised various production well transects where drilling could occur with little to no specific drilling locations which resulted in some uncertainty from landowners. In order to mitigate this uncertainty and provide landowners with specific drilling locations, Tetra4 proposes undertaking a 3D seismic survey over the Cluster 2 area which would provide a high resolution subsurface geological profile and enable Tetra4 to visualise gas placement in the sub-surface and thereby enable more accurate identification of proposed drill sites on specific properties.

The process for a 3D seismic survey starts with creating a controlled sound wave or vibration at the surface, along the Source lines, as shown in the map below (**Figure 3** green lines). This is often done using specialized vibroseis trucks that press a heavy plate onto the ground and vibrate it. The seismic survey within Cluster 2 will be executed using vibroseis source vehicles operating along parallel survey lines spaced 30 meters apart. These sound waves travel down through the layers of rock and sediment beneath the surface. As the sound waves hit the boundaries between different rock layers, some of the energy reflects. Highly sensitive sensors—called geophones — are spread out in a large, systematic grid pattern (the 3-D part) over the survey area to record these returning sound waves (blue lines in **Figure 3**). Finally, computers measure the exact time it takes for the sound wave to travel down, reflect off a layer, and return to all the different sensors. Since the sensors are arranged in a large grid, the computer can process the time measurements to create a detailed, three-dimensional model of the subsurface geology. This model shows the shape, depth, and type of underground rock formations, assisting in the location of helium and natural gas pockets.

Figure 2 - Vibroseis vehicle on site, provide by EIMS.

[1] As provided by Environmental Impact Management Services (Pty) Ltd.

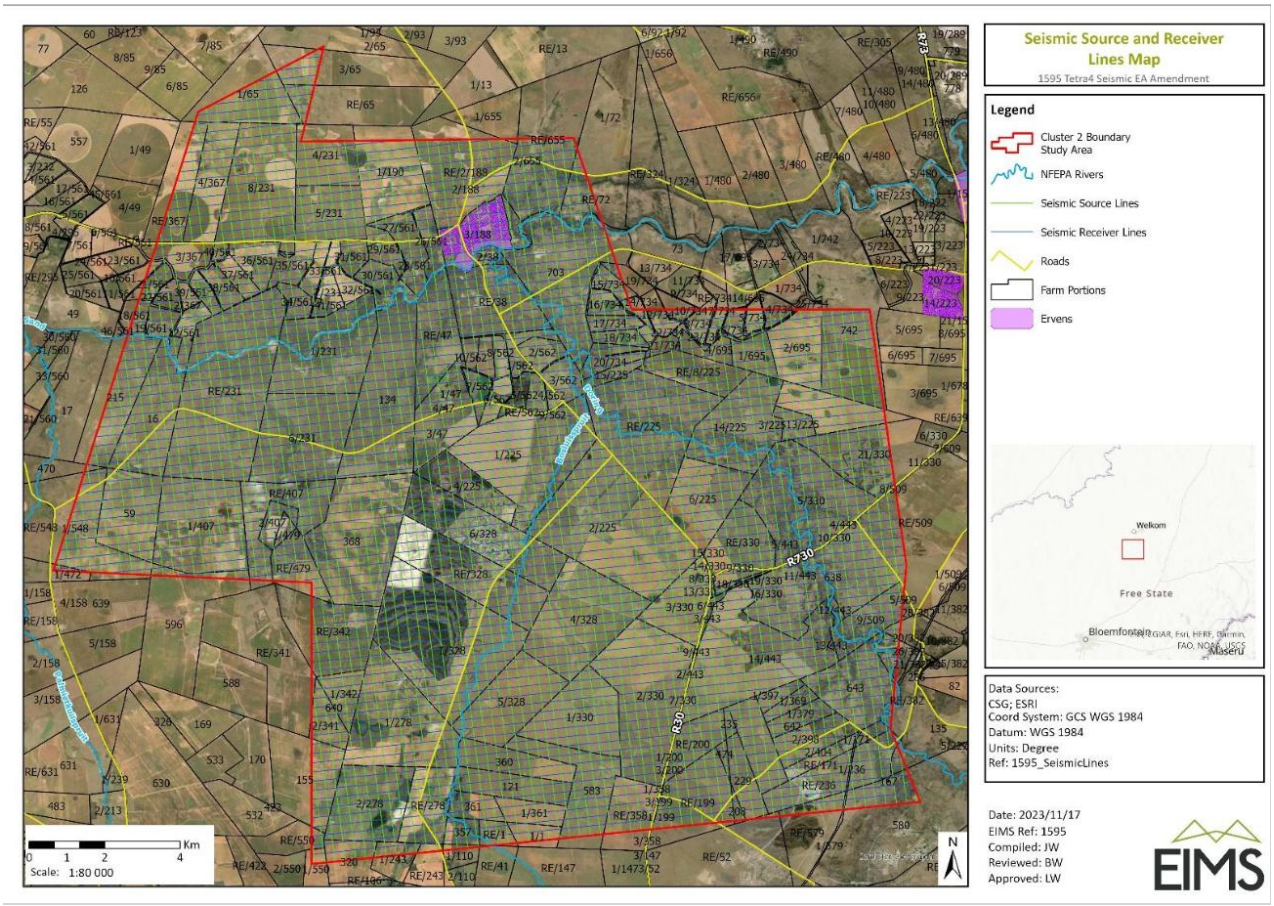

Figure 3 - Seismic Source and Receiver Lines Map as supplied by EIMS.

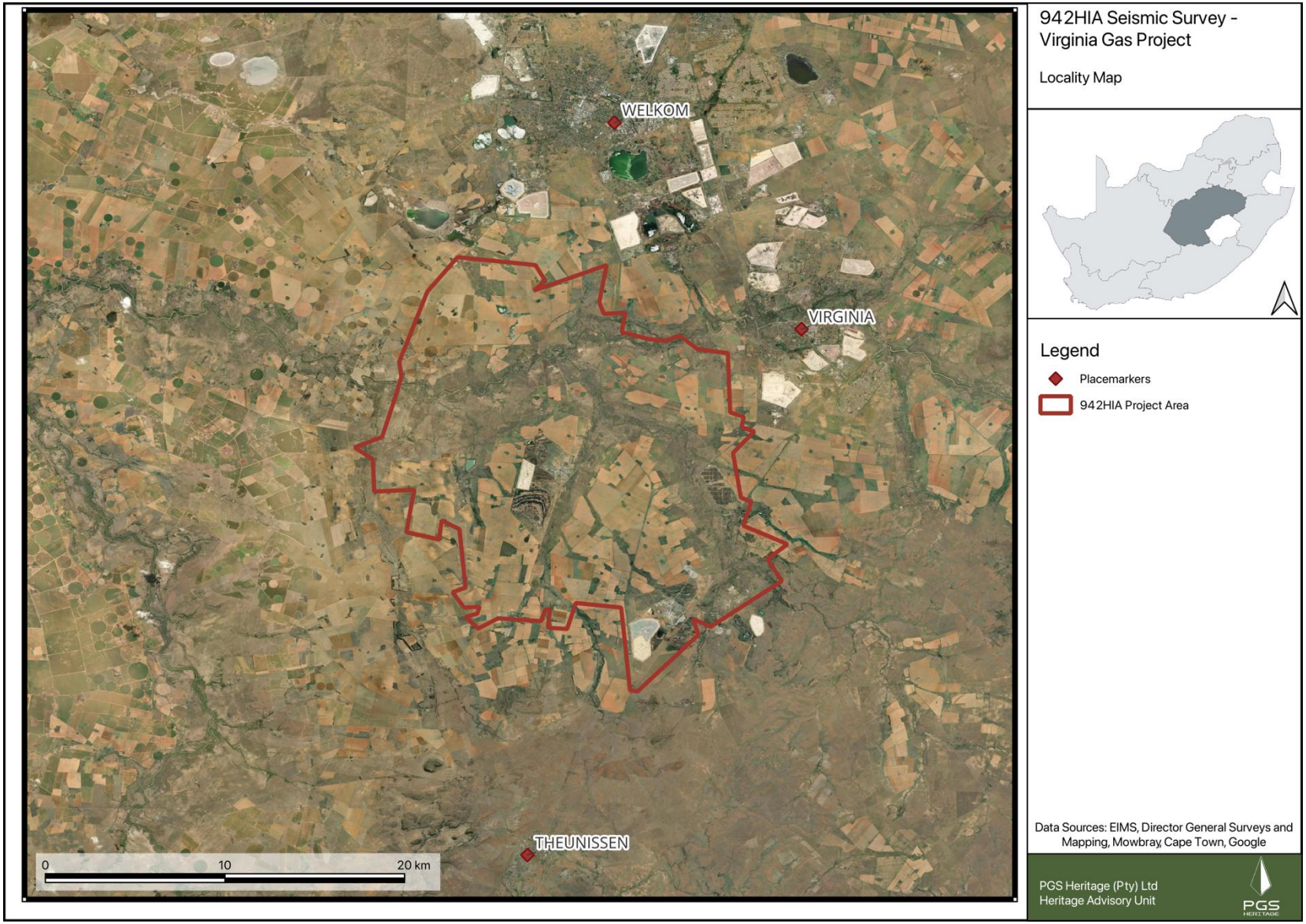

Figure 4 - Regional Locality of the study area.

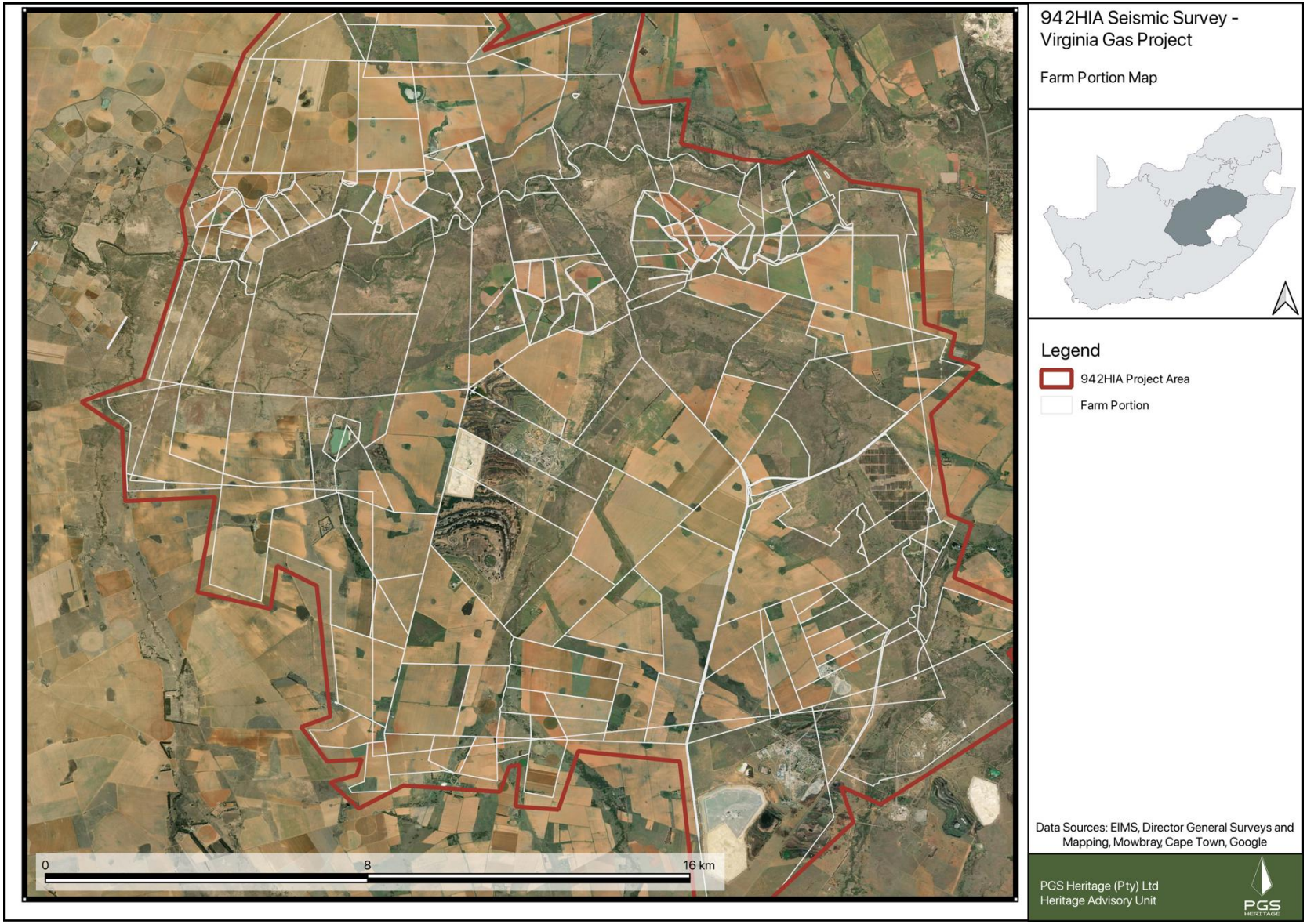

Figure 5 – Cluster 2 Site extent, demarcating farm portions.

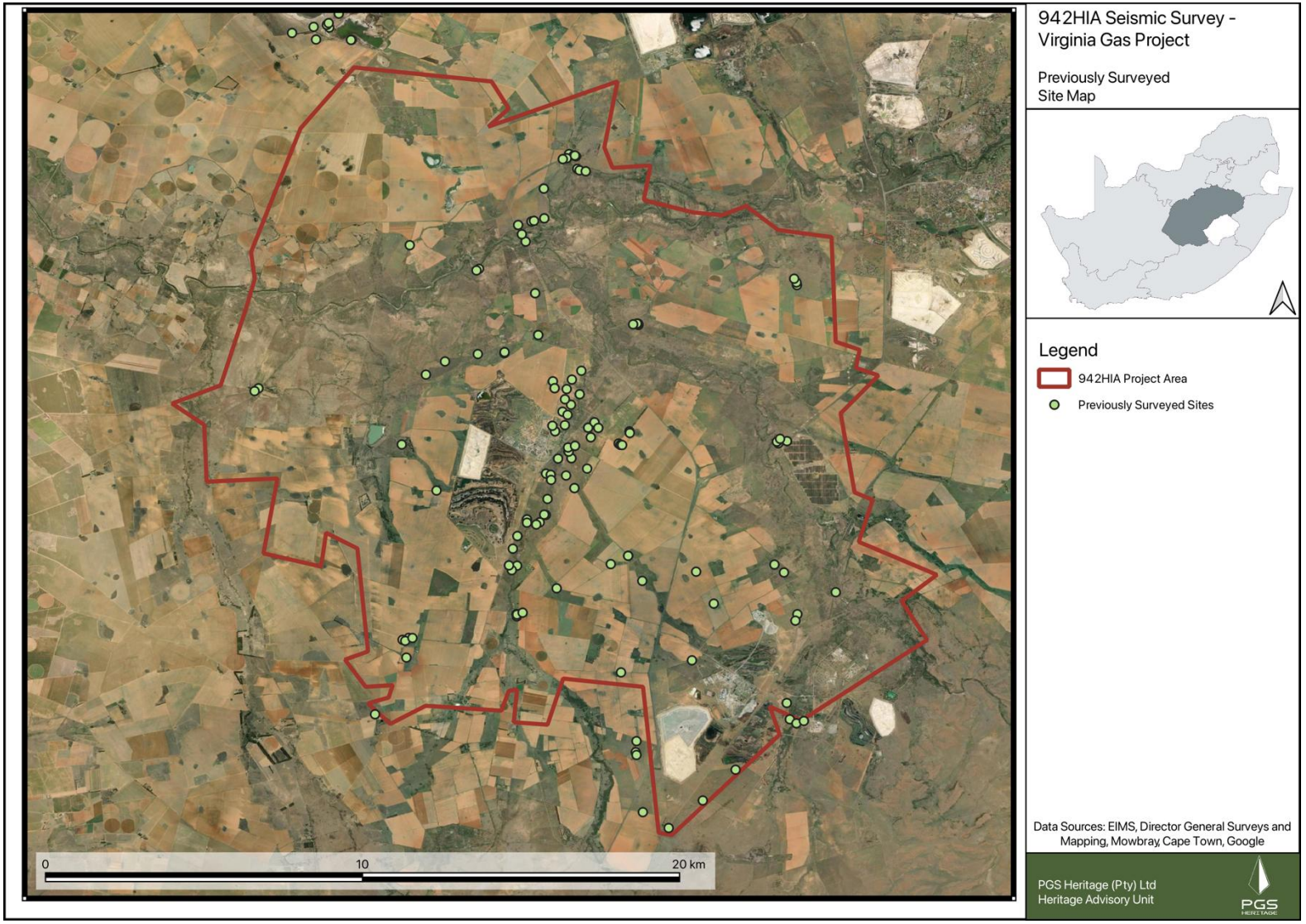

Figure 6 -Cluster 2 Site extent, demarcating previously surveyed sites for Cluster 1.

3 ASSESSMENT METHODOLOGY

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

3.1 Methodology for Assessing Heritage Site significance

This HIA report was compiled by PGS for the proposed Tetra4 Seismic Survey project. The applicable maps, tables and figures are included, as stipulated in the NHRA and NEMA. The HIA process consists of three steps:

Step I – Literature Review and initial site analysis: The background information to the field survey is informed by the Heritage Background Research which was undertaken through archival research and evaluation of satellite imagery and topographical maps of the study area.

Step II – Physical Survey: A physical survey was conducted by a combination of vehicle and pedestrian access through the proposed project area by one qualified heritage specialist and one field assistant and was aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant heritage resources identified in the physical survey, the assessment of these resources in terms of the HIA criteria and reporting, as well as mapping and constructive recommendations.

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 - <10/50 m^2
    - Medium - 10-50/50 m^2
    - High - >50/50 m^2
- Uniqueness and
- Potential to answer present research questions.

Impacts on these sites by the development will be evaluated as follows:

3.1.1 Site Significance

The applied site significance classification standards are based on the heritage classification of section 3 of the NHRA and developed for implementation according to the grading system approved by SAHRA for HIA. The updated classification and rating system as developed by Heritage Western Cape (HWC) (2021) was

implemented in this report. Site significance classification standards prescribed by the HWC Guideline (2016), were used for the purposes of this report (**Table 2** and **Table 3**).

Table 2: Rating system for archaeological resources.

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by a Provincial Heritage Authority (PHRA). Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the NHRA but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
Not Conservation Worthy (NCW)	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 3: Rating system for built environment resources.

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the NHRA but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs. These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e. in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 of the NHRA can even be lifted by HWC for structures in this category if they are older than 60 years.	No research potential or other cultural significance

3.2 Methodology used in determining the significance of environmental impacts

The methodology used to determine the environmental impact significance was provided EIMS and is explained in **Appendix A**.

4 CURRENT STATUS QUO

4.1 Site Description

4.1.1 Biome Overview

The study area is situated within the Grassland Biome as defined by Rutherford and Westfall, and more specifically within the Central Free State Grassland vegetation type (Rutherford & Westfall, 1994; Mucina & Rutherford, 2006). This vegetation unit is characterised by a dominance of perennial C_4 grasses with a generally low shrub and tree component, occurring on flat to gently undulating terrain under semi-arid climatic conditions. Typical species include *Themeda triandra*, *Eragrostis curvula*, and *Aristida* spp., with local variation influenced by soil depth, grazing pressure, and land-use history (Mucina & Rutherford, 2006). Much of the natural vegetation in the area has been transformed or degraded by agriculture, grazing, and associated infrastructure, resulting in secondary grassland and disturbed vegetation along access routes (Rutherford et al., 2012).

The topography of the project area and surrounding landscape is generally flat to gently undulating, characteristic of the central Free State interior plateau (Partridge et al., 2010). Elevation changes are subtle, with broad plains locally dissected by shallow drainage lines and minor seasonal watercourses. Slopes are generally low and uniform, and no prominent ridgelines or steep terrain features occur along the proposed access road alignment. This subdued relief reflects long-term erosional processes acting on relatively homogeneous sedimentary geology and underpins the dominance of extensive agricultural land use across the region (Partridge et al., 2010).

4.1.2 Geological and Palaeontological Overview

Underlying the superficial deposits are sedimentary rocks of the Adelaide Subgroup (Beaufort Group), consisting predominantly of sandstones, mudstones, and shales deposited in fluvial environments. The

Beaufort Group represents the third major subdivision of the Karoo Supergroup, overlying the Ecca Group, and was deposited from the Middle Permian to the early Middle Triassic. It constitutes the first fully continental succession of the Karoo Basin and covers approximately 200 000 km² in South Africa. The Beaufort Group is subdivided into the lower Adelaide Subgroup and the overlying Tarkastad Subgroup. Sedimentation within the Adelaide Subgroup occurred under humid climatic conditions on wet floodplains with high water tables and is interpreted as fluvio-lacustrine in origin. The subgroup reaches thicknesses of up to 5 000 m in the southeastern Karoo Basin, thinning to approximately 800 m in the basin centre and to 100–200 m toward the northern margins.

The Adelaide Subgroup is characterised by alternating greyish-red, bluish-grey, and greenish-grey mudrocks interbedded with very fine- to medium-grained lithofeldspathic sandstones. Thicker sandstone units are commonly multistorey and exhibit cut-and-fill architectures. Internal sedimentary structures include horizontal lamination, parting lineation, trough cross-bedding, and ripple lamination, with ripples typically confined to thinner sandstones near the tops of thicker units. Mudrocks generally weather to massive, blocky forms and may preserve desiccation cracks and raindrop impressions. Calcareous nodules and concretions are widespread throughout Beaufort Group mudstones.

The floodplain deposits of the Beaufort Group are internationally renowned for documenting the early diversification of terrestrial vertebrates and provide the most complete fossil record globally of the transition from early reptiles to mammals. The Beaufort Group is subdivided into a series of vertebrate assemblage zones based on faunal content (Kitching, 1977, 1978; Keyser et al., 1977; Rubidge, 1995; Smith et al., 2020; Viglietti, 2020; Figure 7). A portion of the proposed development area is underlain by the Balfour Formation, which falls within the *Daptocephalu*s Assemblage Zone (DAZ). This Assemblage Zone is further subdivided into the lower *Dicynodon–Theriognathus* Subzone and the upper *Lystrosaurus maccaigi–Moschorhinus kitchingi* Subzone.

The dicynodont *Daptocephalus leoniceps* is the index fossil defining the *Daptocephalus* Assemblage Zone. This Assemblage Zone is characterised by the co-occurrence of *Daptocephalus leoniceps*, the therocephalian *Theriognathus microps*, and the cynodont *Procynosuchus delaharpeae*. The lower *Dicynodon–Theriognathus* Subzone contains *Dicynodon* and *Theriognathus* in association with *Daptocephalus*, while the upper *Lystrosaurus maccaigi–Moschorhinus kitchingi* Subzone is defined by the presence of *Lystrosaurus maccaigi*, *Daptocephalus*, and *Moschorhinus*. The *Daptocephalus* Assemblage Zone displays the highest vertebrate diversity within the Beaufort Group and includes numerous well-preserved dicynodonts, biarmosuchians, gorgonopsians, therocephalians, and cynodont therapsids. Captorhinid reptiles are also present, while eosuchian reptiles, amphibians, and fish are comparatively rare. Trace fossils and *Glossopteris* flora have also been documented.

The *Daptocephalus* Assemblage Zone extends into the lower Palingkloof Member of the Upper Balfour Formation. This interval is of particular significance as it immediately precedes the Permo–Triassic mass extinction event, which resulted in the collapse of terrestrial vertebrate ecosystems and the extinction of

glossopterid plant communities. The overlying *Lystrosaurus declivis* Assemblage Zone forms part of the Katberg Formation and records a marked reduction in faunal diversity. Fossil assemblages from this interval are dominated by *Lystrosaurus* and *Procolophon*, with reduced representation of other therapsids. Large amphibians are characteristic of this interval, and fossil fish, millipedes, and diverse trace fossils have also been recorded.

The study area is partially underlain by rocks of the Karoo Igneous Province, one of the world's classic continental flood basalt provinces. This province comprises extensive intrusive and extrusive igneous rocks emplaced over a large area of southern Africa (Duncan et al., 2006). Flood basalts typically formed through repeated fissure eruptions, producing sub-horizontal lava flows, sills, and dykes of variable thickness rather than prominent volcanic edifices. These lavas once formed a near-continuous cap across much of southern Africa but are now preserved as erosional remnants. The present outcrop area of Karoo lavas is approximately 140 000 km², although they are estimated to have originally covered up to 2 000 000 km² (Cox, 1970, 1972).

In addition to basaltic lavas, the Karoo Igneous Province includes significant volumes of silicic volcanic rocks composed of rhyodacitic and rhyolitic magmas, particularly along the Lebombo monocline. Individual silicic units may extend for up to 60 km and often display massive pyroclastic textures, leading to their classification as rheoignimbrites. The basal lavas generally lie conformably on the Clarens Formation, although localised pre-volcanic erosion of Clarens sandstones has been documented. Early stages of volcanism involved interaction between magma and groundwater, resulting in volcaniclastic deposits and phreatic to phreatomagmatic diatremes (Lock et al., 1974). Additional evidence for aqueous environments during early volcanism includes pillow lavas, hyaloclastite breccias, and thin lenses of fluviatile sandstones interbedded with the lowermost lava flows (Eales et al., 1984). As igneous rocks, these units are unfossiliferous.

The Quaternary Period, often referred to as the "Age of Mammals," is preserved in South Africa across a range of depositional environments, including coastal plains (e.g. Langebaanweg), cave systems (e.g. Makapan), river gravel terraces (e.g. Cornelia), and other sedimentary basins. African Quaternary deposits are subdivided into six Land Mammal Ages: Recent, Florisian, Cornelian, Makapanian, Langebaanian, and Namibian (MacRae, 1999). In the Free State Province, Quaternary fossil assemblages are best documented from the Florisbad and Cornelia localities, where fossils include mammalian teeth and bones, fish, reptiles, freshwater molluscs, trace fossils, fossil wood, rhizoliths, and diatom floras (Groenewald & Groenewald, 2014).

The Virginia–Welkom District is well known for fluvial deposits associated with present-day river systems. These terrestrial sediments include diatomite, calcareous tufa, pedocretes, peats, spring deposits, soils, gravels, and other Tertiary calcrete deposits, which are important for reconstructing Early to Late Pliocene environments in the region (De Ruiter et al., 2010). Late Cenozoic (Plio-Pleistocene) floodplain deposits and pan sites associated with the Sand, Doring, Vals, and Vet river systems have yielded confined but locally abundant vertebrate fossil assemblages. In 1955, Meiring described an in-situ proboscidean fossil recovered

from pebbly channel-fill sediments along the Sand River near Virginia, approximately 40 m above the modern riverbed. The specimen comprised a lower molar, part of a tusk, and a proximal portion of an ulna. Initially described as *Archidiskodon scotti* (Meiring, 1955), it was subsequently reassigned to the Pliocene species *Mammuthus subplanifrons* (Coppens et al., 1978). Later investigations documented a diverse associated fauna, including amphibians, birds, fish, reptiles, and several proboscideans, perissodactyl, and artiodactyl taxa (De Ruiter, 2010).

Terrace gravels above the Vet River southwest of Welkom have yielded Pliocene fossil material, while surveys along the Doring, Vals, Sand, and Vet rivers recorded moderately fossiliferous overbank sediments and erosional gullies containing a variety of Quaternary-aged mammal fossils (Brink et al., 1999; De Ruiter et al., 2011). Ancient pan sites, such as those near Whites, have produced rich Quaternary mammal assemblages. Although Quaternary fossils are generally rare and discontinuous, they may include mammalian teeth and bones, ostrich eggshell fragments, tortoise remains, ostracods, diatoms, reptile skeletons, and a range of trace fossils, including burrows, vertebrate tracks, rhizoliths, and calcretised termite mounds. Plant remains may include leaves, seeds, wood fragments, and pollen. Microfossils and vertebrate remains are most commonly associated with Quaternary deposits near drainage lines and watercourses.

The superficial deposits represent the youngest geological materials, formed during approximately the last 2.6 million years. These deposits are typically unconsolidated and consist of clay, gravel, sand, and silt, occurring as thin, discontinuous patches or more extensive sedimentary spreads. They include channel, floodplain, stream, talus, and glacial drift deposits. Quaternary sediments are of particular scientific importance as they record palaeoclimatic fluctuations and associated geomorphological changes. Most present-day landforms in southern Africa developed during the Quaternary in response to alternating climatic conditions (Hunter et al., 2006; Maud, 2012). Barnosky (2005) demonstrated that Quaternary climate variability, particularly over the last 1.8 million years, was more pronounced than during earlier periods, resulting in significant changes in river dynamics, sedimentation patterns, and vegetation distribution (Tooth et al., 2004).

4.1.3 Archaeological and Historical Overview

DATE	DESCRIPTION
The Study Area during the Stone Age	
Very little is known about the Stone Age archaeology of the study area and its immediate surroundings. In the wider surroundings, probably the most significant Stone Age is at Florisbad, located roughly 78 km south-west of the present study area. Closer to the study area, a number of Middle and Later Stone Age material in associated with mammal fossil remains have been identified in erosion gullies along the Sand, Doring and Vet Rivers between Virginia and Theunissen (De Ruiter *et. al.* 2011). See also Rossouw (n.d.).	
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these 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

DATE	DESCRIPTION
	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 information regarding ESA sites from the study area and surroundings was found.
>250 000 to 40 000 years ago	The Middle Stone Age (MSA) is associated with flakes, points and blades manufactured by means of the prepared core technique. This phase is furthermore associated with modern humans and complex cognition (Wadley, 2013). During research fieldwork by the National Museum in Bloemfontein, ten sites were recorded where Middle Stone Age and/or Later Stone Age lithics were identified in association with mammal fossil remains from erosion gullies along the Sand, Vet and Doring Rivers (De Ruiter *et. al.* 2011).

Figure 7 – Photograph of the archaeological field survey as published in De Ruiter et. al. (2011).

40 000 years ago, to c. 1800s	The Later Stone Age (LSA) is the third archaeological phase identified and is characterised by an abundance of very small stone tools known as microliths as well many rock art sites across the country. This period is associated with hunter-gatherers (San) as well as early pastoralists (Khoekhoe) and lasted up until - and in many cases a considerable number of years after – the arrival of Iron Age and European communities. Apart from the occurrence of Later Stone Age lithics along the Sand, Vet and Doring Rivers (see above), no other Later Stone Age sites are known from the surroundings of the study area. Similarly, no known rock art sites are known from the study area or its wider surroundings.

The Study Area during the Iron Age

The arrival of early farming communities during the first millendium, heralded in the start of the Iron Age for South Africa. The Iron Age is that period in South Africa's archaeological history associated with pre-colonial farming communities associated with agricultural and pastoralsit farming activites, metal working, cultural customs such as lobola as well as the tangible representation of the significance of cattle imprinted on their settlement layouts (known as the Central Cattle Pattern) (Huffman, 2007).
According to the distribution map for Iron Age settlements on the Southern Highveld as published in Maggs (1976), the study area is located to the west of the known distribution of such Late Iron Age sites. It is therefore unlikely for any Late Iron Age sites to be located within the study area or its immediate surroundings. This surmise is largely supported by the distribution maps as published by Huffman (2007),

DATE	DESCRIPTION
albeit these latter distribution maps (which are based on known archaeological information) indicate that the study area is located very close to the periphery of two Iron Age facies. For the sake of completeness, these two Iron Age facies, known as Thabeng and Makgwareng, will be presented here.	
AD 1700 – AD 1840	The Thabeng facies of the Moloko Branch of the Urewe Tradition is one of the facies identified within the wider region. The decoration on the ceramics associated with this facies is characterised by incised triangles, coloured chevrons and arcades. The Tlhaping at Dithakong, Rolong at Platberg and the Kubung from the Free State form a Southwestern Sotho-Tswana cluster that is associated with this Thabeng facies pottery and Type Z settlement layouts (Huffman, 2007). The Type Z settlements are one of the Late Iron Age stonewalled settlement types identified by Tim Maggs during his extensive archaeological research project on the Iron Age of the southern Highveld, which includes the present study area (Maggs, 1976). These sites are characterised by large primary enclosures enclosed by a 'discontinuous ring' of characteristic bilobial dwellings. Each of these bilobial dwellings comprises a hut at its front with a semi-circular courtyard at the back. With the area in front of the hut enclosed by a low stone wall and the courtyard at the back similarly enclosed by a smaller enclosure, the layout plan of these huts comprises two lobes, one larger than the other. The huts are defined by a ring of upright stones and are usually paved with flat stones. Unlike Type V settlements (see below), corbelled hut are rarely associated with these Type Z settlements, and appear to be the result of contact with the Type V settlements located to the east. One of the more prominent ones is OXF1, located a short distance north-west of the town of Ventersburg. This site was excavated by Tim Maggs during the 1970s as part of his overall research project alluded to above (Maggs, 1976). In his conclusions on the history of his entire study area, Maggs (1976:317) states that "…*the conclusion seems inescapable that the Kubung were the builders of Type Z. This conclusion could be put forward on the typological evidence alone, for the Kubung are the only known off-shoot of the Rolong to have settled in our area, and the Type Z industry was clearly the work of a group related to the Rolong*."

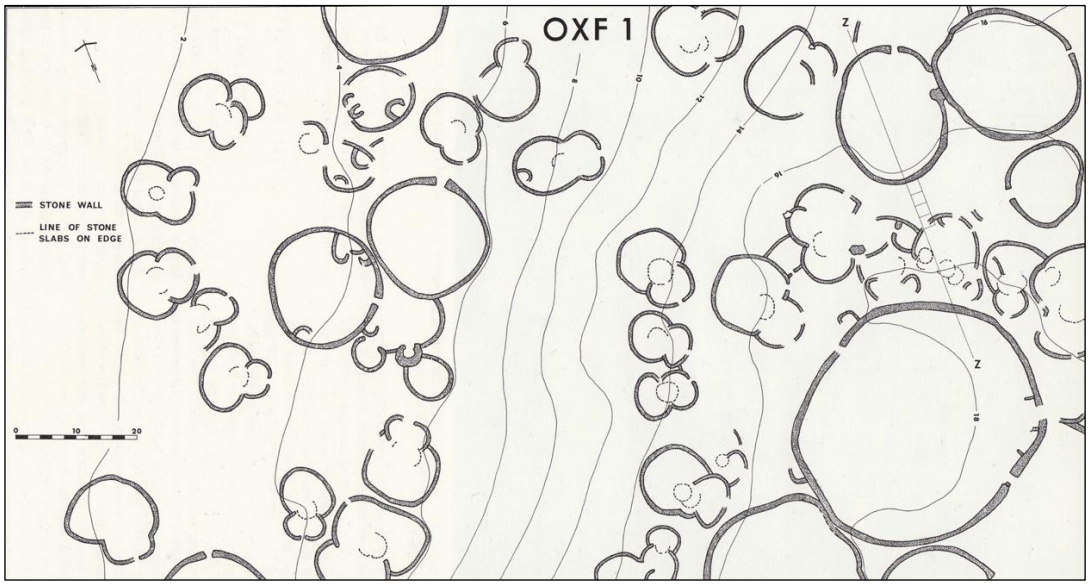

Figure 8 - This plan depicts the settlement layout of a typical Type Z site, and was recorded at site OXF 1 (Maggs, 1976:233).

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	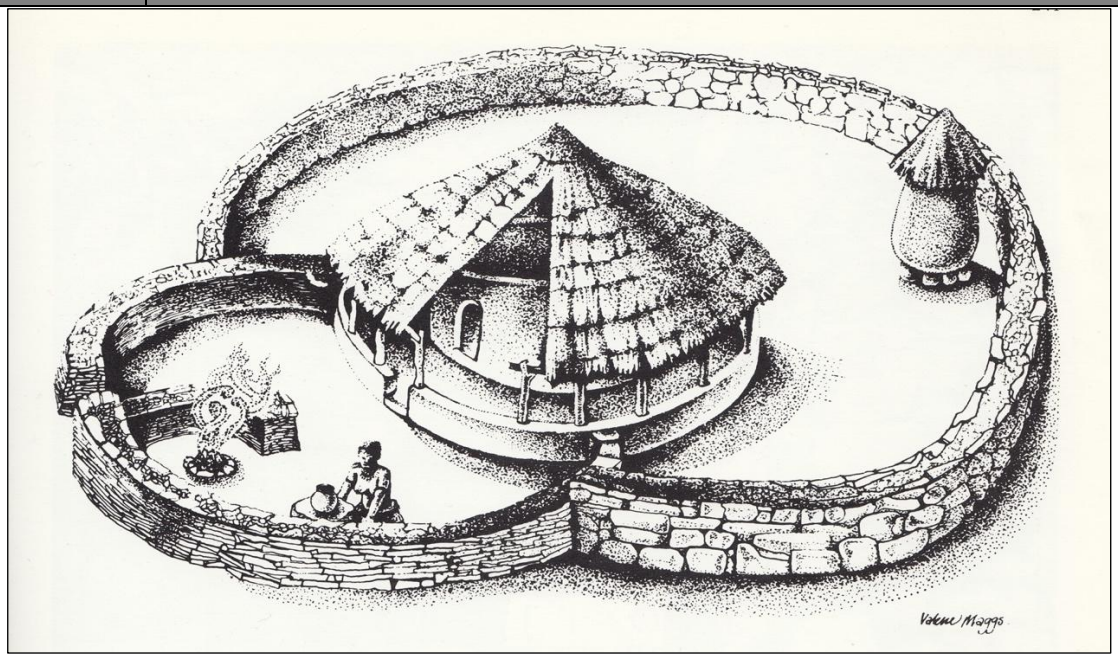 *Figure 9 – Artist's impression of a bilobial dwelling at site OXF 1. These bilobial dwellings represent a characteristic element of Type Z settlements (Maggs, 1976:241).*
AD 1700 – AD 1820	The Makgwareng facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the next known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by finely stamped triangles, rim notching and appliqué (Huffman, 2007). This facies developed from Ntsuanatsatsi south of the Vaal River and can be associated with the Type V stone walling settlement type (Huffman, 2007), the name of which is derived from Vegkop (Maggs, 1976). Van Riet Lowe (1927) was one of the first to record these structures. Dreyer (1990) also conducted excavations on Type V Late Iron Age stonewalled settlements located a short distance south-west of Winburg. The Type V settlements comprise a core of cattle enclosures surrounded by beehive huts. Corbelled stone huts are associated with this walling type, and can be seen as characteristic. They are low stone huts located at the edge of the cattle enclosures and were where the boys herding the cattle often lived (Huffman 2007). As suggested by Huffman (2007), the corbelled huts were in fact beehive huts made of stone rather than grass and reeds. Furthermore, the presence of beehive huts at these sites necessarily indicates a Nguni association or origin with these settlements. Based in information presently avaiable, the best known site of this type found within the surroundings of the study area, comprises a so-called "Early Sotho Settlement, Waterval, Sandrivierhoogte" that was originally declared a National Monument and which is now registered as a Provincial Heritage Site. The site was proclaimed a national monument by virtue of a notice in the Government Gazette on 17 December 1982. In the declaration, the site is described as a 'Leghoya Village' comprising corbelled huts and stonewalls. The site has since been declared a Provincial Heritage Site in terms of the National Heritage Resources Act (www.sahra.org.za).

DATE	DESCRIPTION

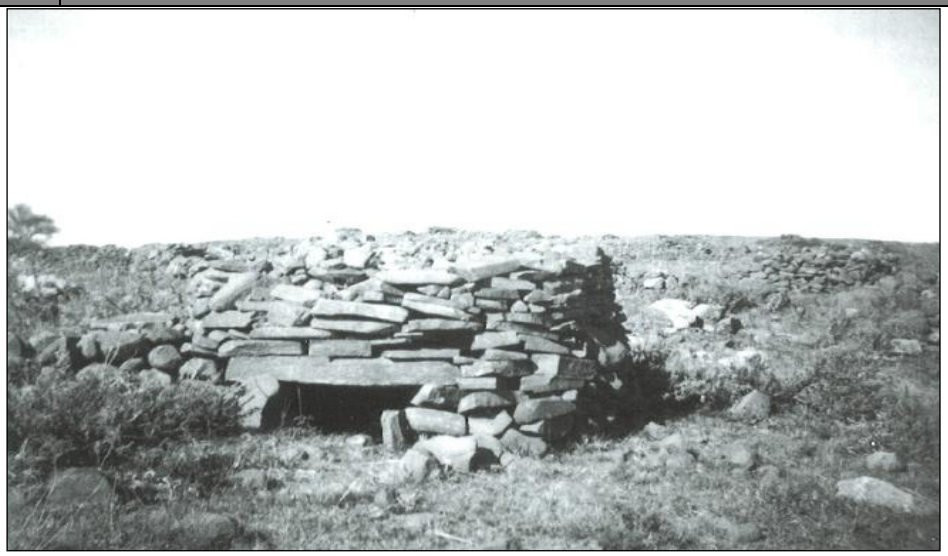

Figure 10 – Corbelled stone huts associated with a Type V settlement (Huffman, 2007:39).

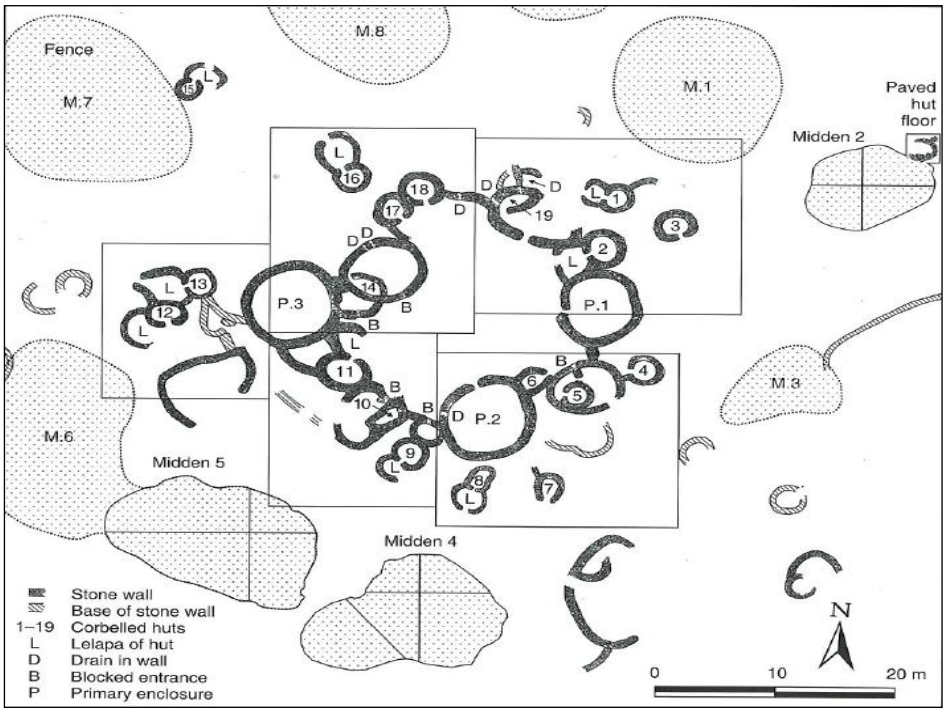

Figure 11 – Layout of a Type V Settlement (Huffman, 2007:38).

1820s	Across the Southern Highveld, this period was characterised by warfare and unrest. Known as the Mfecane, these years of upheaval originated primarily in the migration of three Nguni groups from present day Kwazulu-Natal into the present day Free State as a result of the conquests of the Zulu under King Shaka. The three Nguni groups were the Hlubi of Mpangazitha, the Ngwane of Matiwane and the Khumalo Ndebele (Matabele) of Mzilikazi. In c. 1821, the Hlubi migrated across the Drakensberg Mountains in a westerly direction (Maggs, 1976) and attacked the Tlokwa of MaNthatisi along the banks of the Wilge River. This river has its source near Harrismith and flows into the Vaal River where the Vaal Dam is located today. While it is not exactly certain where MaNthatisi's

DATE	DESCRIPTION
	settlements would have been located (in all likelihood further south), the Tlokwa fled westward as a result of the Hlubi attack and in turn attacked other groups in its path. This started a period of unrest and warfare, which rippled across the Highveld on both sides of the Vaal River (Legassick, 2010) (Lye and Murray, 1980). The Ngwane followed closely on the Hlubi and further augmented the unrest and warfare along the southern Highveld (Legassick, 2010). Although the effects of the migrations of the Hlubi and Ngwane would certainly have had a profound impact on the northern Free State, this was also the case in terms of the Khumalo Ndebele who would have played a significant role in the surroundings of the study area during this time. The Khumalo Ndebele (also known as the Matabele) were also forced to leave Kwazulu-Natal and between 1823 and 1827 settled along the central Vaal River (Bergh, 1999). Mzilikazi attacked a number of Sotho-Tswana groups and settlements and incorporated them into his kingdom. As a result, his activities would have had a definite impact on the northern Free State at the time.

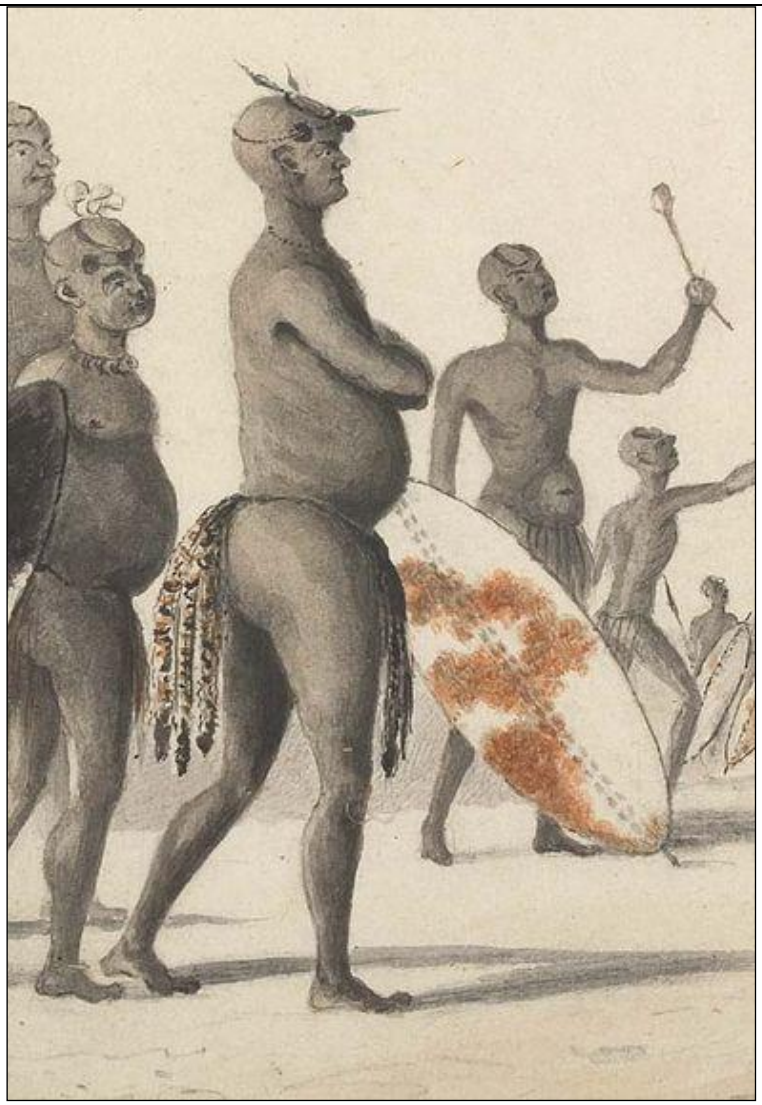

Figure 12 - King Mzilikazi of the Matabele. This illustration was made by Captain Cornwallis Harris in c. 1838 (www.sahistory.org.za).

DATE	DESCRIPTION
The Early Colonial Period	
The early Colonial Period within the study area and surroundings was characterised by the arrival of newcomers to the Transoraniga. The first arrivals were the Griqua followed by white Trekboers, who for the most part practiced a nomadic pastoralist way of life and were small in number. During the 1830s a mass migration of roughly 2 540 Afrikaner families (comprising approximately 12 000 individuals) from the frontier zone of the Cape Colony to the interior of Southern Africa took place. The people who took part in this Great Trek were later to be known as Voortrekkers (Visagie, 2011).	
1804	The Griqua were of European and Khoikhoi descent, and although they had been present on the Orange River for some time, they only established themselves permanently north of the river in 1804 when they settled near present-day Danielskuil (Reader's Digest, 1994).
Early 1800s	During the early 1800s, frequent droughts forced white farmers from the Cape Colony to move with their livestock across the Orange River to look for better grazing. Initially, these Trekboers first obtained permission from the Cape authorities before departing across the frontier, however with time, increasing numbers of Trekboers moved across this river into the Transorangia (as it became known) without any prior permission (Schoeman, 1980).
Early 1836	The first Voortrekker party of some 70 wagons crossed over the Orange River during early 1836. More groups followed and in terms of the surroundings of the study area, established themselves along the Vet River (Schoeman, 1980). Meintjies (1973) mentions that a Voortrekker party under Hendrik Potgieter arrived along the Vet River during this time. The grazing around the Vet River was not enough for all the livestock and animals of the Voortrekkers, so they split into smaller groups with one group establishing itself in May 1836 at Blaaudrift, on the Zand River.
1837 - 1843	In 1841 the town of Winburg was established on the banks of the Vet river. After the annexation of Natal by the British in 1843 and the subsequent dissolution of the Voortrekker Republic of Natalia, Winburg became the capital of the Voortrekkers in what is today known as the Free State (Erasmus, 2004). Winburg is located 55 km south-south-east of the study area. On 10 October 1968, an extensive Voortrekker Monument was opened near Winburg (www.artefacts.co.za).
 *Figure 13 – Depiction of an ox wagon crossing a river during the Great Trek (Reader's Digest, 1994:116).*	
The Mid to Late Nineteenth Century	
3 February 1848	The Orange River Sovereignty was proclaimed over the Transorangia by Great Britain and had its capital at the newly established town of Bloemfontein (www.wikipedia.org).

DATE	DESCRIPTION
	The sovereignty came about after one-sided agreements that favoured the British Government had been reached between Great Britain on the one hand and King Moshesh of the Basotho and Adam Kok III of the Griqua on the other. Those Voortrekkers present in the Transorangia were completely by-passed by these agreements, which led to serious dismay and disappointment amongst them. In terms of the surroundings of the study area, the response of the Voortrekkers was to force the British magistrate at Winburg, one Thomas Biddulph, out of town and proclaim the Republic of Winburg (Reader's Digest, 1994).
16 January 1852	On 16 January 1852 the Sand River Convention was signed between the British Government and the Transvaal Boers. The British Government was represented by British Assistant Commissioners W.S. Hogge and C.M. Owen, whereas the Transvaal Boers were under the leadership of the Voortrekker hero of Blood/Ncome River, General Andries Pretorius. This convention formally recognised the existence and independence of the Boer Republic north of the Vaal River by the British Government. As a result, this agreement allowed for the creation of a Boer Republic, namely the *Zuid-Afrikaansche Republiek* (South African Republic) (Oberholster, 1972). The *Zuid-Afrikaansche Republiek* remained in existence until the end of the South African War in 1902. The site where the signing of the convention took place, was declared a monument and for many years was marked by a stone cairn and plaque (Oberholster, 1972). The present condition of the monument is not known. The site is located near the bridge where the N1 highway passes over the Sand River.
23 February 1854	The Orange River Convention was signed by representatives of Great Britain and the Boers, and resulted in the proclamation of the Boer Republic of the Orange Free State. The convention was signed at Bloemfontein (www.wikipedia.org). As with the proclamation of the Soverignty, the Orange River Convention was again one-sided and did not obtain the blessing or inputs of all the major role-players in the Free State. While the Voortrekkers were excluded in 1848, the signing of the Orange River Convention in 1854 did the same to the Basotho and Griqua. For the next 48 years, the study area fell within the boundaries of the Boer Republic of the Orange Free State. Incidentally, the Orange River Convention is sometimes referred to as the Bloemfontein Convention.
1872	The town of Ventersburg was laid out on the farm Kromfontein in 1872. Kromfontein had originally belonged to one of the early Voortrekker leaders, namely Field-Cornet P.A. Venter. After his death in 1857, his son B.G. Venter allowed church services to be held in his father's homestead. The second Gereformeerde (Dopper) church north of the Orange River was also established at Kromfontein in 1859. The use of the farm for church services led to the establishment of a town. The new town was named after Field-Cornet P.A. Venter, and formal proclamation for Ventersburg took place in 1876 (Erasmus, 2004).
1890	Erasmus (2004) states that two American engineers were responsible for the original survey of sections of the proposed railway line between Bloemfontein and Johannesburg. On the farm Merriespruit they chiselled the name 'Virginia' on a boulder, presumably in honour of the American State of Virginia. When the railway line was built a few years later, the nearby railway siding was named Virginia and some years later, in 1954, the town of Virginia was also established. The exact position of the chiselled boulder, if it still exists today, is not presently known.
Early 1890s	The railway line between Bloemfontein and Johannesburg was built during the early 1890s, and eventually reached Johannesburg during September 1891 and Pretoria in January 1892 (Schoeman, 1980). In terms of the study area, this railway line passed to its east and in this area was built from Smaldeel (present day Theunissen) to Theron, Welgelegen and Virginia.

DATE	DESCRIPTION
9 November 1892 – 1899	The Driekopjes Diamond Mining Company was registered. One of the founding directors of the company was the man who would become synomynous with South African diamond mining and diamonds, Sir Thomas Major Cullinan. The "Driekopjes" in the name of the company referred to a farm of that name north-west of Kroonstad, where diamond mining was taking place. In June 1894 the Driekopjes Diamond Mining Company also acquired an interest in the farm Welgegund from the Van Rensburg Diamond Mining Syndicate. The farm Welgegund is presently known as the farm Driekoppies 422. No information could be found on this syndicate. However, the fact that the Driekopjes Company acquired an interest from the Van Rensburg syndicate, suggests that diamond prospecting and possibly mining activities had taken place within the study area before this transfer took place. A large number of diamonds were subsequently recovered from Welgegund. However all mining activities came to a halt with the South African War (1899 – 1902) (Helme, 1974).
Mid 1890s	During the mid 1890s two men arrived on the farm Aandenk to undertake prospecting work. Alexander Edward King Donaldson was a prospector and his associate Herbert Hinds an engineer. They excavated an 18-meter-deep shaft and took samples from their excavations for further testing and analysis. On their return journey to England, both men died when their ship, the Drummond Castle, wrecked at Ushant off France, and with it the samples they had brought from the Free State (www.sahra.org.za) (Felstar Publishers, 1968). The activities of these two men laid the foundation for the discovery and development of the Free State Goldfields. The farm Aandenk is located immediately south of Allanridge today.
1899	The town of Odendaalsrust was officially established in 1899 when the Dutch Reformed Church chose the farm Kalkkuil for its new parish. The town was proclaimed a municipality in 1912. At the time, it only had about 40 houses, three shops and a hotel (Mayhew, 1982).
The South African War (1899 – 1902)	
The South African War was fought between the Boer Republics of the Transvaal and Free State on the one side and Great Britain on the other, but is referred to as the South African War as the victims and participants of the war were not excluded to Britain or Boer alone. As will be discussed in more detail below, the march of Lord Roberts from Bloemfontein to Pretoria in May and June 1900 was especially significant in terms of the study area. In particular, the so-called Battle of Zand River (7 – 10 May 1900) was fought very close to the study area, with at least the movement of troops during the battle taking place across the study area.	
13 March 1900 – 6 May 1900	Bloemfontein, the capital of the Boer Republic of the Orange Free, was occupied by the British Army under Lord Roberts on 13 March 1900. The Boer Republic of the Orange Free State was renamed the Orange River Colony. With the Republican forces of the Transvaal and Free State retreating northwards from Bloemfontein, Lord Roberts's eyes drifted further north, where the greatest prize of the war lay waiting, Pretoria. Lord Roberts and his staff strongly believed that once the capital of the *Zuid-Afrikaansche Republiek* fell, the war would be over. However, the success of the British Army required all focus on the immediate front, as the land between Bloemfontein and Pretoria was bisected by a myriad of rivers, dongas and hills, all strategically significant obstacles from where the Boer forces could implement a solid defence. The Boer forces standing between Lord Roberts and Transvaal capital were estimated by British Intelligence to comprise two main groups namely a force of between 5 000 to 6 000 burghers with 18 guns under General Louis

DATE	DESCRIPTION
	Botha and a similarly large force in the surroundings of Kroonstad (Maurice & Grant, 1906). After departing from Bloemfontein, Lord Roberts's force was involved in a couple of successful actions on their way to Pretoria, including Brandfort (3 May 1900) and Vet River (4 - 6 May 1900). With the successful conclusion of the battle of Vet River, Lord Robers and almost his entire army crossed over the river successfully, and by the evening of 6 May 1900 bivouacked at the small railway siding known as Smaldeel. The town of Theunissen is located here today and is roughly 39 km south of the present study area (Maurice & Grant, 1906). A short distance to the north lay the next, and far more daunting, obstacle on Lord Roberts's march to Pretoria, the Zand (or Sand) River. It was here, at this river, that General Louis Botha, the commanders-in chief of the Transvaal republican forces, was determined to halt Lord Roberts's march on Pretoria.
	 *Figure 14 – Lord Frederick Sleigh Roberts (left) and General Louis Botha (right). These two officers commanded the opposing forces at the Battle of Zand River (Changuion, 2001:77 & 117)* .
7 – 10 May 1900	On 7 May 1900 a reconnaissance of the Zand River by General Edward Hutton indicated that the northern bank of the river was held by a force of roughly 6 000 Boers supported by two heavy and eight light pieces of artillery. These estimates provided by General Hutton allowed Lord Robers to draw up a battle plan (Maurice & Grant, 1906). On the 9th of May 1900, Lord Roberts moved his army forward and established his headquarters at the Welgelegen Station. The movement of the British Army under Lord Roberts at Smaldeel to a position a short distance east, suggests that the main component of Lord Roberts's force followed the railway line. Lord Roberts's battle plan focussed on securing significant drifts that provides safe crossing of his infantry over the Zand River, and especially

DATE	DESCRIPTION
	so Junction Drift, Merriespruit, Du Preez Leger Drift (where the bridge on the road between Theunissen and Welkom crosses the river) and De Klerks Kraal Drift. For the purposes of this discussion, the events associated with the latter two of these drifts will be discussed in more detail below. On the morning of 9 May 1900, Lieutenant-Colonel Thomas William Porter with the 1s Cavalry Brigade departed from Smaldeel to reconnoitre the two drifts at Du Preez Leger and De Klerks Kraal. They were assisted in this task by Major-General J.B.B. Dickson with the 4th Cavalry Brigade. Meanwhile, at 11 am, Major-General John French with his advance guard reached Kalkoenkrans, a section of which farm is located within the present study area. At Kalkoenrkans, French received word from the reconnaissance units on the river that the Du Preez Leger Drift was not held by the enemy. Seizing the opportunity to outflank the Boer positions, French immediately ordered a squadron of the Scots Greys forward to take possession of the drift and ordered the remainder of the 1st Cavalry Brigade to follow and assist in this task. The 4th Cavalry Brigade was left at Kalkoenkrans in support. By 15h30 that afternoon the area was occupied by the British force, and the De Klerks Kraal Drift was taken shortly thereafter. Incidentally, the other significant drifts on the river had also been taken with similar ease. On the morning of 10 May 1900, Lord Roberts's army advanced on the river. On its left flank (and the side closest to the study area) General French with the 1st Cavalry Brigade, the 4th Cavalry Brigade as well as Hutton's Mounted Infantry, crossed over the Du Preez Leger Drift from where they moved in a north-eastern direction. On the left centre of the front, the 3rd Cavalry Brigade and Henry's Mounted Infantry crossed over the drift at the railway line in proximity to present-day Virginia. The northern bank was occupied by 8 am that same morning. The crossing of the drifts further to the east was achieved with more difficulty, but the northern banks were also occupied a mere half an hour after the crossing over the Merriespruit Drift near the railway line. This meant that Lord Roberts's front comprising cavalry and mounted infantry units had successfully crossed over the Zand River early on the morning of 10 May 1900, without meeting any significant resistance. However, the fortunes of war were about to change for Lord Roberts. A patrol sent out by General French ran into a large Boer force of between 2 000 and 3 000 burghers moving down onto the centre of Lord Roberts's front at the Virginia Station. French ordered an attack by one squadron each from the 6th Inniskilling Dragoons, Scots Greys and Australian Horse and two troops from the 6th Dragoon Guards (Carabiniers). Their attack was focussed on the centre of the advancing Boer force on a ridge located on the farm Vredes Verdrag. Suffice to say that the battle raged for some time and the outcome was not at all clear until 14h00 that afternoon when the Boers abandoned the field of battle, allowing the British to occupy the ridge and proceed forward (Maurice & Grant, 1906). Further battles and actions took place to the east, near Junction Drift. However, by the afternoon of 10 May 1900, all the drifts had been successfully cleared and occupied to allow for the crossing of the Zand River by Lord Roberts's infantry (Maurice & Grant, 1906).

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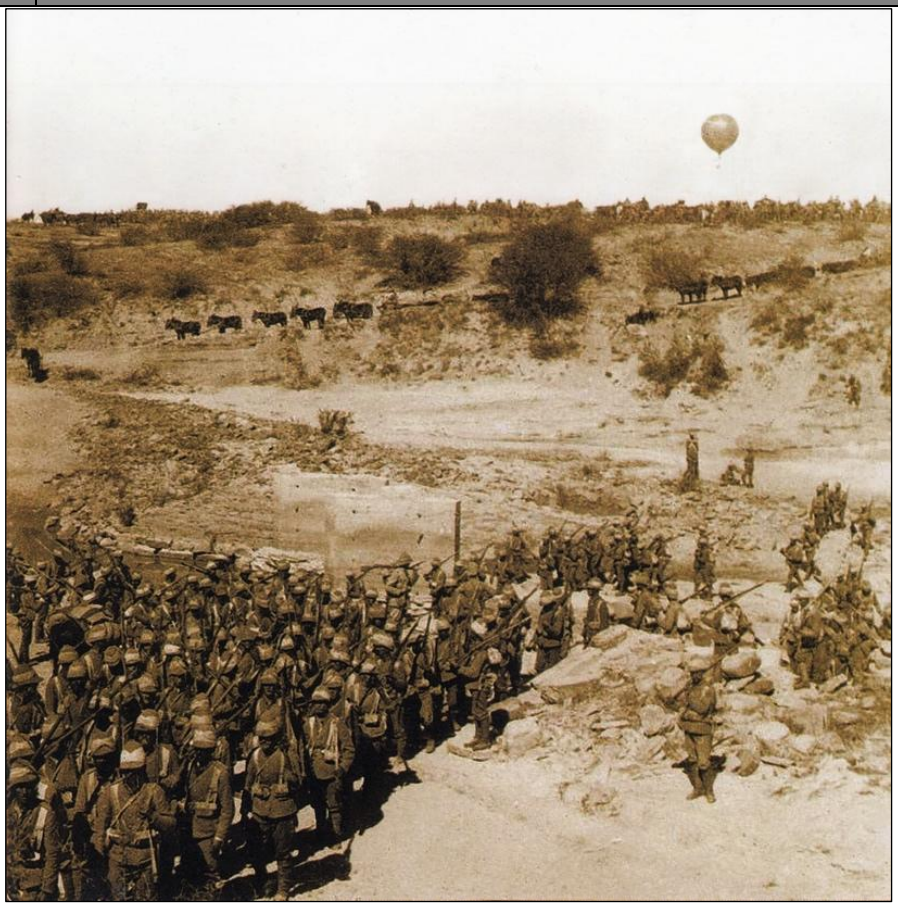

Figure 15 – Lord Roberts's infantry crossing the Zand River at the conclusion of the Battle of Zand River. This photograph was in all likelihood taken during the afternoon of 10 May 1900, after all the significant drifts across the river had been cleared by the cavalry and other units. The crossing and surrounding landscape are monitored by an observation balloon (see top right). It is not possible to identify the exact drift where this crossing took place, although the remnants of a bridge foundation structure can be seen in the river bed (Raath, 2007:351).

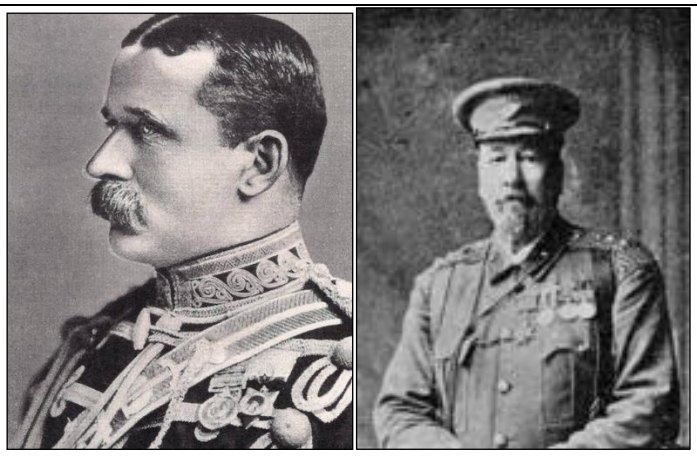

Figure 16 - Two of the British officers at the Battle of the Zand River who were closely associated with the events within the study area, namely the occupation of the Du Preez Leger Drift on 9 May 1900 as

DATE	DESCRIPTION
well as the crossing of the drift on the morning of 10 May 1900. General John French (left) (Changuion, 2001:77) and Colonel Thomas William Porter (www.nzetc.victoria.ac.nz).	
	After the fall of Pretoria on 5 June 1900 and the subsequent battles of Diamond Hill (11-12 June 1900) and Bergendal (21-27 August 1900), the Boer generals decided that the only way to proceed with the war would be the implementation of a completely different strategy, a strategy based on mobility by using smaller commandos to attack and harass the British on all fronts in what was to become known as guerrilla warfare. This style of warfare had significant successes, and extended the war for nearly another two years. However, these successes also came with significant losses as the war increasingly dragged the civilian population of the Boer Republics into the carnage of war. No skirmishes or battles associated with the guerrilla war are known from within the study area or its immediate surroundings. This said, the study area and surroundings, as with almost the entire South Africa, experienced the effects of guerrilla warfare. In retaliation to the new form of warfare, the British High Command devised a strategy of building extensive blockhouse lines across the country as a way of hindering the mobility of the Boer commandoes. By December 1900, points along the railway line north of Bloemfontein had been fortified with hastily constructed trenches shaded by roofs and defended by razor wire. The closest of these defensive works was at Virginia. Shortly thereafter, a number of key positions along the railway line north of Bloemfontein were significantly strengthened with the construction of multi-storey blockhouses. At Virginia, for example, a double storey stone blockhouse as well as one corrugated iron blockhouse were built (Hattingh & Wessels, 1997). Lord Kitchener, in particular, also implemented a strategy that was to become known as scorched earth whereby the Boer farms were burnt to the ground and the civilian population (both white and black) remaining on these farms forced into concentration camps. While no concentration camps existed within the study area, a surprising large number of such camps were located in the surroundings of the study area. Black concentration camps were located at Smaldeel, Virginia, Welgelegen and Winburg (Warwick, 1983) (www.angloboerwar.com). Untold hardship ensued in these concentration camps, and many women and children died as a result of exposure, inadequate nutrition and poor medical facilities. These camps resulted in the deaths of 27 926 white and 14 154 black people (www.sahistory.org.za).
The Early Twentieth Century (1902 – 1913)	
October 1902 – November 1904	In October 1902, some months after the end of the South African War, the name of the Driekopjes Diamond Mining Company was changed to the New Driekopjes Diamond Mining Company, which still had Thomas Major Cullinan as one of its directors. Although work at the Driekopjes Mine north-west of Kroonstad resumed on a small scale during 1903 (in all likelihood work at Welgegund also continued), all work at the mine was permanently halted by November 1904. This was due to disappointing yields and as a result the company was liquidated shortly thereafter (Helme, 1974).

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	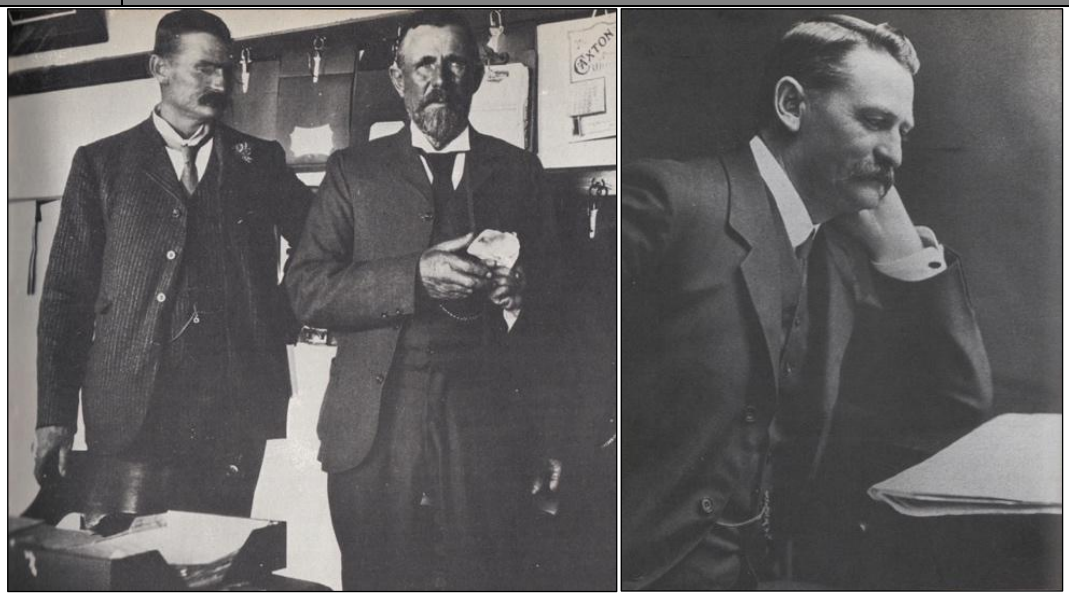 *Figure 17 – Sir Thomas Major Cullinan was one of the founding directors of the Driekopjes Diamond Mining Company, which acquired an interest in the farm Welgegund in 1894. In the historic photograph on the left he is shown shortly after the discovery of the Cullinan diamond (which is held by F. Wells) at the Premier Diamond Mining Company, of which he was the chairman. The photograph on the right depicts Cullinan in 1929 (Helme, 1974: 75 & 146).*
1904	After the South African War, renewed efforts were made to carry out gold prospecting work in the area. In 1904, a prospector named Archibald Megson arrived on the farm Aandenk, and the farmer showed him the trench where Alexander Edward King Donaldson and Herbert Hinds had looked for gold. It had been more than a decade since these two pioneers had prospected the same farm. Megson opened up the old trench and continued with the excavations. At a depth of 30 meters, he found indications of gold and took a number of samples. Megson returned to Johannesburg with his samples and attempted to gain the interest of various mining houses and investors on the rand. However, with the rapid development and expansion of the Witwatersrand gold mining industry attracting all of the attention, no one seemed interested in possible gold discoveries so far away from Johannesburg (www.sahra.org.za).

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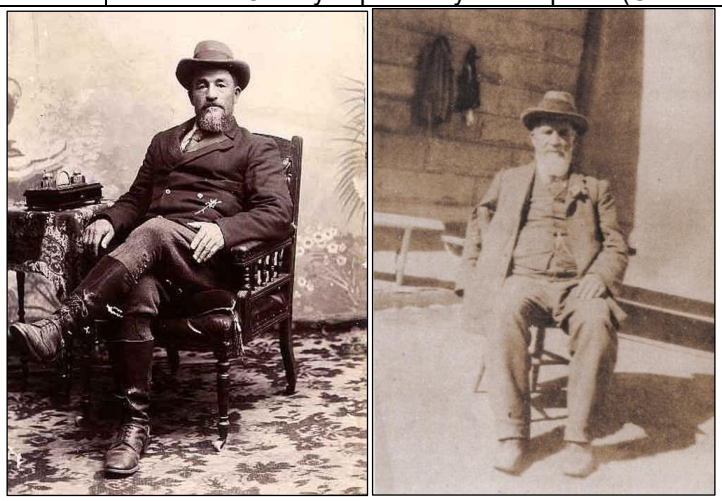
Figure 18 – Archibald Megson standing in the prospecting trench on the farm Aandenk (Felstar Publications, 1968).

August 1907	In August 1907, the town of Theunissen was proclaimed. This proclamation followed on a petition by farmers living in proximity to Smaldeel Siding. The town was named in honour of Commandant Helgaardt Theunissen, who led the petition and had also been the leader of the local commando during the South African War. The town of Theunissen became a municipality in 1912 (Erasmus, 2004).
1910	At the time, the Driekoppies Diamond Mine at Welgegund comprised 50 claims (Johnson, 1910). Although no detailed information on these syndicates and companies could be obtained, it would appear that by this time the farm was prospected and mined by at least the Magnus Diamond Syndicate Limited as well as the Triumph Diamond Mining Company Limited. Based on this information, it would appear that the Magnus and Triumph entities in all likelihood took over at Welgegund after the liquidation of the New Driekopjes Mining Company in 1904.
25 November 1911	The Drie Koppie Diamond Mine Limited was formed on 25 November 1911 by W.G. Griffiths to acquire from the Magnus Diamond Syndicate Limited and the Triumph Diamond Mining Company Limited the farm Welgegund in the Winburg District (The Mining Manual and Mining Year Book, 1914). The later history of the diamond mine and mining activities at Welgegund could not be revealed by way of the desktop study. However, based on the remains of the mine property observed during the field, it would appear that a diamond mine was operated here into the relatively recent past.

The Boer Rebellion (1914 – 1918)

At the end of the South African War (1899 – 1902), the Transvaal and Orange Free State republics lost their independence to the British Empire. In 1910, the Union of South Africa was established consisting of the Cape Colony, Natal, the Transvaal Colony and the Orange River Colony. General Louis Botha was appointed the Union's first prime minister and believed that South Africa's future would be best served as part of the British Commonwealth. In 1914, the South African government under General Louis Botha decided to assist Great Britain in its war with Germany. A number of Boer leaders were not happy about this turn of events, and when General Koos de la Rey was killed at a roadblock in Johannesburg, emotions reached a boiling point and rebellion broke out across the former Boer republics. This rebellion saw more than 11 000 Boer men under the leadership of some of the former Boer War generals such as De Wet, Maritz, Kemp and Beyers rebelling against the South African government and its armed forces under the leadership of former Boer War generals Louis Botha and Jan Smuts.

DATE	DESCRIPTION
16 November 1914	In terms of the study area, the most notable event relating to the Boer Rebellion was the battle that occurred between the commando of General De Wet and the Government forces under the command of Colonel Enslin at the Virginia railway station on 16 November 1914. This battle followed on the defeat of De Wet's rebels at Mushroom Valley, south-east of Winburg, at the hands of General Louis Botha. De Wet and 2 000 rebels managed to escape from Mushroom Valley and followed the railway line north-eastwards towards the Virginia Station on the Zand River. De Wet wanted to cross over the railway line, and as a result, a fight ensued with Colonel Enslin's forces stationed at Virginia Station. General De Wet suffered a number of casualties and 50 of his men were also taken prisoner. After the battle, De Wet and his men followed the Zand River in a western direction and crossed over the river into the Transvaal Colony in proximity to Hoopstad (Union of South Africa, 1916).
	
	Figure 19 –The hardships experienced by General C.R. de Wet during the rebellion can be seen on these photographs. The one on the left shows De Wet shortly after the South African War (Van Schoor, 2007) with the image on the right depicting the general in the Bloemfontein prison after his capture late in 1914 (Raath & Langner, 2014:119).
The Remainder of the Twentieth Century (1915 – Present Day)	
1929 - 1933	Nearly 25 years after finding the first indications of gold on the farm Aandenk, Archibald Megson finally managed to raise the interests of possible investors in Johannesburg. In 1929, during a chance encounter with Joseph Freedman, Megson found a more welcoming response. Freedman introduced the prospector to Johannesburg attorney, Emmanuel Jacobson, and his friend Allan Roberts, a dental technician. Despite being interested in what the prospector had to say, it took almost four years before Jacobson, Roberts and Megson travelled to the Free State (Shorten, 1970). Allan Roberts, who was an amateur prospector, was able to trace a conglomerate outcrop all along the farm Aandenk, and incorrectly identified it as part of the Upper Witwatersrand series. The two friends returned to Johannesburg and formed a syndicate comprising themselves, F.L. Marx, Dr. E.B. Woolf, Samuel Potter and Joseph Freedman. Freedman represented the interests of the old prospector Archibald Megson in the syndicate (Shorten, 1970). The syndicate acquired prospecting options on 31 farms in the area and the company Wit. Extensions Limited was established by the syndicate. On 23 October 1933, drilling commenced at a point roughly 80 m from

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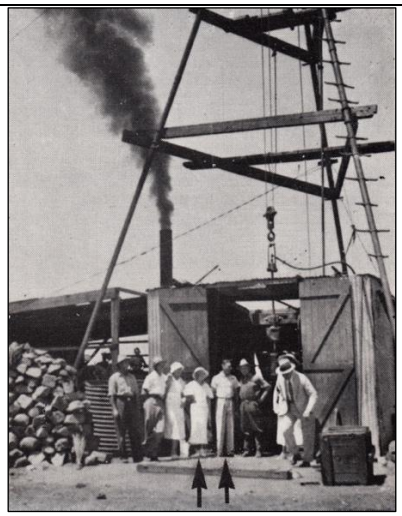
	Megson's trench on the same farm Aandenk. However, by February 1935 the drilling work had to be halted due to a lack of funds without any evidence for gold-bearing reefs identified. Many years later, it was estimated that if the two friends had only managed to deepen the hole by another 400 feet, they would have become very rich men and the discoverers of the Free State goldfields. Sadly, this was not to be their fate. Allan Roberts died in such poverty in 1939 and his friends had to pay for his funeral whereas Emmanuel Jacobson had to sell all his assets to survive (Shorten, 1970). Today, the town of Allanridge (named after Allan Roberts) and a monument to the west of the road between Welkom and Bothaville are all that is left of the dreams and expectations of these two mining pioneers.
	 *Figure 20 - The first gold prospecting borehole in the Free State was sunk on the farm Aandenk between October 1933 and February 1935. The arrows indicate the positions of Allan Roberts and his wife (Felstar Publications, 1968:11).*
1935	After the failure of Wit. Extensions Limited, an agreement was reached with the Anglo-French Exploration Company to continue prospecting work at Aandenk. However, instead of continuing deeper on the same borehole, the Anglo-French Exploration Company decided to rather deflect the borehole and no results were achieved. It was later estimated that if either one of these companies had deepened the borehole by only another 400 feet, payable gold would have been discovered (Shorten, 1970). The agreement between Wit. Extensions Limited and Anglo-French Exploration Company came to an end and the famous geologist Dr. Hans Merensky acquired an interest in Wit. Extensions Limited. He subsequently carried out extensive prospecting work including the drilling of further boreholes. However, even these more extensive attempts by Merensky to find the Free State goldfields also failed (Shorten, 1970). Machens (2009) indicates that when news broke that the famous discoverer of inter alia South Africa's platinum reserves owned options in a company working on the Free State goldfields, the interest from investors and mining companies to this part of the Free State was further awakened.

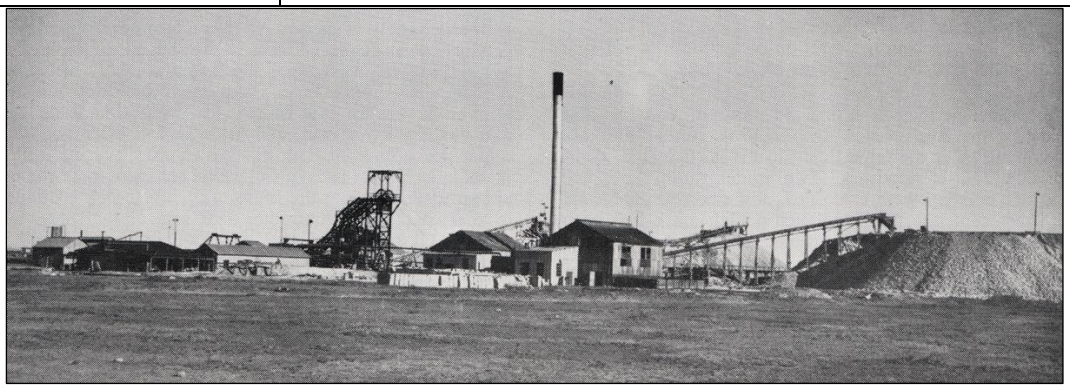
DATE	DESCRIPTION
	 *Figure 21 –The famous geologist Dr. Hans Merensky, who had his role to play in the discovery of the Free State goldfields (Machens, 2009).*
1 February 1937 – April 1939	After failing to discover any payable gold, Merensky sold his shares in Wit. Extensions to the Anglo American Corporation, who on 1 February 1937 established the West Rand Investment Trust. The trust also carried out an extensive drilling operation. The activities and interest of the Anglo American Corporation in this part of the Free State attracted the interest of other mining houses and investment companies, and prospecting options were taken out on a large number of farms from this area (Shorten, 1970).
	Despite all this interest, the first payable gold in the Free state was only identified in March 1939 during drilling operations by the African and European Investment Company on the farm Uitsig at a depth of 2 701 feet (Felstar Publishers, 1968). One month later, during April 1939, another discovery of payable gold was made on the farm St. Helena at a depth of 1 143 feet (Shorten, 1970). The discoveries of payable gold at Uitsig and St. Helena created significant excitement amongst mining companies and investors, and increasing numbers of prospecting options and eventually mines were acquired and developed. The Free State gold rush had begun.
1941	The first gold mining lease in the Free State was granted by the government of the Union of South Africa for the farm St. Helena in 1941, and the St. Helena Gold Mining Company was established to mine and develop the property (Felstar Publishers, 1968). A number of other gold mining companies were also established in a relatively short spate of time, including the Welkom Gold Mining Company, President Steyn Gold Mining Company and the President Brand Gold Mining Company.
	

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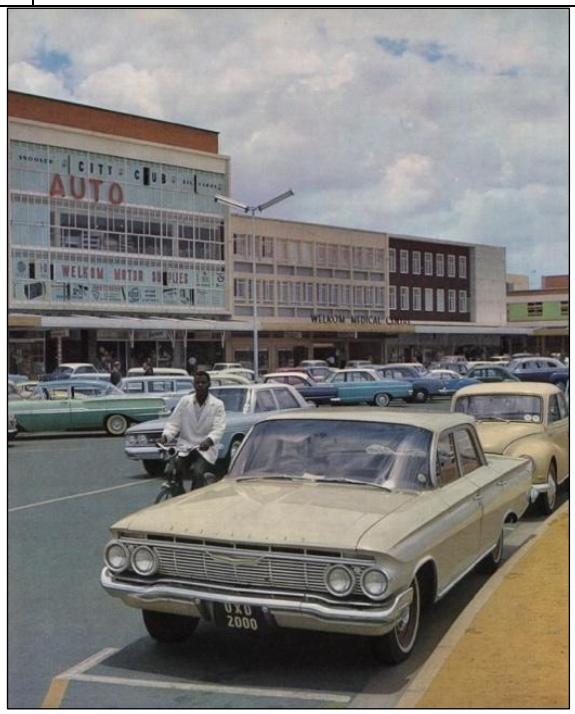
Figure 22 –The first mine shaft ever sunk along the Free State goldfields, namely the No. 3 Incline Shaft at the St. Helena Gold Mine (Felstar Publishers, 1968:151).	
16 April 1946	The borehole of the Blinkpoort Gold Syndicate Limited on the boundary of the farms Geduld and Friedenheim, reached payable gold in 1946. On 16 April 1946 it was announced that the gold-bearing material retrieved at a depth of 3 922 feet from this borehole assayed at an impressive 1 252 dwts per ton which was unique in the history of golf prospecting and mining in South Africa, with averages usually in the region of 250 dwts per ton. This discovery led to further interest in the Free State goldfields (Felstar Publishers, 1968).
11 July 1946 – 15 April 1947	On 11 July 1946 an application was made by the land company of Sir Ernest Oppenhaimer's Anglo American Corporation, namely the South African Township and Mining and Finance Corporation, for the establishment of a new town called Welkom. After some legal and procedural processes and debate between the township applicants and its opponents (including the Odendaalsrus Town Council), the application for the establishment of the town of Welkom was approved on 15 April 1947 (Felstar Publishers, 1968). William Backhouse designed the town as a garden city with a commercial centre built around a town square and traffic circles rather than stop streets or traffic lights. More than a million trees were also planted (Erasmus 2014).
 *Figure 23 –This photograph of Welkom was taken during the 1960s, roughly ten years after its establishment (Felstar Publications, 1968:171).*	
1953	After gold was discovered in the area, Odendaalsrus became a prominent town in the Free State. A railway line was built from Allanridge to Odendaalsrus in 1953 and served the two Freddie's mines (Nienaber et al. 1982).

DATE	DESCRIPTION
1954	Three of the six mines surrounding Welkom had reached production stage by 1954. These were the Welkom, Western Holdings and St. Helena Mines. During the same year, the town of Virginia was laid out on the banks of the Zand River. As indicated elsewhere, the name of this town was derived from the nearby railway station, which in turn was named this after two American engineers working on the line in 1890 had carved the name “Virginia” on a boulder from a nearby hill (Erasmus 2014).
1981 - 1987	Beisa Shaft (now the Beatrix West Section) was commissioned in 1981 to exploit uranium. The sinking of Beatrix 1 and 2 Shafts (now the Beatrix South Section) were also started at the time (www.sibanyegold.co.za). In 1984, the Beisa Uranium Mine was closed due to the low price of uranium at the time. In 1985 the Beatrix 1 and 2 Shafts were commissioned and exploration work commenced in proximity to the Beisa Mine on the farm Kalkoenkrans (www.sibanyegold.co.za). The sinking of two sub-vertical shafts and a ventilation shaft commenced at the Beisa Mine in 1987. During the same year this mine was renamed the Oryx Mine (www.sibanyegold.co.za).

4.1.4 Archival and historical maps

The examination of historical data and cartographic resources represents a critical tool for locating and identifying heritage resources and for determining the historical and cultural context of the study area. Relevant topographic maps and satellite imagery were assessed by overlaying the study area on the images or map sheets to observe the development of the area and to identify and locate historical structures, possible BGG and/or archaeological sites protected under sections 34 and 36 of the NHRA, present in, or immediately adjacent to, the area.

Historical topographic maps (1:50 000) for various years of the map sheets: **Blaauwdrift 2826BA** (**1945, 1954, 1997, 2007**); **Virginia 2826BB** (**1945, 1954, 1997, 2007**); **Theunissen 2826BC** (**1947, 1975, 1997**, **2007**); and **Theronskop 2826BD** (**1947, 1975, 1997, 2007**) were available for utilisation in the background study (**Figure 24**).

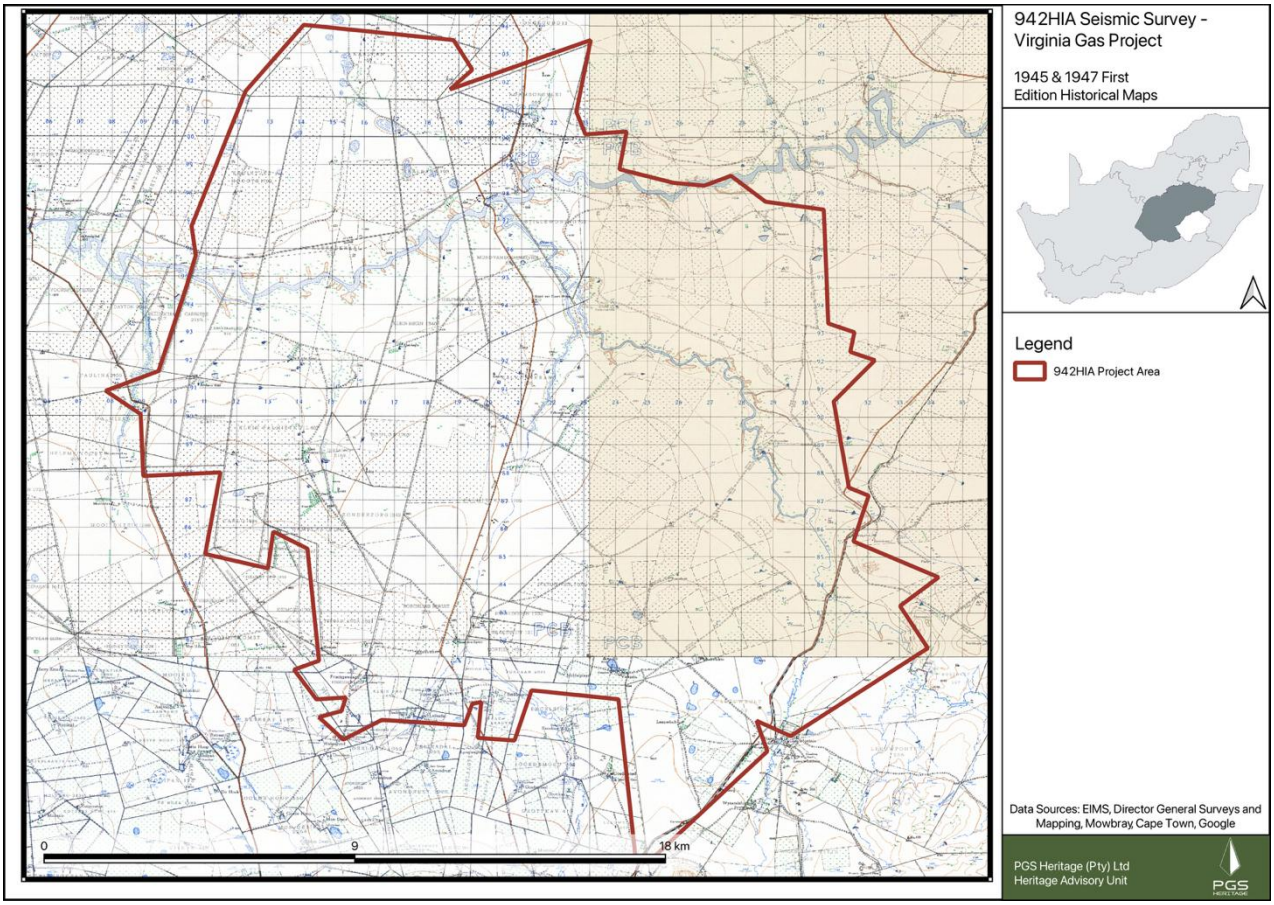


Figure 24 - First edition 1:50000 topographic map (1945).

4.1.5 Previous heritage impact assessment reports from the study area and surroundings

A search of the SAHRIS database revealed that **fifteen** previous archaeological, heritage and palaeontological impact assessments had been undertaken within the surroundings of the study area. These previous studies are listed below in ascending chronological order:

- Dreyer, C. 2004a. First Phase Heritage/Archaeological Assessment of the Proposed Powerline Route at Phakisa Mine, Welkom, Free State. **The survey was conducted approximately 6km north-east of the current study area. No archaeological, cultural, or historical material was identified during the survey.**

- Dreyer, C. 2004b. Archaeological and Historical Investigation of the Graves at the Proposed Housing Developments near Thabong, Welkom, Free State. **The survey was conducted approximately 16km east of the current study area. One grave and several other stones protruding from the ground suggested that it was an old graveyard.**

- Dreyer, C. 2005. Archaeological and Historical Investigation of the Proposed New Filling Station at Virginia, Free State. **The survey was conducted approximately 2.5km south-east of the current study area. No archaeological, cultural, or historical material was identified during the survey.**

- Dreyer, C. 2007. First Phase Archaeological and Cultural Heritage Assessment of the Proposed New MTN Cell Phone Mast at Pumlani Cemetery, Thabong, Welkom, Free State. **The survey was conducted approximately 10.6km north-north-east of the current study area. No archaeological, cultural or historical material was identified during the survey.**

- Coetzee, F. 2008. Cultural Heritage Survey of the Proposed Phakisa Housing Development, Welkom, Free State. **The survey was conducted approximately 4.3km east of the current study area. No Stone Age or Iron Age settlements, structures, features, or artefacts were recorded during the survey. One site that consisted of a mine shaft and various associated buildings and structures that probably older than 60 years were identified. No impact on the site was envisaged.**

- Dreyer, C. 2008. First Phase Archaeological and Heritage Investigation of the proposed Oppenheimer Park Golf Estate, Welkom, Free State. **The survey was conducted approximately 1.2km north of the current study area. No archaeological, cultural, or historical material was identified during the survey due to the surface disturbance.**

- Dreyer, C. 2011. First Phase Archaeological and Heritage Investigation of the proposed Chicken Egg Production Developments at Mooidoorns 319, Welkom, Free State. **No archaeological, cultural, or historical material was identified during the survey due to the surface disturbance (ploughed fields).**

- Van Ryneveld, K. 2013. Phase 1 Archaeological Impact Assessment for the Lebone Solar Farm, Onvewag RE/728 and Vaalkranz 2/220, Welkom, Free State, South Africa. Prepared for Enviroworks. **The survey was conducted approximately 10km east of the current study area. The report identified five sites: colonial period farming infrastructure, farmstead, cultural landscape, structure remains and railway bridge.**

- van Schalkwyk, J. 2014. Cultural Heritage Impact Assessment Report for the Proposed SANRAL Thabong Interchange Development, Welkom Region, Free State Province. **No archaeological, cultural, or historical material was identified during the survey.**

- Birkholtz, P.D. 2017a. Heritage Impact Assessment for the Proposed Tetra4 Cluster 1 Gas Production Project. Prepared for EIMS. **The survey was conducted approximately 4km south of the current study area. The identified sites comprise the following: cemeteries, Stone Age sites, historic structures believed to be older than 100 years, historic structures believed to be older than 60 years, historical buildings of low significance, historic to recent sites with possible stillborn baby graves, possible grave sites and a site comprising a single lower grinder.**

- Birkholtz, P.D. 2017b. Heritage Audit Report for the Beatrix Mining Areas of Sibanye Gold, Between Welkom and Theunissen, Lejweleputswa District, Orange Free State Province. Prepared for Sibanye Gold (Pty Ltd). **A total of 66 heritage sites were identified within the total study area. These identified heritage sites comprise 9 graves or burial grounds, 30 historical structures believed to be older than 60 years, of which 11 are believed to be older than 100 years, and 12 archaeological (Stone Age) sites. Sites where possible unmarked (infant) graves could occur were also identified (15). These sites include the remains of black homesteads. In terms of black African tradition, stillborn babies were often buried in unmarked graves underneath or adjacent to the homesteads of their parents.**

- Fourie, W. 2021. Heritage Impact Assessment for The Proposed Harmony FSS6 Reclamation Pipeline, Welkom, Free State Province. **The survey was conducted approximately 2.5km east of the current study area. No archaeological, cultural, or historical material was identified during the survey.**

- Kruger, N. 2021a. Archaeological Impact Assessment (AIA) On Portions Of The Farms Bloemhoek 509, Welgelegen 382, Mooi Uitzig 352, Florida 633, Le Roux 717 And Detente 744 For The Proposed Virginia Solar Park Power Lines Ba Project, Lejweleputswa District Municipality, Free State Province. **The survey was conducted approximately 13km south-south-east of the current study area. The study noted the remains of a later Historical Period settlement (possibly a farmworkers compound of houses). The site was poorly preserved and of medium to low significance.**

- Kruger, N. 2021b. Archaeological Impact Assessment (AIA) On Portions Of The Farm Blomskraal 216 For The Proposed Virginia 1, 2 & 3 Solar Parks Eia Project, Lejweleputswa District Municipality, Free State Province. **The survey was conducted approximately 13km south-south-east of the current study area. The study noted the remains of a large Iron Age occupation, several Historical Period settlements, and farmsteads, and three burial sites.**

- van Schalkwyk, J.A. 2022. Phase I Cultural Heritage Impact Assessment for The Development of the Nyala Solar Power Plant, Near Virginia, Free State Province. **No archaeological, cultural, or historical material was identified during the survey.**

- Mann, N. 2023. Proposed Pipeline Project from Harmony One Plant to Free State North 1 TSF, Near Welkom, Free State Province. **No archaeological, cultural, or historical material was identified during the survey.**

- Andreou, A.A. 2025. Heritage Impact Assessment for the proposed pipeline infrastructure upgrade for Harmony Gold Mining Co. Ltd, on portions of the Farms St Helena 42, Marmageli 20, and Stuirmanspan 92. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province. **No archaeological, cultural, or historical material was identified during the survey**

- Andreou, A.A. 2026. Heritage Impact Assessment for the proposed Nyala Solar Power Plant Access Road Infrastructure on portions of the Farms Doornrivier 330, Kalkoenkrans 225, Stille Woning 703, and

Glen Ross 734 near Virginia, Free State Province. **The survey was conducted in overlapping areas of the project area, and identified 1 heritage resource of value, a large rectilinear kraal on the Farm Kalkoenkrans 225**.

4.1.6 Heritage screening

A heritage screening was conducted by means of the DFFE National Web-based Environmental Screening Tool as required GN 982**.** According to the heritage screening report, the project area has a **Low Heritage** Sensitivity (**Figure 25**). The remote sensing has shown that no archaeological or heritage resources were present in the study area and thus is in agreement with the original screening rating.

4.1.7 Heritage sensitivity

Analysis of topographical maps and satellite imagery enabled the identification of possible heritage sensitive areas. By superimposition and analysis, it was possible to rate these structures according to age and thus their level of protection under the NHRA. **Table** 4 lists the possible tangible heritage sites identified in the vicinity of the study area and the relevant legislative protection.

Table 4: Tangible heritage site in the study area.

Name	Description	Legislative protection
Archaeology	Older than 100 years	NHRA sections 3 and 35
Structures	Possibly older than 60 years	NHRA sections 3 and 34
Burial grounds	Graves	NHRA sections 3 and 36

Additionally, evaluation of satellite imagery has indicated the following areas that may be sensitive from a heritage perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix (**Table 5**).

Table 5: Landform type to heritage find matrix.

Landform Type	Heritage Type
Crest and foot hill	LSA and MSA scatters, Late Iron Age (LIA) settlements
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Water holes/pans/rivers	MSA and LSA sites, LIA settlements
Farmsteads	Historical archaeological material
Ridges and drainage lines	LSA sites, LIA settlements

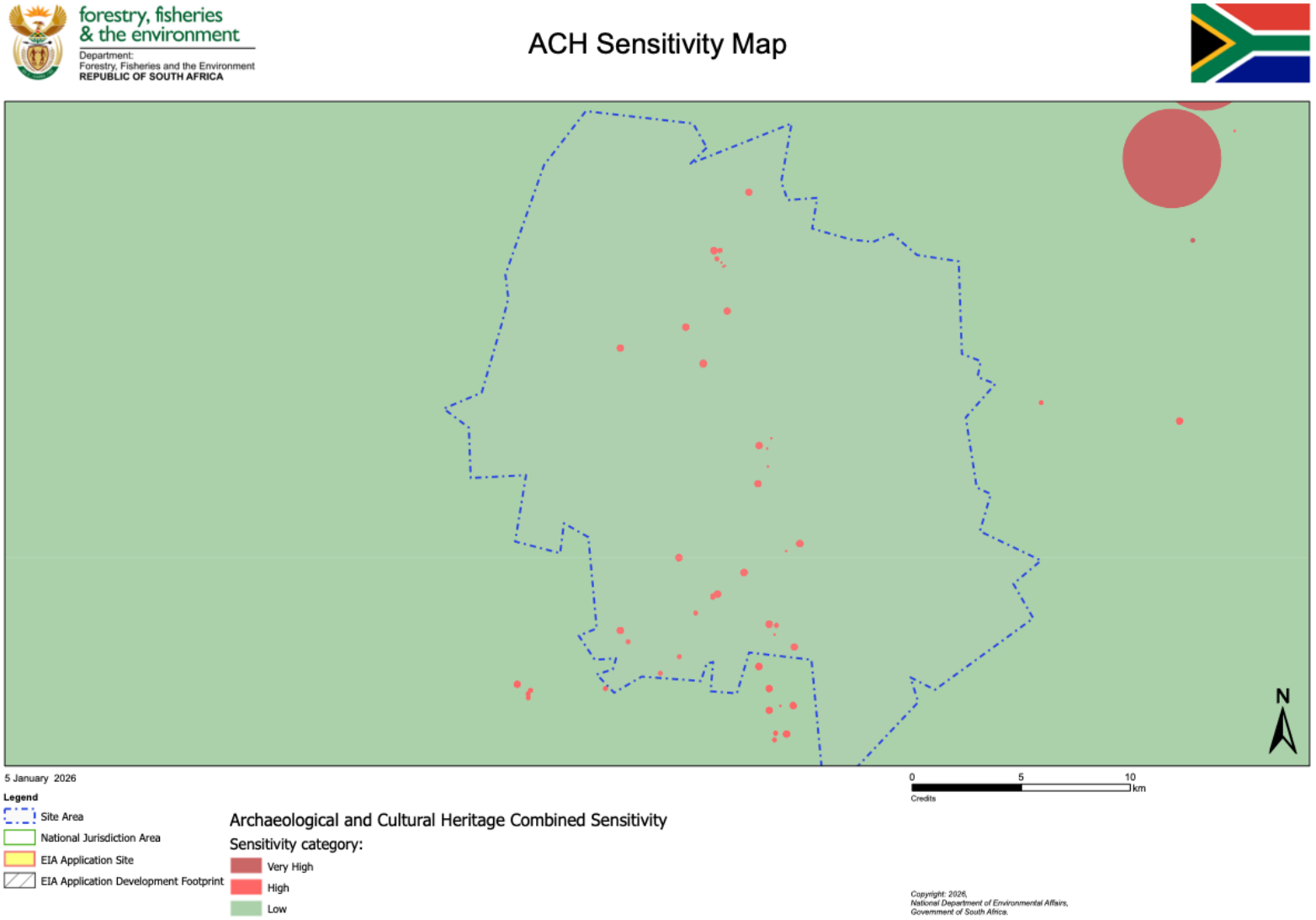


Figure 25 – DFFE Screening map indicating a low sensitivity rating for archaeology and heritage.

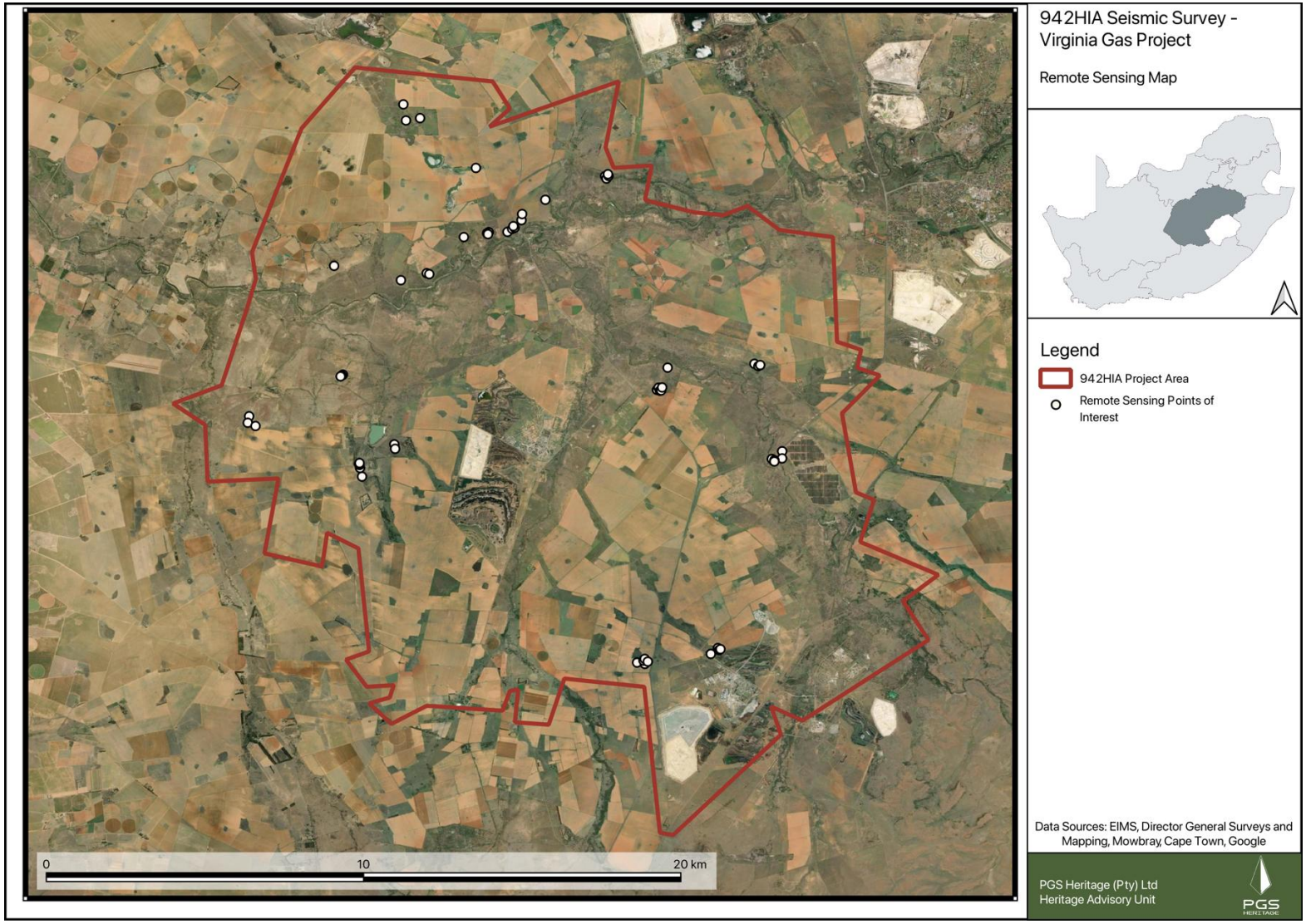


Figure 26 - Possible points of interest, as identified by remote sensing and first edition maps - exclusive of the points discovered in earlier surveys ***(Figure 6)***.

4.2 Fieldwork findings

The fieldwork was conducted on 24 - 26 November 2025 by a PGS field team. Their movement on site was tracked by means of Global Positioning System (GPS) indicated as tracklogs on the map in (**Figure 27**).

During the fieldwork a total of 22 heritage sites and 28 features were identified. These consist of six historical homesteads (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); five metal objects (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**); 12 recent structures (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**) , one ceramic surface scatter (**T_BD_1**); and one grave (**T_BV_1**).

Historical Homesteads/Structures

Of the six historical homesteads/structures identified on site, (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); all were predominantly foundation remnants or had >5% ex situ. All were graded as **NCW** with **zero-low local significance**.

Recent Structures

12 recent structures were identified on site, all were predominantly foundation remnants or had >5% ex situ (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**); all of which were graded as **NCW** with **zero local significance**.

Archaeological/Historical Material

There were five metal objects (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**), graded **NCW** with **low local significance**, and one ceramic surface scatter (**T_BD_1**) of famille-bleu polychrome ceramic sherds, graded **NCW** with **low local significance**.

Burial Grounds and Graves

A single illegibly marked grave was identified (**T_BV_1**), and graded as **Grade IIIA**, with **high significance**. It should be noted that the landowner advised of another grave within the vicinity, but was not forthcoming with a precise bearing, and the receiving environment was incredibly overgrown and impassable.

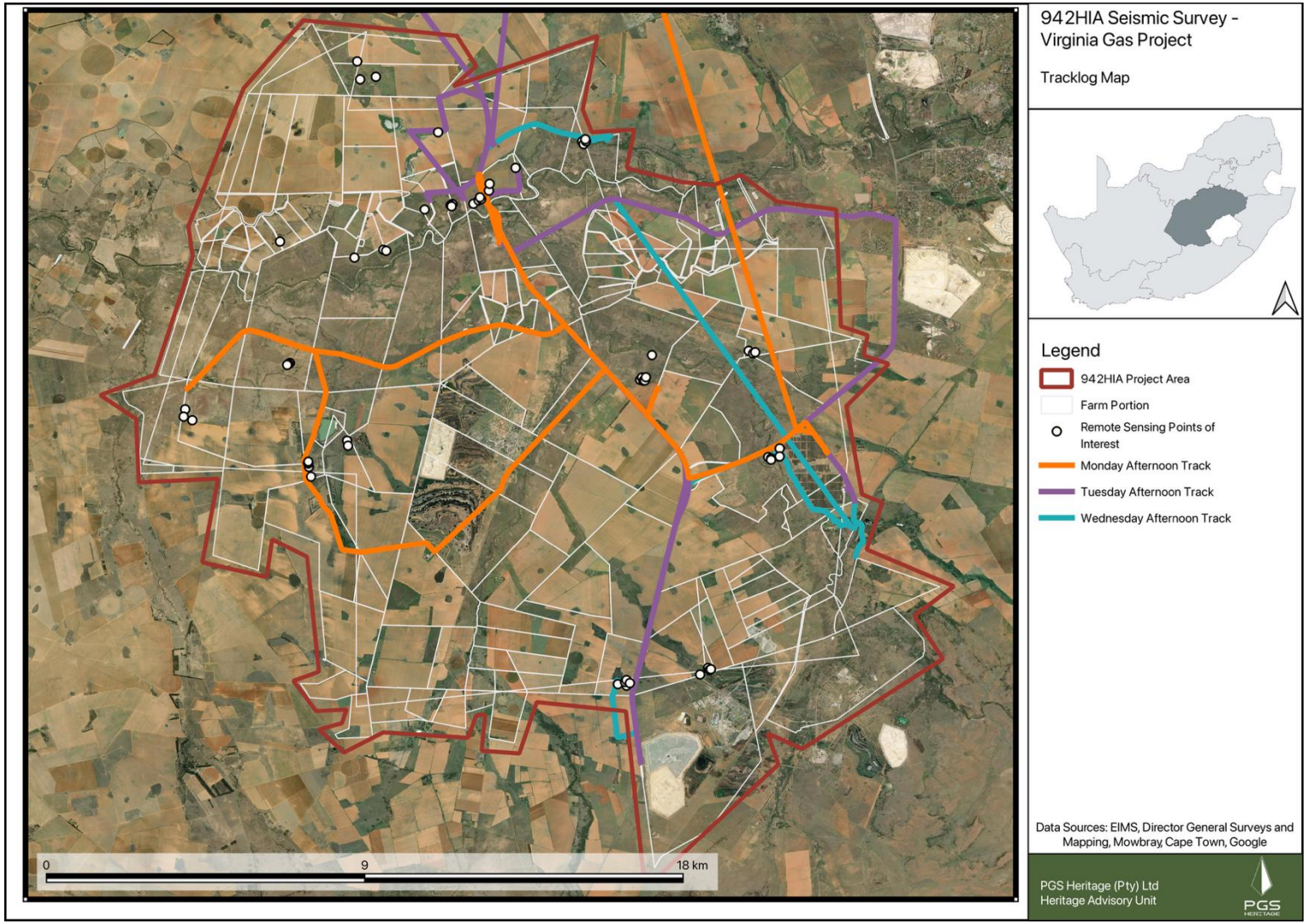


Figure 27 – Tracklog map with remote sensing points of interest, 24 – 26 November 2025.

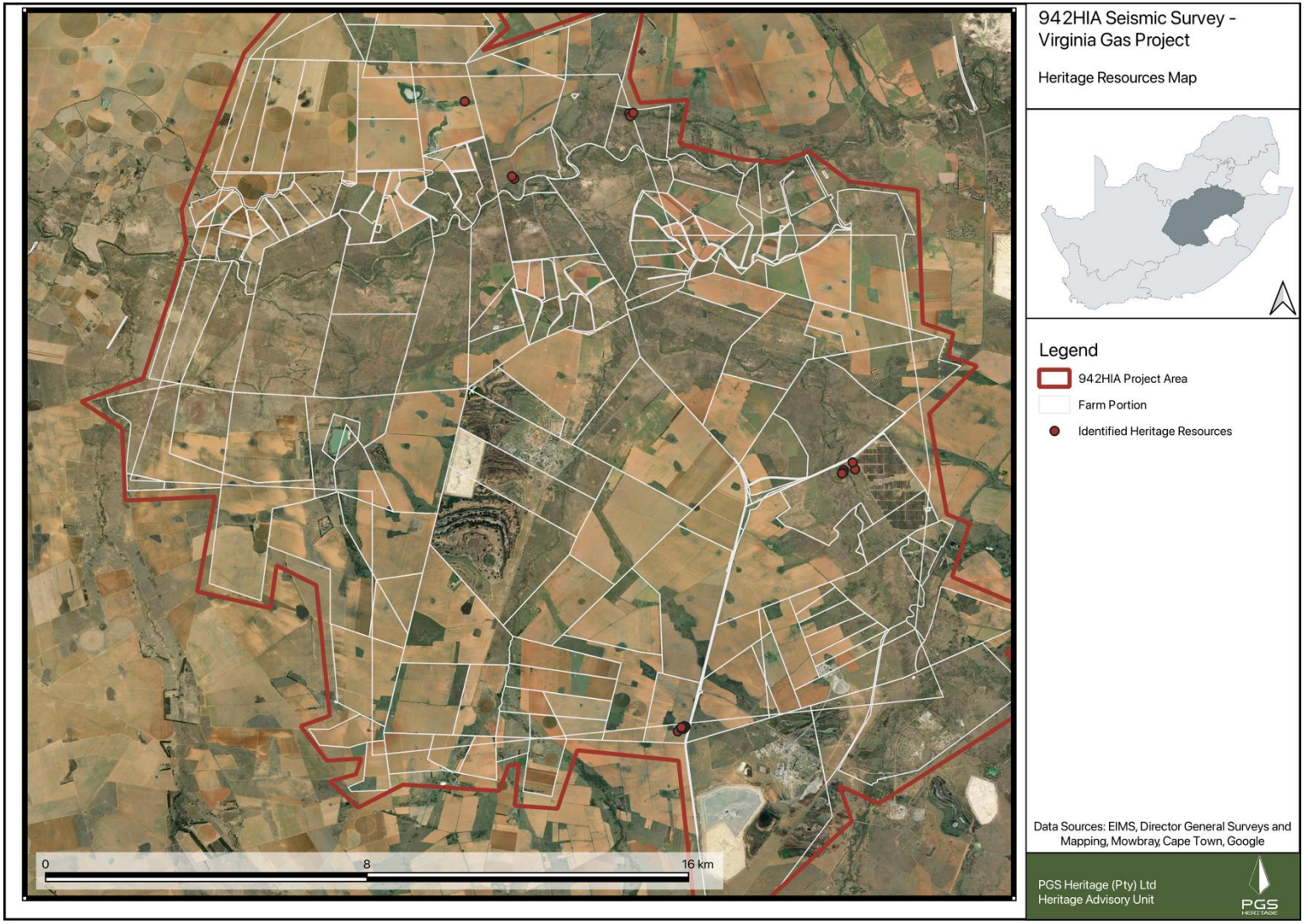


Figure 28 – *Identified heritage resources.*

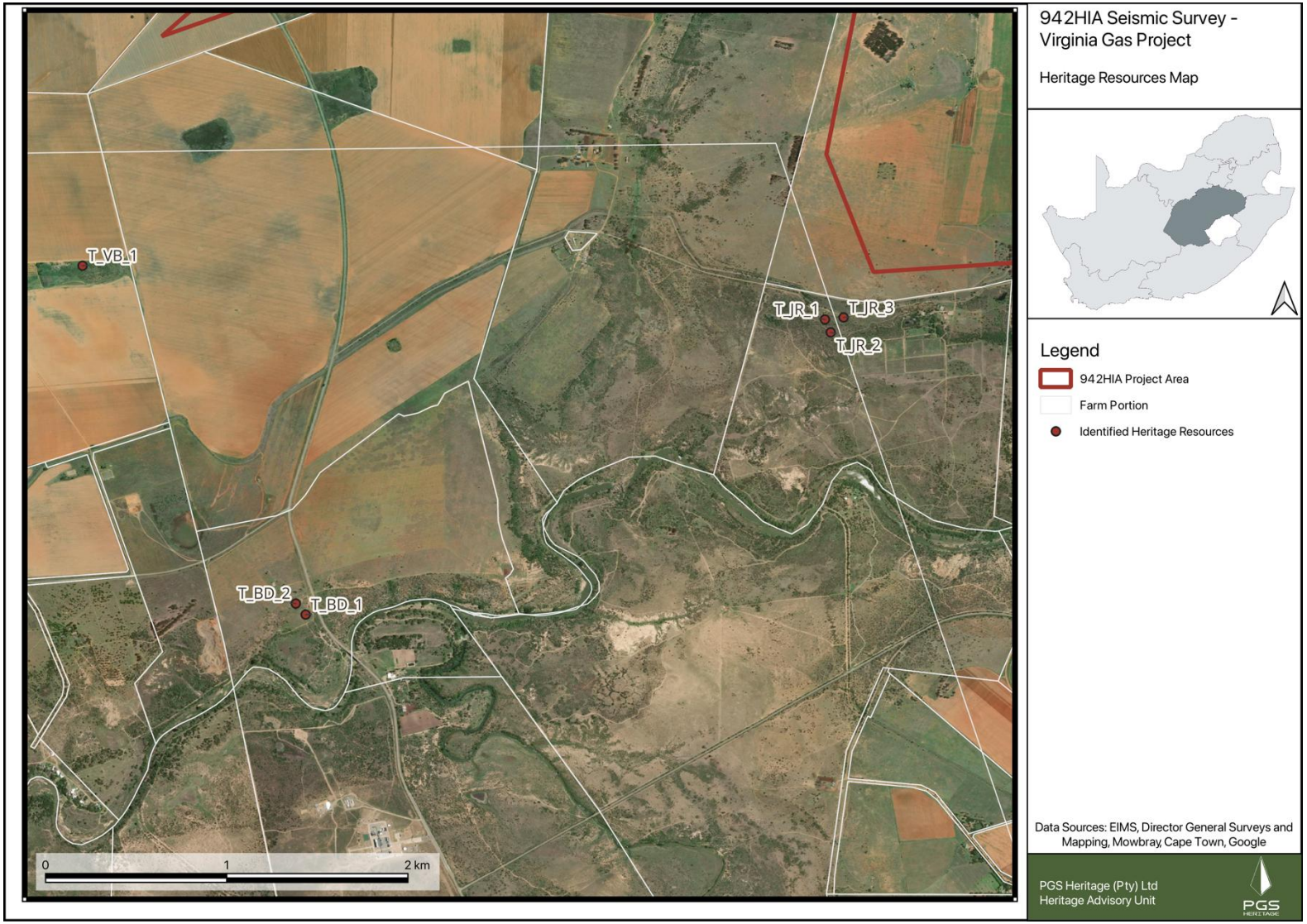


Figure 29 - *Identified heritage resources, as recorded on the Farms Vaalbank 190, Blaauwdrift 188 and Jonkers Rust 72.*

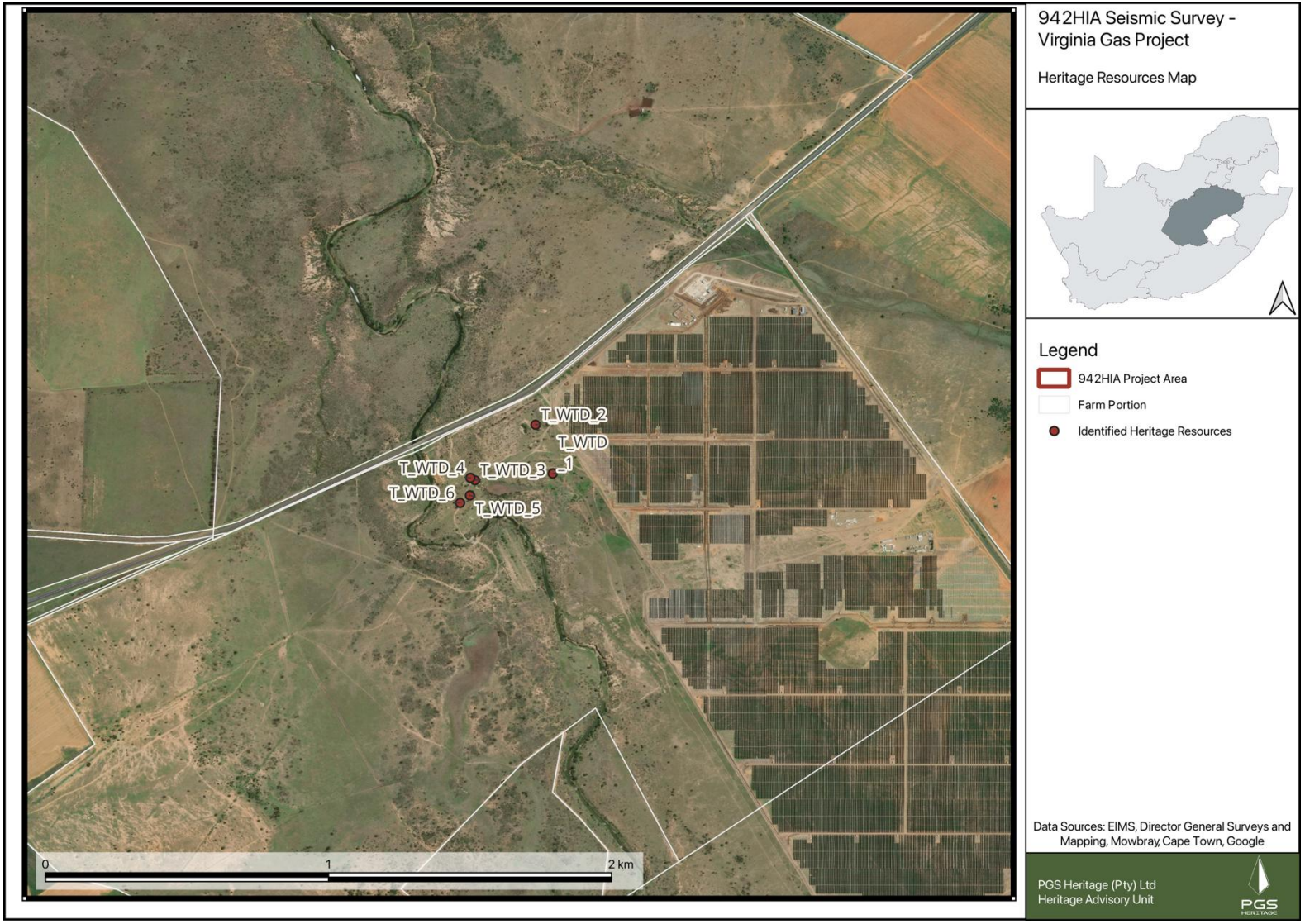


Figure 30 - Identified heritage resources, as recorded on the Farm Weltevrede 638.

Figure 31 - Identified heritage resources, as recorded on the Farm Vlakpan 358.

4.3 Palaeontology

The proposed Tetra4 3D Seismic Survey Project near Virginia, in the Free State Province is indicated on the 1: 250 000 Winburg 2826 Geological Map (Council for Geosciences, Pretoria). The proposed development is underlain by Quaternary alluvium (yellow, single bird figure), Superficial sands (Qs, yellow) the Jurassic dolerite of the Karoo Igneous Province (Jd, red) as well as the Adelaide Subgroup of the Karoo Supergroup (Pa, green) (**Figure 33, Table 6**). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Quaternary sediments is Moderate (green), that of the Karoo Igneous Suite is Zero (grey), while that of the Adelaide Subgroup (Beaufort Group) is Very High (red) (Almond and Pether, 2009; Almond *et al*., 2013, Groenewald et al 2014) (**Figure 34, Table 3**). Palaeontological Sensitivity generated by the Department of Forestry, Fisheries and the Environment National Environmental Web-Based (DFFE) Screening Tool indicates a Very High Palaeontological Sensitivity (deep red, **Figure 6**). Recent research has indicated that the Adelaide Subgroup is represented by the Balfour Formation.

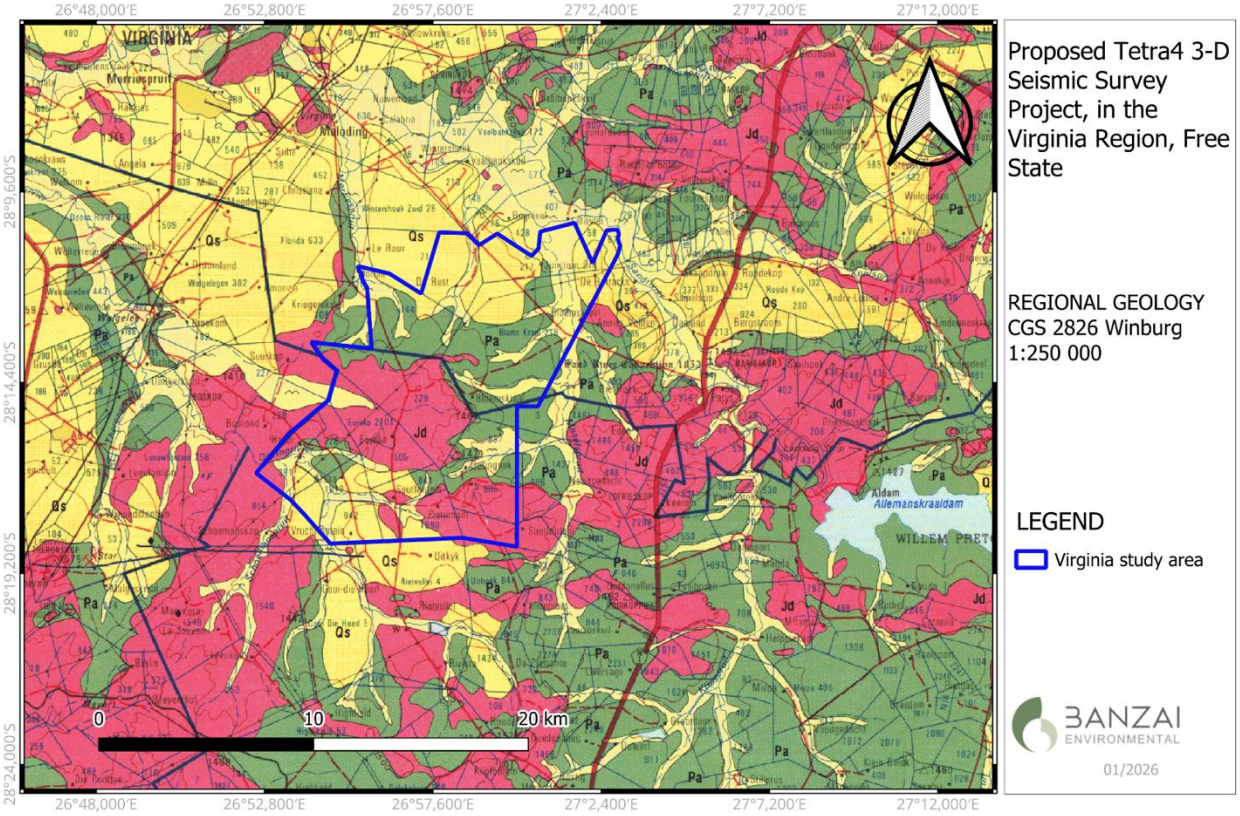


Figure 32 - Extract of the 1:250 000 000 Winburg 2826 Geological Map (Council for Geosciences, Pretoria) indicates that the study area is underlain by Quaternary alluvium (yellow, single bird figure), Quaternary sand (Qs, yellow), Dolerite (Jd, red; Karoo Igneous

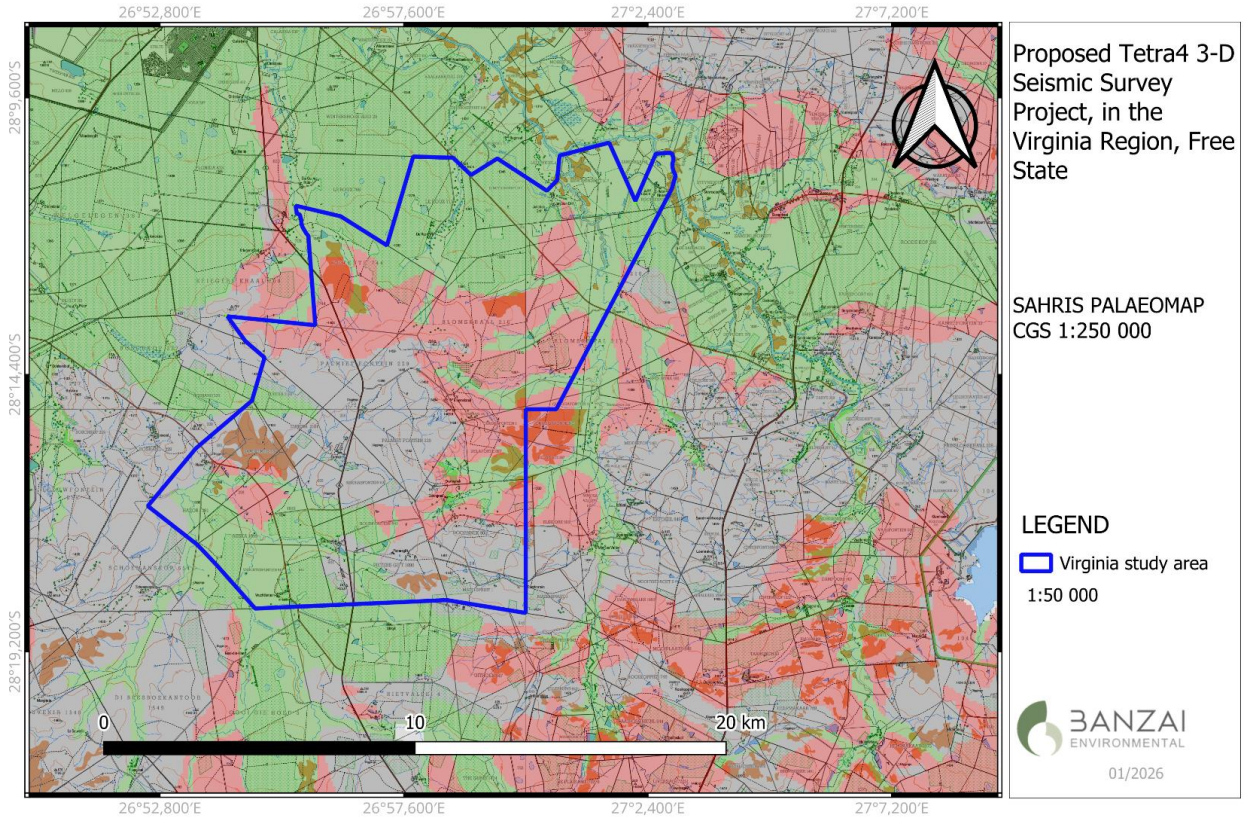


Figure 33 - Extract of the SAHRIS PalaeoMap (Council for Geosciences, Pretoria) indicates that the study area is underlain by sediments with a Very High (red), Moderate (green) and Zero (grey) Palaeontological Sensitivity.

Table 6: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).

Colour	Sensitivity	Required Action
Red	Very high	Field assessment and protocol for finds is required
Orange/yellow	High	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
Green	Moderate	Desktop study is required
Blue	Low	No palaeontological studies are required however a protocol for finds is required
Grey	Insignificant/zero	No palaeontological studies are required
White/clear	Unknown	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

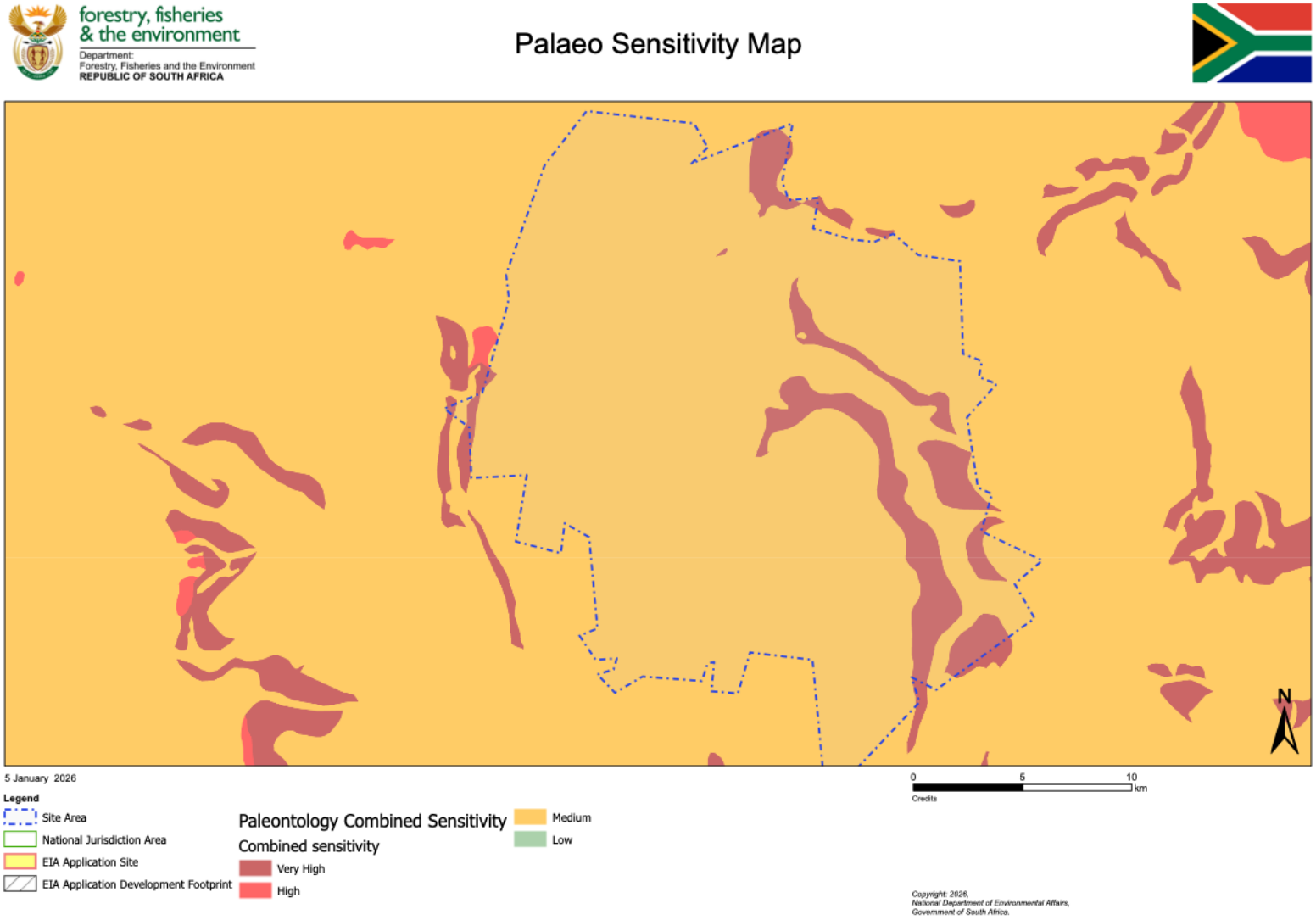


Figure 34 - DFFE Screening map indicating a high-medium sensitivity rating for palaeontology.

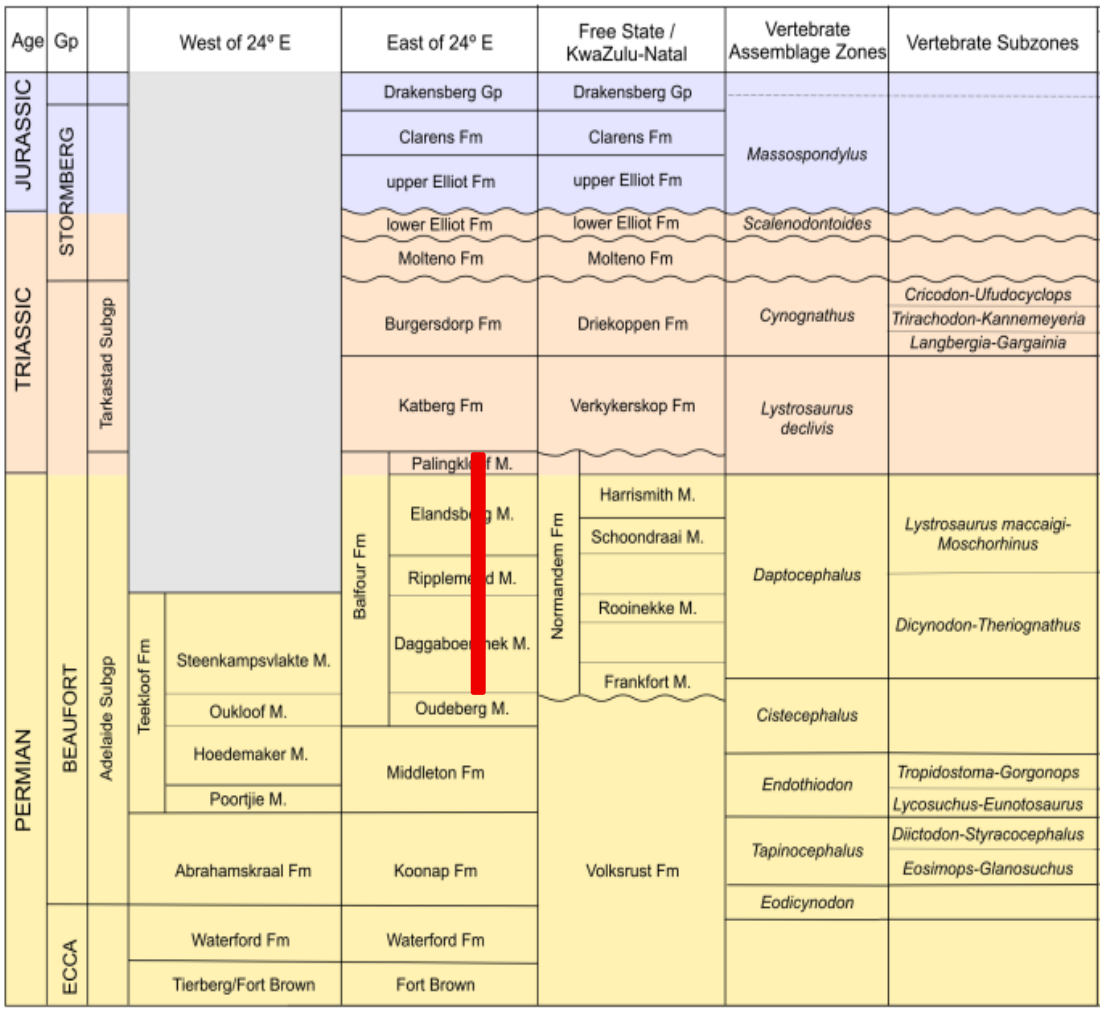


Figure 35 - Vertebrate biozonation range chart for the Main Karoo Basin of South Africa.

Solid lines indicate known ranges, dotted lines indicate suspected but not confirmed ranges, single dot represents the stratigraphic position of the taxa that have only been recovered from a single bed. Wavy lines indicate unconformities. (PLYCSR=Pelycosauria and MAMMFMES+Mammaliaformes. Gp=group, Subgp-Supbroup, Fm=Formation, M=Member. The proposed development is indication by the red polygon (Figure taken from Smith et al., 2020).

The overall Palaeontological Sensitivity of the area is classified as **Very High**, as indicated by the SAHRIS Palaeomap (**Figure 32; Table 8)**.

The SAHRIS PalaeoMap (red, **Figure 33, Table 8**) and the National Environmental Web-based Screening Tool (deep red, **Figure 34**) both classify the development area as having Very High Palaeontological Sensitivity.

5 IMPACT ASSESSMENT

The impact assessment rating is based on the rating scale as contained in **Appendix A**.

The following section provides an analysis of the impact of the proposed project area on heritage resources identified within the project area containing the proposed pipeline infrastructure upgrades:

5.1 Details of all alternatives considered

This section describes alternative means of carrying out the operation and the consequences of not proceeding with the proposed project.

The “no-go” alternative refers to the option of not going ahead with the proposed project. This will entail maintaining the current status quo with no impact from the project.

5.1.1 Damage to unknown finds (Chance Finds Procedure)

A **low significance** has been allocated to chance finds before mitigation, and **very low significance** post-mitigation.

5.1.2 Palaeontology

A high palaeontological significance has been allocated for the construction phase of the development pre-mitigation, and **medium-to-low post-mitigation.**

5.2 Impact assessment summary table

Implementing the EIMS impact assessment methodology provides a quantitative assessment of the impacts of the proposed pipeline infrastructure upgrades.

Table 7: Summary of Impact Tables – Archaeology, Heritage and Graves

Identifier	Discipline	Impact	Alternative	Phase	Event	Pre-Nature	Pre-Extent	Pre-Duration	Pre-Magnitude	Pre-Reversibility	Consequence	Pre-Probability	Pre-Mitigation Significance	Pre-Mitigation Significance	Post-Nature	Post-Extent	Post-Duration	Post-Magnitude	Post-Reversibility	Consequence2	Post-Probability	Post-mitigation Significance Score	Post-Mitigation Significance	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score	Final Significance
1	Heritage & Archaeology	Damage/destruction to known archaeological and heritage material		Construction	Normal operations or events	-1	2	5	2	5	-3,5	4	-14	High -	1	2	5	1	5		1	3,25	Low +	Low	1	1	1,00	3,25	Low +
2	Graves	Damage/ destruction/disturbing of known graves		Construction	Normal operations or events	-1	1	5	5	5	**-4**	5	-20	High -	1	1	5	1	5		1	3	Low +	Low	1	1	1,00	3,00	Low +

Table 8: Summary of Impact Tables – Palaeontology

Identifier	Discipline	Impact	Alternative	Phase	Event	Pre-Nature	Pre-Extent	Pre-Duration	Pre-Magnitude	Pre-Reversibility	Consequence	Pre-Probability	Pre-Mitigation Significance Score	Pre-Mitigation Significance	Post-Nature	Post-Extent	Post-Duration	Post-Magnitude	Post-Reversibility	Consequence2	Post-Probability	Post-mitigation Significance Score	Post-Mitigation Significance	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score	Post-Mitigation Significance
	Palaeontology	Loss of fossil Heritage	No	Construction	Normal Operation	- 1	1	5	5	5	- 4	4	-16	- High	-1	1	5	2	2	-2.5	2	-5	- Medium to Low		1	3	-1.25	-6.25	- Medium to Low

6 MANAGEMENT RECOMMENDATIONS AND GUIDELINES

The following section must be read in conjunction with **Table 10**: Heritage Management Plan for EMPr implementation.

6.1 Construction and operational phases

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camp areas and small-scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during construction and may be recoverable, keeping in mind that delays can be costly during construction, and as such must be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance; however, foundation holes do offer a window into the past, and it may thus be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project, and these must be catered for. Temporary infrastructure developments, such as construction camps and laydown areas, are often changed or added to the project as required. In general, these are low-impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognise any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following Chance Finds Procedure (CFP) be implemented:

6.2 Chance Finds Procedure

- A heritage practitioner/archaeologist should be appointed to develop a heritage induction program and conduct training for the Environmental Control Officer (ECO) as well as team leaders in the identification of heritage resources and artefacts **during the implementation of the Environmental Management Program (EMPr)**.
- An appropriately qualified heritage practitioner/archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.
- Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted.
- The qualified heritage practitioner/archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource.
- The contractor therefore should have a contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.
- Construction can commence as soon as the site has been cleared and signed off by the heritage practitioner/archaeologist.

6.3 Possible finds during construction

The study area occurs within a greater historical and archaeological context as identified during the desktop and fieldwork phase. Soil clearance for infrastructure as well as the proposed reclamation activities, could uncover the following:

- Historical structures and foundations
- Unmarked BGG
- Archaeological sites or resources
- Palaeontological sites or resources

6.4 Timeframes

It must be kept in mind that mitigation and monitoring of heritage resources discovered during construction activity will require permitting for the collection or excavation of heritage resources, and lead times must be worked into the construction time frames. **Table 9** gives guidelines for lead times on permitting.

Table 9: Lead times for permitting and mobilisation.

Action	Responsibility	Timeframe
Preparation for field monitoring and finalisation of contracts	The contractor and service provider	1 month
Application for permits to do necessary mitigation work	Service provider – Archaeologist and SAHRA	3 months
Documentation, excavation and archaeological report on the relevant site	Service provider – Archaeologist	3 months
Handling of chance finds – BGG/Human Remains	Service provider – Archaeologist and SAHRA	2 weeks
Relocation of BGG affected by the development	Service provider – Archaeologist, SAHRA, Local and Provincial Government	6 months

6.5 Heritage Management Plan for Environmental Management Plan

Table 10: Heritage Management Plan for EMPr implementation.

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
General project area	Implement a chance to find procedures in case where possible heritage finds are uncovered. Tentative 30m buffers should be placed on possible remote sensing and historical map markers, as supplied.	Construction	During construction	Applicant ECO Heritage Specialist	ECO (monthly/as or when required)	Ensure compliance with relevant legislation and recommendations from SAHRA under section 34-36 and 38 of NHRA	ECO Monthly Checklist/ Report
Burial grounds and graves	Demarcate a **30 m** buffer during construction and treat as no-go zones. Should a fence be erected, access to the BGG for interested and affected parties and next-of-kin must be allowed, and suitable measures for public access control must be put in place. An access protocol to manage visits	Construction	During Construction	Applicant ECO) Heritage specialist	Monthly	Ensure compliance with relevant legislation and recommendations from SAHRA under section 36 and 38 of NHRA	ECO Monthly Checklist/ Report

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
	by the next of kin must be included in the EMPr. - If direct impact is unavoidable and relocation is required, a grave relocation process (NHRA section 36) must be undertaken. This involves social consultation, public participation, and permits from SAHRA under the NHRA and the National Health Act (Act 61 of 2003) (NHA), as amended.						
Historical Homesteads/Structures	Demarcate a **30 m** buffer during construction and treat as no-go zones for sites graded as **IIIC or higher.** If conservation is not possible, mitigation must be undertaken under a NHRA section 34 permit from SAHRA, as well as a section 36 permit in the case of homesteads which hold the chance of containing graves. For mitigation of these sites,						

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
	documentation by an architectural historian, which consists of drawing and photographing the structure and the layout, as well as recording any special characteristics identified during the recording, after which a destruction permit can be applied for, as discussed in the bullet point below. - This includes detailed documentation of the site layout and infrastructural characteristics, and archaeological geophysics and test excavations to investigate the possibility of infant burials for the homesteads which are assessed to hold the potential for graves, which will require a NHRA section 35 permit from SAHRA. - Destruction may proceed only on condition of the issuing of						

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
	an appropriate permit from the relevant PHRA/SAHRA, which is supported by the mitigation report, or if the cultural heritage resource is to be retained in situ and not altered; an HMP in compliance with section 47(3) of the NHRA must be compiled by a heritage specialist/archaeologist and implemented.						
Archaeological sites	Demarcate a **30 m** buffer during construction and treat as no-go zones for sites graded as **IIIC or higher.** As the 30 m buffer is a guideline, it may be reduced only if the site is clearly demarcated, strictly avoided, and such a reduction is approved by SAHRA. If conservation is not possible, mitigation must be undertaken under a NHRA section 35 permit from SAHRA.	Construction	Construction	Applicant Archaeologist SAHRA Relevant PHRA	Monthly	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 of the NHRA	Report after construction

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
	- This includes a sample surface collection for all types of archaeological material in the impacted areas.						
Palaeontological resources	If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the ECO in charge of these developments must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation can be carried out by a palaeontologist	Construction	During Construction	Applicant ECO	Monthly	Ensure compliance with relevant legislation and recommendations from SAHRA under section 36 and 38 of the NHRA	ECO Monthly Checklist/ Report

7 CONCLUSIONS AND RECOMMENDATIONS

PGS was appointed by EIIMS to undertake an HIA that forms part of the BA for the Phase 2 Seismic Survey investigations by Tetra4/Renergen Ltd., on multiple farm portions. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province.

A standalone Palaeontological Desktop Assessment was conducted by PGS Heritage (Pty) Ltd; **942HIA-002**.

During the study, a total of 22 heritage sites and 28 features were identified. These consist of six historical homesteads (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); five metal objects (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**); 12 recent structures (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**) , one ceramic surface scatter (**T_BD_1**); and one grave (**T_BV_1**).

7.1 Historical Homesteads/Structures

Of the six historical homesteads/structures identified on site, (**T_BD_2**, **T_JR_1**, **T_JR_2**, **T_JR_3**, T_VlkP_1, and T_WTD_1); all were predominantly foundation remnants or had >5% ex situ. All were graded as **NCW** with **zero-low local significance**.

7.2 Recent Structures

12 recent structures were identified on site, all were predominantly foundation remnants or had >5% ex situ (**T_VkIP_1[b]**, **T_VkIP_2**, **T_VkIP_3**, **T_VkIP_5**, **T_VkIP_7[a]**, **T_VkIP_9**, **T_VkIP_10[a]**, **T_WTD_2**, **T_WTD_3**, **T_WTD_4**, **T_WTD_5**, and **T_WTD_6**); all of which were graded as **NCW** with **zero local significance**.

7.3 Archaeological/Historical Material

There were five metal objects, predominantly industrial machinery remnants and oil/water drums (**T_VkIP_1**, **T_VkIP_4[a]**, **T_VkIP_6**, **T_VkIP_7**, and **T_VkIP_10**), graded **NCW** with **low local significance**, and one ceramic surface scatter (**T_BD_1**) of famille-bleu polychrome ceramic sherds, graded **NCW** with **low local significance**.

7.4 Burial Grounds and Graves

A single illegibly marked grave was identified (**T_BV_1**), and graded as **Grade IIIA**, with **high significance**. It should be noted that the landowner advised of another grave within the vicinity, but was not forthcoming with a precise bearing, and the receiving environment was incredibly overgrown and impassable.

7.5 Palaeontology

The proposed development is underlain by Quaternary alluvium, Superficial sands, the Jurassic dolerite of the Karoo Igneous Province, as well as the Adelaide Subgroup of the Karoo Supergroup. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Quaternary sediments is Moderate (green), that of the Karoo Igneous Suite is Zero (grey), while that of the Adelaide Subgroup (Beaufort Group) is Very High (red).

Although the SAHRIS PalaeoMap indicates that the study area falls within a zone of Very High Palaeontological Sensitivity, the significance of potential impacts associated with the proposed survey is assessed as Very Low, owing to the non-invasive nature of the activities. As no vegetation clearance or subsurface disturbance will occur, the proposed survey is not expected to result in any direct impacts on palaeontological heritage resources.

Should any fossil material be encountered during any phase of the project, whether exposed at surface or during unforeseen ground-disturbing activities, the Chance Find Protocol must be implemented immediately by the Environmental Control Officer (ECO) or the responsible site manager. All fossil discoveries must be protected in situ and reported to the South African Heritage Resources Agency (SAHRA) to ensure that appropriate recording and, where necessary, collection can be undertaken by a qualified palaeontologist.

7.6 Mitigation measures

Mitigation measures are described in **Table 10**.

7.7 Conclusion

It is the combined considered opinion of the heritage specialists that the proposed project will have no direct impact on any known cultural heritage resources. **It is the combined considered opinion of the heritage specialists that a field-based palaeontological assessment is urgently conducted**. With the implementation of recommended mitigation measures in case of a chance find, the overall impact on heritage resources will be reduced to acceptable levels during the activities of the project

8 REFERENCES

ANDREOU, A.A. 2025. Heritage Impact Assessment for the proposed pipeline infrastructure upgrade for Harmony Gold Mining Co. Ltd, on portions of the Farms St Helena 42, Marmageli 20, and Stuirmanspan 92. Mathjabeng Local Municipality, Lejeweleputswa District Municipality, Free State Province

ANDREOU, A.A. 2026. Heritage Impact Assessment for the proposed Nyala Solar Power Plant Access Road Infrastructure on portions of the Farms Doornrivier 330, Kalkoenkrans 225, Stille Woning 703, and Glen Ross 734 near Virginia, Free State Province.

BERGH, J.S. 1999. Geskiedenisatlas van Suid-Afrika: die Vier Noordelike Provinsies. Van Schaik, Pretoria.

BIRKHOLTZ, P.D. 2017a. Heritage Impact Assessment for the Proposed Tetra4 Cluster 1 Gas Production Project. Prepared for EIMS.

BIRKHOLTZ, P.D. 2017b. Heritage Audit Report for the Beatrix Mining Areas of Sibanye Gold, Between Welkom and Theunissen, Lejweleputswa District, Orange Free State Province. Prepared for Sibanye Gold (Pty Ltd).

CHANGUION, L. Silence of the Guns: The History of the Long Toms of the Anglo-Boer War. Protea Book House, Pretoria.

COETZEE, F. 2008. Cultural Heritage Survey of the Proposed Phakisa Housing Development, Welkom, Free State.

DE BRUIN, J. C. 1960. Hennenman (‘n Gedenkboek). Hennenman: Volkskool.

DE KOCK, M. G. W. 1985. Gister is Verby! 1910-1985: Verhaal van die Ned. Geref. Gemeente Theunissen. P.p 11 – 24.

DE RUITER, D.J., CHURCHILL, S.E., BROPHY, J.K. AND BERGER, L.R. 2011. Regional Survey of Middle Stone Age Fossil Vertebrate Deposits in the Virginia-Theunissen area of the Free State, South Africa in Navorsinge van die Nasionale Museum, vol. 27, part 1.

DEACON, H.J. & J. DEACON. 1999. Human Beginnings in South Africa: Uncovering the Secrets of the Stone Age. David Philip Publishers. Cape Town.

DREYER, J.J.B. 1990. The Iron Age Prehistory of the Winburg Area, Orange Free State. Unpublished MA Dissertation, University of the Witwatersrand.

DREYER, C. 2004a. First Phase Heritage/Archaeological Assessment of the Proposed Powerline Route at Phakisa Mine, Welkom, Free State.

DREYER, C. 2004b. Archaeological and Historical Investigation of the Graves at the Proposed Housing Developments near Thabong, Welkom, Free State.

DREYER, C. 2005. Archaeological and Historical Investigation of the Proposed New Filling Station at Virginia, Free State.

DREYER, C. 2007. First Phase Archaeological and Cultural Heritage Assessment of the Proposed New MTN Cell Phone Mast at Pumlani Cemetery, Thabong, Welkom, Free State.

DREYER, C. 2008. First Phase Archaeological and Heritage Investigation of the proposed Oppenheimer Park Golf Estate, Welkom, Free State.

DREYER, C. 2011. First Phase Archaeological and Heritage Investigation of the proposed Chicken Egg Production Developments at Mooidoorns 319, Welkom, Free State.

DUNCAN, P. 1915. Report of the Select Committee on Rebellion (SC1 ’15) Cape Town, House of Assembly.

ERASMUS, B.J. 2004. On Route in South Africa. Jonathan Ball Publishers, Johannesburg.
Felstar Publishers. 1968. Welkom: Capital of the Orange Free State Goldfields. Felstar Publishers (Pty) Ltd, Johannesburg.

FOURIE, W. 2008b. Archaeological Impact Assessments within South African Legislation in South African Archaeological Bulletin, 63(187): 77 – 85.

FOURIE, W. 2021. Heritage Impact Assessment for The Proposed Harmony FSS6 Reclamation Pipeline, Welkom, Free State Province.

HELME, N. 1974. Thomas Major Cullinan: A Biography. McGraw-Hill Book Company, Johannesburg.

HUFFMAN, T.N. 2007. Handbook to the Iron Age: The archaeology of Pre-Colonial Farming Societies in Southern Africa. University of KwaZulu-Natal Press, Scottsville.

JOHNSON, J.P. 1910. Geological and Archaeological Notes on Orangia. Longmans, Green & Company, London.

KUMAN K & R. J. CLARKE. 1986. Florisbad-New Investigations at a Middle Stone Age Hominid Site in South Africa. Geoarchaeology: An International Journal, Vol. 1, No. 2, 103-125 (1986). John Wiley & Sons, Inc.

KRUGER, N. 2021A. Archaeological Impact Assessment (AIA) On Portions Of The Farms Bloemhoek 509, Welgelegen 382, Mooi Uitzig 352, Florida 633, Le Roux 717 And Detente 744 For The Proposed Virginia Solar Park Power Lines Ba Project, Lejweleputswa District Municipality, Free State Province.

KRUGER, N. 2021b. Archaeological Impact Assessment (AIA) On Portions Of The Farm Blomskraal 216 For The Proposed Virginia 1, 2 & 3 Solar Parks Eia Project, Lejweleputswa District Municipality, Free State Province.

LANGNER, D. & A. RAATH. 2014. Die Afrikanerrebellie: 1914-1915. Die Erwe van Ons Vaad're Nr. 6. Kraal Uitgewers, Pretoria.

LEGASSICK, M. 2010. The politics of a South African frontier: the Griqua, the Sotho-Tswana and the missionaries, 1780 – 1840. Basler Afrika Bibliographien, Basel.

LYE, W.F. & C. MURRAY. 1980. Transformations on the Highveld: The Tswana and Southern Sotho. David Phillip, Cape Town.

MACHENS, E.W. 2009. Platinum, Gold and Diamonds: The adventure of Hans Merensky's discoveries. Protea Boekhuis, Pretoria.Maggs, T.M. 1976. Iron Age Communities of the Southern Highveld. (Occasional Publication 2). Pietmaritzburg: Natal Museum.

MANN, N. 2023. Proposed Pipeline Project from Harmony One Plant to Free State North 1 TSF, Near Welkom, Free State Province.

MASON, R.J. 1969. The Oppermansdrif Dam Archaeological Project: Vaal Basin in The South African Archaeological Bulletin, Vol. 24, No. 95/96, pp. 182-192.

MAURICE, J.F. & M.H. GRANT. 1906. History of the War in South Africa. Hurst and Blackett, London.

MAYHEW, V. 1982. Reader's Digest: Illustrated Guide to Southern Africa. The Reader's Digest Association.

MEINTJIES, J. 1973. The Voortrekkers. Cassell, London.

MORRIS, D. 2008. Archaeological and Heritage Phase 1, Impact Assessment for proposed upgrading of Sishen Mine Diesel Depot Storage Capacity at Kathu, Northern Cape. Kimberley: McGregor Museum.

MUCINA, L. & RUTHERFORD, M.C. (eds) (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

NIENABER, P. J. & LE ROUX, C. J. P. 1982. Vrystaat-Fokus. Pretoria: Sigma Press (Pty) Ltd.

OBERHOLSTER, J.J. 1972. The Historical Monuments of South Africa. The Rembrandt van Rijn Foundation for Culture, Cape Town.

PAKENHAM, T. 1979. The Boer War. Bergvlei: Jonathan Ball Publishers.

RAATH, A.W.G. 2007. De La Rey: Die Stryd vir Vryheid. Kraal Uitgewers, Pretoria.

ROSSOUW, L. n.d. Phase 1 Heritage Impact Assessment of a proposed new rehabilitation facility at Odendaalsrust, Free State Province. Prepared for EKO Environmental Consultants.

SCHOEMAN, K. Bloemfontein: die ontstaan van ‘n stad 1846 – 1946. Human & Rousseau, Cape T own.

SHORTEN, J.R., 1970: The Johannesburg Saga. John R. Shorten (Pty) Ltd, Johannesburg.

THE MINING MANUAL AND YEARBOOK, 1914.

THE READER’S DIGEST. 1994. Illustrated History of South Africa: The Real Story. The Reader’s Digest Association Limited, Cape Town.

UNION OF SOUTH AFRICA, 1916. Report of the Judicial Commission of Enquiry into the Causes of and Circumstances relating to the recent Rebellion in South Africa, December 1916.
Unpublished References

VAN DER WALT, J. 2013a. Archaeological Scoping Report for the Proposed Oryx Solar Energy Facility. Prepared for Savannah Environmental (Pty) Ltd.

VAN DER WALT, J. 2013b. Archaeological Impact Assessment for the Proposed Oryx Solar Energy Facility. Prepared for Savannah Environmental (Pty) Ltd.

VAN RYNEVELD, K. 2013. Phase 1 Archaeological Impact Assessment for the Lebone Solar Farm, Onvewag RE/728 and Vaalkranz 2/220, Welkom, Free State, South Africa. Prepared for Enviroworks.

VAN SCHALKWYK, J. 2014. Cultural Heritage Impact Assessment Report for the Proposed SANRAL Thabong Interchange Development, Welkom Region, Free State Province.

VAN SCHOOR, M.C.E. 2007. Christiaan Rudolph de Wet: Krygsman en Volksman. Protea Boekhuis, Pretoria.

VISAGIE, J.C. 2011. Voortrekkerstamouers: 1835 – 1845. Protea Boekhuis, Pretoria.

WADLEY, L. 2013. Recognizing complex cognition through innovative technology in Stone Age and Palaeolithic sites in Cambridge Archaeological Journal, 23: 163-183.

WARWICK, P. 1983. Black People and the South African War: 1899 – 1902. Ravan, Johannesburg.

APPENDIX A

ENVIRONMENTAL IMPACT METHODOLOGY

EIMS: IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as presented herein and utilised for all EIMS Impact Assessment Projects, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The approach may be altered or substituted on a case-by-case basis if the specific aspect being assessed requires such- such instances require prior EIMS Project Manager approval. The broad approach to the significance rating methodology is to determine the significance (S) of an environmental risk or impact by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relating this to the probability/ likelihood (P) of the impact occurring. The S is determined for the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the S to determine the overall final significance rating (FS). The impact assessment will be applied to all identified alternatives.

Determination of Significance

The final significance (FS) of an impact or risk is determined by applying a prioritisation factor (PF) to the post-mitigation environmental significance. The significance 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:

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

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

Criteria for Determining 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. Highly localised, limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).
	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).
Duration	1	Immediate (<1 year, quickly reversible)
	2	Short term (1-5 years, less than project lifespan)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).
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, or affected environmental components are already degraded)
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)

	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)
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 very high time and cost.
	5	Irreversible Impact.

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

It is noted that both environmental risks as well as environmental impacts should be identified and assessed. Environmental Risk can be regarded as the potential for something harmful to happen to the environment, and in many instances is not regarded as something that is expected to occur during normal operations or events (e.g. unplanned fuel or oil spills at a construction site). Probability and likelihood are key determinants or variables of environmental risk. Environmental Impact can be regarded as the actual effect or change that happens to the environment because of an activity and is typically an effect that is expected from normal operations or events (e.g. vegetation clearance from site development results in loss of species of concern). Typically, the probability of an unmitigated environmental impact is regarded as highly likely or certain (management and mitigation measures would ideally aim to reduce this likelihood where possible). In summary, environmental risk is about what could happen, while environmental impact is about what does happen.

Probability/ Likelihood Scoring

Probability	1	Improbable (Rare, the event may occur only in exceptional circumstances, the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <5% chance).
	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).
	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).

The result is a qualitative representation of relative significance associated with the impact. Significance is therefore calculated as follows:

$$S = C \times P$$

Determination of Significance

	5- Very High[1]	5	10	15	20	25
	4- High	4	8	12	16	20

	3- Medium	3	6	9	12	15
	2- Low	2	4	6	8	10
	1- Very low	1	2	3	4	5

[1] In the event that an impact or risk has very high or catastrophic consequences, but the likelihood/ probability is low, then the resultant significance would be Low-medium. This does in certain instances detract from the relative important of this impact or risk and must consequently be flagged for further specific consideration, management, mitigation, or contingency planning

		1- Improbable	2- Low	3- Medium/ Possible	4- High/ Probable	5- Highly likely/ Definite
	Probability					

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

Significance Scores

S Score	Description
≤4.25	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
>4,25, ≤8.5	Low-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>8.5, ≤13.75	High-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>13.75	High (i.e. where the impact will have a significant environmental risk/ reward).

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

Impact Prioritization

Further to the assessment criteria presented in the section above, it is necessary to consider each potentially significant impact in terms of:

Cumulative impacts; and

The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impacts' post-mitigation significance (post-mitigation). This prioritisation factor does not aim to

detract from the significance 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 post-mitigation significance based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 5: Criteria for Determining Prioritisation

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.
	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
Irreplaceable Loss of Resources (LR)	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 5. The impact priority is therefore determined as follows:

$$\boldsymbol{Priority = CI + LR}$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from

1 to 1.5 (Refer to Table below).

Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance (FS), the PF is multiplied by the post-mitigation significance scoring. The ultimate aim of the PF is an attempt to increase the post mitigation

environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a higher significance).

Final Environmental Significance Rating

Significance Rating	Description
<-25	**Very High (Impacts in this class are extremely significant and pose a very high environmental risk. In certain instances these may represent a fatal flaw. They are likely to have a major influence on the decision and may be difficult or impossible to mitigate. Offset's may be necessary.**
<-13.75 to -25	High negative (These impacts are significant and must be carefully considered in the decision-making process. They have a high environmental risk or impact and require extensive mitigation measures).
-8.5 to -13.75	Medium-High negative (i.e. Impacts in this class are more substantial and could have a significant environmental risk. They may influence the decision to develop in the area and require more robust mitigation measures).
<-4.25 to <-8.5	Medium- Low negative (i.e. These impacts are slightly more significant than low impacts but still do not pose a major environmental risk. They might require some mitigation measures but are generally manageable).

Significance Rating	Description
-1 to -4.25	Low negative (i.e. Impacts in this class are minor and unlikely to have a significant environmental risk. They do not influence the decision to develop in the area and are typically easily mitigated.
0	No impact
1 to 4.25	Low positive
>4.25 to <8.5	Medium-Low positive
8.5 to 13.75	Medium-High positive
>13.75	High positive

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

Nature	-1	Likely to result in a negative/ detrimental impact	CONSEQUENCE	ENVIRONMENTAL
	1	Likely to result in a positive/ beneficial impact		
Extent	1	Activity (i.e. Highly localised, limited to the area applicable to the specific activity)		

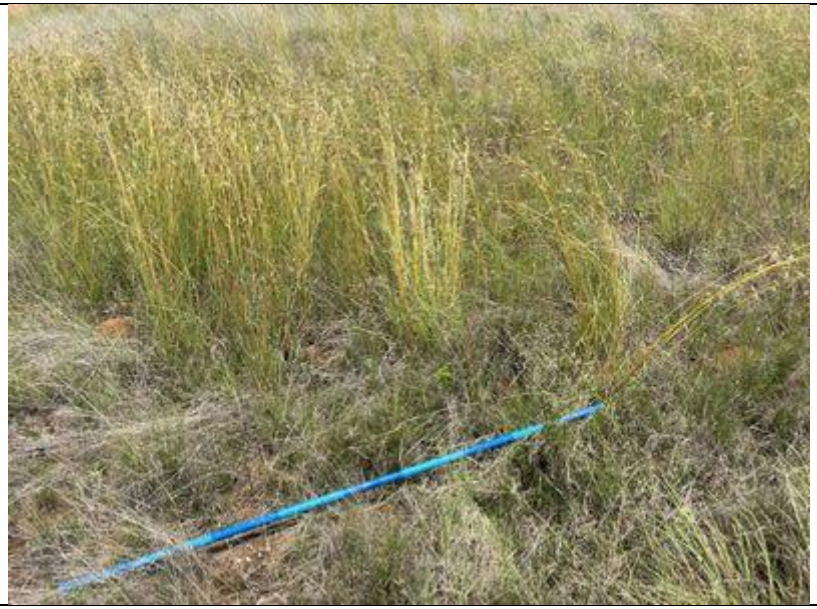
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)		
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)		
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).		
	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).		
Duration	1	Immediate (<1 year, quickly reversible)		
	2	Short term (1-5 years, less than project lifespan)		
	3	Medium term (6-15 years)		
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)		
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).		
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, or affected environmental components are already degraded)		
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).		
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)		
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)		
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		
Probability	1	Improbable (Rare, the event may occur only in exceptional circumstances, the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <5% chance).	PROBABILITY	
	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).		
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).		
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).		

	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).		
Cumulative Impact	1	Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	PRIORITISATION FACTOR	
	2	Medium: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.		
	3	High: 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	1	Low: Where the impact is unlikely to result in irreplaceable loss of resources.		
	2	Medium: 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.		
	3	High: Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).		
Degree of Confidence	Low	<30% certain of impact prediction		

APPENDIX B

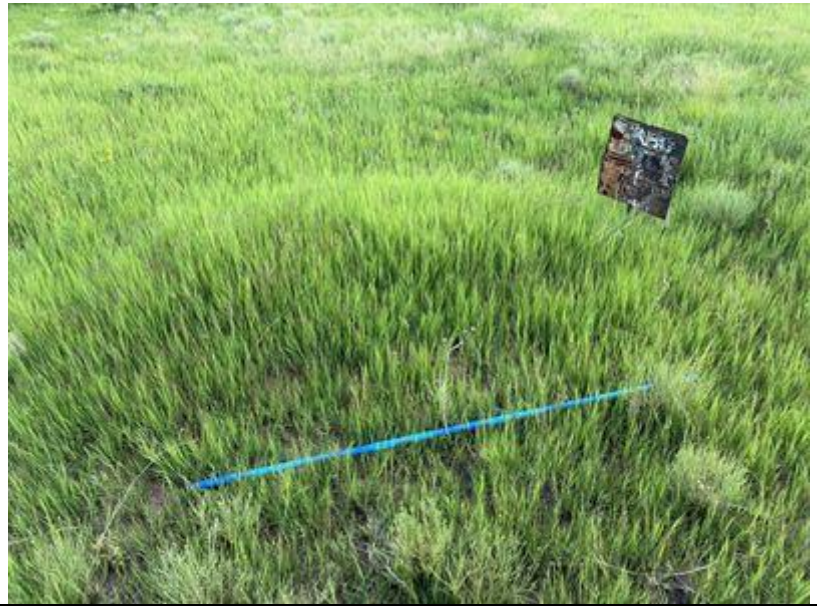
SITE DESCRIPTION FORMS

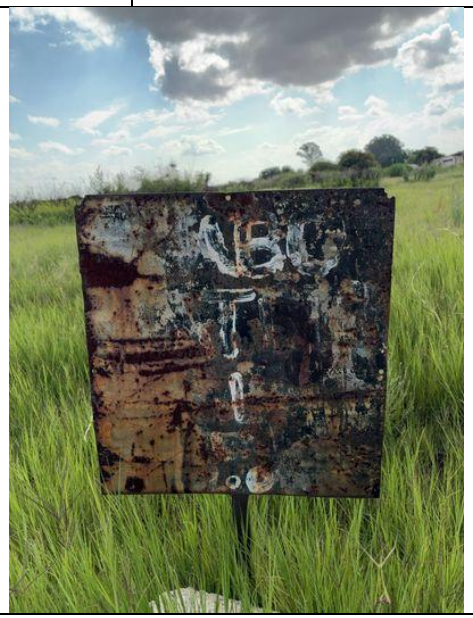
Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_BD_1	-28.11548	26.71674	Small (4) surface scatter of famille bleu polychrome glaze ceramic sherds	Low local	NCW



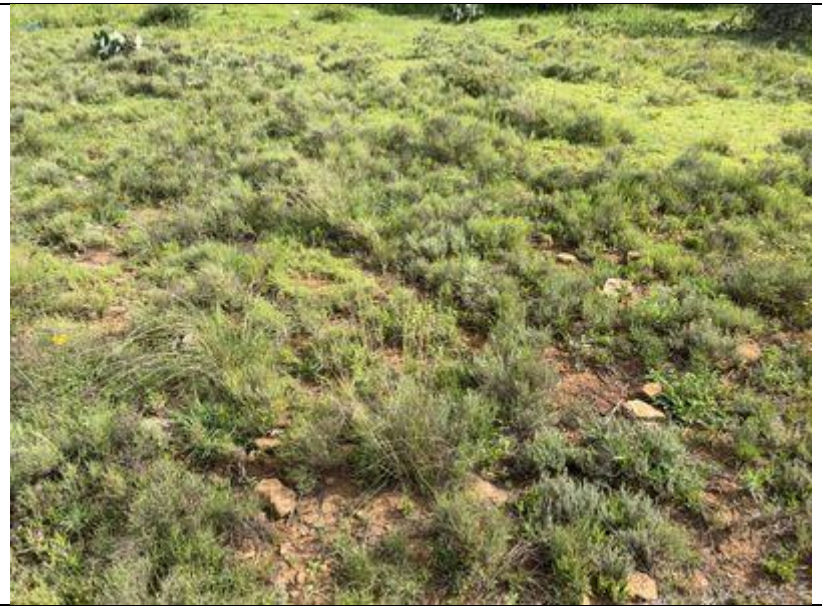
Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_BD_2	-28.11486	26.71618	Surface remains of structure, with prefab pylons partially erect. Area is very overgrown and has been used as a rubbish heap by the surrounding community.	Low local	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VB_1	-28.09587	26.7042	Single overgrown grave. Sign is illegible.	High local	Grade 3 - A (IIIA),





Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_JR_1	-28.09889	26.74592	Structure foundation outline, not much present.	Low local	NCW



Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_JR_2	-28.09962	26.74624	Packed stone foundation.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_JR_3	-28.09878	26.74696	Packed rock foundations, intersected by farm fencing.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_1	-28.25565	26.75828	Cluster of at least two structure remains. Large industrial machinery and associated waste present.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_2	-28.25499	26.75916	Concrete slab, industrial use. Large area of industrial waste (electronica etc).	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_3	-28.25504	26.75968	Single brick column base and concrete mix.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_4	-28.25471	26.75999	Borehole pipe, associated to T_VlkP_5	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_5	-28.25444	26.76021	Water reservoir, spalling present.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP6	-28.25431	26.75992	Large metal oil/liquid drum		NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_7	-28.25457	26.75973	Site consists of two water reservoirs, one oil drum, one windmill pump pile and an old farm sign.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_8	-28.25472	26.75968	Two metal oil/liquid drums	Low	NCW

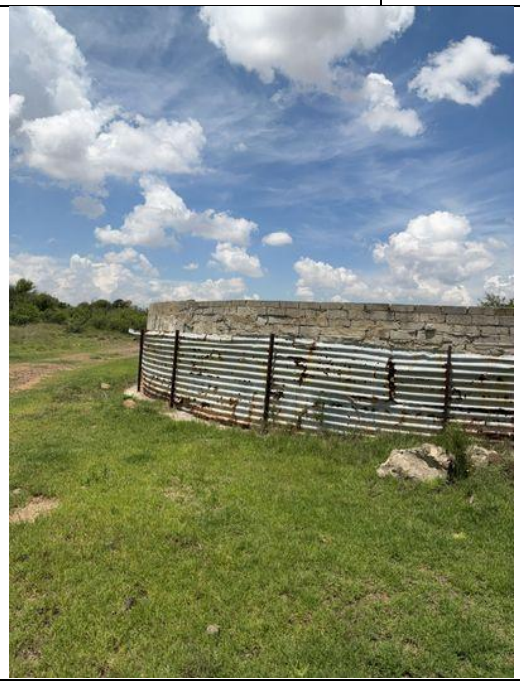
Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_9	-28.25467	26.75942	Derelict structure, industrial waste surrounding area	Low	NCW

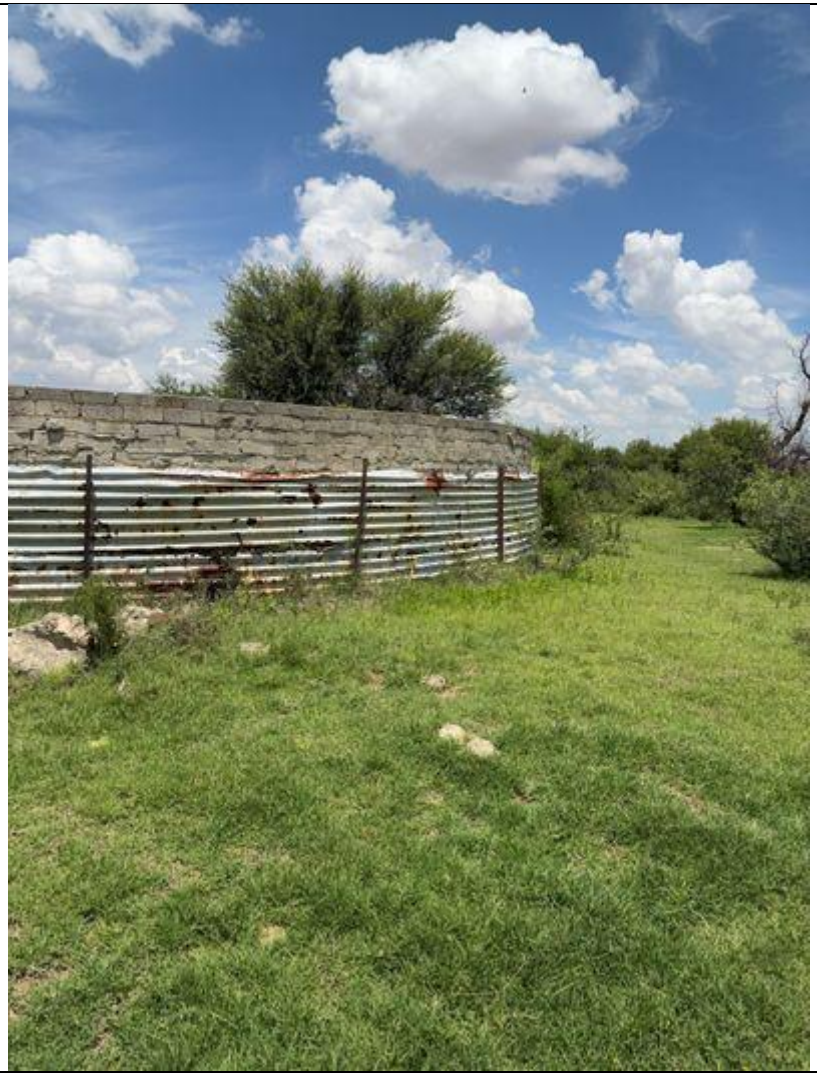
Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_VlkP_10	-28.25465	26.75917	Water / oil drum in stilts, and structure remnants	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_1	-28.18921	26.80324	Brick scatter from structure remains. Point as close as possible, unable to alight from vehicle due to buffalo.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_2	-28.18745	26.80262	Large farmstead structure remnants. Could not alight from vehicle due to buffalo. Range of red brick structure and large stone packed walls	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_3	-28.18945	26.80044	Large water reservoir. Recent. Could not alight from vehicle due to buffalo.	Low	NCW





Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_4	-28.18937	26.80028	Several small structure remnants. Potentially from agricultural or livestock use. Could not alight from vehicle due to buffalo.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_5	-28.19	26.80026	Structure remains, house of red brick. Could not alight vehicle due to buffalo.	Low	NCW

Site Number	X	Y	Brief Site Description	Significance	Heritage Rating
T_WTD_6	-28.19027	26.79991	Concrete foundation. Could not alight from vehicle due to Buffalo.	Low	NCW

APPENDIX C

PGS SPECIALIST CV

ALEXANDER ANDREOU

Heritage Practitioner & Built Environment Specialist

PROFILE

My professional career includes research, curation, conservation, risk mitigation, critical urbanism, and legislative compliance. I hold two advanced postgraduate degrees; with my MPhil research focusing on (re)interpretation in the archaeological praxis, and my PhD research on the role of heritage built environment and what I coined as 'archived buildings' in the creation and recording of public and social histories.

My work at PGS Heritage is centered on leading the Built Environment Unit, which focuses on the safeguarding and activation of South Africa's historic fabric.

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EMAIL ADDRESS:
alex@pgsheritage.com

PGS HERITAGE

EDUCATION

University of Pretoria
2011 - 2013
BA Archaeology & Ancient Cultures

University of Pretoria
2015
Post-Graduate Diploma Museum and Heritage Studies

University of Cape Town
2019 - 2021
MPhil Conservation of the Built Environment

University of Pretoria
2023 - 2025
PhD Development Studies (Research Chair for Critical Architecture and Urbanism)

WORK EXPERIENCE

PGS Heritage Group of Companies
(South Africa, Lesotho, Mozambique, and Portugal)
Senior Heritage Specialist
2025 - present
I support the advancement of PGS Heritage's presence within the built heritage sector, providing specialist input on conservation management strategies, interpretive frameworks, and practical application of national heritage legislation within development and planning contexts. My role includes authorship, editorial, and technical review support for HIAs and related reports, as well as archival and historical research.

Nedbank Group Ltd
Heritage & Arts Manager *(i.a.)*
2016 – 2025
Led a series of dynamic and multidisciplinary roles that blended cultural stewardship with practical management. It ensured that Nedbank's heritage and art assets were safe guarded in alignment with best practice and national legislation. The role wove together archival expertise with strategic initiatives, ensuring the preservation, accessibility, and visibility of the institution's historical legacy.

University of Pretoria Museums
Cultural Officer *(i.a.)*
2014 – 2016
Championed public engagement, documentation, and preservation across UP's museological collections, specifically the Mapungubwe gold, bone, ivory, and ceramics. I contributed to key research, access, and conservation initiatives through collaborative, community-focused projects and international partnerships.

PROFESSIONAL AFFILIATION

Accredited Heritage Practitioner
Association of Professional Heritage Practitioners

Accredited Archaeologist
Association of Southern African Professional Archaeologists