

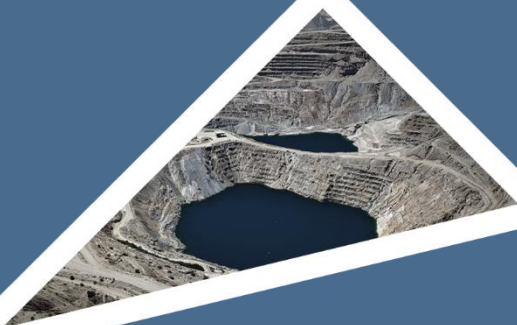


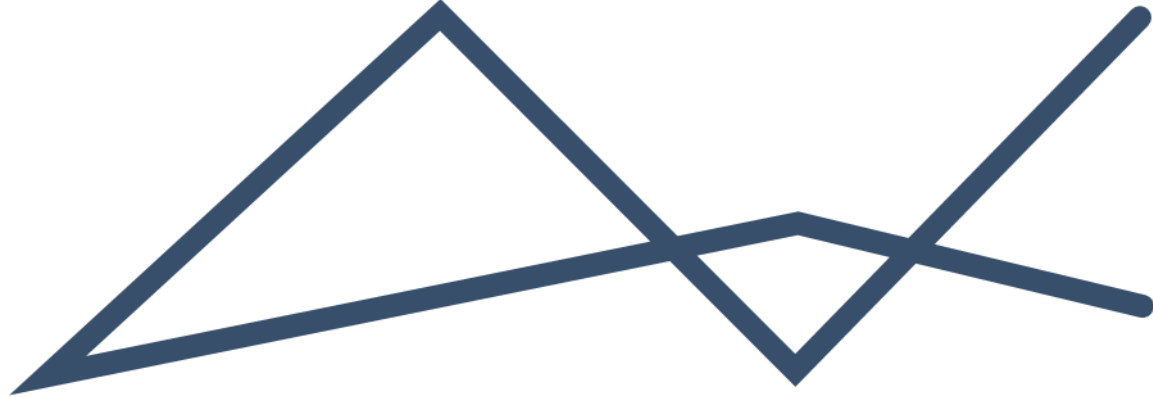
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D3 ENERGY PRODUCTION RIGHT
APPLICATION ON MULTIPLE FARM
PORTIONS, FREE STATE PROVINCE
PHASE 1 HERITAGE IMPACT ASSESSMENT REPORT

JUNE 2026





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Table of Contents

1	Background Information	1
1.1	Description of Project	1
1.2	Heritage Specialist Details	1
1.3	Declaration	2
1.4	Terms of Reference	2
1.5	legislative Requirements	2
2	Archaeological Background.....	5
2.1	Literature Review	5
2.1.1	Overview of Archaeology in South Africa	5
2.1.2	The Stone Age	5
2.1.3	The Iron Age.....	10
2.1.4	Historical Period.....	16
2.2	Site-Specific Background	21
2.2.1	Early Human Evolutionary Evidence	21
2.2.2	Iron Age Finds of the Free State	22
2.2.3	Heritage of the Closest Towns and Locations of Heritage Interest	22
2.3	Databases and Collections	23
2.4	Previous Relevant Impact Assessments	23
2.5	Motuoane Hennenman Part II EA Amendment	24
3	Environmental Attributes and Baseline Environment	24
3.1	Climate	24
3.2	Topography	25
3.3	Drainage and Catchment	25
3.4	Geology	25
4	Methodology.....	28
4.1	Initial Desktop Assessment	28
4.2	Field Survey	28
4.3	Documentation and Analysis	28
4.4	Classification of Sites.....	30
4.5	Limitations.....	30
4.5.1	General Limitations.....	30
4.5.2	Project-Specific Limitations	31
5	Findings.....	31
5.1	Desktop Assessment Results	31
5.2	Field Assessment Results	34
5.2.1	General Observations	34
5.2.2	Archaeological Finds	34



5.3	Summary of Findings	39
6	Impact Assessment	43
6.1	Impact Assessment Methodology	43
6.2	Identified Heritage Impacts	48
7	Recommendations and Mitigations	51
7.1	Site-Specific Recommendations and Mitigations	51
7.2	Overall Recommendations	51
7.3	Heritage Protocol and Chance Finds	52
8	Conclusion and Impact Statement	52
9	References	53

List of Figures

Figure 1: Locality Map	4
Figure 2: Examples of ESA lithics. Typical Oldowan tools (a-f). Acheulean LCTs (v-z) (after Kuman and Gibbon, 2018).	6
Figure 3: Examples of MSA material evidence or artefacts after Wadley (2015). Abalone (<i>Haliotis midae</i>) shell with traces of an ochre-rich liquid (A); engraved ochre slab (B); perforated shells (C); Still Bay points (D). (after Henshilwood, 2012)	7
Figure 4: Examples of an adze (A), scrapers (B-D, G), backed bladelets (I), bladelet cores (e), and segments (F, H). Typical pieces associated with the LSA (after Forssman <i>et al.</i> , (2010))	8
Figure 5: Some examples of LSA organic material remains from Border Cave. Bone awls and points (1-7), Ostrich Eggshell beads (8-21), tick shell beads (22-23), bound organic material (24), digging stick (25), poison applicator (26), implement made from warthog or bushpig lower canine (27), and notched bone tools (28-30)(after Backwell <i>et al.</i> (2023) and d’Errico <i>et al.</i> (2012))	9
Figure 6: General understanding of Bantu migrations related to the larger ceramic traditions, Kalundu (Western Stream) and Urewe (Nkope and Kwale Branches) (After Huffman, 1989).	11
Figure 7: Examples of Bambata Potsherds (Huffman, 2005).	12
Figure 8: An Iron Age ceramic sequence demonstrating transitions between K2 and Mapungubwe ceramic styles (Huffman, 2009)	12
Figure 9: Famous golden implements of Mapungubwe (A - Golden Rhinoceros, B - Golden anklets) (Woodborne <i>et al.</i> , 2009).	13
Figure 10: Type N stone wall structures as illustrated by Maggs (1976).	13
Figure 11: An on-site photograph of a Group I or Type N stone wall structure at Klipriviersberg Nature Reserve (James, 2018).	14
Figure 12: An aerial photograph of stone wall structures part of the Bokoni complex, Mpumalanga (after Delius <i>et al.</i> (2012)).	14
Figure 13: LiDAR imagery of Molokwane stone wall structures of Kweneng, a lost city discovered at Suikerbosrand Nature Reserve (after Sadr and Mshuqwana (2020)).	15
Figure 14: Distribution of the different types of stone wall structures across the northeastern region of South Africa (after Huffman, 2007)	16



Figure 15: A 1700s drawing of Vergelegen, a Cape Colony homestead including multiple buildings including slave lodges. (after Markell <i>et al.</i> 1995).....	17
Figure 16: An Arabic script representing the first written texts of the Afrikaans language (late 19th Century) (after Davids (2018))	18
Figure 17: A photograph of Johannesburg from the 1890s (after Chirisa and Matamanda (2019))	19
Figure 18: A picture of Springfontein, a refugee war camp which was established as a repercussion of the war's influence (after British National Archives).....	20
Figure 19: Nelson Mandela burning his pass in 1959. A pass was a requirement for people to move across the country. Such documents have now become items representing the Apartheid regime (Thompson, 2001).	21
Figure 20: Map taken from the Motuoane Hennenman Part II EA Amendment HIA conducted by PGS Heritage. Note that some of the transects considered as part of the current project were surveyed for this project.	24
Figure 21: Annual Climatic conditions typical of the Western Free State (considering data from Welkom, after https://www.meteoblu.com/en/weather/historyclimate/climatemodelled/welkom_south-africa_940909)	25
Figure 22: Topography Map of the site and surrounding areas.	26
Figure 23: Map of the geology of the site and surrounding areas.	27
Figure 24: IFRAO Standard Scale used for photography of Archaeological finds.	29
Figure 25: Map of relative Archaeological and Cultural Heritage Sensitivity (DFE Screening Tool).	32
Figure 26: Extract of the First Edition Topographic map 2826BB dated 1945 indicating the presence of settlements (circled in red). Blue lines = seismic transects, green lines = gas line, orange dots = proposed production wells.	33
Figure 27: Aerial photograph of 1944. Note the presence of features (circled in red) corresponding with observations made in the First Edition Topographic maps.....	33
Figure 28: Extract of the First Edition Topographic map 2826BD dated 1947 indicating the presence of settlements (circled in red). Blue lines = seismic transects. Error! Bookmark not defined.	
Figure 29: Google Earth imagery of a disturbed area which once held settlements (general location circled in red) as heritage features along the proposed seismic transects (illustrated in blue). Error! Bookmark not defined.	
Figure 30: Extract of the First Edition Topographic map 2826BD dated 1947. Map includes the farm complex, Siberiasfontein. Note the grave and historical structures which fall along the proposed seismic transect (blue line).	34
Figure 31: Map of areas surveyed and tracked.	35
Figure 32: MPR019 – LSA lithics associated with the identified LSA Site	36
Figure 33: MPR018 – Foundation previously identified in past HIAs	37
Figure 34: MPR018 – A post or marker associated with the foundation. Similar posts were noted at MPR007 .	37
Figure 34: MPR020 – Photograph of Farm dam which was confirmed as not being of heritage significance	38
Figure 35: MPR021 – The most well-preserved grave of the grave site	39
Figure 36: MPR021 – A seemingly older grave of the grave site	39
Figure 36: Map of the different finds and sites of interest identified	42



List of Tables

Table 1: Details of the Archaeologist.....	2
Table 2: Different criteria and questions which guided the analysis of Archaeological and Heritage finds or sites.	29
Table 3: Classification of heritage sites as per the SAHRA Minimum Standards (2007) and adopted in this report	30
Table 4: Summary of different finds and sites identified.	40
Table 5: Criteria for Determining Impact Consequence.	43
Table 6: Probability Scoring.	45
Table 7: Determination of Risk.	45
Table 8: Significance Classes.....	45
Table 9: Criteria for Determining Prioritisation.	46
Table 10: Determination of Prioritisation Factor.....	47
Table 11: Final Significance Rating.....	47
Table 12: Archaeological Impact Assessment.....	50
Table 13: List of site-specific mitigations and recommendations	51

Appendices

Appendix 1: CV of the Archaeologist

Appendix 2: Specialist Declaration



Abbreviations

AD	<i>Anno Domini</i>
APHP	Association of Professional Heritage Practitioners
ASAPA	Association of South African Professional Archaeologists
CDNGI	Chief Directorate of National Geo-spatial Information
CRM	Cultural Resource Management
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioner Association of South Africa
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ESA	Earlier Stone Age
HIA	Heritage Impact Assessment
LCT	Large Cutting Tool
LSA	Later Stone Age
MPRDA	Minerals and Petroleum Resources Development Act
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
NRF	National Research Foundation
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
WRC	Water Research Commission
WUL	Water Use License
ya	Years ago



Executive Summary

D3 Energy South Africa (Pty Ltd, previously Motuoane Energy (Pty) Ltd (Motuoane) (hereafter referred to as the applicant) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Independent Environmental Assessment Practitioner (EAP) to assist with undertaking the required authorisation processes. This Heritage Impact Assessment forms part of the assessments required as part of the Environmental Authorisation (EA) application process.

The applicant wishes to convert a portion of their existing Exploration Right area (ER315) into a Production Right (PR). The proposed PR development will target world class helium and methane reserves, and will consist of up to 43 production wells, gas gathering pipelines, a helium recovery and gas processing plant (CNG or LNG) and associated infrastructure. In addition, ongoing exploration activities will include drilling of exploration wells, seismic and/or audio magnetotelluric surveys.

A comprehensive assessment was conducted to evaluate the potential impact of the project on archaeological and heritage resources. The study included a literature review, desktop assessment, and three-day field survey.

Using past studies, first edition topographic maps, aerial photography, and current satellite imagery, a total of 13 distinct heritage features were identified which may potentially be impacted by the proposed development. These included burial grounds or graves, historical period remains, structures associated with farmsteads, and a Later Stone Age site.

Based on the current layouts, the construction activities will not affect any of the features identified. However, a recommendation has been made to still consider buffers around the foundation and grave sites identified to ensure avoidance of these features. A Chance Find Procedure is also recommended to manage any discoveries during development should finds be discovered during the proposed construction activities. This includes halting activities if significant finds are discovered during construction, recording their location, and consulting a qualified archaeologist for further evaluation.

The proposed infrastructure does intersect with heritage features or the proposed buffers thereof (particularly MPR018 and MPR021). Avoidance of these features is advised. As long as the proposed mitigation measures are implemented there should be no significant heritage impacts as a result of the development. Therefore, from an Archaeological perspective, the development will not have significant foreseeable impacts and can proceed, providing the mitigation measures are implemented.



1 BACKGROUND INFORMATION

This section provides an overview of the proposed project as well as details of the Archaeologist, the terms of reference, and legislative background informing this assessment.

1.1 DESCRIPTION OF PROJECT

D3 Energy South Africa (previously Motuoane Energy (Pty) Ltd (Motuoane)) (hereafter referred to as the applicant) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Independent Environmental Assessment Practitioner (EAP) to assist with undertaking required authorisation processes. This Heritage Impact Assessment forms part of the assessments required as part of the application process.

The applicant wishes to convert a portion of their existing Exploration Right area (ER315) into a Production Right (PR). The proposed PR development will target world class helium and methane reserves, and will consist of up to 43 production wells, gas gathering pipelines, a helium recovery and gas processing plant (CNG or LNG) and associated infrastructure. In addition, ongoing exploration activities will include drilling of up to 48 exploration wells, and 8 seismic transects and 7 telluric lines with a combined length of ~66.74 km of seismic and/or audio magnetotelluric surveys.

The proposed development of the Production Right area will involve the following activities:

- Pre-drilling seismic and/or audio magnetotelluric surveys to optimize well locations for maximum deliverability;
- Drilling and completion of wells;
- Maintenance workovers of wells;
- Construction of gas gathering pipeline systems;
- Installation of gas compression and processing facilities;
- Construction of a helium recovery facility (gas or liquid helium) and gas (methane) processing plant (CNG or LNG); and
- Construction of associated infrastructure including roads, borrow pits, communications facilities and temporary accommodation facilities if necessary.

The proposed production right application area covers a total of ~14 440 hectares, covering various farm portions near the towns of Virginia and Ventersburg, Free State Province. See Figure 1 for Locality Map.

1.2 HERITAGE SPECIALIST DETAILS

As prescribed by the SAHRA (South African Heritage Resources Agency) Minimum Standards (2007), a Heritage Specialist (Professional Archaeologist) was appointed for the undertaking of the Archaeological Impact Assessment. Dr Lucien James was appointed in this regard. The following is a summary of the Heritage Specialist's details. Table 1 provides a summary of the Archaeologist's contact details, qualifications, and professional membership. Refer to Appendix 1 for full CV of Archaeologist.

Dr Lucien James is an Environmental Consultant and Archaeologist with experience in different fields across the Arts, Social Science, Natural Science, and academia in general. He has been employed by EIMS as an environmental consultant since March 2023 working on several projects under various roles. He is registered with EAPASA (Environmental Assessment Practitioners Association of South Africa) as a Candidate EAP (Environmental Assessment Practitioner). Lucien has obtained a BSc (Hons) in Geography, Archaeology and Environmental Studies (Archaeology-focused) and is accredited as a Professional Archaeologist with the Association of South African Professional Archaeologists (ASAPA). He holds a MSc in Geography having done research on phytoremediation and the mining industry. In 2024, he completed his Ph.D. through research with a focus on collaborative River Basin Management in South Africa. He has worked as a Teaching Assistant (TA) and researcher since 2018 and engages in academic work through publications and conferences. He has taught



undergraduate and Honour's Archaeology and Geography courses. His research has been funded by the National Research Foundation (NRF) and the Water Research Commission (WRC). He is also actively publishing new papers in international academic journals. He has presented his research at a national level through various conferences in South Africa and has participated in other conferences and workshops on Climate Change and Climate Change Adaptation.

Table 1: Details of the Archaeologist

Name:	Lucien Nicolas James
Tel no.	+27 11 789 7170
E-mail	lucien@eims.co.za
Professional Qualification/ Training:	BA (Archaeology and Geography); Wits University, 2017
	BSc (Hons) Geography, Archaeology and Environmental Studies; Wits University, 2018
	MSc (Geography, Archaeology and Environmental Studies); Wits University, 2021
	Ph. D; Wits University, 2024
Professional Membership/ Registrations:	Registered Candidate Environmental Assessment Practitioner (EAPASA reg. no. 2023/6772)
	Accredited Professional Archaeologist (ASAPA member no. 0619)
	Candidate Member of the Associated of Professional Heritage Practitioners (APHP member no. CHP0173)

1.3 DECLARATION

Refer to Appendix 2 for Declaration of the Archaeologist.

1.4 TERMS OF REFERENCE

This report aims to achieve several pre-defined objectives as per the prescription of the SAHRA Minimum Standards (2007), i.e. this report:

- Identifies the sites as well as potential associated heritage objects within and in close proximity of the footprint of a study area,
- Assesses the significance of sites and heritage objects,
- Comment on the impact of the development,
- Make recommendations for the mitigation or conservation of sites and associated Heritage objects

To address the terms of reference, a methodology has been adopted. This methodology is further elaborated on in sections to follow.

1.5 LEGISLATIVE REQUIREMENTS

This section describes the legislative requirements relating to this HIA report.

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority...” The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource



Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the National Environmental Management Act (Act 107 of 1998 – NEMA), and Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA). In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA.

The NEMA 23(2)(b) gives effect to the NHRA and states that an integrated environmental management plan should, “...identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”. A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken into account of in the EIA Regulations under the NEMA relates to the Specialist Report requirements (Appendix 6 of EIA Regulations 2014, as amended) which apply to Heritage Impact Assessments.

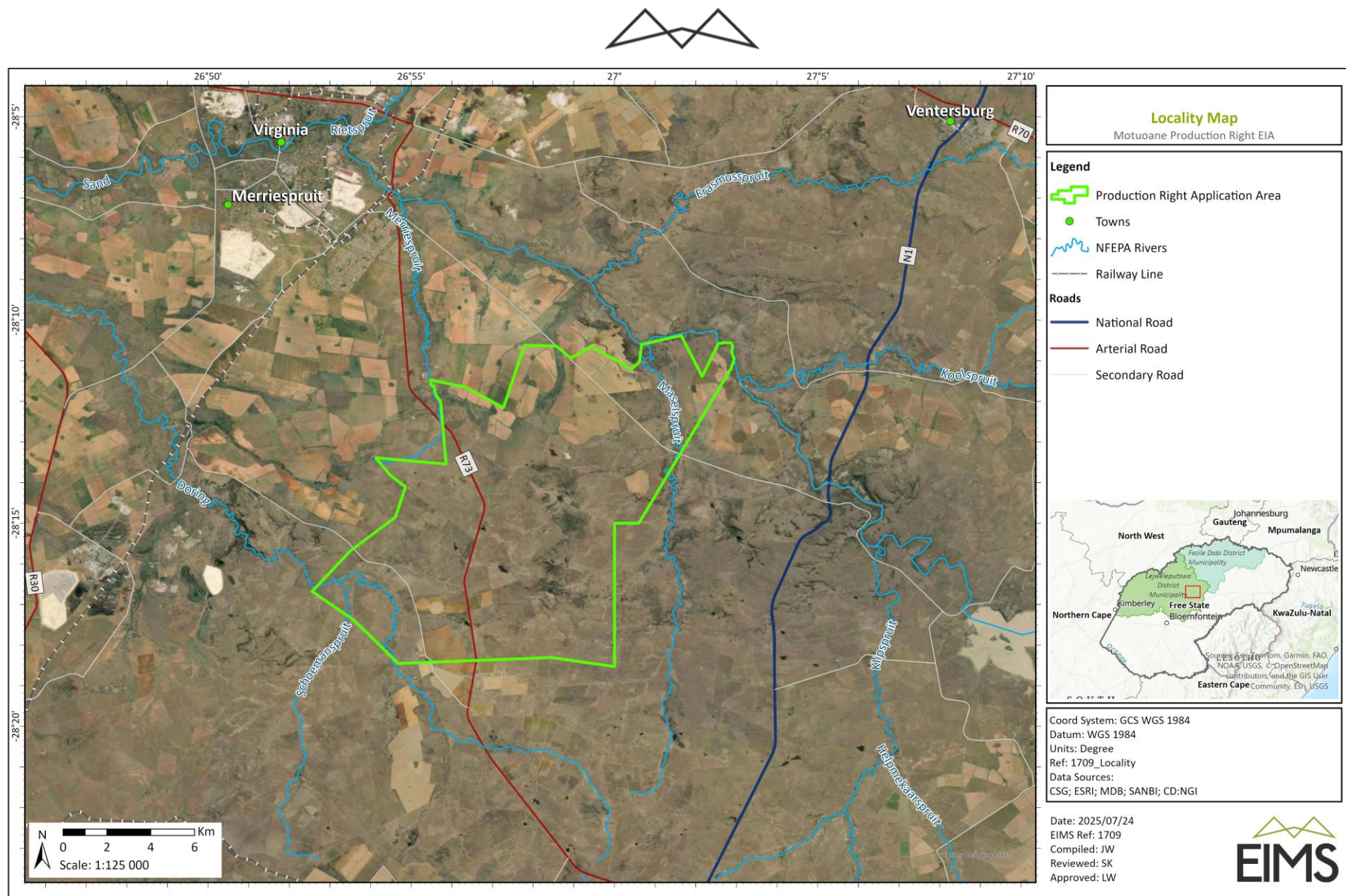


Figure 1: Locality Map



2 ARCHAEOLOGICAL BACKGROUND

This section presents the archaeological background to the study. A review of literature is presented to contextualise archaeology in South Africa. Available information on databases and collections as well as previous relevant assessments is presented.

2.1 LITERATURE REVIEW

Prior to the implementation of the methodology to be discussed, a comprehensive literature review was conducted to understand the archaeological and historical background of the site. Two main components were considered, that is, (1) the pre-historical linkages (that is relationships between people and the area pre-dating written records) and (2) historical linkages between people and the area in question. A brief overview of South Africa's Archaeology is necessary to contextualise this report, and this is provided in the sections below.

2.1.1 OVERVIEW OF ARCHAEOLOGY IN SOUTH AFRICA

South Africa's Archaeology is characterised by pre-historic events for the most part of the record. In this regard, the earliest archaeological evidence is mainly associated with the presence of hunter-gatherers and precolonial pastoralism. It is mainly in the last 2000 years when major social changes take place, including migrations, colonialism, industrialisation, and the establishment of complex societies and associated settlements (Huffman, 1982; Hall, 1993; Huffman, 2004; Mitchell and Whitelaw, 2005; Huffman, 2007). The country is characterised by three main periods, which are each associated with corresponding material evidence. These periods include:

1. The Stone Age (as early as 2.6 Million ya to as late as the last 100 years)
2. The Iron Age (100 AD to as late as the 19th century)
3. Historical Period (last 500 years)

This literature review considers these periods expanding on the context of each in terms of the current development and associated project site.

2.1.2 THE STONE AGE

South Africa's Stone Age stretches as far back as 2.6 Million ya, pre-dating modern humans. South Africa's Stone Age can be divided into three phases, namely:

- A. Earlier Stone Age (ESA)
- B. Middle Stone Age (MSA)
- C. Later Stone Age (LSA)

A) EARLIER STONE AGE

The Early Stone Age (ESA) represents the oldest material evidence in the archaeological record of South Africa. The phase can be divided according to different stone tool industries which are characterised by differing lithic technologies and assemblages. Specifically, ESA examples identified and studied in South Africa mainly relate to (a) Oldowan and (b) Acheulean stone tool industries (Klein, 2000).

The Oldowan dates as far back as 2.6 Million ya and examples of this industry can be found across Africa (Leakey, 1971; Chazan *et al.*, 2012; Kuman *et al.*, 2018; Stollhofen *et al.*, 2021; Favreau, 2023). The industry includes the earliest examples of key lithics such as hammerstones, manuports, cores, and flakes among other stone tool types. Figure 2 illustrates some of the different tools of this industry. Oldowan examples can be found across South Africa with some archaeological sites being the origins of some of the key examples of the type of lithics specifically found (Chazan *et al.*, 2012; Kuman *et al.*, 2018). These archaeological sites include Wonderwerk Cave in the Northern Cape and, Swartkrans Cave which forms part of the Cradle of Humankind near the Johannesburg area. Both of these sites are National Heritage Sites.

The Acheulean stone tool industry differs from the Oldowan since it includes examples of Large Cutting Tools (LCTs). This includes tools such as handaxes, picks, and cleavers. As highlighted by Li *et al.* (2018), the Acheulean



is characterised by the handaxe, which has been extensively studied. Differing from the Oldowan, these LCTs dating as far back as 1.7 Million ya (Kuman and Gibbon, 2018). Once more, the Cradle of Humankind and associated Sterkfontein hominid sites are key locations where some of the best examples of Acheulean stone tools have been found (Kuman and Gibbon, 2018; Li *et al.*, 2018). Figure 2 includes examples of the Acheulean LCTs (labelled v-z).

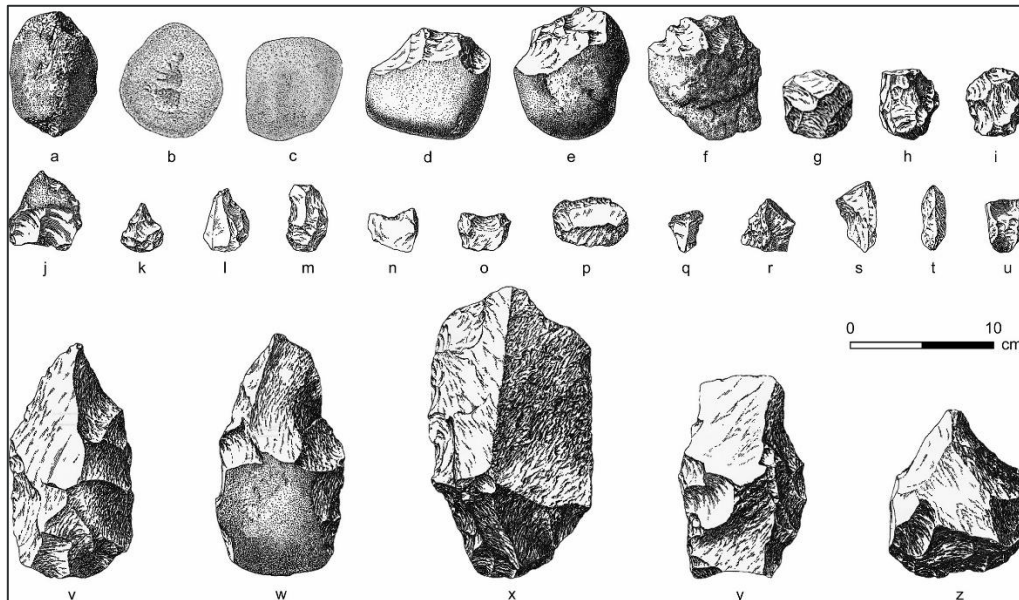


Figure 2: Examples of ESA lithics. Typical Oldowan tools (a-f). Acheulean LCTs (v-z) (after Kuman and Gibbon, 2018).

B) MIDDLE STONE AGE

Following the ESA, a phase related to very specific industries and stone tool examples chronologically occurs. The Middle Stone Age (MSA) represents one of the most interesting prehistoric periods of, not only South Africa's archaeological record, but of global significance. The MSA brought with it new material evidence which suggests changes in lifestyle and complexity being inspired by environmental changes (Wadley, 2015). Dating between 280 000 and 30 000 ya, the MSA is characterised by a material culture that includes lithic technology, as well as an emerging material culture including artefacts such as shell beads (Villa *et al.*, 2009; Henshilwood, 2012). While MSA sites occur across South Africa, key sites include Blombos Cave, Sibudu Cave, and Klasies River. Figure 3 offers an illustrative overview of the material associated with the MSA.



Figure 3: Examples of MSA material evidence or artefacts after Wadley (2015). Abalone (*Haliotis midae*) shell with traces of an ochre-rich liquid (A); engraved ochre slab (B); perforated shells (C); Still Bay points (D). (after Henshilwood, 2012)

In terms of Stone tool technology, flake-based lithics are characteristic of the MSA (Jacobs *et al.*, 2008). In this regard, stone tool industries of the MSA include examples of worked stone flakes knapped off cores. Notable MSA examples include Still Bay and Howieson's Poort tools. Both Still Bay and Howieson's Poort lithics include examples of pointed tools, with the idea that such would have represented the earliest examples of hafted tools in South Africa (Jacobs *et al.*, 2008; Villa *et al.*, 2009; Henshilwood, 2012; Wadley, 2015). Still Bay technology (as seen in Figure 3), for example, includes examples of bifacial sharpened points which differ from past technologies such as the Acheulean (Henshilwood, 2012). Other examples of hafted stone tools are also associated with this phase, particularly those found at Klasies River (Wurz, 2002; Morrissey, Mentzer and Wurz, 2022).

C) LATER STONE AGE

The Later Stone Age (LSA) represents a phase in the Stone Age which includes the widest record of material evidence. Dating between 43 000 ya and as late as the last 100 years, the LSA is associated with a period in South Africa's prehistory and history during which modern human ways of life, particularly hunter-gatherer activity is observed. Since South Africa was mainly occupied by hunter-gathering groups for the most of this period, LSA material culture has been studied in this regard. In other words, LSA material culture and artefacts have been associated with the lives of the San, for example (Mitchell, 2012; Villa *et al.*, 2012; Mesfin, 2024).

Key archaeological finds associated with the LSA are, firstly, a broad array of lithics. All LSA lithics include features of advanced shaping and working, otherwise referred to as retouch. Key tools include blades, bladelets and scrapers as pictured in Figure 4. Other tools include segments and adzes which are specific to the LSA. As previously stated, the LSA includes a large array of material evidence such as ostrich eggshell beads, bone tools, digging sticks, as well as other material which are also associated with Iron Age archaeology (Figure 5).

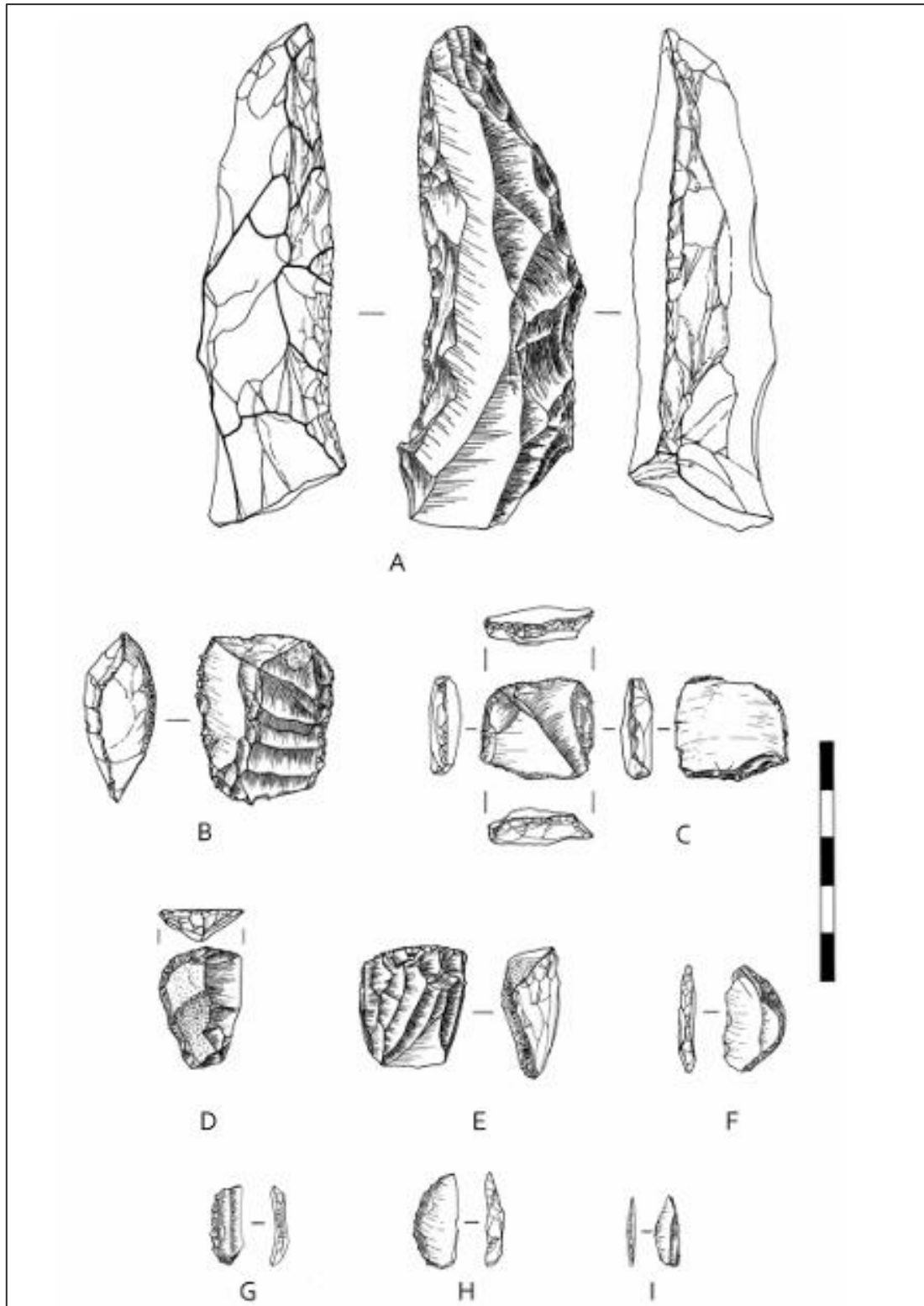


Figure 4: Examples of an adze (A), scrapers (B-D, G), backed bladelets (I), bladelet cores (e), and segments (F, H). Typical pieces associated with the LSA (after Forssman *et al.*, (2010))

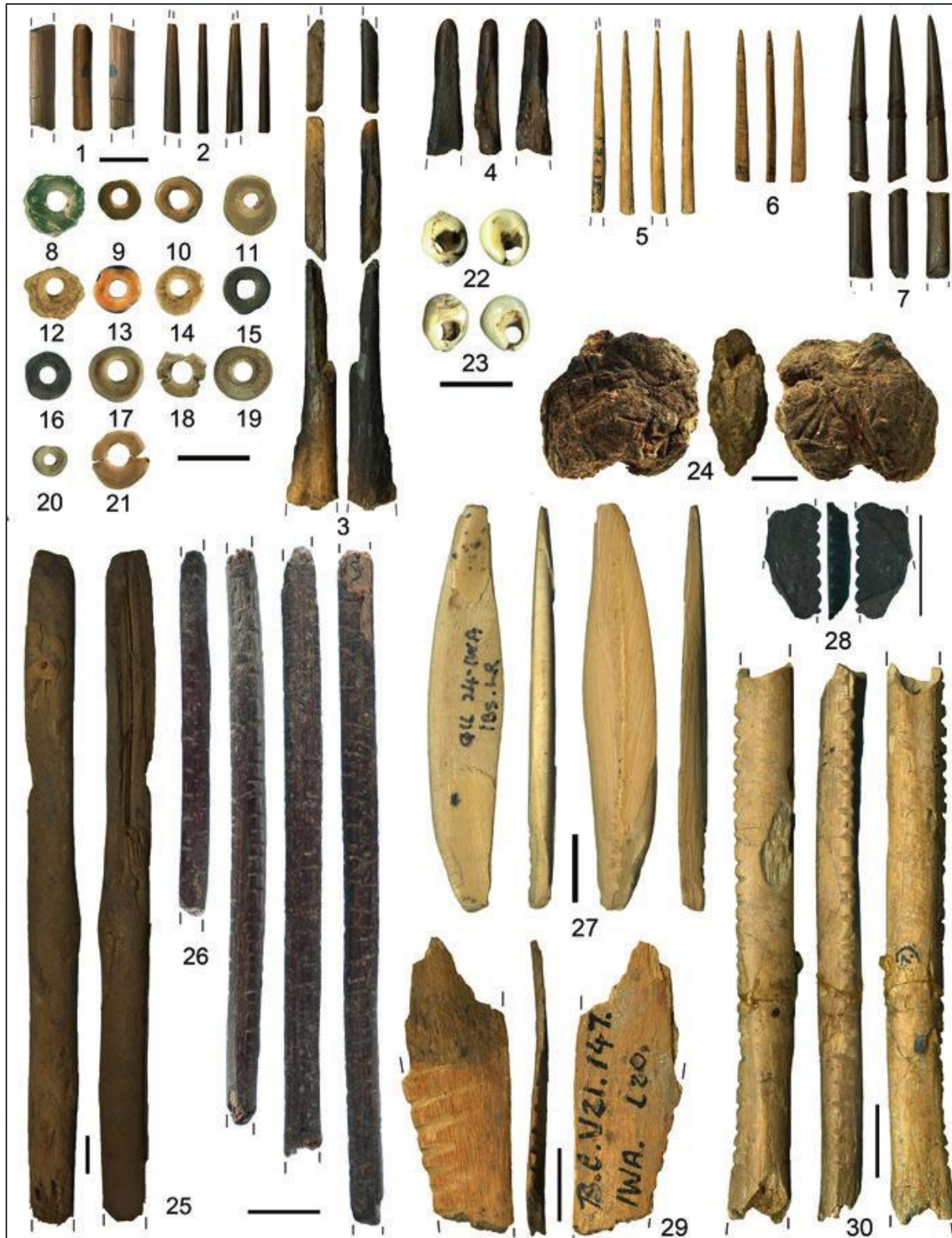


Figure 5: Some examples of LSA organic material remains from Border Cave. Bone awls and points (1-7), Ostrich Eggshell beads (8-21), tick shell beads (22-23), bound organic material (24), digging stick (25), poison applicator (26), implement made from warthog or bushpig lower canine (27), and notched bone tools (28-30)(after Backwell *et al.* (2023) and d'Errico *et al.* (2012))



2.1.3 THE IRON AGE

South Africa's archaeological record diversifies as interactions, migrations, and major changes take place over the last 2000 years. While hunter-gatherers continue to occupy most of the southern African landscape, the area becomes a melting pot with pastoralists gradually moving in from the North, and changes in hunter-gatherer lifestyles take effect. Bantu pastoralists bring with them iron working, together with key associated markers of pastoralist lifestyles. Unlike hunter-gatherer lifestyles in South Africa which are generally nomadic, and without distinct settlement patterns, pastoralists transform the landscape, introducing structures and complex societies. Altogether, the Iron Age is characterised by materials that signify the depth of change that takes place across southern Africa over the last 2000 years.

The Iron Age can be divided into three phases:

- A. Early Iron Age
- B. Middle Iron Age
- C. Late Iron Age

A) EARLY IRON AGE

Coinciding with the LSA, the Early Iron Age is characterised by the arrival of Bantu-speaking pastoralists, as well as Khoe herders. Dating between 200 and 1000 AD (200 to 900 AD according to Huffman (2007)), the Early Iron Age represents a period which transforms the southern African landscape with more people coming into the area, more interaction taking place, and the earliest examples of complex societies developing. The Early Iron Age and associated material evidence represent the first signs of migration and exchanges between hunter-gatherers, sheep herders, and pastoralists.

As summarised by Huffman (2007), during this period, the first occurrences of material culture related to groups originating from central to northern Africa can be observed. Huffman (2007) relates this occurrence to the spread and diffusion of Bantu languages across most of southern Africa. Above all, Huffman (2007) argues for the relationship between the spread of language to the spread of material culture and tradition observable through the stylistics of pottery and ceramic tradition.

Key ceramic types relate to the broader Kalundu and Urewe traditions, that is, the two main traditions associated with the Eastern and Western streams of migration supported by migration theories (Figure 6). Associated ceramic styles include Silver Leaves, Happy Rest, and Lydenberg, all related to similarly named sites. Another key ceramic tradition that occurs during this period is Bambata pottery which is indicative of hunter-gatherer and pastoralist interaction. Figure 7 provides an illustration of some examples of Bambata pots/herds.

B) MIDDLE IRON AGE

The Middle Iron Age sees the rise of complex societies relating to interaction events, particularly those around the Shashe-Limpopo confluence area. As iconic markers in South Africa's Archaeological record, sites such as K2 and Mapungubwe represent examples of the Middle Iron Age which has been associated with dates between 1000 and 1300 AD. Several studies have considered the dynamics of the ways of life associated with the Shashe-Limpopo confluence area and its complex societies (Calabrese, 2000; Huffman, 2000; Meyer, 2000; Huffman, 2009). While this period marks more interaction between hunter-gatherers and farmers, its material culture becomes very specific.

In terms of ceramic tradition, Huffman (2009) suggests a development of ceramic styles throughout the Middle Iron Age (Figure 8). Huffman (2009) suggests that the phase is indicative of developing complex societies. Altogether, the Middle Iron Age is a period in South Africa's archaeological record that is indicative of some of the earliest examples of trade and interaction as well as the inception of complex societies in the country. This phase also sees the first occurrences of the use of gold and golden implements (Figure 9).

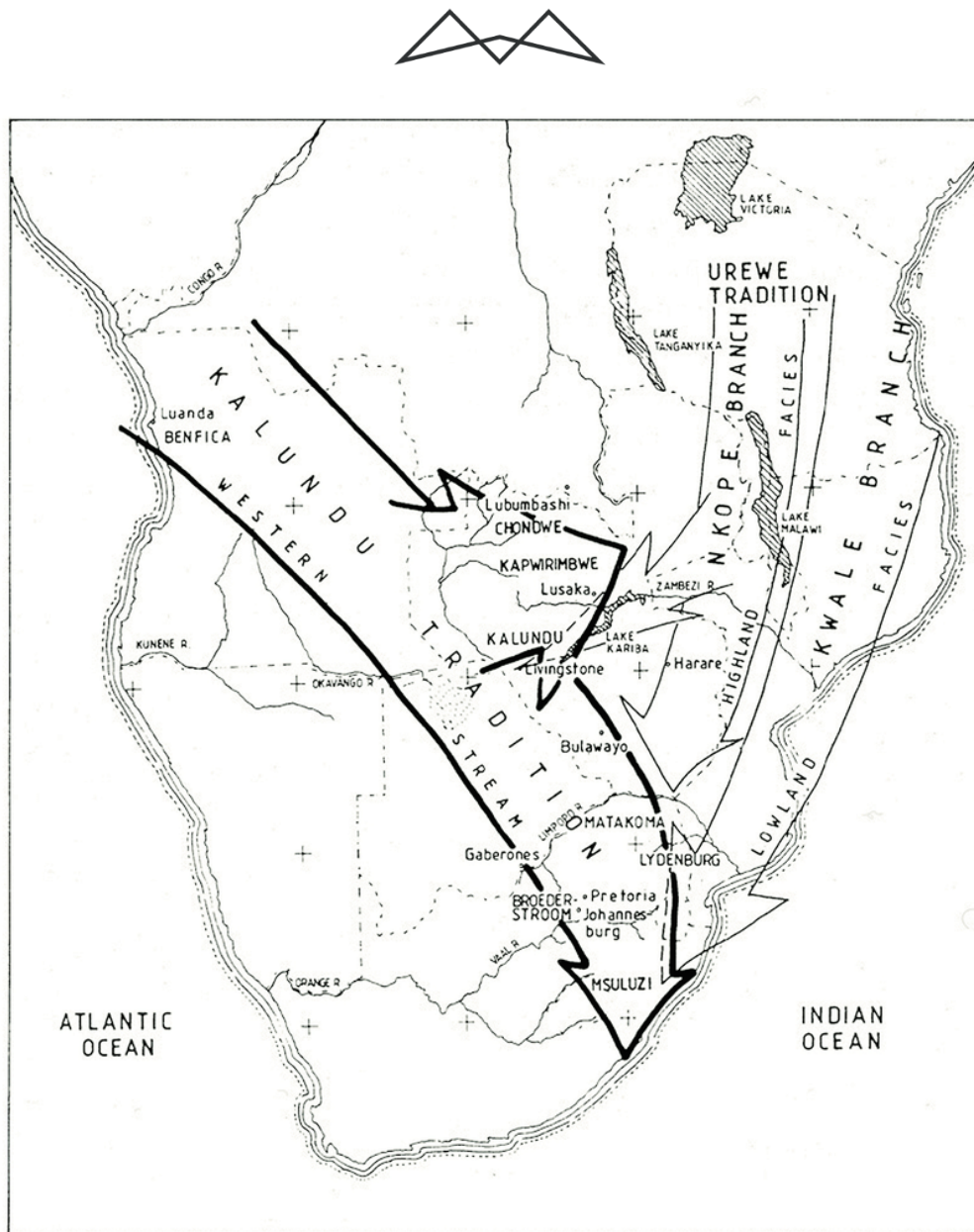


Figure 6: General understanding of Bantu migrations related to the larger ceramic traditions, Kalundu (Western Stream) and Urewe (Nkope and Kwale Branches) (After Huffman, 1989).

C) LATE IRON AGE

Moving towards and intersecting with the historical period of South Africa's archaeological record, Huffman (2007) emphasizes the importance of the occurrence of Great Zimbabwe following K2 and Mapungubwe. While Great Zimbabwe forms a cornerstone in understanding the life ways of the Late Iron Age, this phase, dating between 1300 until as late as 1840 AD, is associated with extensive migrations and diffusions of groups. These migrations and diffusions eventually result in the formation of a large part of the contemporary cultural makeup of South Africa. Above and beyond anything else, stone wall structures represent the archaeological evidence of these cultural developments.

Representing Late Iron Age community organisation and structure, stone wall structures have been studied extensively (Maggs, 1976; Huffman, 1989, 2002; Sadr, 2012; Sadr and Rodier, 2012). A main aim of these studies has been to date stone wall structures, as unlike most archaeological remains, these cannot be easily chronologically placed nor definitively associated with specific groups. Research has developed over the years, leading to the classification of stone wall structures based on their layout and patterning.

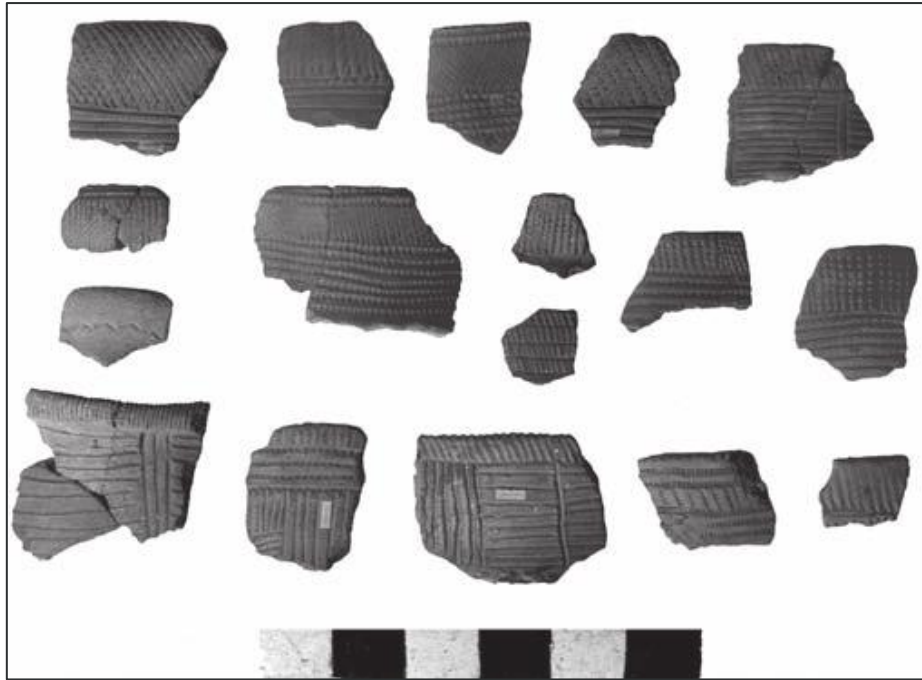


Figure 7: Examples of Bambata Potsherds (Huffman, 2005).

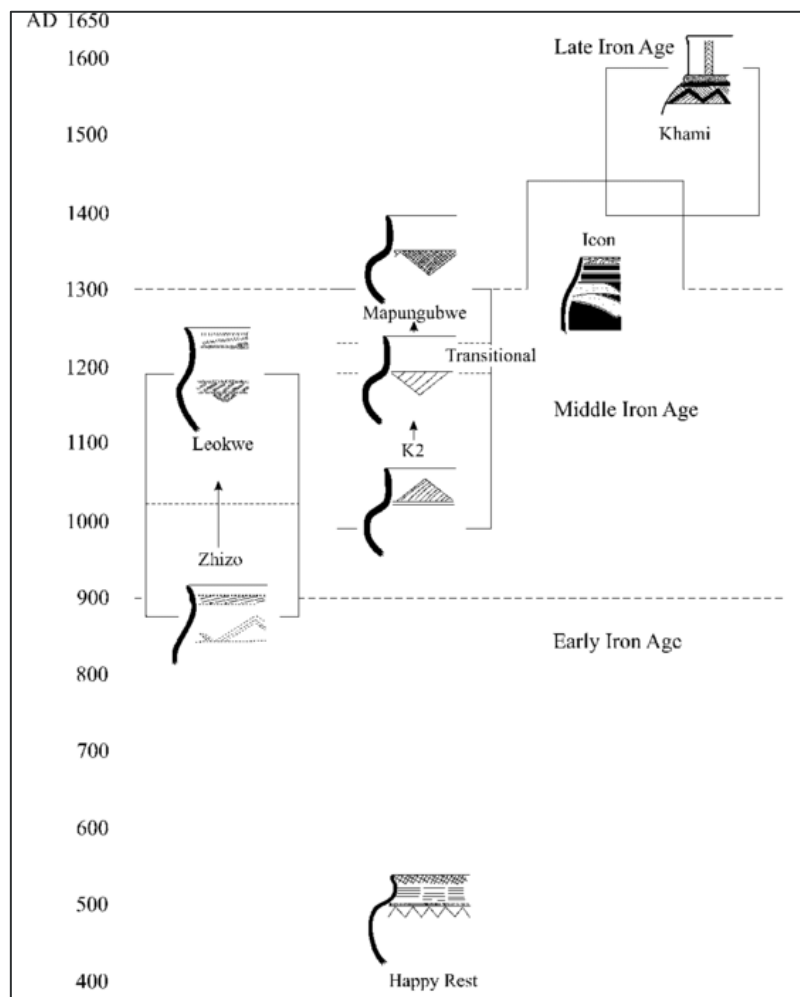


Figure 8: An Iron Age ceramic sequence demonstrating transitions between K2 and Mapungubwe ceramic styles (Huffman, 2009).

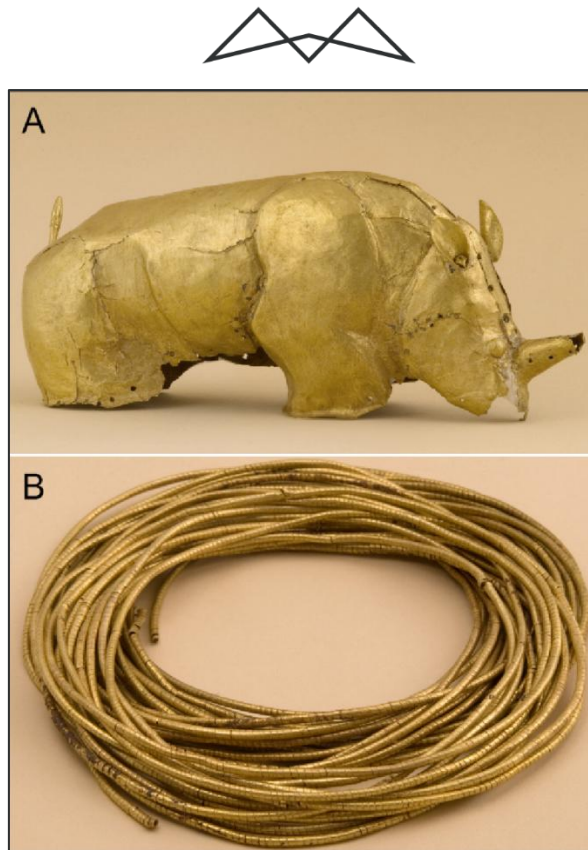


Figure 9: Famous golden implements of Mapungubwe (A - Golden Rhinoceros, B - Golden anklets) (Woodborne *et al.*, 2009).

Sadr and Rodier (2012) provide one of the most direct classifications of stone wall structures, drawing from previous understandings (Maggs, 1976; Huffman, 2007). Grouping stone wall structures into three groups (I, II and III), Sadr and Rodier (2012) argue for differences between stone wall structures. Group I stone wall structures are considered the earliest of the structures chronologically. These have also been classified as Type N structures, mainly being described as consisting of several cattle kraals in the centre linked by other walls (Maggs, 1976) (Figure 10). These structures have been noted in areas such as Klipriviersberg, south of Johannesburg, which has been related to early agropastoral activities in the area (James, 2018) (Figure 11).

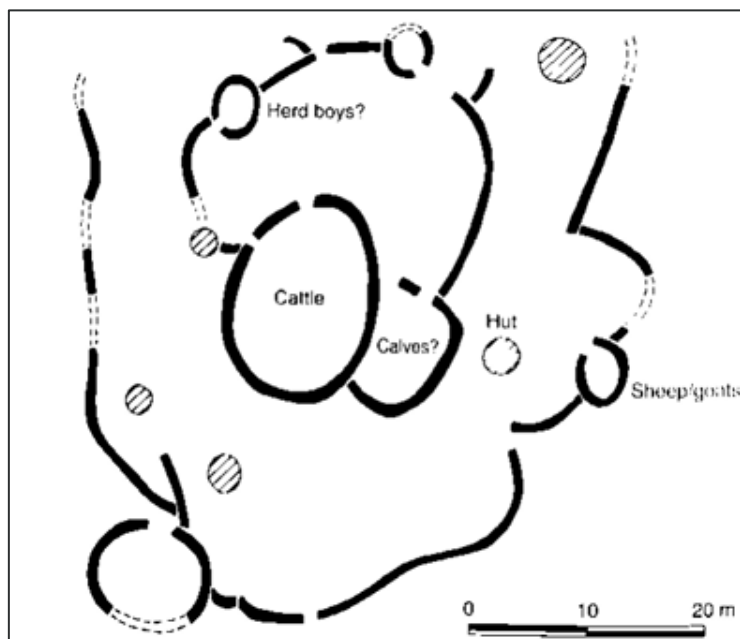


Figure 10: Type N stone wall structures as illustrated by Maggs (1976).



Figure 11: An on-site photograph of a Group I or Type N stone wall structure at Klipriviersberg Nature Reserve (James, 2018).

Representing later events of occupation during the Later Iron Age, Group II and III stone wall structures consist of more complex layouts and clustering. Group II and III structures include structures that make up the Bokoni (Mpumalanga) (Figure 12) and Kweneng (Suikerbosrand Nature Reserve, Gauteng) complexes (Figure 13).



Figure 12: An aerial photograph of stone wall structures part of the Bokoni complex, Mpumalanga (after Delius *et al.* (2012)).

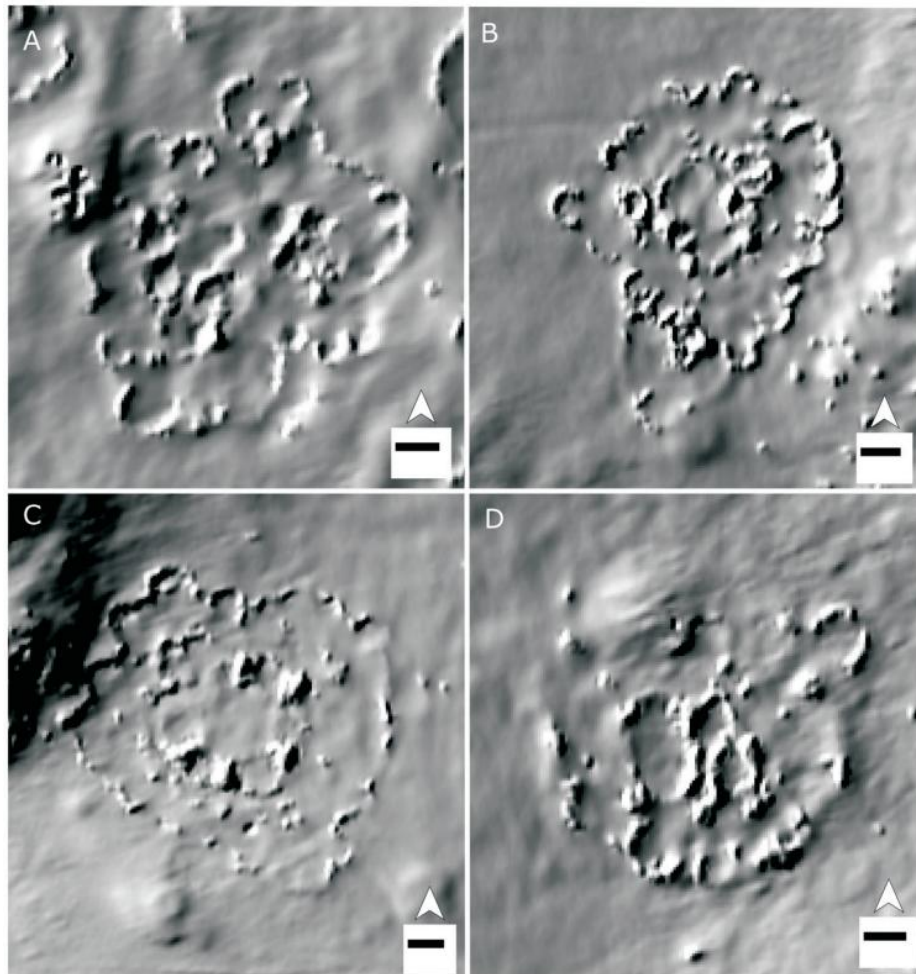


Figure 13: LiDAR imagery of Molokwane stone wall structures of Kweneng, a lost city discovered at Suikerbosrand Nature Reserve (after Sadr and Mshuqwana (2020)).

Different material culture is associated with the Late Iron Age including burials, ceramic remains, as well as LSA tools which continued to be used by different groups. The Late Iron Age and the groups associated coincide with the Historical Period of South Africa, which involved events including colonialism, industrialisation, various conflicts and social movements, ultimately leading to the development of the state as at present. Figure 14 provides an overview of the distribution of stone wall structures across the northeastern region of South Africa.

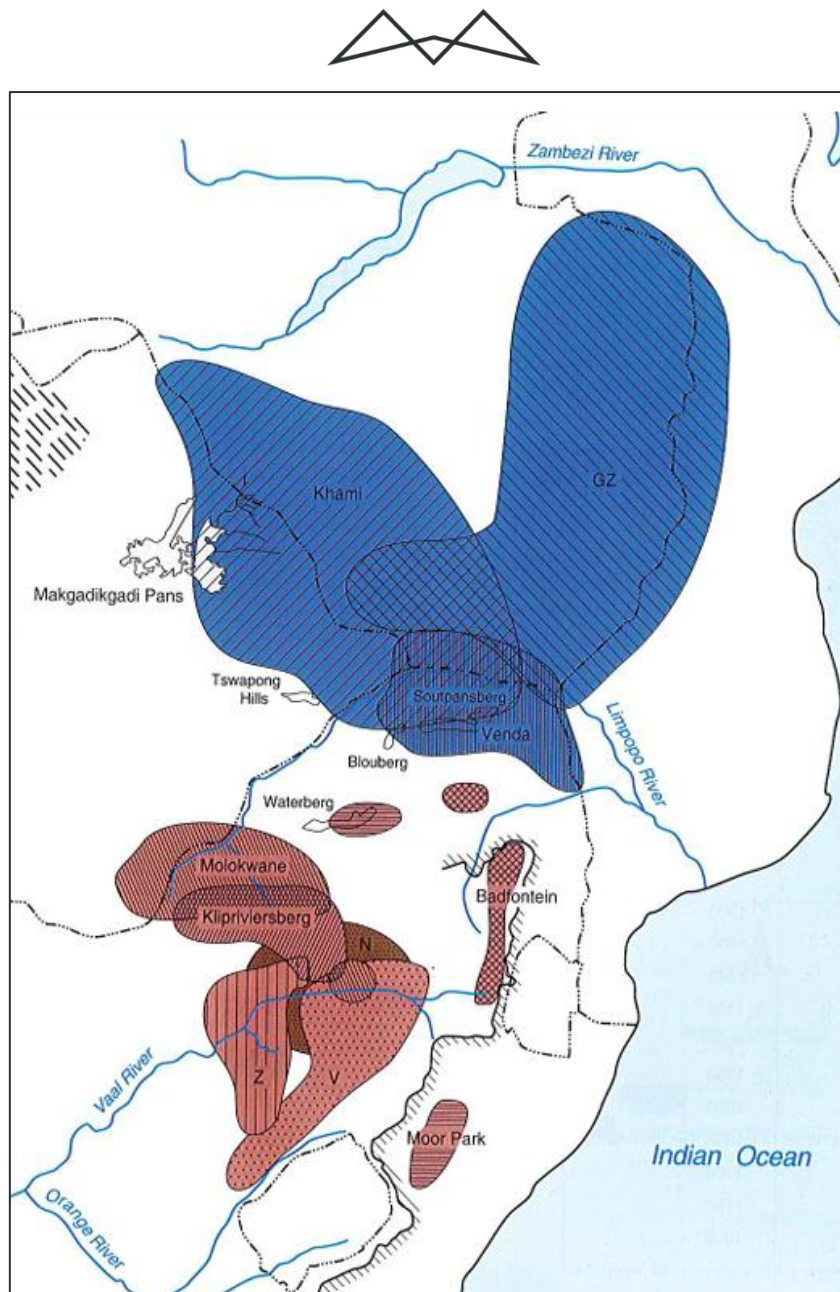


Figure 14: Distribution of the different types of stone wall structures across the northeastern region of South Africa (after Huffman, 2007)

2.1.4 HISTORICAL PERIOD

A) PORTUGUESE MARINERS AND SHIPWRECKS

Marking the documented history of South Africa, the Historical Period starts when the first European settlers arrive. Thompson (2001) provides an overview of the historical events in South Africa which have contributed to the archaeological record and overall heritage profile of the country.

The country's first encounter with Europeans is allocated to the first Portuguese expeditions which rounded the Cape of Good Hope in the sixteenth century. During their expeditions, several ships were wrecked given the harsh conditions the small vessels had to endure (Thompson, 2001; Gribble, 2002; Werz, 2010). Gribble (2002) provides a brief overview of the extent of shipwrecks off the South African coast, stating that over 3000 shipwrecks have been recorded. Shipwrecks represent the first signs of historical European interactions with South Africa.



B) THE CAPE COLONY

While Vasco de Gama and Bartolomeu Dias represent two of the first Portuguese mariners to round or interact with the South African coast, the country's history is transformed with the formation of the Dutch Cape Colony. The Dutch East India Company, establishing a port of call at Table Bay through the arrival of Jan van Riebeeck, intended for Cape Town to become a base for the rapidly growing enterprise. In the mid-1600s, the company encouraged some individuals to participate in farming and food production, in the hopes of solidifying and establishing the Cape Colony (Thompson, 2001). The Cape Colony developed into a melting pot of different people due to the expansion of the colony through slave trade, and arrival of other European groups. In terms of archaeology, research of some of the early homesteads of the Cape Colony such as Vergelegen provide more understanding of the extent of interaction between different groups from as far as East Asia, to Brazil (Markell *et al.*, 1995) (Figure 15).

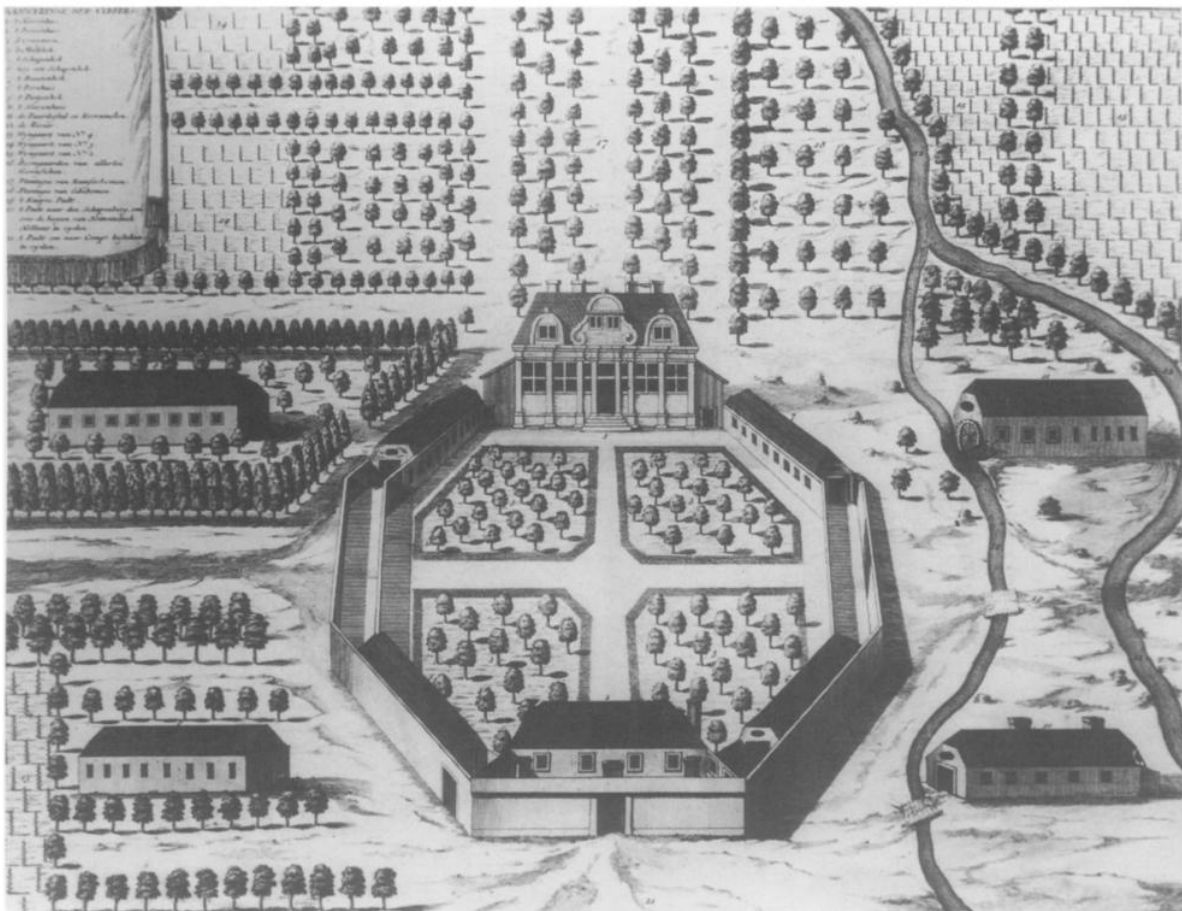


Figure 15: A 1700s drawing of Vergelegen, a Cape Colony homestead including multiple buildings including slave lodges. (after Markell *et al.* 1995).

It was through these first extensive events of interaction that essentially led to the formation of the Afrikaans language, and Afrikaner culture. In short, through extensive interaction and influence, Afrikaans was formed, with the first written scripts of the language curiously having been written in Arabic script (Figure 16).



Figure 16: An Arabic script representing the first written texts of the Afrikaans language (late 19th Century) (after Davids (2018))

In the context of the Northern Cape, the Cape Colony's influence is argued by Penn (2005) to have taken a different form characterised by shifting frontiers between the colony and original inhabitants of the region. Interaction between the group, documented through records which were often forgotten to the historical narrative of South Africa. As the Cape Colony advanced towards the Orange River, conflicts ensued between trekboers and the Khoisan hunters and herders. This led to either, the detriment of Khoisan groups, or the absorption of these groups into the colony itself. This further demonstrates the extensive nature of interaction and resulting influence of the Cape Colony on South Africa.

C) DEVELOPMENT OF THE SOUTH AFRICAN MINING INDUSTRY

It was in the late 1800s that South Africa's economic development reached a point of rapid acceleration. While the coast was represented by a richly diverse Cape Colony, the central landmass of the country had been heavily invested in for the exploitation of mineral resources following key discoveries. Diamonds and gold were of particular interest. It was only later when platinum was discovered as part of the Bushveld Complex to the north of the country, which further inspired investment in mining and mining infrastructure (Cawthorn, 2010). Given the complex nature of the deep gold reefs of key locations such as Johannesburg, investments of substantial time and money were necessary, ultimately leading to the establishment of merged and expansive mining companies (Durand, 2012; Harrison and Zack, 2012). This fact led to the development of key settlements which have since developed into modern cities such as Kimberley and Johannesburg (Figure 17).



As South Africa's influence in the world economy grew, so did colonial interest. This essentially initiated the first colonial and civil conflicts recorded in the modern history of the country. Essentially, these conflicts involved the British Empire's efforts towards colonising the country, being opposed by Afrikaans Boers and associated powers.



Figure 17: A photograph of Johannesburg from the 1890s (after Chirisa and Matamanda (2019))

The deeper consequence of the mining industry's development was experienced not only at a national level, but also localised. Some historians (Turrell, 1987; Worger, 1987) have contemplated the social impact of South Africa's diamond mining industry. As Kimberley represents the origins of South Africa's early diamond mining industry, the location was characterised by different social phenomena including immigration, industrialisation, and establishment of labour forces. Further, the initial labour conditions of the diamond mining industry had effects on local populations, which can ultimately be argued to have shaped the development of the industry

D) CONFLICTS OF SOUTH AFRICA

As the country continued to economically expand, several conflicts arose prior to the intense colonial imposition the country was about to face. In the early 1800s, conflict had arisen among Nguni groups, essentially being driven by environmental pressures as well as the injection of trade activities. Shaka Zulu becomes a key figure in what has come to be known as the Mfecane, or the period of "the crushing". The period is marked by the conquests and rise of the Zulu kingdom which essentially had a bearing on the lifestyle and organisation of groups across the country. Given that this conflict had taken place during a period when South Africa was being extensively documented, the events of the Mfecane have formed part of historical records.

Similarly, conflicts west of the Drakensberg including groups such as the Sesotho, Pedi, and Tswana, become more relevant to the interior parts of the country. The conflicts and period in question are referred to Difaqane. Although the word is often used synonymously with Mfecane, the two words describe different events and repercussions thereof.



Near the turn of the 20th century, conflict between colonial powers took form. One of the most notable of these conflicts was the Anglo-Boer War, or the South African War. Between 1899 and 1902, this war was largely supported by the British Empire's push towards controlling the country and its many smaller colonies. As Thompson (2001) highlights, the war essentially ended in the favour of the British. The influence of the British had since transformed the South African landscape with much of its cultural and colonial history being founded on the Empire's rule. It is important to note this conflict as it presents opportunity in terms of archaeological and cultural heritage resources.

Locations such as Mafikeng (now Mahikeng) have become key in recounts of the South Africa War. The war also led to the movement of people, which has been recorded, for example, Springfontein, which saw the formation of a war refugee camp (Figure 18). As many battle sites have been recorded, key archaeological finds related to these events can still be found. These resources, and in some cases, monuments, tell the story of South Africa's early struggles of colonialism and the origins of racial laws and regulations.



Figure 18: A picture of Springfontein, a refugee war camp which was established as a repercussion of the war's influence (after British National Archives).

E) APARTHEID AND CONTEMPORARY HISTORY

It was after the Anglo-Boer War that the initial motions towards racial segregation through law and regulation came to be. The establishment and expansion of mining towns led to the marginalisation of different racial groups. By the mid-20th century, the Apartheid regime had been put in place, controlling the movement and settlement of people. For one, new documentation was required for many racially marginalised people to move into areas that were otherwise restricted. Such laws inspired revolutionary responses (Figure 19), ultimately leading to the struggle against apartheid, which has characterised the 20th century of South Africa ((Thompson, 2001).



After being abolished in 1994, the legacy of Apartheid has been argued to have had a lasting effect on society. This has been argued beyond the context of history, being observed in social dynamics, contemporary infrastructure, as well as urban growth and development. Leading to contemporary history and modern approaches to development, Apartheid is seen as the most recent event having shaped and formed South Africa as we know it today.

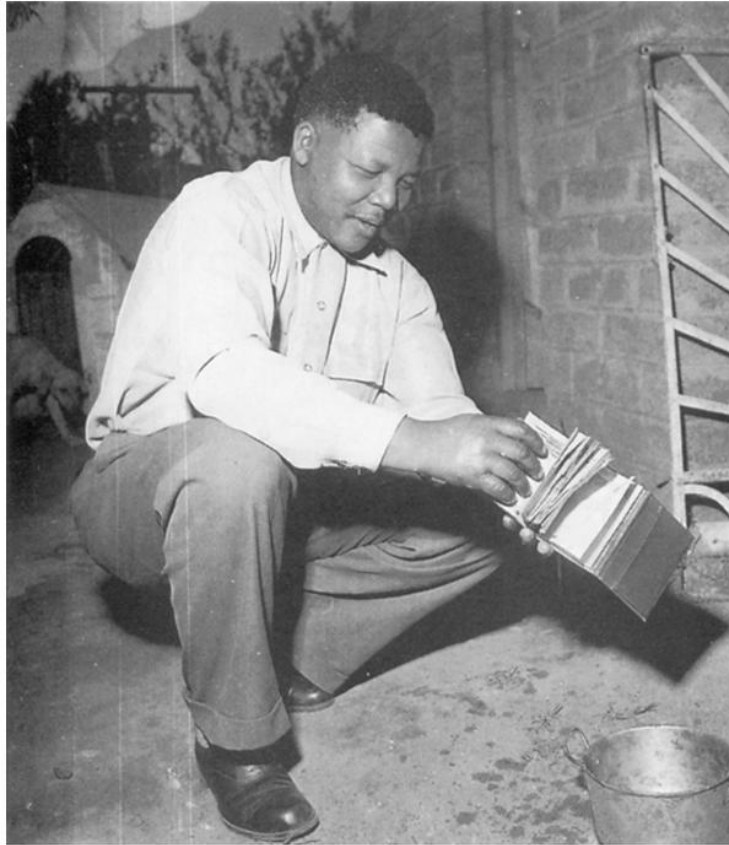


Figure 19: Nelson Mandela burning his pass in 1959. A pass was a requirement for people to move across the country. Such documents have now become items representing the Apartheid regime (Thompson, 2001).

2.2 SITE-SPECIFIC BACKGROUND

The Free State Province holds key markers in the Archaeological and palaeontological record dating back to some of the earliest evidence of modern humans. The Free State has also been occupied by Iron Age farmers, and these occupations are evidenced through the distribution of Stone Wall structures across the province. Further, the landscape of the Free State has witnessed transformation in terms of its developmental history. The province was also a key location in terms of Boer strongholds during the South African War, or the Second Anglo-Boer War. The archaeological background of the Free State as well as sites of heritage significance is discussed in this section.

2.2.1 EARLY HUMAN EVOLUTIONARY EVIDENCE

The Free State Province is the origin of one of the most famous hominid fossil finds related to human evolution. In 1937, a partial skull of an early human species was discovered by T. F. Dreyer at the site known as Florisbad (Kuman and Clarke, 1986). Florisbad has yielded a range of artefacts including faunal assemblages, lithic pieces of the ESA, MSA, and LSA, as well as other markers of human occupation such as hearths and charcoal. However, the artefact now known as the Florisbad Skull has been the most significant find allowing for arguments around the origins and evolution of modern humans and the complex speciation of *Homo Sapiens*. The skull itself is almost 260 000 years old, being predated by key finds such as Jebel Irhoud of Morocco.



Together with early human evidence, the Free State is also noted for some examples of stone age archaeology. Examples of the type of Later Stone Age lithic pieces which can be observed in the Free State have been documented by some such as Witelson (2016). Some key sites associated with stone age archaeology and related human occupations include Holkrans Rock Shelter.

2.2.2 IRON AGE FINDS OF THE FREE STATE

Similar to other parts of South Africa, the Free State Province hosts evidence of Iron Age pastoral occupation. Several examples of Stone Wall Structures can be observed across the province. These Stone Wall Structures have been covered extensively in the literature base, and can be observed prominently in the northern sections of the Free State (Huffman, 2007; Sadr, 2012; Sadr and Rodier, 2012; James, 2018). Stone Wall Structures which can be encountered in the Free State have been classified as Type Z and V as per Huffman (2007).

The Stone Walled Structures are markers of past occupation which are associated with different material evidence such as ceramics and iron implements or tools.

2.2.3 HERITAGE OF THE CLOSEST TOWNS AND LOCATIONS OF HERITAGE INTEREST

Several towns are in proximity of the PR area, corridors, and pipelines proposed. This section provides a brief description of the history and cultural heritage of these locations.

A) WELKOM

As the closest city, Welkom has its history founded around the first prospecting activities of the Free State province. It was only until 1948 that Welkom was proclaimed as a town. The town at the time saw rapid growth related to the expanding gold mining industry of the area. By 1968, Welkom was declared a city. Welkom continues to be an important economic hub of South Africa, contributing to the country's mining industry. Welkom's significance in terms of heritage is therefore founded on historical events related to the early development of gold mining in South Africa. The town includes several monuments and provincial heritage features including the graves of several political figures which have been nominated as Grade II heritage sites. To the south of the town, another Grade II heritage site is located, that is, the farmhouse, Ferreirasrust.

B) VIRGINIA

As the gold mining industry of the Free State continued to grow, the growing economy led to the establishment of more towns. Virginia was one of these towns which was established. Virginia was first established as a railway siding or terminal, which then developed into a town, much like other towns across South Africa. By 1954, the town itself was established and its development continued in parallel with the expanding gold mining industry. Like other towns and cities of this area, Virginia was founded on the early mining industry of South Africa and its heritage is founded on events related to same.

C) HENNENMAN

Hennenman was a town founded after the establishment of a railway station had led to further surrounding developments. Linked to the gold mining industry of the region, the small town was established and named in 1927. The history of the town includes events and spaces related to racial segregation.

D) VENTERSBURG

Ventersburg was one of the earliest towns to be established in the region being proclaimed in 1876. The town is located along the main road, the N1, which runs from South Africa's northern border to Cape Town. Specifically, its establishment can be attributed to the town's central location between Johannesburg and Bloemfontein. The town and area have a rich history based on different conflicts including events of the Basotho Wars, as well as the Second Anglo-Boer War. Key heritage monuments include the Reformed (Gereformeerde) Church, which was built in 1891, and later burnt down during the Anglo-Boer or South African War. The church was later rebuilt and stands to this day (ruralexploration.co.za).



2.3 DATABASES AND COLLECTIONS

A key source of information and material on finds and sites of the area in question, and the closest town, Welkom, is housed by the Welkom Museum. The Welkom Museum holds historical evidence of the early establishment of the mining town as well as collections associated with the gold mining industry of South Africa.

In addition, several museums in Bloemfontein hold information and collections of archaeological evidence associated with the Free State.

2.4 PREVIOUS RELEVANT IMPACT ASSESSMENTS

In the context of the current assessment, a background examination of previous historical finds and associations was conducted. Considering available information through the SAHRIS database and previous Archaeological assessments of the area, the following key reports on finds have come to light:

- *Kruger, N. (2021) AGES Limpopo: Proposed Virginia 1, 2 & 3 Solar Parks EIA Project on Portions of the Farm Blomskraal 216, Lejweleputswa District Municipality, Free State Province*
 - This study was conducted assessing the impacts of the proposed Virginia 1, 2 & 3 Solar Parks Project. The study area is east of the PR area, with some of the surveyed area falling within the PR area. Several features were identified including a number of historical farmsteads, as well as burials. These features intersect with the proposed activities of the current proposed project and have therefore been included as heritage sensitivities.
- *Kruger, N. (2023) Heritage Impact Assessment report for the Quagga Solar Park Project, Lejweleputswa District Municipality, Free State Province*
 - This study was conducted assessing the impacts of the proposed Quagga Solar Park Project. The study area is east of the PR area, with some of the surveyed area falling within the PR area. Several features including additional burial sites and historical sites were noted and do intersect with the current project.
- *Kruger, N. (2022) Heritage Impact Assessment report for the Corona Solar Park Project, Lejweleputswa District Municipality, Free State Province.*
 - This study was conducted assessing the impacts of the proposed Corona Solar Park Project. The study area falls within the PR area. Several features including additional historical sites were noted and do intersect with the current project.
- *Kruger, N. (2021) AGES Limpopo: Proposed Virginia Solar Park Power Lines BA Project, Lejweleputswa District Municipality, Free State Province.*
 - This study was conducted assessing the impacts of a proposed powerline for the Virginia Solar Park Project described above. While the survey covered northern sections of the PR area, no finds were noted within the PR area.
- *Angel, J. (2024) Heritage Impact Assessment for the Proposed Motuoane Hennenman Part II EA Amendment Project on Farms Palmiet Fontein 229, Détente 744, Kriegers Kraal 708, Siberiasfontein 605 and Nooitgedacht 245, Lejweleputswa District Municipality, Free State Province*
 - As one of the most critical studies undertaken in the context of the current study, the Motuoane Hennenman Part II EA Amendment Project included a study of the PR area as an Exploration Right (ER) area. The area in question was surveyed and the findings of this study form the baseline which will inform the current study and its associated findings.



2.5 MOTUOANE HENNENMAN PART II EA AMENDMENT

As highlighted above, the current study was informed by the findings of the Motuoane Hennenman Part II EA Amendment, as the study area covered some of the transects and areas considered for the PR application. In this regard, the heritage features noted in the study were considered as the first set of features worth noting as part of the baseline assessment.

The study itself was undertaken by PGS Heritage in 2024. The study included the survey of a large extent of the area which forms part of the current study as illustrated in Figure 20. Across this area, a number of heritage features were located which have been considered sensitivities in the current project.

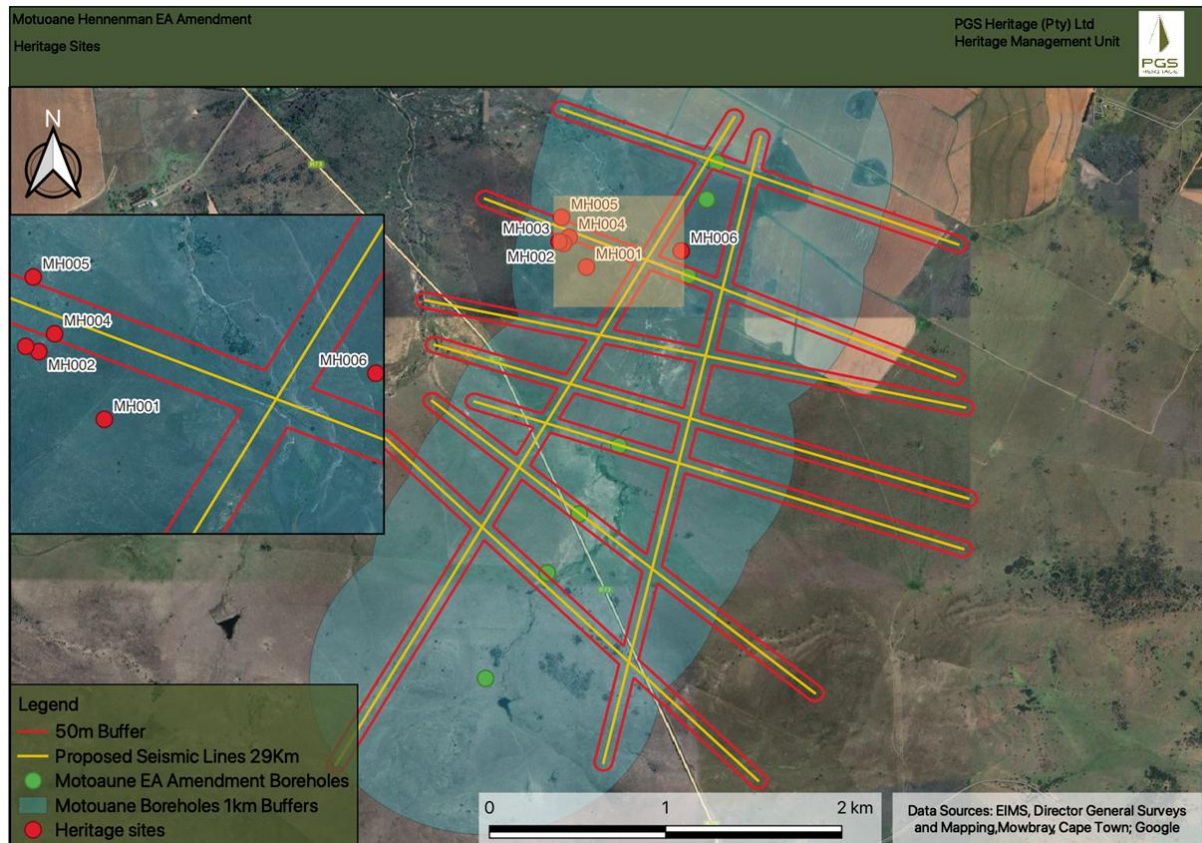


Figure 20: Map taken from the Motuoane Hennenman Part II EA Amendment HIA conducted by PGS Heritage¹.

3 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section discusses the overall environmental attributes of the site in question. This includes key aspects of the landscape and general conditions associated with the area.

3.1 CLIMATE

The climate of the Free State is characterized by a continental climate, with cold winters and warm to hot summers. The rainy season typically occurs from late spring through to early autumn, with the months of October to April being particularly notable for precipitation.

Temperature and precipitation vary significantly across the province, with the eastern and mountainous areas receiving higher rainfall of about 600-800 mm per annum, while the western areas are drier, receiving less than 400 mm per annum.

¹ Note that some of the transects considered as part of the current project were surveyed for this project.



The climate in the Free State is mostly semi-arid to arid, characterized by warm to hot and often dry summers during the months of November to February and cold winters starting from May to August. The province experiences occasional thunderstorms in the summer months, and the winter season sees little to no precipitation, often with frost and occasional snow in the eastern highlands.

Figure 21 provides an understanding of the general climatic conditions of the area, including an understanding of monthly temperatures and rainfall.

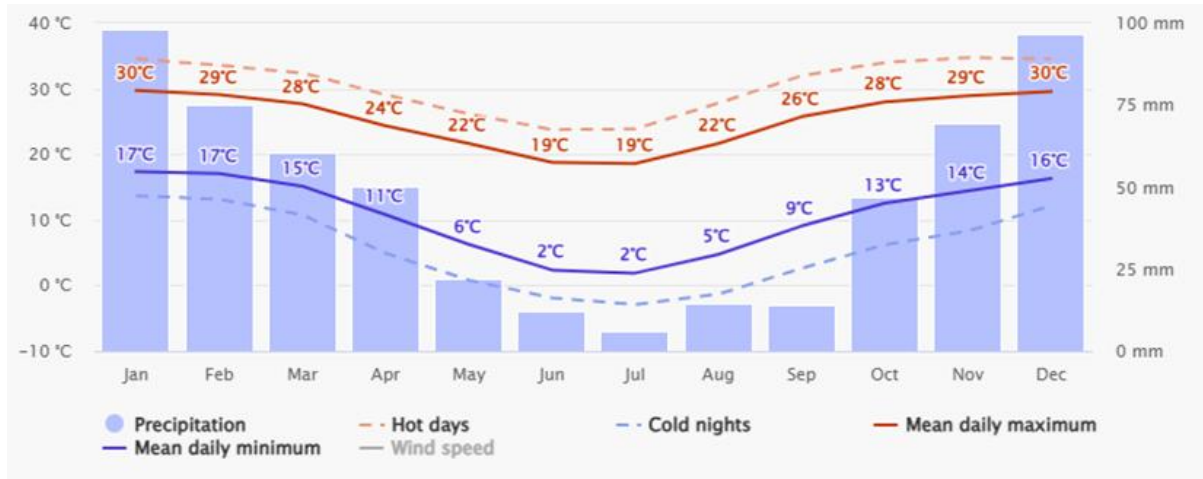


Figure 21: Annual Climatic conditions typical of the Western Free State (considering data from Welkom, after https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/welkom_south-africa_940909)

3.2 TOPOGRAPHY

The development area falls in an area between 1300 and 1478 m above sea-level in elevation. The landscape gently slopes towards to the northeast. The landscape is generally flat, with elevated areas located in the centre of the study area. See Figure 22 for an overview of the topography of the site to be developed and surrounding areas.

3.3 DRAINAGE AND CATCHMENT

The closest river to the site is the Sand River, which runs along the northern boundary of the site. The proposed development falls across the C42G, C42H, and C42K Quaternary Catchments.

3.4 GEOLOGY

The overall geology of the site is characterised by four geological types. At the higher elevations, the Karoo Dolerite subgroup is observed. This observation changes moving downslope, towards the watercourses, where the Adelaide subgroup is noted. Areas along the watercourse are subsequently characterised by aeolian sand and alluvium. Figure 23 is a simplified overview of the geology of the site and surrounding areas.

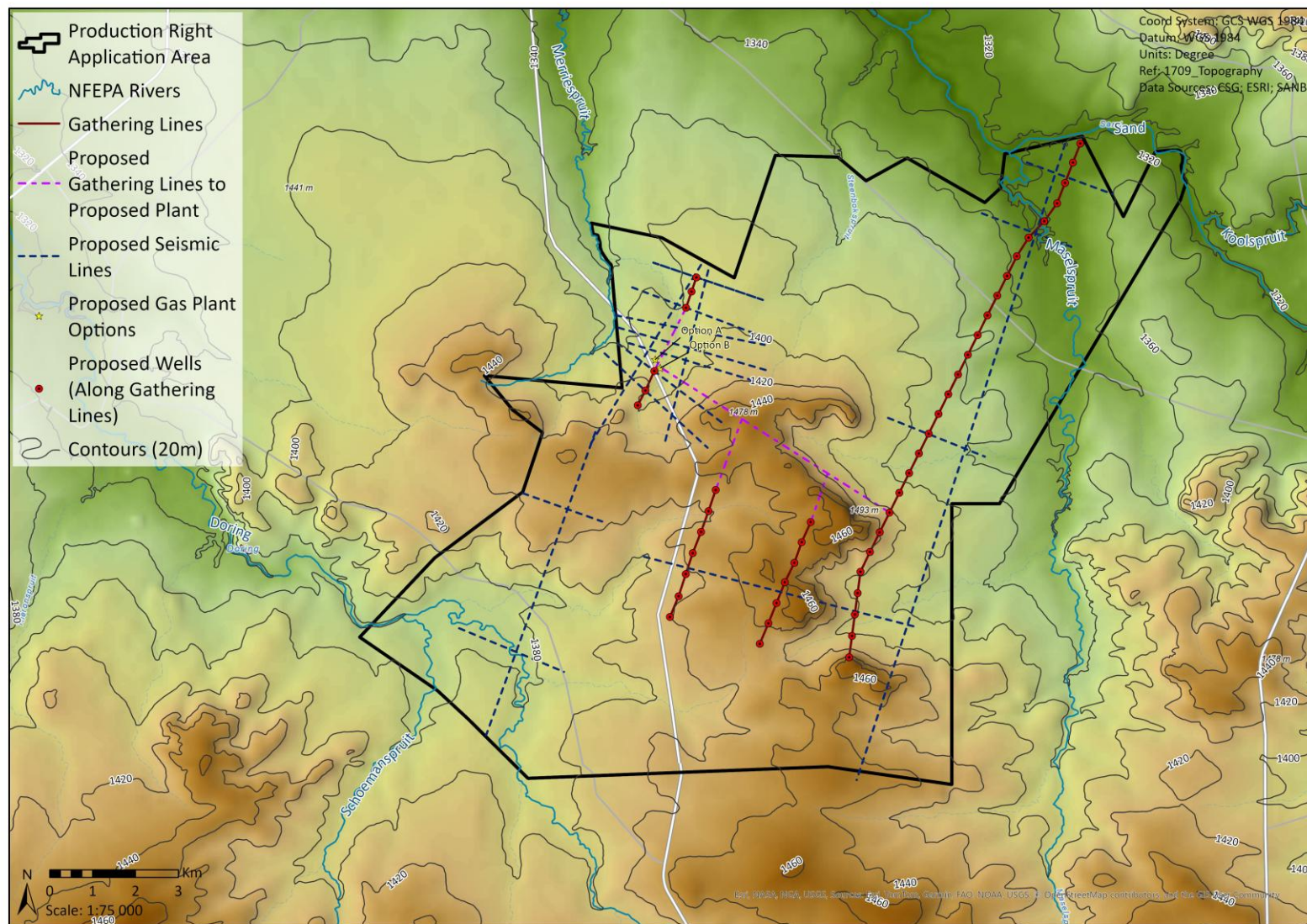


Figure 22: Topography Map of the site and surrounding areas.

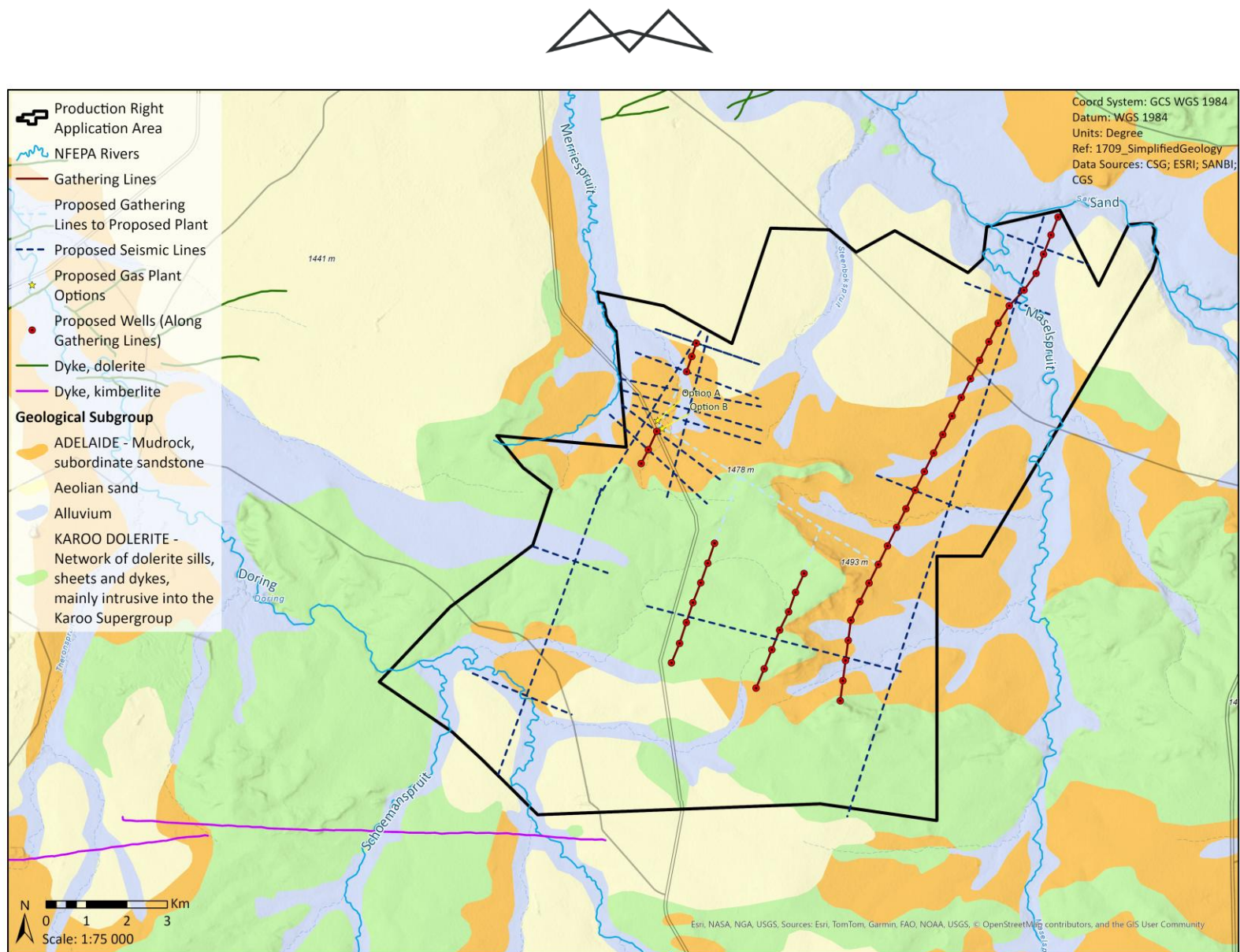


Figure 23: Map of the geology of the site and surrounding areas.



4 METHODOLOGY

The following section describes the methodology used to gather information on potential heritage resources and impacts in this report. Firstly, an initial desktop assessment was conducted to identify key areas of heritage sensitivity and potential features identified in the past. A field survey was then conducted to verify the significance of any identified features as well as identify any additional features.

4.1 INITIAL DESKTOP ASSESSMENT

To evaluate the overall sensitivity and extent of Archaeological and Heritage features within and around the development footprint, a desktop assessment of the area was conducted. The desktop assessment involved making use of existing information related to heritage resources of the area.

As an initial step, the Web-based Environmental Screening Tool (Screening Tool) of the Department of Forestry, Fisheries and the Environment was consulted. The Screening Tool includes a geospatial database of recorded and identified sensitivities relating to Archaeological and Cultural Heritage sites or finds. The information available through the Screening Tool provided a basis which informed further desktop assessments and the extent to which the field survey would be conducted. This information was then corroborated with information available through the South African Heritage Resources Information System (SAHRIS), Chief Directorate: National Geospatial Information (CD:NGI), as well as Google Earth Imagery. Various aerial photographs and 1st Edition Topographic maps were consulted to verify the extent of heritage and archaeological sensitivity in and around the development footprint. Altogether, the data consulted included geospatial records dating as far back as 1945.

4.2 FIELD SURVEY

To verify and add to the observations made through the desktop assessment, a three-day field survey was conducted by Dr Lucien James on 18, 25 and 26 May 2026. The field survey involved traversing the proposed development footprint, with a focus on assessing areas which appear to be undisturbed. The survey also included consulting personnel on site, to gather more insight on any known archaeological sites and finds. While most of the area is already disturbed by different land uses including agriculture, a site survey was necessary to evaluate the overall sensitivity of the area, as well as identify archaeological sites and objects which may not have been identified since.

The Archaeologist surveyed key areas of the development footprint, as well as key areas immediately outside of the development footprint, for example, some surrounding roads. A Garmin eTrex 10 was used to record track logs of the extent of the survey itself.

4.3 DOCUMENTATION AND ANALYSIS

All observations gathered through the desktop assessment as well as the field survey were documented and analysed in terms of their significance. Through remote sensing, any sites noted through the Screening Tool and SAHRIS were documented in relation to the proposed development. During the field survey, the location of larger Archaeological and Heritage finds was recorded. A 30-meter buffer was placed around finds which constituted a site. A 50-meter buffer was placed around graves or potential grave sites.

In the context of this report, sites were defined as locations of a 15-meter radius, which included more than three individual finds. Sites in this regard, included finds which were not in context. However, given that multiple finds were noted, these specific locations were noted as sites as they would have the potential to yield more finds.

Geotagged photographs will be taken throughout the survey. This includes the photographing of finds, as well as the surrounding environment. Physical scales will be included in all photographs which require an understanding of dimensions, sizes and the colour of finds. For larger finds, a 1,5-meter scale divided into 10cm segments will be used. For smaller finds, an IFRAO Standard Scale (Figure 24) will be used.



Figure 24: IFRAO Standard Scale used for photography of Archaeological finds.

The appointed Archaeologist also kept written notes about the different findings as well as their context. These were recorded in the Archaeologist's personal field journal.

Sites and finds were subsequently analysed in terms of their significance. Several criteria were used to assess the significance of finds and their bearing on the overall heritage significance and sensitivity of the affected area

Table 2 provides a list of the different criteria considered when assessing the significance of finds and or site. In relation to each criterion, different questions were embedded in the analysis of sites and finds.

Table 2: Different criteria and questions which guided the analysis of Archaeological and Heritage finds or sites.

Criterion	Questions which guided analysis
Overall Integrity or condition	1. Is the find or site recognisable beyond initial identification? 2. Is the find or site well or poorly preserved? 3. Has the find or site been disturbed or removed from their original context? 4. Has the find been exposed to severe post-depositional damage or disturbance? 5. What types of meteorological and geomorphological events may have disturbed or compromised the integrity of the find or site?
Context	1. Has the surrounding area been highly disturbed? 2. Is it likely that the find has been removed from its original context? 3. Have other individual finds been located within 15 meters of the find, meriting the description of the find as part of a site? 4. Does the find form part of a collection of more than 3 finds located within 15 meters of each other? 5. Could the find form part of a larger, chronologically or contextually related collection of finds in the area?
Spatial relation to other sites	1. Are there any identified sites located near the find or site? 2. To what extent can the find or site be related to all other sites identified? 3. How close are the other sites to the site or find? 4. Does the occurrence of this site or find change the regional heritage or archaeological narrative?
Prehistoric and historical provenance	1. Can the find or site be identified in terms of which period it relates to, i.e. Stone Age, Iron Age, or Historical?



	2. Does the find corroborate or correlate with general understandings of the period it relates to? 3. Does the find or site fit into the heritage narrative of the region or province? 4. Does this find or site add new insight to contemporary understandings of the period it relates to? 5. Does this find or site add new insight to contemporary understandings of Archaeology in South Africa?
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4.4 CLASSIFICATION OF SITES

Considering the above-described documentation and analysis methods, heritage finds and sites were classified or graded according to the SAHRA Minimum Standards (2007) recommendations. The grading system adopted in this report is captured in Table 3.

Table 3: Classification of heritage sites as per the SAHRA Minimum Standards (2007) and adopted in this report

Level	Grade	Significance	Action
National	I	High	Nominate for Field Rating/Grade I
Provincial	II	High	Nominate for Field Rating/Grade II
Local	IIIA	High	Retain as heritage register site, no mitigation advised
Local	IIIB	High	Mitigate and retain as heritage register site
General Protection A	IV A	High/Medium	Mitigate before destruction
General Protection B	IV B	Medium	Record before destruction
General Protection C	IV C	Low	No further recording required

The different criteria considered when analysing finds and sites allowed for subsequent grading and classification. In this regard, prehistoric and historic provenance, spatial relations to other sites, and context allowed for the identification of the level of importance of the site or find. In this regard, finds and sites were graded according to if they were of National, Provincial, Local or General significance. Overall Integrity or condition and context guided the advised mitigation action.

4.5 LIMITATIONS

This section details the different limitations associated with the implemented methodology of this assessment. Approaches to mitigate these limitations are therefore presented.

4.5.1 GENERAL LIMITATIONS

Several limitations were expected and encountered while implementing the above-described methodology. Some of these limitations relate to the project itself, while some are more general, relating to the implementation of the methodology itself.

Firstly, such investigations are limited to desktop and field surveys from which findings are drawn. In this regard, the findings presented here are limited to surface observations. Below-ground archaeological contexts would only apply in cases where the methodology includes components involving excavations and test pits. To mitigate this limitation, this report advises the application of heritage procedures adopted by the developer in cases where construction activities lead to the identification of unexpected finds.



The field survey conducted for this report does not account for any finds further than immediate surrounding areas which are not potentially affected by the proposed development. To mitigate this, the initial desktop assessment considers surrounding pre-identified heritage resources and prior heritage studies done in the area.

Although an extensive methodology was adopted to address the desktop assessment and field survey, one must remain cognisant of the fact that this assessment may not identify all heritage features possibly existing. For this reason, mitigation measures have been proposed to accommodate for chance finds as well as features that may not have been encountered and identified through the implementation of this study's methodology.

4.5.2 PROJECT-SPECIFIC LIMITATIONS

The field survey itself was limited to a 3-day site visit which may present as a limitation to the extent of the investigation. However, strategic points were identified prior to the survey to ensure that an adequate representation of the site could be obtained through the site visit.

The surface of majority of the area is densely covered in grass. This presented as a limitation during the site visit as smaller finds were more difficult to identify. Mitigations have been built into this assessment to account for this limitation.

5 FINDINGS

The following section presents the findings of both the desktop assessment as well as the field survey. In summary, 15 potential heritage features were identified through the desktop assessment, and 3 were identified through the field survey. Of these features, 13 were identified as being of heritage significance, and possibly being impacted by the development.

5.1 DESKTOP ASSESSMENT RESULTS

An initial desktop assessment was undertaken to ascertain the overall sensitivity of the area in terms of heritage features. The DFFE Screening Tool was used as an initial point of reference in this regard. The Screening Tool suggested that the area to be developed is of Low Sensitivity as captured in Figure 25.

The DFFE Screening Tool highlighted no heritage features within or in close proximity of the area to be affected by the proposed activities. Following the site survey, the sensitivity of the area flagged by the Screening Tool can be confirmed.

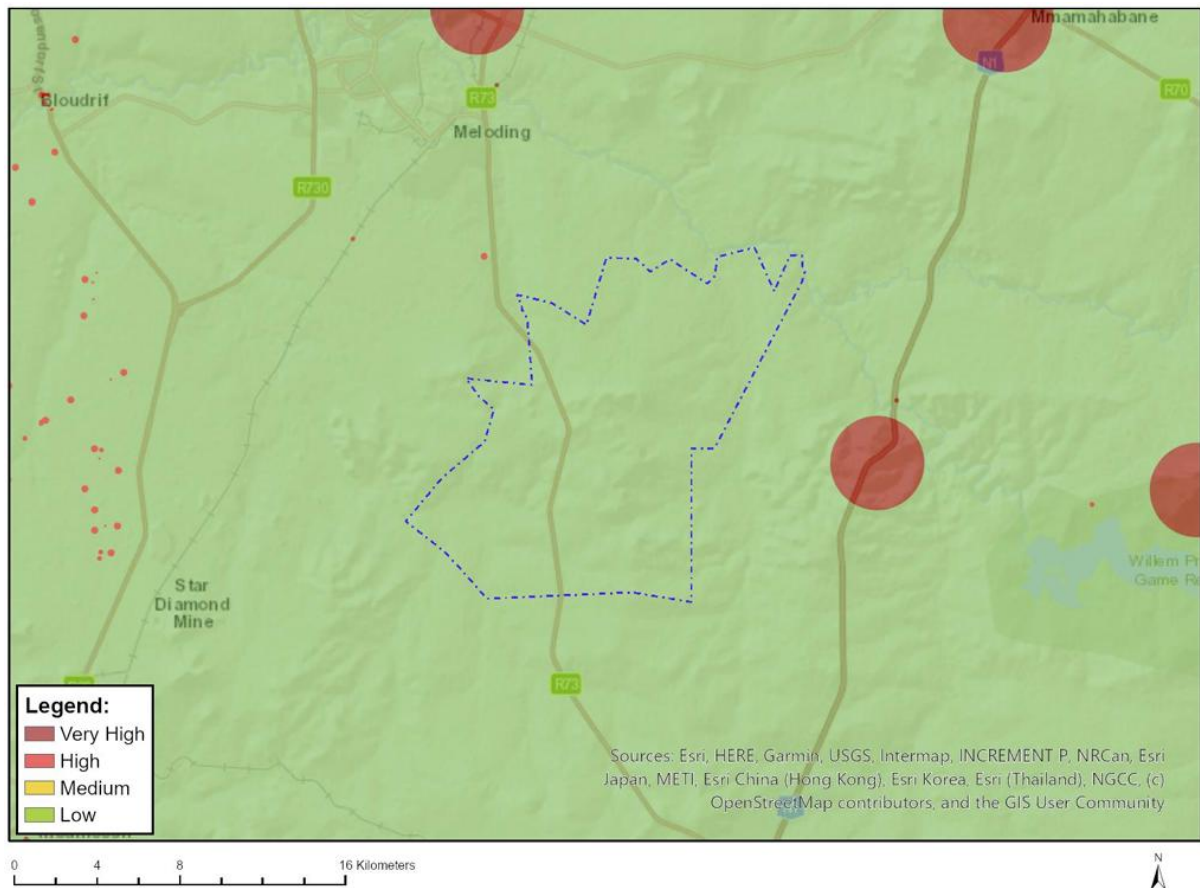


Figure 25: Map of relative Archaeological and Cultural Heritage Sensitivity (DFFE Screening Tool).

The affected area was assessed using Google Earth as well as available surveys and mapping resources via the CDNGI Geospatial Portal (<http://www.cdngiportal.co.za/cdngiportal/>). First Edition Topographic maps (2826BB, 2827AA, 2826BD and 2827AC) of the area were analysed. As the maps were drawn between 1945 and 1975, it would include information on observations within the footprint of the development. An assessment of the maps revealed that the area in question has included several features such as settlements. The earliest map (2826BB dated 1945) indicates the presence of such settlements or “native huts” along a proposed seismic transect (PR4 and previously authorised BI-2023-2) (Figure 26). The features can be seen in aerial photographs from as early as 1944 (Figure 27). The features seem to have been disturbed and destroyed since, as they do not appear in current satellite imagery.

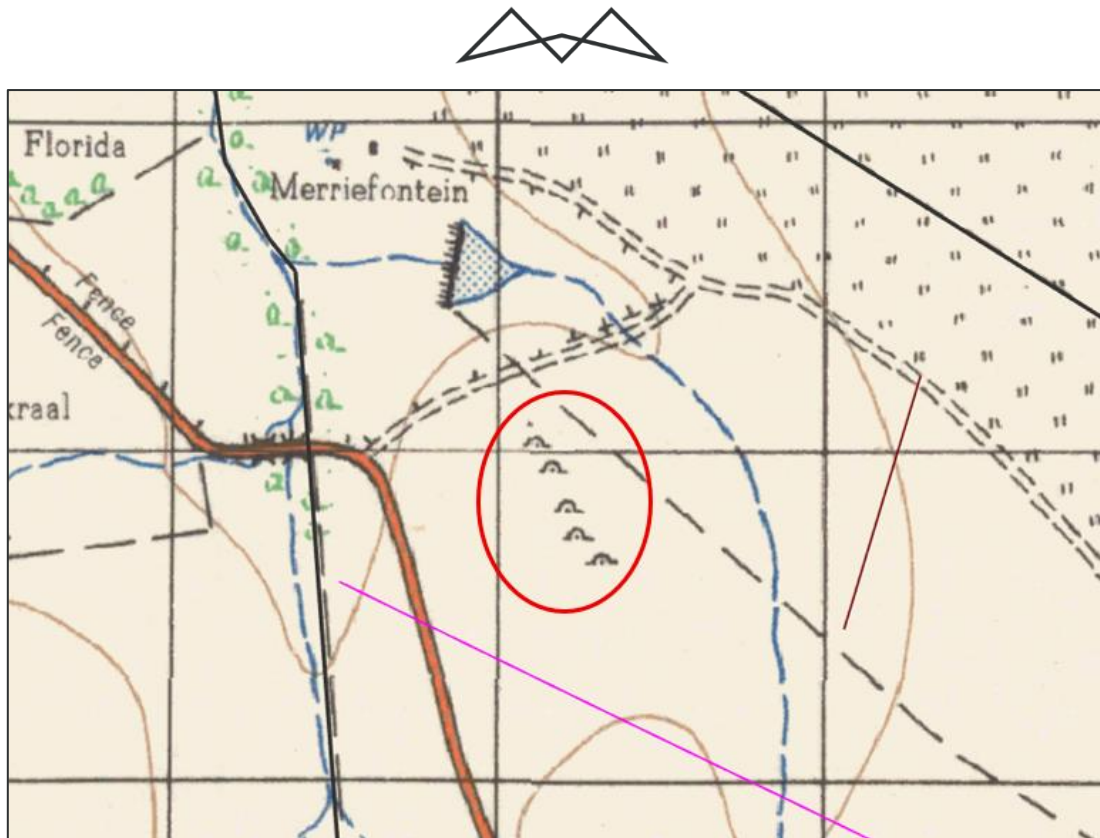


Figure 26: Extract of the First Edition Topographic map 2826BB dated 1945 indicating the presence of settlements (circled in red). Magenta lines = seismic transects (PR04), purple line = gas line.

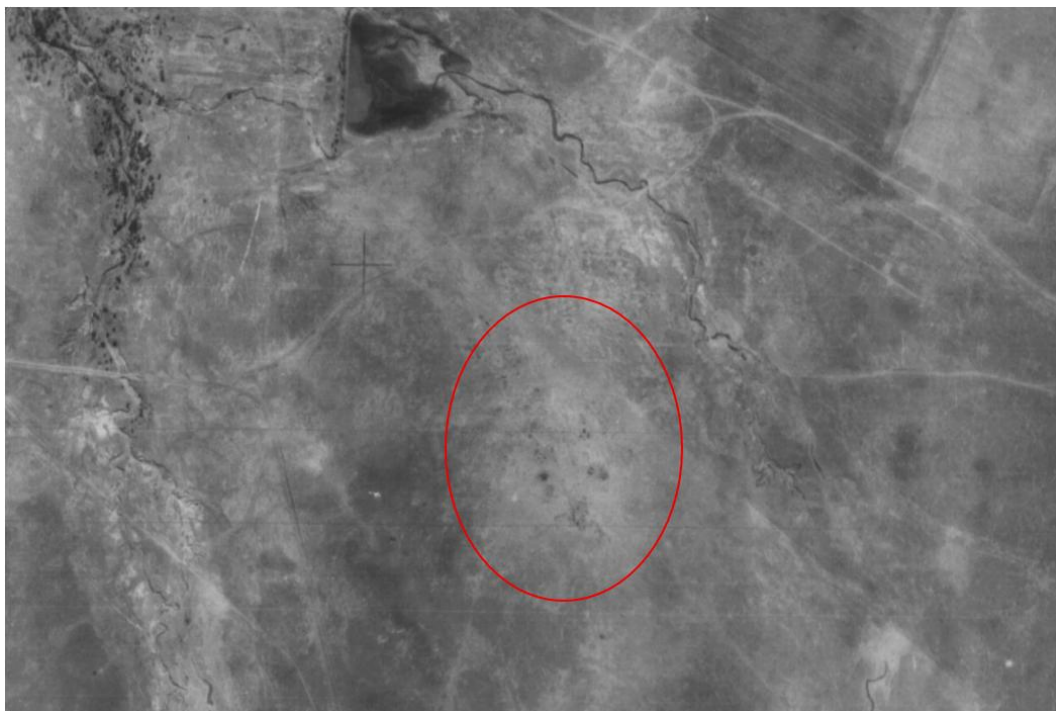


Figure 27: Aerial photograph of 1944. Note the presence of features (circled in red) corresponding with observations made in the First Edition Topographic maps.

Another important feature noted through the desktop assessment was the farm complex Siberiasfontein, which appeared on first edition topographic maps, and is still present and in use (Figure 28). The complex includes, not only historical buildings, but also a graveyard which fall along a seismic transect (PR07).



Figure 28: Extract of the First Edition Topographic map 2826BD dated 1947. Map includes the farm complex, Siberiasfontein. Note the grave and historical structures which fall along the proposed seismic transect (magenta line).

5.2 FIELD ASSESSMENT RESULTS

The appointed Archaeologist surveyed the various areas which fall within the proposed development footprint. The survey covered the extent of the area to be developed with the intention to identify and confirm sensitivities in terms of heritage significance. Figure 29 is a map of all the areas surveyed, specifically including the paths tracked out by the Archaeologist. The field survey was conducted on three separate days during Autumn.

5.2.1 GENERAL OBSERVATIONS

The area of the proposed development traverses large farmlands. These farmlands are used for cattle grazing as well as game farming. Several paths and roads cross the area, allowing for the area to be traversed by vehicle to some extent. However, majority of the infrastructure had to be surveyed on foot. Pertaining to its general heritage significance, the area can be related to colonial period or historical significance. This is specifically in relation to farming prior to the extensive development of surrounding areas such as Virginia and Welkom.

5.2.2 ARCHAEOLOGICAL FINDS

Inclusive of the verification of two desktop finds (MPR007 and MPR018), three additional observations were made during the site survey (MPR019, MPR020, MPR021), of which only two (MPR019 and MPR021) were considered of heritage significance. In addition, MPR002, which was initially identified as a heritage feature now falls within the footprint of a renewable development (an HIA for this development was conducted by Kruger (2021), as mentioned previously). This site was removed from the initial list of finds and sites together with MPR011 which was not verified on site as the survey focused on the finds within the development footprint.

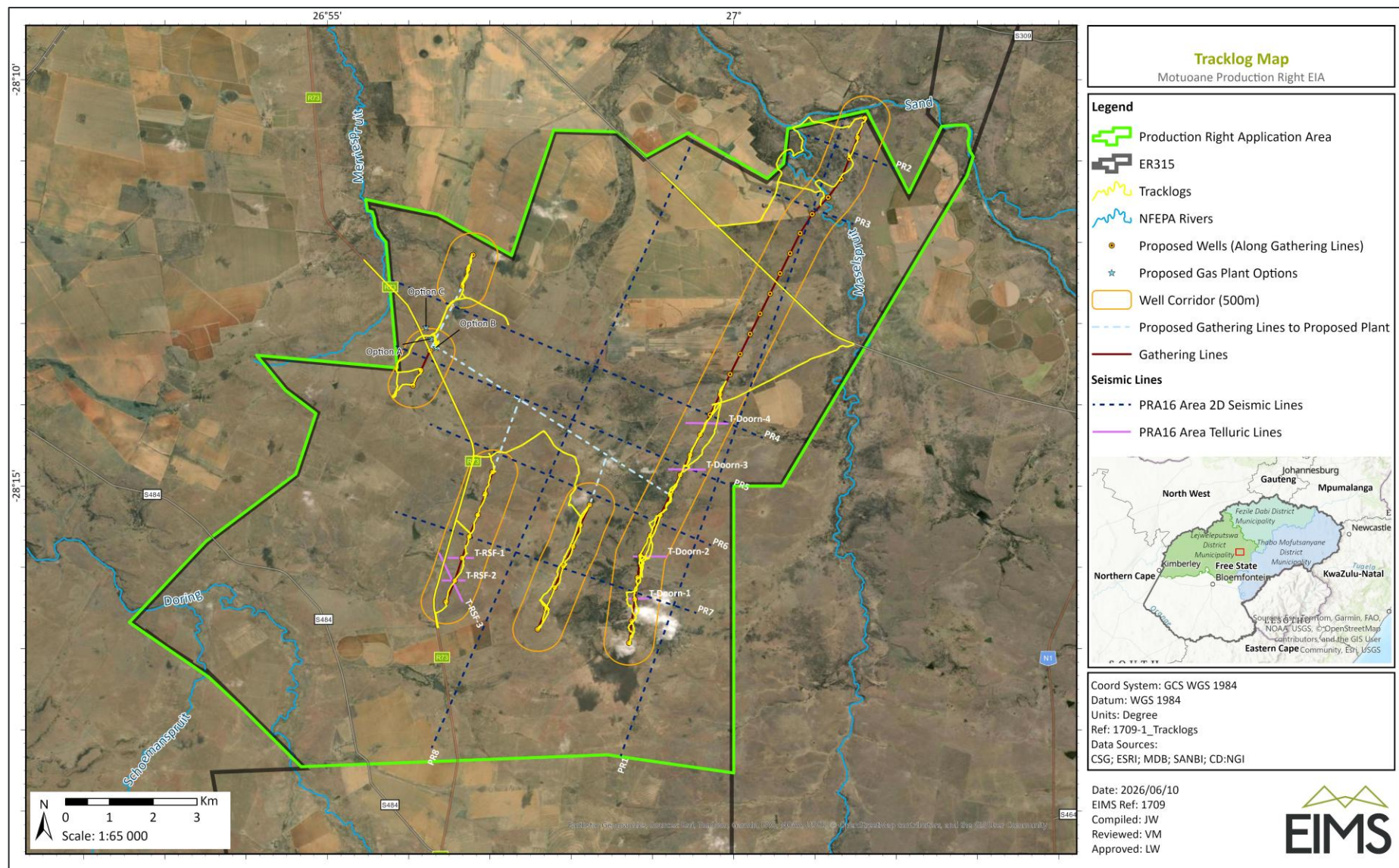


Figure 29: Map of areas surveyed and tracked.



A) STONE AGE FINDS

A Later Stone Age site (MPR019) was identified along the southeastern gathering line, between proposed well locations RPF229 F and RPF229 G. More than five individual lithic pieces were identified. The site itself was rocky and less vegetated than its surroundings. Pieces identified included cores, an adze, as well as smaller flakes. Figure 30 is a photograph of some of the lithic pieces identified. Note that the material used to make these tools was not noted in the area, suggesting that their manufacture took place away from the site.

This site has been graded as Grade IV B, that is of Medium heritage significance. Although the site does not intersect with the proposed well locations and gathering lines, it is advised that the site be first recorded in more detail prior to any disturbance.



Figure 30: MPR019 – LSA lithics associated with the identified LSA Site

B) HISTORICAL PERIOD FINDS

As a feature initially identified through previous HIAs, MPR018 was verified through the site survey as a foundation which is in proximity to a proposed southwestern gathering line (Figure 31). The feature also included associated material evidence such as metal. Given its proximity to the less-significant kraal structure observed (MPR007), it was likely a similar building as it included posts which were of a similar placement and construction (Figure 32). While this may suggest that the feature is of a lower significance than initially suggested, its initial rating is here upheld. The feature may be affected by the construction of the proposed gathering line. Therefore, mitigations for its avoidance are here advised. This is specifically in relation to the previous suggestion that the feature may include underground infant burials.



Figure 31: MPR018 – Foundation previously identified in past HIAs



Figure 32: MPR018 – A post or marker associated with the foundation. Similar posts were noted at MPR007



Although no additional Historical Period Finds were noted during the survey, several finds including foundations, kraal structures, farm dams and wind pumps (windmills) were observed. While these features were not considered as heritage features as they were not observed as being older than 60 years, they were further considered as not conservation worthy (NCW). Figure 33 is a photograph of a farm dam (MPR020) which was located close to the eastern gathering line, south of seismic transect PR07. This feature is not of heritage significance and was therefore not graded.



Figure 33: MPR020 – Photograph of Farm dam which was confirmed as not being of heritage significance

C) GRAVES

In addition to the graves and grave sites identified through the desktop assessment, an additional grave site (MPR021) was identified. The grave site included 10-15 identifiable marked and unmarked graves. The area was extensively vegetated and may include more graves which could not be identified. The engravings on the headstones were hardly legible, however, the most well-preserved of the graves (Figure 34) indicated the date of death of the individual buried dating back to 1990. This suggests that the grave site is at least 36 years old as at the time of discovery. This observation is corroborated with the fact that less preserved and seemingly older graves were also identified (Figure 35). It is important to note that this feature is in proximity to the eastern proposed gathering line and hence may be affected by the proposed infrastructure.

The grave site has been graded as a Grade III A heritage feature, that is of High heritage significance.



Figure 34: MPR021 – The most well-preserved grave of the grave site



Figure 35: MPR021 – A seemingly older grave of the grave site

5.3 SUMMARY OF FINDINGS

Following a desktop assessment and field survey, a total of 18 potential heritage features were identified within the area, of which 13 were in proximity and intersecting the development footprint. The following is a categorised description of the different potential heritage features identified through the desktop assessment:

- MPR003, MPR004, MPR006, MPR021 – Burials and cemeteries



- MPR001, MPR005, MPR007, MPR008, MPR009, MPR010, MPR017, MPR018 – Historical Farmsteads and structures
- MPR019 – Stone Age Site

Figure 36 presents a visual summary of the different findings and their locations. Table 4 provides a summary of the different features identified, a description of the feature, as well as the coordinates of where the feature are located or associated relative central points. All features highlighted in brown will not be affected by the development. All features highlighted in blue were verified desktop assessment finds.

Table 4: Summary of different finds and sites identified.

Feature No.	Description	Rating and Significance	Coordinate
MPR001	Historical Farmstead or farm complex known as Bloemskraal identified by Kruger (2021).	Grade IIIC Medium	28°14'46.46"S 26°58'35.47"E
MPR002	Historical Period remains including an ash midden and material culture of metal and plastic. Identified by Kruger (2021).	Grade IIIC Medium	28°12'30.85"S 27° 0'17.46"E
MPR003	Historical Period burial site including at least two graves. Identified by Kruger (2021).	Grade IIIA High	28°14'40.01"S 26°58'28.38"E
MPR004	Burial site holding a large number of graves. Some graves include headstones dating as far back as 1976. Site was identified by Kruger (2023).	Grade IIIA High	28°13'55.72"S 26°59'2.22"E
MPR005	Potential Historical Period Settlement. Identified by Kruger (2022).	Grade IIIC Medium	28°13'27.13"S 26°56'41.00"E
MPR006	Burial site holding at least 4 graves. Identified most recently by Angel (2024).	Grade IIIA High	28°15'44.99"S 26°56'23.73"E
MPR007	Kraal Structure which may not be older than 60 years. Identified by Angel (2024). – Verified through site survey.	NCW	28°15'49.82"S 26°56'42.76"E
MPR008	Historical structures part of old farmstead or complex.	Grade IIIC Medium	28°15'42.27"S 26°56'16.51"E
MPR009	Historical Farmstead and associated structures.	Grade IIIC Medium	28°17'0.54"S 26°59'17.14"E
MPR010	Historical Farmstead and associated structures.	Grade IIIC Medium	28°11'25.25"S 27° 0'33.82"E
MPR011	Potential historical settlement identified through archival study	N/A	28°12'22.01"S 26°56'11.30"E
MPR012	Grave site including 15-18 graves. Identified by Angel (2024).	Grade IIIA High	28°12'31.02"S 26°56'20.19"E



Feature No.	Description	Rating and Significance	Coordinate
MPR013	Foundation of stone-built structure identified by Angel (2024).	Grade IIIA High	28°12'26.10"S 26°56'15.43"E
MPR014	Burial or grave site including 1-2 graves. No headstones included. Identified by Angel (2024).	Grade IIIA High	28°12'25.70"S 26°56'14.50"E
MPR015	Midden including ash, glass and metal cultural material remains. Identified by Angel (2024).	Grade IIIA High	28°12'24.80"S 26°56'16.58"E
MPR016	Possible grinding stone identified by Angel (2024).	Grade IIIC Medium	28°12'20.66"S 26°56'15.04"E
MPR017	Foundation of stone-built structure identified by Angel (2024).	Grade IIIA High	28°12'27.65"S 26°56'39.95"E
MPR018	Foundation of stone-built structure identified by Angel (2024). – Verified through site survey.	Grade IIIA High	28°15'45.68"S 26°56'41.75"E
MPR019	Later Stone Age Site – included examples of different lithic types of material not of the area.	Grade IV B Medium	28°15'52.32"S 26°57'55.11"E
MPR020	Farm Infrastructure which may not be older than 60 years.	NCW	28°16'28.90"S 26°58'48.41"E
MPR021	Grave site including 10-15 identifiable headstones.	Grade IIIA High	28°16'50.92"S 26°58'44.80"E

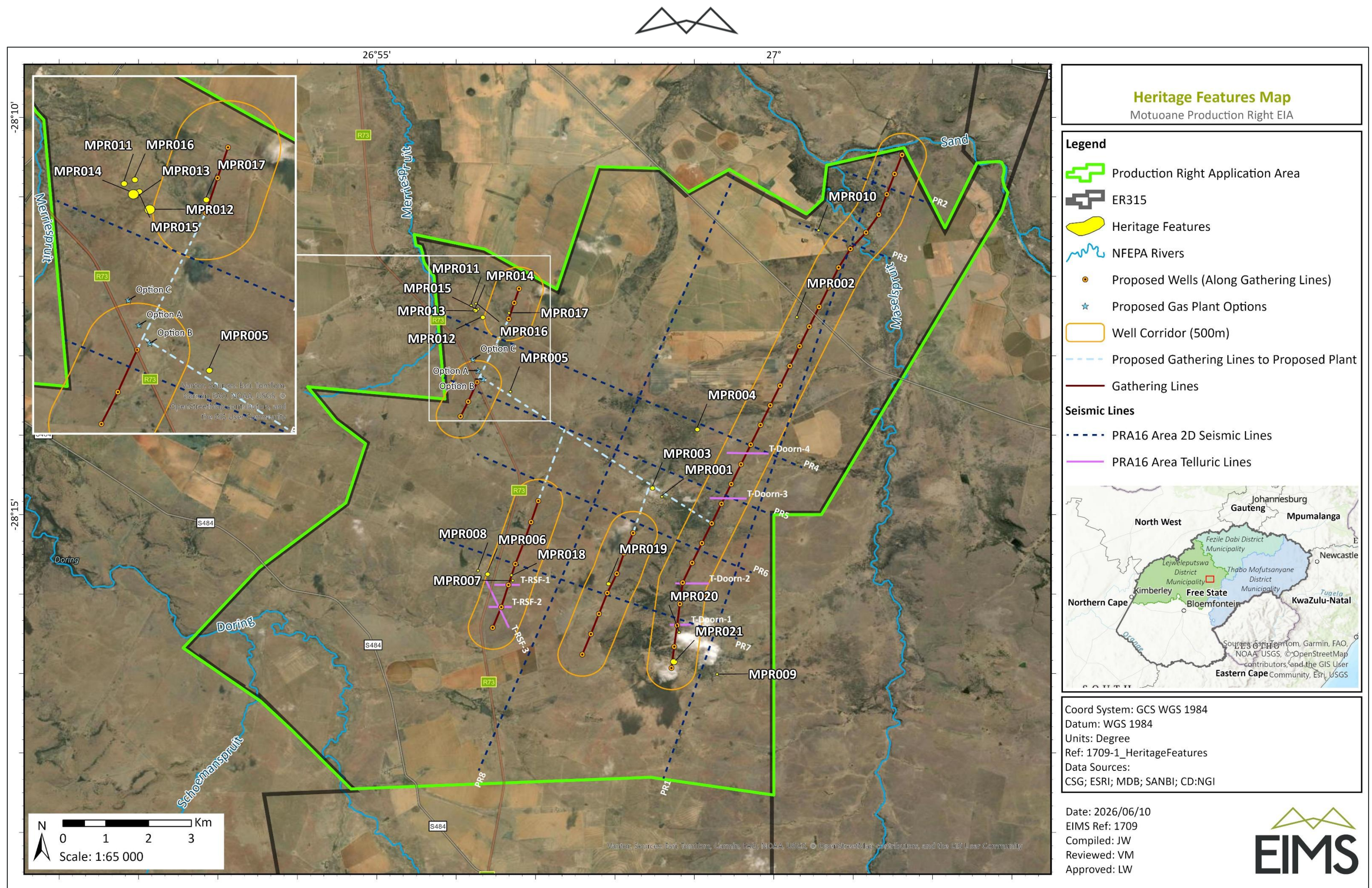


Figure 36: Map of the different finds and sites of interest identified



6 IMPACT ASSESSMENT

This section describes the impact assessment methodology adopted, and the impacts identified during the Heritage Impact Assessment.

6.1 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.

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 5 below.

Table 5: 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 6.

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.

Table 6: Probability 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:

$$S = C \times P$$

Table 7: Determination of Risk.

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

The outcome of the risk assessment will result in a range of scores, ranging from 1 through to 25. These R scores are then grouped into respective classes as described in Table 8.

Table 8: Significance Classes.

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).

² 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 importance of this impact or risk and must consequently be flagged for further specific consideration, management, mitigation, or contingency planning.



S Score	Description
>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.

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

1. Cumulative impacts; and
2. 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 9: Criteria for Determining Prioritisation.

Cumulative Impact (CI)	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 9. The impact priority is therefore determined as follows:

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

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 10).



Table 10: 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).

Table 11: Final 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. Offsets 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).
-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



Significance Rating	Description
>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 (in this case, the Archaeologist) 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.

6.2 IDENTIFIED HERITAGE IMPACTS

Table 13 provides a breakdown of the potential impacts identified through this assessment, considering the above-cited and adopted methodology.

As described in previous sections, finds include the identified 13 heritage features which may be affected by the development. These included foundations and historical farmstead buildings now destroyed, grave sites, a LSA site, and other features. While most of these features have been identified through past HIAs and studies, they have been considered to provide a baseline of the heritage significance of the area in general. Some of these features were verified through the site survey.

A key impact identified was the proximity of MPR018 and MPR021 to proposed gathering lines. These features have been rated as being of High heritage significance and therefore will need to be avoided. As MPR021 represents a grave site, the impact on this site may be significant, and hence, it is here advised that this section of the gathering line be shifted to accommodate the proposed 50m buffer. The same would apply to MPR018 which was previously identified as a foundation of potentially High heritage value as it may hold infant burials.

For the purposes of understanding the fundamental linkage between project activities and Heritage impact pathways, Table 12 has been provided to provide the Environmental Assessment Practitioner and the developer with an understanding of how the various project activities may ultimately lead to the impacts listed in the Impact Matrix, or Archaeological Impact Assessment (Table 13).

Table 12: Linkage between activity, impact pathway, and likely affected features

Project activity	Heritage impact pathway	Likely affected features
Seismic / magnetotelluric surveys	Surface disturbance, vehicle/personnel movement, vegetation clearing, pegging or line access may disturb or damage heritage material	Graves, farmstead remains, LSA lithics where close to transects
Drilling and well-pad preparation	Ground clearance, excavation, levelling and vehicle movement may destroy or disturb surface/subsurface heritage resources	Any features within/near well pads or access routes
Gathering pipelines	Trenching, stockpiling and servitude preparation may directly disturb or destroy heritage resources	MPR018, MPR019, MPR021 where lines are nearby
Roads / associated infrastructure	Clearance, grading and increased access may disturb, damage or expose heritage material	Any mapped or chance-find heritage resources
Operations / maintenance	Lower likelihood, but maintenance access or workovers could disturb buffered sites if controls are not maintained	Mainly buffered grave/foundation areas



Project activity	Heritage impact pathway	Likely affected features
Decommissioning / rehabilitation	Removal works, re-grading and vehicle access could repeat construction-phase disturbance risks	Same receptors as construction phase

While the nature of the potential impact on heritage resources is broadly consistent across the proposed project activities, namely the disturbance, damage, destruction or loss of contextual integrity of archaeological and heritage features, the activities through which these impacts may occur differ. The relationship between the proposed project activities and the identified heritage impact is therefore described below to clarify how the various components of the project may contribute to the same assessed impact. The impact itself is assessed in Table 13.

Of features in proximity and those which intersect with the proposed activities, it is here proposed that buffers be placed around each of these features, with proposed activities not taking place within 30 meters of the buildings or structures, and 50 meters of the grave sites. It is here argued that the features should be avoided, and in doing so, there will be little to no impact on the features. The impact assessment methodology has therefore been applied considering scenarios where the proposed activities would impact identified features.

The potential cumulative heritage impacts associated with the proposed project relate primarily to the incremental disturbance of an already modified rural heritage landscape. Existing exploration wells and associated exploration activities, together with surrounding land uses such as renewable energy developments, existing infrastructure and agricultural activities, have already contributed to varying degrees of landscape alteration and surface disturbance. The proposed production-related activities may therefore add to these existing disturbances, particularly where new ground disturbance, vehicle movement, trenching, drilling, vegetation clearance or maintenance activities occur in proximity to identified or previously recorded heritage features. The most sensitive receptors in this regard are the identified grave sites and burial grounds, as well as any as-yet unidentified archaeological material that may be encountered as chance finds during construction or operational activities. While the proposed project is not expected to fundamentally alter the regional heritage character on its own, it may contribute incrementally to the continued reduction, fragmentation or loss of local heritage context if avoidance, buffering and chance find procedures are not implemented. With strict adherence to the recommended mitigation measures, including avoidance of known graves and heritage features, implementation of appropriate buffers, and application of a Chance Find Procedure, the cumulative heritage impact is expected to remain manageable.

While the features identified represent markers of heritage significance (in particular, structures, material evidence, and graves), the occurrence of below-ground heritage finds may be possible. For this reason, as a mitigation measure proposed, a Heritage Finds or Chance Find Procedure for addressing heritage finds must be adopted as part of construction processes. Should finds of an alarming significance, for example, a grave or high density of small finds be discovered during construction, this procedure will inform the next steps taken to ensure the documentation of these finds, and further action to be taken should a heritage professional deem necessary.

Altogether, post-mitigation of the identified heritage impacts is rated a Medium to Low Negative, given that the impacts can be avoided, and the potential for a heritage procedure to allow for the documentation, recording, and further assessment of undiscovered finds and sites. A heritage procedure can present opportunity to limit the impact of development on heritage finds to construction activities, with the potential to document and further assess finds should they be related to broader sites. This ultimately presents opportunity to reverse the adverse effects of development on heritage finds, given that their value can be evaluated through documentation. This also presents opportunity to better understand the heritage significance of the area to be developed.



Table 13: Archaeological Impact Assessment

Impact Description				Pre-Mitigation									Post Mitigation										Priority Factor Criteria				
Identifier	Impact	Alternative	Phase	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	Consequence	Post-Probability	Post-mitigation Significance Score	Post-Mitigation Significance2	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final Score	Final Score Significance
Historic Structures and LSA Site	Destruction of structures older than 60 years and associated material culture Potential disturbance of an identified LSA site	Alternative 1	Construction	-1	1	5	2	5	-3,25	2	-6,5	Medium to low -	-1	1	1	1	1	-1	1	-1	Low -	Medium	1	1	1,00	-1,00	Low -
Graves (G)	Destruction or disturbance of identified graves	Alternative 1	Construction	-1	2	5	3	5	-3,75	2	-7,5	Medium to low -	-1	1	1	1	1	-1	2	-2	Low -	High	1	2	1,13	-2,25	Low -
Unidenti ed below- ground heritage features (U)	Destruction or disturbance of undiscovered below-ground heritage features.	Alternative 1	Construction	-1	1	5	4	5	-3,75	3	-11,25	Medium to high-	-1	1	1	2	3	-1,75	3	-5,25	Medium to low -	Medium	1	2	1,13	-5,91	Medium to low -



7 RECOMMENDATIONS AND MITIGATIONS

Considering the Impact Assessment above, the following presents a list of mitigations proposed in light of the identified impacts.

7.1 SITE-SPECIFIC RECOMMENDATIONS AND MITIGATIONS

Table 14 provides a breakdown of recommendations and mitigations to be considered for inclusion in the EMP related to this project. These mitigations are associated with construction phase which may involve clearing of land for the proposed infrastructure, leading to the potential disturbance of heritage. Firstly, mitigation measures here advise for the avoidance of identified heritage features at risk considering a 30-meter buffer for historic buildings, and 50-meter buffer for graves. Further, the mitigation measures recommended serves to address the potential of further discoveries advising for the implementation or recognition of a heritage protocol and chance find procedure as contemplated in 7.3.

Table 14: List of site-specific mitigations and recommendations

Activities	Phase	Size and Scale of Disturbance	Mitigation Measures / Management Actions	Compliance with Standards	Time Period for Implementation
Clearing of land for the proposed infrastructure (various pipelines, wells), as well as traversing the landscape along seismic transects	Construction	Destruction of disturbance of structures older than 60 years and associated material culture, LSA Site, and Graves (G)	- A 30m buffer around all identified heritage structures (particularly MPR018) and the LSA site (MPR019) must be implemented, within which no proposed activities are to take place. - A 50m buffer around all identified graves (particularly MPR021) must be implemented within which no proposed activities are to take place. - Should finds of an alarming significance, for example, a grave or high density of small finds be discovered during construction, the ECO must be informed of the discovery. SAHRA (or the relevant provincial heritage authority) must likewise be contacted, and a qualified Archaeologist must be consulted to provide advice on how to proceed.	NHRA	During construction activities
		Unidentified below-ground heritage features (U)	A Chance Find Procedure is advised to be followed should additional heritage finds or sites be encountered.	NHRA	During construction activities

7.2 OVERALL RECOMMENDATIONS

As a key overall recommendation, identified heritage features are located within the development footprint, and these need to be considered as development progresses. It is expected that these will not be disturbed or



impacted on through the proposed activities. A 30-meter buffer has been proposed for the avoidance of farm infrastructure (including MPR018 which intersects with the proposed gathering lines), old farmhouses, and the LSA site, and a 50-meter buffer has been proposed for the avoidance of grave sites, particularly MPR021. The developer is further reminded to remain cognizant of the potential to discover unidentified above-ground and below-ground finds and sites. Upon discovery of any additional heritage finds of high significance, for example, graves or high density of small finds, a Heritage Finds or Chance Find Procedure should be followed.

7.3 HERITAGE PROTOCOL AND CHANCE FINDS

A heritage procedure is applicable where finds are identified during the initiation of the proposed activities. This procedure is guided by the NHRA but should correspond with the overall EMPr drafted for the development. The following is a guideline on how a Heritage or Chance Find Procedure can be structured:

- In the event of a chance find which appears of significant value to the lay person, all development activities must be temporarily halted.
- Finds should not be displaced. Instead, their location should be recorded, and a short description prepared for further evaluation to follow.
- A qualified Archaeologist must be consulted, firstly to record the find and evaluate its heritage significance, reporting observations to the heritage authority. The Archaeologist should provide recommendations on how to approach the finds moving forward. This may include recommendations for the mitigation of impacts on the heritage resources in question.
- Should the Archaeologist recommend, development can resume following the application of recommendations and mitigation measures.
- Alternatively, the Archaeologist may advise towards the application for heritage permits from the heritage authority in the event of unavoidable disturbance, relocation, or the need for Phase 2 mitigation.

The above should act as a brief guideline which should form an intrinsic element of current or future Heritage Procedures or Protocols adopted by the developer of the project in question.

8 CONCLUSION AND IMPACT STATEMENT

This report was prepared as part of a Phase 1 Heritage Impact Assessment for the proposed D3 Energy Production Right Project. As part of this assessment, a desktop as well as an on-site evaluation of heritage impacts was conducted.

Through the methodology adopted as part of this assessment, heritage features were identified which can all be avoided during the implementation of the proposed activities. Apart from unassessed chance finds, a Low to Medium impact on heritage features can be expected should the proposed mitigation measures be followed. Therefore, from an Archaeological perspective, the development will not have any significant foreseeable impacts and can proceed as long as the recommended mitigation measures are implemented.



9 REFERENCES

- Backwell, L. *et al.* (2023) 'Border Cave, South Africa', in, pp. 1297–1310. Available at: https://doi.org/10.1007/978-3-031-20290-2_84.
- Calabrese, J.A. (2000) 'Metals, Ideology and Power: The Manufacture and Control of Materialised Ideology in the Area of the Limpopo-Shashe Confluence, c.AD 900 to 1300', *Goodwin Series*, 8, pp. 100–111. Available at: <https://doi.org/10.2307/3858051>.
- Cawthorn, R.G. (2010) 'The Platinum Group Element Deposits of the Bushveld Complex in South Africa', *Platinum Metals Review*. Johnson Matthey. Available at: <https://doi.org/10.1595/147106710X520222>.
- Chazan, M. *et al.* (2012) 'The Oldowan horizon in Wonderwerk Cave (South Africa): Archaeological, geological, paleontological and paleoclimatic evidence', *Journal of Human Evolution*, 63(6), pp. 859–866. Available at: <https://doi.org/10.1016/j.jhevol.2012.08.008>.
- Chirisa, I. and Matamanda, A. (2019) 'Forces shaping urban morphology in Southern Africa Today: unequal interplay among people, practice and policy', *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 12(3), pp. 354–372. Available at: <https://doi.org/10.1080/17549175.2019.1626262>.
- Dauids, A. (2018) *Afrikaans van die Kaapse Moslems*. Western Cape: Taal Museum.
- Delius, P., Maggs, T. and Schoeman, M. (2012) 'Bokoni: Old Structures, New Paradigms? Rethinking Pre-colonial Society from the Perspective of the Stone-Walled Sites in Mpumalanga', *Journal of Southern African Studies*, 38(2), pp. 399–414. Available at: <https://doi.org/10.1080/03057070.2012.682841>.
- Durand, J.F. (2012) 'The impact of gold mining on the Witwatersrand on the rivers and karst system of Gauteng and North West Province, South Africa', *Journal of African Earth Sciences*, 68, pp. 24–43. Available at: <https://doi.org/10.1016/j.jafrearsci.2012.03.013>.
- d'Errico, F. *et al.* (2012) 'Early evidence of San material culture represented by organic artifacts from Border Cave, South Africa', *Proceedings of the National Academy of Sciences*, 109(33), pp. 13214–13219. Available at: <https://doi.org/10.1073/pnas.1204213109>.
- Favreau, J. (2023) 'Sourcing Oldowan and Acheulean stone tools in Eastern Africa: Aims, methods, challenges, and state of knowledge', *Quaternary Science Advances*, 9, p. 100068. Available at: <https://doi.org/10.1016/j.qsa.2022.100068>.
- FORSSMAN, T.R. *et al.* (2010) 'A LATER STONE AGE ASSEMBLAGE FROM CANTEEN KOPJE, NORTHERN CAPE', *The South African Archaeological Bulletin*, 65(192), pp. 204–214.
- Gribble, J. (2002) 'Past, Present, and Future of Maritime Archaeology in South Africa', in C.V. Ruppé and J.F. Barstad (eds) *International Handbook of Underwater Archaeology*. Boston, MA: Springer US, pp. 553–567. Available at: https://doi.org/10.1007/978-1-4615-0535-8_33.
- Hall, M. (1993) 'The Archaeology of Colonial Settlement in Southern Africa', *Annual Review of Anthropology*, 22, pp. 177–200.
- Harrison, P. and Zack, T. (2012) 'The power of mining: the fall of gold and rise of Johannesburg', *Journal of Contemporary African Studies*, 30(4), pp. 551–570. Available at: <https://doi.org/10.1080/02589001.2012.724869>.
- Henshilwood, C.S. (2012) 'Late Pleistocene Techno-traditions in Southern Africa: A Review of the Still Bay and Howiesons Poort, c. 75–59 ka', *Journal of World Prehistory*, 25(3), pp. 205–237. Available at: <https://doi.org/10.1007/s10963-012-9060-3>.
- Huffman, T.N. (1982) 'Archaeology and ethnohistory of the African Iron Age', *Annual review of Anthropology*, pp. 133–150.



- Huffman, T.N. (1989) 'Ceramics, settlements and Late Iron Age migrations', *African Archaeological Review*, 7(1), pp. 155–182. Available at: <https://doi.org/10.1007/BF01116842>.
- Huffman, T.N. (2000) 'Mapungubwe and the Origins of the Zimbabwe Culture', *Goodwin Series*, 8, pp. 14–29. Available at: <https://doi.org/10.2307/3858043>.
- Huffman, T.N. (2002) 'Regionality in the Iron Age: the case of the Sotho-Tswana', *Southern African Humanities*, 14, pp. 1–22.
- Huffman, T.N. (2004) 'The archaeology of the Nguni past', *Southern African Humanities*, 16(1), pp. 79–111.
- Huffman, T.N. (2007) *Handbook to the Iron Age: The Archaeology of Pre-colonial Farming Societies in Southern Africa*. Scottville: University of KwaZulu-Natal Press.
- Huffman, T.N. (2009) 'Mapungubwe and Great Zimbabwe: The origin and spread of social complexity in southern Africa', *Journal of Anthropological Archaeology*, 28(1), pp. 37–54. Available at: <https://doi.org/10.1016/j.jaa.2008.10.004>.
- Jacobs, Z. *et al.* (2008) 'Ages for the Middle Stone Age of southern Africa: implications for human behavior and dispersal', *Science*, 322(5902), pp. 733–735.
- James, L. (2018) *Plants of the walls: Studying the relationship between plants and stone walls of the Klipriviersberg Nature Reserve*. Unpublished Honour's Research Report. University of the Witwatersrand.
- James, L. (2024) *Perspectives on the role of Stakeholder engagement and participation in River Basin Management in South Africa: A study of the Hennops River*. Doctoral Thesis. University of the Witwatersrand.
- Klein, R.G. (2000) 'The earlier stone age of southern Africa', *The South African Archaeological Bulletin*, pp. 107–122.
- Kuman, K. *et al.* (2018) 'The Oldowan industry from Swartkrans cave, South Africa, and its relevance for the African Oldowan', *Journal of Human Evolution*, 123, pp. 52–69. Available at: <https://doi.org/10.1016/j.jhevol.2018.06.004>.
- Kuman, K. and Gibbon, R.J. (2018) 'The Rietputs 15 site and Early Acheulean in South Africa', *New perspectives on Acheulean and Acheulean-like adaptations*, 480, pp. 4–15. Available at: <https://doi.org/10.1016/j.quaint.2016.12.031>.
- Leakey, M.D. (1971) *Olduvai Gorge: Volume 3, excavations in beds I and II, 1960-1963*. Cambridge University Press.
- Li, H. *et al.* (2018) 'Handaxes in South Africa: Two case studies in the early and later Acheulean', *New perspectives on Acheulean and Acheulean-like adaptations*, 480, pp. 29–42. Available at: <https://doi.org/10.1016/j.quaint.2016.08.025>.
- Maggs, T. (1976) 'Iron age patterns and Sotho history on the southern Highveld: South Africa', *World Archaeology*, 7(3), pp. 318–332. Available at: <https://doi.org/10.1080/00438243.1976.9979644>.
- Markell, A., Hall, M. and Schrire, C. (1995) 'The historical archaeology of Vergelegen, an early Farmstead at the Cape of Good Hope', *Historical Archaeology*, 29(1), pp. 10–34. Available at: <https://doi.org/10.1007/BF03374206>.
- Mesfin, I.I. (2024) 'The Knapping of Quartz Crystals during the Later Stone Age at Matupi Cave, Ituri Province, Democratic Republic of Congo', *Lithic Technology*, 49(1), pp. 41–62. Available at: <https://doi.org/10.1080/01977261.2023.2188342>.
- Meyer, A. (2000) 'K2 and Mapungubwe', *Goodwin Series*, 8, pp. 4–13. Available at: <https://doi.org/10.2307/3858042>.



- Mitchell, P. (2012) 'San origins and transition to the Later Stone Age: New research from Border Cave, South Africa', *South African Journal of Science*, 108(11/12), p. 2 pages.
- Mitchell, P. and Whitelaw, G. (2005) 'THE ARCHAEOLOGY OF SOUTHERNMOST AFRICA FROM c. 2000 BP TO THE EARLY 1800s: A REVIEW OF RECENT RESEARCH', *The Journal of African History*. 2005/07/01 edn, 46(2), pp. 209–241. Available at: <https://doi.org/10.1017/S0021853705000770>.
- Morrissey, P., Mentzer, S.M. and Wurz, S. (2022) 'A Critical Review of the Stratigraphic Context of the MSA I and II at Klasies River Main Site, South Africa', *Journal of Paleolithic Archaeology*, 5(1), p. 5. Available at: <https://doi.org/10.1007/s41982-022-00110-2>.
- Penn, N. (2005) *The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century*. Ohio University Press (The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century). Available at: <https://books.google.co.za/books?id=-gX2QTfSkMMC>.
- Sadr, K. (2012) 'The origins and spread of dry laid, stone-walled architecture in pre-colonial southern Africa', *Journal of Southern African Studies*, 38(2), pp. 257–263.
- SADR, K. and MSHUQWANA, F. (2020) 'KWENENG', *The South African Archaeological Bulletin*, 75(212), pp. 75–86.
- Sadr, K. and Rodier, X. (2012) 'Google Earth, GIS and stone-walled structures in southern Gauteng, South Africa', *Journal of Archaeological Science*, 39(4), pp. 1034–1042. Available at: <https://doi.org/10.1016/j.jas.2011.11.024>.
- Stollhofen, H. et al. (2021) 'Olduvai's oldest Oldowan', *Journal of Human Evolution*, 150, p. 102910. Available at: <https://doi.org/10.1016/j.jhevol.2020.102910>.
- Thompson, L.M. (2001) *A history of South Africa*. Yale University Press.
- Turrell, R.V. (1987) *Capital and labour on the Kimberley diamond fields, 1871-1890*. Cambridge University Press.
- Villa, P. et al. (2009) 'The still bay points of Blombos cave (South Africa)', *Journal of Archaeological Science*, 36(2), pp. 441–460.
- Villa, P. et al. (2012) 'Border Cave and the beginning of the Later Stone Age in South Africa', *Proceedings of the National Academy of Sciences*, 109(33), pp. 13208–13213. Available at: <https://doi.org/10.1073/pnas.1202629109>.
- Wadley, L. (2015) 'Those marvellous millennia: the Middle Stone Age of Southern Africa', *Azania: Archaeological Research in Africa*, 50(2), pp. 155–226. Available at: <https://doi.org/10.1080/0067270X.2015.1039236>.
- Werz, B.E.J.S. (2010) 'SUB-SAHARAN AFRICA'S OLDEST SHIPWRECK: HISTORICAL-ARCHAEOLOGICAL RESEARCH OF AN EARLY MODERN-ERA PORTUGUESE MERCHANTMAN ON THE NAMIBIAN COAST', *The Mariner's Mirror*, 96(4), pp. 430–442. Available at: <https://doi.org/10.1080/00253359.2010.10657159>.
- Woodborne, S., Pienaar, M. and Tiley-Nel, S. (2009) 'Dating the Mapungubwe Hill Gold', *Journal of African Archaeology*, 7(1), pp. 99–105. Available at: <https://doi.org/10.3213/1612-1651-10122>.
- Worger, W.H. (1987) *South Africa's city of diamonds: mine workers and monopoly capitalism in Kimberley, 1867-1895*. New Haven: Yale University Press (!821530038!Yale historical publications, Miscellany), p. 330.
- Wurz, S. (2002) 'Variability in the Middle Stone Age Lithic Sequence, 115,000–60,000 Years Ago at Klasies River, South Africa', *Journal of Archaeological Science*, 29(9), pp. 1001–1015. Available at: <https://doi.org/10.1006/jasc.2001.0799>.



Appendix 1: CV of the Archaeologist



Appendix 2: Specialist Declaration