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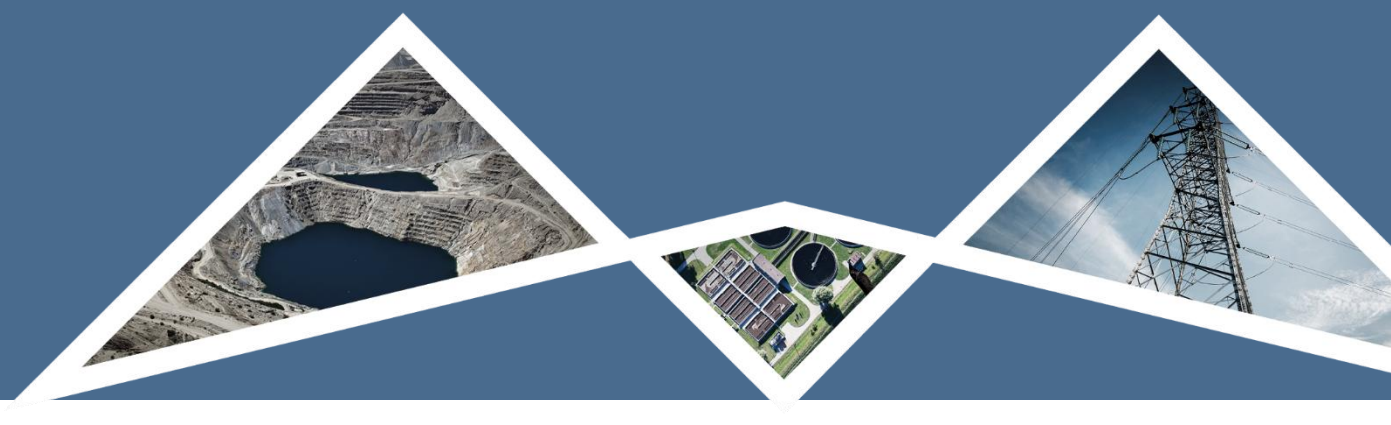
ENVIRONMENTAL IMPACT ASSESSMENT PROCESS AS PART OF THE MOTUOANE EXPLORATION RIGHT 386 APPLICATION

DESKTOP PHASE 1 HERITAGE IMPACT ASSESSMENT REPORT AS PART OF THE SCOPING PHASE



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Abbreviations

AD	*Anno Domini*
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
DMR	Department of Mineral Resources
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioner Association of South Africa
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ER	Exploration Right
ESA	Earlier Stone Age
ha	hectares
HIA	Heritage Impact Assessment
LCT	Large Cutting Tool
LSA	Later Stone Age
MPRDA	Mineral and Petroleum Resources Development Act
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
TA	Target drilling areas
TCP	Technical Cooperation Permit
ya	Years ago

Executive Summary

Motuoane proposes to prospect for all saleable gases including but not limited to Methane, Carbon Dioxide, Helium and Nitrogen on the licensed area. 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 assessment and authorisation processes. Dr Lucien James was appointed as the independent Heritage Specialist (Professional Archaeologist) for the undertaking of the Archaeological Impact Assessment (see attached Specialist CV and Declaration, **Appendix 1** & **Appendix 2**).

As part of the Scoping Phase, a Desktop assessment was conducted to evaluate the potential impact of the project on archaeological and heritage resources as well as indicate the plan of study for the EIA phase. The study included a literature review, and an analysis of available data as part of a desktop assessment.

A total of thirty-one (31) structures, buildings, or complexes as well as three (3) grave sites were identified as having or potentially having heritage significance. Some of these features fall within the 500m buffer assessment area of the Target Areas (TA), and along 60m buffer assessment area for the proposed seismic transects. Two Grade II provincial heritage features were also identified, of which buffer areas intersect with proposed seismic transects. After assessment, Grade II features themselves nor their sense of place will not be affected by the proposed activities. Impacts considered here include, but are not limited to, the potential destruction or disturbance of identified sites which may occur through the implementation of proposed activities. As for other identified heritage sites, suitable mitigation measures proposed include the suggestion for the avoidance of the identified heritage features. Buffers are proposed to be placed around each of these features corresponding with previous recommendations of the South African Heritage Resources Agency (SAHRA), with proposed activities not taking place within 30 meters of the buildings or structures, and 50 meters of the grave sites identified.

Apart from the possibility of the identification of below-ground finds, identified sensitivities can be avoided, allowing the proposed activities to have no impact on heritage features. A Chance Find Procedure is recommended to manage any further discoveries during development should finds be discovered during the proposed activities. This includes halting activities if significant finds are discovered, recording their location, and consulting a qualified archaeologist for further evaluation.

This report is to be followed by an on-site evaluation to further assess and corroborate the observations and finds presented here.

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

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 assessment and authorisation processes (including the statutory public participation), and to compile and submit the required documentation in support of application for:

- An Environmental Authorisation (EA) in accordance with the National Environmental Management Act (Act 107 of 1998) (NEMA), Environmental Impact Assessment (EIA) Regulations, 2014 as amended for the following listed activity:
    - EIA Regulations, 2014 as amended GNR 983 Activity 21C; and
    - EIA Regulations, 2014 as amended GNR 984 Activity 18;
- Other NEMA EIA Regulations, 2014 as amended applicable listed activities are:
    - EIA Regulations, 2014 as amended GNR 983 Activity 27; and
    - EIA Regulations, 2014 as amended GNR 985 Activity 12
- Additional listed activities and/or water uses may be identified during the process.

Motuoane proposes to explore all saleable gases including but not limited to Methane, Carbon Dioxide, Helium, and Nitrogen in the licensed area. Published reports, general experience, experience within Motuoane and contacts with individuals familiar with the area indicate the presence of potentially commercial quantities of these gases. Direct evidence includes gas-emitting boreholes, nearby commercial gas production, gas encountered during drilling and underground mining operations. Due to the large area and complex exploration methodology, the ER will be required for an initial period of three years with the option to renew three additional periods of two years resulting in a total of nine years.

Exploration Right 386 is a consolidation of Technical Cooperation Permit (TCP) 235 and 240 & Exploration Release Area (ERA) 341 which were tenures in 2024 before ER386 application was submitted to PASA on the 8th of October 2024. TCP235 & TCP240 were granted in October 2023 for a 12 Month Term, an ER application was applied for in October 2024. ERA341 was an application previously submitted to PASA which was held up due to changing legislation and subsequently withdrawn. The areas (ERA341, TCP235 and TCP240) were then consolidated to one ER (ER386). Motuoane's application for an exploration right (ER) for hydrocarbons was accepted on the 22nd of October 2024 in terms of Section 79 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended). The accepted application for an exploration right (ER386) is located over an area of approximately 58 000 hectares (ha), covering various farm portions in Welkom near the towns of Virginia, Hennenman and Odendaalsrus, Free State Province. The boundaries of ER386 are 28°13'28.95"S; 26°55'2.76"E in the South, 27°57'37.57"S; 26°48'49.15"E in the West, 27°59'13.57"S; 27°11'13.06"E in the East and 27°46'34.45"S; 26°57'44.05"E in the North, the central coordinates are approximately 27°58'23.27"S; 26°59'38.94"E. See **Figure 1** for Locality Map.

The proposed activities to be undertaken as part of the exploration activities include the following:

- Identifying existing blowers within the ER, undertaking well workover and Intervention if necessary;
- The undertaking of new core exploration well drilling where necessary (at preidentified / new areas of interest);
- Undertaking seismic survey and/or magnetotellurics survey activities (at preidentified / new areas of interest);

- Clearance of an area of 300m^2 or more of indigenous vegetation within specified geographical area;
- Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation; and
- Perform gas composition analysis on gas from existing boreholes and newly drilled wells on the ER.

The main activities are core exploration drilling and seismic survey activities. The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. The geophysical wireline logging of existing boreholes (where possible) will include monitoring of water levels. If no existing gas emitting boreholes are identified near a target area, new drilling activities are proposed within that area using percussion or rotary drilling method. Although up to eleven (11) target drilling areas (TA) with 500m buffer (1km corridor) within the exploration right may be undertaken over the 9-year period, the current Works Program caters for only three (3) drilling wells. It must be noted that there may be a single, multiple or no drilling activities within some of the target drilling areas. Should more than 3 drilling wells be required within the ER, the current Works Program will be required to be updated accordingly.

Majority of the drilling target areas, Target Area 3 (ED G), Target Area 4 (ED H), Target Area 5 (ED J), Target Area 6 (ED I), Target Area 7 (ED F) and Target Area 8 (VEG A) as well as seven (7) seismic transects (Transects, ED 1-5, VEG 1-2) are proposed within the western section of the exploration right on the agricultural fields between Saaiplaas, Bronville, Thabong and Whites. Two target drilling areas, Target Area 1 (RSB D) and Target Area 2 (RSB E) are located in the south of ER386, approximately 7km southeast of Meloding while Target Area 9 (HF C) and associated transects (Transects HF 1, HF2 and HF7) is located approximately 6km west the eastern boundary of ER386 (N1). There are currently two target areas proposed within the northern section namely, Target Area 10 (GP B) and Target Area 11 (GP A) and three seismic transect (Transect G1, G2 and G3) R34 located between Odendaalsrus and Kroonstad. Each exploration well will have an overall depth of approximately 650m and a maximum width of 350mm, commencing with a 6m x 323mm spud hole section, followed by 80m x 254mm conductor hole section, then an intermediate hole section of 450m x 203mm and finally an open hole section of 650m x 144mm. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional requirements. Each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage.

The seismic survey activities are proposed throughout the exploration right as and when necessary. Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data are available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. There are sixteen (16) preliminary proposed transects for seismic / telluric survey, approximately 100km long around known structures and possible drill locations. Seismic and/or telluric locations and lengths are subject to be changed as knowledge increases. Although the Vibroseis technique is the likely method to be undertaken for the seismic activities. There is also a potential alternative to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) which Motuoane may consider over the Vibroseis.

It must be noted that there are at least 14 approved renewable energy projects from various applicants located within ER386. Motuoane and the renewable energy applicants will need to discuss the way forward and/or make necessary arrangements to coexist especially for TA 3 (EDG) and Transects EDG1 and EDG2 as the renewable energy projects overlap with the target drilling areas.

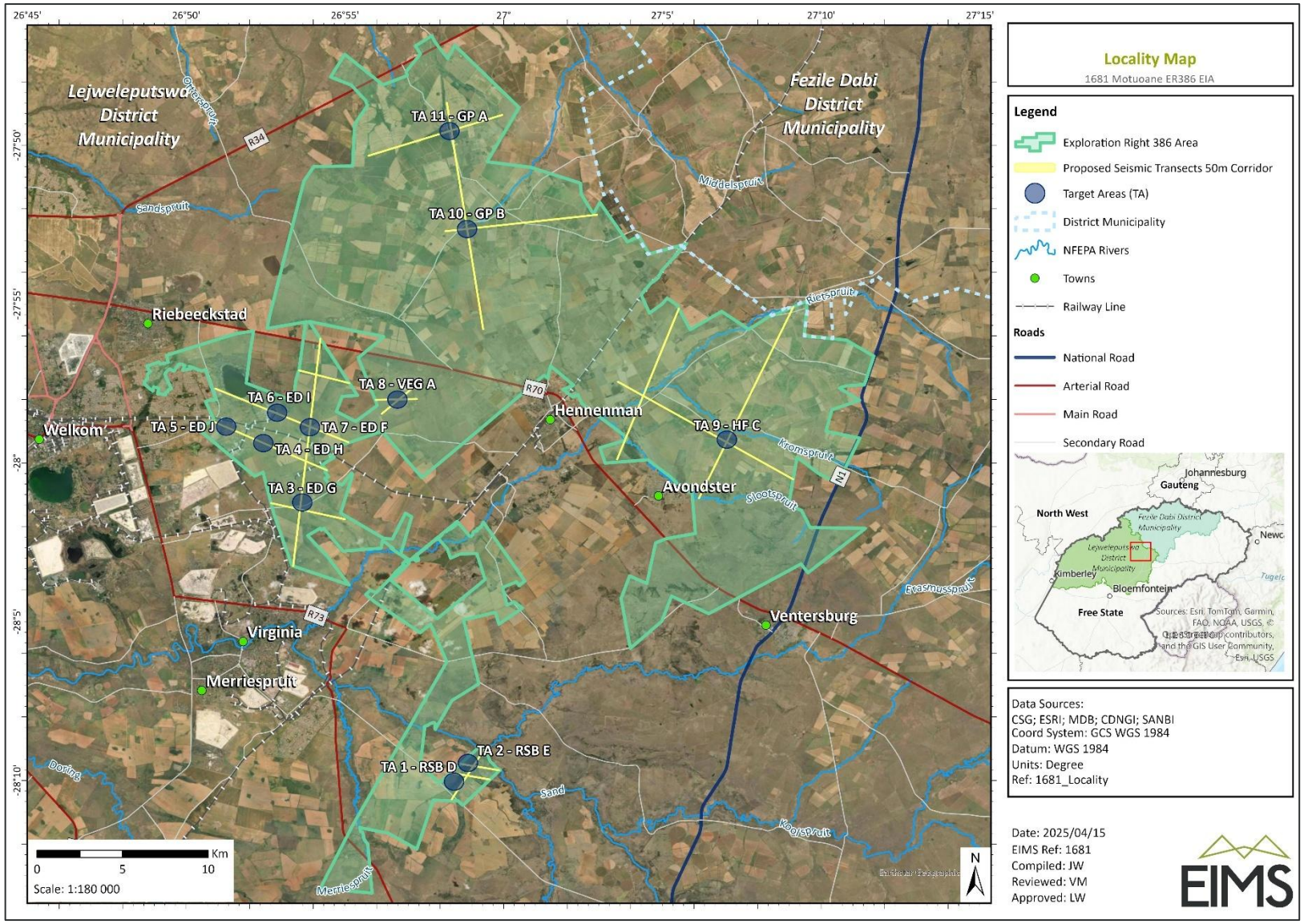

Figure 1: Locality Map

1.2 HERITAGE SPECIALIST DETAILS

As prescribed by the SAHRA Minimum Standards (2007), an independent Heritage Specialist (Professional Archaeologist) was appointed for the undertaking of the Desktop Archaeological Impact Assessment. Dr Lucien James was appointed in this regard. A summary of the Heritage Specialist's qualifications and experience is detailed below. **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, and Natural Science. He has been employed by EIMS as an environmental consultant since March 2023 working on several projects under various roles. As his highest qualification, Lucien completed his Ph.D in 2024. He is accredited as a Professional Member of the Association of South African Professional Archaeologists (ASAPA). He is also registered with EAPASA (Environmental Assessment Practitioner Association of South Africa) as a Candidate EAP (Environmental Assessment Practitioner) and engages in related work. He has worked as a Teaching Assistant and researcher since 2018 and engages in academic work through publications and conferences. He has taught 1st year, 2nd year, 3rd year 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:	**Dr 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)

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):

a) Identify the sites as well as potential associated Heritage objects,

b) Assesses the significance of sites and Heritage objects,

c) Comment on the impact of the development,

d) 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

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.

The Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA) also gives effect to the NHRA as this Act defines 'environment' as it is in the NEMA and, therefore, acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the NHRA that are to be impacted on by activities governed by the MPRDA. Section 40 of the MPRDA requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities.

2 ARCHAEOLOGICAL BACKGROUND

This section presents the archaeological background of the study area. 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, 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.

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 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 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 (Chazan *et al.*, 2012; Favreau, 2023; Kuman *et al.*, 2018; Leakey, 1971; Stollhofen *et al.*, 2021). 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).

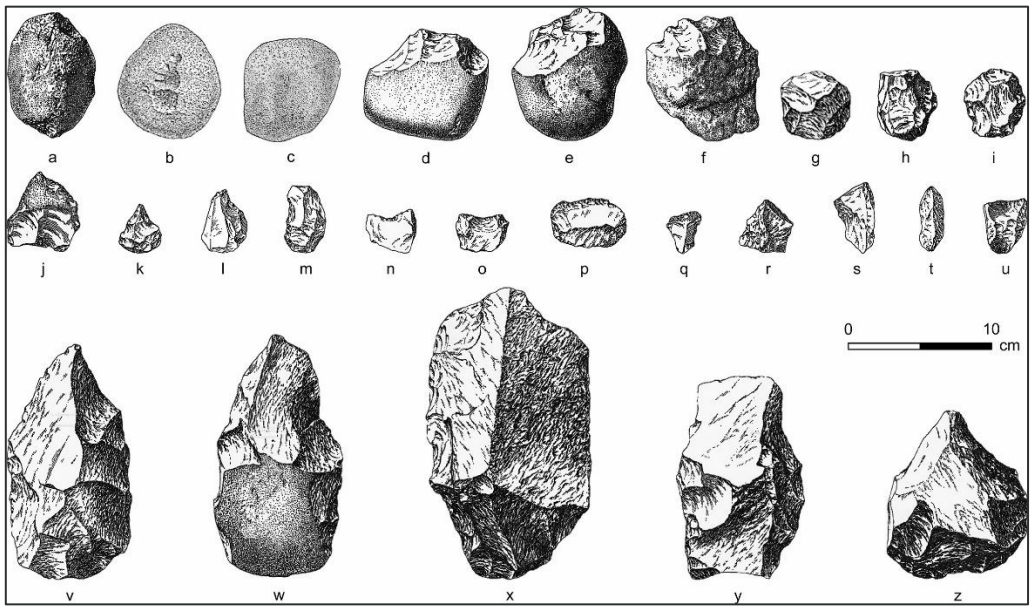

Figure 2: Examples of ESA lithics. Typical Oldowan tools (a-f). Acheaulean LCTs (v-z) (after Kuman and Gibbon, 2018).

B) MIDDLE STONE AGE

Following the ESA, a phase related to very specific industries and stone tool examples chronologically occurs. The 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 (Henshilwood, 2012; Villa *et al.*, 2009). 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 (Henshilwood, 2012; Jacobs *et al.*, 2008; Villa *et al.*, 2009; 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 (Morrissey *et al.*, 2022; Wurz, 2002).

C) LATER STONE AGE

The 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 (Mesfin, 2024; Mitchell, 2012; Villa *et al.*, 2012).

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**).

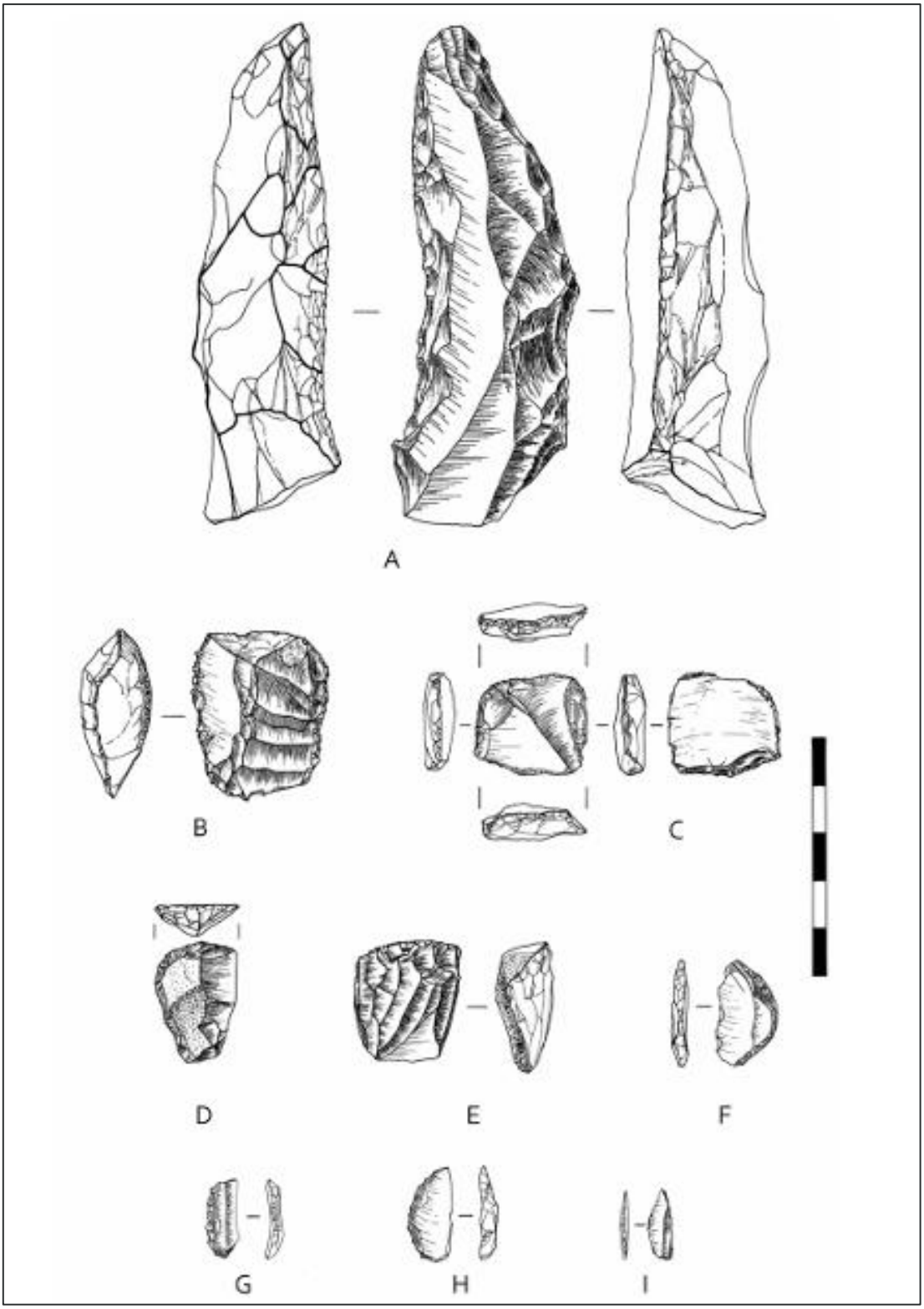

Figure 4: Examples of an adze (A), scrapers (B-D, G), backed bladelets (I), bladelet cores (e), and segments (F, H). Typical pieces associated with the LSA (after Forssman *et al.*, (2010))

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-gather 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 potsherds.

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**).

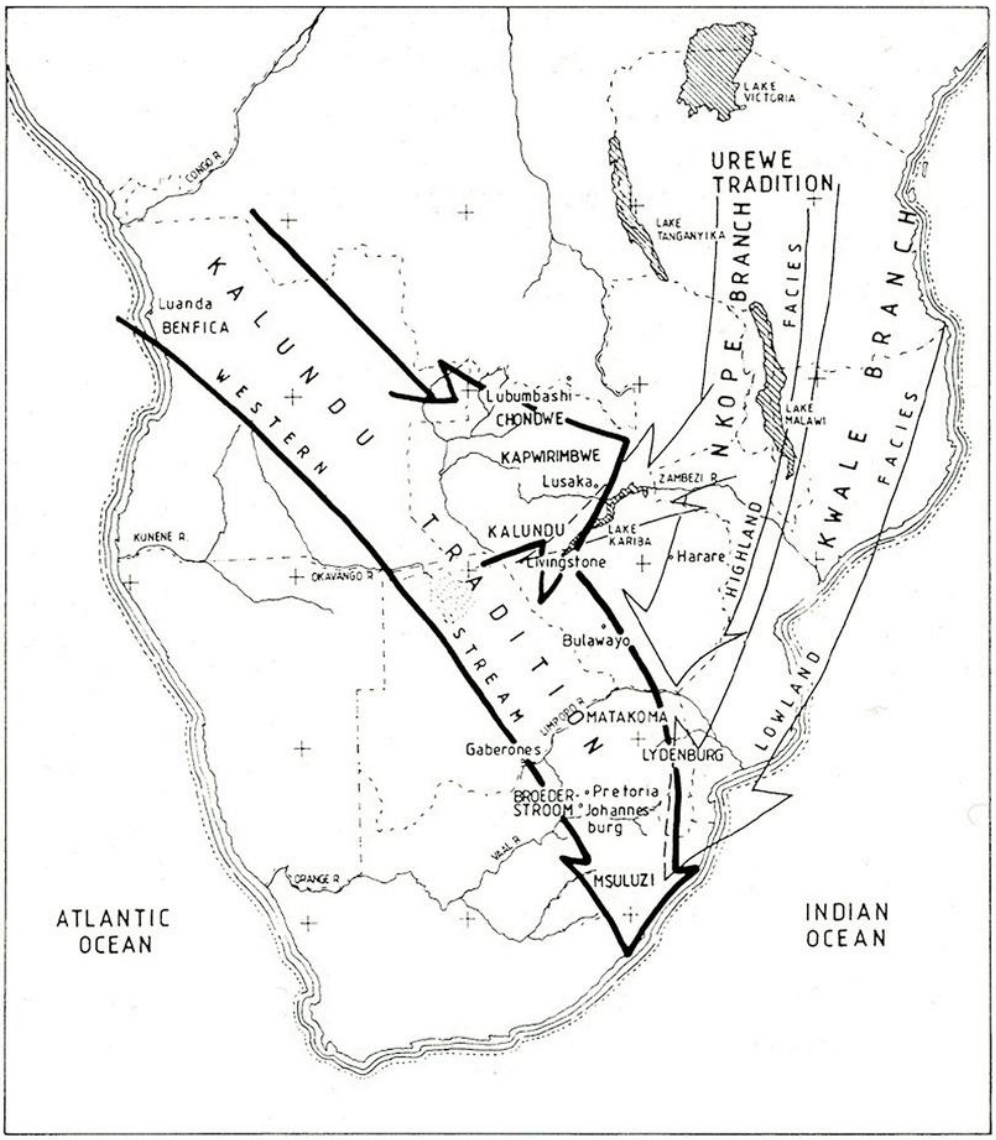

Figure 6: General understanding of Bantu migrations related to the larger ceramic traditions, Kalundu (Western Stream) and Urewe (Nkope and Kwale Branches) (After Huffman, 1989).

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 (Huffman, 2002, 1989; Maggs, 1976; 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.

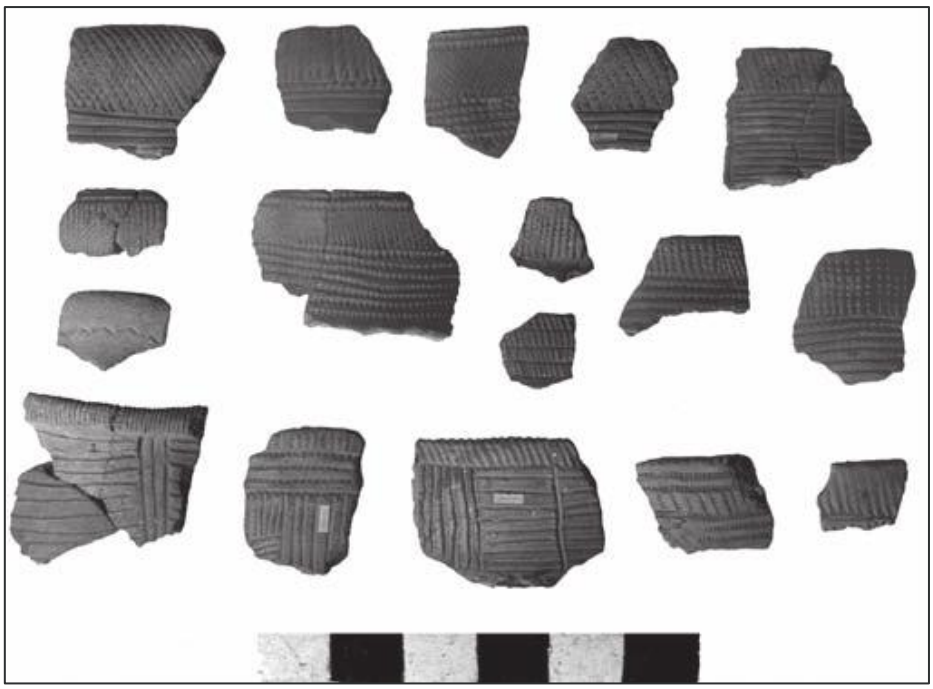

Figure 7: Examples of Bambata Potsherds (Huffman, 2005).

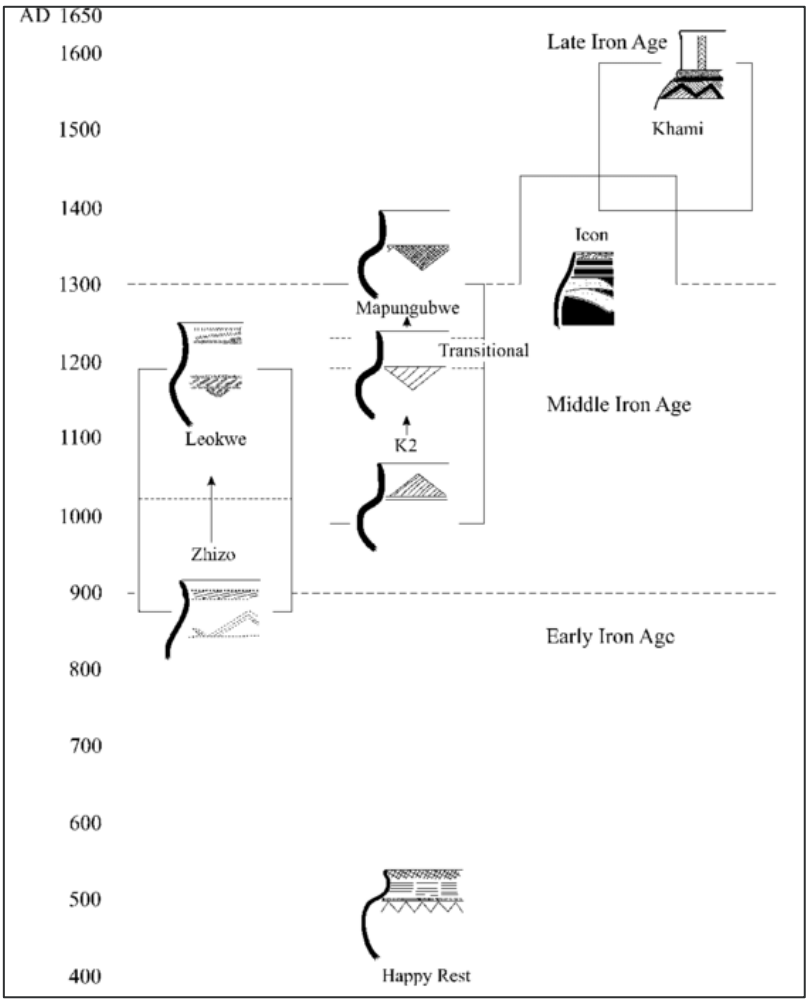

Figure 8: An Iron Age ceramic sequence demonstrating transitions between K2 and Mapungubwe ceramic styles (Huffman, 2009).

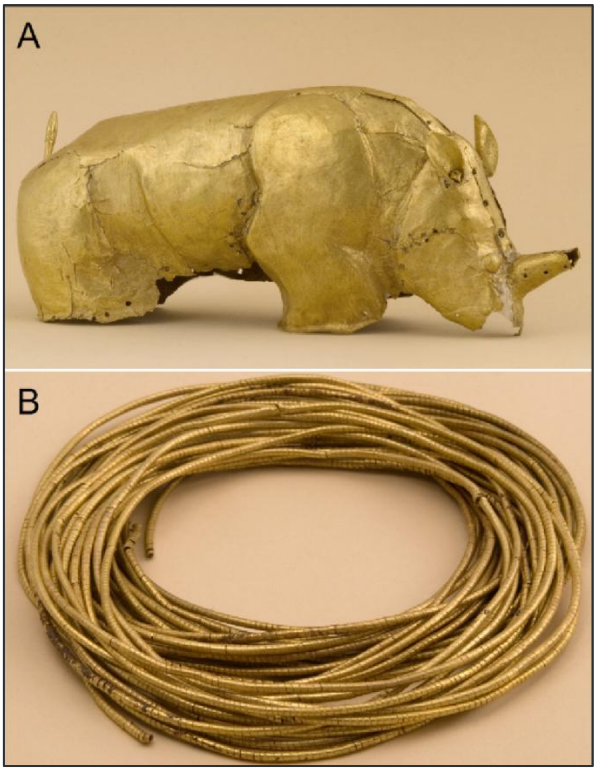

Figure 9: Famous golden implements of Mapungubwe (A - Golden Rhinoceros, B - Golden anklets) (Woodborne *et al.*, 2009).

Sadr and Rodier (2012) provide one of the most direct classifications of stone wall structures, drawing from previous understandings (Huffman, 2007; Maggs, 1976). 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**).

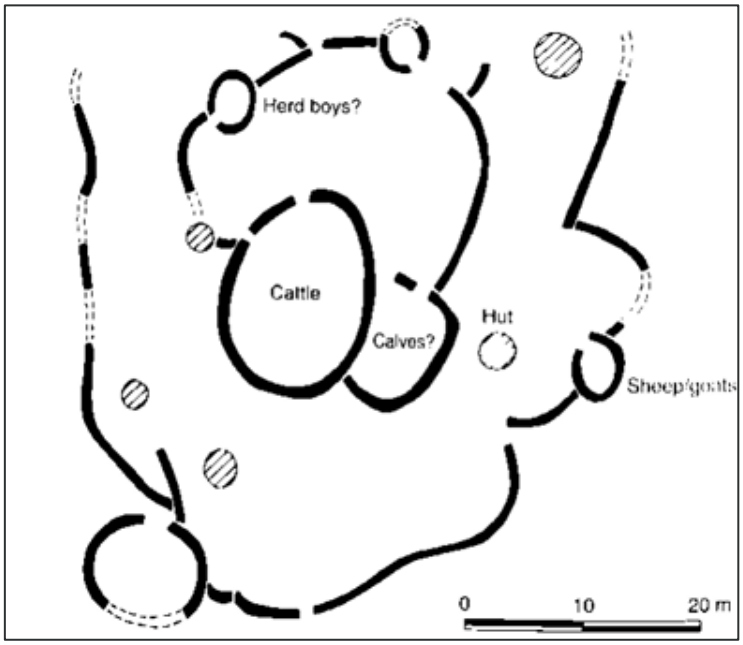

Figure 10: Type N stone wall structures as illustrated by Maggs (1976).

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)).

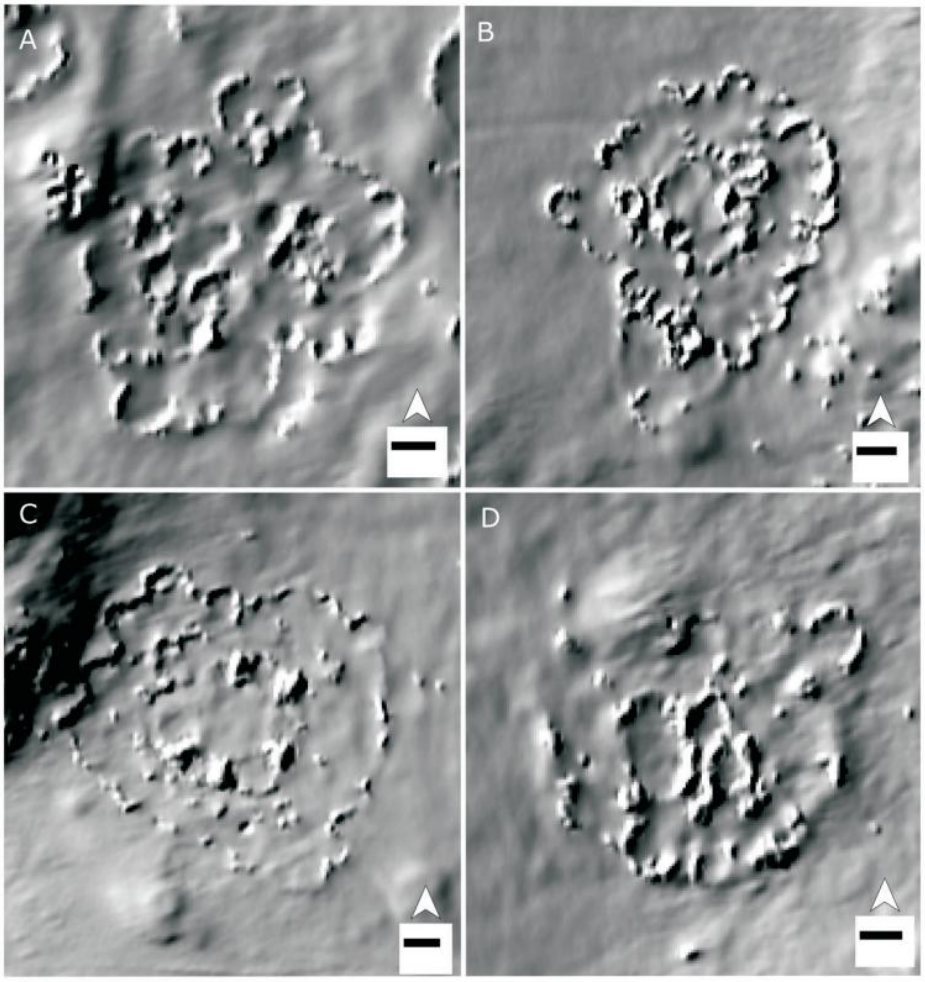

Figure 13: LiDAR imagery of Molokwane stone wall structures of Kweneng, a lost city discovered at Suikerbosrand Nature Reserve (after Sadr and Mshuqwana (2020)).

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.

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 (Gribble, 2002; Thompson, 2001; 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 14**).

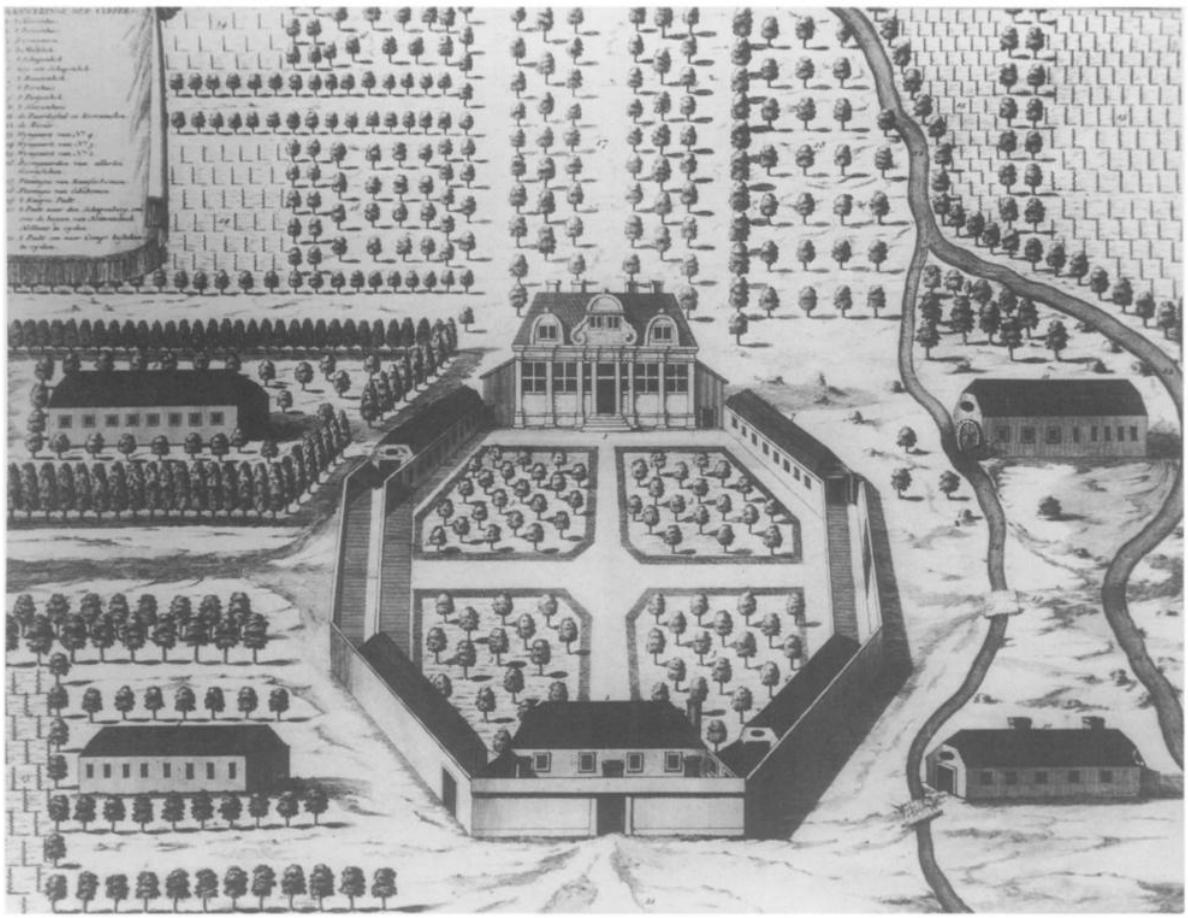

Figure 14: A 1700s drawing of Vergelegen, a Cape Colony homestead including multiple buildings including slave lodges. (after Markell *et al.* 1995).

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 15**).

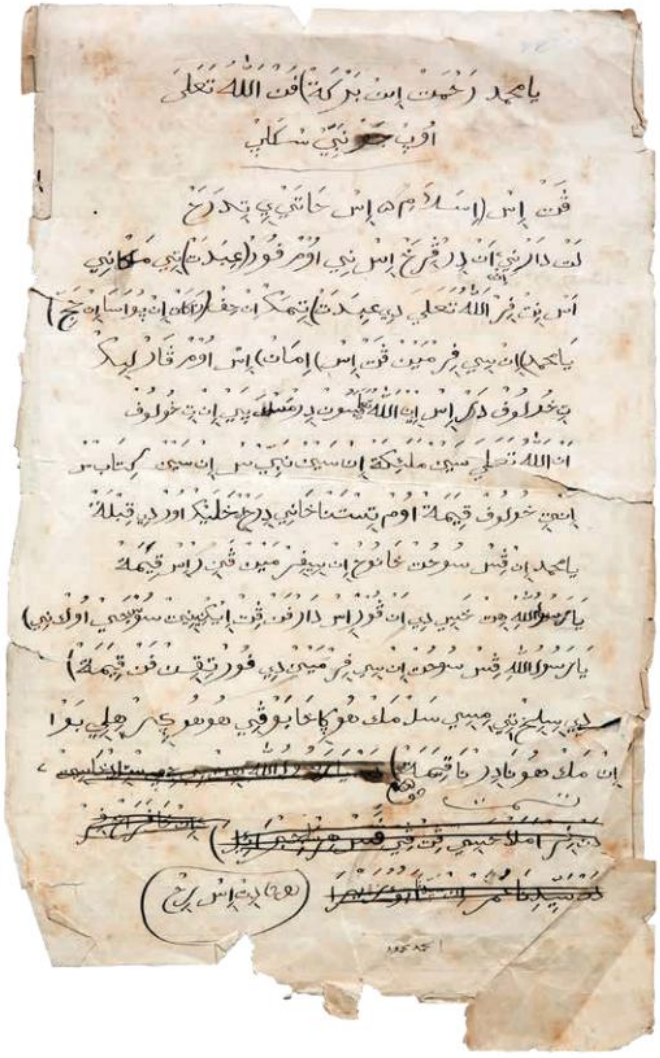

Figure 15: An Arabic script representing the first written texts of the Afrikaans language (late 19th Century) (after Davids (2018))

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 16**).

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

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.

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 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 17**). 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.

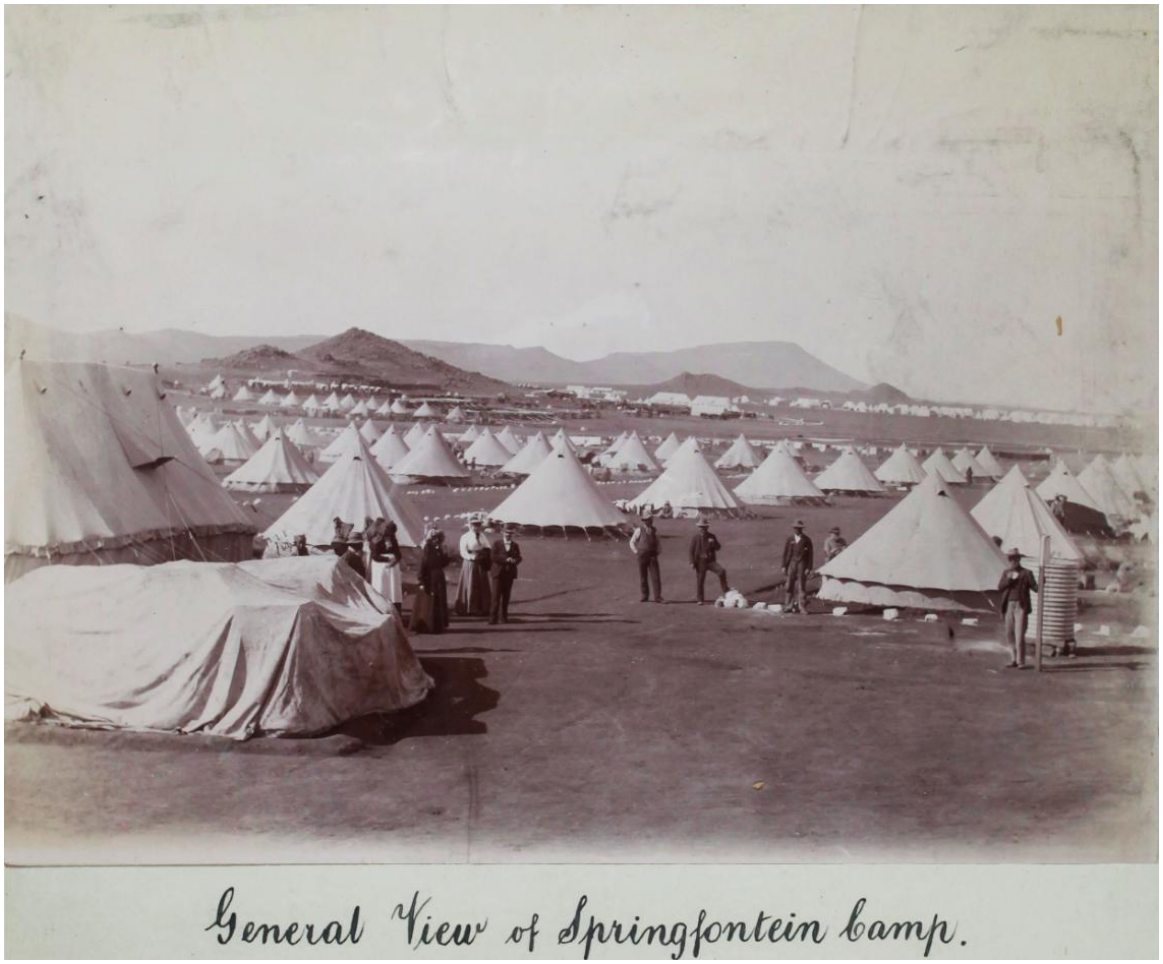

Figure 17: A picture of Springfontein, a refugee war camp which was established as a repercussion of the war's influence (after British National Archives).

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 18**), 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.

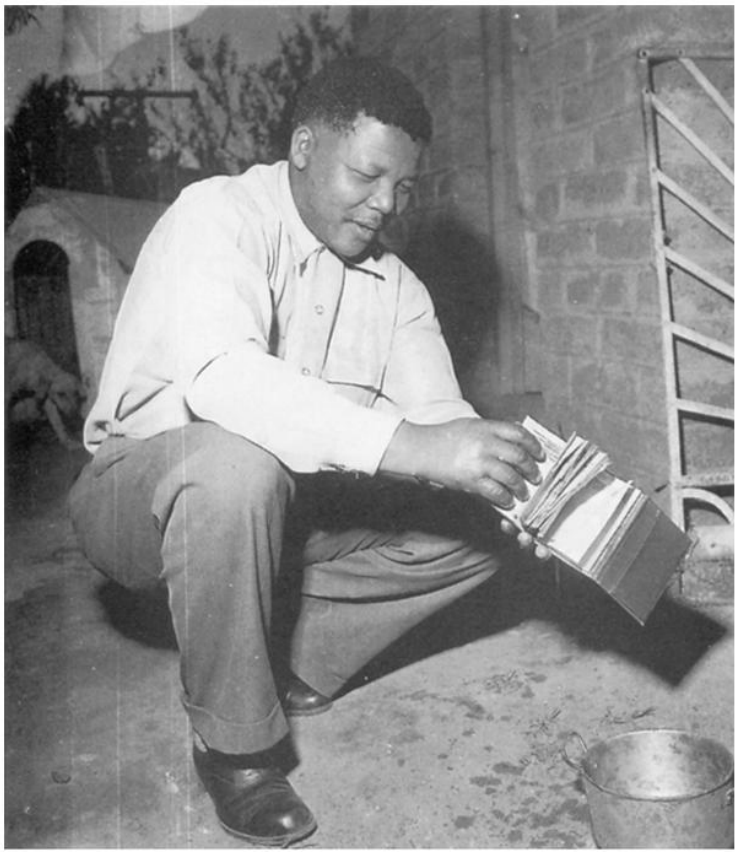

Figure 18: Nelson Mandela burning his pass (“Dompas” or Passbook) in 1959. A pass was a requirement for people to move across the country. Such documents have now become items representing the Apartheid regime. (Thompson, 2001)

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 ER area and target locations. 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. Viriginia 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:

- *Archaeological Impact Assessment, proposed Khauta e Nyane Solar PV Facility near Riebeeckstad, Free State Province.*
    - This report was compiled assessing the impacts of a proposed solar PV facility. The proposed project is northwest of the ER area. Since the area covered by the proposed PV facility is considerably small, only a single MSA core was discovered.
- *Archaeological Impact Assessment, proposed Khauta West Solar PV Facility near Riebeeckstad, Free State Province.*
    - Associated with the previous study listed here, this study considered a proposed solar PV facility to the northwest of the ER area. No archaeological evidence was discovered.
- *Archaeological Impact Assessment, proposed Khauta South Solar PV Facility near Riebeeckstad, Free State Province.*
    - An extension of the previous study listed here, this study considered a proposed solar PV facility northwest and directly adjacent to the ER area. Several potential finds were highlighted including graves and what is described in the report as a "Boer Outspan". The Boer Outspan was pointed out by stakeholders, but the presence of the feature was not verifiable through observable or archival evidence. However, the Archaeologist advised caution to be exercised and a buffer around the area was implemented, ultimately affecting the proposed development.
- *Archaeological Impact Assessment, proposed Khauta North Solar PV Facility near Riebeeckstad, Free State Province.*
    - Associated with the previous study listed here, this study considered a proposed solar PV facility to the northwest of the ER area. No archaeological evidence was discovered.
- *Phase 1 Archaeological Impact Assessment: The Thabong Solar Farm, Uitkyk 509, Welkom, Free State, South Africa.*
    - This study was conducted assessing the impacts the proposed Thabong solar farm or facility would have on archaeological features. The study area falls within the west section of the ER area. Several features were identified through this study including graves, historical structures, and colonial period homesteads protected by the NHRA.
- *Heritage Impact Assessment in terms of Section 38(8) of the NHRA for the Proposed Phemelo Solar PV Project development near Henneman in the Free State.*
    - This study was conducted for the proposed development of a solar PV facility which falls within the western section of the ER area. Heritage features identified through the assessment include mainly historical features. Graves were among the most abundant, followed by historic ruins and structures.
- *Heritage Impact Assessment in terms of Section 38(8) of the NHRA for the Proposed Anker Solar PV Project development near Henneman in the Free State.*
    - This study was conducted for a proposed solar PV development which falls within the western section of the ER area. Several features were identified including graves and historical structures. However, a provincial heritage site is also highlighted, that is, Ferreira's Rust, which

is a historical structure which housed WWII conscripts. The building is protected and rated as a Grade II heritage feature. The Archaeologist recommended a buffer of 1km to be observed within which no development activities are to take place. Since the feature falls within the ER area, this observation is key to consider in the context of the current study.

- *Heritage Impact Assessment in terms of Section 38(8) of the NHRA for the Proposed Grid Connection for the Anker Solar PV Project development near Henneman in the Free State*.
    - This study was conducted for the grid connection for the previously mentioned solar PV project. Similarly, this project is situated within the western section of the ER area. No heritage resources were identified as part of this assessment.
- *Phase 1 Heritage Impact Assessment for the proposed Thaba Battery Energy Storage System (BESS) and associated infrastructure on remainder of Portion 1 of Farm Barbiena No. 398, near Welkom, Matjhabeng Local Municipality, Lejweleputswa District Municipality, Free State*.
    - This study was an HIA conducted to assess the potential impacts of a proposed project on heritage resources near the central section of the ER area. No heritage resources were identified as part of this assessment.
- *Archaeological Desktop Study for the Proposed Mulilo BESS Facility on several portions of the Farms Erfdeel 188, Welgegund 86 and Zomersveld 395 near Welkom, Free State Province*.
    - Similarly to the previous assessment listed, this desktop assessment considered the impacts of a proposed BESS facility on heritage resources. The site in question is located within the western section of the ER area. This study was considered key especially since the area assessed corresponds with 4 target areas of the ER area. Findings of this study highlighted several demolished historical buildings and huts.
- *Heritage Impact Assessment Report for the Laksman Energy Facility and Associated Grid Connection Corridor Project, Lejweleputswa District Municipality, Free State Province*.
    - This study assessed the impact of the proposed Laksman Energy Facility and grid connection corridor on potential heritage resources. The affected area is located within the ER area and is approximately 1 km from the nearest target area assessed. Finds of this study include the identification of a grave site which is located within the ER area, and approximately 1 km from the nearest target area.
- *A report on a Cultural Heritage Impact Assessment for the proposed Wits Gold DBM project close to Virginia, Free State Province.*
    - This study was conducted for a proposed mining project south of Virginia, and adjacent to the southernmost section of the ER area. A grave site was identified through the assessment. The site falls outside of the ER area.
- *Archaeological Impact Assessment (AIA) on Portions of the farms Bloemhoek 509, Welgelegen 382, Mooi Uitzig 352, Florida 633, Le Roux 717 and Detente 744 for the proposed Virginia Solar Park power lines BA Project, Lejweleputswa District Municipality, Free State Province*.
    - This study was conducted assessing the impact of a proposed powerline project on heritage features. The project is located near the southernmost section of the ER area. A historical period site was located within the proposed powerline corridor. This identified site falls outside the ER area.
- *Heritage Impact Assessment in terms of Section 38(8) of the NHRA for the Proposed Henneman Solar Energy Facility in the Free State.*

- This desktop-based study was conducted assessing the impact of a proposed solar facility located within the central section of the ER area. No heritage resources were identified as part of this assessment.

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.

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 19 provides an understanding of the general climatic conditions experienced in Welkom, for reference, including an understanding of monthly temperatures and rainfall.

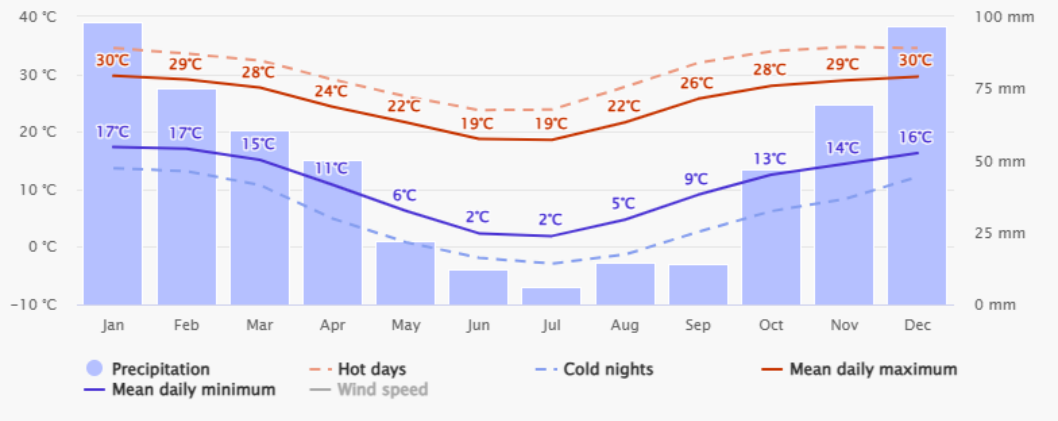

Figure 19: Annual Climatic conditions typical of the Western Free State (considering data from Welkom, after https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/welkom_south-africa_940909)

3.2 TOPOGRAPHY

The development area falls in an area between 1300 and 1480 m above sea-level in elevation. The landscape is generally flat, with areas of the lowest elevation associated with the Sand River which crosses the southern section of the ER area.

3.3 DRAINAGE AND CATCHMENT

The closest river to the site is the Sand River, which crosses the southern section of the ER area. The proposed development falls across the C25D, C60H, C42H, and C42J Quaternary Catchments.

3.4 GEOLOGY

The regional geology consists of sedimentary rocks belonging to the Karoo Supergroup with a stable floor comprising the Kaapvaal Craton. The Karoo Supergroup ranges in age from Late Carboniferous to Middle Jurassic and attains a total cumulative thickness of approximately 12km. The proposed exploration area is underlain by the Beaufort Group and comprises a lower Adelaide Subgroup and an upper Tarkastad Subgroup, with the latter subgroup eroded away to expose sandstones and mudrocks. Several post-Karoo dyke intrusions and faults give

rise to the development of linear structures developed through the Karoo Supergroup. These dykes are composed of dolerite and porphyritic dolerite and occur as tabular bodies with a thickness of 2 to 20m.

In depth, the Karoo Supergroup is underlain by lavas of the Ventersdorp Supergroup and sediments of the Witwatersrand Supergroup. **Figure 20** is a simplified overview of the geology of the site and surrounding areas.

3.5 LAND USE AND LAND COVER

Figure 21 provides an overview of the land uses and land cover of the overall area. Land uses of the surrounding area include for the most part, commercial rain-fed/ dry land agriculture. It is important to recognise that the extensive agricultural activity of the area (such as clearing and ploughing of land) would have potentially had an impact on above-ground heritage features, especially those that are not easily recognised.

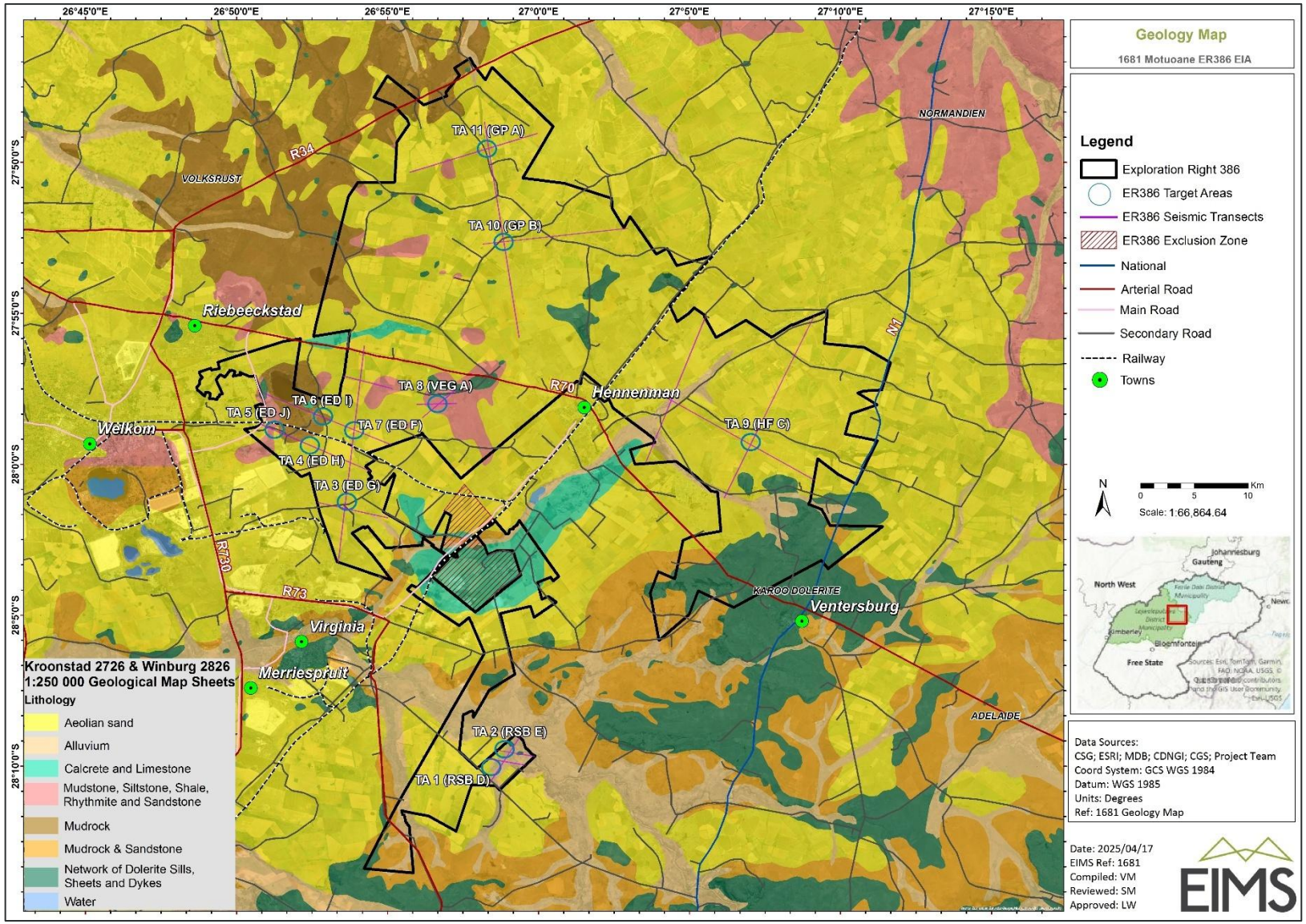

Figure 20: Simplified Geology map of the area.

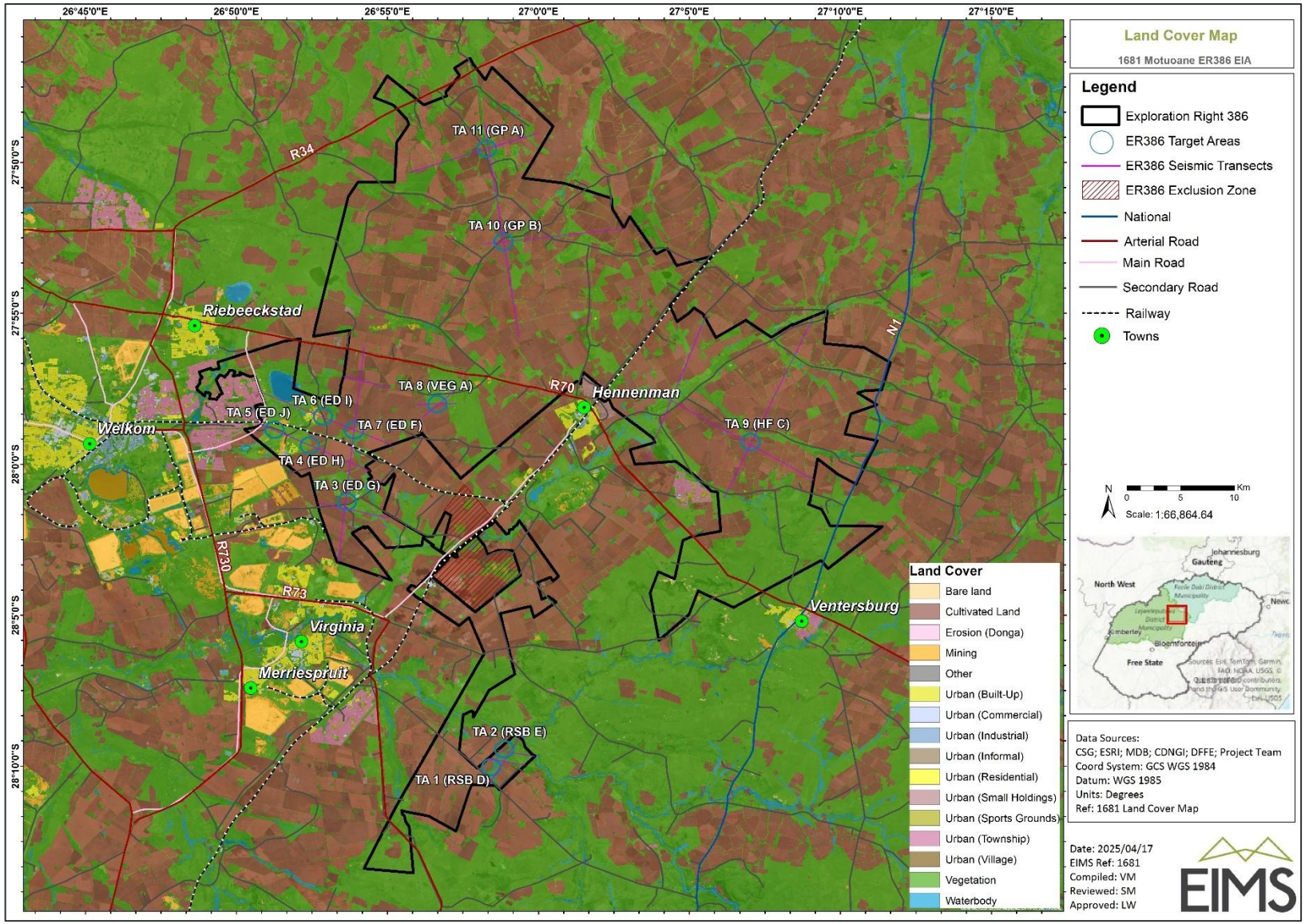

Figure 21: Land use and land cover of the area.

4 METHODOLOGY

The following section describes the methodology used to gather information on potential heritage resources and impacts in this report. A desktop assessment was conducted to identify key areas of heritage sensitivity and potential features identified in the past. Several methods were employed in this regard.

4.1 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 National Web-Based Environmental Screening Tool of the Department of Forestry, Fisheries and the Environment (DFFE Screening Tool) 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 1944.

4.2 DOCUMENTATION AND ANALYSIS

All observations gathered through remote sensing 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.

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?

4.3 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.

4.4 LIMITATIONS

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

4.4.1 GENERAL LIMITATIONS

Such investigations are limited to desktop-based observations from which findings are drawn. Below-ground archaeological contexts would only apply in cases where the methodology includes components involving on-site surveys, excavations and test pitting. To mitigate this limitation, this report advises the application of adopted by the developer in cases where construction activities lead to the identification of unexpected finds.

4.4.2 PROJECT-SPECIFIC LIMITATIONS

As a key limitation of this assessment, a desktop study is by nature limited to data available through different resources such as literature, maps, and photographs. The absence of a field survey would imply a lack of observational data to corroborate findings interpreted through desktop research. A site survey will be conducted during EIA Phase, which will address this limitation.

5 FINDINGS

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 DFFE Screening Tool suggested that the area to be developed is of Very High Sensitivity as captured in **Figure 22**. As the prospecting area is extensive, the site intersects, and is in proximity of several Grade III heritage sites, as well as several Grade II or nominated Provincial heritage sites. This highlighted sensitivity corresponds with Grade II sites, the farmhouse, Ferreirasrust (9/2/318/0001), and several graves of political figures located along the outskirts of Welkom, discussed relating to previous relevant studies (**Section 2.4**) as well as the Site-Specific background (**Section 2.2.3**).

It was further ascertained that the Very High sensitivity attributed to the site is in relation to Ferreirasrust, and the graves nominated as Grade II provincial sites. Since the ER area is so extensive, sections of the area intersect with the applied buffers of 2km which surrounds these Grade II provincial heritage sites. It is understood that the proposed seismic transects may intersect with the 2km buffers associated with Ferreirasrust and a Grade II grave in Welkom, however, the proposed activities will have no impact on the Provincial heritage features highlighted given their distance from the TAs, and the nature of the proposed seismic survey activities (the impact of this survey is not expected to affect the sense of place which the buffer in place is meant to preserve). Further, the defined 500 m TAs do not fall within any of the buffers associated with these features.

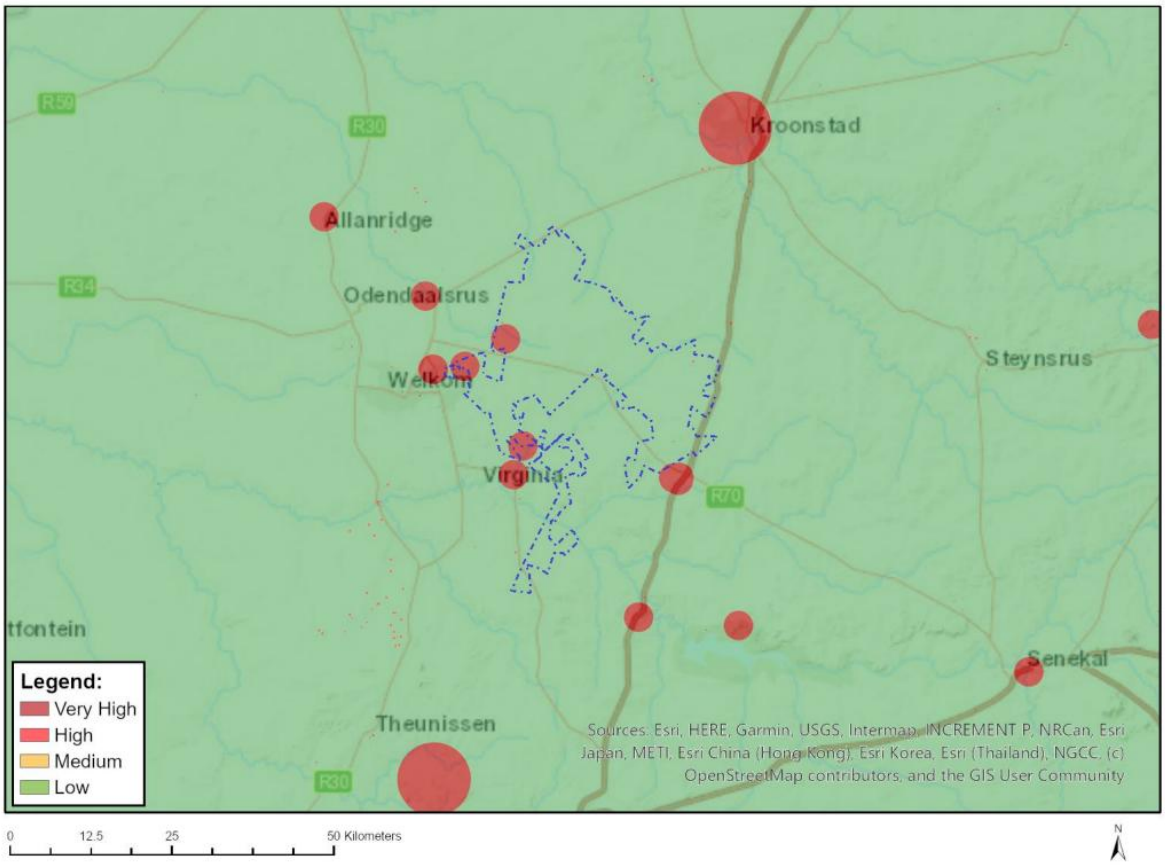

Figure 22: Map of relative Archaeological and Cultural Heritage Sensitivity (DFFE Screening Tool)

5.1 FIRST EDITION TOPOGRAPHIC MAPS

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 (2726DD, 2826BB, 2827AA, 2727CC) 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. Altogether, 38 potential heritage features were identified, including, ruins, potential stone wall structures, old farm complexes, and graves or grave sites. The two Grade II provincial heritage features previously identified and discussed are further presented in terms of their location and proximity to proposed activities. The following is an overview of the potential heritage features identified on the various topographic maps consulted.

5.1.1 2726DD

The area covered by these topographic maps includes 8 target areas and associated seismic transects. Several observations were made considering topographic maps dated 1945 and 1954. A total of 17 potential heritage features were identified which may be affected by the proposed activities. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. The area covered by the maps also includes one of the identified Grade II sites, that is, the grave of Itumeleng Caswell Mokobo, a political figure. The grave is located in the Phumulani Cemetery of Welkom. Although the further sections of the 2km buffer associated with the feature does intersect with proposed activities' area of interest, it is anticipated that the activities will in no way affect the grave. The feature is almost 1,9 kms from the closest seismic transect. This is further substantiated by the fact that the feature does not stand alone and is located in a cemetery which will not be affected by the proposed activities. Refer to **FiguresFigure** 23**Figure 24Figure 25Figure 26Figure 27** for extracts of the maps indicating the approximate location of heritage features as identified through Google Earth.

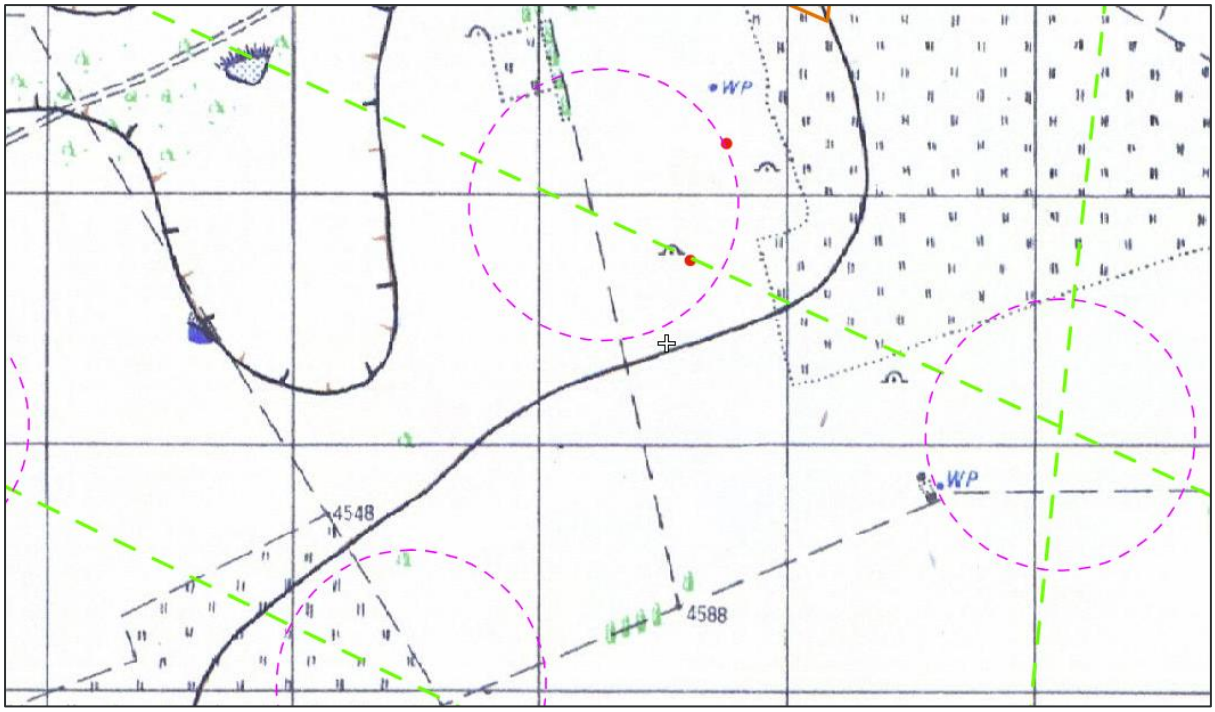

Figure 23: Extract of the 2726DD First Edition Topographic Map dated 1945. Map indicates the approximate location (determined through Google Earth) of a potential heritage feature (red point) within a target area (magenta circle). Seismic transects are represented as green dashed lines.

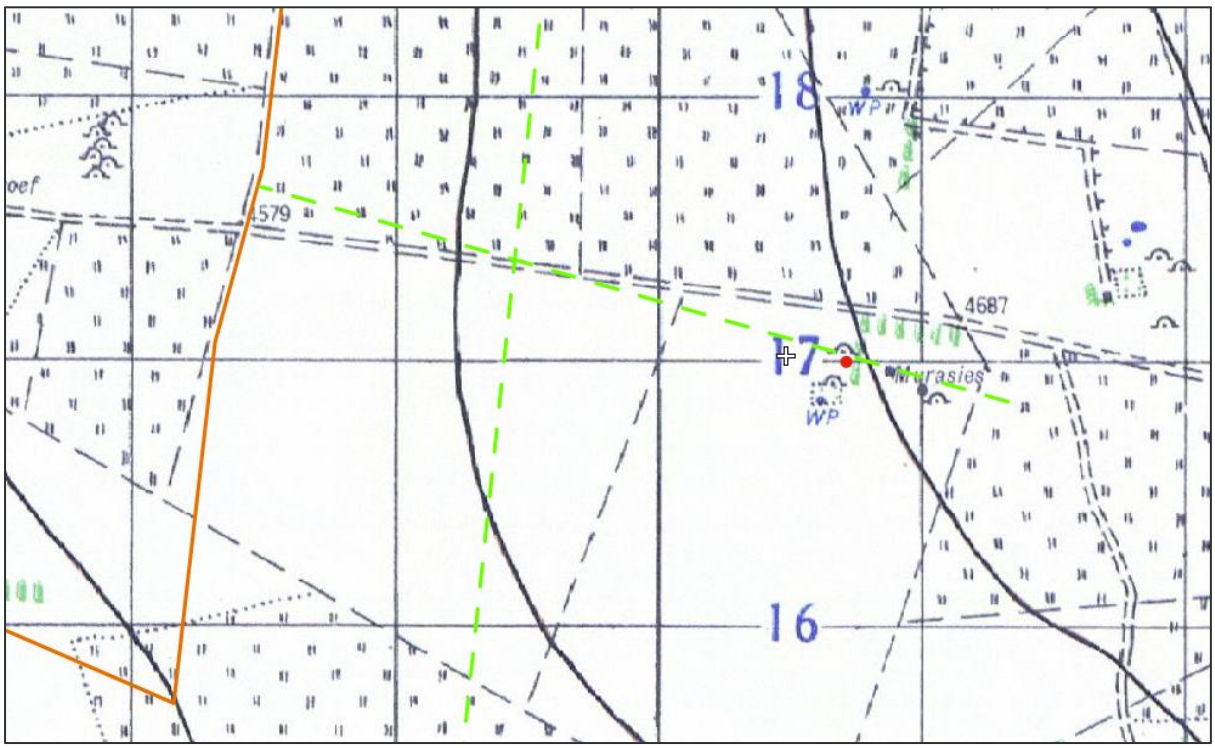

Figure 24: Extract of 2726DD First Edition Topographic Map dated 1945. Map indicates the approximate location (determined through Google Earth) of a potential heritage feature (red point) along a seismic transect (green dashed line). Note the other features along the same transect, including a feature labelled "Murasie" or ruin in Afrikaans.

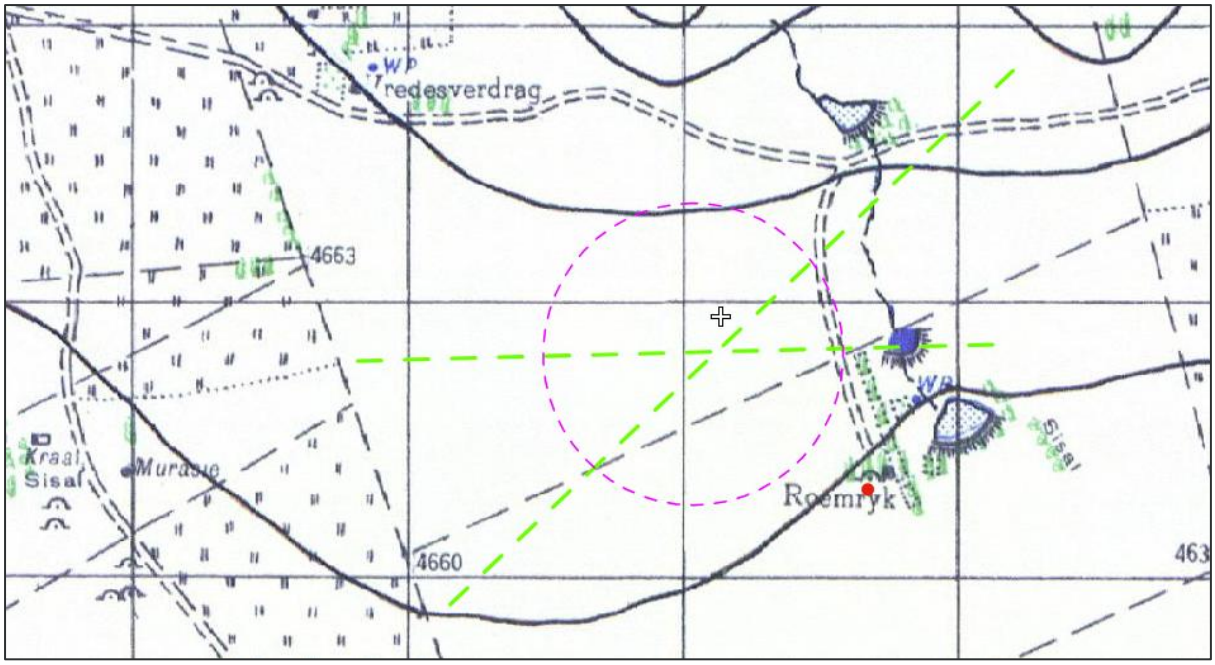

Figure 25: Extract of 2726DD First Edition Topographic Map dated 1945. Features that still stand associated with the complex labelled "Roemryk" were identified as structures older than 60 years within the surrounding area of a target area, and their approximate location (determined through Google Earth) plotted (red points).

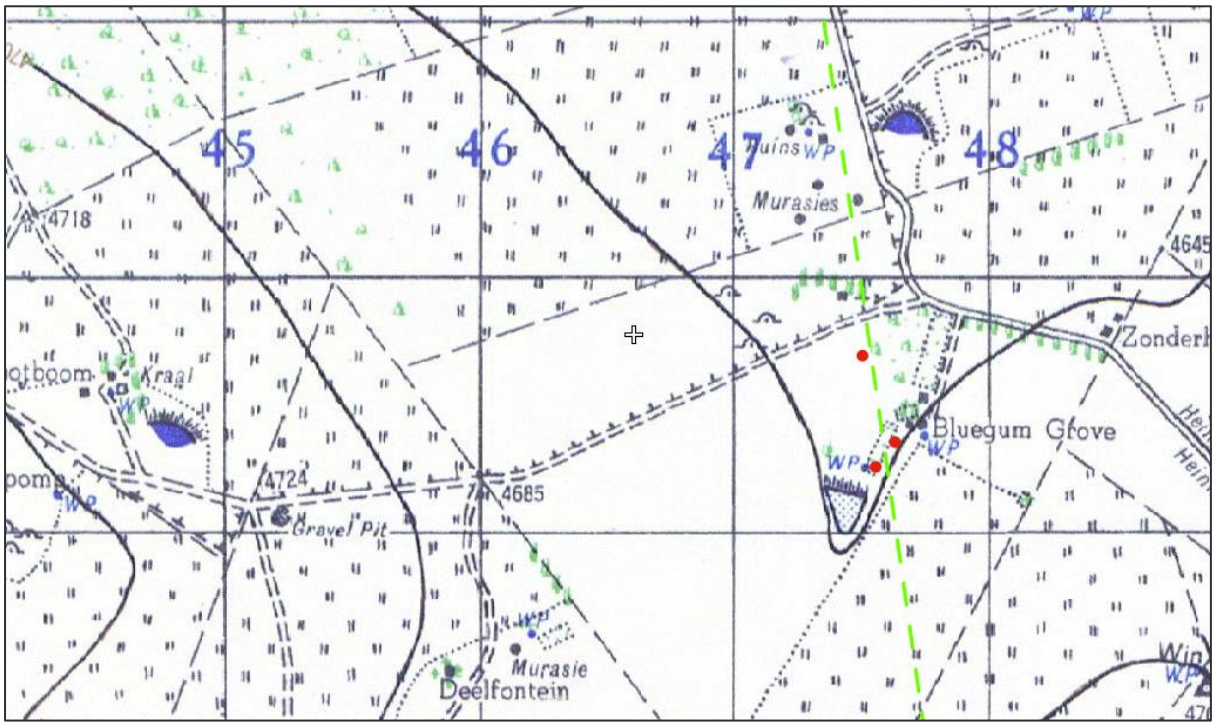

Figure 26: Extract of 2726DD First Edition Topographic Map dated 1945. Features that still stand associated with the complex labelled "Bluegum Grove" were identified as structures older than 60 years along a seismic transect (green dashed line) and their approximate location (determined through Google Earth) plotted (red points).

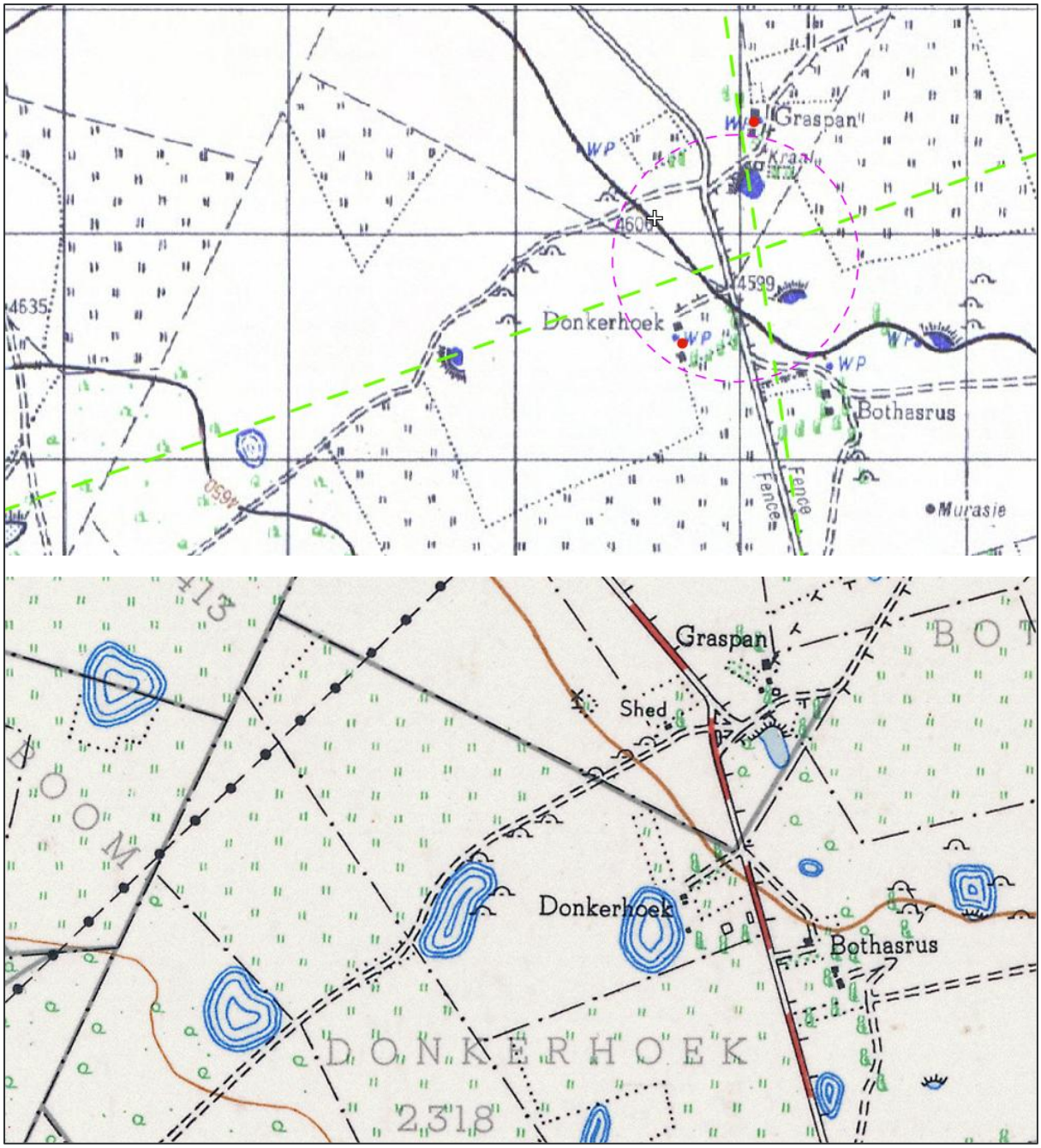

Figure 27: Extract of 2726DD First Edition Topographic Map dated 1945 (top) and a 1954 map (bottom). Features that still stand associated with complexes Donkerhoek, Graspan, and Bothasrus were identified as structures older than 60 years found along a seismic transect (green dashed line) and within a target area (magenta circle) and their approximate location (determined through Google Earth) plotted (red points).

5.1.2 2826BB

The area covered by these topographic maps includes 3 target areas and associated seismic transects. Several observations were made considering the first edition topographic map dated 1954. A total of 6 potential heritage features were identified which may be affected by the proposed activities. An additional 4 potential heritage features were identified within, and adjacent to the ER Area. While these features (MO003, MO004, MO005, MO006) will not be affected by the proposed activities, they have been identified providing context to the nature of heritage structures of the area. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. A potential stone wall structure complex was also identified (MO030). A prospecting borehole was also identified

(MO029). Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. The area covered by the maps also includes one of the identified Grade II sites, that is, Ferreirasrust, a farmhouse which was nominated as a provincial heritage site. Similarly to the grave of Itumeleng Caswell Mokobo, the further reaches of the 2km buffer associated with Ferreirasrust intersects with the proposed seismic transects. Activities are expected to take place approximately 1,8 kms from the Grade II heritage feature but will not affect the feature or surrounding sense of place. Refer to **Figure 28Figure 29** for extracts of the maps indicating the approximate location of heritage features as identified through Google Earth.

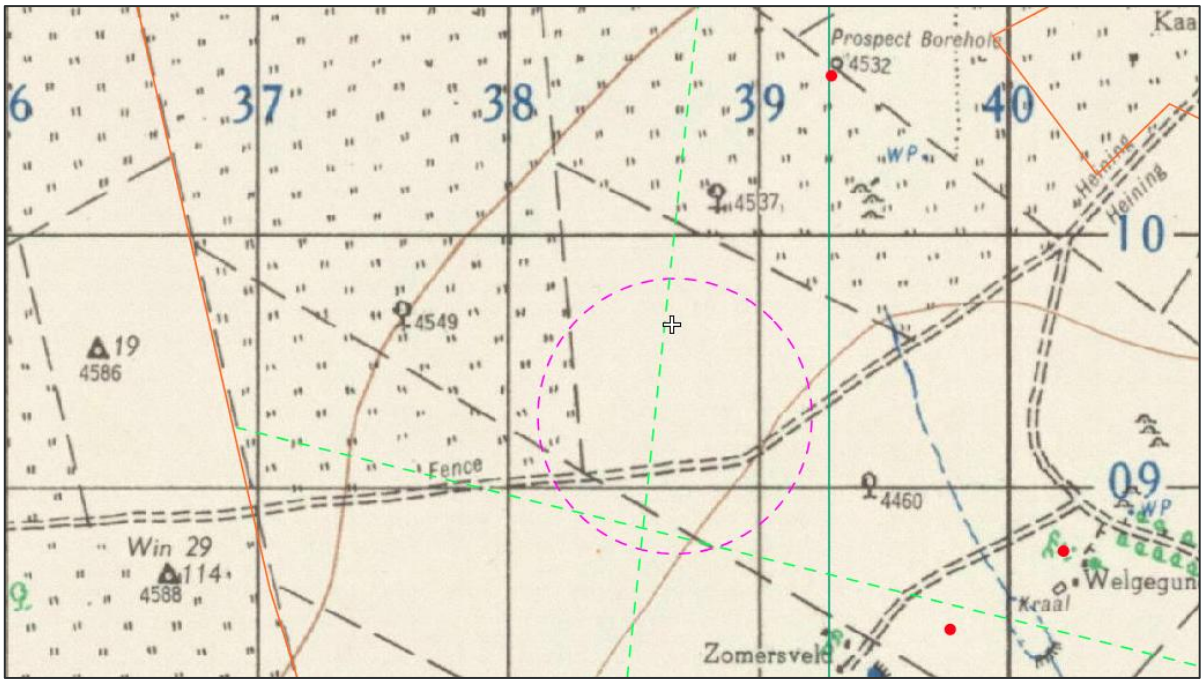

Figure 28: Extract of 2826BB First Edition Topographic Map dated 1954. Features depicted in this extract include a prospecting borehole. The approximate location of this feature (determined through Google Earth) was subsequently plotted (red point).

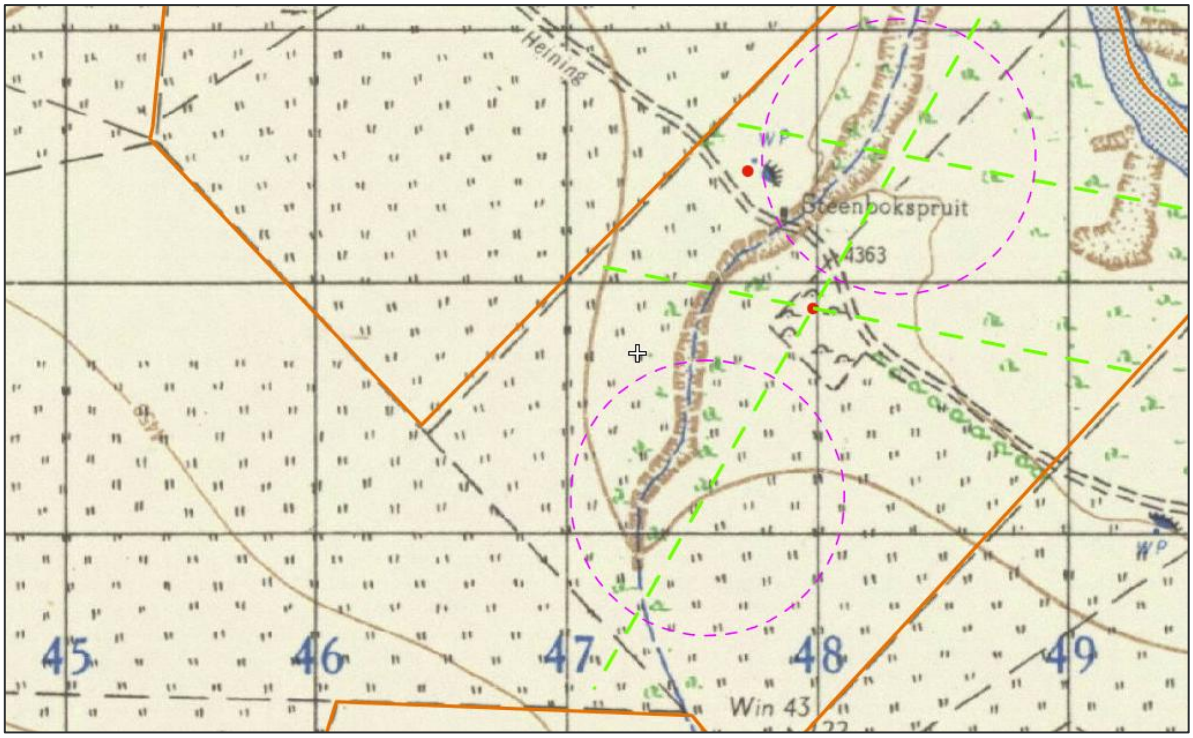

Figure 29: Extract of 2826BB First Edition Topographic Map dated 1954. The approximate location (determined through Google Earth) of features that still stand associated with farm complex "Steenbokspruit" such as a farm dam were plotted (red points).

5.1.3 2827AA

The area covered by these topographic maps includes no target areas, but a short section of a seismic transect. Several observations were made considering the topographic maps dated 1951 and 1975. A total of 3 potential heritage features were identified which may be affected by the proposed activities. This included a feature marked on the maps as a “shed” (MO020) and a feature marked as a “native hut” (MO021). A grave (MO035) was also identified however, this feature is more than 500m away from the closest seismic transect. Refer to **Figure 30** for extracts of the map indicating the approximate location of heritage features as identified through Google Earth.

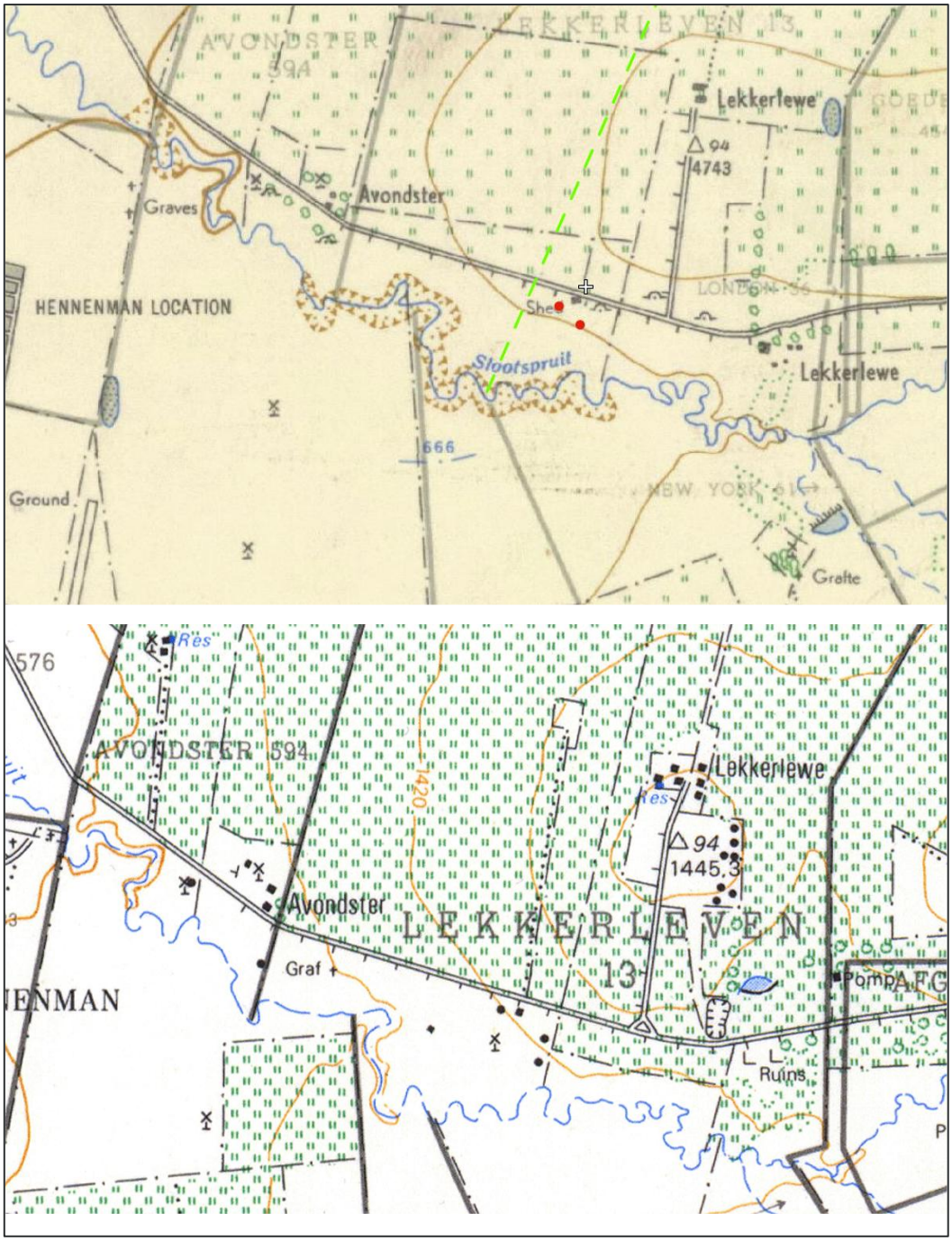

Figure 30: Extract of 2827AA First Edition Topographic Map dated 1951 (top) and a 1975 map (bottom). The approximate location (determined through Google Earth) of features (red points) labelled “Shed” and a nearby structure were identified as structures older than 60 years in proximity of a seismic transect (green dashed lines). A grave (labelled “Graf”) on the 1975 map was also identified.

5.1.4 2727CC

The area covered by these topographic maps includes no target areas but does cover an area intersected by several proposed seismic transects. Several observations were made considering the topographic maps dated 1958. A total of 8 potential heritage features were identified which may be affected by the proposed activities. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. Further, a cemetery was also identified

(MO010), as well as a feature marked as “Graves” (MO023). Refer to **Figure 31 Figure 32** for extracts of the map indicating the approximate location of heritage features as identified through Google Earth.

Figure 31: Extract of 2727CC First Edition Topographic Map dated 1958. The approximate location (determined through Google Earth) of features that still stand associated with complexes "Dewdrop" and “Alicedale” were plotted (red points).

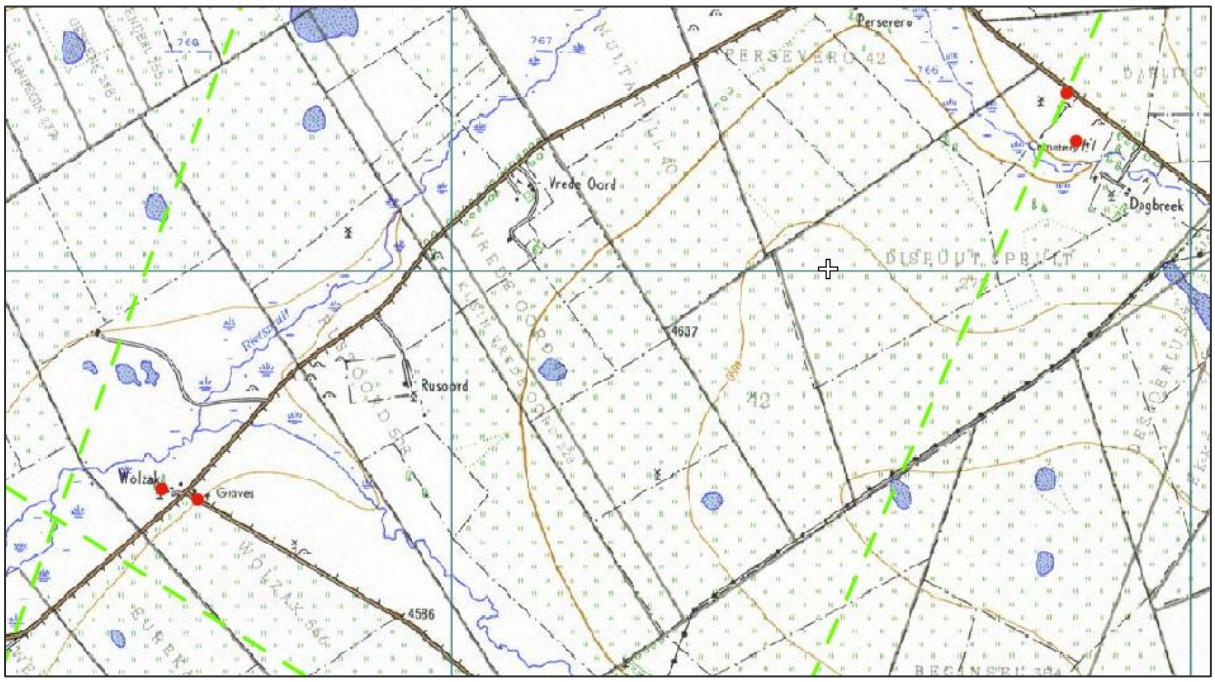

Figure 32: Extract of 2727CC First Edition Topographic Map dated 1958. The approximate location (determined through Google Earth) of graves (bottom left) and a cemetery (top right) along and in proximity to seismic transects (green dashed lines) were plotted (red points).

5.2 AERIAL PHOTOGRAPHY

Aerial photographs were also consulted to verify the presence or absence of features which proved to be more difficult to identify through Google Earth and because of vegetation. Aerial photographs consulted include imagery from 1944-2000, which allowed for a corroboration of observations made through the analysis of the First Edition Topographic maps.

Of particular interest were features which were not discernible through Google Earth imagery. MO001, MO010, MO019, MO022, MO023, MO027, MO030, MO032, MO033 were further assessed to formulate a better description of the features.

MO001 identified on the topographic maps as “native huts” or structures. Aerial photography from 1968 was studied to identify these features and their potential extent. The potential structures seem to have been demolished or removed and do not appear on the aerial photographs. Given that the site was still identified on the topographic maps, it may hold remains related to the structures which were once present.

MO010 was identified and described as a cemetery on the topographic maps. Aerial photography from 1950 were studied to identify this feature and its potential extent. A grove of trees is observable, indicating that the cemetery may pre-date available data (**Figure 33**).

MO019 identified on the topographic maps as “native huts” or structures. Aerial photography from 1968 was studied to identify these features and their potential extent (**Figure 34**). The potential structures were clearly visible. The structures seem to have been demolished since.

MO022 and MO023 were identified as the farm complex “Wolzak”, and a nearby grave or grave site. Since these structures have since been disturbed and destroyed, aerial photographs of 1963 were able to corroborate the extent of features (**Figure 35**). A vegetated area was also identified corresponding with the location of the identified grave or grave site.

MO027 was identified as the farm complex “Uitzicht” or “Uitkyk”. The structure appears to have since been demolished, with little to no remains visible on Google Earth. The complex does appear in 1963 aerial photography as highlighted in **Figure 36**. Therefore, heritage finds may still be remain at the location identified.

MO030 was identified as the only potential stone wall structure site. The site was not marked on the topographic maps, however, evidence of SWSs were observable through Google Earth imagery. Aerial photography of 1996 suggests that the area had been disturbed (**Figure 37**). Therefore, this point cannot be corroborated as a heritage find or site and was therefore excluded.

MO032 identified on the topographic maps as “native huts” or structures. Aerial photographs from 1963 to 1965 were studied to identify these features and their potential extent (**Figure 38**). The potential structures were indistinguishable from the area they were supposed to be located in. However, the area appears undisturbed by any activities. Therefore, the site may hold remains related to the structures plotted on the topographic maps.

MO033 identified on the topographic maps as a “native hut” or structure. Aerial photography from 1944 was studied to identify this feature and its potential extent (**Figure 39**). The potential structure was clearly visible as the area was not a densely vegetated at the time.

Figure 33: Aerial Photograph confirming the presence of activity (cemetery) at point MO010 in 1950.

Figure 34: Aerial Photograph confirming the presence of structures at point MO019 in 1968.

Figure 35: Aerial Photograph confirming the presence of structures and potential grave site at points MO022 and MO023 in 1963.

Figure 36: Aerial Photograph confirming the presence of structures at point MO027 in 1963.

Figure 37: Aerial Photograph confirming that no SWSs were present at the point MO030.

Figure 38: Aerial photography confirming the presence of activities around point MO032 in 1965.

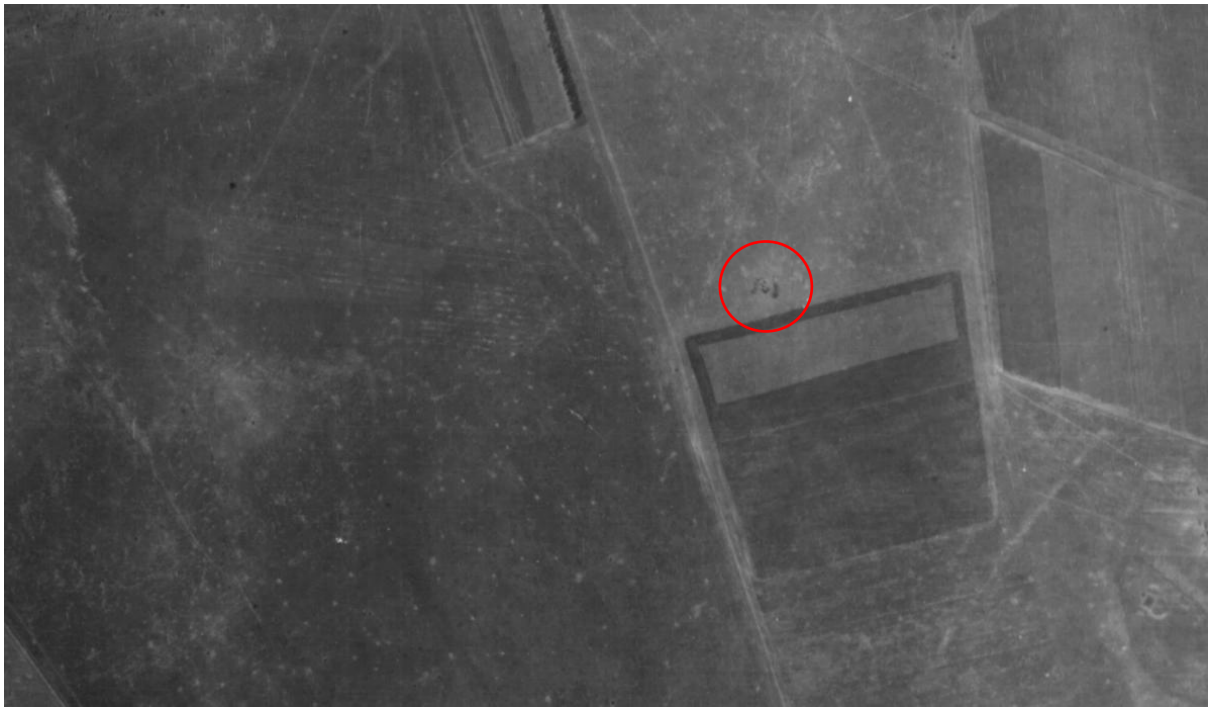

Figure 39: Aerial photography confirming the presence of a "hut" or structure at MO033 in 1944.

5.3 SUMMARY OF FINDINGS

Altogether, besides for Grade II provincial heritage features identified, 31 structures, buildings, or complexes as well as three grave sites were identified as having or potentially having heritage significance. The graves in question are protected by the NHRA and have been provisionally graded as Grade III A or of High significance. All structures, buildings, complexes, or ruins thereof have been provisionally graded as Grade IV A or of Medium significance. This suggests that mitigation must take place should proposed activities have the potential to disturb these features. **Figure 40** and**Figure** 41 present a visual summary of the main findings and their locations. Buffers of the Grade II features are illustrated on the maps. Buffers associated with other sites are too small to be illustrated on the maps. **Table 4** provides a summary of the different features identified, a description of the feature, as well as the coordinates of a relative central point associated with the find.

Table 4: Summary of different finds identified. Grade III A features highlighted in yellow. MO030 has been removed (highlighted in blue)

Feature No.	Description	Ratings and Significance	Coordinate
MO001	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	28°9'50.73"S, 26°58'51.04"E (approximate location)
MO002	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	28°9'34.51"S, 26°58'42.32"E
MO003	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	28°2'9.46"S, 26°57'23.46"E
MO004	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	28°2'24.61"S, 26°57'12.05"E

Feature No.	Description	Ratings and Significance	Coordinate
MO005	Farm Complex – Structures dating 60 years or older.	Grade IV A Medium	28°2'41.14"S, 26°58'23.09"E
MO006	Ruins of a farm dam – foundation remains dating 60 years or older.	Grade IV A Medium	28°2'42.82"S, 26°58'13.19"E
MO007	Farm Complex – Welgegund. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	28°1'30.53"S, 26°54'31.33"E
MO008	Farm Complex – Roemryk. Farm complex may include structures dating 60 years or older. Also includes a nearby hut.	Grade IV A Medium	27°58'14.81"S, 26°57'0.58"E
MO009	Historical ruins of a settlement area – structure dating 60 years or older.	Grade IV A Medium	27°56'21.84"S, 27°8'29.78"E
MO010	Cemetery – Graves may be 60 years or older.	Grade III A High	27°56'32.13"S, 27°8'32.11"E
MO011	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	27°55'10.98"S, 27°5'29.68"E
MO012	Historical ruins of a settlement area – structure dating 60 years or older.	Grade IV A Medium	27°52'21.61"S, 26°59'12.08"E
MO013	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	27°51'20.91"S, 26°58'37.08"E
MO014	Farm Complex – Bluegum Grove. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°51'18.03"S, 26°58'39.63"E
MO015	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	27°51'7.97"S, 26°58'35.34"E
MO016	Farm Complex – Graspan. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'15.07"S, 26°58'20.42"E
MO017	Ruins of Farm Complex – Donkerhoek. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'44.18"S, 26°58'9.80"E
MO018	Farm dam and Kraal area - structures dating 60 years or older.	Grade IV A Medium	27°54'8.61"S, 26°59'15.77"E
MO019	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	27°52'26.02"S, 27°0'27.92"E

Feature No.	Description	Ratings and Significance	Coordinate
MO020	Historical ruin – foundation of structure dating 60 years or older.	Grade IV A Medium	28°0'54.37"S, 27°6'20.88"E
MO021	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	28°0'57.06"S, 27°6'24.33"E
MO022	Location of demolished Farm Complex – Wolzak. Site may include heritage finds.	Grade IV A Medium	27°57'46.77"S, 27°4'49.38"E
MO023	Grave site - Graves may be 60 years or older.	Grade III A High	27°57'49.01"S, 27°4'58.16"E
MO024	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	27°57'24.80"S, 26°54'47.82"E
MO025	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	27°56'17.31"S, 26°54'5.26"E
MO026	Farm Complex – Dew Drop. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°52'28.35"S, 27°1'40.77"E
MO027	Location of demolished Farm Complex – Uitzicht or Uitkyk. Site may include heritage finds.	Grade IV A Medium	27°50'12.63"S, 26°56'22.40"E
MO028	Location marked as ruins - Site may include heritage finds.	Grade IV A Medium	27°50'43.90"S, 26°55'35.43"E
MO029	Prospecting borehole – feature older than 60 years	Grade IV A Medium	28°0'34.41"S, 26°54'0.32"E
~~**MO030**~~	Potential Stone Walled Structure – removed from list as observations were not confirmed.	None	28°1'39.78"S, 26°54'16.19"E
MO031	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	27°56'23.30"S, 26°54'11.65"E
MO032	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	27°55'15.93"S, 27°8'58.63"E
MO033	Hut or structure – Site is densely vegetated but may still hold remains dating 60 years or older.	Grade IV A Medium	27°58'31.72"S, 26°53'3.69"E
MO034	Hut or structure – Site is densely vegetated but may still hold remains dating 60 years or older.	Grade IV A Medium	27°58'17.72"S, 26°53'8.61"E

Feature No.	Description	Ratings and Significance	Coordinate
MO035	Cemetery – Graves may be 60 years or older.	Grade III A High	28°0'48.61"S, 27° 5'54.48"E
MO036	Farm Complex – Bothasrus. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'48.46"S, 26°58'27.12"E

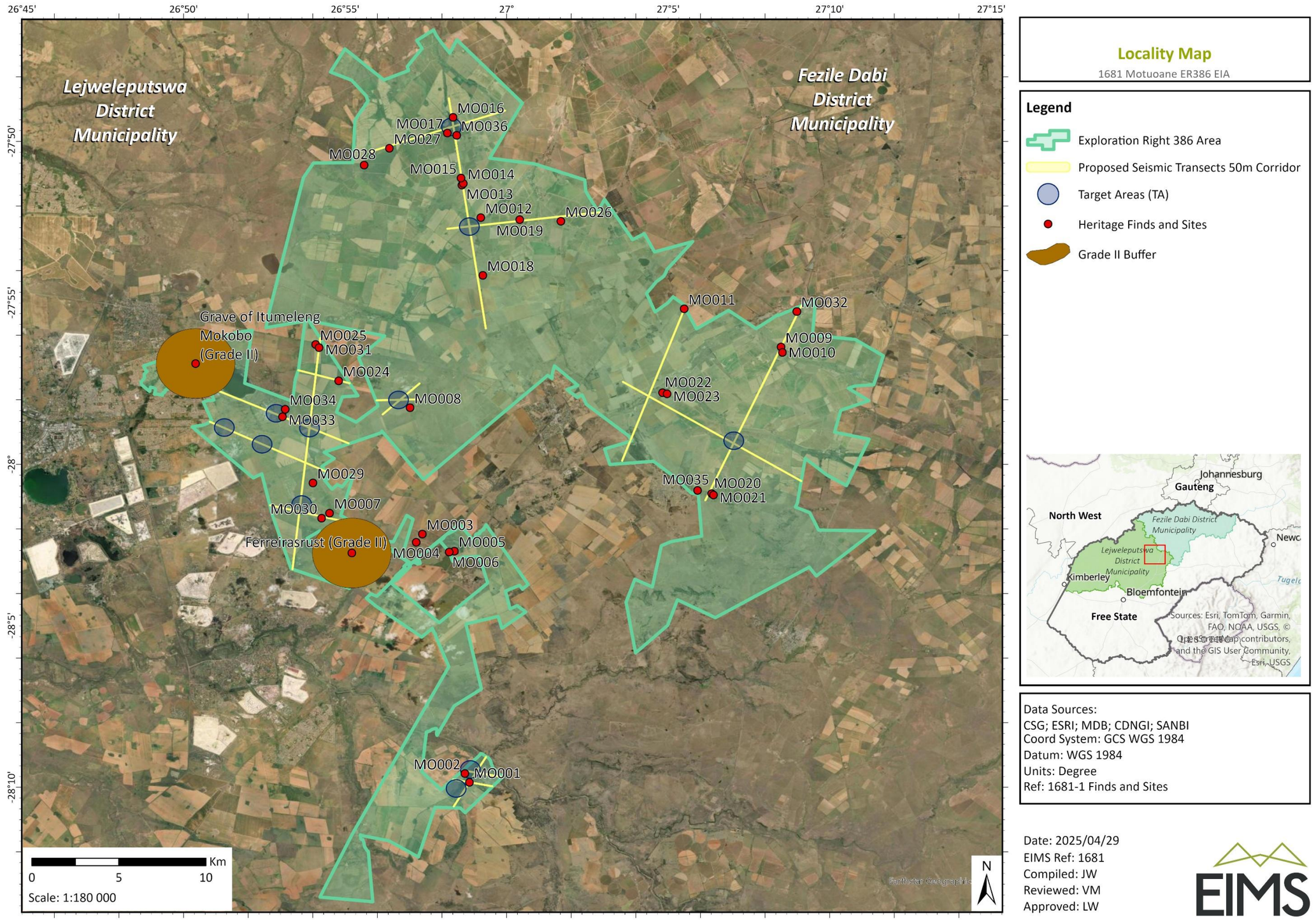

Figure 40: Map of potential heritage features across the ER Area (includes Grade II site 2km buffers).

Figure 41: Focused map of potential heritage features across the ER Area

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:

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

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 x P

Table 7: Determination of Risk.

Consequence	5- Very High[1]	5	10	15	20	25
	4- High	4	8	12	16	20
	3- Medium	3	6	9	12	15
	2- Low	2	4	6	8	10
	1- Very low	1	2	3	4	5
		1- 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).

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

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

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

Priority = CI + LR

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (refer to **Table 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. Offset's may be necessary.**
<-13.75 to -25	High negative (These impacts are significant and must be carefully considered in the decision-making process. They have a high environmental risk or impact and require extensive mitigation measures).
-8.5 to -13.75	Medium-High negative (i.e. Impacts in this class are more substantial and could have a significant environmental risk. They may influence the decision to develop in the area and require more robust mitigation measures).
<-4.25 to <-8.5	Medium- Low negative (i.e. These impacts are slightly more significant than low impacts but still do not pose a major environmental risk. They might require some mitigation measures but are generally manageable).
-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 12 provides a breakdown of the potential impacts identified through this assessment, considering the above-cited and adopted methodology. It must be noted that this section will be updated accordingly during the EIA Phase.

As described in previous sections, finds include the identified 32 structures, buildings, or complexes as well as three grave sites. 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.

Two Grade II provincial heritage features were also identified intersecting with the ER Area. Proposed activities, particularly the proposed seismic survey transects, intersect with the assigned 2km buffers of these features. It is argued that due to the nature of the proposed seismic activities, the project will have no impact on these features nor the sense of place the buffers aim to preserve.

While the features identified represent markers of heritage significance (in particular, ruins 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 of 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 12: 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 (HS)	Destruction of disturbance of structures older than 60 years	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 -
Unidentified 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 low -	-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 13 provides a breakdown of recommendations and mitigations to be considered for inclusion in the EMPr related to this project (this section will be updated accordingly during the EIA Phase). These mitigations are associated with construction phase activities which may involve clearing of vegetation and removal of topsoil for proposed exploration activities. 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 serve to address the potential of further discoveries advising for the implementation or recognition of a heritage protocol and chance find procedure as contemplated in **Section 7.3**.

Table 13: 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
Exploration activities (core exploration well drilling and seismic surveying) may also involve the clearing of vegetation, increased traffic and disturbance of the area.	Construction	Destruction or disturbance of identified heritage features including Heritage Structures (HS), Graves (G), Unidentified below-ground heritage features (U)	• A 30m buffer around all identified heritage structures must be implemented, within which no proposed activities are to take place. • A 50m buffer around all identified graves 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 must likewise be contacted, and a qualified Archaeologist must be consulted to provide advice on how to proceed. • 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, the developer is 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 an alarming significance, example, grave 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 within that area 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 to, firstly, record the find and evaluate its heritage significance. 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.

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

This report was prepared as part of a Heritage Impact Assessment for the proposed Motuoane ER386 Prospecting Project. As part of this assessment, a desktop evaluation of heritage impacts was conducted.

Through the methodology adopted as part of this assessment, heritage features were identified which can be avoided during the implementation of the proposed activities. Apart from unassessed chance finds, little to no impact on heritage features can be expected should the proposed mitigation measures be followed. Therefore, from an Archaeological perspective, the development will not have significant foreseeable impacts save for its impact on the overall sense of place of the site.

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Appendix 1: CV of the Archaeologist

Appendix 2: Specialist Declaration