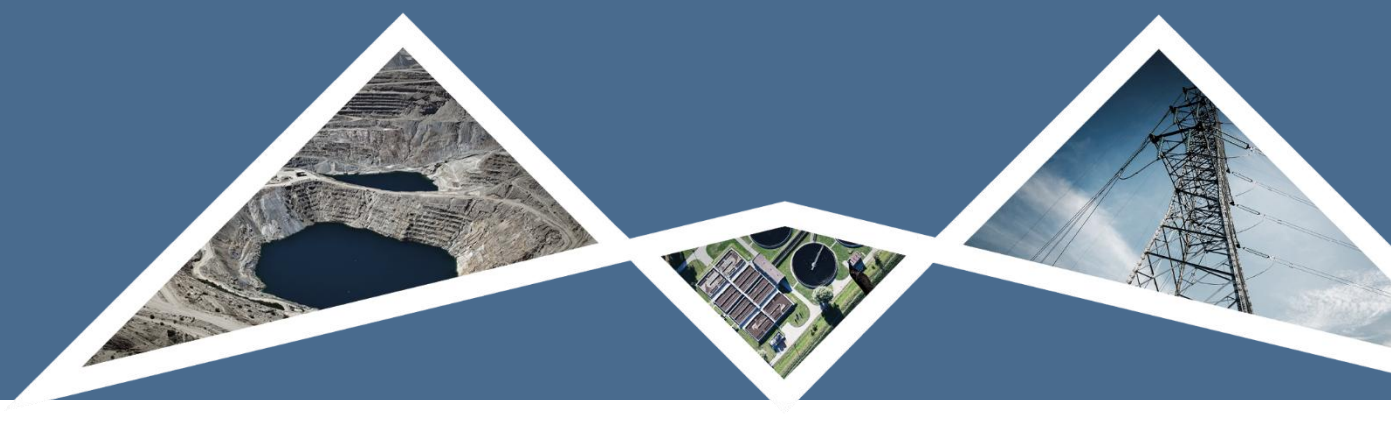
EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

T 011 789 7170 E info@eims.co.za W www.eims.co.za

BLACK MOUNTAIN MINING SANDGAT PROSPECTING RIGHT ON FARMS GEELVLOER 197 (PORTIONS 0, 1, 2, 3, 4, 6, 8), VAALKOP 225, HAARTEBEES-VLEI 199, QUAGGA-MAAG 200, AND LOVEDALE 201 IN THE KAI! GARIB LOCAL MUNICIPALITY OF THE ZF MGCAWU DISTRICT MUNICIPALITY, AS WELL AS THE KHAI-MA LOCAL MUNICIPALITY OF THE NAMAKWA DISTRICT MUNICIPALITY, IN THE NORTHERN CAPE PROVINCE

PHASE 1 DESKTOP HERITAGE IMPACT ASSESSMENT REPORT



DOCUMENT DETAILS

EIMS REFERENCE:	1675-1
DOCUMENT TITLE:	Black Mountain Mining Sandgat Prospecting Right on Farms Geelvloer 197 (Portions 0, 1, 2, 3, 4, 6, 8), Vaalkop 225, Haartebees-Vlei 199, Quagga-Maag 200, and Lovedale 201 in the Kai! Garib Local Municipality of the ZF Mgcawu District Municipality, As well as the Khai-Ma Local Municipality of the Namakwa District Municipality, in the Northern Cape Province: Phase 1 Desktop Heritage Impact Assessment

DOCUMENT CONTROL

	NAME	SIGNATURE	DATE
COMPILED:	Dr Lucien James		2025/02/20
CHECKED:	Monica Niehof		2025/03/05
AUTHORIZED:	Liam Whitlow		2025/03/05

REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2025/03/05	ORIGINAL DOCUMENT	Desktop Assessment for BAR

Table of Contents

List of Figures

List of Tables

Appendices

Abbreviations

AD	*Anno Domini*
ASAPA	Association of South African Professional Archaeologists
BAR	Basic Assessment Report
BMM	Black Mountain Mining
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
EMP	Environmental Management Programme
ESA	Earlier Stone Age
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
PR	Prospecting Right
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
ya	Years ago

Executive Summary

Black Mountain Mining (Pty) Ltd (BMM) (the Applicant) has submitted an application for a Prospecting Right in terms of Section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA) and an Application for Environmental Authorization in terms of Chapter 4 of GNR 982 promulgated under the National Environmental Management Act (Act 107 of 1998) (NEMA) to prospect for ferrous and base metals (Copper Ore, Iron Ore, Lead, Ore, Zinc Ore, Manganese Ore, Nickel and Molybdenum), precious metals (Gold Ore, Silver Ore), and all associated metals and minerals. Environmental Impact Management Services (Pty) Ltd (EIMS) have been appointed by Black Mountain Mining to compile the BAR (this report) in support of the Prospecting Right application submitted by EIMS on behalf of Black Mountain Mining, which in turn will be submitted to the DMR for adjudication. Dr Lucien James was appointed as the Heritage Specialist (Professional Archaeologist) for the undertaking of the Archaeological Impact Assessment.

A Desktop assessment was conducted to evaluate the potential impact of the project on archaeological and heritage resources, including an assessment of Palaeontology. The study included a literature review, and an analysis of available data as part of a desktop assessment.

A total of eight (8) (apart from farm dams or reservoirs) structures, buildings, or complexes as well as two grave sites were identified as having or potentially having heritage significance. Mitigations proposed include the suggestion for the avoidance of the identified heritage features. Buffers are proposed to 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 identified. As a mitigation measure considering that final borehole locations will be determined at a later stage in the development, is the proposal of the conducting of pre-drilling surveys undertaken by an Archaeologist.

Apart from the possibility of the identification of below-ground finds, and the overall impact of the activities on sense of place, 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.

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

Black Mountain Mining (Pty) Ltd (BMM) (the Applicant) has submitted an application for a Prospecting Right in terms of Section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA) and an Application for Environmental Authorization in terms of Chapter 4 of GNR 982 promulgated under the National Environmental Management Act (Act 107 of 1998) (NEMA) to prospect for ferrous and base metals (Copper Ore, Iron Ore, Lead, Ore, Zinc Ore, Manganese Ore, Nickel and Molybdenum), precious metals (Gold Ore, Silver Ore), and all associated metals and minerals.

The proposed project will aim to ascertain if economically viable mineral deposits exist within the application area. In order to undertake prospecting activities, Black Mountain Mining will require a Prospecting Right in terms of the Mineral and Petroleum Resources Development Act (MPRDA, Act No.28 of 2002). The Applicant is also required to obtain an Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA, Act No. 107 of 1998) which involves the submission of a Basic Assessment Report (BAR). Environmental Impact Management Services (Pty) Ltd (EIMS) have been appointed by Black Mountain Mining to compile the BAR (this report) in support of the Prospecting Right application submitted by EIMS on behalf of Black Mountain Mining, which in turn will be submitted to the DMR for adjudication.

The area is located approximately 75 to 138 km east of Aggeneys and 25 to 85 km east of Pofadder, Namaqualand District, Northern Cape Province. The associated farms of the PR area are located across the Kai! Garib Local Municipality of the ZF Mgcawu District Municipality, as well as the Khai-Ma Local Municipality of the Namakwa District Municipality, in the Northern Cape Province. The prospecting area cover 5 farms namely; Lovedale 201, Guagga- Maag 200, Haartebeestvlei 199, Vaalkop 225, and Adjoining Geelvloer 197. See Figure 1 for Locality Map.

1.2 HERITAGE SPECIALIST DETAILS

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

Dr Lucien James is an Environmental Consultant and Archaeologist with experience in different fields across the Arts, Social Science, Natural Science, and academia in general. He has been employed by EIMS as an environmental consultant since March 2023 working on several projects under various roles. He is registered with EAPASA as a Candidate EAP. Lucien has obtained a BSc (Hons) in Geography, Archaeology and Environmental Studies (Archaeology-focused) and is accredited as a Professional Archaeologist with Association of South African Professional Archaeologists (ASAPA). He holds a MSc in Geography having done research on phytoremediation and the mining industry. In 2024, he completed his Ph.D. through research with a focus on collaborative River Basin Management in South Africa. He has worked as a Teaching Assistant (TA) and researcher since 2018 and engages in academic work through publications and conferences. He has taught 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:	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 achieves several pre-defined objectives as per the prescription of the SAHRA Minimum Standards (2007):

a) Identifies 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.

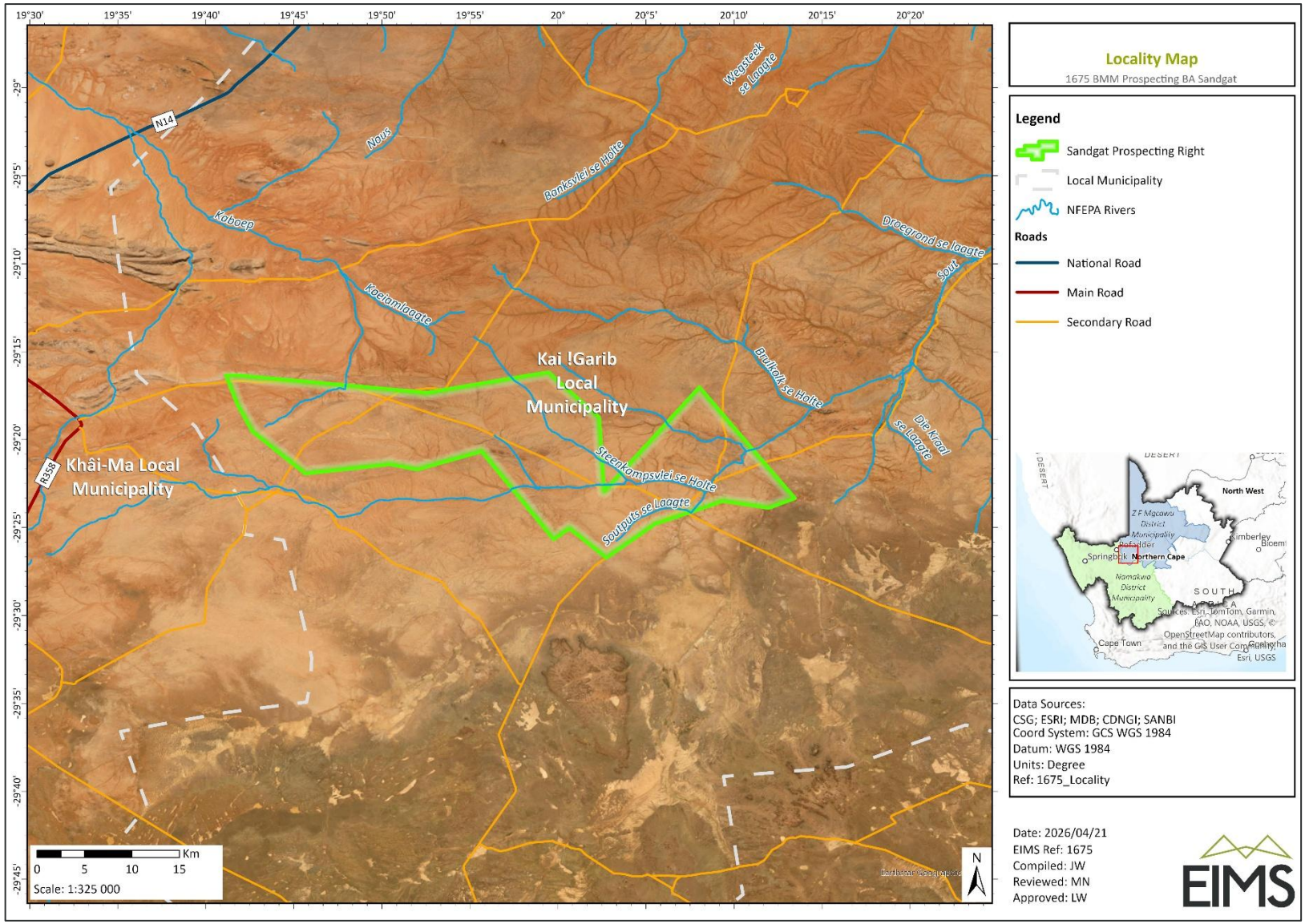


Figure 1: Locality Map of the Sandgat PR Area

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

2.1 LITERATURE REVIEW

Prior to the implementation of the methodology to be discussed, a comprehensive literature review was conducted to understand the archaeological and historical background of the site. Two main components were considered, that is, (1) the pre-historical, 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 (Leakey, 1971; Chazan *et al.*, 2012; Kuman *et al.*, 2018; Stollhofen *et al.*, 2021; Favreau, 2023). The industry includes the earliest examples of key lithics such as hammerstones, manuports, cores, and flakes among other stone tool types. Figure 2 illustrates some of the different tools of this industry. Oldowan examples can be found across South Africa with some archaeological sites being the origins of some of the key examples of the type of lithics specifically found (Chazan *et al.*, 2012; Kuman *et al.*, 2018). These archaeological sites include Wonderwerk Cave in the Northern Cape and, Swartkrans Cave which forms part of the Cradle of Humankind near the Johannesburg area. Both of these sites are National Heritage Sites.

The Acheulean stone tool industry differs from the Oldowan since it includes examples of Large Cutting Tools (LCTs). This includes tools such as handaxes, picks, and cleavers. As highlighted by Li *et al.* (2018), the Acheulean is characterised by the handaxe, which has been extensively studied. Differing from the Oldowan, these LCTs dating as far back as 1.7 Million ya (Kuman and Gibbon, 2018). Once more, the Cradle of Humankind and associated Sterkfontein hominid sites are key locations where some of the best examples of Acheulean stone tools have been found (Kuman and Gibbon, 2018; Li *et al.*, 2018). Figure 2 includes examples of the Acheulean LCTs (labelled v-z).

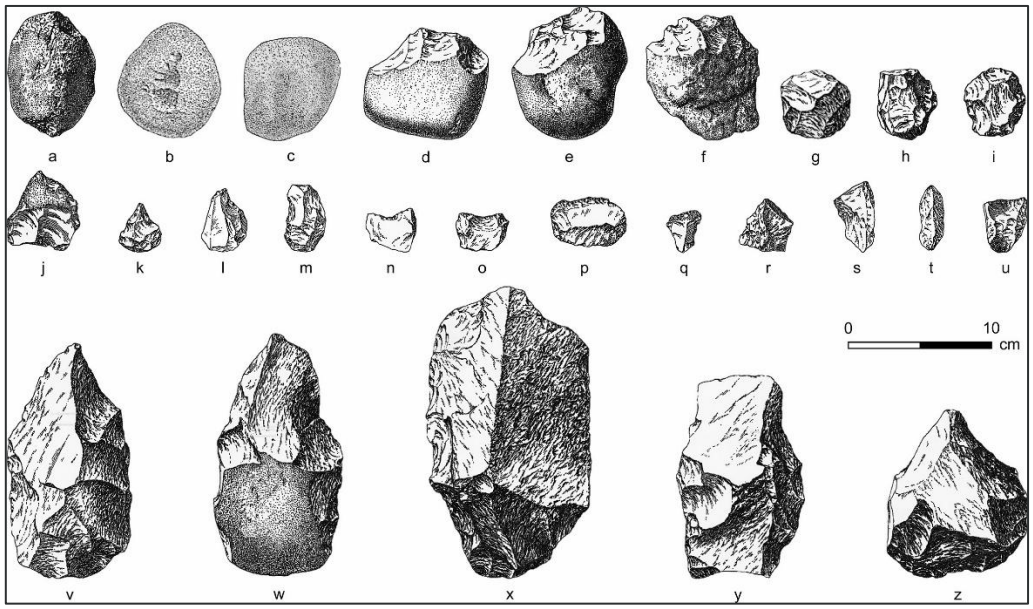


Figure 2: Examples of ESA lithics. Typical Oldowan tools (a-f). Acheaulean LCTs (v-z) (after Kuman and Gibbon, 2018).

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 (Villa *et al.*, 2009; Henshilwood, 2012). While MSA sites occur across South Africa, key sites include Blombos Cave, Sibudu Cave, and Klasies River. Figure 3 offers an illustrative overview of the material associated with the MSA.

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

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)

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

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

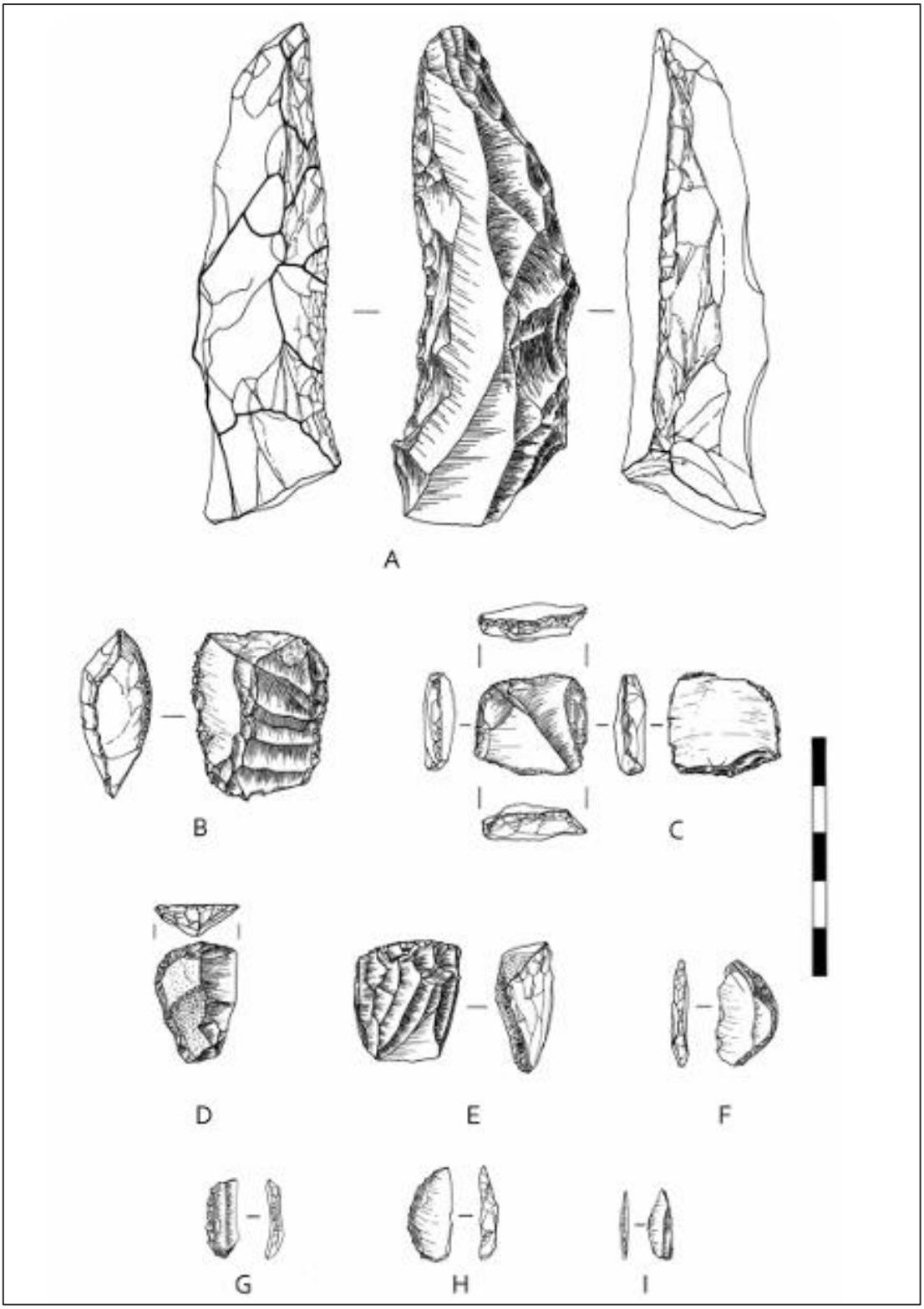


Figure 4: Examples of an adze (A), scrapers (B-D, G), backed bladelets (I), bladelet cores (e), and segments (F, H). Typical pieces associated with the LSA (after Forssman *et al.*, (2010))

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

2.1.3 THE IRON AGE

South Africa's archaeological record diversifies as interactions, migrations, and major changes take place over the last 2000 years. While hunter-gatherers continue to occupy most of the southern African landscape, the area becomes a melting pot with pastoralists gradually moving in from the North, and changes in hunter-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).

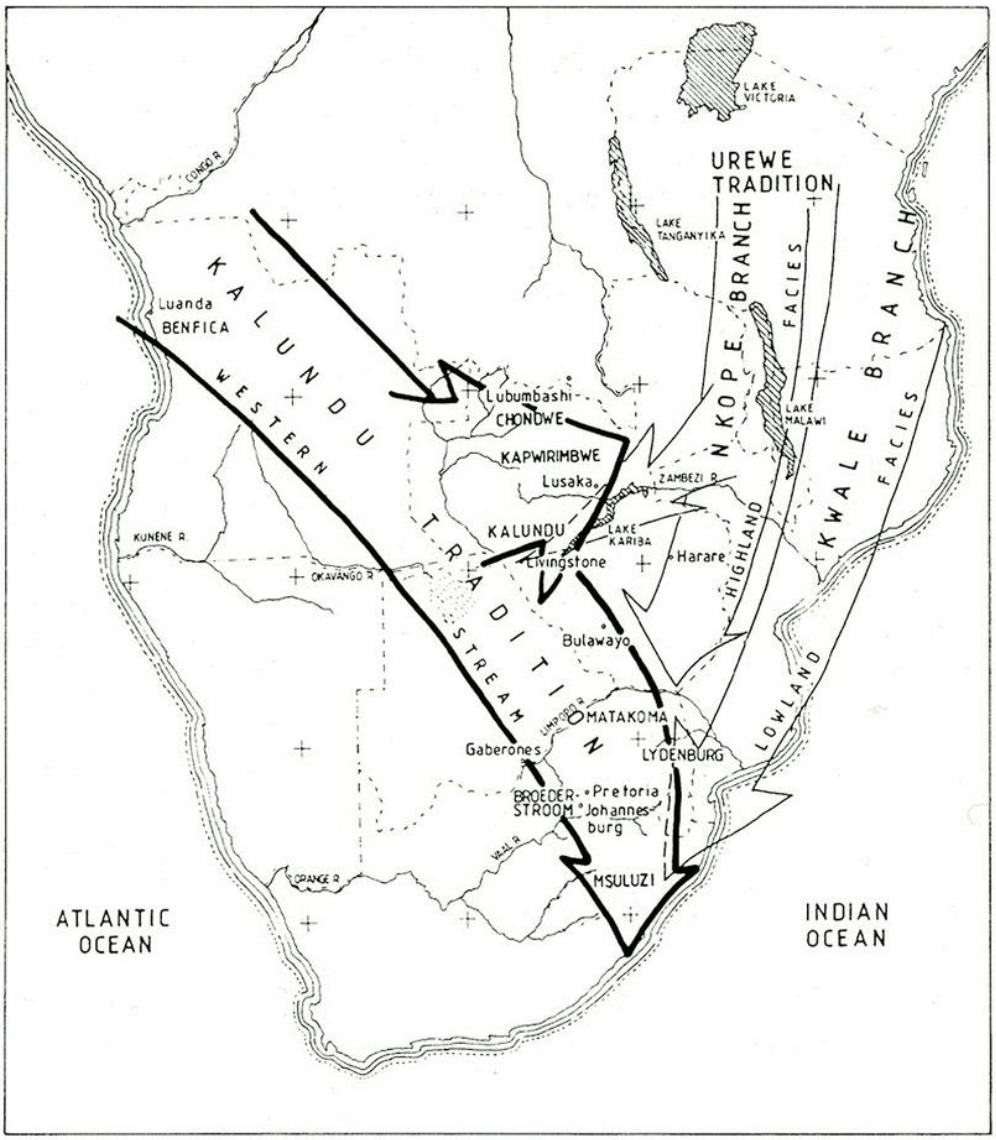


Figure 6: General understanding of Bantu migrations related to the larger ceramic traditions, Kalundu (Western Stream) and Urewe (Nkope and Kwale Branches) (After Huffman, 1989).

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

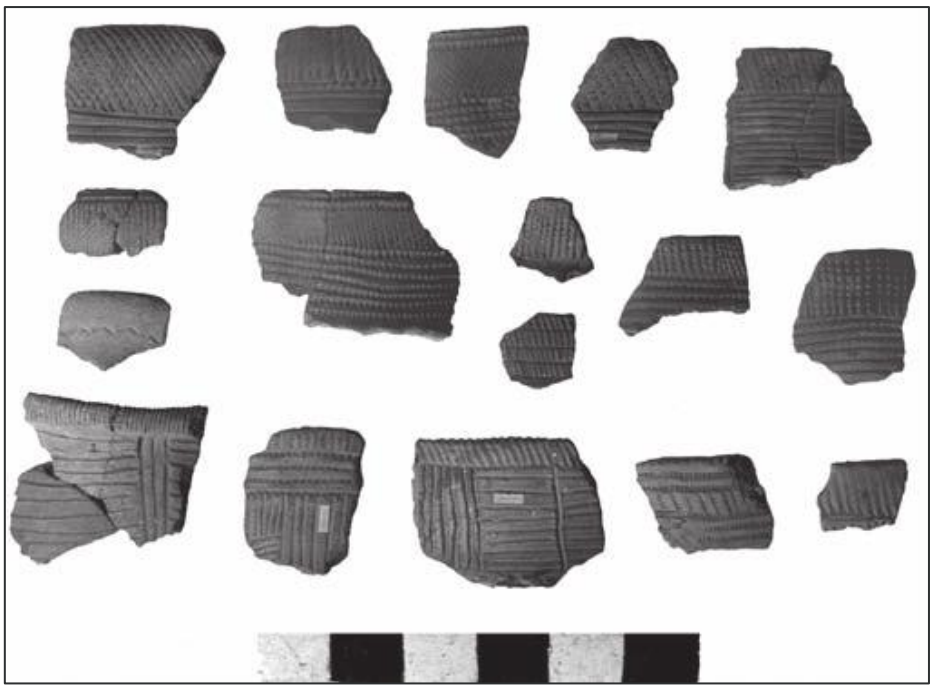


Figure 7: Examples of Bambata Potsherds (Huffman, 2005).

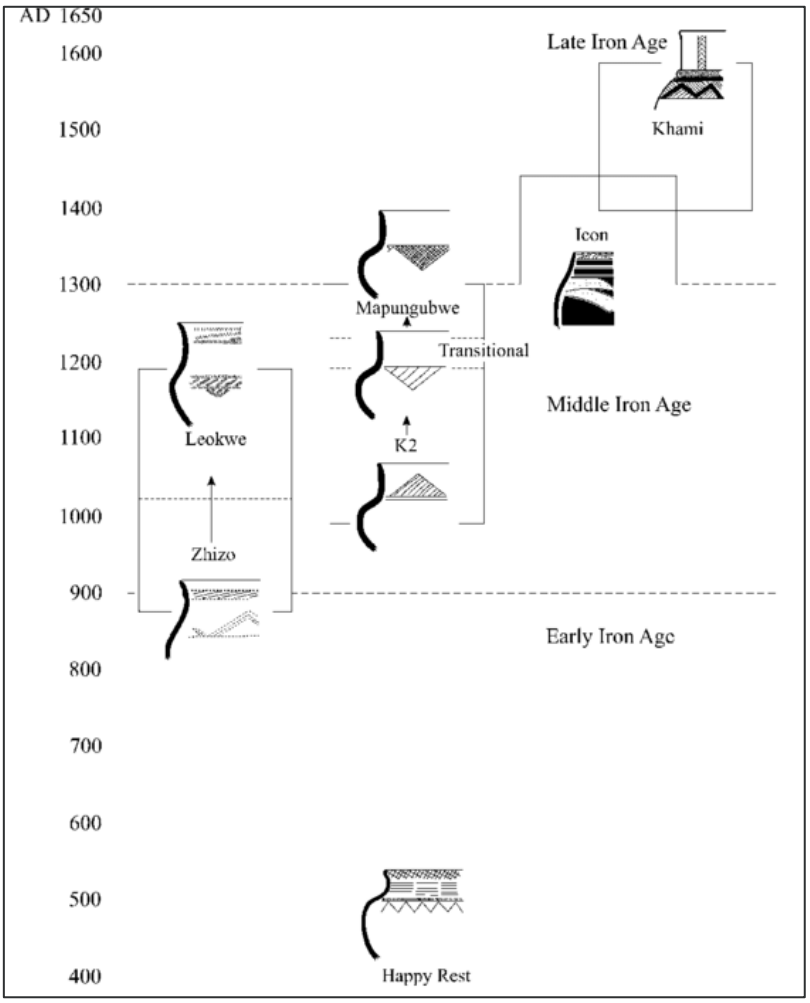


Figure 8: An Iron Age ceramic sequence demonstrating transitions between K2 and Mapungubwe ceramic styles (Huffman, 2009).

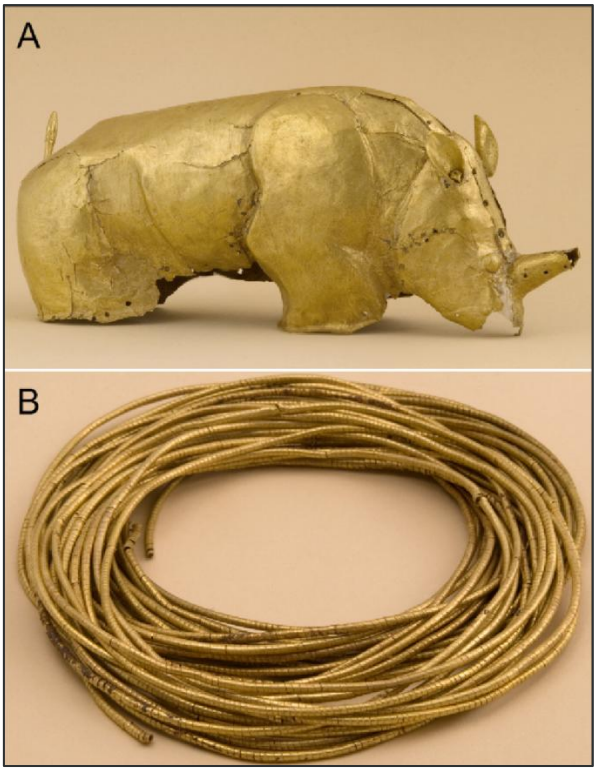


Figure 9: Famous golden implements of Mapungubwe (A - Golden Rhinoceros, B - Golden anklets) (Woodborne *et al.*, 2009).

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

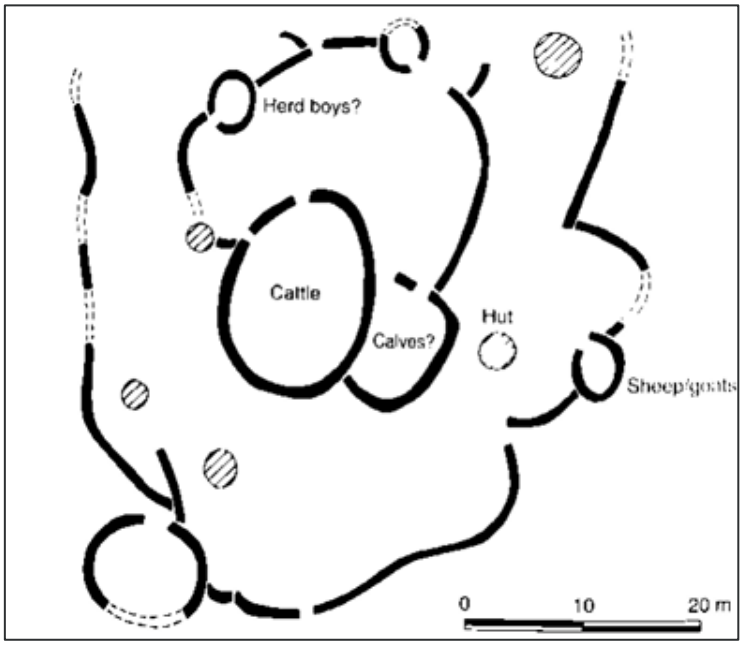


Figure 10: Type N stone wall structures as illustrated by Maggs (1976).

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

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

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

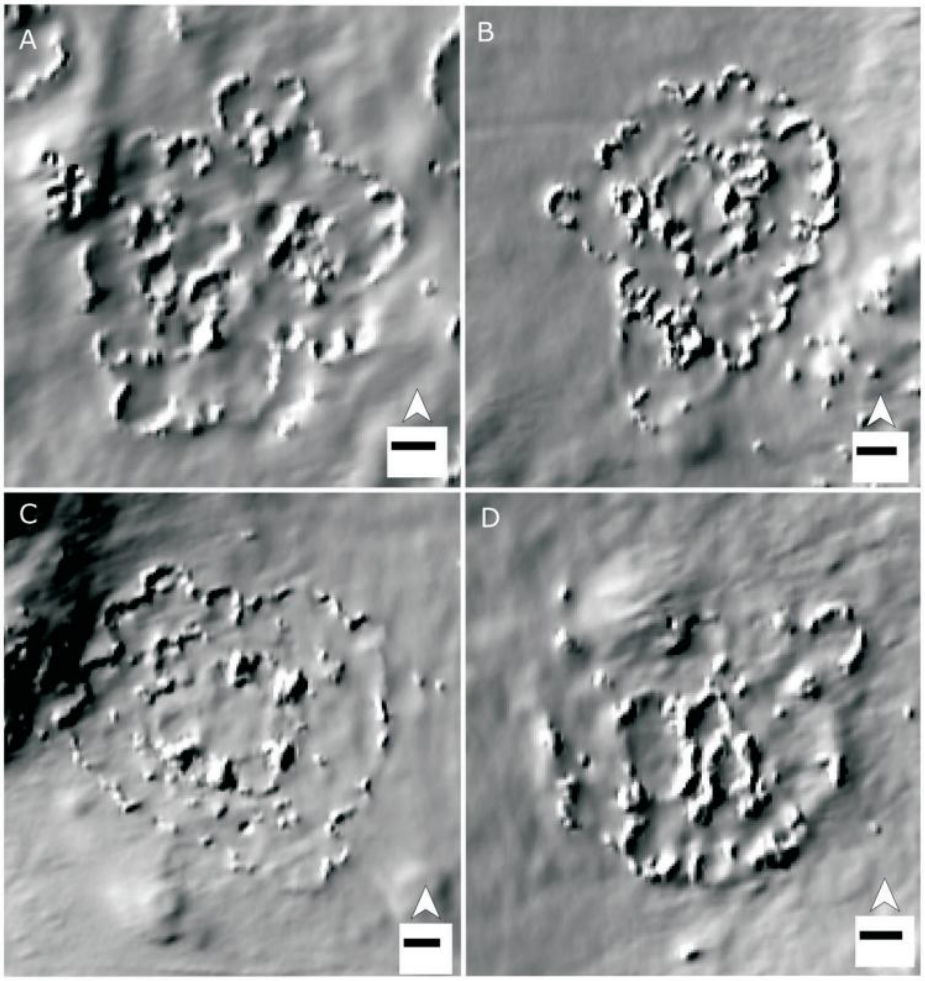


Figure 13: LiDAR imagery of Molokwane stone wall structures of Kweneng, a lost city discovered at Suikerbosrand Nature Reserve (after Sadr and Mshuqwana (2020)).

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

2.1.4 HISTORICAL PERIOD

A) PORTUGUESE MARINERS AND SHIPWRECKS

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

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

B) THE CAPE COLONY

While Vasco de Gama and Bartolomeu Dias represent two of the first Portuguese mariners to round or interact with the South African coast, the country's history is transformed with the formation of the Dutch Cape Colony. The Dutch East India Company, establishing a port of call at Table Bay through the arrival of Jan van Riebeeck, intended for Cape Town to become a base for the rapidly growing enterprise. In the mid-1600s, the company encouraged some individuals to participate in farming and food production, in the hopes of solidifying and establishing the Cape Colony (Thompson, 2001). The Cape Colony developed into a melting pot of different people due to the expansion of the colony through slave trade, and arrival of other European groups. In terms of archaeology, research of some of the early homesteads of the Cape Colony such as Vergelegen provide more understanding of the extent of interaction between different groups from as far as East Asia, to Brazil (Markell *et al.*, 1995) (Figure 14).

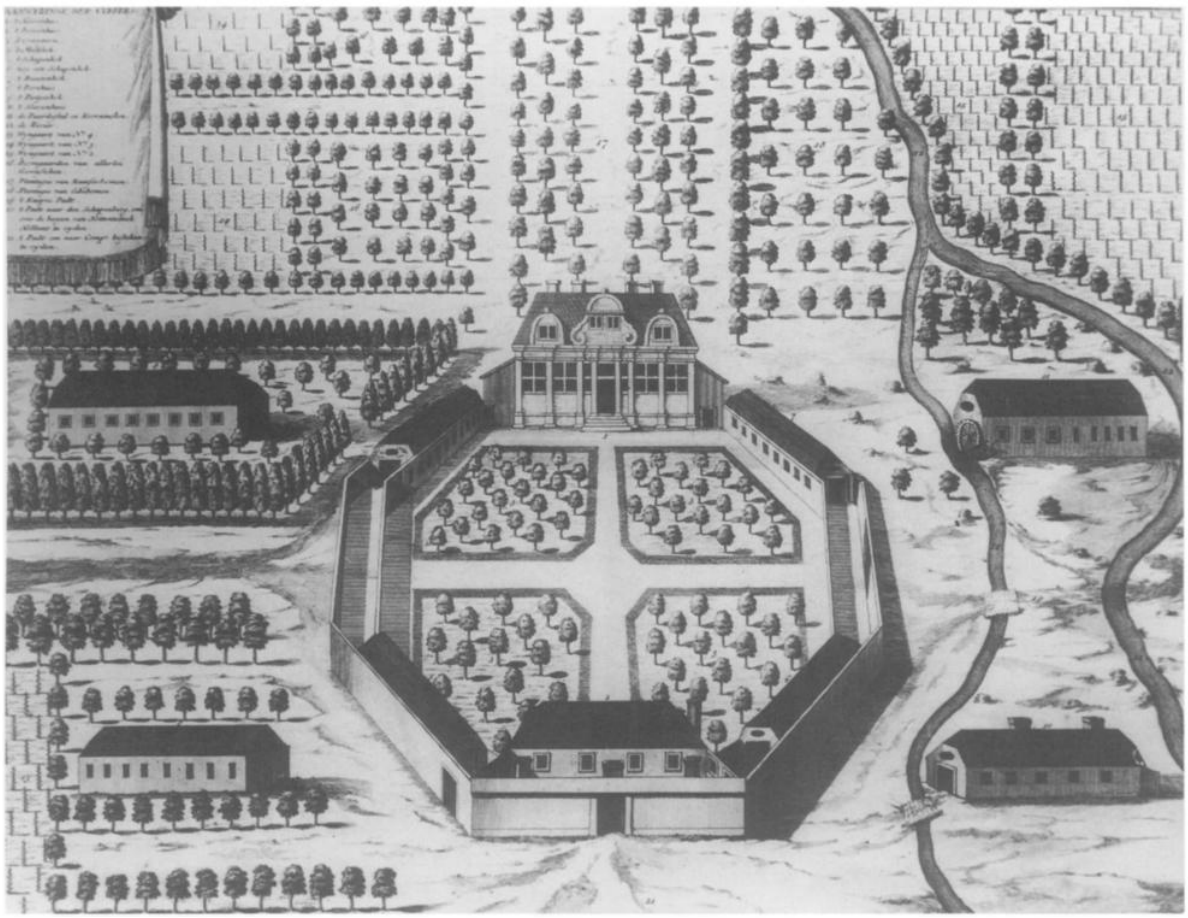


Figure 14: A 1700s drawing of Vergelegen, a Cape Colony homestead including multiple buildings including slave lodges. (after Markell *et al.* 1995).

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).

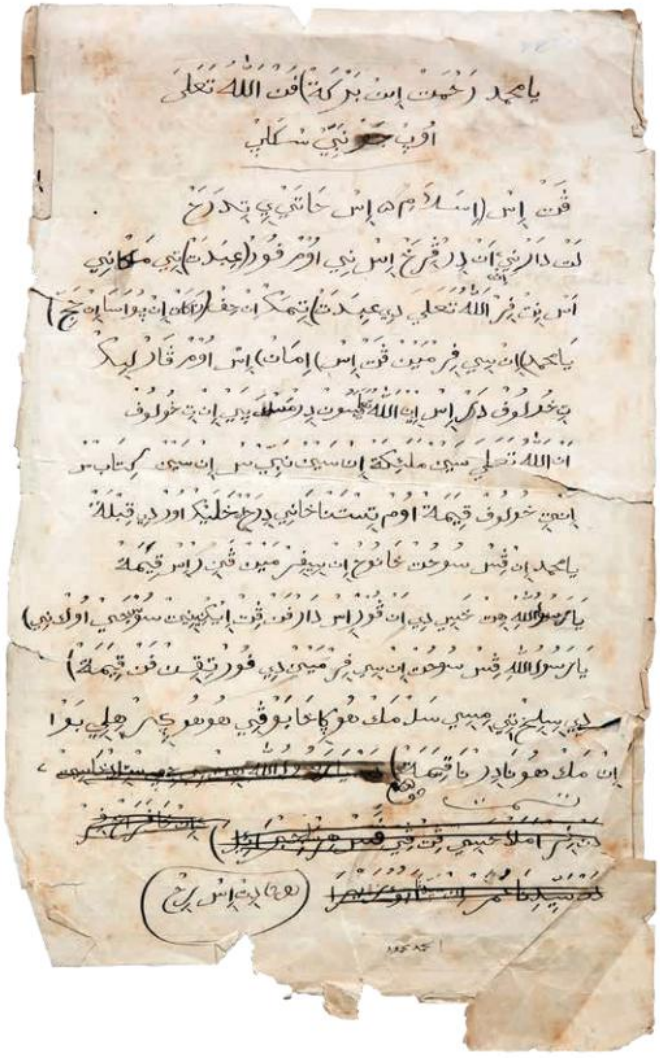


Figure 15: An Arabic script representing the first written texts of the Afrikaans language (late 19th Century) (after Davids (2018))

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.

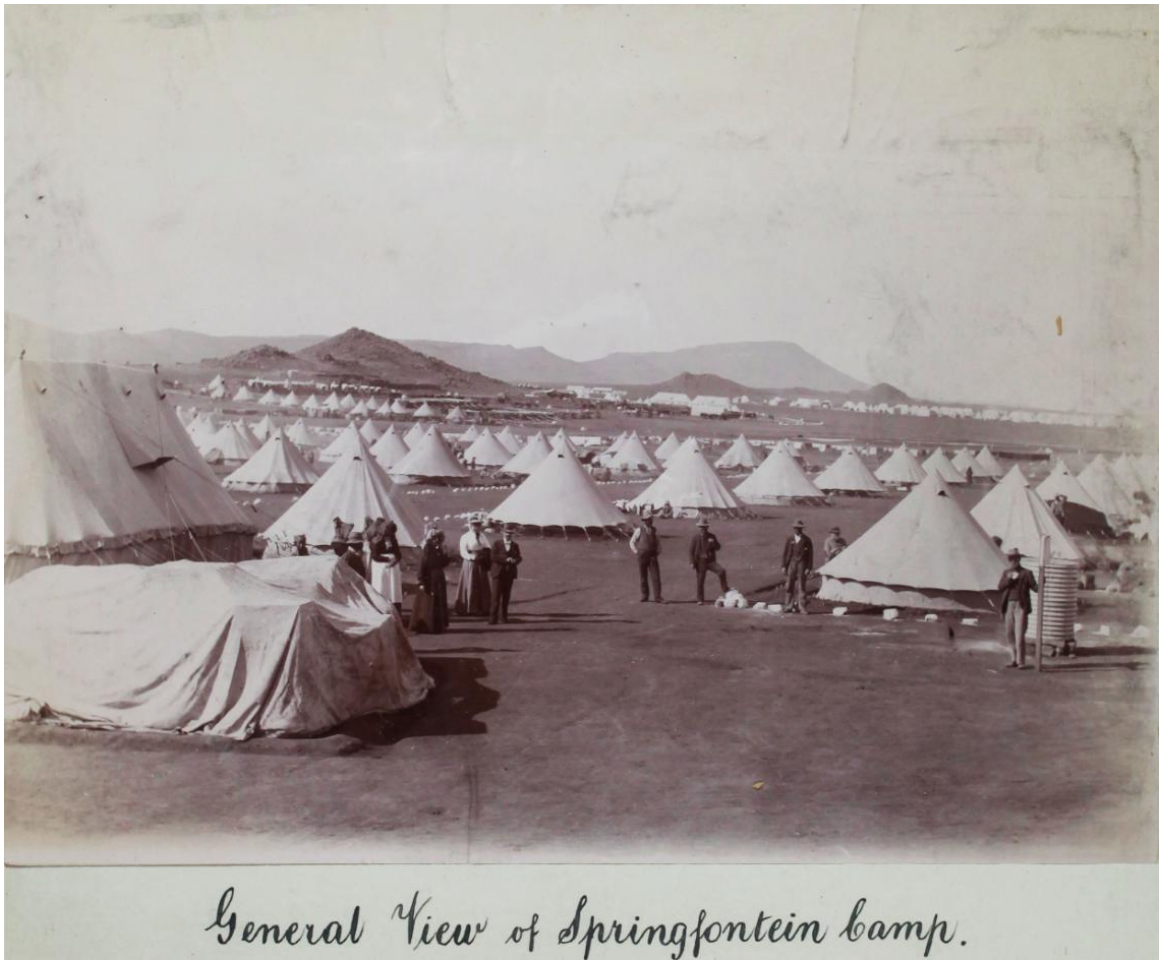


Figure 17: A picture of Springfontein, a refugee war camp which was established as a repercussion of the war's influence (after British National Archives).

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.

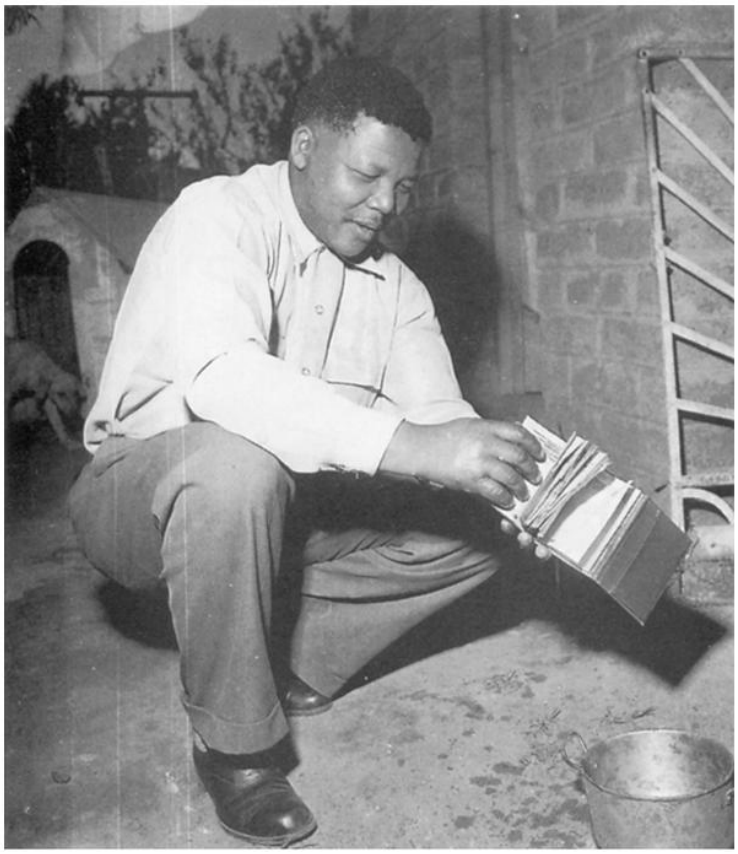


Figure 18: Nelson Mandela burning his pass in 1959. A pass was a requirement for people to move across the country. Such documents have now become items representing the Apartheid regime. (Thompson, 2001)

2.2 SITE-SPECIFIC BACKGROUND

The Northern Cape is associated with a long archaeological record that spans across pre-colonial and colonial periods. Most notable is the region's significant role in terms of Hunter-gatherer activity. The closest town to the site in question is Pofadder, which itself embodies rich heritage in relation to the colonial history and modern economic development of South Africa.

2.2.1 STONE AGE AND EARLY HUNTER-GATHERER EVIDENCE

Stone Age artefacts or finds and sites form a key component of the archaeological record of the Northern Cape. This is related to the extensive hunter-gatherer activity in the area. The Northen Cape Stone Age is defined by its lithic collection which includes examples of ESA, MSA, and LSA. Key examples of the lithic finds associated with the Northern Cape can be observed at Wonderwerk Cave and Canteen Kopje as previously discussed, and around the Kathu Townlands (Walker *et al.*, 2014). Figure 19 and Figure 20 includes some examples of the lithic finds one can expect associated with early hunter-gatherer activity in the Northern Cape.

Other finds include the occurrence of graves and human remains as well as stone engravings or petroglyphs. Stone engravings have been observed in areas around the Northern Cape and have been attached to hunter-gatherer activity. Driekopseiland near Kimberley is a key example site including stone engravings in the Northern Cape. This site has been extensively studied and interpreted in relation to hunter-gatherer traditions and belief systems (van Riet Lowe, 1952; Deacon, 1997; Morris, 2016, 2022). Further, the petroglyphs observed in the Northern Cape (Figure 21) are but some examples of similar rock art found across the country.

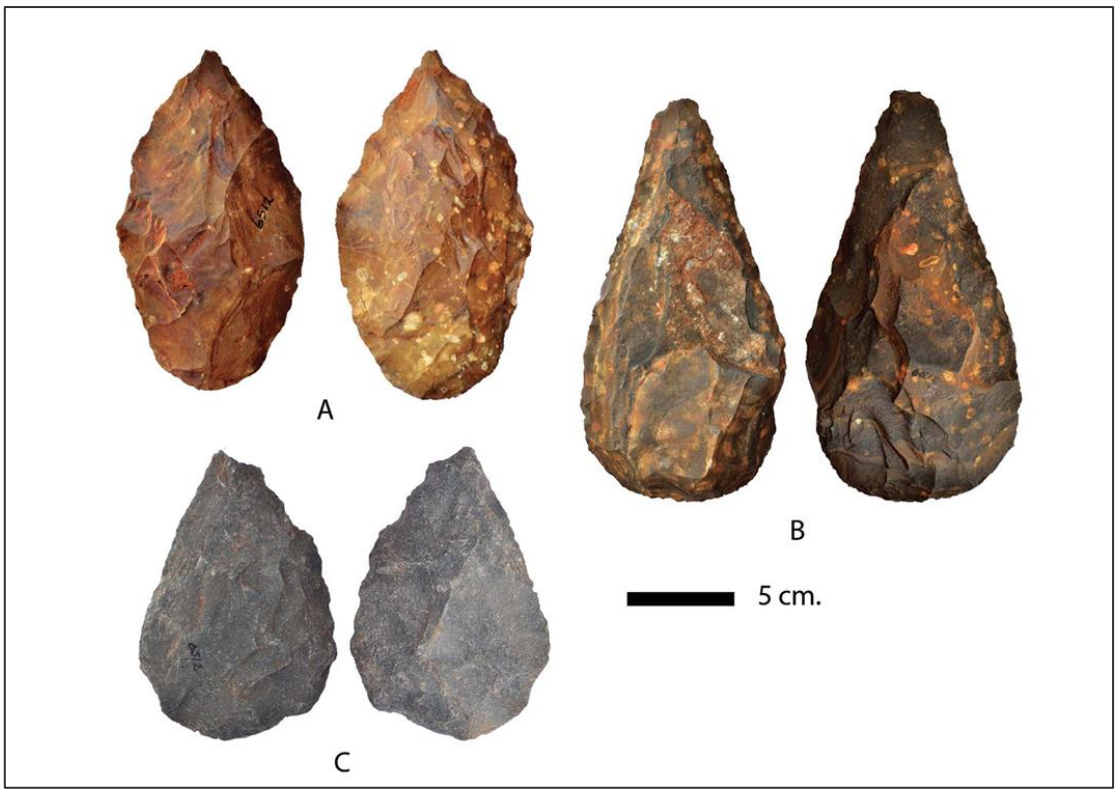


Figure 19: Some key examples of handaxes found near the Kathu Townlands. The examples are banded ironstone (A and B), and Quartzite (C) (After Walker *et al.*, 2014).

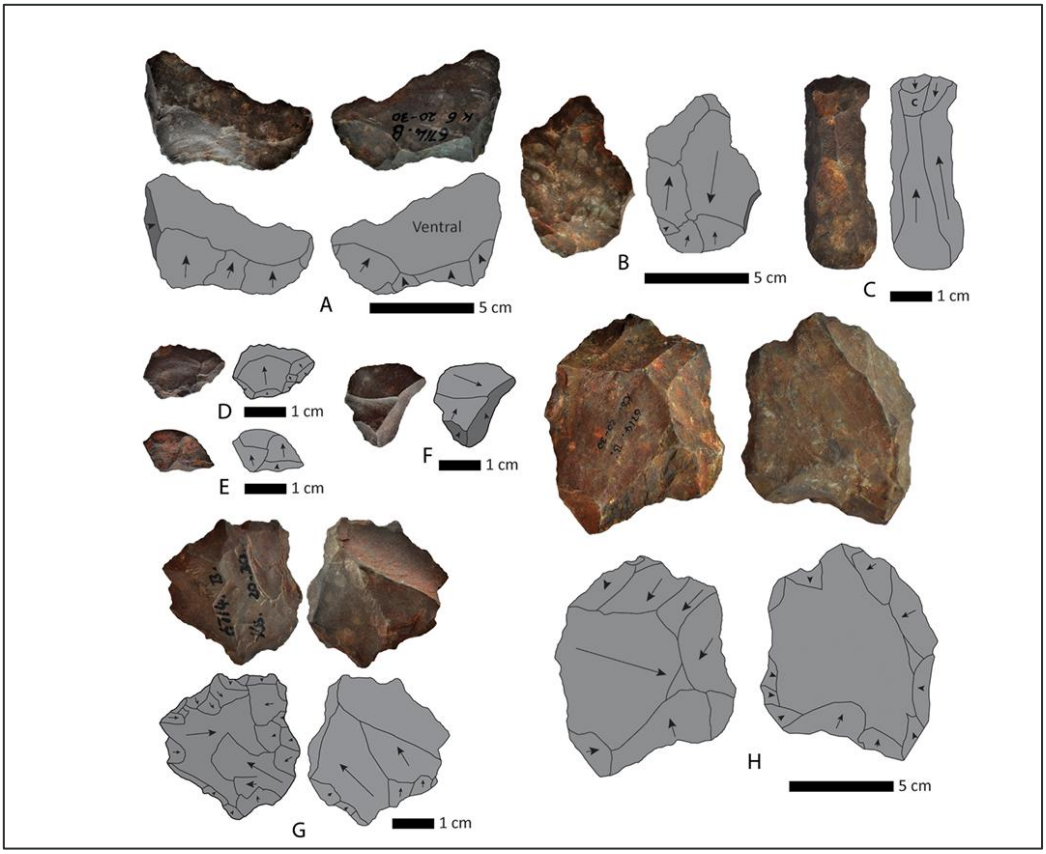


Figure 20: Examples of small flakes and cores. (A) Large flake off of the edge of the core consistent with biface shaping removal, (B) Large flake with dorsal scars (C) Blade (D–F) Small flakes (G-H) Discoidal cores.

Figure 21: A photograph taken of engraved motifs forming part of the petroglyphs identified at Driekopseiland near Kimberley, Northern Cape.

2.2.2 HERITAGE OF CLOSEST TOWNS AND LOCATIONS OF HERITAGE INTEREST

The closest towns to the site of interest are Pofadder and Aggeneys. A brief background on each of these towns is provided below encapsulating the colonial history of the area itself.

A) POFADDER

Established in 1875 as a mission station, Pofadder has a rich colonial history. The town was named after the Koranna chief, Klaas Pofadder. The town had been subsequently renamed to Theronsville, but the name was never fully adopted hence why the town preserved its original name. A notable landmark of Pofadder is a Roman Catholic Church. Many of the original mission buildings and churches of the town continue to be used as cultural heritage markers

B) AGGENEYS

Contrary to the origin of Pofadder, Aggeneys was originally established as a town to support mining activities in the area, namely the Black Mountain Mine. Named after an existing farm on which the town was established, Aggeneys has supported a community engaging in the various activities of the mine. Unlike Pofadder, the town's cultural heritage is limited given that Aggeneys was only established in 1976.

2.3 DATABASES AND COLLECTIONS

A key source of information and material on the finds and sites of the Northern Cape is housed by the McGregor Museum in Kimberley. The museum hosts both pre-colonial and colonial archaeological collections. Further, the museum also hosts geological and palaeontological collections. Specifically, the museum houses key examples of lithic artefacts, as well as examples of fossils found in the Northern Cape.

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:

> *Heritage Impact Assessment: Proposed Pofadder Wind Energy Facility 1, Kenhardt Magisterial District, Northern Cape*

This report was compiled assessing the impacts of a Wind Energy Facility on potential heritage resources. This report is one of three Wind Energy Facility (WEF) projects (numbered WEF 1, 2, 3) which were assessed. The properties affected by the develop intersect with some which form part of the proposed PR area. A field survey was conducted during which large areas were traversed on foot. Through this assessment, several heritage features were identified including stone age artefacts and collections, as well as historical structures. In particular, the ruins of several historical structures were identified to the west of the proposed PR area. These structures often formed part of farm complexes. One example of such farm complexes identified was the Lovedale farm complex on the farm Lovedale 201 (Figure 22). The Lovedale farm complex includes a graveyard with graves dating back to 1920 (Figure 23). Other finds associated with the WEF 1 assessment include ostrich eggshell, and stone walled structures or kraals. The report concludes that the finds identified were considered not of high significance.

Figure 22: Main farmhouse of the Lovedale farm complex. The building has been modified and maintained since its construction.

> *Heritage Impact Assessment: Proposed Pofadder Wind Energy Facility 2, Kenhardt Magisterial District, Northern Cape*

This report is an assessment that was done for the WEF 2 of the projects described above. In addition to the finds above, other artefacts were identified in the footprint of WEF 2. Of note were historical items such as fragments of glass bottles. These finds were considered not of high significance.

Figure 23: The Lovedale farm complex graveyard. Note the photograph of the tombstone indicative of the oldest grave which dates back to 1920.

Heritage Impact Assessment: Proposed Pofadder Wind Energy Facility 3, Kenhardt Magisterial District, Northern Cape

This report is an assessment that was done for the WEF 3 of the projects described above. No additional heritage features aside for stone tool scatters were identified in the footprint of WEF 3. These finds were considered not of high significance.

3 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

3.1 CLIMATE

The climate of the Northern Cape is characterized by extreme temperatures, with hot summers and very cold winters. The rainy season usually occurs from late summer through to autumn, with the months of January to April being particularly notable for precipitation. Temperature and precipitation vary significantly across the region, with the eastern and mountainous areas receiving rainfall of about 200-400 mm per annum, while the arid western areas receive less than 100 mm per annum.

The climate in the Northern Cape is mostly semi-arid to arid, characterized by hot and dry summers during the months of November to February and cold winters starting from May to August. The region experiences occasional thunderstorms in the late summer months, and the winter season sees little to no precipitation.

Figure 24 provides an understanding of the general climatic conditions of the area, including an understanding of monthly temperatures and rainfall.

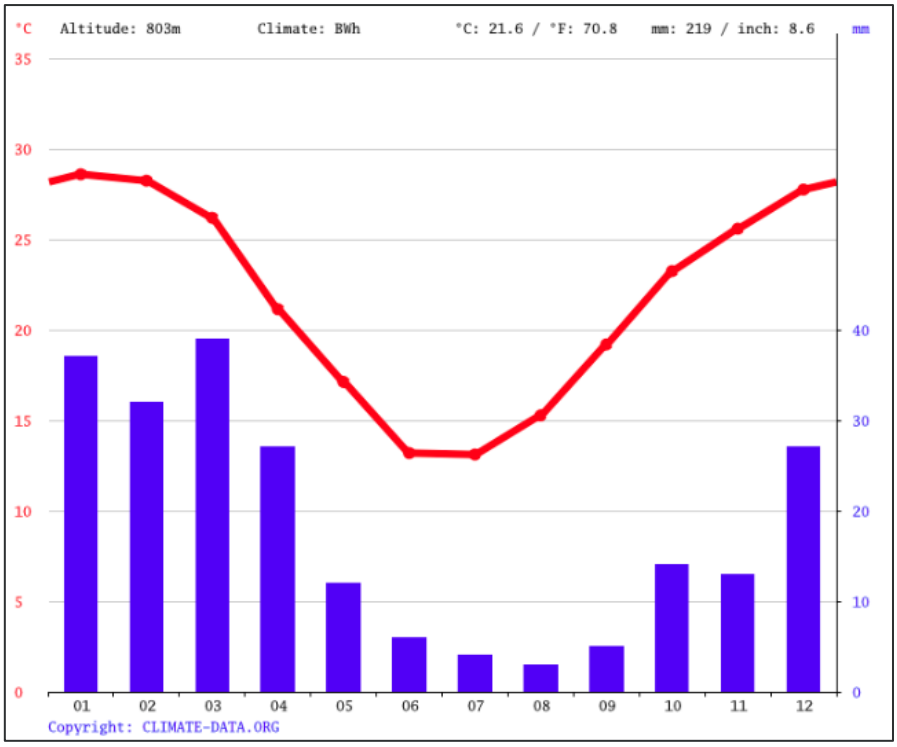


Figure 24: Annual Climatic conditions typical of the Northern Cape (considering data from Upington)(x-axis: 01=January, to 12=December)

3.2 TOPOGRAPHY

The development area falls in an area between 900 and 1040 m above sea-level in elevation. The landscape gently slopes towards to the East. Ridges or hilly areas are noted to the West of the site. Figure 25 for an overview of the topography of the site and surrounding areas.

3.3 DRAINAGE AND CATCHMENT

The closest river to the site is Steenkampse se Holte which flows through the southeast of the PR area itself which runs from East to West. The closest large river system is the Orange approximately 60 km to the North. The proposed development intersects with three Quaternary Catchments, namely, D53G, D81F, and D81G.

3.4 GEOLOGY

As a simplified overview of the geology of the area, the area is vast including many different geological subgroups and associated rock types. The eastern and southern sections of the PR area is characterised by superficial cover sand, rubble and soil. Calcrete dominates the northern section of the PR area. The western section is characterised by several different geological subgroups including the Mbizane (that is of Diamictite, sandstone, siltstone, and mudstone), as well as Koeipoort Granite, Kraansdraai (Calc-silicate rocks and amphibolite), and Volmoed subgroups. Figure 26 is a simplified overview of the geology of the site and surrounding areas.

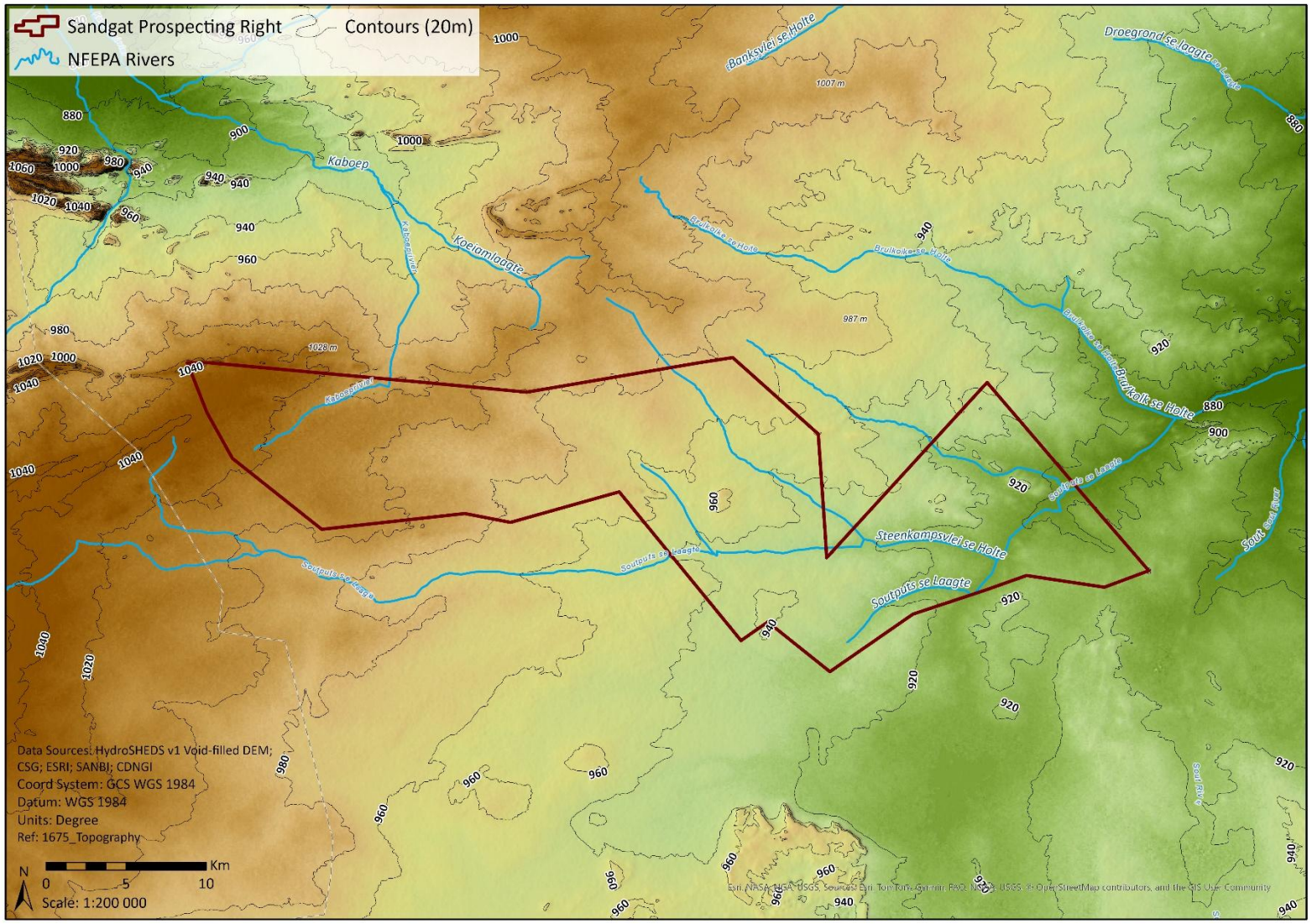


Figure 25: Topography Map of the site and surrounding areas.

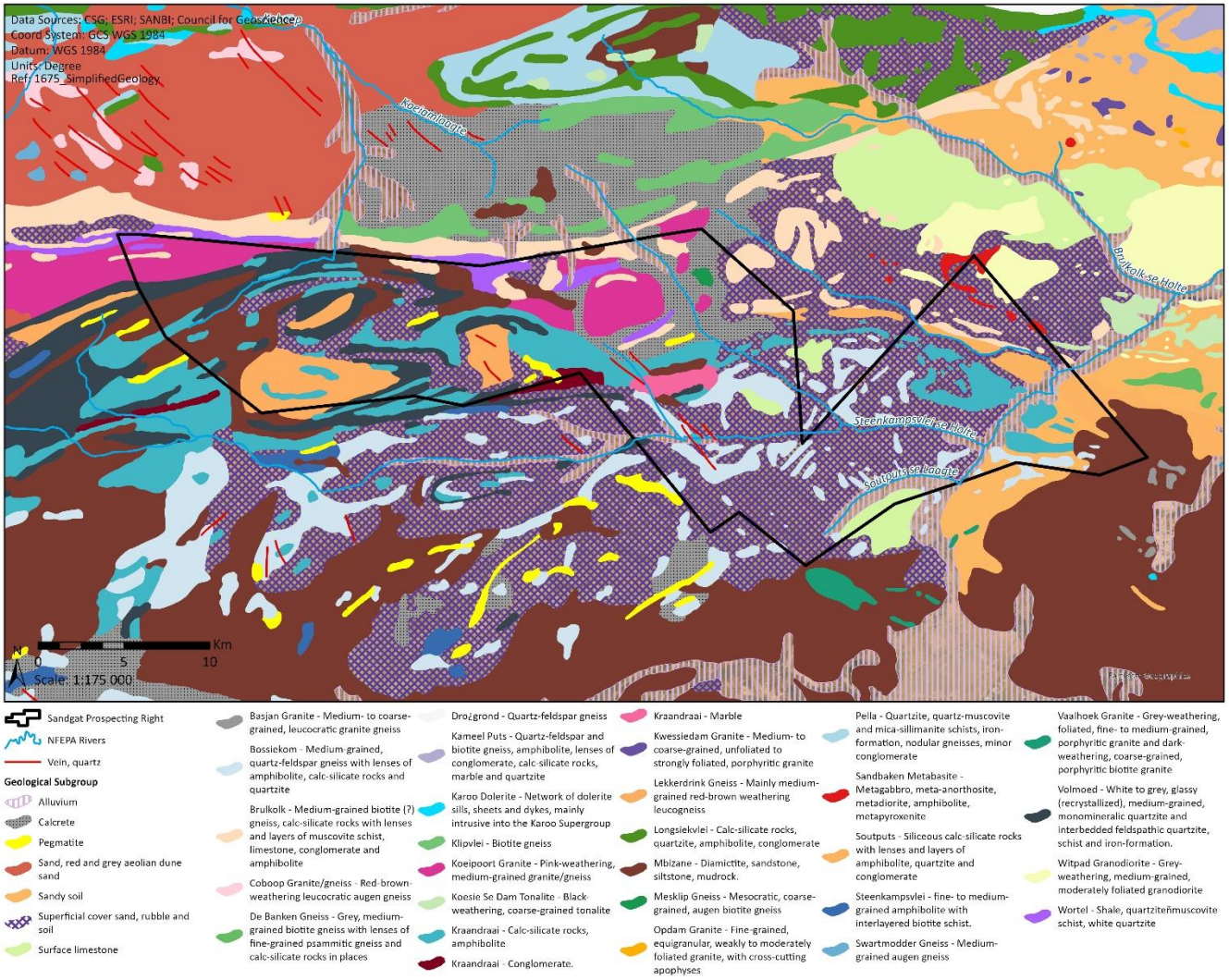


Figure 26: Map of the geology of the site and surrounding areas.

4 METHODOLOGY

The following section describes the methodology used to gather information on potential heritage resources and impacts in this report. 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 Screening Tool of the Department of Forestry, Fisheries and the Environment was consulted. The Screening Tool includes a geospatial database of recorded and identified sensitivities relating to Archaeological and Cultural Heritage sites or finds. The information available through the Screening Tool provided a basis which informed further desktop assessments and the extent to which the field survey would be conducted. This information was then corroborated with information available through the South African Heritage Resources Information System (SAHRIS), Chief Directorate: National Geospatial Information (CD:NGI), as well as Google Earth Imagery. Various aerial photographs and 1st edition topographic maps were consulted to verify the extent of heritage and archaeological sensitivity in and around the development footprint. Altogether, the data consulted included geospatial records dating as far back as 1962.

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	III A	High	Retain as heritage register site, no mitigation advised
Local	III B	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. To address this limitation, site screening was conducted confirming the identification of key sites. Further triangulation was achieved through stakeholder engagement. It is important to note that final locations for proposed invasive activities (mainly the drilling of boreholes) are to be identified at later stages of the project. This has therefore affected the assessment of potential impacts. Mitigations have therefore considered 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 Screening Tool suggested that the area to be developed is of Low Sensitivity as captured in Figure 27.

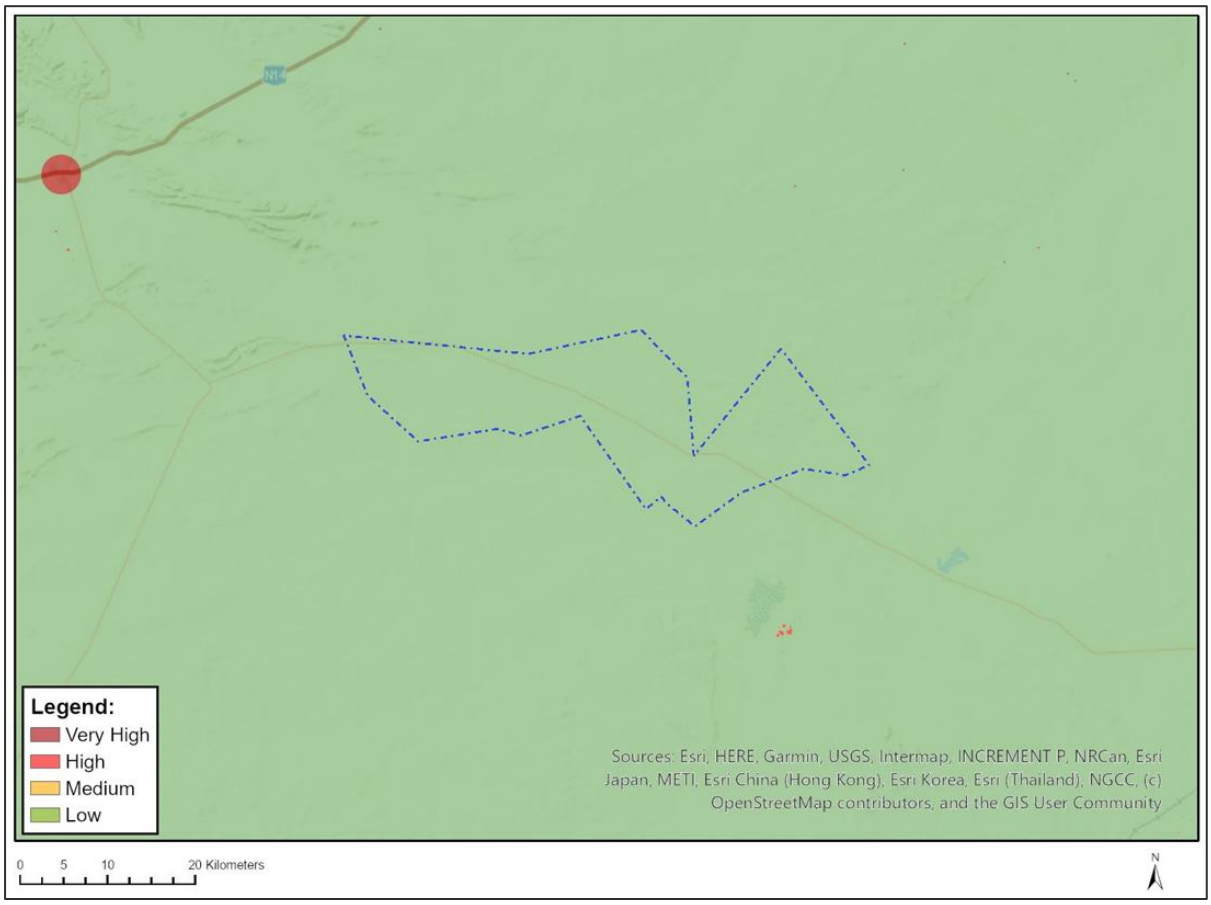


Figure 27: Map of Relative Archaeological and Cultural Heritage Sensitivity (DFFE Screening Tool)

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 (2919BC, BD, and 2920AC) of the area were analysed. As the maps were drawn between 1973 and 1974, it would include information on observations within the footprint of the development. It is important to note that since the map was drawn within the last 60 years, not all features highlighted would constitute heritage features. In this sense, some structures may have been built earlier than 60 years ago. Ten (10) features were identified to be of heritage significance. The following is an overview of the potential heritage features identified on the various topographic maps consulted.

5.1.1 2919BC

The extent of the PR area covered by the first edition topographic map covers the eastern section of Farm Lovedale 201. A single feature was identified as being of potential heritage significance (See Figure 28). This was identified as the farm complex of Lovedale (SG001), including several structures and a grave site (SG002). This corresponds with the background research undertaken and covered in Section 2.4.

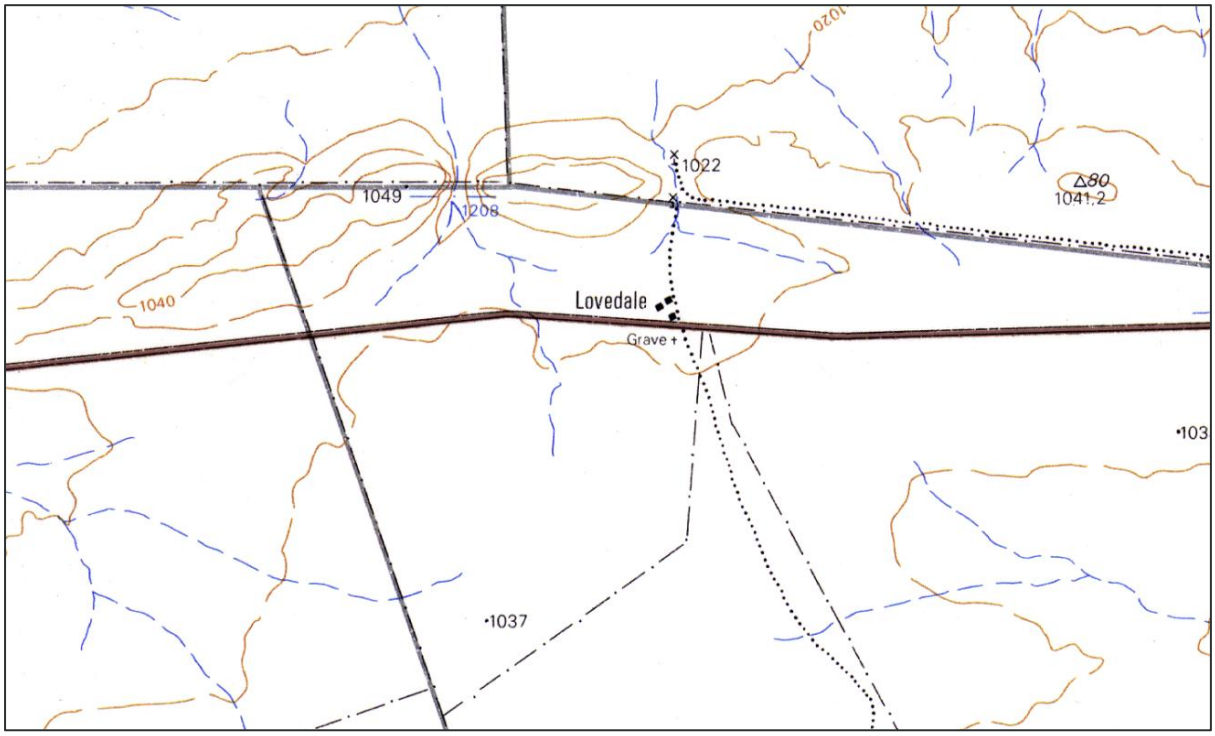


Figure 28: Extract of the 2919BC First Edition Topographic Map dated 1973. Map indicates the location of the Lovedale farm complex (SG001) and associated grave site (SG002).

5.1.2 2919BD

The extent of the PR area covered by the first edition topographic map covers the southeastern section of Farm Lovedale 201, the full extent of Farm Quagga-Maag 203, large portions of the western extents of Farm Haartbeestvlei 199, and Farm Vaalkop 225. Several features were identified as being of potential heritage significance which fall within the PR area (see Figure 29 and Figure 30). This included buildings or farm complexes referred to on the maps as “Nuwedam” (SG003), “Quaggamaag” (SG004), and “Hartebeesvlei” (SG005). Quaggamaag and Hartebeesvlei correspond with the names of their associated farms. Further, 10 farm dams or reservoirs were noted across the map.

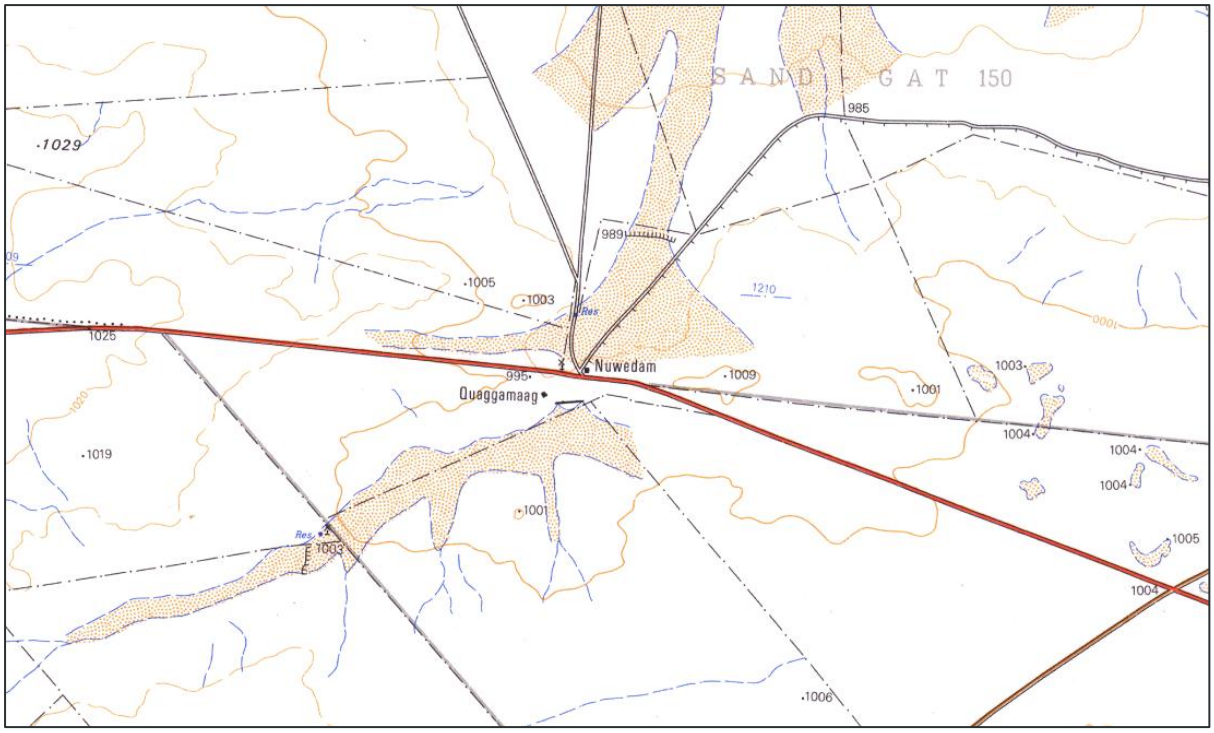


Figure 29: Extract of the 2919BD First Edition Topographic Map dated 1973. Map indicates the location of the Quaggamaag and Nuwedam buildings or farm complexes.

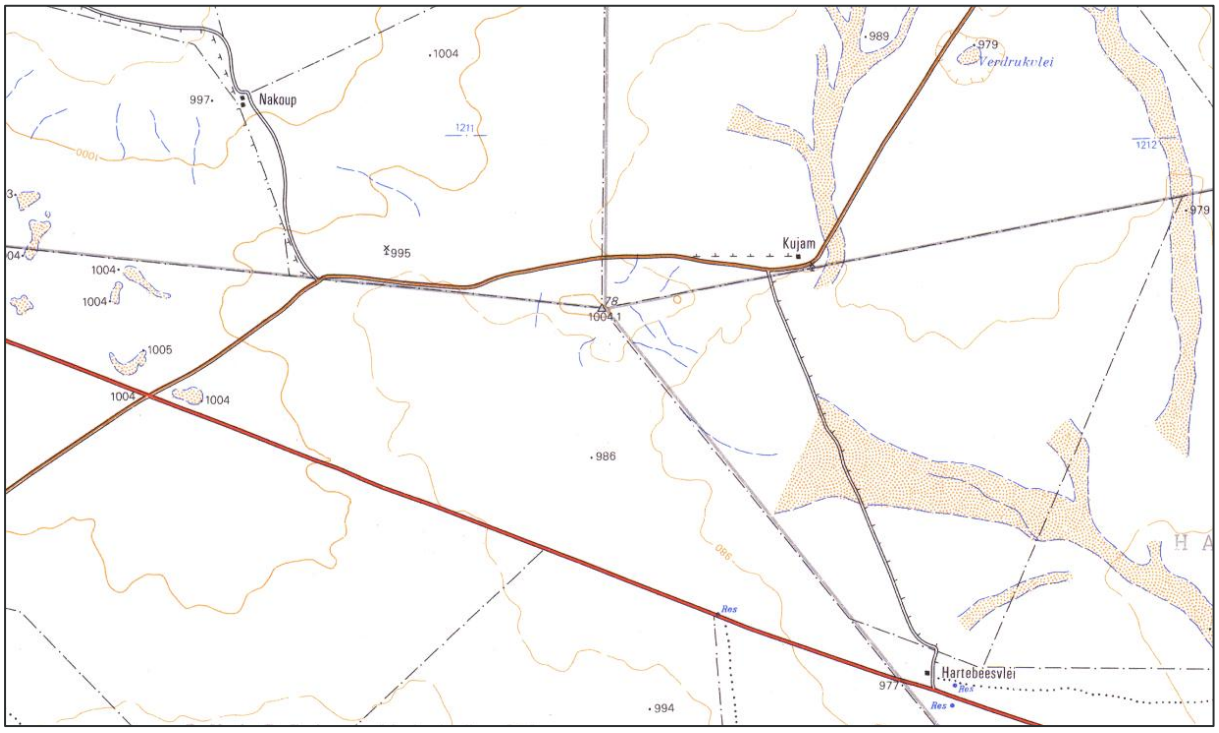


Figure 30: Extract of the 2919BD First Edition Topographic Map dated 1973. Map indicates the location of the Hartebeesvlei farm complex.

5.1.3 2920AC

The extent of the PR area covered by the first edition topographic map covers a small eastern section of Haartebeesvlei 199, the eastern section of Vaalkop 225, the full extent of the adjoining portions of Farm Geelvloer 197. The topographic map indicated locations of the buildings or farm complexes “Soutputs” (two

points of interest on the adjoining Farm Geelvloer 197)(SG006)(Figure 31). Of note is a single grave (SG007) marked near the building "Bossiekom" (SG008) to the south of the adjoining Farm Geelvloer 197 (Figure 32). Further investigation revealed that the grave dates to at least 1953. Other features identified on the topographic map included the buildings labelled "Vaalkop" (associated with Farm Vaalkop 225) (SG009), "Kraandraai" (southern section of adjoining Farm Geelvloer 197) (SG010). Additionally, six farm dams or reservoirs were identified across the PR area.

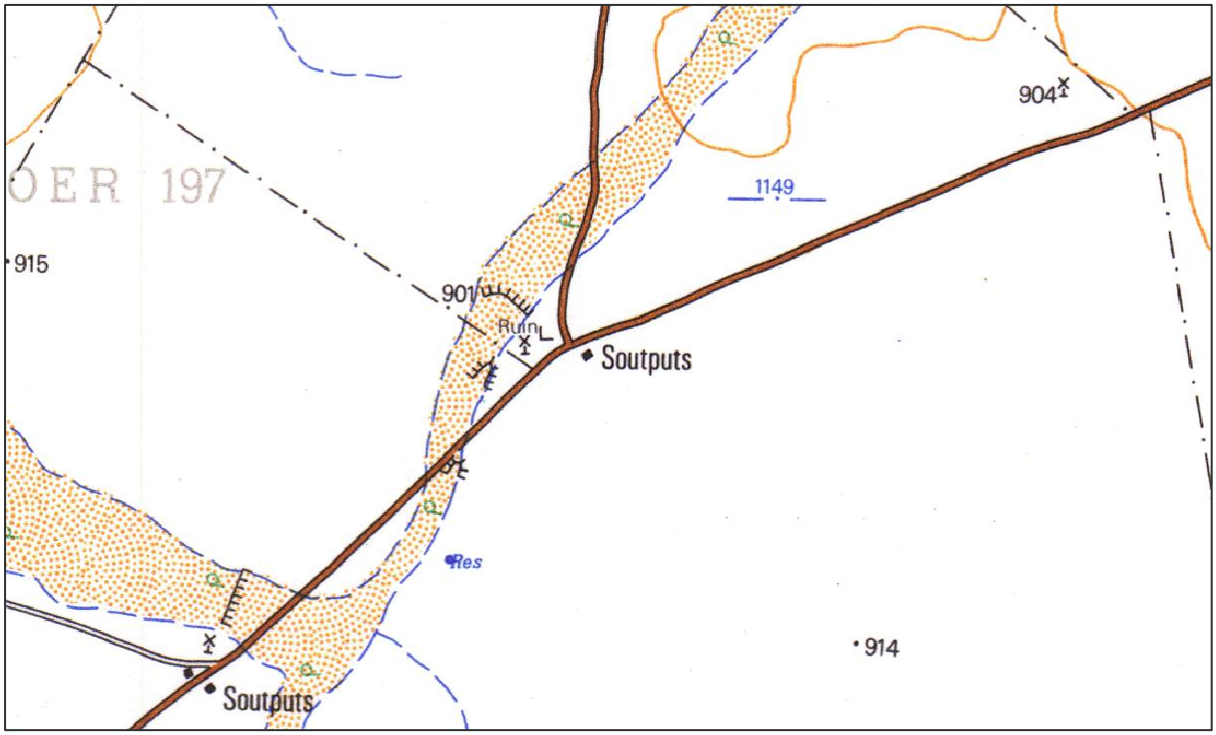


Figure 31: Extract of the 2920AC First Edition Topographic Map dated 1973. Map indicates the location of the Soutputs farm buildings and or complex. Note the ruin demarcated on the map.

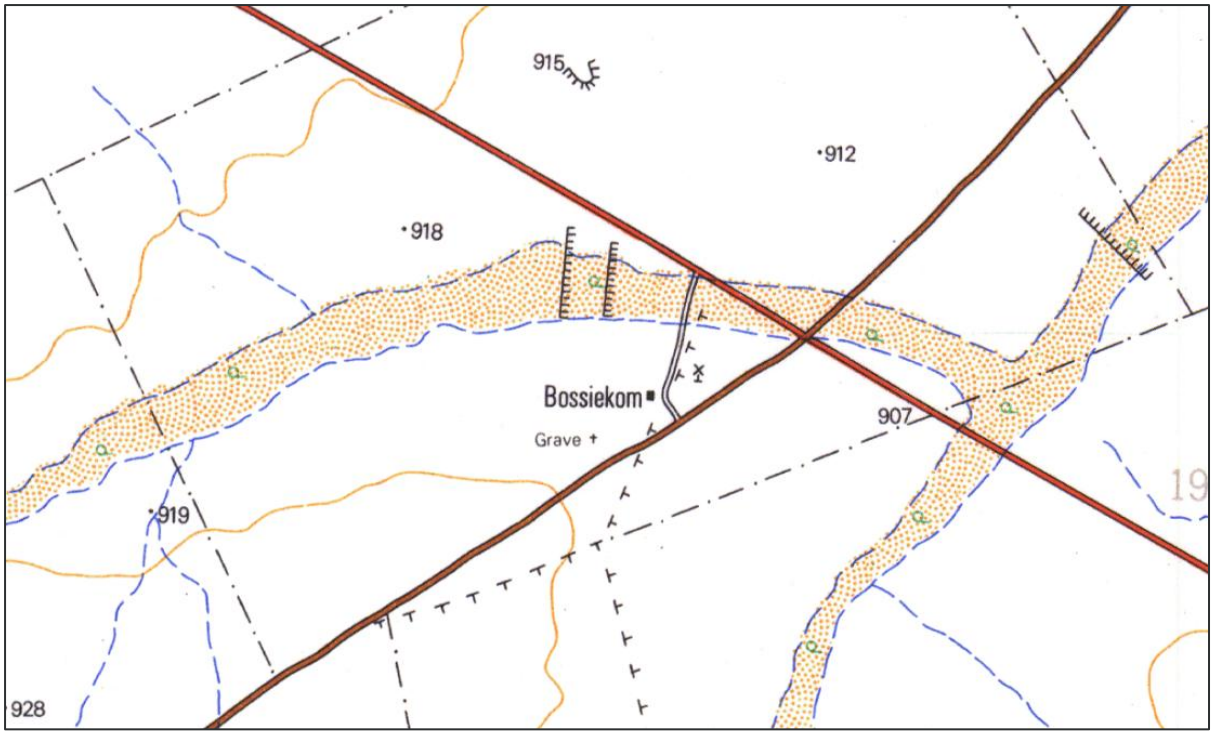


Figure 32: Extract of the 2920AC First Edition Topographic Map dated 1973. Map indicates the location of the Bossiekom farm complex or building. A grave site is also demarcated.

5.2 AERIAL PHOTOGRAPHY

Aerial photographs were also consulted to verify the presence or absence of features within and around the affected area. Aerial photographs consulted include imagery from 1962-1963, which allowed for a corroboration of observations made through the analysis of the First Edition Topographic maps. Since the First Edition Topographic maps would have been dated between 1973 and 1974, further assessments of available information were necessary to qualify identified features as potentially having heritage significance.

Altogether, the features identified through analysing the First Edition Topographic maps all date back to 1962, predating the drawing of the Topographic maps themselves and confirming their potential heritage significance (refer to Figure 33 to Figure 38). It is important to note that several of these features are still in use as part of existing farm complexes. Two of the identified farm complexes were considered as significant, that is, Lovedale and Bossiekom, each of which included grave sites.

In this regard, features and associated structures identified may be older than 60 years and are therefore protected under the NHRA as they may have heritage significance.

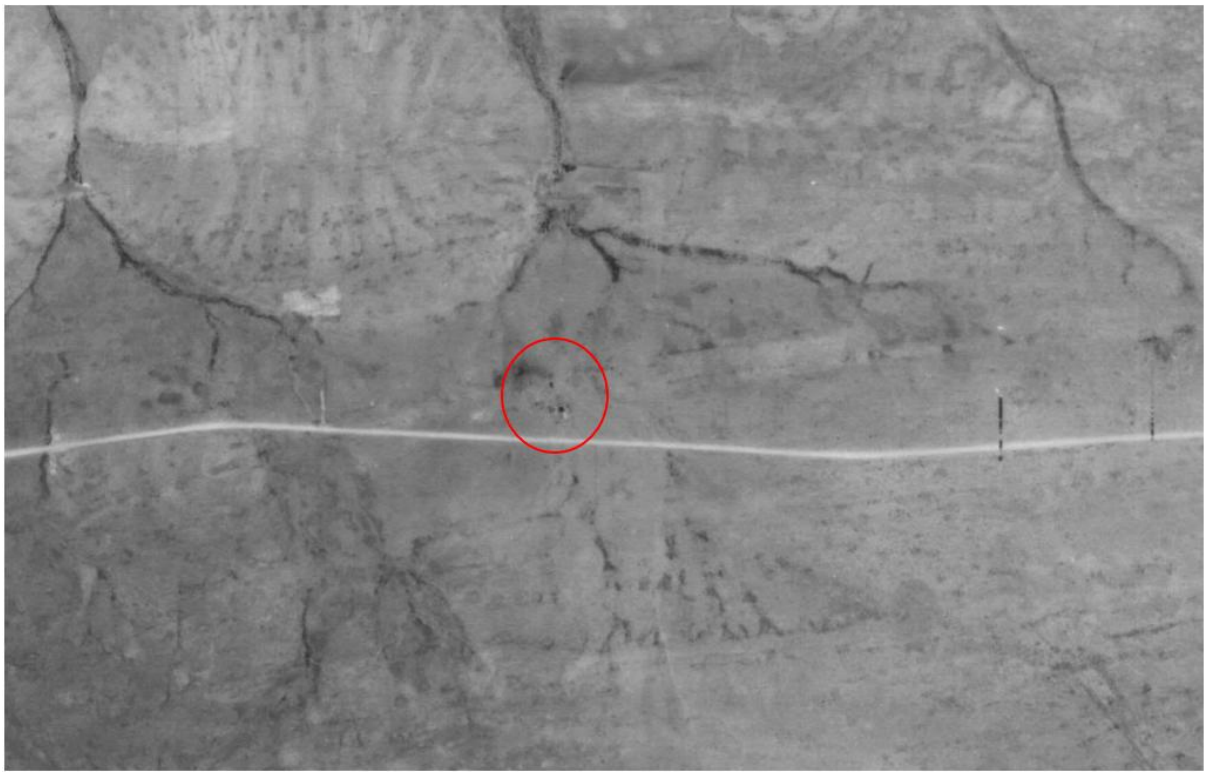


Figure 33: Aerial Photograph confirming the presence of the Lovedale Farm complex in 1962.

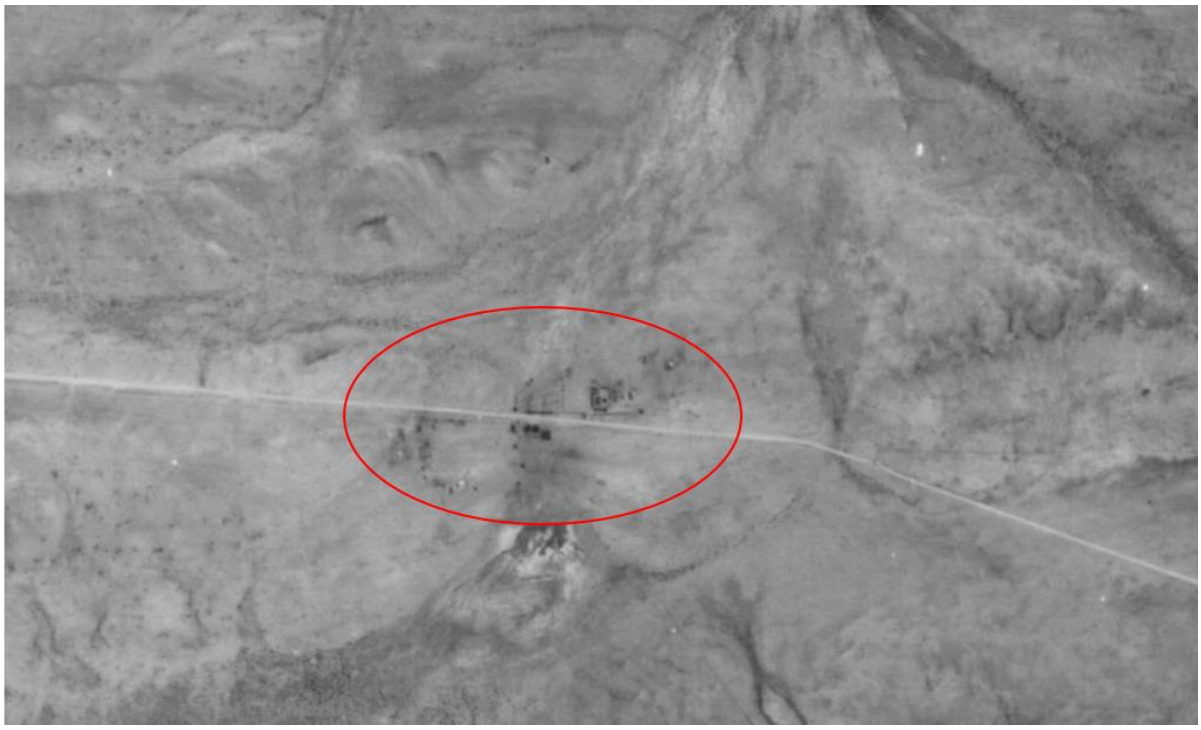


Figure 34: Aerial Photograph confirming the presence of the Nuwedam and Quaggamaag farm buildings or complexes in 1962.

Figure 35: Aerial photograph confirming the presence of some structures associated with the feature labelled Hartebeesvlei in 1962.

Figure 36: Aerial Photograph confirming the presence of farm complexes at locations labelled Vaalkop and Kraandraai in 1962.

Figure 37: Although faint, the occurrence of structures has been noted in the 1962 Aerial Photograph.

Figure 38: Aerial Photograph confirming the presence of the Bossiekom Farm complex in 1962.

5.3 PALAEONTOLOGY DESKTOP ASSESSMENT

Banzai Environmental was appointed by EIMS to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed Sandgat Prospecting Right (PR) Application in the Northern Cape Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the planned development area and to evaluate the potential impact of the proposed development on the Palaeontological Heritage of the area.

The PDA was undertaken by Mrs. Elize Butler. Elize Butler has completed almost 850 palaeontological impact assessments, including assessments in the Free State, KwaZulu-Natal, Eastern, Western and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga Provinces of South Africa. She has more than 30 years of experience in the field and an MSc (cum laude) in Zoology from the University of the Free State in South Africa with a focus in Palaeontology. She is adept at locating, collecting, and storing fossils. In 2006, she became a member of the Palaeontological Society of South Africa (PSSA), and in 2014, she began performing PIAs.

The study area is basically underlain by the potentially fossiliferous Late Cenozoic surface layers of the Kalahari Group, as well as the Dwyka Group (Karoo Supergroup). At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (c. 2 billion years old) of the Namaqua-Natal Province. The PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database indicates that the Palaeontological Sensitivity of the study area is Moderate, Low and Zero (Almond et al, 2013; SAHRIS website) (Figure 39), while the National Environmental Web-based Screening Tool indicates that the development has a Medium, Low and Unknown Palaeontological Sensitivity (Figure 40).

The fossil assemblages of the Kalahari Group are generally very low in diversity and occur over a wide range, the Dwyka Group has a Moderate Palaeontological Sensitivity while the Namaqua-Natal Province is unfossiliferous and thus have a Zero Palaeontological Sensitivity. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. **It is considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.** Please refer to Appendix 3 for the complete PDA report.

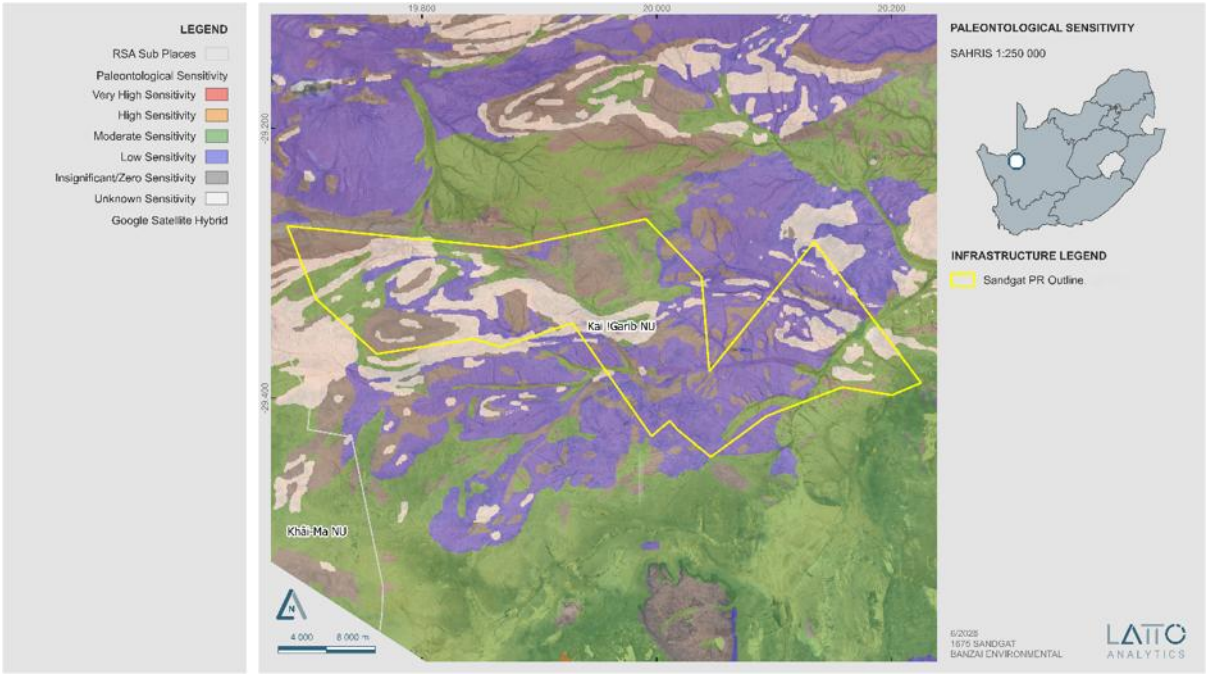
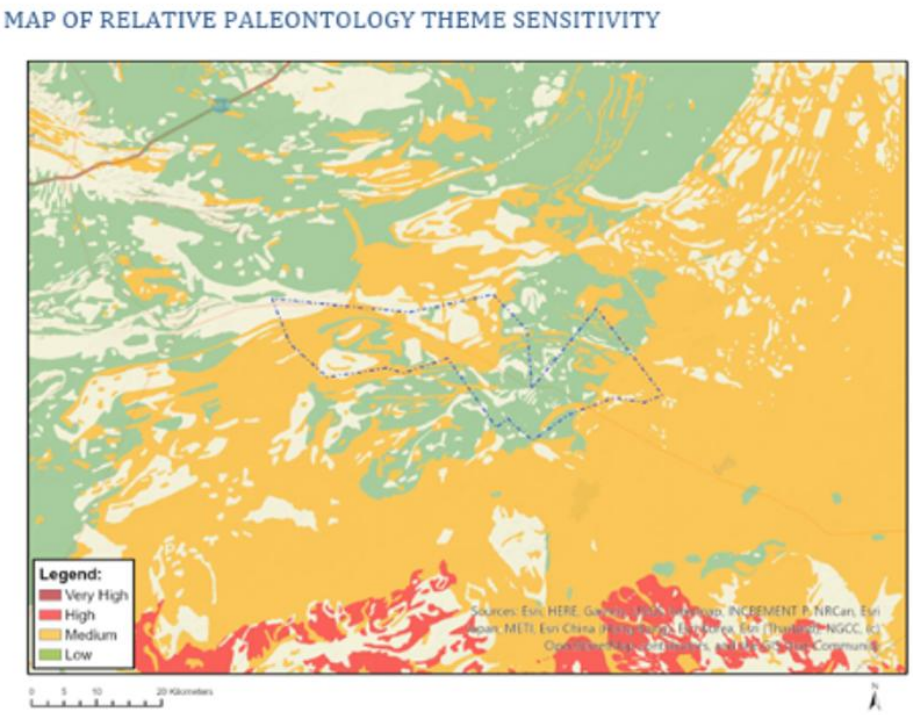


Figure 39: Extract of the SAHRIS PalaeoMap map (Council of Geosciences) indicates that the development is underlain by sediments with a Moderate (green), Low (blue) and Zero (grey) Palaeontological Sensitivity.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Features with a Low paleontological sensitivity
Medium	Features with a Medium paleontological sensitivity

Figure 40: Palaeontological Sensitivity of the study site by the National Environmental Web-based Screening Tool indicates a Medium (yellow), Low (green) and Unknown (white) Palaeontological Sensitivity.

5.4 SUMMARY OF FINDINGS

Altogether, eight (8) (apart from the noted farm dams or reservoirs) structures, buildings, or complexes as well as two grave sites were identified as having or potentially having heritage significance. The Lovedale grave site includes graves dating back to 1920. Therefore, the graves in question are protected by the NHRA, and have been provisionally graded as Grade III A or of High significance, corresponding with previous ratings as per previous studies (see Section 2.4). Similarly, the Lovedale farm complex has been graded as Grade III A given its connection with the grave site. Corresponding with this grading, the Bossiekom farm complex and associated grave site has similarly been provisionally graded as Grade III A. This suggests that the site must be retained as a heritage register site. In essence, this site must be avoided during the proposed activities. All other farm complexes 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 41 presents a visual summary of the main findings and their locations. Table 4 provides a summary of the different features identified, a description of the feature, as well as the coordinates of a relative central point associated with the find. Note that this list does not include the many farm dams and associated infrastructure.

Table 4: Summary of different finds identified

Feature No.	Description	Ratings and Significance	Coordinate
SG001	Farm Complex – Lovedale. Farm complex may include structures dating 60 years or older.	Grade III A High	29°16'38.01"S, 19°42'21.45"E
SG002	Grave site – Associated with the Lovedale farm complex.	Grade III A High	29°16'48.51"S, 19°42'28.52"E
SG003	Farm Complex – Nuwedam. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°16'47.61"S, 19°47'41.00"E
SG004	Farm Complex – Quaggamaag. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°16'53.61"S, 19°47'32.71"E
SG005	Farm Complex – Hartebeesvlei. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°18'50.49"S, 19°54'9.39"E
SG006	Farm Complex – Soutputs. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°22'21.81"S, 20°9'2.13"E
SG007	Grave site – Associated with the Bossiekom farm complex.	Grade III A High	29°24'12.57"S, 20°6'25.62"E
SG008	Farm Complex – Bossiekom. Farm complex may include structures dating 60 years or older.	Grade III A High	29°24'8.36"S, 20°6'34.03"E
SG009	Farm Complex – Vaalkop. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°22'43.11"S, 20°2'9.39"E
SG010	Farm Complex – Kraandraai. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	29°22'40.23"S, 20°4'23.38"E

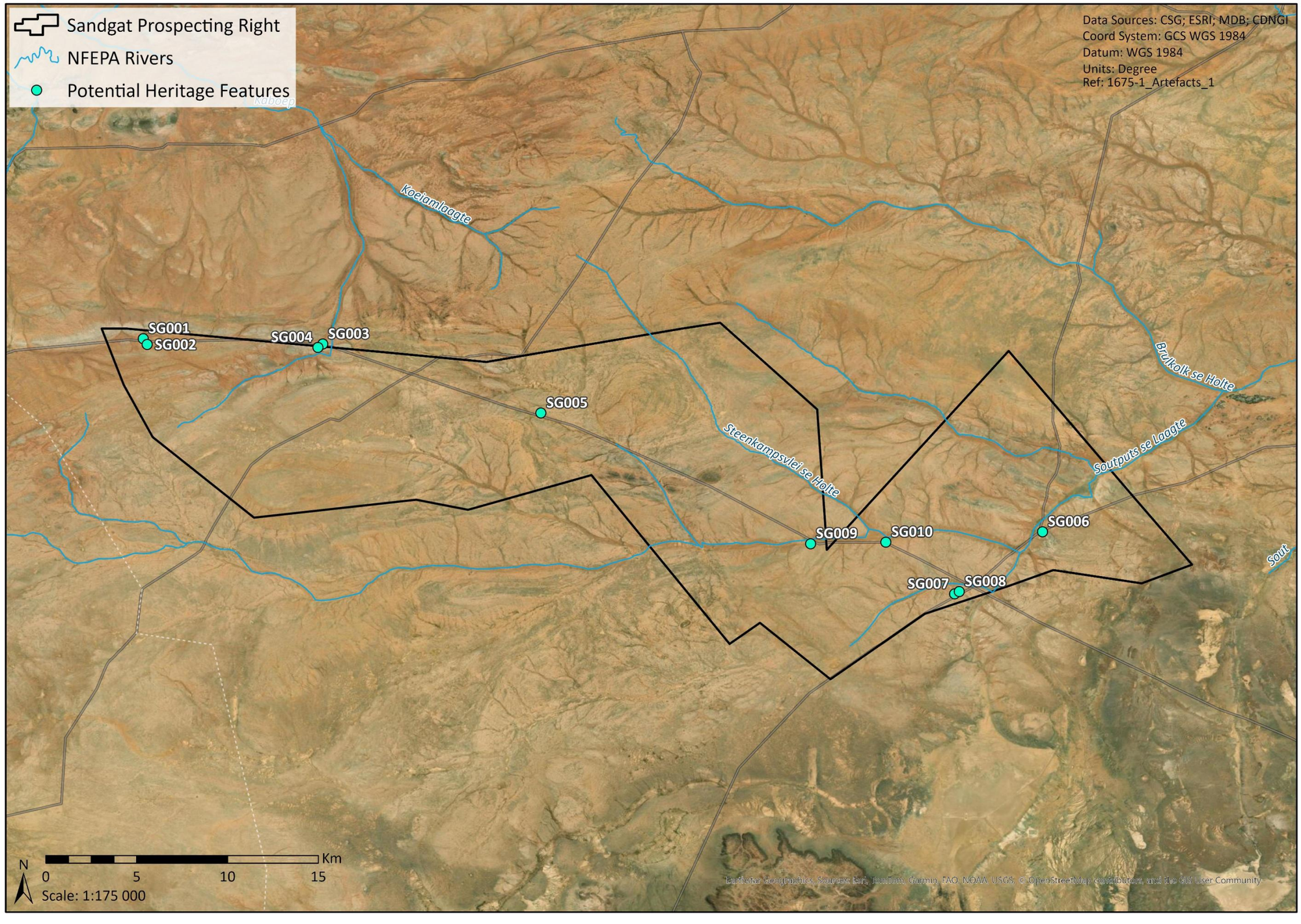


Figure 41: Map of potential heritage features across the PR area

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

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

As described in previous sections, finds include the identified eight (8)(apart from farm dams or reservoirs) structures, buildings, or complexes as well as two 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. Although farm dams and associated infrastructure was identified, these features were not graded and not considered given that many of these features may not hold heritage value. The developer is reminded that these features may still be protected by the NHRA and verification with an Archaeologist is suggested prior to disturbing these features. This can be accomplished through a pre-drilling survey as detailed below.

As a mitigation measure considering that final borehole locations will be determined at a later stage in the development, is the proposal of the conducting of pre-drilling surveys. Undertaken by an Archaeologist once a drilling location has been identified, a short report can subsequently be compiled to supplement the desktop findings of this assessment identifying any heritage features which may be impacted on by proposed activities.

While the features identified represent markers of heritage significance (in particular, the 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.

A key impact identified was that on sense of place. The proposed activities, although short-term, will have an impact on the overall sense of place of the area, altering its cultural significance. In this regard, while heritage features may not be affected by the proposed activities, the activities may alter the landscape which may, in

itself, hold intangible heritage value. The implementation of buffers and avoidance of identified features during construction is presented as a mitigation measure to decrease the impact of activities on the overall sense of place of the site.

Altogether, post-mitigation of the identified heritage impacts is rated a Medium to Low Negative, given 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	Pre-Mitigation Significance2	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final Score	Post-mitigation Significance
Heritage Structures (HS)	Destruction or disturbance of structures older than 60 years	Alternative 1	Construction	-1	2	5	2	5	-3,5	2	-7	Medium to low -	-1	2	1	1	1	-1,25	1	-1,25	Low -	Medium	1	1	1,00	-1,25	Low -
Graves (G)	Destruction or disturbance of identified graves (Lovedale and Bossiekom)	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 -
Sense of place (SP)	Disturbance of overall sense of place	Alternative 1	Construction	-1	2	5	3	3	-3,25	4	-13	Medium to high -	-1	1	2	3	3	-2,25	3	-6,75	Medium to low -	High	2	2	1,25	-8,44	Medium to low -
Unidentified below-ground heritage features (U)	Destruction or disturbance of below-ground heritage features.	Alternative 1	Construction	-1	1	5	4	5	-3,75	3	-11,25	Medium to high -	-1	1	1	2	3	-1,75	3	-5,25	Medium to low -	Medium	1	2	1,13	-5,91	Medium to low -
Palaeontology (P)	Refer to Appendix 3 for PDA Report.	Alternative 1	Construction	-1	1	5	2	5	-3,25	2	-6,5	Medium to low -	-1	1	5	3	1	-2,5	1	-2,5	Low -	Medium	1	3	1,25	-3,13	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 12 provides a breakdown of recommendations and mitigations to be considered for inclusion in the EMPr related to this project. These mitigations are associated with construction phase which may involve clearing of vegetation and removal of topsoil for drilling activities. Firstly, mitigation measures here advise for the avoidance of identified heritage features. Further the mitigation measures recommended serves to address the potential of further discoveries.

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
Drilling of boreholes which 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), Sense of place (SP), Unidentified below-ground heritage features (U), and Palaeontology (P).	• A 30m buffer around all confirmed heritage structures must be implemented, within which no proposed activities are to take place. • A 50m buffer around all confirmed graves must be implemented within which no proposed activities are to take place. • A pre-drilling survey undertaken by an Archaeologist is proposed once borehole locations are determined. A supplementary report is to be prepared highlighting any additional impacts on heritage features identified. • 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 CHANCE FIND PROCEDURE

A Chance Find Procedure is applicable where finds are identified during 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:

- If a chance find is made, the person responsible for the find must immediately stop working, and all work in the immediate vicinity of the find must stop as well.
- 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 Desktop Heritage Impact Assessment for the proposed BMM Sandgat 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.

9 REFERENCES

Backwell, L. *et al.* (2023) 'Border Cave, South Africa', in, pp. 1297–1310. Available at: https://doi.org/10.1007/978-3-031-20290-2_84.

Calabrese, J.A. (2000) 'Metals, Ideology and Power: The Manufacture and Control of Materialised Ideology in the Area of the Limpopo-Shashe Confluence, c.AD 900 to 1300', *Goodwin Series*, 8, pp. 100–111. Available at: https://doi.org/10.2307/3858051.

Cawthorn, R.G. (2010) 'The Platinum Group Element Deposits of the Bushveld Complex in South Africa', *Platinum Metals Review*. Johnson Matthey. Available at: https://doi.org/10.1595/147106710X520222.

Chazan, M. *et al.* (2012) 'The Oldowan horizon in Wonderwerk Cave (South Africa): Archaeological, geological, paleontological and paleoclimatic evidence', *Journal of Human Evolution*, 63(6), pp. 859–866. Available at: https://doi.org/10.1016/j.jhevol.2012.08.008.

Chirisa, I. and Matamanda, A. (2019) 'Forces shaping urban morphology in Southern Africa Today: unequal interplay among people, practice and policy', *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 12(3), pp. 354–372. Available at: https://doi.org/10.1080/17549175.2019.1626262.

Davids, A. (2018) *Afrikaans van die Kaapse Moslems*. Western Cape: Taal Museum.

Deacon, J. (1997) 'My heart stands in the hill': rock engravings in the Northern Cape', *Kronos: Journal of Cape History*, 24(1), pp. 18–29.

Delius, P., Maggs, T. and Schoeman, M. (2012) 'Bokoni: Old Structures, New Paradigms? Rethinking Pre-colonial Society from the Perspective of the Stone-Walled Sites in Mpumalanga', *Journal of Southern African Studies*, 38(2), pp. 399–414. Available at: https://doi.org/10.1080/03057070.2012.682841.

Durand, J.F. (2012) 'The impact of gold mining on the Witwatersrand on the rivers and karst system of Gauteng and North West Province, South Africa', *Journal of African Earth Sciences*, 68, pp. 24–43. Available at: https://doi.org/10.1016/j.jafrearsci.2012.03.013.

d'Errico, F. *et al.* (2012) 'Early evidence of San material culture represented by organic artifacts from Border Cave, South Africa', *Proceedings of the National Academy of Sciences*, 109(33), pp. 13214–13219. Available at: https://doi.org/10.1073/pnas.1204213109.

Favreau, J. (2023) 'Sourcing Oldowan and Acheulean stone tools in Eastern Africa: Aims, methods, challenges, and state of knowledge', *Quaternary Science Advances*, 9, p. 100068. Available at: https://doi.org/10.1016/j.qsa.2022.100068.

FORSSMAN, T.R. *et al.* (2010) 'A LATER STONE AGE ASSEMBLAGE FROM CANTEEN KOPJE, NORTHERN CAPE', *The South African Archaeological Bulletin*, 65(192), pp. 204–214.

Gribble, J. (2002) 'Past, Present, and Future of Maritime Archaeology in South Africa', in C.V. Ruppé and J.F. Barstad (eds) *International Handbook of Underwater Archaeology*. Boston, MA: Springer US, pp. 553–567. Available at: https://doi.org/10.1007/978-1-4615-0535-8_33.

Hall, M. (1993) 'The Archaeology of Colonial Settlement in Southern Africa', *Annual Review of Anthropology*, 22, pp. 177–200.

Harrison, P. and Zack, T. (2012) 'The power of mining: the fall of gold and rise of Johannesburg', *Journal of Contemporary African Studies*, 30(4), pp. 551–570. Available at: https://doi.org/10.1080/02589001.2012.724869.

Henshilwood, C.S. (2012) 'Late Pleistocene Techno-traditions in Southern Africa: A Review of the Still Bay and Howiesons Poort, c. 75–59 ka', *Journal of World Prehistory*, 25(3), pp. 205–237. Available at: https://doi.org/10.1007/s10963-012-9060-3.

Huffman, T.N. (1982) 'Archaeology and ethnohistory of the African Iron Age', *Annual review of Anthropology*, pp. 133–150.

Huffman, T.N. (1989) 'Ceramics, settlements and Late Iron Age migrations', *African Archaeological Review*, 7(1), pp. 155–182. Available at: https://doi.org/10.1007/BF01116842.

Huffman, T.N. (2000) 'Mapungubwe and the Origins of the Zimbabwe Culture', *Goodwin Series*, 8, pp. 14–29. Available at: https://doi.org/10.2307/3858043.

Huffman, T.N. (2002) 'Regionality in the Iron Age: the case of the Sotho-Tswana', *Southern African Humanities*, 14, pp. 1–22.

Huffman, T.N. (2004) 'The archaeology of the Nguni past', *Southern African Humanities*, 16(1), pp. 79–111.

Huffman, T.N. (2007) *Handbook to the Iron Age: The Archaeology of Pre-colonial Farming Societies in Southern Africa*. Scottville: University of KwaZulu-Natal Press.

Huffman, T.N. (2009) 'Mapungubwe and Great Zimbabwe: The origin and spread of social complexity in southern Africa', *Journal of Anthropological Archaeology*, 28(1), pp. 37–54. Available at: https://doi.org/10.1016/j.jaa.2008.10.004.

Jacobs, Z. *et al.* (2008) 'Ages for the Middle Stone Age of southern Africa: implications for human behavior and dispersal', *Science*, 322(5902), pp. 733–735.

James, L. (2018) *Plants of the walls: Studying the relationship between plants and stone walls of the Klipriviersberg Nature Reserve*. Unpublished Honour's Research Report. University of the Witwatersrand.

Klein, R.G. (2000) 'The earlier stone age of southern Africa', *The South African Archaeological Bulletin*, pp. 107–122.

Kuman, K. *et al.* (2018) 'The Oldowan industry from Swartkrans cave, South Africa, and its relevance for the African Oldowan', *Journal of Human Evolution*, 123, pp. 52–69. Available at: https://doi.org/10.1016/j.jhevol.2018.06.004.

Kuman, K. and Gibbon, R.J. (2018) 'The Rietputs 15 site and Early Acheulean in South Africa', *New perspectives on Acheulean and Acheulean-like adaptations*, 480, pp. 4–15. Available at: https://doi.org/10.1016/j.quaint.2016.12.031.

Leakey, M.D. (1971) *Olduvai Gorge: Volume 3, excavations in beds I and II, 1960-1963*. Cambridge University Press.

Li, H. *et al.* (2018) 'Handaxes in South Africa: Two case studies in the early and later Acheulean', *New perspectives on Acheulean and Acheulean-like adaptations*, 480, pp. 29–42. Available at: https://doi.org/10.1016/j.quaint.2016.08.025.

Maggs, T. (1976) 'Iron age patterns and Sotho history on the southern Highveld: South Africa', *World Archaeology*, 7(3), pp. 318–332. Available at: https://doi.org/10.1080/00438243.1976.9979644.

Markell, A., Hall, M. and Schrire, C. (1995) 'The historical archaeology of Vergelegen, an early Farmstead at the Cape of Good Hope', *Historical Archaeology*, 29(1), pp. 10–34. Available at: https://doi.org/10.1007/BF03374206.

Mesfin, I.I. (2024) 'The Knapping of Quartz Crystals during the Later Stone Age at Matupi Cave, Ituri Province, Democratic Republic of Congo', *Lithic Technology*, 49(1), pp. 41–62. Available at: https://doi.org/10.1080/01977261.2023.2188342.

Meyer, A. (2000) 'K2 and Mapungubwe', *Goodwin Series*, 8, pp. 4–13. Available at: https://doi.org/10.2307/3858042.

Mitchell, P. (2012) 'San origins and transition to the Later Stone Age: New research from Border Cave, South Africa', *South African Journal of Science*, 108(11/12), p. 2 pages.

Mitchell, P. and Whitelaw, G. (2005) 'THE ARCHAEOLOGY OF SOUTHERNMOST AFRICA FROM c. 2000 BP TO THE EARLY 1800s: A REVIEW OF RECENT RESEARCH', *The Journal of African History*. 2005/07/01 edn, 46(2), pp. 209–241. Available at: https://doi.org/10.1017/S0021853705000770.

Morris, D. (2016) 'Snake and veil: the rock engravings of Driekopseiland, Northern Cape, South Africa', in *Seeing and Knowing*. Routledge, pp. 37–53.

Morris, D. (2022) 'River, Rock, and "The Rain's Magic Power": Rock Art and Memory in the Northern Cape, South Africa', in L.F. Zubieta (ed.) *Rock Art and Memory in the Transmission of Cultural Knowledge*. Cham: Springer International Publishing, pp. 245–267. Available at: https://doi.org/10.1007/978-3-030-96942-4_11.

Morrissey, P., Mentzer, S.M. and Wurz, S. (2022) 'A Critical Review of the Stratigraphic Context of the MSA I and II at Klasies River Main Site, South Africa', *Journal of Paleolithic Archaeology*, 5(1), p. 5. Available at: https://doi.org/10.1007/s41982-022-00110-2.

van Riet Lowe, C. (1952) *The rock engravings of Driekops Eiland*. Algeria (Congrès Panafricain de Préhistoire : Actes de la IIe session).

Sadr, K. (2012) 'The origins and spread of dry laid, stone-walled architecture in pre-colonial southern Africa', *Journal of Southern African Studies*, 38(2), pp. 257–263.

SADR, K. and MSHUQWANA, F. (2020) 'KWENENG', *The South African Archaeological Bulletin*, 75(212), pp. 75–86.

Sadr, K. and Rodier, X. (2012) 'Google Earth, GIS and stone-walled structures in southern Gauteng, South Africa', *Journal of Archaeological Science*, 39(4), pp. 1034–1042. Available at: https://doi.org/10.1016/j.jas.2011.11.024.

Stollhofen, H. *et al.* (2021) 'Olduvai's oldest Oldowan', *Journal of Human Evolution*, 150, p. 102910. Available at: https://doi.org/10.1016/j.jhevol.2020.102910.

Thompson, L.M. (2001) *A history of South Africa*. Yale University Press.

Villa, P. *et al.* (2009) 'The still bay points of Blombos cave (South Africa)', *Journal of Archaeological Science*, 36(2), pp. 441–460.

Villa, P. *et al.* (2012) 'Border Cave and the beginning of the Later Stone Age in South Africa', *Proceedings of the National Academy of Sciences*, 109(33), pp. 13208–13213. Available at: https://doi.org/10.1073/pnas.1202629109.

Wadley, L. (2015) 'Those marvellous millennia: the Middle Stone Age of Southern Africa', *Azania: Archaeological Research in Africa*, 50(2), pp. 155–226. Available at: https://doi.org/10.1080/0067270X.2015.1039236.

Walker, S.J., Lukich, V. and Chazan, M. (2014) 'Kathu Townlands: a high density Earlier Stone Age locality in the interior of South Africa', *PLoS One*, 9(7), p. e103436.

Werz, B.E.J.S. (2010) 'SUB-SAHARAN AFRICA'S OLDEST SHIPWRECK: HISTORICAL-ARCHAEOLOGICAL RESEARCH OF AN EARLY MODERN-ERA PORTUGUESE MERCHANTMAN ON THE NAMIBIAN COAST', *The Mariner's Mirror*, 96(4), pp. 430–442. Available at: https://doi.org/10.1080/00253359.2010.10657159.

Woodborne, S., Pienaar, M. and Tiley-Nel, S. (2009) 'Dating the Mapungubwe Hill Gold', *Journal of African Archaeology*, 7(1), pp. 99–105. Available at: https://doi.org/10.3213/1612-1651-10122.

Wurz, S. (2002) 'Variability in the Middle Stone Age Lithic Sequence, 115,000–60,000 Years Ago at Klasies River, South Africa', *Journal of Archaeological Science*, 29(9), pp. 1001–1015. Available at: https://doi.org/10.1006/jasc.2001.0799.

Appendix 1: CV of the Archaeologist

Appendix 2: Specialist Declaration

Appendix 3: Palaeontology Desktop Assessment

CURRICULUM VITAE

Name:	Lucien Nicolas James
Nationality:	South African
Date of Birth:	4 May 1993
Profession:	Environmental Consultant and Archaeologist
Professional Qualification/ Training:	BA (Archaeology and Geography); Wits University, 2017
	BSc (Hons) Geography, Archaeology and Environmental Studies; Wits University, 2018
	MSc (Geography); Wits University, 2021
	Ph. D. (Geography); Wits University, 2024
Professional Membership/ Registrations:	Registered Candidate Environmental Assessment Practitioner (EAPASA reg. no. 2023/6772)
	Accredited Professional Archaeologist (ASAPA member no. 0619)
Publications:	James, L. & Simatele, M.D. 2024. Bystanders or active participants? Mobilising meaningful participation in River Basin Management: Lessons from the Gauteng Province, South Africa. *International Journal of River Basin Management.* https://doi.org/10.1080/15715124.2024.2417405.
Current Employer:	Environmental Impact Management Services (Pty) Ltd.

KEY EXPERIENCE

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

CAREER SUMMARY

Period: Current	Organisation: EIMS	Position: Environmental Consultant and Archaeologist
Key Projects/Assignments	Project experience: • AEMFC Herbert Prospecting Basic Assessment – Public Participation • Aries-Kronos 400kV Powerline Upgrade – Project Assistance, on-site specialist oversight, Water Use License • Block 3B/4B Oil and Gas Offshore Exploration EIA – Public Participation • ENEL Solar PV – External Audit • Harmony Freddies to Target Pipeline Part 1 EA Amendment and WUL Amendment – Project Management • Harmony FSN Pipeline Basic Assessment – Public Participation • Harmony Kusasalethu Pipeline Basic Assessment – Public Participation • Harmony Mispah Pipeline Basic Assessment – Public Participation • Harmony Nooitgedacht TSF EIA – Public Participation • Harmony Valley TSF EIA – Public Participation • Kusile Power Station Temporary Stacks MES Postponement and AEL Variation Application • Mine Waste Solutions Kareerand Pipeline Basic Assessment – Public Participation • Mooiplaats WUL Amendment – Project Management • Mulilo Struisbult PV2 EMPr Amendment – Public Participation • Mulilo Struisbult PV2 Grid Connection Basic Assessment – Public Participation • Selkirk Avenue Development Pipeline Basic Assessment and EMPr – Project Assistance • Sibanye KDT1 Remining EIA – Public Participation and Heritage Impact Assessment (Exemption) • Sibanye Western Limb Tailings Re-treatment Facility Retrofitting Basic Assessment – Public Participation • Tetra4 Cluster 2 Gas Production EIA – Public Participation • Tetra4 Powerline Basic Assessment – Public Participation • Thungela Lephalale CBM EIA – Public Participation and Water Use License	
Heritage Project/ Assignments	• Motouane RBD12 Pre-drill Survey Heritage Reporting	

	• Glencore RCM Phase 1 HIA • BMM Sandgat Prospecting Desktop HIA • BMM Oubip Prospecting Desktop HIA • Aqua Farming Droogfontein Pivot Agriculture HIA

LANGUAGE CAPABILITY

Language	Speak	Read	Write
English	Excellent	Excellent	Excellent
Afrikaans	Basic	Intermediate	Intermediate
French	Excellent	Excellent	Excellent
Spanish	Basic	Intermediate	Intermediate
Latin	N/A	Basic	Basic

DECLARATION

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications at the time of signature.

Signature of Staff Member

24/01/2025

Date

EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES		SPECIALIST DECLARATION	
EIMS Ref	1675	Project Name	BMM Sandgat Prospecting BA

Project Details

Project Name	BMM Sandgat Prospecting BA
Applicant	Black Mountain Mining (Pty) Ltd
Competent Authority	DMRE

Specialist Details

Specialist Company	Environmental Impact Management Services (Pty) Ltd			
Specialist Name	Lucien James			
Contact details	Tel	0117897170	Cell	0812376735
	E-mail	lucien@eims.co.za		
	Postal Address	PO Box 2083, Pinegowrie 2123, South Africa		
	Physical Address	8 Dalmeny Road, Pine Park, Randburg		

General Declaration

By signing this form, I hereby declare that:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.
- All the particulars furnished by me this form are true and correct.

A 8 Dalmeny Road, Pine Park, Randburg
E mail@eims.co.za | **W** www.eims.co.za | **F** (086) 571- 9047 | **T** (011) 789-7170
P PO Box 2083, Pinegowrie 2123, South Africa

- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Undertaking Under Oath/Affirmation

By signing this form, I swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signatures

Specialist					
Name	Lucien James	Signature		Date	14/01/2025
Commissioner of Oaths					
Name		Signature		Date	
Commissioner of Oaths Official Stamp					

A 8 Dalmeny Road, Pine Park, Randburg
E mail@eims.co.za | **W** www.eims.co.za | **F** (086) 571- 9047 | **T** (011) 789-7170
P PO Box 2083, Pinegowrie 2123, South Africa

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL DESKTOP ASSESSMENT

SANDGAT PROSPECTING RIGHT APPLICATION, IN THE NAMAQUALAND DISTRICT, IN THE NORTHERN CAPE PROVINCE

June 2026

Compiled for ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PTY) LTD (EIMS)

Declaration of Independence

I, Elize Butler, declare that –

- I act as the independent palaeontological specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations, and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected of a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal, or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

SIGNATURE: 

This Palaeontological Impact Assessment Report (as part of the Heritage Impact Assessment), has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 (as amended), requirements for specialist reports, Appendix 6, as indicated in the Table 1 below.

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix 2	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix 2**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Methods and TOR	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Executive Summary, Section 8	Desktop Assessment
(e) a description of the methodology adopted in preparing the report or carrying out the	Section 4 Approach and Methodology	-

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
specialised process inclusive of equipment and modelling used		
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Executive Summary, Section 8	
(g) An identification of any areas to be avoided, including buffers	Executive Summary, Section 8	
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Executive Summary, Section 8	
(k) Any mitigation measures for inclusion in the EMPr	Section 9	
(l) Any conditions for inclusion in the environmental authorisation	Section 9	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Executive Summary, Section 8	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Executive Summary, Section 8	

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Executive Summary, Section 8	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
		specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by EIMS to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed Sandgat Prospecting Right (PR) Application in the Northern Cape Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the planned development area and to evaluate the potential impact of the proposed development on the Palaeontological Heritage of the area.

The study area is basically underlain by the potentially fossiliferous Late Cenozoic surface layers of the Kalahari Group, as well as the Dwyka Group (Karoo Supergroup). At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province. The PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database indicates that the Palaeontological Sensitivity of the study area is Moderate, Low and Zero (Almond et al, 2013; SAHRIS website), while the National Environmental Web-based Screening Tool indicates that the development has a Medium, Low and Unknown Palaeontological Sensitivity.

The fossil assemblages of the Kalahari Group are generally very low in diversity and occur over a wide range, the Dwyka Group has a Moderate Palaeontological Sensitivity while the Namaqua-Natal Province is unfossiliferous and thus have a Zero Palaeontological Sensitivity. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries should be protected and the ECO must report the finding to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) to ensure that appropriate mitigation measures can be carried out by a palaeontologist. Preceding the collection of any fossil material, the specialist would need to apply for a collection permit from SAHRA. Furthermore, collected fossil material must be housed in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the Sandgat PR Application Project.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Fossil

A fossil is the preserved remains or traces of an organism that lived in the distant past, typically millions of years ago. Fossils may include mineralized skeletal structures, shells, or other durable components of ancient flora and fauna, as well as impressions, moulds, and casts formed in sedimentary rock as a result of the decomposition of the organism's remains. These preserved remnants offer significant insights into the evolutionary processes and biodiversity of past species, thereby enabling scientists to investigate and comprehend

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act No 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

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

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past (other than fossil fuels or fossiliferous rock intended for industrial use) and any site which comprises of fossilised remains or traces of past life.

.

LIST OF ABBREVIATIONS

BA	Basic Assessment
BMM	Black Mountain Mining (Pty) Ltd
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
DM	District Municipality
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
LM	Local Municipality
Ma	Millions of years ago
MPRDA	Mineral and Petroleum Resources Development Act
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PSSA	Palaeontological Society of South Africa
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference

1 INTRODUCTION

Black Mountain Mining (Pty) Ltd (BMM) (the Applicant) has submitted an application for a Prospecting Right in terms of Section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA) and an Application for Environmental Authorization in terms of Chapter 4 of GNR 982 promulgated under the National Environmental Management Act (Act 107 of 1998) (NEMA) to prospect for ferrous and base metals (Copper Ore, Iron Ore, Lead, Ore, Zinc Ore, Manganese Ore, Nickel and Molybdenum), precious metals (Gold Ore, Silver Ore), and all associated metals and minerals.

The proposed project will aim to ascertain if economically viable mineral deposits exist within the application area. In order to undertake prospecting activities, Black Mountain Mining will require a Prospecting Right in terms of the Mineral and Petroleum Resources Development Act (MPRDA, Act No.28 of 2002). The Applicant is also required to obtain an Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA, Act No. 107 of 1998) which involves the submission of a Basic Assessment Report (BAR). Environmental Impact Management Services (Pty) Ltd (EIMS) have been appointed by Black Mountain Mining to compile the BAR (this report) in support of the Prospecting Right application submitted by EIMS on behalf of Black Mountain Mining, which in turn will be submitted to the DMR for adjudication.

The area is located approximately 75 to 138 km east of Aggeneys and 25 to 85 km east of Pofadder, Namaqualand District, Northern Cape Province. The associated farms of the PR area are located across the Kai! Garib Local Municipality of the ZF Mgcawu District Municipality, as well as the Khai-Ma Local Municipality of the Namakwa District Municipality, in the Northern Cape Province. The area is 92 642.783276 hectares (Ninety-two thousand six hundred and forty-two hectares). The prospecting area cover 10 farms namely; Puts Berg 203, Ganna- Poort 202, Lovedale 201, Guagga- Maag 200, Haartebeestvlei 199, Vaalkop 225, Adjoining Geelvloer 197, Graaf Water 198, Sandgat 150 and Long Ziekvlei 151.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Mrs. Elize Butler has completed almost 850 palaeontological impact assessments, including assessments in the Free State, KwaZulu-Natal, Eastern, Western and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga Provinces of South Africa.,. She has more than 30 years of experience in the field and an MSc (cum laude) in Zoology from the University of the Free State in South Africa with a focus in Palaeontology. She is adept at locating, collecting, and storing fossils. In 2006, she became a member of the Palaeontological Society of South Africa (PSSA), and in 2014, she began performing PIAs.

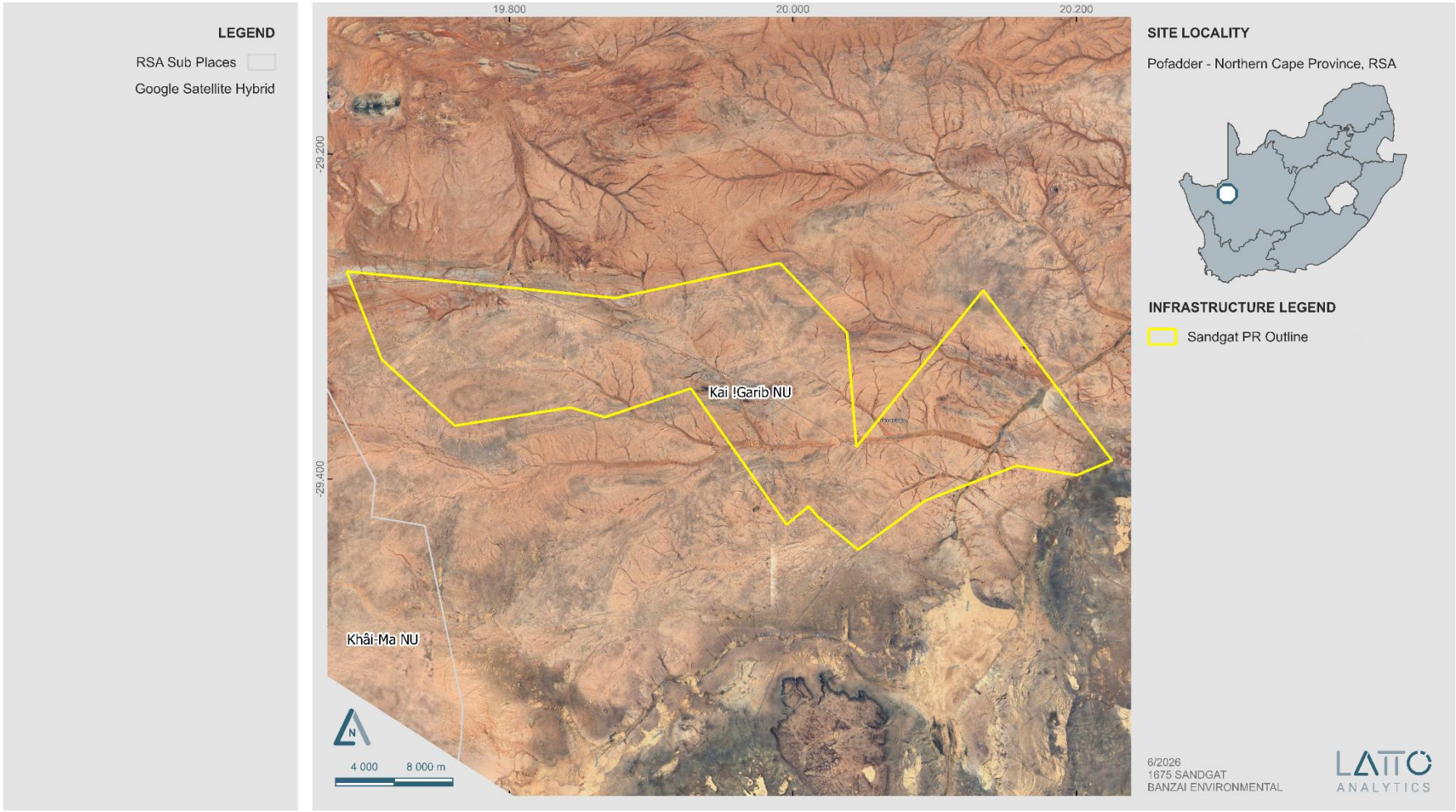


Figure 1: Regional locality of the Sandgat PR Application in the Northern Cape Province.

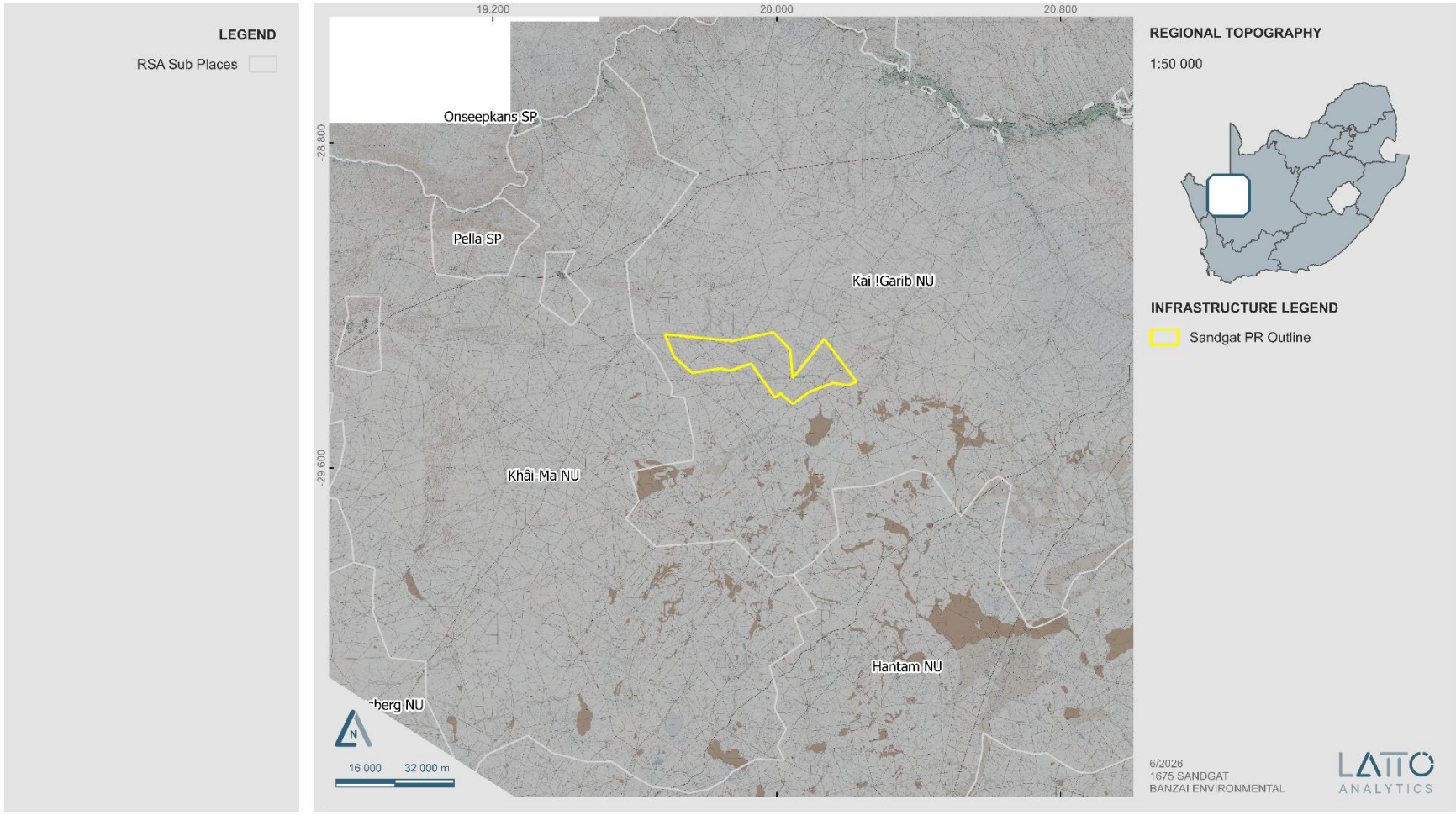


Figure 2: Site locality of the proposed Sandgat PR Application in the Northern Cape Province.

3 NATIONAL HERITAGE RESOURCES ACT (25 OF 1999)

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens".

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

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural*

heritage".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to Section 38 (1), an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 METHODS AND TERMS OF REFERENCE

This PDA assesses the development's potential impact on the fossil heritage. This Palaeontological Assessment is part of the HIA Report. The PIA's goals are to: 1) identify the palaeontological significance of the rock formations in the footprint; 2) evaluate the palaeontological magnitude of the formations; 3) clarify the impact on fossil heritage; and 4) make recommendations for how the developer might protect and minimize potential harm to fossil heritage, according to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports".

Calculations of the palaeontological state of each rock segment and the potential impact of development on fossil history take into account the palaeontological status of the rocks, the type of development, and the amount of bedrock removed.

The Provisional DFFE Screening Tool, the SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports for the same area, Google Earth images, topographical and geological maps, as well as academic articles about specimens from the development area and Assemblage Zones, are all used to create Basic Assessment reports.

When the development footprint has a moderate to high palaeontological sensitivity, a field-based assessment is necessary. A desktop or field assessment of the exposed rock is used to evaluate the significance of the proposed development's impact, and recommendations for more research or mitigation are made. Excavations for the project often only take place during the building phase, changing the terrain and destroying or permanently encasing fossils at or below the ground surface. Then, access to Fossil Heritage will no longer be available for academic study.

When doing a site investigation, a palaeontologist examines the local development as well as the quantity and variety of fossils found there. This can be demonstrated by looking at representative fossiliferous rock exposures (most igneous and metamorphic rocks are not fossiliferous, whereas sedimentary rocks contain fossil heritage). Examined rock exposures frequently contain a sizeable portion of the stratigraphic unit, which is primarily made up of recently exposed (unweathered) rock. These exposures may be man-made (such as quarries, open building excavations, even railway and road cuttings) or natural (such as cliffs, and dongas as well as rocky outcrops along stream or river banks). It is usual practice for palaeontologists to record well-preserved fossils (GPS, and stratigraphic data) during field assessment examinations.

Although mitigation is often done prior to construction, it may take place if potentially fossiliferous bedrock is revealed during construction for example; fossil collection and documentation. A permit from SAHRA must be obtained before beginning any fossil excavation, and the material must be stored at an authorised facility. When mitigation is properly used, it is possible to have a positive impact by raising awareness of the palaeontological past of the area.

By physically evaluating bedrock outcrops to determine their lithology and fossil richness and crisscrossing the development footprint, one can assess an area's fossil potential. Because the presence of fossils at the surface is so unexpected, an average sample size of the region is investigated. To be clear, however, the lack of fossils in a development footprint does not automatically suggest that there is no palaeontologically important material present on the site (on or below the ground surface).

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014 (as amended);
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Describe of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Describe location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area;
- Identify sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluate the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Detail the implications of specialist findings for the proposed development (such as permits, licenses etc.).

4.1 Assumptions and Limitations

The geology of the area is primarily represented in geological maps, with the accompanying sheet explanations not being specifically focused on palaeontological heritage. Numerous inaccessible regions in South Africa have yet to be examined by palaeontologists, and as a result, available data often relies heavily on aerial imagery. The locality and geological information found in museums and university databases is frequently outdated, and historical data is not always properly documented.

In addition, comparable Assemblage Zones from other regions are used to infer the presence of fossils in areas that have not been previously studied. When conducting Desktop studies, it is generally assumed

that fossil exposures exist within the footprint based on the similarities of the geological formations and Assemblage Zones in other areas.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The Sandgat PR Application is depicted on the 1:250 000 Pofadder 2918 (2007) and 2920 Kenhardt (1998) Geological Map (Council for Geosciences, Pretoria) (Figure 3). The study area is basically underlain by the potentially fossiliferous Late Cenozoic surface layers of the Kalahari Group(Q), as well as the Dwyka Group (Pmb/ C-Pd; Karoo Supergroup). The Kalahari Group comprise of red coloured aeolian sand and dunes (Q-s1) and sand, scree, rubble and sandy soil (Q-s2). Almond (2019) described the Late Cenozoic surface layers of the Gordonia Formation (Kalahari Group) as primarily thin, unconsolidated deposits comprising of patches of calcretes (soil limestones), small gravelly to sandy river alluvium, pan sediments along watercourses, colluvium (scree), surface gravels and Quaternary to Recent aeolian (wind-blown) sands. At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province. The basement rocks of the Namaqua-Natal Province comprise mainly of highly metamorphosed sediments and volcanic rocks (amphibolites gneisses, quartzites and schists) as well as major granitic and gabbroic (norite) intrusions, dated between 2050 and 1000 Ma (Cornell et al., 2006). Basement inliers form small surface outcrops that are entirely unfossiliferous. Inliers comprise of (Aggeneys Subgroup, Wortel Formation, ƙwr); Droëboom Group (Klipvlei Formation, ƙkv) and Gladkop Metamorphic Suite (Koeipoort Gneiss, ƙkop) and Gabaib Granite (Ngb). The 1: 1 000 000 geological map indicates that the majority of the study area is underlain by the Kalahari Formation (K-Qk), with inliers of the Aggeneys Subgroup (EC-STa); Namies Suid Gneiss (STns); Koeipoort Granite (STkp) and Kamiesberg Group (EC-STm) (Council for Geosciences, Pretoria) (Figure 4). According to the PalaeoMap (Figure 5, Table 2) on the South African Heritage Resources Information System (SAHRIS) database the Palaeontological Sensitivity of the study area is Moderate (green), Low (blue) and Zero (grey) (Almond et al, 2013; SAHRIS website). The National Environmental Web-based Screening Tool indicates that the development has a Medium (yellow), Low (green) and Unknown (white) Palaeontological Sensitivity (Figure 6). An extract of the Palaeotechnical report of the Northern Cape is indicated in Table 3 with the preliminary sensitivity rating in Table 4 (Almond, J and Pether, J. 2009).

The Dwyka Group (pmb) is Late Carboniferous to Early Permian in age (300-290 million years ago (Ma) and overlies glaciated Precambrian bedrock faces along the northern margin of the basin. Visser (1986) identified several types of lithofacies which he perceived to be deposited in a marine basin.
The Dwyka Group is divided into northern and southern facies (Visser, 1981) due to the distinctive lithological variations over the basin. The Mbizane Formation consists mainly of the northern inlet facies which is characterised by thickness changes, extremely varying lithology and low massive diamictite (~20 %) and high mudrock (~40%) content. Visser et al. (1990) and Von Brunn and Visser (1999) found

that the Dwyka rocks in the Douglas-Prieska area (close to the northern edge of the Main Karoo Basin) belong to the Mbizane Formation which can be up to 190 m thick. The Elandsvlei Formation is the southern platform and are depicted by a high massive diamictite (~70%) and low mudrock (~8%) content, gradual southernly increase in thickness (100 m to 800 m). Debris eroded, from the highlands was deposited by a ground ice sheet but in the west fluctuations in the ice front caused bedded diamictons and subaqueous and subglacial outwash sediments (Visser *et al* 1987). The key Reference Stratotype C section for the Mbizane Formation is situated a few km west of Douglas on the northern side of the Vaal River (Von Brunn & Visser, 1999).

The Permo-Carboniferous Dwyka Group is known for its track-ways (trace fossils), which are also known as ichnofacies, that were formed by fish and arthropods, while fossilized coprolites (faeces) have also been recovered. Body fossils comprise gastropods, invertebrates, and marine fish. Fossil plants include a rich diversity of conifers, glossopterids, cordaitaleans, ginkgoaleans, horsetails, lycopods, pollens and fern spores (Almond and Pether, 2008). Fossil assemblages of the Kalahari are generally low in diversity that occur over a wide range. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods, and trace fossils. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter. Fossils are mostly associated with ancient lakes, pans, and river systems.

The basement inliers scattered through the study area are made up of a variety of weather-resistant igneous and high-grade metamorphic rocks, mostly amphibolites, gneisses, quartzites, and schists of Late Precambrian (Mokolian/Mid-Proterozoic) age. The ancient basement rocks belong to the Namaqua Sector within the Namaqua-Natal Province and are estimated to be one to two billion years old (Cornell et al., 2006; Moen, 2007; Agenbacht, 2007; Moen & Toogood, 2007). The various units of the Mokolian basement in the study area are detailed in the corresponding sheet descriptions and comprise (1) older Keisian rocks, including the gneisses of the Gladkop Metamorphic Suite and metasediments from the Bushmanland Group (Aggenys Subgroups), and (2) younger Namaquan metasediments and intrusive rocks. Due to the absence of fossils in these basement rocks, they will not be discussed in detail in this report.

The study area is located within the Namaqua Mobile Belt, a tectonostratigraphic terrane that is divided into multiple terranes (Hartnady et al., 1985; Colliston et al., 1989; Colliston & Schoch, 1991; Thomas et al., 1994). The Aggeneys Subgroup comprises of six formations (Colliston, et al., 1989). The Wortel Formation forms the lowermost and oldest formation and is followed by the younger Witputs Formation, Skelmpoort Formation, T'hamma berg Formation, Hotson Formation (Praekelt, et al., 1992), and the youngest Koeris Formation. The Koeipoort Gneiss (dates to 1800 Ma) are also present in the study area. These metamorphic rocks igneous in origin and thus unfossiliferous.

The Kalahari Group sediments range in age from Quaternary to Recent, and they contain sand and gravel that were most likely deposited as braided fluvial or sheet wash. A layer of surface gravel and colluvial deposits is also present, but not shown on the geological map (Almond, 2019). The surface sediments are occasionally overlain by unconsolidated dune sand from the Gordonia Formation. The satellite image shows dunes as orange-to-red linear formations (Figure 1). The Kalahari Group sediments cover the majority of the study area (Figure 3-4). The deposits are Cenozoic in age, while the sands and gravel range from Quaternary to Recent. These sediments were most likely from braided fluvial systems (Q-s2). The deposits include alluvial fan deposits, fluvial gravels and sands, colluvial deposits, and lacustrine deposits. The Gordonia Formation, which is made up of unconsolidated aeolian sands, date from the Pleistocene to the Holocene (Q-s1). The Bushmanland Group is totally unfossiliferous, according to PIAs done by Almond (Almond, 2011; Almond, 2017; 17 Almond, 2019).

The Late Cretaceous to Recent Kalahari Group's geology has been thoroughly studied by Haddon (2000), Thomas & Shaw (1991), Dingle et al. (1983), Partridge et al. (2006), and Thomas (1981). The unconsolidated, reddish aeolian sands of the Gordonia Formation, referred to as "Kalahari sands," are the uppermost section of the Kalahari Group sequence. The sands are estimated to date from the Late Pliocene/Early Pleistocene to the present, with certain sections dated by Middle to Late Stone Age lithic artefacts (Dingle et al., 1983, p. 291). Recent modifications to the Pliocene-Pleistocene border, now adjusted from 1.8 Ma to 2.588 Ma, include the whole Gordonia Formation into the Pleistocene Epoch.

The majority of the sand in this formation is believed to have originated locally (Partridge et al., 2006). In the research region, these sands include scarce, vegetated linear dune formations in the south of the study area. Certain dune fields may originate from the Pleistocene epoch. In regions where sands are modified by fluvial processes and sheet wash, the sands may exhibit a greyish or white colouration as a result of leaching. In certain locations, the sand may reach a thickness of up to 40 meters. These unconsolidated sands are frequently underpinned by thin surface gravels, which may be residual (down-wasted) or water-transported clasts, in addition to calcretes of Plio-Pleistocene or more recent origin (Mokalanen Formation). Calcrete formation is often more prevalent in low-lying regions, particularly adjacent to basic intrusions, but it is not indicated on the pertinent 1:250 000-scale maps of the study area.

The Kalahari Group's paleontological research has yielded a substantial quantity of fossils. Fossil biotas encompass a varied array of organisms, including mammals, reptiles, and trace fossils. Nonetheless, it is crucial to note that the fossil record in this region is very sparse, with ongoing study and excavation indicating the potential for more fossil discoveries. Vertebrate faunal remains have been recovered from the alluvial strata of the Koa River Palaeovalley system next to Bosluis Pan. The fossil fauna is believed to be around 15 to 16 million years old. The fossils comprise rare bones, molars, tusks, and parts of

Gomphotherium teeth. The latter was a browsing proboscidean characterised by four teeth and rounded cusps.

Crocodile teeth, fragments of tortoise shells, rhinoceros remains, bovids, elephant shrews, giraffids, and an air-breathing catfish have all been excavated from the Kalahari Group. Fossilised teeth of the three-toed horse, Hipparion namaquense, were discovered in Areb within a granitic grit deposit situated beneath a calcrete layer. Fossils of the dinosaur species *Kangnasaurus coetzeei* were discovered in a well on Farm Kangnas in the Orange River area. The specimen is thought to be part of an iguanodontian ornithopod dinosaur genus that lived during the Early Cretaceous period.

A molar, possible postcranial remains, a nearly complete femur, cervical vertebrae, and rib fragments were among the recovered artefacts (Haughton, 1915; Cooper, 1985). Plant relics, including peats and palynomorphs (pollen and spores), have been identified in biologically rich alluvial deposits next to Platbakkies. Quaternary sedimentary strata may include fossil remains and human artefacts, including ancient stone tools, which are significant for both palaeontology and archaeology. Surface gravel deposits resulting from sheet wash and downwasting processes may include enduring silicified wood fragments, together with bones and teeth reintroduced from ancient sedimentary layers. These surface gravels may contain petrified wood fragments from the Karoo Supergroup or Tertiary alluvium.

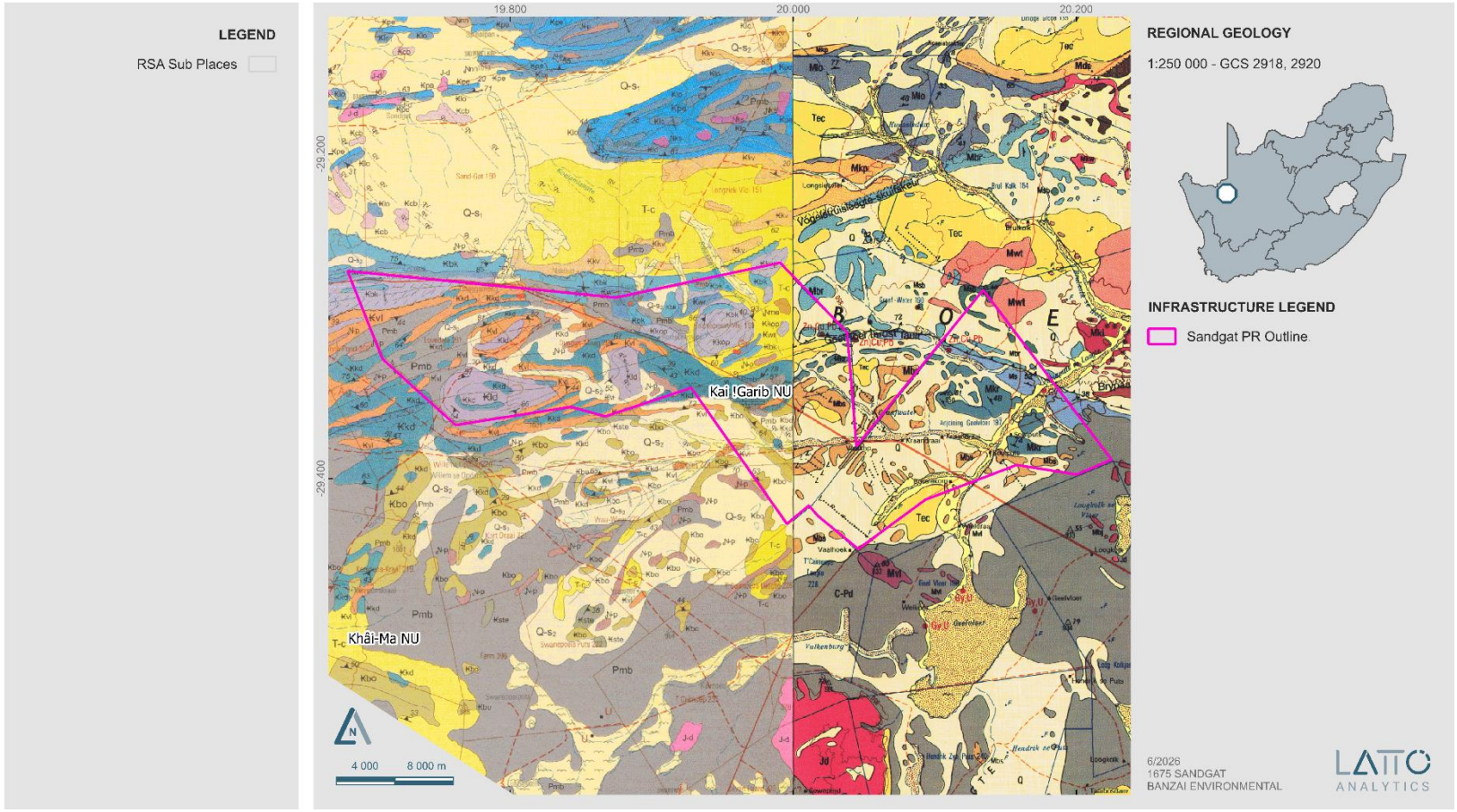


Figure 3. Extract of the Pofadder 2918 (2007) Geological Map (Council for Geosciences, Pretoria) indicating that the study area is mantled by red coloured aeolian sand and dunes (Q-s1) and sand, scree, rubble and sandy soil (Q-s2) as well the unfossiliferous Namaqua-Natal Province basement rocks comprising of highly metamorphosed sediments and volcanic rocks as well as major granitic and gabbroic (norite) intrusions.

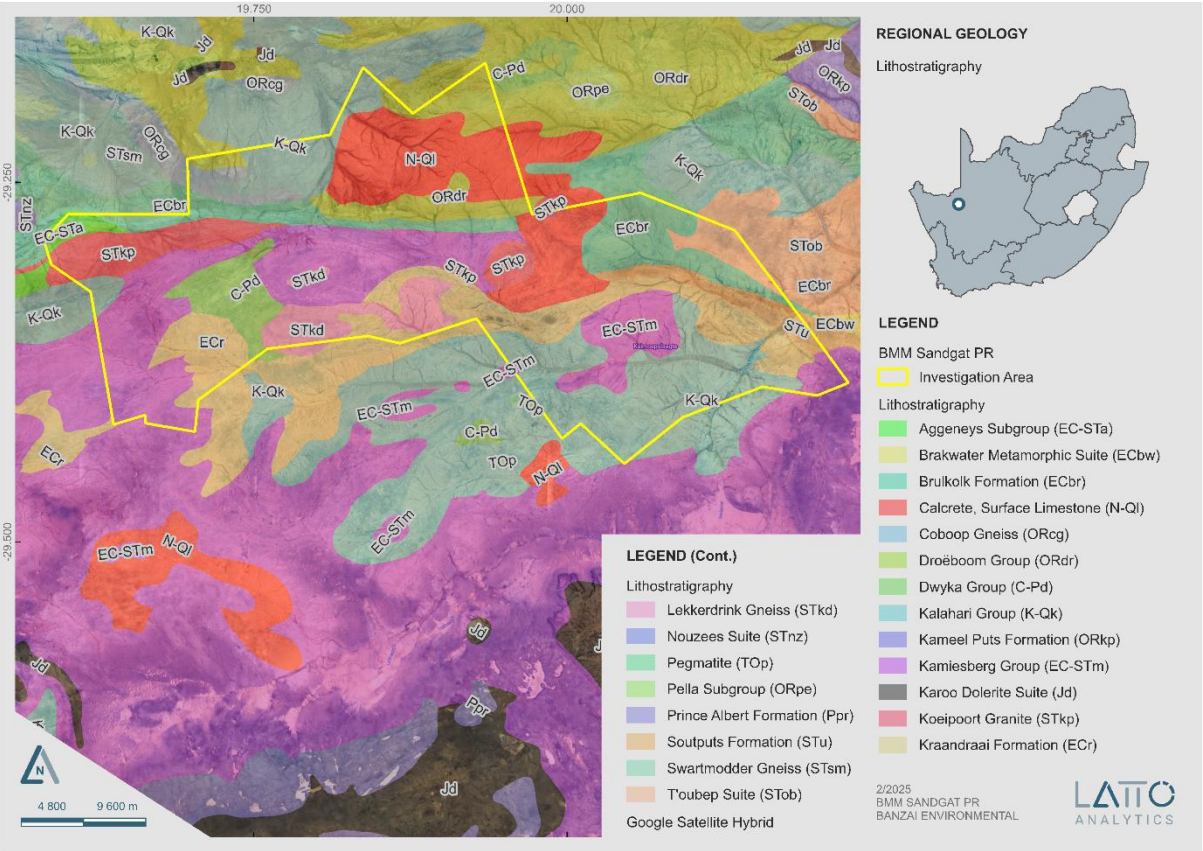


Figure 4: Updated geology (2014, Council for Geosciences, Pretoria) indicates that the majority of the study area is mantled by the Kalahari Group (k-qk), with basement inliers of the Aggeneys Subgroup (EC-STa); Namies Suid Gneiss (STns); Koeipoort Granite (STkp) and Kamiesberg Group (EC-STm).

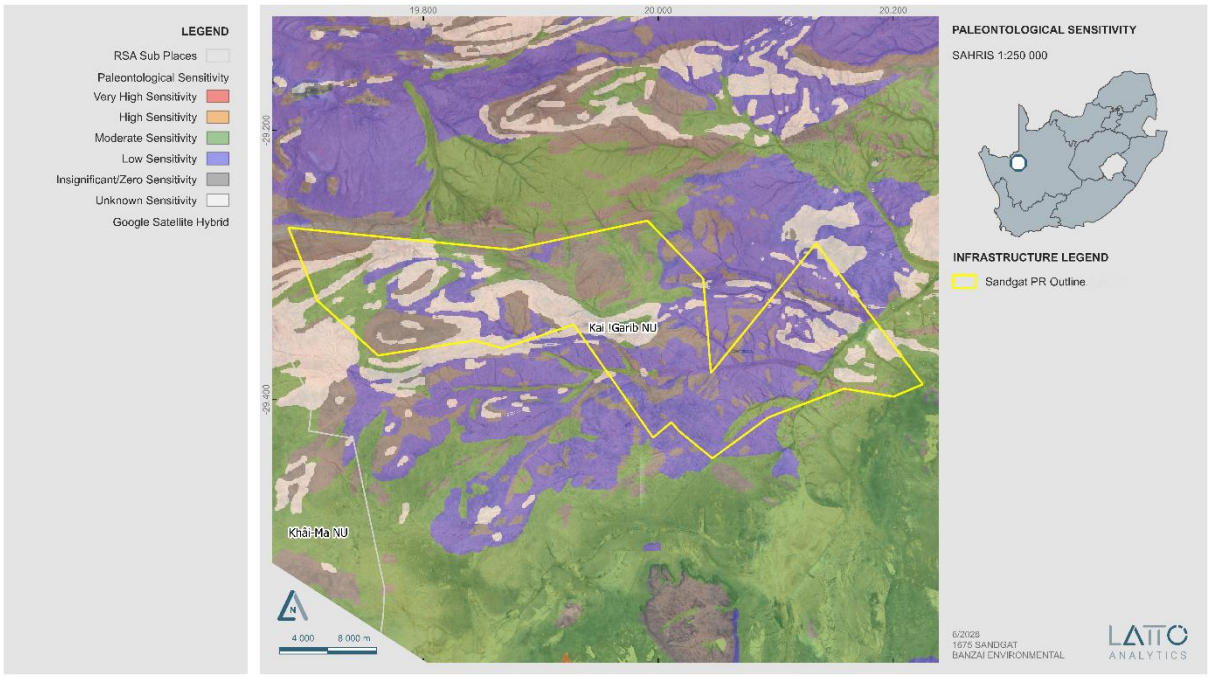
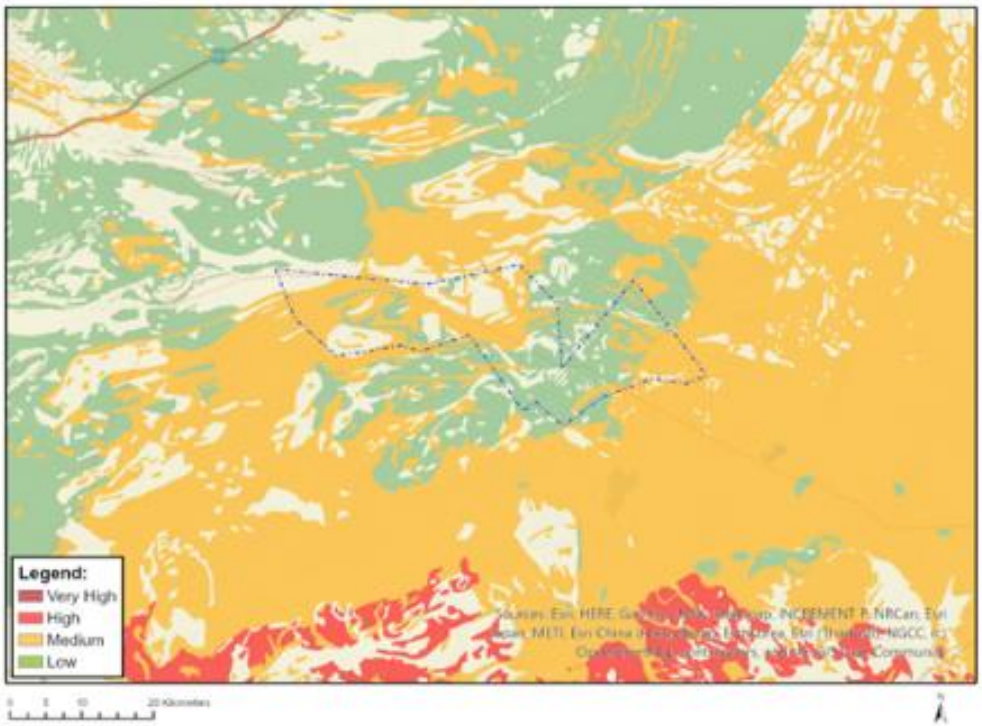


Figure 5: Extract of the SAHRIS PalaeoMap map (Council of Geosciences) indicates that the development is underlain by sediments with a Moderate (green), Low (blue) and Zero (grey) Palaeontological Sensitivity.

Table 2:Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).		
Colour	**Sensitivity**	**Required Action**
RED	VERY HIGH	Field assessment and protocol for findings is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	**MODERATE**	**Desktop study is required**
BLUE	**LOW**	**No palaeontological studies are required however a protocol for finds is required**
GREY	**INSIGNIFICANT/ZERO**	**No palaeontological studies are required**
WHITE/CLEAR	**UNKNOWN**	**These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.**

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Medium (yellow), Low (green), while areas with an unknown (white) sensitivity (Figure 5) is also crossed. Due to the Low Palaeontological Sensitivity (SAHRIS, Figure 5 and DFFE Figure 6) of the site no site investigation was conducted for this project. However, desktop research of the study site has indicated that the Paleontological Sensitivity of the area is LOW.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		x	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Features with a Low paleontological sensitivity
Medium	Features with a Medium paleontological sensitivity

Figure 6: Palaeontological Sensitivity of the study site by the National Environmental Web-based Screening Tool indicates a Medium (yellow), Low (green) and Unknown (white) Palaeontological Sensitivity.

Table 3: Extract of the Northern Cape Palaeotechnical report (Almond, J and Pether, J. 2009) present in the study area

19. OTHER CAENOZOIC FLUVIAL, LACUSTRINE & TERRESTRIAL DEPOSITS OF INTERIOR **(Most too small to be indicated on 1: 250 000 geological maps)** ***eg* Kwaggaskop, Dasdap, Vaalputs, Arries Drift, Windsorton, Rietputs, Riverton Fms**		Fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes, spring tufa / travertine, cave deposits, peats, colluvium Late Cretaceous /Palaeocene to Holocene	Bones and teeth of wide range of mammals, including mammals (*eg* teeth & bones of mastodont proboscideans, rhinos, bovids, horses, micromammals), reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*eg* termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, diatom floras, peats and palynomorphs. Calcareous tufas at edge of Ghaap Escarpment might be highly fossiliferous (*cf* Taung in NW Province – abundant Makapanian Mammal Age vertebrate remains, including australopithecines)	Scattered records, many poorly studied and of uncertain age Reflect ancient drainage systems of subcontinental interior (eg Geelvloer – Koa River Valley system, Palaeo-Orange and Vaal systems) Include fossil equivalents of famous Arriesdrift Mid Miocene fauna from S. Namibia (*eg* at Bosluispan, Proto-Orange Terrace Gravels of lower Orange River) Fossils threatened by alluvial diamond mining (Vaal & Mid to Lower Orange River gravels) Orange River Man (100-50 Ka, *H. heidelbergensis*) See archaeological literature for fossil & subfossil remains from archaeological sites (eg Wonderwerk Cave nr Kuruman, Kathu Pan near Sishen)
18. KALAHARI GROUP **Wessels (Tw), Budin (Tb), Eden (Te), Mokalanen (T-Qm), Obobogorop, Gordonia (Qg) and Lonely Formations**		Fluvial gravels, sands, lacustrine and pan mudrocks, diatomites and diatomaceous limestones, evaporites, consolidated to unconsolidated aeolian sands, pedocretes (especially calcrete) Late Cretaceous to Recent <90 Ma → 0 Ma	Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (*eg* termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell *etc*), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes	Fossils mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs?) but v. rarely exposed.
12. DWYKA GROUP (C-Pd) Late Carboniferous – Early Permian *c.* 320-290 Ma	**12c. Mbizane Fm** Early Permian	Varied glacially-related sediments, including valley glacier deposits (tillites, conglomerates, sandstones mudrocks)	Low diversity non-marine trace fossil assemblages (predominantly fish, arthropod traces, *Rhizocorallium*) scattered vascular plant remains (*eg* *Glossopteris* leaves, petrified wood)	Restricted to N. margin of Main Karoo Basin. Overlies basement (N)or Elandsvlei Fm (S). Reports of stromatolites, oolites in limestone lenses require confirmation.
	12b. Elandsvlei Fm Late Carboniferous – Early Permian	Predominantly massive tillites, with interglacial mudrocks at intervals	Interglacial mudrocks occasionally with low diversity marine fauna of invertebrates (molluscs, starfish, brachiopods, coprolites *etc*), palaeoniscoid fish, petrified wood, leaves (rare) and palynomorphs of *Glossopteris* Flora. Well-preserved non-marine ichnofauna (traces of fish, arthropods) in laminated mudrocks. Possible stromatolites, oolites at top of succession.	Main Dwyka subunit within south and central portion of Main Karoo Basin. Body fossils v. rare. Richer interglacial & postglacial biotas recorded from southern Namibia (*eg Eurydesma* fauna) and may eventually be traced into N. Cape. Reports of stromatolites require confirmation.
	12a. "Red Dwyka" Late Carboniferous (>300Ma)	Glacial tillites, proglacial outwash sandstones & conglomerates, glaciolacustrine mudrocks *etc.*	Well-preserved, non-marine trace fossil assemblages (mainly of fish, arthropods), sparse *Glossopteris* Flora plant remains (wood, twigs, leaves)	This unit occurs just south of Orange River, extending into S. Namibia. Underlies Elandsvlei Fm.
4. NAMAQUA METAMORPHIC PROVINCE **large number of subunits (M*….)**		Igneous and metamorphic rocks (including high grade metasediments) Early to Mid Proterozoic (Mokolian) *c.* 2-1 Ga	NO FOSSILS RECORDED	Check map keys to identify metamorphic and igneous rocks

Table 4: Palaeontological Significance of Rock units in the Northern Cape Paleotechnical Report (Almond, J and Pether, J. 2009).

COLOUR OF ROCK UNIT	PALAEONTOLOGICAL SIGNIFICANCE / VULNERABILITY	RECOMMENDED ACTION
RED	very high	field scoping study recommended before excavation takes place
PURPLE	high	desk top study + scoping study may be necessary
GREEN	moderate	desk top study
BLUE	low	no action required (any fossil finds to be reported by developer)
BLACK	insignificant or zero	no action required

NB.1. These significance / vulnerability ratings are *provisional*
NB.2. Some rock units are largely unfossiliferous, but have thin subunits of high palaeontological significance (*eg* Table Mountain Group).

6 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984).
- Google Earth© satellite imagery.
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website.
- Background information was obtained from EIMS.
- National Environmental Web-based Screening Tool
- 1:250 000 Pofadder 2918 (2007) and 2920 Kenhardt (1998) Geological Map *(Council for Geosciences, Pretoria)*
- PIAs in the area include Almond, 2010a, 2010b, 2011, 2012a, 2012b, 2012c, 2013,2 017,2 019); Bamford, 2018.

7 ASSESSMENT METHODOLOGY

Table 5: Summary of Impact Tables

Identifier	Discipline	Impact	Alternative	Phase	Event	Pre-Nature	Pre-Extent	Pre-Duration	Pre-Magnitude	Pre-Reversibility	Consequence	Pre-Probability	Pre-Mitigation Significance Score	Pre-Mitigation Significance	Post-Nature	Post-Extent	Post-Duration	Post-Magnitude	Post-Reversibility	Consequence2	Post-Probability	Post-mitigation Significance Score	Post-Mitigation Significance	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score	Post-Mitigation Significance
1	Palaeontology	Loss of fossil Heritage	No	Construction	Normal Operation	- 1	1	5	2	5	-3.5	2	-6.6	-Medium to Low	-1	1	5	1	5	-3	1	-3	-Low	High	1	3	1.25	-3.75	-LOW

8 FINDINGS AND RECOMMENDATIONS

The study area is basically underlain by the potentially fossiliferous Late Cenozoic surface layers of the Kalahari Group, as well as the Dwyka Group (Karoo Supergroup). At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province. The PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database indicates that the Palaeontological Sensitivity of the study area is Moderate, Low and Zero (Almond et al, 2013; SAHRIS website), while the National Environmental Web-based Screening Tool indicates that the development has a Medium, Low and Unknown Palaeontological Sensitivity.

The fossil assemblages of the Kalahari Group are generally very low in diversity and occur over a wide range, the Dwyka Group has a Moderate Palaeontological Sensitivity while the Namaqua-Natal Province is unfossiliferous. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries should be protected and the ECO must report the finding to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) to ensure that appropriate mitigation measures can be carried out by a palaeontologist. Preceding the collection of any fossil material, the specialist would need to apply for a collection permit from SAHRA. Furthermore, collected fossil material must be housed in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.
These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the Sandgat PR Application Project.

The fossil assemblages of the Kalahari Group are generally very low in diversity and occur over a wide range, while the Namaqua-Natal Province is unfossiliferous. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries should be protected and the ECO must report the finding to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) to ensure that appropriate mitigation measures can be carried out by a palaeontologist. Preceding the collection of any fossil material, the specialist would need to apply for a collection permit from SAHRA. Furthermore, collected fossil material must be housed in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

9 MITIGATION AND EMPR REQUIREMENTS

The naturally preserved remnants (or traces) of plants or animals embedded in rock are known as fossils. These plants and animals existed millions of years ago in the geologic past. Fossils are incredibly valuable and difficult to replace. It is possible to identify the environmental conditions in a certain geographical area millions of years ago by analysing fossils.

This fact sheet is intended for construction workers and foremen. It describes what to do if fossil material is discovered accidentally during mining.

It is the responsibility of the project's Environmental Control Officer (ECO) or site manager to train the workers and foremen on what to do if a fossil is accidentally discovered. In the absence of the ESO, a member of staff must be designated to be accountable for the effective application of the chance discovery protocol so that the conservation of fossil material is not jeopardised.

If fossils are discovered during excavation, the following method shall be followed:

9.1 Legislation

Cultural Heritage in South Africa (including all heritage resources) is protected by the National Heritage Resources Act (Act No 25 of 1999) (NHRA). According to Section 3 of the Act, all Heritage resources include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens".

The NHRA protects and owns the state's palaeontological legacy, which is unique and non-renewable. It is consequently the responsibility of the state to manage and protect fossils on behalf of South African citizens. According to Section 35 of the NHRA, palaeontological resources may not be excavated, broken, transferred, or destroyed by any development without previous assessment and a permit from the relevant heritage resources authority.

9.2 Chance Find Procedure

- If a chance find is made, the person responsible for the find must immediately stop working, and all work in the immediate vicinity of the find must stop as well.

- The individual who discovered the item must immediately notify his or her direct supervisor, who must then notify his or her management and the ECO or site manager. The ECO or site manager must notify the relevant Heritage Agency (South African Heritage Resources Agency, SAHRA) of the discovery. (Contact information: SAHRA, 111 Harrington Street, Cape Town, South Africa. PO Box 4637, Cape Town 8000, South Africa. Fax: +27 (0)21 462 4509. Tel: 021 462 4502. Web address: www.sahra.org.za). Photographs of the find from various perspectives, as well as GPS coordinates, must be submitted to the Heritage Agency.
- Within 24 hours of the discovery, a preliminary report must be sent to the Heritage Agency, which must include the following: 1) the date of finding; 2) a description of the discovery; and 3) a description of the fossil and its context (depth and position of the fossil), as well as GPS coordinates.
- Photographs of the discovery (the more the merrier) must be of high quality, in focus, and accompanied by a scale. Photographs of the vertical part (side) where the fossil was discovered are also required.
- Upon receipt of the preliminary report, the Heritage Agency will notify the ECO (or site manager) whether a palaeontologist rescue excavation or collection is required.
- The fossil site must be guarded to prevent future damage. There should be no attempt to remove material from their environment. Stabilize the exposed items and cover them with a plastic sheet or sand bags. The Heritage organization will also be able to advise on the best way to protect the find.
- If the fossil cannot be stabilized, the ECO (site manager) may carefully collect the fossil.
- Once the Heritage Agency has received the written authorization, the mine may continue with the mining activity in the affected area.
- Fossil finds must be placed in tissue paper and in an appropriate box while necessary care must be taken to remove any fossil material from the rescue site.

10 BIBLIOGRAPHY

AGENBACHT, A.L.D. 2007. The geology of the Pofadder area. Explanation of 1: 250 000 geology sheet 2918. 89 pp. Council for Geoscience, Pretoria.

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences. Schweitzer *et al*. (1995) pp. p288.

ALMOND, J.E. & PETHER, J. 2009. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

ALMOND, J.E. 2008b. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience. Pretoria, 32 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2010a. Proposed wind farm near Springbok, Namaqualand, Western and Northern Cape Provinces. Palaeontological impact assessment: desktop study, 8 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2010b. Prospecting application for iron ore and manganese between Sishen and Postmasburg, Northern Cape Province: farms Jenkins 562, Marokwa 672, Thaakwaneng 675, Driehoekspan 435, Doringpan 445 and Macarthy 559: desktop palaeontological assessment, 20 pp. Natura Viva cc, Cape Town.

Almond, J. E., 2011. Proposed photovoltaic project at Black Mountain near Aggeneys, Northern Cape Province, Natura Viva cc, PO Box 12410 Mill Street, Cape Town 8010

ALMOND, J.E. 2012a. Proposed Wind and Solar (Photovoltaic) Energy Facilities on Kangnas Farm near Springbok in the Northern Cape. Palaeontological specialist study: desktop assessment, 21 pp.

ALMOND, J.E. 2012b. Proposed westerly extension of Sishen Iron Ore Mine near Kathu, Kalagadi District Municipality, Northern Cape. Palaeontological specialist study" desktop study, 18 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2012c. Proposed 16 Mtpa expansion of Transnet's existing manganese ore export railway line & associated infrastructure between Hotazel and the port of Ngqura, Northern & Eastern Cape. Part 1: Hotazel to Kimberley, Northern Cape. Palaeontological assessment: desktop study, 28 pp.

ALMOND, J. E., 2017. Proposed Aggeneis-Paulputs 400 kV Transmission Powerline and Substation Upgrades, Namaqua and Siyanda Districts, Northern Cape Province, Cape Town, South Africa: Natura Viva cc.

ALMOND, J. E., 2019. Two proposed photovoltaic energy facilities on the farms Naroep (remainder of farm No. 45) and Haramoep (remainder of farm No. 53) near Aggeneys, Namaqua District Municipality, Northern Cape, Cape Town, South Africa: Natura Viva cc.

ALMOND, J. E., 2011. *Proposed photovoltaic project at Black Mountain near Aggeneys, Northern Cape Province,* Natura Viva cc, PO Box 12410 Mill Street, Cape Town 8010

ALMOND, J. E., 2017. *Proposed Aggeneis-Paulputs 400 kV Transmission Powerline and Substation Upgrades, Namaqua and Siyanda Districts, Northern Cape Province,* Cape Town, South Africa: Natura Viva cc.

ALMOND, J. E., 2019. *Two proposed photovoltaic energy facilities on the farms Naroep (remainder of farm No. 45) and Haramoep (remainder of farm No. 53) near Aggeneys, Namaqua District Municipality, Northern Cape,* Cape Town, South Africa: Natura Viva c

BAMFORD. M. 2018. Palaeontological Impact Assessment for the proposed mining operation near Nababeep and Springbok, Northern Cape Province.

BAMFORD, M.K. & DE WIT, M.C.J. 1993. Taxonomic description of fossil wood from Cainozoic Sak River terraces, near Brandvlei, Bushmanland, South Africa. *Palaeontologia Africana* 30: 71-80.

BAMFORD, M.K. 2000a. Fossil woods of Karoo age deposits in South Africa and Namibia as an aid to biostratigraphical correlation. *Journal of African Earth Sciences* 31, 119-132.

BARNOSKY, A.D. 2005. Effects of Quaternary Climatic Change on Speciation in Mammals. *Journal of Mammalian Evolution.* 2005(12):247-264, June.

COLLISTON, W. P., PRAEKELT, H. E. & SCHOCH, A. E., 1989. A broad perspective (Haramoep) of geological relations was established by sequence mapping in the Proterozoic Aggeneys Terraine, Bushmanland. South African Journal of Geology, Volume 92, pp. 42-48.

COLLISTON, W. P. & SCHOCH, A. E., 1991. A progressive ductile shear model for the Proterozoic Aggeneys Terrane, Namaqua mobile belt, South Africa. *Precambrian Research,* Volume 49, pp. 205-215.

CORNELL, D.H., THOMAS, R.J., MOEN, H.F.G., REID, D.L., MOORE, J.M. & GIBSON, R.L. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

COOPER, M. R., 1985. A revision of the ornithischian dinosaur Kangnasaurus coetzeei Haughton, with a classification of the Ornithischia. *Annals of the South African Museum,* 95(8), pp. 281-317.

DE WIT, M.C.J. & BAMFORD, M.K. 1993. Fossil wood from the Brandvlei area, Bushmanland as an indication of palaeoenvironmental changes during the Cainozoic. *Palaeontologia Aafricana* 30: 81-89.

DE WIT, M.C.J., MARSHALL, T.R. & PARTRIDGE, T.C. 2000. Fluvial deposits and drainage evolution. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.55-72. Oxford University Press, Oxford.

DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.

GRESSE, P.G., VON VEH, M.W. & FRIMMEL, H.E. 2006. Namibian (Neoproterozoic) to Early Cambrian successions. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 395-420. Geological Society of South Africa, Marshalltown. HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Southern Africa, pp. 173-181. Oxford University Press, Oxford.

HADDON, I.G. 2005. The sub-Kalahari geology and tectonic evolution of the Kalahari Basin, Southern Africa. Unpublished PhD thesis, University of Johannesburg, 343 pp.

HARTNADY, C. H., JOUBERT, P. & STOWE, C. W., 1985. Proterozoic crustal evolution in southwestern Africa. *Episodes,* Volume 8, pp. 236-244.

HAUGHTON, S., 1915. On some dinosaur remains from Bushmanland. *Transactions of the Royal Society of South Africa,* Volume 5, pp. 259-264.

HAUGHTON, S.H. 1932. The fossil Equidae of South Africa. Annalsof the South African Museum 28, 407-427.

MARAIS, J.A.H., AGENBACHT, A.L.D., PRINSLOO, M. & BASSON, W.A. 2001. The geology of the Springbok area. Explanation to 1: 250 000 geology Sheet 2916 Springbok, 103 pp. Council for Geoscience, Pretoria.

MOEN, H.F.G. 2007. The geology of the Upington area. Explanation to 1: 250 000 geology Sheet 2820 Upington, 160 pp. Council for Geoscience, Pretoria.

NASH, D.J. & MCLAREN, S.J. 2003. Kalahari valley calcretes: their nature, origins, and environmental significance. Quaternary International III, 3-22.

ROZENDAAL, A., 1975. The Geology of Gamsberg, Namaqualand, South Africa. 115 ed. University of Stellenbosch: M.Sc. thesis (unpubl.).

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

PICKFORD, M. & SENUT, B. 2002. The fossil record of Namibia. 39 pp. The Geological Survey of Namibia.

PRAEKELT, H. E. & SCHOCH, A. E., 1997. Stratigraphical synthesis of the metasediments of the Aggeneys terrane in the Namaqua Mobile Belt. *South African Journal of Geology,* 100(1), pp. 85-100.

PRAEKELT, H. E. & SCHOCH, A. E., 1997. Stratigraphical synthesis of the metasediments of the Aggeneys terrane in the Namaqua Mobile Belt. *South African Journal of Geology,* 100(1), pp. 85-100.

SG 2.2 SAHRA APMHOB Guidelines, 2012. Minimum standards for palaeontological components of Heritage Impact Assessment Reports, Pp 1-15.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press.

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, R.J., THOMAS, M.A. & MALHERBE, S.J. 1988. The geology of the Nossob and Twee Rivieren areas. Explanation for 1: 250 000 geology sheets 2520-2620. 17pp. Council for Geoscience, Pretoria.

THOMAS, M. J., 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, p. 138.

THOMAS, R. J., CORNELL, D. H., MOORE, J. M. & JACOBS, J., 1994. Crustal evolution of the Namaqua-Natal Metamorphic Province, southern Africa. *South African Journal of Geology,* Volume 97, pp. 8-14.

APPENDIX 1

IMPACT ASSESSMENT

Nature	-1	Likely to result in a negative/ detrimental impact	CONSEQUENCE	ENVIRONMENTAL SIGNIFICANCE
	1	Likely to result in a positive/ beneficial impact		
Extent	1	Activity (i.e. Highly localised, limited to the area applicable to the specific activity)		
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)		
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)		
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).		
	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).		
Duration	1	Immediate (<1 year, quickly reversible)		
	2	Short term (1-5 years, less than project lifespan)		
	3	Medium term (6-15 years)		
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)		
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).		
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected)		
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected, or affected environmental components are already degraded)		
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).		
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)		
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)		
Reversibility	1	Impact is reversible without any time and cost.		
	2	Impact is reversible without incurring significant time and cost.		
	3	Impact is reversible only by incurring significant time and cost.		
	4	Impact is reversible only by incurring prohibitively high time and cost.		

	5	Irreversible Impact		
Probability	1	Improbable (Rare, the event may occur only in exceptional circumstances, the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <5% chance).	PROBABILITY	
	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).		
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).		
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).		
	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).		
Cumulative Impact	1	Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	PRIORITISATION FACTOR	
	2	Medium: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.		
	3	High: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.		
Irreplaceable loss of resources	1	Low: Where the impact is unlikely to result in irreplaceable loss of resources.		
	2	Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.		
	3	High: Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).		
Degree of Confidence	Low	<30% certain of impact prediction		
	Medium	>30 and < 60% certain of impact prediction		
	High	>60% certain of impact prediction		

APPENDIX 2

CURRICULUM VITAE

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	University of the Orange Free State B.Sc Botany and Zoology, 1988
	University of the Orange Free State B. Sc (Hons) Zoology, 1991
	University of the Free State M. Sc. *Cum laude* (Zoology), 2009

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

EMPLOYMENT HISTORY

Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–2022
Banzai Environmental	2016 to present

Elize Butler has conducted approximately 850 Palaeontological Impact Assessments for developments in the Free State, KwaZulu-Natal, Eastern, Northern and Western Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa. She has experience in locating, collecting, and curating fossils. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently.