PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT

For

The Proposed Rehabilitation of Quarry 6 of the Krugerspost Mine, Mashishing, Mpumalanga

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A Phase 1 Archaeological Impact Assessment for the Proposed Rehabilitation of Quarry 6 of the Krugerspost Mine, Mashishing, Mpumalanga

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I, Tobias Coetzee, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Quarry 6 Rehabilitation Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

Date: 16 March 2021

List of Abbreviations

AIA – Archaeological Impact Assessment

CRM – Cultural Resource Management

DMR – Department of Mineral Resources

EIA – Environmental Impact Assessment

ESA – Early Stone Age

GPS – Global Positioning System

ha – Hectare

HIA – Heritage Impact Assessment

km – Kilometre

LIA – Late Iron Age

LSA – Later Stone Age

m – Metre

MASL – Metres Above Sea Level

MEC – Member of the Executive Council

MSA – Middle Stone Age

NEMWA - National Environmental Management Waste Act 59 of 2009 (as amended)

NHRA – National Heritage Resources Act

NEMA - National Environmental Management Act

SAHRA – South African Heritage Resources Agency

Executive Summary

The author was appointed by BECS Environmental (Pty) Ltd to undertake a Phase 1 Archaeological Impact Assessment for the proposed rehabilitation of Quarry 6 of the Imerys Refractory Minerals Krugerspost Mine on Portion 31 of the Farm Klipfontein 400 KT near Lydenburg/Mashishing in the Mpumalanga Province. It should be noted, however, that the existing mining right includes Portion 32 as well. The proposed rehabilitation project is located approximately 20 km north of Mashishing/Lydenburg with the Mpumalanga/Limpopo boundary forming the northern border of Portion 31. Surrounding towns include Steelpoort 34 km to the northwest and Graskop 43 km to the east. The aim of the study is to determine the scope of archaeological resources that could be impacted on by the proposed rehabilitation of Quarry 6.

Three archaeological sites (K01, K03, K04) were observed during the pedestrian survey of Quarry 6. Site K01 consists of a transitional ESA (Early Stone Age) handaxe just inside of the boundary of Quarry 6, while Site K03, also a transitional ESA handaxe, falls to the outside. Site K04, consisting of three undecorated potsherds that possibly date to the LIA (Late Iron Age), falls just outside of the quarry 6 boundary. All three sites, however, are located near the eastern boundary of Quarry 6, outside of the pit section and on a disturbed area of the mine. The archaeological context is therefore regarded as disturbed, resulting in a low site significance. One contemporary site, K02, consists of modern plastic items and are not significant from a heritage perspective.

Subject to adherence of the recommendations and approval by SAHRA, the proposed rehabilitation of Quarry 6 of the Krugerspost Mine as per the indicated demarcation may continue. Should skeletal remains be exposed during rehabilitation, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). Also, should culturally significant material be discovered during the course of the said development, all activities must be suspended pending further investigation by a qualified archaeologist.

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1. Project Background

1.1 Introduction

The author was appointed by BECS Environmental (Pty) Ltd to undertake a Phase 1 Archaeological Impact Assessment for the proposed rehabilitation of Quarry 6 of the Imerys Refractory Minerals Krugerspost Mine. Quarry 6 is located on Portion 31 of the Farm Klipfontein 400 KT near Lydenburg/Mashishing in the Mpumalanga Province (**Table 1 & Figures 1 & 2**). The existing mining right, however, includes Portion 32 as well. The proposed rehabilitation project is located approximately 20 km north of Mashishing/Lydenburg with the Mpumalanga/Limpopo boundary forming the northern border of Portion 31. Surrounding towns include Steelpoort 34 km to the northwest and Graskop 43 km to the east. The purpose of this study is to examine the demarcated portion in order to determine if any archaeological resources of heritage value will be impacted on by the proposed rehabilitation of Quarry 6, as well as to archaeologically contextualise the general study area. The aim of this report is to provide the developer with information regarding the location of heritage resources on the demarcated portion.

The following report discusses the implication for the rehabilitation of Quarry 6 and the associated activities on the demarcated portion of Portion 31 of the Farm Klipfontein 400 KT with regard to heritage resources. The demarcated portion is roughly rectangular in shape, forms the mid-section of Portion 31 and is located in the northern corner of the parent farm. The legislation section included serves as a guide towards the effective identification and protection of heritage resources and will apply to any such material unearthed during the project within the demarcated study area.

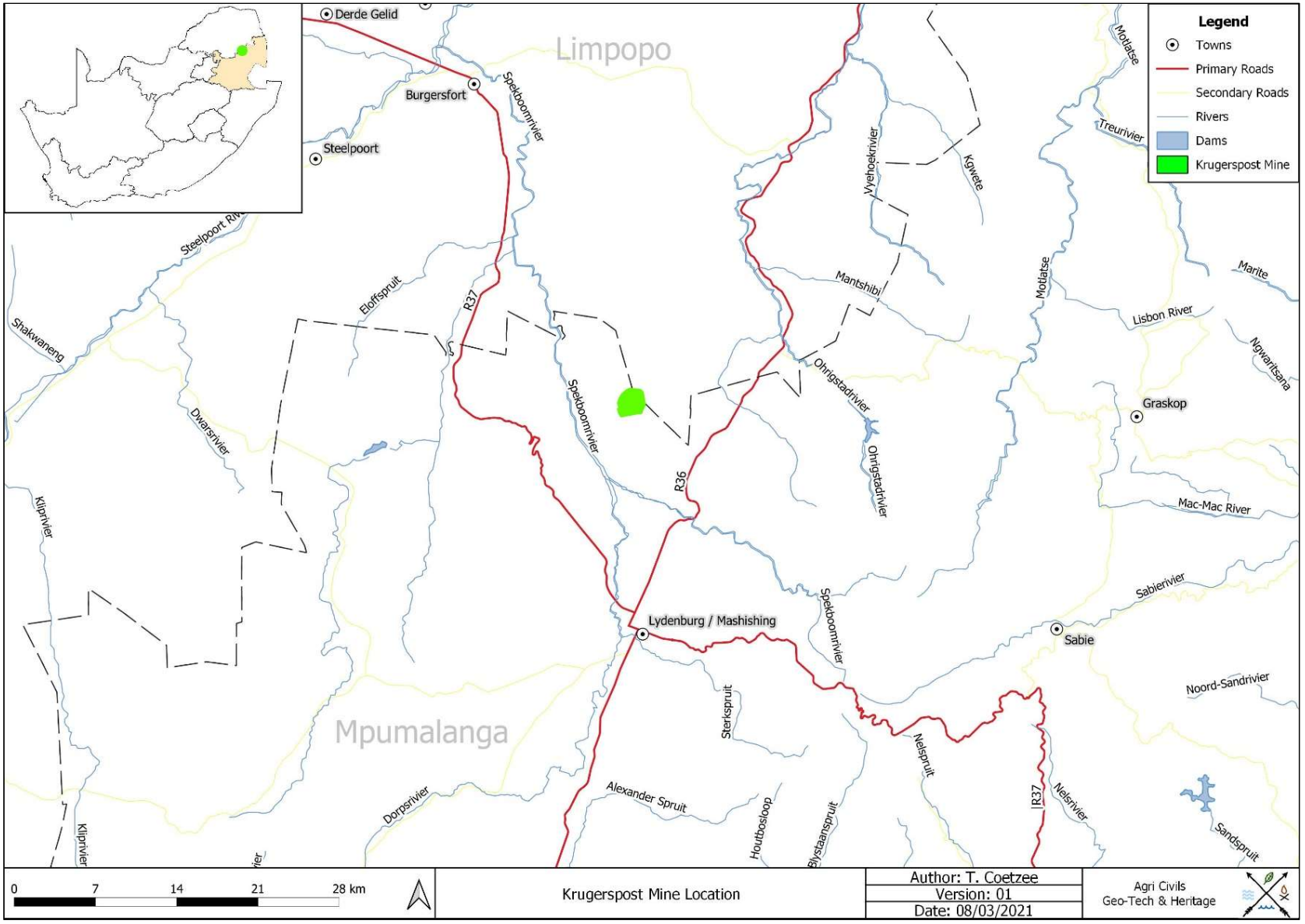

Figure 1: Regional and Provincial location of the study area.

1.2 Legislation

The South African Heritage Resources Agency (SAHRA) aims to conserve and control the management, research, alteration and destruction of cultural resources of South Africa and to prosecute if necessary. It is therefore crucially important to adhere to heritage resource legislation contained in the Government Gazette of the Republic of South Africa (Act No.25 of 1999), as many heritage sites are threatened daily by development. Conservation legislation requires an impact assessment report to be submitted for development authorisation that must include an AIA (Archaeological Impact Assessment) if triggered.

AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources that might occur in areas of development and (b) make recommendations for protection or mitigation of the impact of the sites.

1.2.1 The EIA (Environmental Impact Assessment) and AIA processes

Phase 1 Archaeological Impact Assessments generally involve the identification of sites during a field survey with assessment of their significance, the possible impact that the development might have, and relevant recommendations.

All Archaeological Impact Assessment reports should include:

a. Location of the sites that are found;

b. Short descriptions of the characteristics of each site;

c. Short assessments of how important each site is, indicating which should be conserved and which mitigated;

d. Assessments of the potential impact of the development on the site(s);

e. In some cases a shovel test, to establish the extent of a site, or collection of material, to identify the associations of the site, may be necessary (a pre-arranged SAHRA permit is required); and

f. Recommendations for conservation or mitigation.

This AIA report is intended to inform the client about the legislative protection of heritage resources and their significance and make appropriate recommendations. It is essential to also provide the heritage authority with sufficient information about the sites to enable the authority to assess with confidence:

a. Whether or not it has objections to a development;

b. What the conditions are upon which such development might proceed;

c. Which sites require permits for mitigation or destruction;

d. Which sites require mitigation and what this should comprise;

e. Whether sites must be conserved and what alternatives can be proposed to relocate the development in such a way as to conserve other sites; and

f. What measures should or could be put in place to protect the sites which should be conserved.

When a Phase 1 AIA is part of an EIA, wider issues such as public consultation and assessment of the spatial and visual impacts of the development may be undertaken as part of the general study and may not be required from the archaeologist. If, however, the Phase 1 project forms a major component of an AIA it will be necessary to ensure that the study addresses such issues and complies with Section 38 of the National Heritage Resources Act (NHRA).

1.2.2 Legislation regarding archaeology and heritage sites

National Heritage Resource Act No.25 of April 1999

Buildings are among the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Farming Community settlements. The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives;
- any other prescribed category.

With regards to activities and work on archaeological and heritage sites this Act 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." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority:

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites." (35. [4] 1999:58)

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources authority:

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals." (36. [3] 1999:60)

On the development of any area the gazette states that:

"…any person who intends to undertake a development categorised as:

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

i. exceeding 5000m² in extent; or

ii. involving three or more existing erven or subdivisions thereof; or

iii. involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10000m² in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."(38. [1] 1999:62-64)

and

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;

(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(c) an assessment of the impact of the development on such heritage resources;

(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) plans for mitigation of any adverse effects during and after the completion of the proposed development." (38. [3] 1999:64)

Human Tissue Act and Ordinance 7 of 1925

The Human Tissues Act (65 of 1983) and Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) protects graves younger than 60 years. These fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities. Graves 60 years or older fall under the jurisdiction of the National Heritage Resources Act as well as the Human Tissues Act, 1983.

2. Study Area and Project Description

2.1 Location & Physical Environment

The existing mining right is situated 20 km north of Mashishing/Lydenburg across the land parcels listed in **Table 1**. Quarry 6, however, is located within the boundary of Portion 31 only.

Table 1: Property name & coordinates

Property	Portion	Map Reference (1:50 000)	Lat	Lon	Parcel Size (ha)	Quarry 6 (ha)
Klipfontein 400 KT	31	2430 CD	-24.921372	30.450210	214.9	16.8
Klipfontein 400 KT	32	2430 CD	-24.931523	30.444343	237	-

Steelpoort is located roughly 34 km to the northwest and Graskop 43 km to the east of Quarry 6 (**Figures 1 & 2**). The study area falls within the Ehlanzeni District Municipality and the Thaba Chweu Local Municipality in the Mpumalanga Province. In terms of vegetation, the study area falls within the Grassland Biome, Mesic Highveld Grassland Bioregion and the Lydenburg Thornveld vegetation unit. The Grassland Biome covers approximately 28% of South Africa (Mucina & Rutherfords 2006). Lydenburg Thornveld is found in the Mpumalanga Province in a broad band between the high-lying mountains around Ohrigstad in the north to the Kwena Dam in the south. This vegetation unit's conservation status is considered to be vulnerable with a conservation target of 27%. Only about 2% is protected within the Gustav Klingbiel and Ohrigstad Dam Nature Reserves, while a total of 22% of this unit has been transformed by dryland and irrigated cultivation. Erosion associated with this vegetation unit varies between very low and moderate (Mucina & Rutherfords 2006).

The average elevation for Lydenburg Thornveld ranges from 1160 to 1660 MASL (Mucina & Rutherfords 2006). The average elevation of the project area is 1407 MASL and slopes from the slightly more elevated northern boundary towards the lower southern area.

The study area falls within the summer rainfall region with an average annual rainfall of roughly 673.89 mm. The average summer temperature is approximately 20 ºC and the average winter temperature 10 ºC. Highs of 32 ºC and lows of 3 ºC are reached (BECS Environmental 2020: 40 & 41).

The study area falls within the B42E Quaternary Catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. The closest perennial river to the study area is the Spekboom River that flows 4.8 km to the southwest of the study area. An offshoot of the Ohrigstad River flows approximately 7 km to the east.

When the surrounding environment is considered, the area directly west of the mine is associated with mountainous terrain, while the areas directly east of the mine is associated with cultivated land. Access to the study area (**Figure 2**) is via a local road turning from the R36 primary road to the east.

On a local scale, the study areas consists of a quarry that is partially filled with water. The eastern boundary is fenced-off and was disturbed by previous mining activity. Quarries border Quarry 6 to the north and south, while the area directly to the west of the western border was disturbed as well. At present no mining activity is taking place at the mine.

Historical aerial images (**Appendix A**) show the study area to be cultivated since at least 1938 with a road running north-south through what would alter become Quarry 6.

2.2 Project description

Krugerspost Mine has been mining andalusite for more than 35 years and has an existing mining right on portions 31, 32, 36 and the Remaining Extent of Portion 1 of the Farm Klipfontein 400 KT near Mashishing/Lydenburg in the Mpumalanga Province. Approximately 978 ha of the Farm Klipfontein 400 KT is used for mining operations – **Figure 3** indicates the existing mining infrastructure. According to Mr Eddie van Niekerk, the site manager, the project proposes the backfilling and rehabilitation of Quarry 6 through using material to be mined to the north of Quarry 6 (Eddie van Niekerk, pers. Comm. 2021). At present, however, no mining activity is taking place at the Krugerspost Mine.

The following note and summary of impacts were adapted from the EIA and EMP (Environmental Management Plan) reports:

"Note: The DMR stated that a Category B(11) waste license in terms of GN 921 (as amended by GN 633 of 2015) under NEMWA for the backfilling of mine residue in to Quarry 6 (this includes slimes and waste rock) is not necessary and that a closure plan can be submitted instead to demonstrate the rehabilitation of the quarry. It was confirmed by the DMR that the mine is not applying for closure and that no closure application will need to be lodged as the purpose of the closure plan is to demonstrate the rehabilitation of Quarry 6. This closure plan is attached to the EIA as an addendum

Summary of impacts

- Soil, surface water, and groundwater pollution
    - Backfilling, the storage of water in the quarry and the construction of the plant can lead to soil, surface water, and groundwater due to the pollution from hydrocarbons. Spillages and the generation of waste can also lead to contamination.

- Soil erosion and sedimentation
    - Backfilling and sloping may lead to soil erosion and sedimentation. Run off from mine residue and sloped soil may also occur. The mine has combatted this by storing water in the quarry to reduce the potential of erosion and surface water run-off.

- Land capability and visual aspects
    - Rehabilitation efforts will change the topography to a more natural state which will positively impact the visual aspect of the region. This will also positively impact the drainage patterns and the land use will be returned to what it was prior to mining.

- Alien vegetation establishment
    - Alien vegetation may establish on areas that have been backfilled if they are not managed appropriately.

- Groundwater pollution
    - Backfilling poses a risk of groundwater pollution post-closure. This is due to the long-term release and accumulation of low risk elements. However, rainwater shall ensure that it is diluted. No sulphidic minerals are present in the ore or overburden that could result in acidity of drainage or mine water.

- Air quality pollution and noise generation
    - Activities associated with the backfilling of quarry 6 with mine residue can generate dust and noise. The new plant can also lead to air pollution. “

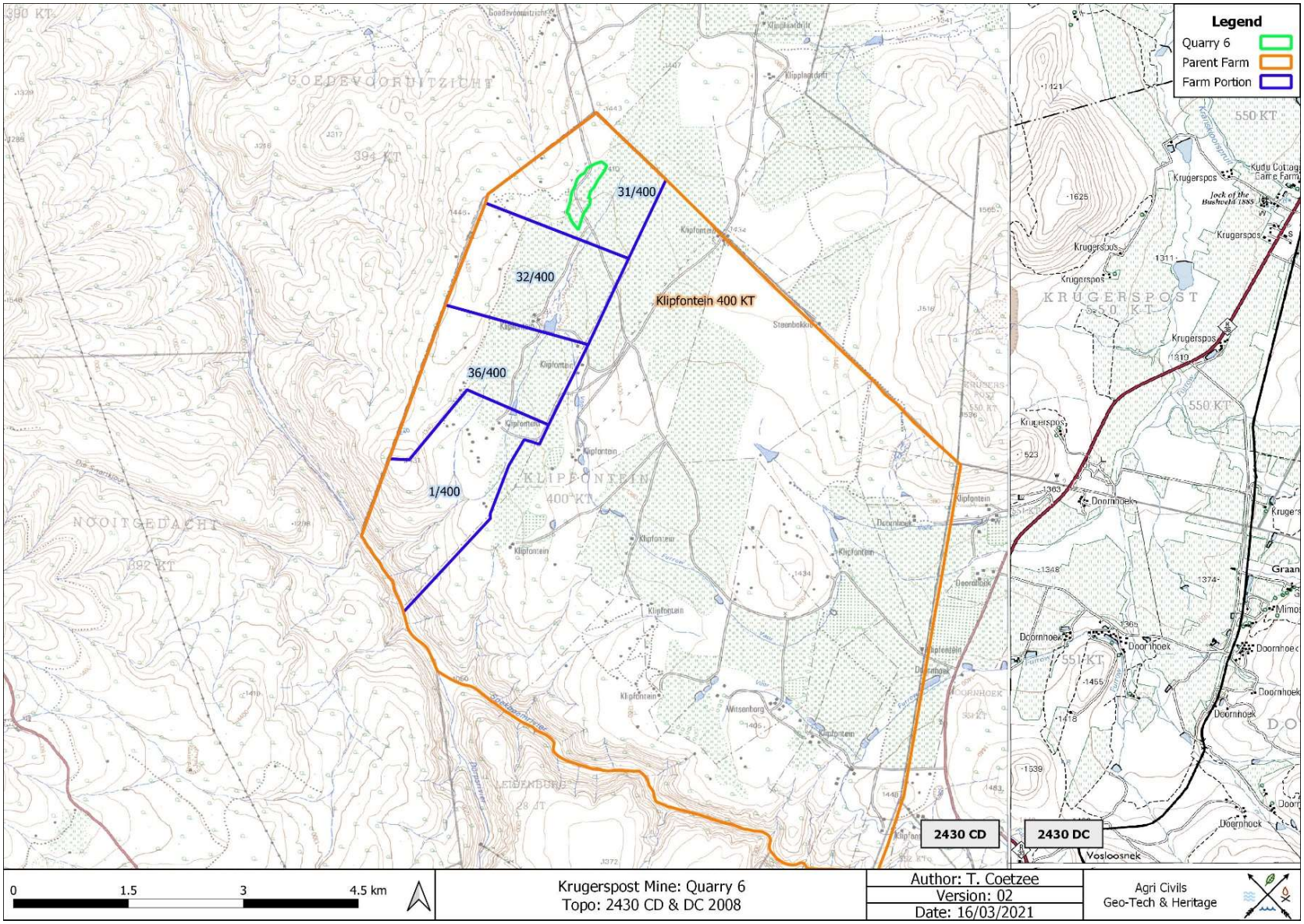

Figure 2: Segments of SA 1: 50 000 2430 CD & DC indicating the study area.

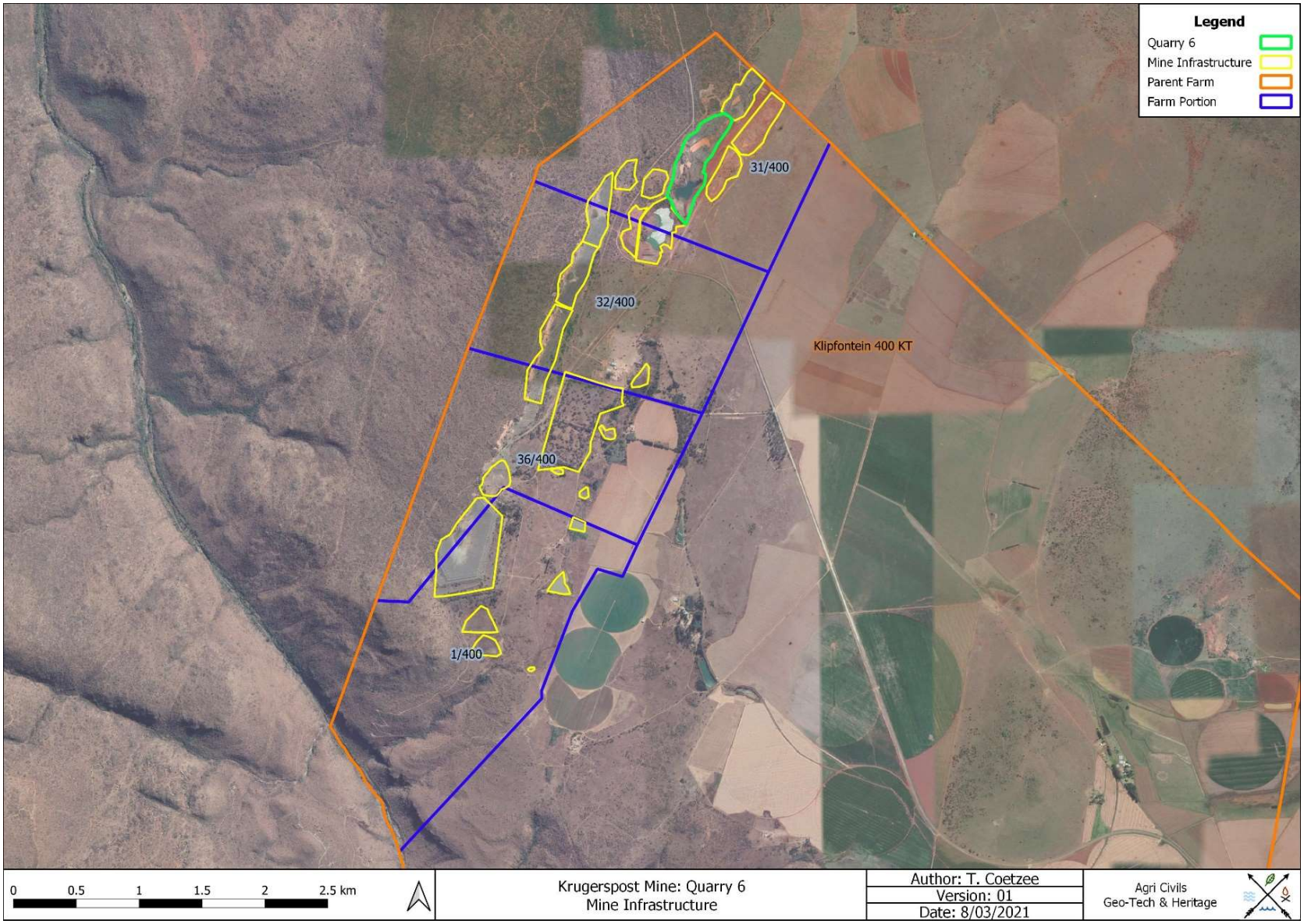

Figure 3: Mining Infrastructure.

3. Archaeological Background

Southern African archaeology is broadly divided into the Early, Middle and Later Stone Ages; Early, Middle and Later Iron Ages; and Historical or Colonial Periods. This section of the report provides a general background to archaeology in South Africa and focuses on more site-specific elements where relevant.

3.1 The Stone Ages

The earliest stone tool industry, the Oldowan, was developed by early human ancestors which were the earliest members of the genus *Homo,* such as *Homo habilis*, around 2.6 million years ago. It comprises tools such as cobble cores and pebble choppers (Toth & Schick 2007). Archaeologists suggest these stone tools are the earliest direct evidence for culture in southern Africa (Clarke & Kuman 2000). The advent of culture indicates the advent of more cognitively modern hominins (Mitchell 2002: 56, 57)

The Acheulean industry completely replaced the Oldowan industry. The Acheulian industry was first developed by *Homo ergaster* between 1.8 to 1.65 million years ago and lasted until around 300 000 years ago. Archaeological evidence from this period is also found at Swartkrans, Kromdraai and Sterkfontein. The most typical tools of the ESA are handaxes, cleavers, choppers and spheroids. Although hominins seemingly used handaxes often, scholars disagree about their use. There are no indications of hafting, and some artefacts are far too large for it. Hominins likely used choppers and scrapers for skinning and butchering scavenged animals and often obtained sharp ended sticks for digging up edible roots. Presumably, early humans used wooden spears as early as 5 million years ago to hunt small animals.

Middle Stone Age (MSA) artefacts started appearing about 250 000 years ago and replaced the larger Early Stone Age bifaces, handaxes and cleavers with smaller flake industries consisting of scrapers, points and blades. These artefacts roughly fall in the 40-100 mm size range and were, in some cases, attached to handles, indicating a significant technical advance. The first *Homo sapiens* species also emerged during this period. Associated sites are Klasies River Mouth, Blombos Cave and Border Cave (Deacon & Deacon 1999).

Although the transition from the Middle Stone Age to the Later Stone Age (LSA) did not occur simultaneously across the whole of southern Africa, the Later Stone Age ranges from about 20 000 to 2000 years ago. Stone tools from this period are generally smaller, but were used to do the same job as those from previous periods; only in a different, more efficient way. The Later Stone Age is associated with: rock art, smaller stone tools (microliths), bows and arrows, bored stones, grooved stones, polished bone tools, earthenware pottery and beads. Examples of Later Stone Age sites are Nelson Bay Cave, Rose Cottage Cave and Boomplaas Cave (Deacon & Deacon 1999).

3.2 The Iron Age & Later History

The Early Iron Age marks the movement of farming communities into South Africa in the first millennium AD, or around 2500 years ago (Mitchell 2002:259, 260). These groups were agro-pastoralist communities that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Archaeological evidence from Early Iron Age sites is mostly artefacts in the form of ceramic assemblages. The origins and archaeological identities of this period are largely based upon ceramic typologies. Some scholars classify Early Iron Age ceramic traditions into different "streams" or "trends" in pot types and decoration, which emerged over time in southern Africa. These "streams" are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). Early Iron Age ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. This period continued until the end of the first millennium AD (Mitchell 2002; Huffman 2007). Some well-known Early Iron Age sites include the Lydenburg Heads in Mpumalanga, Happy Rest in the Limpopo Province and Mzonjani in Kwa-Zulu Natal.

The Middle Iron Age roughly stretches from AD 900 to 1300 and marks the origins of the Zimbabwe culture. During this period cattle herding appeared to play an increasingly important role in society. However, it was proved that cattle remained an important source of wealth throughout the Iron Age. An important shift in the Iron Age of southern Africa took place in the Shashe-Limpopo basin during this period, namely the development of class distinction and sacred leadership. The Zimbabwe culture can be divided into three periods based on certain capitals. Mapungubwe, the first period, dates from AD 1220 to 1300, Great Zimbabwe from AD 1300 to 1450, and Khami from AD 1450 to 1820 (Huffman 2007: 361, 362).

The Late Iron Age roughly dates from AD 1300 to 1840. It is generally accepted that Great Zimbabwe replaced Mapungubwe. Some characteristics include a greater focus on economic growth and the increased importance of trade. Specialisation in terms of natural resources also started to play a role, as can be seen from the distribution of iron slag which tend to occur only in certain localities compared to a wide distribution during earlier times. It was also during the Late Iron Age that different areas of South Africa were populated, such as the interior of KwaZulu Natal, the Free State, the Gauteng Highveld and the Transkei. Another characteristic is the increased use of stone as building material. Some artefacts associated with this period are knife-blades, hoes, adzes, awls, other metal objects as well as bone tools and grinding stones.

The Historical Period mainly deals with Europe's discovery, settlement and impact on southern Africa. Some topics covered by the Historical period include Dutch settlement in the Western Cape, early mission stations, Voortrekker routes and the Anglo Boer War. This time period also saw the compilation of early maps by missionaries, explorers, military personnel, etc.

3.2.1 Mashishing/Lydenburg Archaeo-History

The Mashishing/Lydenburg area has a rich history spanning from early to Historical times. Below is a brief account of earlier events in the Mashishing/Lydenburg area.

One of the more famous Early Iron Age sites in Mpumalanga is attributed to the Lydenburg Heads site which comprises seven hollow ceramic sculptures. Pieces of the Lydenburg Heads were discovered and collected by Ludwig von Bezing in the Sterkstroom Valley near Lydenburg in 1957. Over the years he collected the remains of seven heads and while studying medicine at the University of Cape Town brought his finds under the attention of Prof Ray Inskeep of the department of Archaeology. Under Prof Ray Inskeep's supervision two large heads and five small ones were reconstructed. The Lydenburg Heads are housed in the Iziko Museum in Cape Town. Prof Inskeep also arranged for the systematic excavation of the site. Excavations revealed that the site was occupied during two periods. The first period was dated to around AD 600 and the second from the 9th – 11th century AD. Because the Lydenburg Heads were removed from their context, dating is difficult. Compared to ceramics found at the dated sites of Ndondonwane and Msuluzi near the KwaZulu-Natal coast, it is believed that the Lydenburg Heads date to the second period of occupation. These similarities reinforce the fact that Early Iron Age communities moved and interacted (Delius 2007: 53 – 55).

Regarding the decorations of the Lydenburg Heads there is a striking similarity. Its form is elongated and bag-shaped orientated in order so that the mouth of the pot becomes the base of the neck of the head. Clay was added to form the eyes, ears, lips and scarification-like features. Patterns were also cut into the wet clay. Some societies typically carry out dental mutilation during initiation and might explain why the bigger heads are missing teeth and the smaller heads have gaps between the front teeth. The Lydenburg Heads may therefore have been used in pre-marital initiation schools. Also, it should be noted that some human remains dating to the Iron Age are missing front teeth, which reinforces the connection (Delius 2007: 55).

Late Iron Age activity are generally marked by stone walled enclosures. The numerous stone-walled enclosures in Mpumalanga have long been the subject of identity disputes. Research into these sites were conducted by researchers such as Van Hoepen (1939), Mason (1962), Evers (1975), Marker & Evers (1976), Collett (1979), Maggs (2008), (Delius & Schoeman 2008), Delius, Maggs & Schoeman (2012). Research identified the area occupied by these stone-walled enclosures stretching more or less from Carolina in the south to Ohrigstad in the north as Bokoni.

Oral traditions from Bokoni are scarce but some historical information from other groups such as the Pedi have been collected. Oral traditions from the Maroteng, who established a Pedi kingdom in the eastern Transvaal, indicate contact between them and the Koni when they crossed the Crocodile River around 1650. Thus the Koni were already established in the Crocodile River area by that time (Delius & Schoeman 2008: 142-143). Pedi oral traditions indicate that Bokoni was occupied from the 1500s to the mid-1800s (Delius & Schoeman 2008). This

occupation phase, marked by a period of peace, was disrupted by episodes of prolonged violence. One of these, the mfecane, resulted in major shifts in Bokoni and a reconfiguration of the region.

Van Hoepen's research indicated that Pedi or Ndzundza groups settled in the study area while research by Evers (1975) and Collett (1979) drew on similarities between ceramics and settlement layout patters of modern Pedi communities. Later research done by Schoeman (1997) and Delius and Schoeman (2008) challenged the Pedi model.

Research by Marker and Evers (1976), which focused on settlement attributes, identified three different levels of settlement complexity in their study of stone-walled enclosures in the eastern Transvaal. The first type is associated with smaller isolated settlements and consists of two concentric circles. The second settlement type is characterized by large central enclosures with two entrances on both sides and smaller stone circles which are found in association with these large enclosures. Whereas the first two types may be associated with terracing, the third type is not and consists of small stone-walled enclosures grouped together.

Revil Mason (1962) conducted research on a larger scale and also employed aerial photographs. His study focused on the stone-walled settlements of the Steelpoort, Crocodile, Komati and Sabi rivers where he located 1792 sites. Evers (1975) then covered the area between Lydenburg and Machadodorp also using aerial photography and identified 166 sites which and based on Mason's definition, is equivalent to 5000 sites.

4. Methodology

Archaeological reconnaissance of Quarry 6 was conducted during February 2021 (summer) through an unsystematic pedestrian site survey that lasted one day (**Figure 4**). The inspection consisted of a pedestrian survey of the boundary of Quarry 6, as well as accessible areas within the quarry. General site conditions were recorded via photographic record (**Figures 5 – 12**). Also, the site was inspected beforehand on Google Earth, historical aerial imagery and topographical maps in order to identify possible heritage remains (**Appendix A**). No potential sites were identified on historical topographical maps or aerial images. Four sites (2430CD-K01 – 2430CD-K04), however, were identified during the survey. It should be noted that the prefix '2430CD' is not used as a site reference due to the length of the name, but is recorded as such in **Tables 2 & 4**. The historical topographical datasets dating to 1965, 1976, 1997 and 2002, as well as the historical aerial photographs dating to 1938, 1954 and 1970 proved useful in terms of determining the presence of structures and features associated with the study area, as well as determining past land uses of the demarcated study area. The total area surveyed was 16.8 ha.

The reconnaissance of the area under investigation served a twofold purpose:

- To obtain an indication of heritage material found in the general area as well as to identify or locate archaeological sites on the area demarcated for development. This was done in order to establish a heritage context and to supplement background information that would benefit developers through identifying areas that are sensitive from a heritage perspective.

- All archaeological and historical events have spatial definitions in addition to their cultural and chronological context. Where applicable, spatial recording of these definitions were done by means of a handheld GPS (Global Positioning System) during the site visit.

Table 2: Site coordinates & description

Abbreviated name	Site / Survey Point Name	Longitude	Latitude	Description	Current Status	Identification Source
K01	2430CD-K01	30.449899	-24.923949	Handaxe	Disturbed	Survey
K02	2430CD-K02	30.450324	-24.923177	Plastic items	Disturbed	Survey
K03	2430CD-K03	30.450912	-24.922304	Handaxe	Disturbed	Survey
K04	2430CD-K04	30.452483	-24.919739	Potsherds	Disturbed	Survey

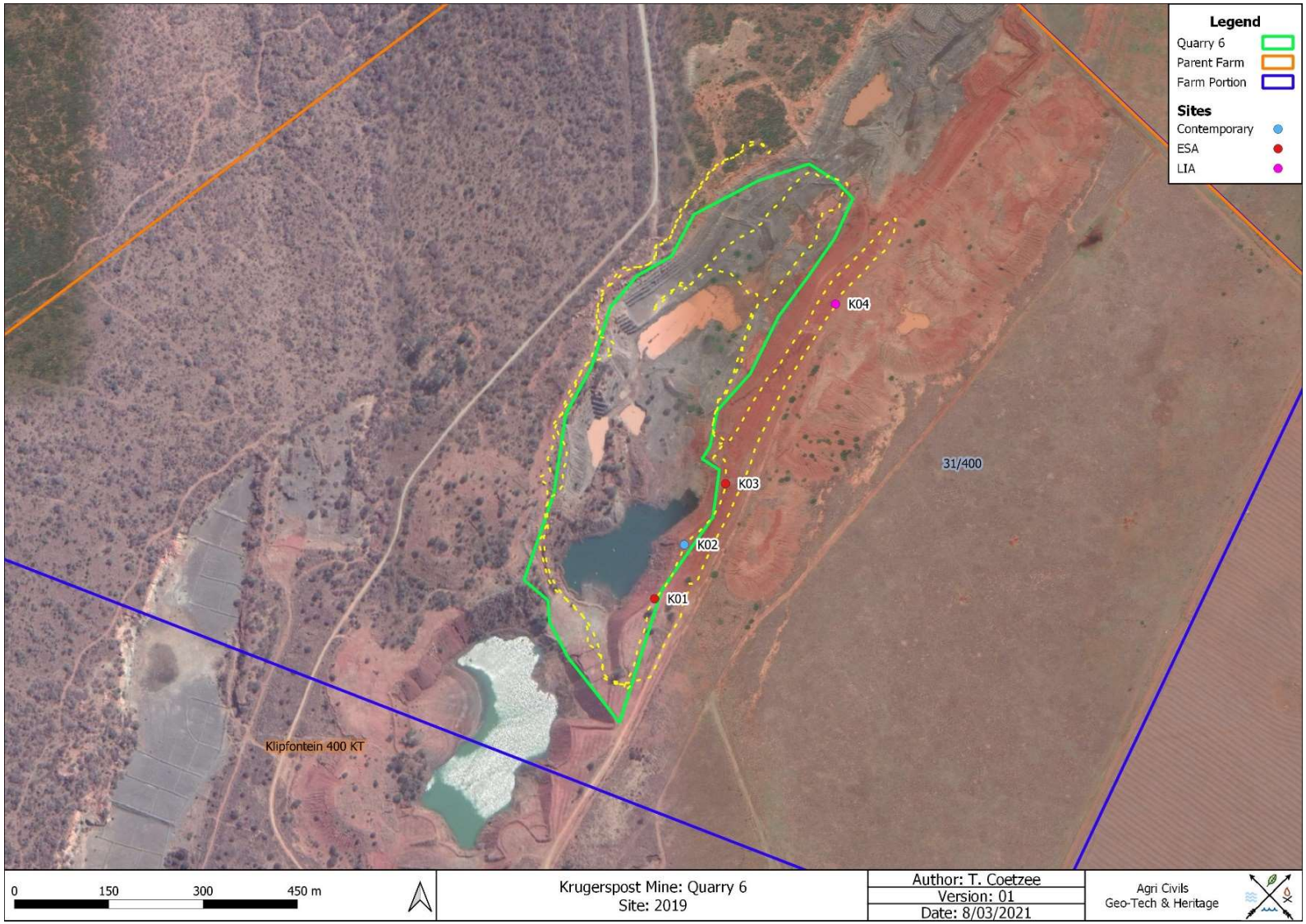

Figure 4: Study area with survey track on a 2019 aerial backdrop.

Figure 5: Quarry 6 as seen from the north towards the south.

Figure 6: Quarry 6 as seen from the east towards the west.

Figure 7: Quarry 6 as seen from the south towards the north.

Figure 8: Quarry 6 as seen from the west towards the east.

Figure 9: Disturbed section along the eastern boundary.

Figure 10: Mined area to the north.

Figure 11: Mined area to the south.

Figure 12: Disturbed western edge of Quarry 6.

4.1 Sources of information

At all times during the survey, standard archaeological procedures for the observation of heritage resources were followed. As most archaeological material occur in single or multiple stratified layers beneath the soil surface, special attention was paid to disturbances; both man-made such as roads and clearings, and those made by natural agents such as burrowing animals and erosion. Locations of archaeological material remains were recorded by means of a Garmin Oregon 750 GPS. These sites, as well as the general conditions of the terrain, were photographed with a Samsung S7 mobile phone.

A literature study, which incorporated previous work done in the region, was conducted in order to place the study area into context from a heritage perspective.

Mr Eddie van Niekerk, the site manager at Krugerspost Mine, provided useful background information and confirmed the absence of structures and cemeteries in the direct vicinity of Quarry 6 (Eddie van Niekerk, pers. Comm. 2021).

4.1.1 Historical aerial and topographical maps

The historical aerial image dating to 1938 (**Appendix A: Figure 22**) indicates that the area where Quarry 6 would later be established, used to be cultivated fields. A very small section along the western boundary, however, was not cultivated at this stage. A road is also shown crossing the area in a northwest-southeast direction. The general area to the east of the study area was also cultivated. The same level of cultivation is also present on the 1954 and 1970 aerial images (**Appendix A: Figures 23 & 24**).

When the 1965 topographical map is inspected, the area associated with Quarry 6 is indicated to be a cultivated field, while the same road visible on the aerial images is shown. Also, a few huts, a footpath, as well as a telephone line are indicated west of the study area (**Appendix A: Figure 25**). In terms of Quarry 6, the 1976 topographical map indicates the same land use as the 1965 topographical map. The area to the west of the study area, however, is characterised by a slightly altered footpath and a few new buildings in the place of the previously indicated huts (**Appendix A: Figure 26**). By 1997 (**Appendix A: Figure 27**), the area demarcated as Quarry 6 still consisted of cultivated land, but the road running through the study area was altered. Also, three buildings are indicated in the southern corner of the study area. The buildings and footpath to the west of the area are also no longer indicated, but a cluster of buildings with and a road are shown. The first mining activities are indicated to the southwest of what would later be Quarry 6. The topographical maps dating to 2002 (**Appendix A: Figure 28**) marks a significant increase in mining activity as the southern section of Quarry 6, as well as the area directly to the north formed part of opencast mining activity. A new road is also shown running along the eastern boundary, while parts of the study area were still cultivated. By 2008 (**Appendix A: Figure 29**), the entire area was associated with opencast mining activities and diggings.

4.1.2 Previous Heritage Studies

Low-density Development on Buffelskloof 382 JT, Waterval 385 JT, Roodewalshoek 17 JT, Naauwpoort 11 JT and Belvedere 385KT

African Heritage Consultants cc (Küsel 2006) conducted a Cultural Heritage Resources Impact Assessment for the low-density township development on the farms Buffelskloof 382 JT, Waterval 385 JT, Roodewalshoek 17 JT, Naauwpoort 11 JT and Belvedere 385 KT. The study recorded two localities associated with burial sites and one possible grave. Other findings include angular stone-walled enclosures most likely used for keeping cattle and sheep. It was suggested that some of the structures exceed 60 years of age. Two Late Iron Age sites consisting of stone-walled enclosures, one which was damaged by modern agricultural activities and the other still in a good condition, were recorded as well. Accordingly stones from the damaged enclosure were used to construct a new angular enclosure, while the preserved settlement is characterised by a roughly circular enclosure and several

additional circular walls. A farm worker settlement was also observed, as well as a historical school house and demolished historical school. This development is located roughly 21 km southwest of the Krugerspost Mine.

132kV Distribution Line Between the Merensky and Lydenburg Substations

The heritage assessment for the construction of a 132kV distribution line between the Merensky and Lydenburg substations was done by Van Schalkwyk (2013). The study recorded several heritage sites in the larger study area. These include Stone Age sites, Iron Age sites, historic farmsteads, infrastructure and cemeteries. It should be noted that a high-level assessment was conducted as access to the different properties was not possible. The closest section of the distribution line to the Krugerspost Mine is located approximately 6.5 km southwest of the proposed rehabilitation project.

Establishment of new Orchards on Portions of the Remaining Extent of Portions 2 and 7 of the Farm Olifantshoek 387 KT

A Phase 1 Heritage Resources Scoping Report was done by Shasa Heritage Consultants for the establishment of new citrus orchards on portions of the Remaining Extent of Portions 2 and 7 of the Farm Olifantshoek 387 KT near Burgersfort (Roodt & Stegmann 2017). The investigation of five areas revealed the presence of two localities associated with burial sites, some marked and some unmarked. The project area referred to is located along the R37 road between Lydenburg and Burgersfort and approximately 14 km to west of the Krugerspost Mine.

4.2 Limitations

The majority of the study area is disturbed by mining activities and is associated with either no or very little vegetation cover inside, as well as directly east of Quarry 6. This resulted in good visibility during the time of surveying (February 2021). The area to the west of Quarry 6, however, is associated with dense vegetation cover that hampered visibility (**Figure 13**). The undisturbed western section, however, falls outside of the study area. No other access constraints were encountered.

Figure 13: Dense vegetation associated with the area directly west of Quarry 6.

5. Archaeological and Historical Remains

5.1 Stone Age Remains

Two Stone Age artefacts were observed (Sites K01 & K03). Due to the smaller size, both artefacts appear to date to the transitional ESA (**Figures 14 & 15**). These artefacts were observed outside of the quarry near the eastern boundary. Site K01 is located just inside of the Quarry 6 boundary and Site K03 about 60 m outside. Both sites are located on a disturbed section of the mine.

Stone Age artefacts are often associated with rocky outcrops or water sources. **Figures 16 – 18** are examples of stone tools often associated with the Early, Middle and Later Stone Age of southern Africa.

The heritage studies done by Küsel (2006) and Roodt & Stegmann (2017) did not locate material pertaining to the Stone Age, however, the study done by Van Schalkwyk (2013) mentions the presence of Stone Age sites in the greater study area.

According to Bergh (1999: 5), Bushman Rock Shelter is a prominent Stone Age site just south of Ohrigstad that is characterised by material from the Oakhurst complex.

Figure 14: Transitional ESA handaxe at site K01.

Figure 15: Transitional ESA handaxe at site K03.

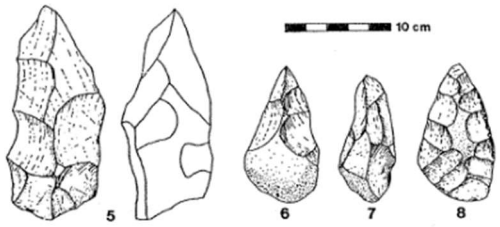

Figure 16: ESA artefacts from Sterkfontein (Volman 1984).

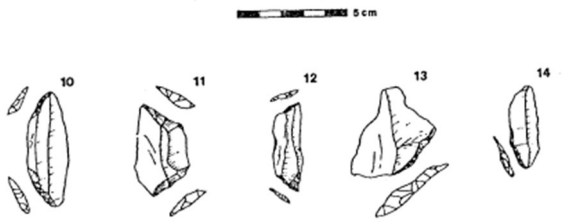

Figure 17: MSA artefacts from Howiesons Poort (Volman 1984).

Figure 18: LSA scrapers (Klein 1984).

5.2 Iron Age Farmer Remains

Three undecorated potsherds were located at Site K04 on the eastern bank of Quarry 6, approximately 53 m east of the study area boundary (**Figure 19**). One of the potsherds is characterised by a black interior surface, suggesting that the pot was used for cooking (**Figure 20**). The site is located on a disturbed section of the mine.

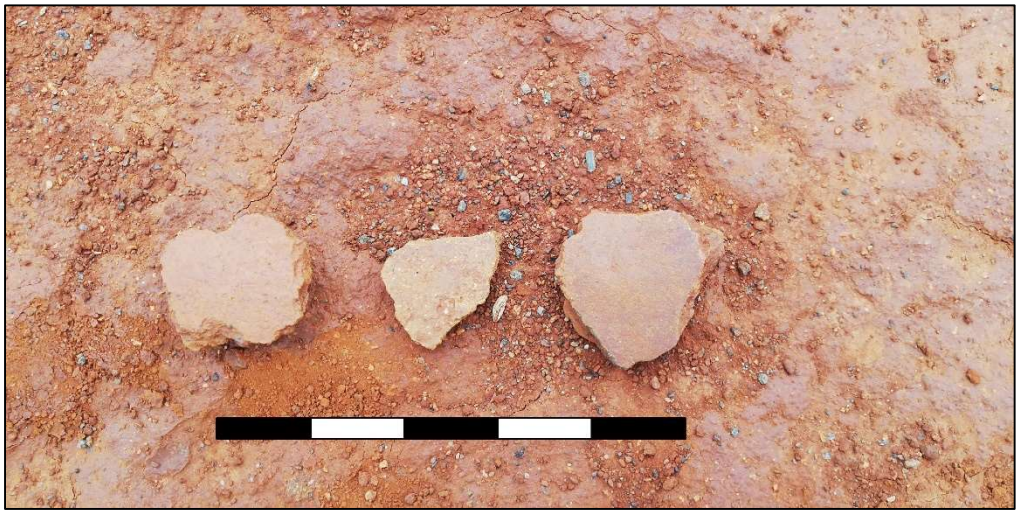

Figure 19: Exterior view of potsherds at site K04.

Figure 20: Interior view of potsherds at site K04.

Archaeological studies done in the surrounding areas recorded several Iron Age sites that include stone-walled sites (Küsel 2006 & Van Schalkwyk 2013).

5.3 Historical

No historical remains were observed within the demarcated study area.

Two of the heritage studies done in the surrounding areas recorded buildings, structures and ruins dating to the Historic Period (Küsel 2006 & Van Schalkwyk 2013). These include farmsteads, a demolished school and a school building.

5.4 Contemporary Remains

One site (K02) dating to contemporary times were identified within the demarcated study area. The site consist of unidentified plastic material of contemporary origin that are not considered significant from a heritage perspective (**Figure 21**).

The heritage study done by Küsel (2006) recorded angular stone-walled enclosures that possibly date to contemporary times.

Figure 21: Contemporary remains at site K02.

5.5 Graves

No grave or burial site was observed within the demarcated study area.

The heritage studies done by Roodt & Stegmann (2017), Küsel (2006) and Van Schalkwyk (2013) mention the presence of formal and informal graves, cemeteries and potential graves in the form of stone cairns.

6. Evaluation

The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences.

A fundamental aspect in the conservation of a heritage resource relates to whether the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. There are many aspects that must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and if appropriate mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed.

6.1 Field Ratings

All sites should include a field rating in order to comply with section 38 of the National Heritage Resources Act (Act No. 25 of 1999). The field rating and classification in this report are prescribed by SAHRA.

Table 3: Field Ratings

Rating	Field Rating/Grade	Significance	Recommendation
National	Grade 1		National site
Provincial	Grade 2		Provincial site
Local	Grade 3 A	High	Mitigation not advised
Local	Grade 3 B	High	Part of site should be retained
General protection A	4 A	High/Medium	Mitigate site
General Protection B	4 B	Medium	Record site
General Protection C	4 C	Low	No recording necessary

Table 4: Individual site ratings

Site / Survey Point Name	Type	Rating	Field Rating/Grade	Significance	Recommendation
2430CD-K01	Handaxe	General Protection B	4 B	Medium	Record site
2430CD-K02	Plastic items	General Protection C	Grade 4 C	Low	No recording necessary
2430CD-K03	Handaxe	General Protection B	4 B	Medium	Record site
2430CD-K04	Potsherds	General Protection B	4 B	Medium	Record site

7. Statement of Significance & Recommendations

7.1 Statement of significance

The study area: Quarry 6 of the Krugerspost Mine

As can be seen form heritage studies done in the surrounding areas, as well as the findings made in this study, the greater study area is considered to be significant from a heritage perspective. However, historical aerial imagery and topographical maps indicate that the area associated with Quarry 6 has been cultivated since at least 1938, followed by mining activity in later years. At present, the demarcated study area mainly consists of a quarry that is partially filled with water. The area associated with Quarry 6 is therefore considered to be completely disturbed, meaning that the archaeological artefacts associated with Sites K01, K02 and K04 occur not within context and may have been introduced form outside. These sites are therefore not considered significant from a heritage perspective. Also, Sites K03 and K04 are located outside of the demarcated study area and might not be impacted.

Site K02 consists of contemporary plastic material that is not significant from a heritage perspective.

7.2 Recommendations

The following recommendations are made in terms with the National Heritage Resources Act (25 of 1999) in order to avoid the destruction of heritage remains associated with the area demarcated for development:

- Because past agricultural and mining activities disrupted the area associated with Quarry 6, Sites K01, K02 and K04 are of low significance as the context has been disturbed. The recording done is therefore considered sufficient and no further action is required.

- Site K02 is not considered significant from a heritage perspective as this site dates to recent times. No further action is required.

- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the rehabilitation phase, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during the course of the project, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).

- Should the need arise to expand the proposed project beyond the surveyed area outlined in this study, the following applies: A qualified archaeologist must conduct a full Phase 1 Archaeological Impact Assessment (AIA) on the sections beyond the demarcated area that will be affected by the development, in order to determine the occurrence and extent of any archaeological sites and the impact development might have on these sites.

- From a heritage point of view, the rehabilitation of Quarry 6 may proceed, subject to the abovementioned conditions, recommendations and approval by the South African Heritage Resources Agency.

8. Addendum: Terminology

Archaeology:
The study of the human past through its material remains.

Artefact:
Any portable object used, modified, or made by humans; e.g. pottery and metal objects.

Assemblage:
A group of artefacts occurring together at a particular time and place, and representing the sum of human activities.

Context:
An artefact's context usually consist of its immediate *matrix* (the material surrounding it e.g. gravel, clay or sand), its *provenience* (horizontal and vertical position within the matrix), and its *association* with other artefacts (occurrence together with other archaeological remains, usually in the same matrix).

Cultural Resource Management (CRM):
The safeguarding of the archaeological heritage through the protection of sites and through selvage archaeology (rescue archaeology), generally within the framework of legislation designed to safeguard the past.

Excavation:
The principal method of data acquisition in archaeology, involving the systematic uncovering of archaeological remains through the removal of the deposits of soil and other material covering and accompanying it.

Feature:
An irremovable artefact; e.g. hearths or architectural elements.

Ground Reconnaissance:
A collective name for a wide variety of methods for identifying individual archaeological sites, including consultation of documentary sources, place-name evidence, local folklore, and legend, but primarily actual fieldwork.

Matrix:

The physical material within which artefacts is embedded or supported, i.e. the material surrounding it e.g. gravel, clay or sand.

Phase 1 Assessments:

Scoping surveys to establish the presence of and to evaluate heritage resources in a given area.

Phase 2 Assessments:

In-depth culture resources management studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required.

Sensitive:

Often refers to graves and burial sites although not necessarily a heritage place, as well as ideologically significant sites such as ritual / religious places. *Sensitive* may also refer to an entire landscape / area known for its significant heritage remains.

Site:

A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity.

Surface survey:

There are two kinds: (1) unsystematic and (2) systematic. The former involves field walking, i.e. scanning the ground along one's path and recording the location of artefacts and surface features. Systematic survey by comparison is less subjective and involves a grid system, such that the survey area is divided into sectors and these are walked ally, thus making the recording of finds more accurate.

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National Heritage Resource Act No.25 of 1999, Government Gazette, Cape Town

Removal of Graves and Dead Bodies Ordinance No. 7 of 1925, Government Gazette, Cape Town

Appendix A: Historical Aerial Photographs and Topographical Maps

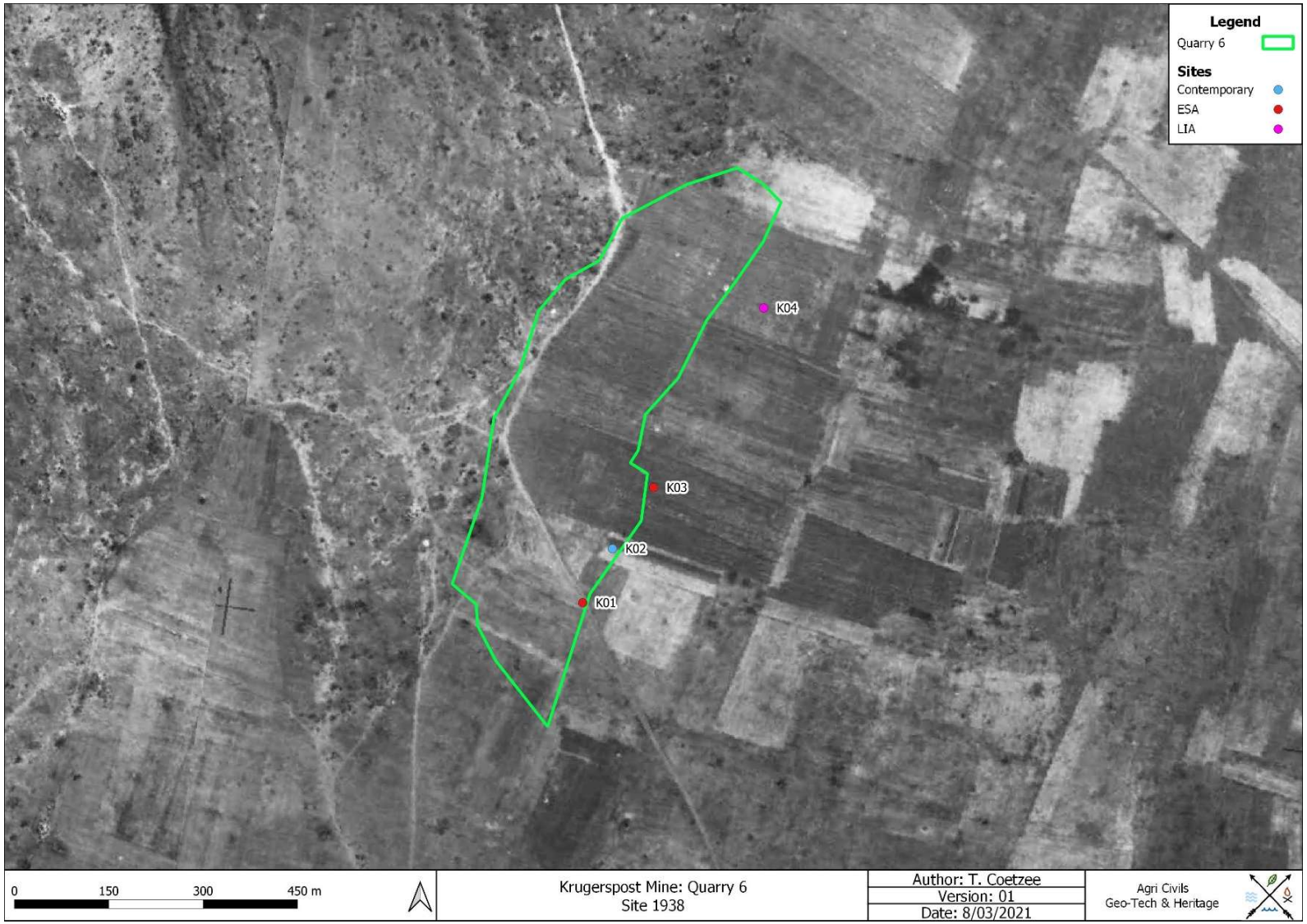


Figure 22: Quarry 6 superimposed on a 1938 aerial image.

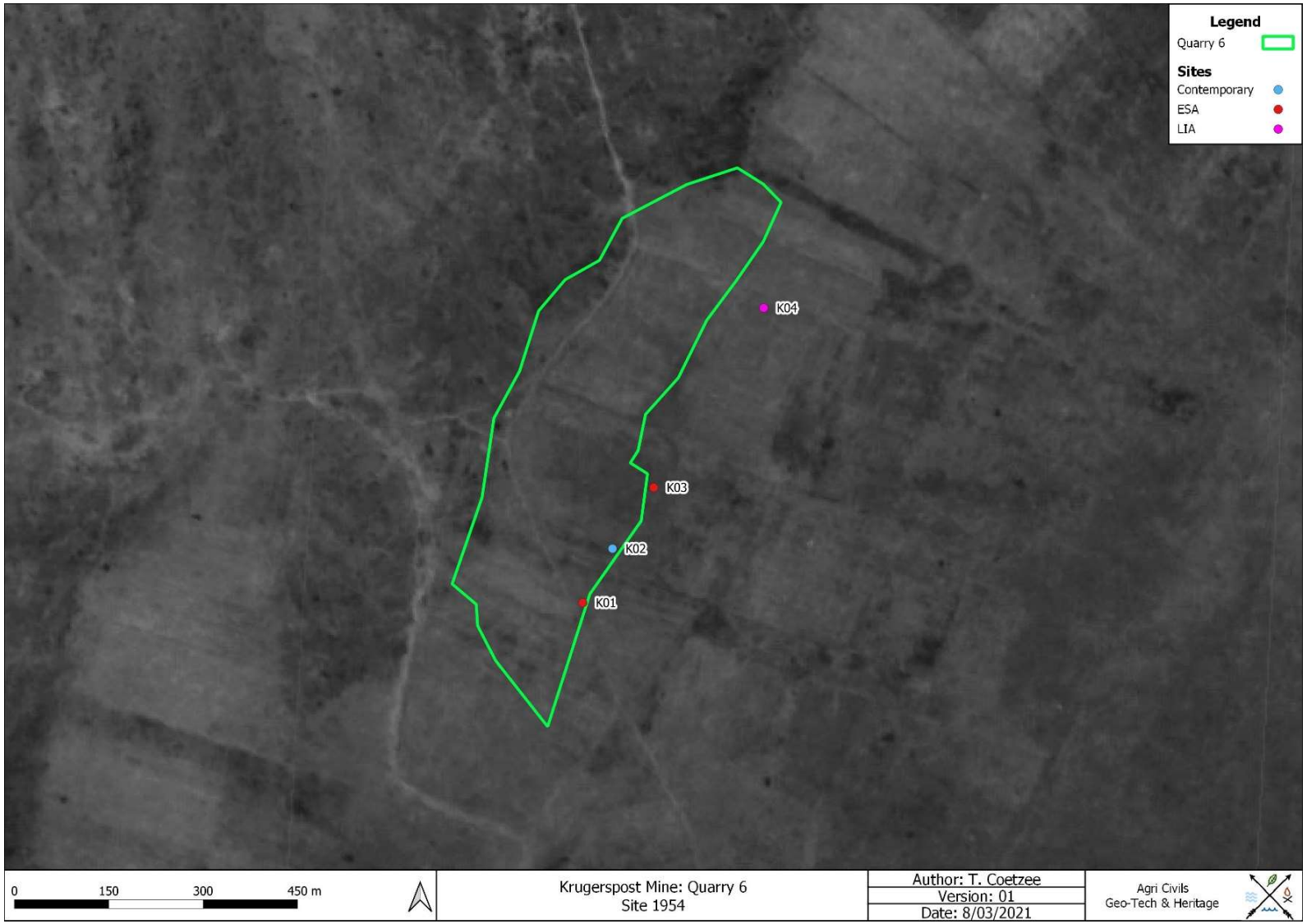


Figure 23: Quarry 6 superimposed on a 1954 aerial image.

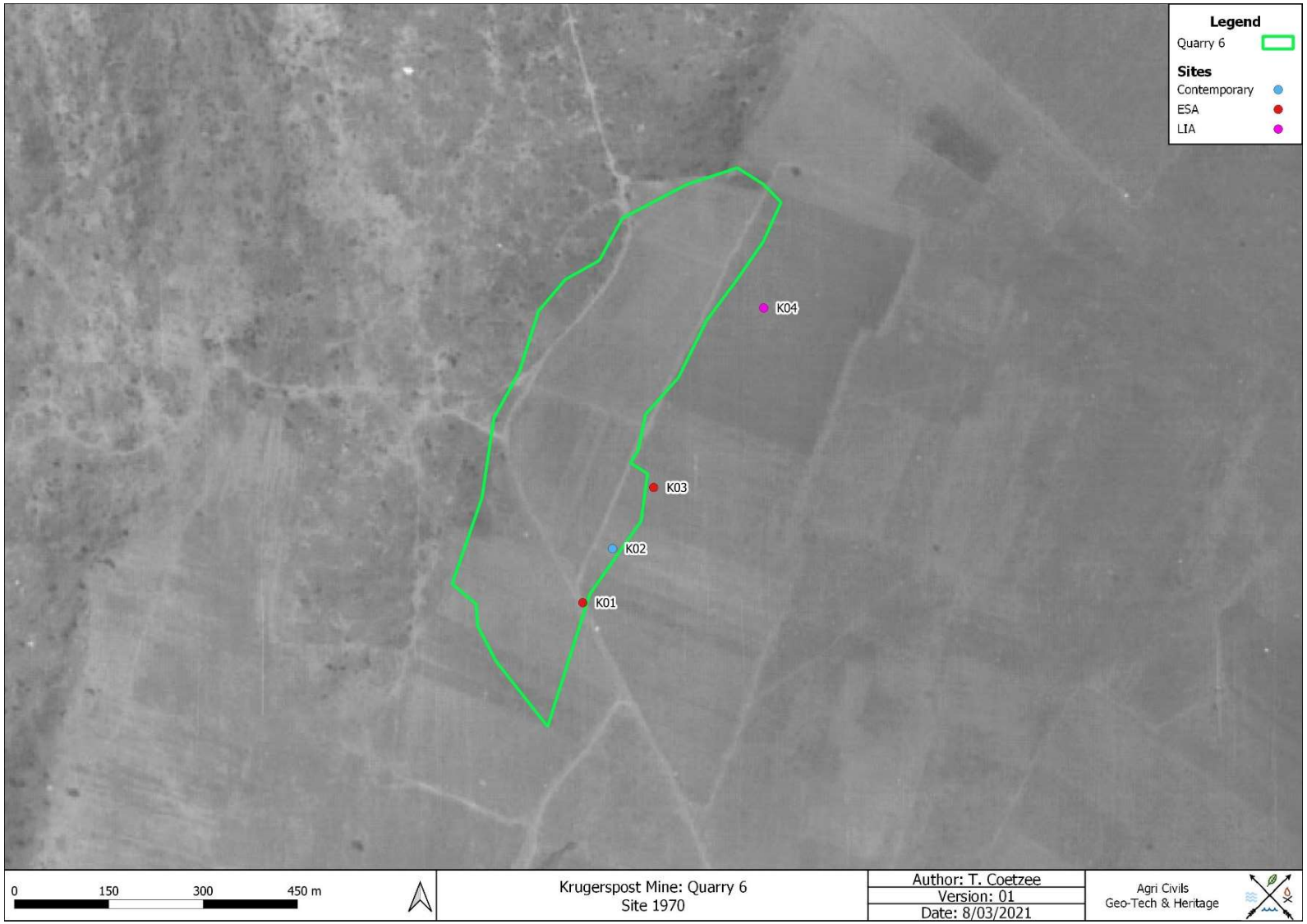


Figure 24: Quarry 6 superimposed on a 1970 aerial image.

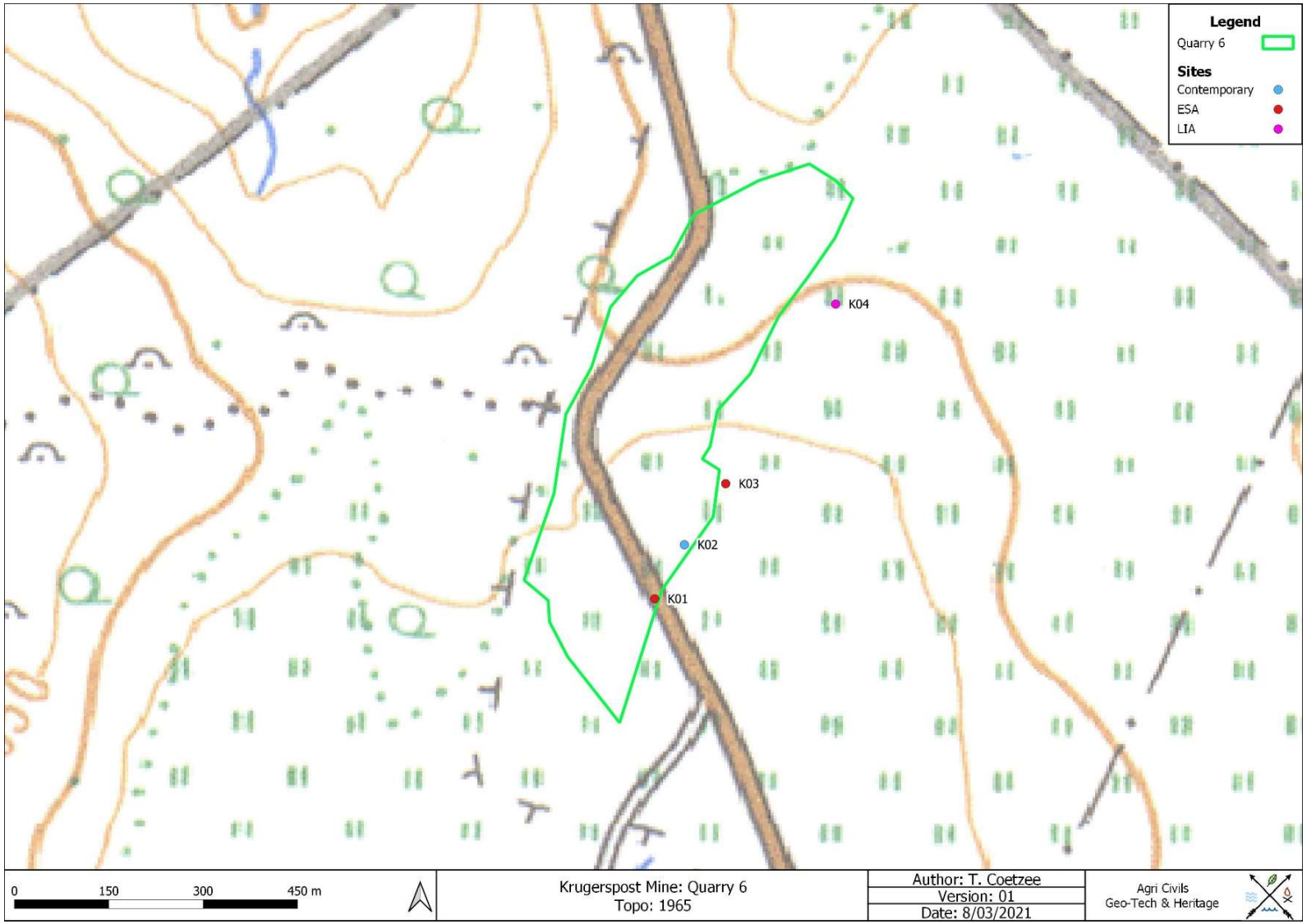


Figure 25: Quarry 6 superimposed on a 1965 topographical map.

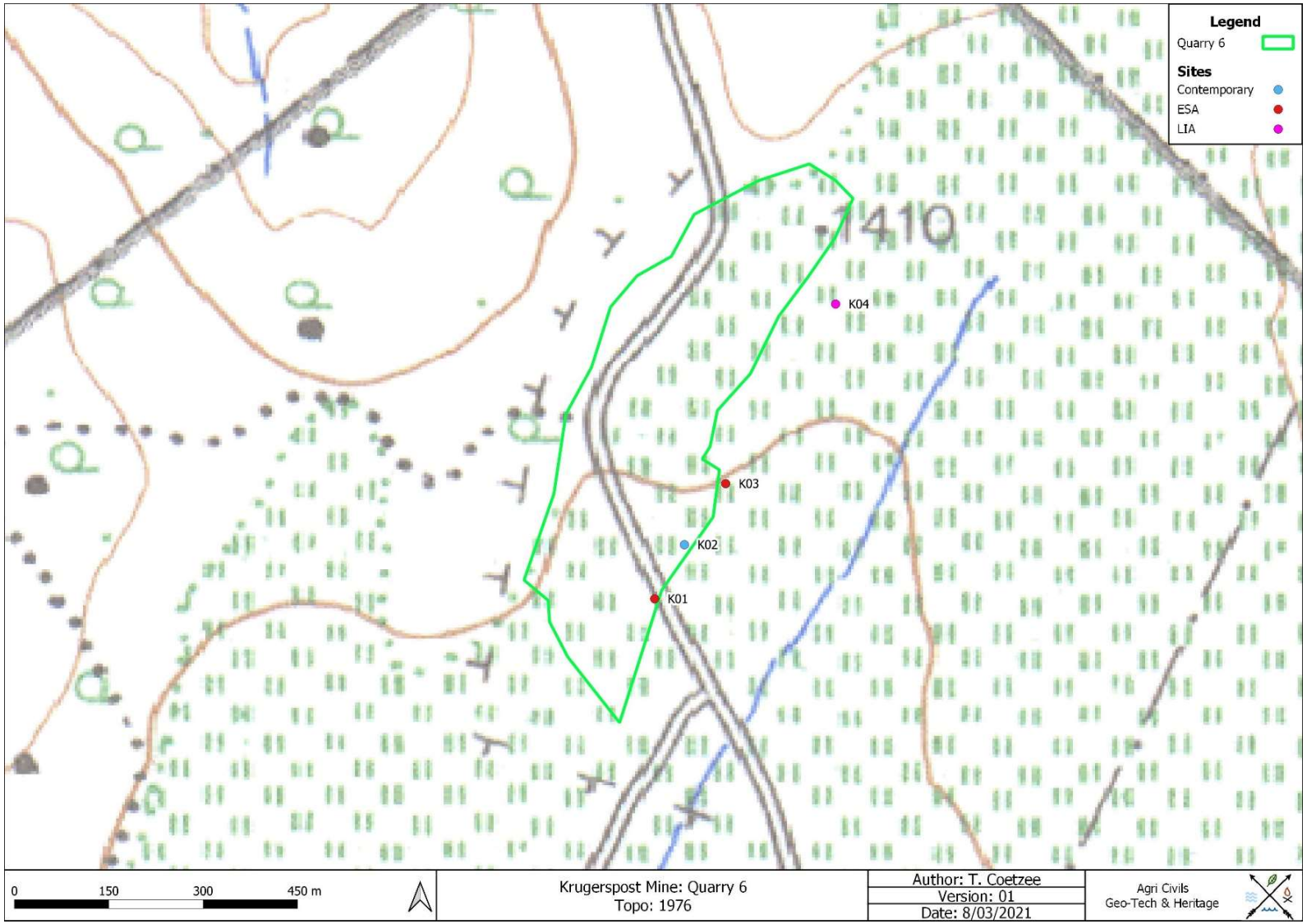


Figure 26: Quarry 6 superimposed on a 1976 topographical map.

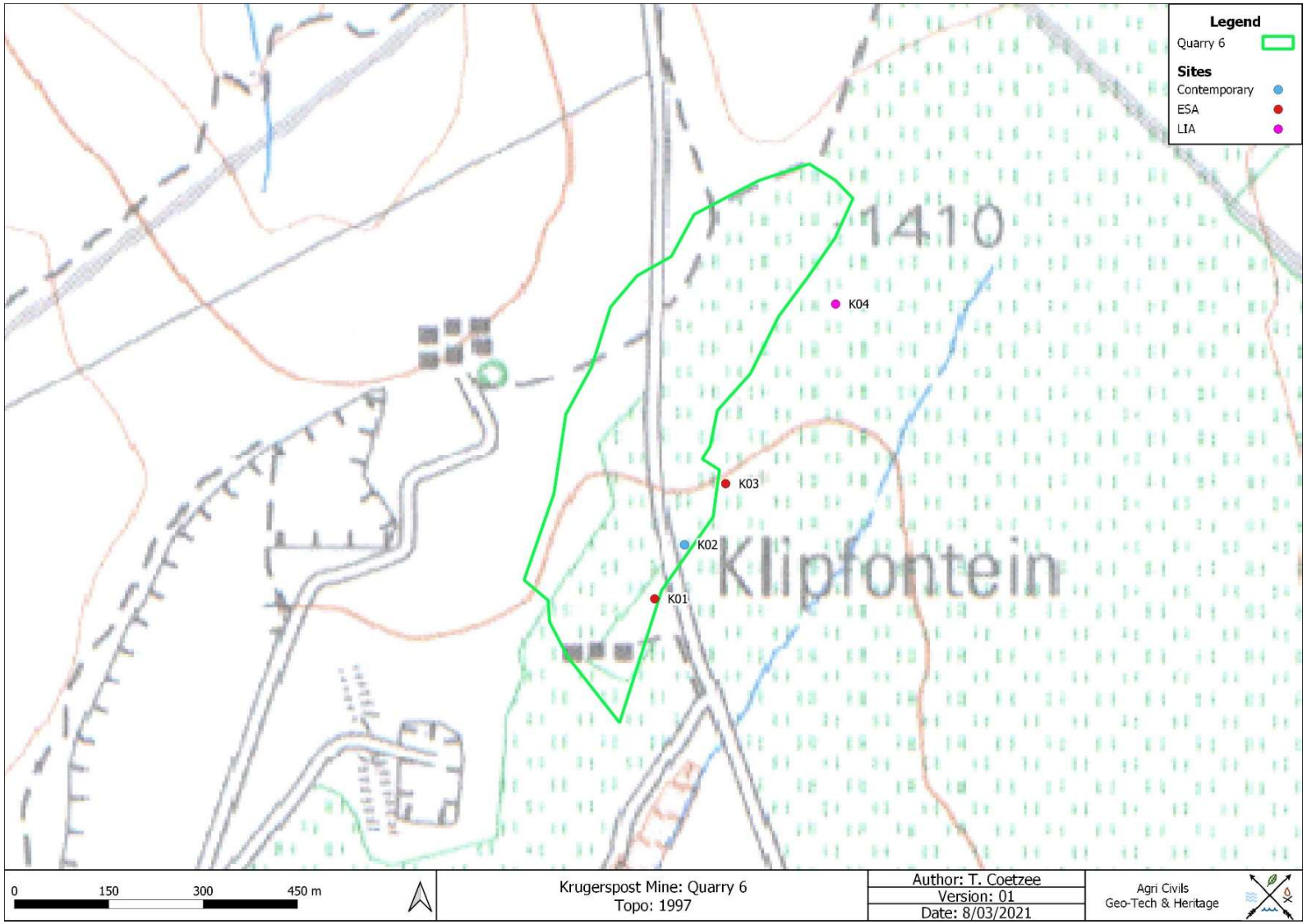


Figure 27: Quarry 6 superimposed on a 1997 topographical map.

Figure 28: Quarry 6 superimposed on a 2002 topographical map.

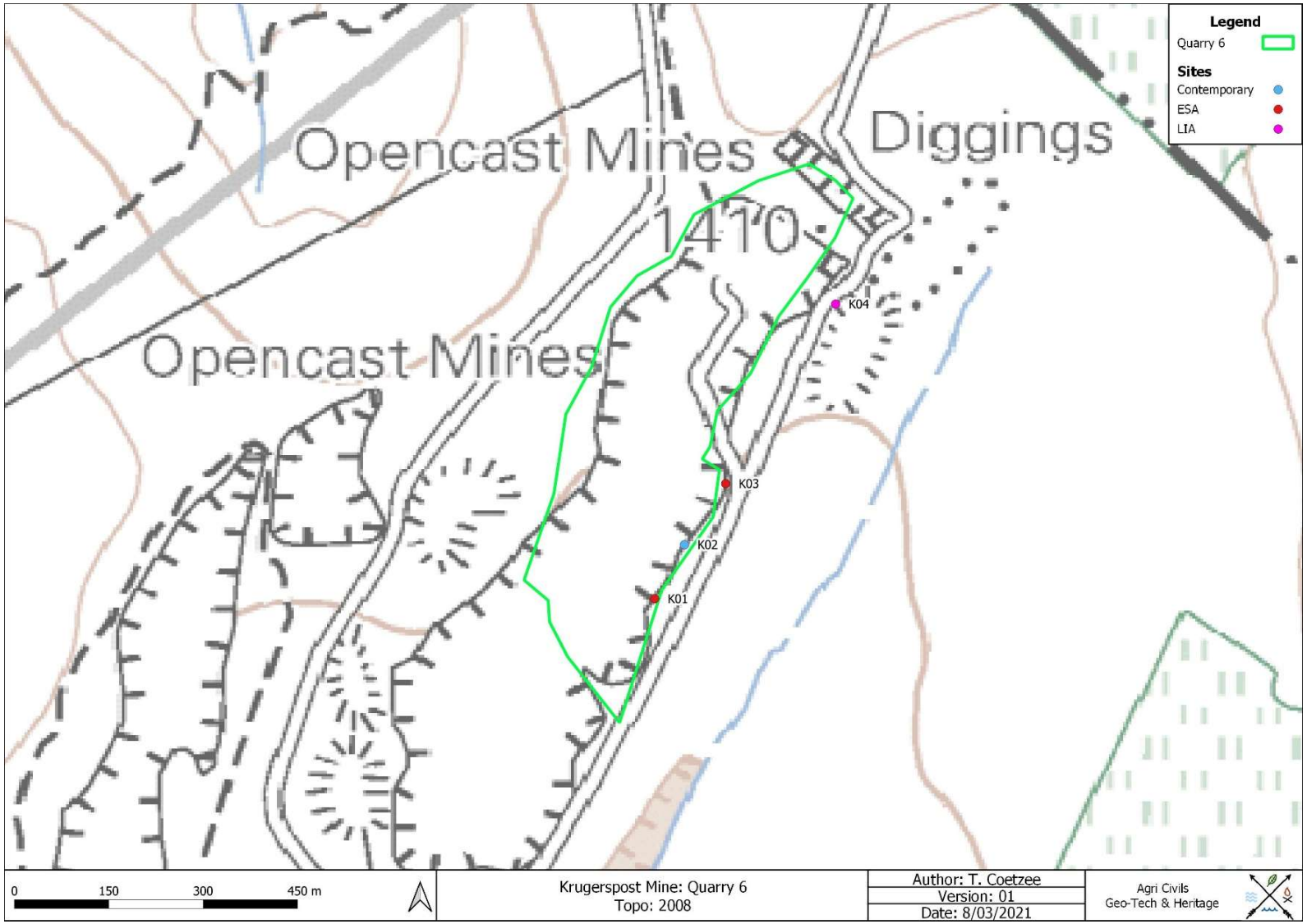


Figure 29: Quarry 6 superimposed on a 2008 topographical map.

Appendix B: Impact Table

v) Impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts

This section includes the impact management for the rehabilitation of Quarry 6.

1 Surface and subsurface impact on heritage resources due to rehabilitation

Activity, nature, and consequence of impact:

During the rehabilitation phase, surface and subsurface impacts take place. These activities can lead to irreparable damage or complete destruction of heritage resources if not correctly managed.

Cumulative impacts:

Based on current observation none are foreseen

Assumptions, uncertainties, and gaps in knowledge:

Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the rehabilitation phase. Potential heritage surface indicators are therefore rather considered sites than assuming the presence of a natural feature.

Impact pre-mitigation:

	Heritage sites		
Intensity and magnitude	2 Potential destruction of subsurface culturally significant material		
Resource replaceability	3 Damage is irreversible		
Duration	3 Risk exists as long as project is operational		
Extent or spatial scale	1 The impact will be site specific.		
Probability	2 There is a probability for the impact to occur.		
Significance	11 Medium		

Impact post-mitigation:

	Heritage sites		
Intensity and magnitude	1 The proposed project can monitor for potential heritage sites and implement precautionary measures, thereby limiting/avoiding impact.		
Resource replaceability	2 Damage is irreversible		
Duration	2 Risk exists as long as project is operational		
Extent or spatial scale	1 The impact will be site specific.		
Probability	1 With correct management, it is unlikely that the impact will occur.		
Significance	7 Low		

Environmental objective

To ensure that heritage resources are not negatively impacted.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
Heritage awareness must be included in normal site induction for all employees, contractors and visitors to the subject properties. This will ensure that the general level of heritage awareness is raised and that there is compliance with the act. The sections of the NHRA must be highlighted to each visitor, contactor and employee or any other person acting on the sites or immediate surrounds.	Rehabilitation	General awareness	Site inspections	Inspections during construction and development	ECO	Only necessary if any resource is found.	Prevent
All actions on the property will be subject to the provisions of the NHRA and any transgressions of the act will make the transgressor liable in terms of the act.	Operational.	NHRA	Site inspections	Inspections during operation	ECO	Only necessary if any resource is found.	Prevent
The demarcated project boundary must be enforced to limit the footprint of the impact of activities outside the project area.	Rehabilitation.	General awareness.	Site inspections.	Inspections during operation	ECO	Only necessary if any resource is found.	Prevent
Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).	Rehabilitation.	General awareness	Site inspections	Inspections during rehabilitation	ECO	Only necessary if any resource is found.	Prevent
Prior to the commencement of any work or action that will impact or effect a heritage resource, the relevant authorisation must be obtained from the SAHRA.	Planningl.	N/A.	N/A.	N/A.	N/A.	N/A.	N/A.
Where there is uncertainty with regard to the status of a heritage resource, object, place or artefact, or any legislative or other policy issue the SAHRA can be contacted for clarity.	Rehabilitation.	General awareness	Site inspections	Inspections during rehabilitation	ECO	Only necessary if any resource is found.	Prevent

Stakeholder expectations and / or comments

None received.

Residual and latent risks

If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

Pre- and post-mitigation impacts per site (table1/2)

				Impact pre-mitigation						Impact post-mitigation					
Line No	Site No	Site Type	Activity	Intensity & Magnitude	Resource replaceability	Duration	Extent or spatial scale	Probability	Significance	Intensity & Magnitude	Resource replaceability	Duration	Extent or spatial scale	Probability	Significance
1	2430CD-K01	Handaxe	Potential destruction of heritage resources	3	3	2	1	2	**11 Medium** Stone Age artefacts are protected by the National Heritage Resources Act 25 of 1999.	1	2	2	1	1	**7 Low**
2	2430CD-K02	Plastic items	Potential destruction of contemporary remains	3	3	3	2	2	**13 High** Not culturally significant material	1	1	1	1	1	**5 Low**
3	2430CD-K03	Handaxe	Potential destruction of heritage resources	2	3	2	1	1	**9 Medium** Stone Age artefacts are protected by the National Heritage Resources Act 25 of 1999.	1	2	2	1	1	**7 Low**
4	2430CD-K04	Potsherds	Potential destruction of heritage resources	2	3	2	1	1	**9 Medium** Iron Age artefacts are protected by the National Heritage Resources Act 25 of 1999.	1	2	2	1	1	**7 Low**

Pre- and post-mitigation impacts per site (table2/2)

Line No	Environmental objective	Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy	Residual and latent risks
1	To ensure that heritage resources are not negatively impacted.	Inspect rehabilitation process	Rehabilitation	General awareness	Site inspections	Inspection during rehabilitation	ECO	Only necessary if significant heritage site encountered	Prevent	If effective management takes place, there should not be residual impacts. No latent impacts foreseen
2	N/A	None	None	None	None	None	N/A	None	N/A	None
3	To ensure that heritage resources are not negatively impacted.	Inspect rehabilitation process	Rehabilitation	General awareness	Site inspections	Inspection during rehabilitation	ECO	Only necessary if significant heritage site encountered	Prevent	If effective management takes place, there should not be residual impacts. No latent impacts foreseen
4	To ensure that heritage resources are not negatively impacted.	Inspect rehabilitation process	None	General awareness	Site inspections	Inspection during rehabilitation	ECO	Only necessary if significant heritage site encountered	Prevent	If effective management takes place, there should not be residual impacts. No latent impacts foreseen

vi) Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

Impact assessment

The methodology used to assess the significance of an impact is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA. The impact significance methodology described below also complies to Appendix B of the Operational Guideline to Integrated Water and Waste Management of 2010 in terms of the NWA. In the event of any Section 21c&i water uses in terms of the NWA being assessed, Appendix A of the General Authorisations of 2016, GN 509 in terms of the NWA will be used to construct a risk matrix. Regulation 3(b) of the General Authorisations of 2016, GN 509 in terms of the NWA states that a suitably qualified SACNASP professional member must determine risks associated with this risk matrix.

Impact identification and prediction means forecasting the change of environmental parameters due to developmental patterns. These parameters may also be changing due to climate change and should be included.

Method of assessment: Impact identification and prediction is a stepwise procedure to identify the direct, indirect and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community. This should be undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies. Likely impacts should be described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.

Significance rating: Ratings should then be assigned to each criterion. Significance of impacts should be determined for each phase of the mining lifecycle this includes; preconstruction, construction, operational, closure (including decommissioning) and post closure phases. The significance of impacts should further be assessed both with and without mitigation action. The description of significance is largely judgemental, subjective and variable. However, generic criteria can be used systematically to identify, predict, evaluate and determine the significance of impacts resulting from project construction, operation and decommissioning. The process of determining impact magnitude and significance should never become mechanistic. Impact magnitude is determined by empirical prediction, while impact significance should ideally involve a process of determining the acceptability of a predicted impact to society. Making the process of determining the significance of impacts more explicit, open to comment and public input would be an improvement of environmental assessment practice. Impact magnitude and significance should as far as possible be determined by reference to either legal requirements (accepted scientific standards) or social acceptability. If no legislation or scientific

standards are available, the EAP can evaluate impact magnitude based on clearly described criteria. A matrix selection process is the most common methodology used in determining and ranking the site sensitivities:

- The consequence: includes the nature / intensity / severity of the impact, spatial extent of the impact, and duration of the impact.
    - The nature / intensity / severity of the impact: An evaluation of the effect of the impact related to the proposed development on the receiving environment. The impact can be either positive or negative. A description should be provided as to whether the intensity of the impact is high, medium, or low or has no impact in terms of its potential for causing negative or positive effects. Cognisance should be given to climate change which may intensify impacts.
    - The spatial extent of the impact: Indication of the zone of influence of the impact: A description should be provided as to whether impacts are either limited in extent or affect a wide area or group of people. Cumulative impacts must also be considered as the extent of the impact as may increase over time.
    - The duration of the impact: It should be determined whether the duration of an impact will be short-term, medium term, long term or permanent. Cumulative impacts must also be considered as the duration of the impact as it may increase over time.
- The likelihood: includes the probability of the potential occurrence of the impact, and frequency of the potential occurrence of the impact
    - The probability of the impact: The probability is the quality or condition of being probable or likely. The probability must include the degree to which these impacts can be reversed; may cause irreplaceable loss of resources; and can be avoided, managed or mitigated
    - The frequency of the potential occurrence of the impact.
- The significance: This is worst case scenario without any management measures. See below how significance is determined: Impact that may have a notable effect on one or more aspects of the environment or may result in noncompliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence. Mitigation measures should be provided with evidence or motivation of its effectiveness

Example of significance rating:

Prior to mitigation

Intensity and magnitude	1 Natural processes or functions are not affected and will adequately return to its natural state. The impact will be completely reversed with correct management, and can be completely avoided, managed, or mitigated.	2 Natural processes or functions are affected, and natural processes or functions will continue in a modified manner. The impact will be reversed to some degree with correct management, and can be somewhat avoided, managed, or mitigated	3 Natural processes or functions are to the extent where it temporarily or permanently ceases. The impact cannot be reversed even with correct management, and cannot be avoided, managed, or mitigated
Resource replaceability	1 Loss of resource can be completely replaced.	2 Loss of resource can somewhat be replaced.	3 Resources will be completely lost.
Duration	1 The impact will be short-lived.	2 The impact will last for the entire operational life of the activity but will be mitigated thereafter.	3 The impact will not cease after the operational life of the activity ceases but will be permanent.
Extent or spatial scale	1 The impact will be site specific.	2 The impact will affect the local area.	3 The impact will affect an area larger than just the local area.
Probability	1 It is unlikely that the impact will occur.	2 There is a probability for the impact to occur.	3 The impact will definitely occur.
Significance	None or low If the sum of the above ranking is equal or more than 5 and 7, and no ranking equals 3.	Medium If the sum of the above ranking is equal or more than 8 to 11.	High If the sum of the above ranking is 12 or more.

Post to mitigation

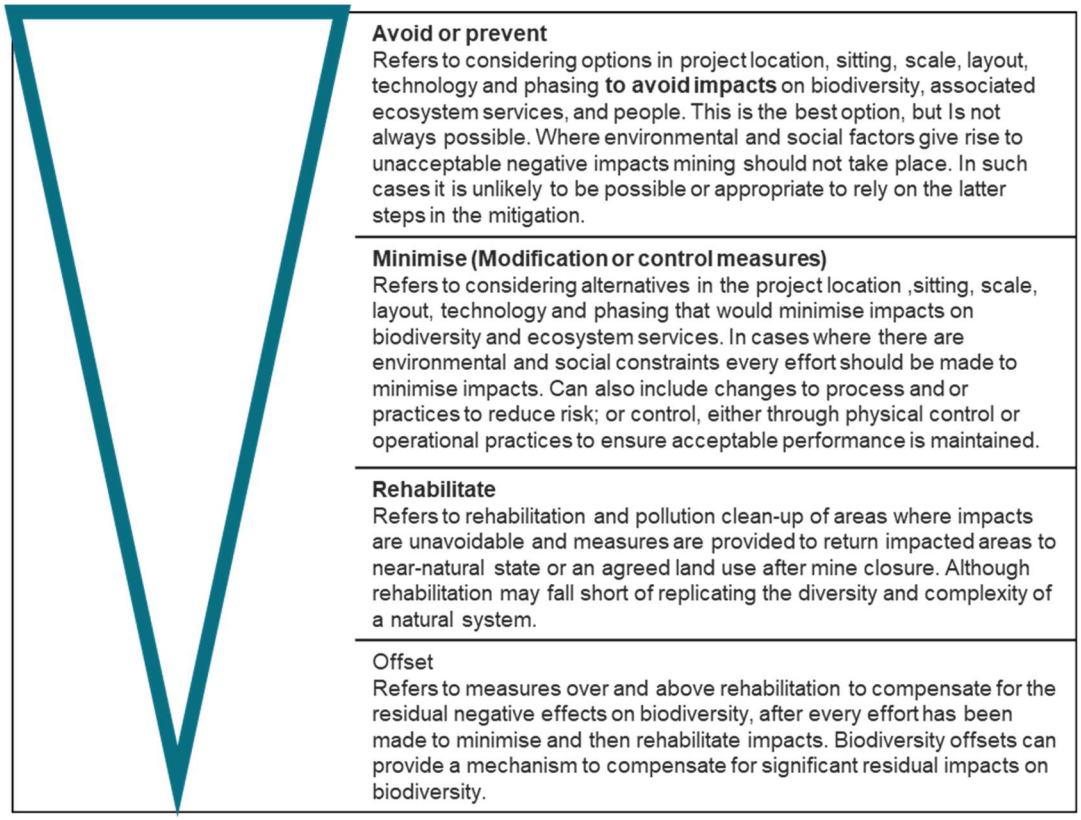
Intensity and magnitude	1 Natural processes or functions are not affected and will adequately return to its natural state. The impact will be completely reversed with correct management, and can be completely avoided, managed, or mitigated.	2 Natural processes or functions are affected, and natural processes or functions will continue in a modified manner. The impact will be reversed to some degree with correct management, and can be somewhat avoided, managed, or mitigated	3 Natural processes or functions are to the extent where it temporarily or permanently ceases. The impact cannot be reversed even with correct management, and cannot be avoided, managed, or mitigated
Resource replaceability	1 Loss of resource can be completely replaced.	2 Loss of resource can somewhat be replaced.	3 Resources will be completely lost.
Duration	1 The impact will be short-lived.	2 The impact will last for the entire operational life of the activity but will be mitigated thereafter.	3 The impact will not cease after the operational life of the activity ceases but will be permanent.
Extent or spatial scale	1 The impact will be site specific.	2 The impact will affect the local area.	3 The impact will affect an area larger than just the local area.
Probability	1 It is unlikely that the impact will occur.	2 It is likely for the impact to occur.	3 The impact will definitely occur.
Significance	None or low If the sum of the above ranking is equal or more than 5 and 7, and no ranking equals 3.	Medium If the sum of the above ranking is equal or more than 8 to 11.	High If the sum of the above ranking is 12 or more.

Mitigation and management

Management methodology is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA; and the Mining and Biodiversity Guideline (Mainstreaming Biodiversity into the Mining Sector) IDB of 2013 in terms of the MPRDA.

Management statements detail the processes, procedures and practices required to achieve an impact management outcome. A hierarchy of management tools used can also be used as seen below.

Mitigation should include measures in the following order of priority. The aim is to prevent adverse impacts from happening or, where this is unavoidable, to limit their significance to an acceptable level.



Avoiding or preventing impacts

If the biodiversity (an ecosystem, habitat for threatened species, ecological corridor or area that provides essential ecosystem services) is of conservation value or importance, it is best to plan to avoid or prevent impacts altogether by changing the location, siting, method or processes of the mining activities and related infrastructure.

Minimising impacts

Minimising impacts of mining is a mitigation measure that deals with the environment in general. In areas where the biodiversity is to be affected is of conservational value or importance, then every effort should be made to minimise those impacts that cannot be avoided or prevented. Mining companies should strive to minimise impacts on biodiversity to ensure environmental protection. Section 2 of NEMA contains environmental management principles that resonates with minimising the impact rather than stopping at mitigation, this is imperative in the mining sector.

Rehabilitating impacted areas

Rehabilitation is the measures that are undertaken to “as far as it is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which aligns to the generally accepted principle of sustainable development. A closure plan is an essential part of rehabilitation and must be developed based on the establishment of the closure objectives and criteria.

Biodiversity offsets

Biodiversity offsets are measurable conservation gains that help to balance any significant biodiversity losses that remain after actions to avoid, minimise and restore negative impacts have been taken. They are the last stage of mitigation and should be considered after appropriate avoidance, minimisation, and rehabilitation/restoration measures have been applied already.

When dealing with management, impact management outcomes must:

- be set for the expected activity-based impacts;
- describe the desired outcome of the management measure/s prescribed or the standard to be achieved (environmental objective);
- be clearly documented and identified per project phase as in the impact identification and significance rating process (this must be aligned to the mines closure objectives, and must therefore include predicted long-term result of the applied management measures);
- be measurable to determine compliance, which includes time frames and schedule for the implementation of the management measures; responsibilities for implementation and long-term maintenance of the management measures; financial provision for long-term maintenance; and monitoring programmes to be implemented;
- be informed by stakeholder expectations; and
- ensure legal compliance;

Finally, the impact assessment must refer to the residual and latent impact after successful implementation of the management measures.

Appendix C: Curriculum Vitae

Curriculum vitae

Tobias Coetzee

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Registered Professional Archaeologist, Association of Southern African Professional Archaeologists (ASAPA), CRM accredited, membership no: 289

Full names: Tobias Johannes Coetzee
Date of birth: 19 May 1986
Qualifications: MA (Archaeology)

Education:

2017	MA (Archaeology) University of Pretoria Dissertation: *Mapping Bokoni: Exploring Bokoni settlement choices and changes in Mpumalanga and Limpopo, South Africa using GIS site distribution analysis techniques*
2008	BA (Hons) (Archaeology) University of Pretoria Dissertation: *Mapping Bokoni towns & trade: Applying Geographic Information Systems to the articulation of Mpumalanga stonewalled sites with pre-colonial trade routes*
2006 – 2008	BA (Archaeology & Geography) University of Pretoria Subjects: Zulu, Afrikaans, Cartography, GIS and ArcGIS applications, Meteorology, Anthropology, Ancient History, Isotope Ecology and Dating, Computer and Information Literacy, Academic Skills and Introduction to research

Employment:

2020	Heritage Practitioner Agri Civils Geo-Tech & Heritage
2013 – 2019	GIS Practitioner Bigen Group (Pty) Ltd
2013	Specialist consultant: Heritage Environmental Assurance (Pty) Ltd
2011	Junior lecturer in Archaeology at the University of South Africa (UNISA) at the department of Anthropology & Archaeology Primary lecturer for: The Prehistory of South Africa Assistant lecturer for: Applied Archaeology - Heritage Conservation
2009	Tutor Department of Anthropology & Archaeology, University of Pretoria

Conference papers, publications & Cultural Resources Management Reports:

Coetzee, T. 2020. *Conservation Management Plan for Cemetery 1 at the Kwagga North Mine, Middelburg, Mpumalanga*. Lydenburg: Agri Civils Geo-Tech & Heritage

Coetzee, T. 2020. *Conservation Management Plan for Cemetery 4 at the Kwagga North Mine, Middelburg, Mpumalanga*. Lydenburg: Agri Civils Geo-Tech & Heritage

Coetzee, T. 2020. *A Phase 1 Archaeological Impact Assessment for the Proposed Trentra Mining Development near Kriel, Mpumalanga*. Lydenburg: Agri Civils Geo-Tech & Heritage

Coetzee, T. 2020. *A Phase 1 Archaeological Impact Assessment for the Proposed Lakeside/Leeuwfontein Colliery Expansion near Ogies, Mpumalanga*. Lydenburg: Agri Civils Geo-Tech & Heritage

Coetzee, T. 2020. *A Phase 1 Archaeological Impact Assessment for the proposed Blesboklaagte Colliery near eMalahleni, Mpumalanga*. Lydenburg: Agri Civils Geo-Tech & Heritage

Coetzee, T. 2020. *Integrated Heritage Impact Assessment for The Proposed Buchuberg Resources Prospecting Right Project On Portion 1 Of The Farm Karoovlei 454; Portion 21 Of The Farm Elsie Erasmuskloof 158; Erf 624 In The Matzikama Local Municipality, West Coast District Municipality, Western Cape Province*. Pretoria

Coetzee, T. 2019. *Grave relocation report of Tlabane Mamoloko Mankge from Portion 2 of the Farm Diepgezet 18 JT, Mashishing, Mpumalanga*. Pretoria

Coetzee, T. 2019. *Conservation Management Plan for the Cemetery on the Farm Portions of the Proposed Bothashoek Mine, Pullens Hope, Mpumalanga*. Pretoria

Coetzee, T. 2019. *A Phase 1 Archaeological Impact Assessment for Rivanet Mining & Exploration on Several Portions of the Farm Palmietfontein 189 IP near Ventersdorp, North West*. Pretoria

Coetzee, T. 2019. *A Phase 1 Archaeological Impact Assessment for the Wildebeestfontein Colliery near Phola, Mpumalanga*. Pretoria

Coetzee, T. 2019. *A Phase 1 Archaeological Impact Assessment for the Weltevreden Colliery near Emalahleni, Mpumalanga*. Pretoria

Coetzee, T. 2019. *A Phase 1 Archaeological Impact Assessment for the Construction of Chicken Broiler Houses on a Portion of Portion 78 of the Farm Mezeg 77 JP, Zeerust, North West*. Pretoria

Coetzee, T. 2019. *A Phase 1 Archaeological Impact Assessment for South 32 on a Portion of the Farm Prinshof 2 IS near Ogies, Mpumalanga*. Pretoria

Coetzee, T. 2019. *Phase 1 Archaeological Impact Assessment for the Isiko Malt Grain Milling Plant on Pt 7 of the Farm Reydal 165 IQ, Krugersdorp, Gauteng*. Pretoria

Coetzee, T. 2019. *Heritage Scoping Report for the Development of Erf 96, Kilner Park, Pretoria, Gauteng*. Pretoria

Coetzee, T. 2019. *Archaeological Scoping Report for the Proposed Prospecting of Manganese, Baryte and Iron Ore on the Farm Vlak Fontein 433, Postmasburg, Northern Cape*. Pretoria

Coetzee, T. 2019. *Phase 1 Archaeological Impact Assessment for the Proposed Woestalleen/Noodhulp Coal Mining Project near Middelburg, Mpumalanga*. Pretoria

Coetzee, T. 2019. *Phase 1 Archaeological Impact Assessment for the Refurbishment of the Reception and Construction of a New Double Storey Office Extension at Sender Technology Park, Roodepoort, Gauteng*. Pretoria

Coetzee, T. 2019. *Conservation Management Plan for the Graveyards and Infrastructure on Portion 5 of the Farm Op Goedenhoop 205 IS, Mpumalanga*. Pretoria

Coetzee, T. 2018. *Conservation Management Plan for a Graveyard on Portion 5 of the Farm Van Dykspruit 431 JR, Mpumalanga*. Pretoria

Coetzee, T. 2018. *A Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd for the Construction of the Mareesburg Haul Road near Boschfontein, Mpumalanga*. Pretoria

Coetzee, T. 2018. *Phase 1 Archaeological Impact Assessment for the proposed Gulf service station on erf 10742, Umhlathuze Village, Empangeni, KwaZulu-Natal*. Pretoria

Coetzee, T. 2018. *A Phase 1 Archaeological Impact Assessment for the Proposed Tala Bethal Coal Project Between Hendrina and Bethal, Mpumalanga*. Pretoria

Coetzee, T. 2018. *A Phase 1 Archaeological Impact Assessment for the Proposed Diep Vaalbank Coal Project Between Hendrina and Bethal, Mpumalanga*. Pretoria

Coetzee, T. 2018. *A Phase 1 Archaeological Impact Assessment for the Expansion of the Kleinfontein Colliery Between Hendrina and Bethal, Mpumalanga*. Pretoria

Coetzee, T. 2018. *Grave Relocation Report for the Jeremiah Nyathi Grave from Portion 7 of the Farm Enkeldedoorns 35 JT, Lydenburg, Mpumalanga*. Pretoria

Coetzee, T. 2017. *Phase 1 Archaeological Impact Assessment for M² Environmental Connections (Pty) Ltd for the proposed Township Blue Hills Ext. 77 on the Farm Blue Hills 397 JR, Midrand, Gauteng.* Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for the Proposed Witbank Siding on erf 5197 and portions of portion 2, 144, 150, 219 and 244 of the Farm Blesboklaagte 296 JS, Emalahleni, Mpumalanga.* Pretoria

Coetzee, T. 2017. *Heritage Management Plan for Sedibeng Iron Ore Mine on Annex Taaibosch 1, Portion 3 and the RE of Farm 445 Postmasburg, Northern Cape.* Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for the Emfuleni Local Municipality landfill development on a Portion of Portion 178 of the Farm Vlakfontein 546 IQ, Vereeniging, Gauteng*. Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd on a portion Intersecting Portions 19, 22 and 29 of the Farm Kennedy's Vale 361 KT, Steelpoort, Limpopo Province.* Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd on erf 1 of Masehlaneng and erf 1480 of Sekgakgapeng, Mokopane, Limpopo.* Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd on two portions of Portion 6 of the Farm Mareesburg 8 JT, Steelpoort, Limpopo*. Pretoria

Coetzee, T. 2017. *A Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd for the construction of a powerline to supply electricity to a Vodacom tower between Roossenekal and Mashishing, Mpumalanga.* Pretoria

Coetzee, T. 2017. *Phase 1 Archaeological Impact Assessment for Eco Elementum (Pty) Ltd for the proposed expansion of the Moeijelyk Chrome Mine on the remaining extent of the Farm Moeijelijk 412 KS, Sekhukhune, Limpopo.* Pretoria

Coetzee, T. 2017. *Phase 1 Archaeological Impact Assessment for M² Environmental Connections (Pty) Ltd for the proposed Service Station on a portion of Portion 836 of the Farm Knopjeslaagte 385 JR, Centurion, Gauteng*. Pretoria

Coetzee, T. 2017. *Limited Phase 1 AIA for Diepsoils Investments (Pty) Ltd on a portion of Portion 5 of the Farm Kalabasfontein 232 IS and a portion of Portion 10 of the Farm Rietkuil 224 IS, Bethal, Mpumalanga*. Pretoria

Coetzee, T. 2017. *Phase 1 Archaeological Impact Assessment for the proposed opencast mining and initial site areas of the Northern and Southern Clusters of the Bauba Platinum Farms Mining Project, Sekhukhune, Limpopo.* Pretoria

Coetzee, T. 2016. *Phase 1 Archaeological Impact Assessment for Vunene Mining (Pty) Ltd on a portion of portion 6 of the Farm Jan Hendriksfontein 263 IT and a portion of the Farm Transutu 257 IT, Ermelo, Mpumalanga.* Pretoria

Coetzee, T. 2016. *Phase 1 Archaeological Impact Assessment for I-Cat (Pty) Ltd on a Portion of Portion 25 of the Farm Vlakfontein 523 JR, Bronkhorstspruit, Gauteng.* Pretoria

Coetzee, T. 2016. *Phase 1 AIA & Scoping for Yoctolux Collieries (Pty) Ltd on Portions 13 & 16 of the Farm Mooifontein 109 IT, Ermelo, Mpumalanga.* Pretoria

Coetzee, T. 2016. *Phase 1 Archaeological Desktop Study for Eco Elementum (Pty) Ltd on a portion of the remaining portion of the Farm Dingwell 276 JT, White River, Mpumalanga.* Pretoria

Coetzee, T. 2016. *Phase 1 Archaeological Impact Assessment for Eco Elementum (Pty) Ltd on a Portion of Portion 9 of the Farm Goedvertrouwd 499 JR, Emalahleni.* Pretoria

Coetzee, T. 2015. *Conservation Management Plan for Vunene Mining Usutu Colliery on Portion 3 and 4 of the farm Jan Hendriksfontein 263 IT, Ermelo, Mpumalanga.* Pretoria

Coetzee, T. 2015. *Phase 1 Archaeological Impact Assessment for Millsell Chrome Mine on a portion of portion 410 of the farm Waterkloof 305 JQ, Rustenburg, North West.* Pretoria

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Coetzee, T. 2015. *Phase 1 Archaeological Impact Assessment for Vus'ithemba Project Solutions CC on a portion of the remaining extent of the farm Witklip 388 KR, Modimolle, Limpopo.* Pretoria

Coetzee, T. 2015. *Phase 1 Archaeological Impact Assessment for Rock Environmental Consulting (Pty) Ltd on a portion of Portion 74 of the Farm Rietkol 237 IR, Delmas, Mpumalanga.* Pretoria

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Coetzee, T. 2014. *A Phase 1 Archaeological Impact Assessment for the proposed Kebrafield (Pty) Ltd open cast coal mine on Portion 17 of the farm Roodepoort 151 IS, Pullens Hope, Mpumalanga.* Pretoria

Coetzee, T. 2014. *Phase 1 Archaeological Impact Assessment for Environmental Assurance (Pty) Ltd on Portion 43, a portion of Portion 16 of the Farm Rooidraai 34 JT - Mpumalanga.* Pretoria

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Coetzee, T. 2012. *Phase 1 AIA for the proposed Medium Density Fibre plant on portion 60 of the farm Lothair 124 IT, Mpumalanga.* Pretoria: ENVASS Pty. Ltd.

Coetzee, T. 2012. *Phase 1 AIA for the proposed mining of sand and clay from the remaining portion of the Farm Papkuilfontein 469 JR, Mpumalanga.* Pretoria: ENVASS Pty. Ltd.

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References:

- Dr M.H. Schoeman, Lecturer, Honours project and Masters supervisor
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