

Archaeological Impact Assessment of the proposed Krone-Endora Diamond Mine (Mining Rights Applications 10011MR & 10017MR) on portions of farms Krone 104MS and Endora 66MS near Alldays, Musina, Limpopo Province

Report Prepared for EcoPartners & DMI Minerals South Africa (Pty) Ltd

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Internal Review

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1. Management Summary

EcoPartners (Pty) Ltd, on behalf of DMI Minerals South Africa (Pty) Ltd, contracted Siyathembana Trading 293 (Pty) Ltd, an independent heritage risk management company to conduct an Archaeological Impact Assessment (AIA) of the potential direct, indirect and cumulative impacts of the proposed Krone-Endora Mine (Mining Rights Applications 10011MR and 10017MR) about 40 kilometers northeast of Alldays and approximately 80 kilometres west of Musina. Direct impacts are those that result in the destruction of archaeological resources while indirect impacts have potential to affect but are unquantifiable. Cumulative impacts are the sum of both direct and indirect in the short, and medium to long term. The proposed development is situated inside but on the southern edge of the De Beers Consolidated Mines owned by Venetia Limpopo Nature Reserve, a thriving biodiversity sanctuary governed by a very strict code of conduct to sustainably protect cultural and natural heritage as part of the Diamond Route (Davies-Mostert 2012). The proposed mining area is adjacent to a pre-existing mining development that was established over twenty years ago.

More importantly, the proposed development footprint is located 22 kilometres due south of the Mapungubwe World Heritage Site and National Park (Figure 1). According to Pikirayi (2001) and Huffman (2007), the Mapungubwe state with its capital at Mapungubwe Hill between AD1220 and 1290 covered an area that is approximately 30 000 square kilometres in size. As such, the area proposed for development lies on the Mapungubwe Cultural Landscape as broadly defined. Best practice in terms of heritage management now advocates for the co-existence of conservation and development provided that adequate assessment and mitigation strategies are carried out (Kristiansen 2009; Makuvaza 2014). This sensitivity motivated DMI Minerals to commission a robust and rigorous Archaeological Impact Assessment. A palaeontological study of the project was carried out by Durand (2012).

After prospecting by De Beers Consolidated Mines and an ownership of rights transfer, DMI purchased the farms Endora 66MS and Krone 104MS with the aim of exploiting alluvial diamonds which are restricted to ancient water channels closer to the Venetia Kimberlite pipe. The alluvial deposits on portions of Krone 104 MS and Endora 66MS were washed over millions of years from the high ground kimberlite pipes on Venetia 103MS (EcoPartners 2012). To exploit these deposits, DMI Minerals South Africa proposes to employ a mining method which involves simultaneous mining and rehabilitation. The mining method will involve opening up to 1 hectare of land at a time, and mining diamond rich gravels up to a maximum depth of 15metres. The mined areas will be rehabilitated as the mining progresses. Most importantly, the proposed mine will have no permanent structures, only a mobile mineral processing plant, to be moved around when the need arises. DMI has already experimented with rehabilitating the mined areas and the trial results have been hugely successful in restoring vegetation in exposed areas during the prospecting stage (EcoPartners 2012). This will positively limit the visual impacts of the proposed development as well as its impact on sense of place.

DMI proposes to mine the alluvial diamonds in two phases: The first phase, Mining Right Application 10011MR seeks to extract diamonds from an area of about 665 hectares in size. It is anticipated that this mining will take place over a 10 to 15 year period. After that, DMI

proposes to commence with the second phase, Mining Right Application 10017MR. During this phase, attention will be directed to palaeogravels on portions of the farms Endora 66MS and Krone 104MS which will be mined using exactly the same method of opening up 1 hectare at a time and rehabilitating the area before moving onto the other area. Although no mining plans are yet available for Mining Right Application 10017MR, it is obvious that the entire farms will not be mined out owing to the limited distribution of palaeogravels. Furthermore, the infrastructure for processing minerals will be located in Mining Right Area 10011MR.

The extent of the proposed development exceeds 5000 square meters and demands an Archaeological Impact Assessment in terms of Section 38 of the South African Heritage Resources Act (No. 25 of 1999). In order to assess impact, Siyathembana devised a multi-stepped methodology that combined desktop studies with scoping online databases such as Google Earth and Google Maps. This enabled a detailed understanding of the archaeological resources around the proposed development, particularly those making up the Mapungubwe Cultural Landscape. The major categories of identified sites belong to the following periods: Early Stone Age (2.5 million to 200 000 years ago), Middle Stone Age (200 000 to 30 000 years ago), Later Stone Age (30 000 to 2000 years ago), Early Iron Age (AD300 to 900), Middle Iron Age (AD900 to 1300), Late Iron Age (AD1300 to 1850) and historical sites (1850 to 1960). All these sites are protected by the National Heritage Resources Act and may not be disturbed or altered without permission from the South African Heritage Resources Agency.

Based on the results of desktop studies, a predictive model was devised to guide field walking in the proposed development footprint to assess impact. Most Stone Age sites are located on exposed patches, on ancient water courses or in rock shelters while Iron Age and historical sites are mostly situated on raised ground near permanent water sources. The survey methodology therefore targeted flats, raised areas, river valleys and also randomly sampled areas where no sites were expected. In assessing impact, a 100 % survey coverage for the area to be mined under Mining Right Application 10011MR was conducted, while a robust walk down was conducted for Mining Right Area 10017MR. In the context of Europe, Kristiansen (2009) has observed that there is a tendency to assess parts of the same development separately, with the result of under assessing the impact. As such, he calls for cumulative impact assessment as a standard of best practice. Siyathembana felt it extremely important to assess the impact cumulatively because separating the two areas may produce misleading impact assessment results. Given the sensitive nature of the Mapungubwe Cultural Landscape in general, Siyathembana adhered to this rigorous standard of best practice. Furthermore, the South African Heritage Resources Agency now encourages cumulative impact assessment of potential impacts because this allows for informed decision making and assists in the gestation of sustainable mitigation strategies.

Based on this study, the following conclusions were reached for Mining Rights Areas 10011MR and 10017MR:

1. No Iron Age sites were recorded in the area proposed for mining as part of Mining Rights Area 10011MR. Three Iron Age sites belonging to the Icon type (AD1300)

were located on the western corner of Mining Right Area 10017MR, along the Kolope River.

2. Only one MSA site was recorded in the area proposed for mining in 10011MR. This site is of low scientific value because there is no properly defined context.
3. Three Middle Stone Age sites and two historical sites were found in the area to be mined as part of Mining Right Application 10017MR. These also have a low significance consistent with Grade 3c.
4. No rock art sites were discovered in the two areas.
5. Due to unusually very high rainfall in Limpopo in late 2013 and early 2014, there is very high vegetation cover which limited ground visibility in many areas. This mainly affected sections of Mining Right Application 10017MR.
6. There is potential to encounter poorly marked historical graves of farm inhabitants.
7. The cumulative impact of the proposed mining in the two mining right areas, based on the density of sites, depth of deposits and material culture concentration is very low.

Based on the above conclusions, the following recommendations were made:

- i.** Development may proceed in Mining Right Application Area 10011MR with a detailed recording of the scatter of MSA tools.
- ii.** Should chance archaeological finds be discovered in the process of mining, they must be reported to the heritage authorities without delay.
- iii.** The proposed development has potential to affect the few Stone Age, Iron Age, and historical sites inside Mining Right Application Area 10017MR. However, because no mining plan is available yet, such sites may not be affected.
- iv.** It is strongly recommended that a full heritage impact assessment be carried out to assess potential impacts when mining plans are available and should mining be extended to Mining Right Application Area 10017MR.
- v.** Should any grave or human remains be encountered during the development, work must be stopped immediately and the developer should alert SAHRA Limpopo or the SAHRA Head office.
- vi.** The direct, indirect and cumulative impacts of the proposed development are very low. As such, the development must be authorised, subject to recommendations made in this report.

Stakeholders and people responsible for decisions

The following stakeholders are collectively and individually responsible for implementing the recommendations of this study:

1. Developer – DMI must ensure that no heritage sites are destroyed without permission from the relevant authority and that all chance discoveries are reported to the relevant authorities.
2. Developer – DMI must ensure that a full HIA is conducted before mining associated with Mining Right 10017MR begins.
3. Archaeologists must carry out detailed salvage work in the event of chance finds
4. The South African Heritage Resources Agency must ensure that the developer produces periodic reports as a way of monitoring to ensure that no unknown heritage sites are destroyed.
5. The South African Heritage Resources Agency, South African National Parks and Department of Environmental Affairs must ensure that the activities of DMI do not compromise the integrity of the Mapungubwe Cultural Landscape as broadly defined through continuous monitoring.

In summary, the archaeological impact assessment indicated that the area proposed for development is situated on the very sensitive Mapungubwe Cultural Landscape. However, no significant sites were found on the proposed development footprint for Application 10011MR. A few sites of low to medium significance were found on the area for Mining Right Application 10017MR. A full HIA must be carried out before mining begins in this area. The cumulative impact of the development is very low.

2. Technical Summary

Property details	
Province	Limpopo
Magisterial District	Musina
Topo-cadastral map	2229AD
Closest town	Alldays
Farm name	Krone 104MS and Endora 66MS

Development criteria in terms of Section 38(1) of the NHR Act	Yes	No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length		
Construction of bridge or similar structure exceeding 50m in length		
Development exceeding 5000 sq m	Yes	
Development involving three or more existing erven or subdivisions		
Development involving three or more erven or divisions that have been consolidated within past five years		
Rezoning of site exceeding 10 000 sq m		
Any other development category, public open space, squares, parks, recreation grounds		

Development	
Description of development	Alluvial mining of diamond rich paleogravels to maximum depth of 15 meters
Project name	Proposed Krone-Endora diamond mine

Land use	
Previous land use	Agriculture
Current land use	Diamond mining, nature reserve

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5. Terms of reference (ToR)

Siyathembana 293 (Pty) Ltd was contracted by EcoPartners (Pty) Ltd, on behalf of DMI Minerals South Africa (Pty) Ltd to carry out an Archaeological Impact Assessment of the proposed Krone-Endora Diamond Mine (Mining Right Applications 10011MR and 10017MR) and associated developments. According to the SAHRA minimum standards, a specialist archaeological impact assessment report must clearly describe the nature of the project and terms of reference for the developer and achieve the following:

- a. Identify and map the sites;
- b. Assess their significance in terms of Section 7;
- c. Comment on the impact of the proposed development on identified archaeological resources individually and collectively

- d. Make recommendations for their mitigation or conservation
- e Consider alternatives, if archaeological resources will be adversely impacted.

The study carried out a wide ranging desktop research followed by 100 percent coverage of Mining Right Area 10011MR. A detailed field walking was also carried out for Mining Right Area 10017MR in search of archaeological sites.

6. Abbreviations

AIA	Archaeological Impact Assessment
BEA	Basic Environmental Assessment – Section (23)(2)(d)
EIA	Environmental Impact Assessment
ESA	Early Stone Age
ESR	Environmental Scoping Report – Section (29)(1)(d)
EIA	Environmental Impacts Assessment – Section (32)(2)(d)
EMP	Environmental Management Plan
HP	Historical Period
IA	Iron Age
MIA	Middle Stone Age
LIA	Late Iron Age
LSA	Later Stone Age
MSA	Middle Stone Age
National Development Plan	National Development Plan
NEMA	National Environmental Management Act 107 of 1998
NHRA	National Heritage Resources Act 25 of 1999
PHRA	Provincial Heritage Resource Agency
SAHRA	South African Heritage Resources Agency

7. Introduction

Developing countries such as South Africa absolutely require economic growth to meet their developmental imperatives. Traditionally, such growth has been anchored on the exploitation of mineral resources such as diamonds. One of the main advantages of mining is that it has potential to generate development in less developed areas thereby uplifting the standards of living for residents of such areas. Indeed, the South African government established the National Development Plan (NDP) to ensure that it meets key objectives such as reducing unemployment through job creation. In line with this national strategic goal, DMI Minerals South Africa seeks to exploit aluvial diamonds on portions of farms Endora 66MS and Krone 104MS (Mining Rights Application 10011MR and 10017MR) near Alldays, Musina in Limpopo Province.

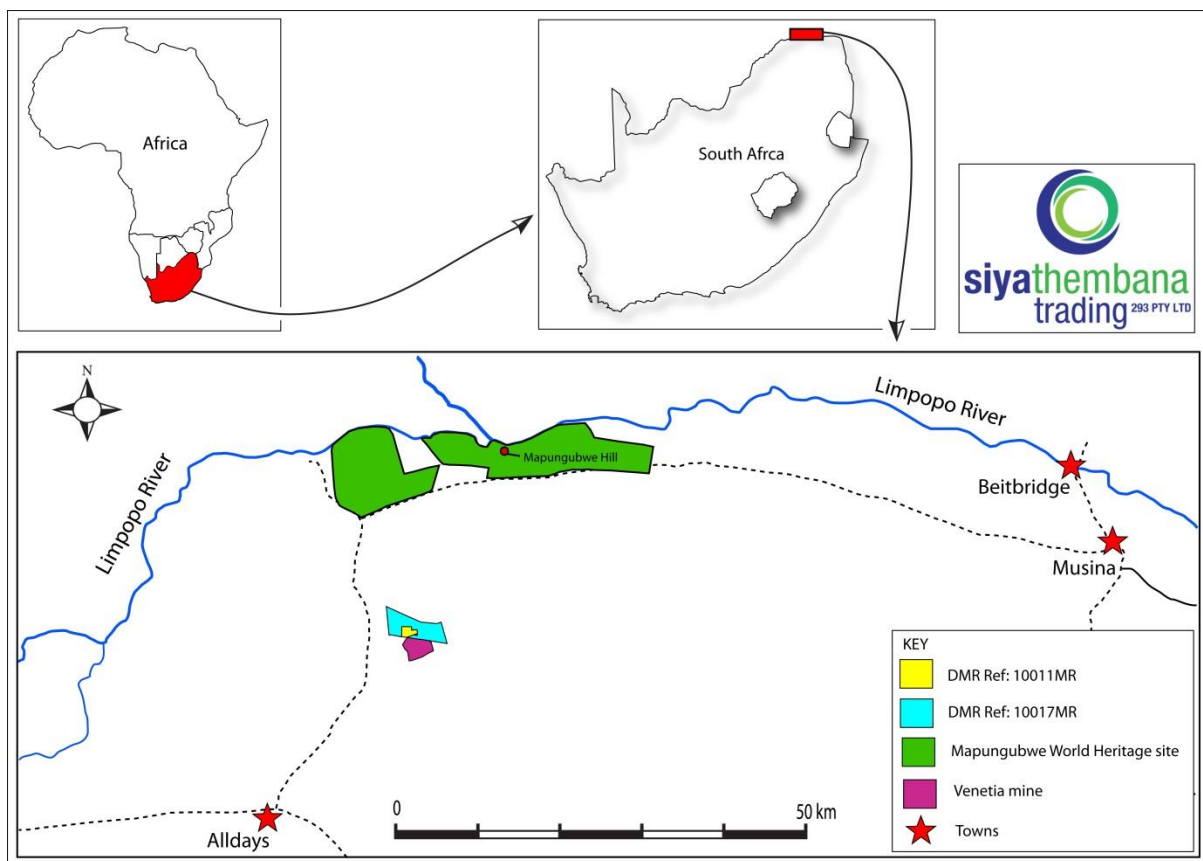


Figure 1: Map showing the location of proposed development in relation to Alldays and the Mapungubwe World Heritage Site and National Park (Complied by Siyathembana Research)

However, because minerals are situated underground, mining them poses a very strong risk to the survival of the non-renewable heritage resources (MacEachern 2010; AWHF & DEA 2013; Makuvaza and Chiwaura 2014). Heritage resources are important in promoting social

cohesion and hold significant scientific and cultural values. As such, the National Heritage Resources Act of 1999 mandates within a value based framework that as part of the national estate, heritage must be protected for posterity. The act calls for impact assessments to be carried out to mitigate the potential impact of proposed developments on the heritage.

The Mapungubwe Cultural Landscape, where the proposed development is situated, is highly significant. Part of this landscape was listed as a UNESCO World Heritage site in 2003 and hosts individual sites such as Leokwe Hill, Mapungubwe Hill and Schroda which are all National Heritage sites in terms of the National Heritage Resources Act of 1999. As such, extra care must be taken to consider the potential impact of proposed developments on the attributes that convey the value of this landscape singly and in combination (Elandou and Avango 2012). The purpose of this study is to establish the archaeological sensitivity of the proposed diamond mining (Mining Right Applications 10011MR and 10017MR) in order to avoid or mitigate the potential impact that the development may have on archaeological sites. Additionally, the study also seeks to inform the developer about relevant legislative requirements and steps that should be followed before and or during the development process. To achieve the above objectives, the study combined desk based research with reconnaissance surveys.

The Mapungubwe Cultural Landscape is an archaeologically layered landscape (Deacon and Norton 2003). It consists of various layers of human occupation dating back millions of years. The earliest layer belongs to the Early Stone Age (ESA) (2.6 million – 200 000 BP) which is followed by the Middle Stone Age (MSA) (300 000 – 20 000 BP) and the Later Stone Age (LSA) (20 000 -to the recent historical time (last 2000 years) (Sampson 1974; 1984; Sadr 2008; Barham & Mitchell 2008). Then, there is the layer corresponding to Early Iron Age farmers in the first millennium AD (Huffman 2007). This layer is followed by Middle Iron Age peoples who are associated with the state capitals at Schroda, K2 and Mapungubwe. Subsequent to this various groups of Late Iron Age period settled in the area. The last layers relates to colonial history and the early history of the twentieth century. The material signatures for all these cultural periods have been identified in the area under study and should be taken cognisance of.

8. Legislative context

The identification, evaluation and assessment of any cultural heritage sites, artifacts or finds in the South African context is required and governed by the following national and provincial legislations:

- (a) National Heritage Resources Act (NHRA) Act 25 of 1999
 - (i). Protection of Heritage Resources – Sections 34 to 36; and
 - (ii). Heritage Resources Management – Section 38
- (b) National Environmental Management Act (NEMA) Act 107 of 1998 - Sections 24(5), 24M and 44
 - (i). Basic Environmental Assessment (BEA) – EIA Regulation 22
 - (ii). Environmental Scoping Report (ESR) – – EIA Regulation 28
 - (iii). Environmental Impacts Assessment (EIA) – EIA Regulation 31

The NHRA of 1999 stipulates that cultural heritage resources may not be disturbed without authorization 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...”. Subsection 35(4) of the same act states that: 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 with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.

The purpose of Chapter 5 in NEMA is to promote the application of appropriate environmental management tools in order to ensure the integrated environmental management of activities. To give effect to the general objectives of integrated environmental management laid down in Chapter 5, the potential consequences for or impacts on the environment of listed activities or specified activities must be considered, investigated, assessed and reported on. NEMA defines Environment as " the surroundings within which humans exist and that are made up of-

- (i) the land, water and atmosphere of the earth;
- (ii) micro-organisms, plant and animal life;
- (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and
- (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being

This Heritage Impact Assessment report is meant to assist the developer to comply with the relevant South African legislations noted above and to ensure that development is done in a sustainable way. The legislation also provides useful working definitions on what constitute heritage resources, archaeological resources, cultural significance and development. The following definitions are adopted in this archaeological impact assessment report:

Heritage resources

This means any place or object of cultural significance

Cultural significance

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

Archaeological resources

This includes:

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

Development

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

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

9. Description of the project area (Mining Right Application 10011MR & 10017MR)

Prospecting activities by De Beers and further work carried out by DMI Minerals revealed the presence of diamonds along ancient water channels in very restricted parts of the farms Endora 66MS and Krone 104MS. To extract these minerals DMI Minerals submitted a mining rights application (10011MR), approximately ~665.8 ha in size (Figure 2). It is estimated that this area will be mined for 10 to 15 years. Subsequent to this, DMI minerals plan to prospect and mine small portions with diamond rich palaeosands within the farms Krone 104MS and Endora 66MS indicated by red outline (Mining Rights Application 10017MR) (Figure 3).

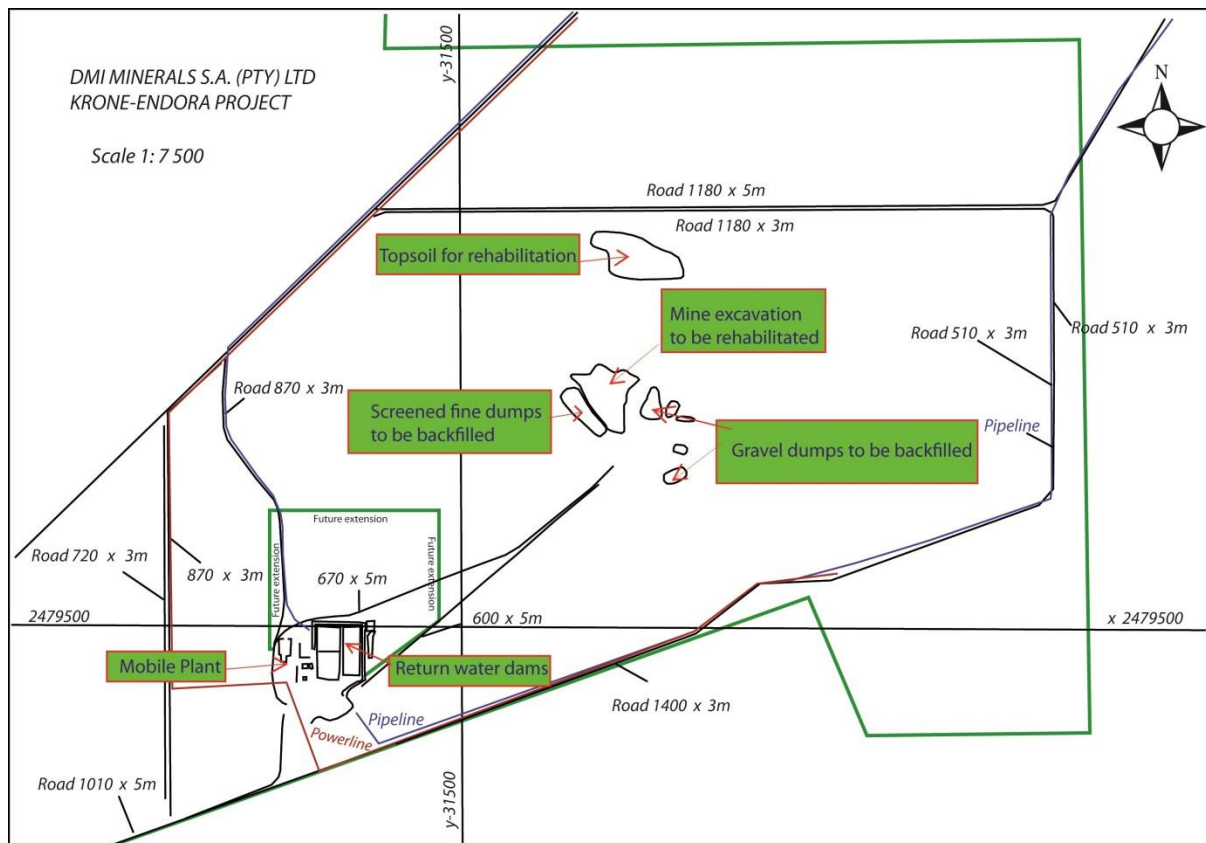


Figure 2 shows the development plan for the proposed Krone-Endora Mine (Mining Right Applications 10011MR). The area is very small and is adjacent to a receiving environment already affected by mining. Diamond extraction in the Mining Right Application 10017MR will only begin after this mine has reached the end of its life. However, 10017 MR will use pre-existing infrastructure established during this phase (Source: EcoPartners 2012 & Gerald Engelsman *pers. com* 2014).

So far no mining plans are available for Mining Rights Application 10017MR but the mining will be restricted to ancient river courses and is therefore not going to cover the entire property. It is estimated that this mining will take place over 5 to 10 years. The plant and other infrastructure in Phase II or Mining Rights Application 10017MR will continue to be based in Mining Right Application 10011MR area. As such, this will be a continuation of existing mining operations. The mining method proposed for Krone-Endora (Mining Right

Applications 10011MR & 10017MR) combines simultaneous mining with rehabilitation and involves the following steps:

- Removal and Storage of Topsoil - The topsoil is 40-80cm thick and only varies slightly across the property.
- Removal of Remaining Overburden – A thin (0.5-3m) barren soil layer that grades into the topsoil zone.
- Removal of Intermediate gravel horizons (the ‘Upper Gravels’) – A layer or multiple layers of gravel, which are more sparsely distributed than the Basal Gravel but has also been found to contain diamonds.
- Removal of Basal Gravels – The Basal gravels are expected to contain the highest diamond grades and highest diamond values. The gravels, once excavated will be treated as follows:
 - i. In-field screening
 - ii. Disaggregation of pebbles/conglomerates
 - iii. Washing and Concentration of Dense Material (including diamonds)
 - iv. Recovery of Diamonds
 - v. Stockpiling of Concentrate

Backfilling of the open pit quarry will be carried out continuously as the mining progresses. Such a measure prevents the development of very high spoil heaps which have potentially negative visual impacts. From a heritage point of view, any disturbance of the ground has potential to impact on sites, both known and unknown. However, if impacts are minimised or mitigated then the damage to the heritage is minimised or avoided altogether.

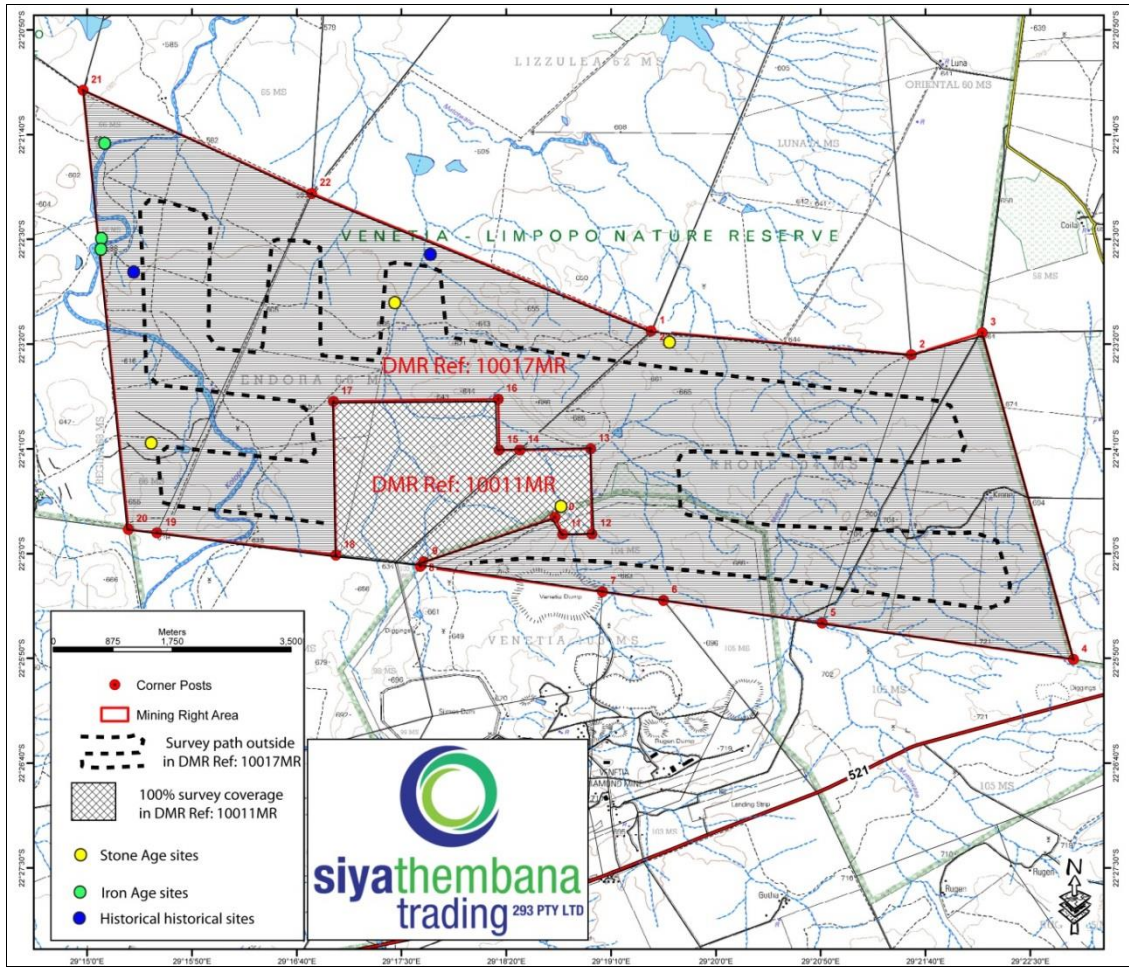


Figure 3 shows the relationship between Mining Right Application 10011MR and 10017MR. Not everything inside this area will be mined but only those portions with palaeosands.

10. Methodology and limitations

The study was based on a combination of desktop research of the available literature and databases, and reconnaissance surveys on the proposed development. The literature consulted includes both published and unpublished archaeological, historical and anthropological works. The reports of previous archaeological impact assessments carried out in the area formed a key component of this research. In addition, SAHRA databases were also consulted together with the database hosted by the Chief Directorate of Surveys and Mapping in Mowbray. The archaeological surveys were limited in some parts by the very thick vegetation cover which made ground visibility difficult (Figure 4).



Figure 4 shows the dense grass cover on the banks of the Kolope River. These areas are known to host Iron Age sites, particularly those belonging to Icon and Khami periods

11. Description of the archaeology of the project area

Based on the literature and reconnaissance surveys, it was noted that the area under study has a substantial number of archaeological sites belonging to the Stone and Iron Ages as well as the historical period. A photographic record of the general landscape is shown in Figure 5.

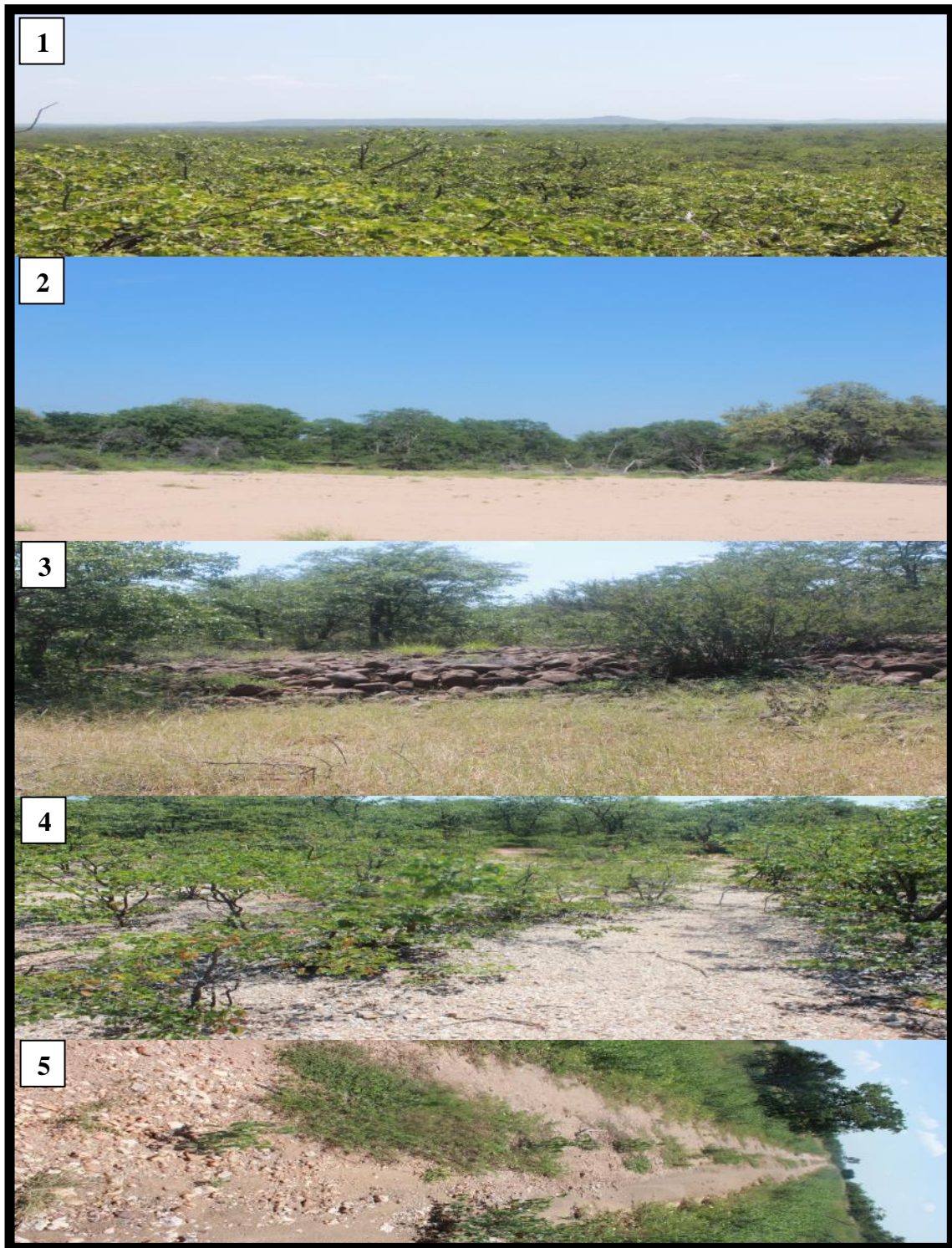


Figure 5: Landscape photos taken during field surveys. 1=thick Mopane bush visible from Diorite Ridge on Krone 104MS, 2= Kolope River, in Endora 66MS, 3=View of diorite rocks on Krone 104MS, 4=View of portions of gravels with stone artefacts, Krone 104 MS, 5=View of existing service roads with rehabilitated water pipeline from borehole, Krone 104 MS.

The next section describes the archaeology of the area according to relevant phases.

i. Earlier Stone Age, Middle and Later Stone Ages

Material dating to the three Stone Ages – Earlier (2.6 million to 200 000 years BP), Middle (200 000 – 30 000 BP) and Later Stone Ages (30 000 – 2 000BP) (Deacon and Deacon 1999; Phillipson 2005) has been repeatedly found on archaeological sites within the Mapungubwe Cultural Landscape and adjacent areas. A team led by Professor Kathy Kuman of the University of the Witwatersrand identified important sites that have enhanced our understanding of the Stone Age sequence of the Limpopo Valley and surrounding areas (e.g. Sutton 2003; Pollarolo 2004; Kuman *et al.* 2005a, b; Kempson 2007; Le Baron 2007; Pollarolo *et al.* 2010; Wilkins *et al.* 2010). Most of the sites in the area are open-air sites that experienced episodic deflation during the arid periods of the Pleistocene (Kuman *et al.* 2005b). For example, due to the deflation, the stratigraphy of sites such as Hackthorne and Keratic Koppie was destroyed, thus reducing them to single component sites. However, the stratigraphy at Kudu Koppie remained intact (Kuman *et al.* 2005a, b). Based on a preliminary assessment of these sites' surface collections of stone artefacts, that include simple core types, bifaces, occasional unifaces as well as pieces typical of MSA tools such as retouched points, Kuman and colleagues (2005a) suggested that the earliest occupation of the sites was during the ESA, either in the Acheulean or the post-Acheulean Sangoan Industry. Further, they indicated that the sites bear resemblance to industries that are transitional between the ESA and Middle Stone Age (MSA), especially those found north of the Limpopo in Zimbabwe.

Lithic analyses indicated that Hackthorne is primarily a late ESA site with a mix of MSA tools. The site however, had a very low proportion of formal tools and a high proportion of flakes indicating that it may have been a manufacturing site (Kempson 2007). Hackthorne tools were produced from locally sourced rocks such as quartzite, quartz, chert and dolerite. The other important site is that of Keratic Koppie which is dominated by a Middle Stone Age assemblage. Formal tools form a small component of the assemblage and include heavy-duty tools such as picks, core axes, a uniface and a denticulate. Light-duty tools include some utilised flakes and some denticulated/notched scrapers. In addition, the site has the highest numbers of irregular cores (Kempson 2007). Based on these tools, the site's ESA is argued to be the final-post Acheulean with a major component of woodworking tools, suggesting it may be a local variant of the Sangoan Industry (Kuman *et al.* 2005b; Kempson 2007). The MSA sites are dominated by scrapers and points (Lombard *et al.* 2012).

Kudu Koppie has the longest occupation period of the Stone Age sites studied in the Limpopo Valley, with assemblages spanning from the ESA to the Later Stone Age (LSA). It is the first open-air site in the northernmost part of South Africa with a late ESA assemblage overlain by an MSA industry in a stratified context (Pollarolo & Kuman 2009). The site was excavated in layers, the first containing highly weathered ESA tools (Kuman *et al.* 2005b), while Layer 2 contains ESA material at the base and some MSA tools higher up. Layer 3 contains MSA artefacts, while Layer 4 represents the uppermost MSA horizon and the overlying Layer 4 contains LSA tools. Kudu Koppie like the other two sites has high frequencies of small flaking debris, hence knapping could have taken place here too (Kuman

et al. 2005b). The site has a variety of heavy-duty and light-duty tools such as picks, choppers, core-axes, denticulated/notched scrapers, retouched flakes and cutting tools and some miscellaneous retouch, as well as prepared cores and radial cores typical of MSA assemblages (Kempson 2007). It does not appear as if there was a rock type preference at this site as a wide variety of rock types available locally were used as was the case at the other two sites.

These sites demonstrate the potential information value of Stone Age sites appearing in open air contexts and suggest that the Limpopo Valley is important for enhancing our understanding of the Stone Age (see, for example, Volman 1984; Kuman 2007; Mitchell 2002; Lombard *et al.* 2012). Outmost care should therefore be exercised to protect the Stone Age sites because they contribute an important layer of information.

ii. Rock Art of the Mapungubwe Cultural Landscape

The Mapungubwe Cultural Landscape hosts important rock art which the beliefs and experiences of the people who made it; predominantly the hunter-gatherers, early farming communities and Khoi herders. Different traditions are demonstrated in this area, among them; pictographs (drawings or paintings); petroglyphs (carvings or inscriptions), engravings (incised motifs), and rarely petroforms (rocks laid out in patterns), and geoglyphs (ground drawings) (Schoonraad 1960). In general, both paintings and engravings have similar themes and images, but the engravings tend to include less detail and fewer human figures (Deacon 2002). The first three rock-art traditions occur in Limpopo valley with distinctive styles and content that is largely a result of differences in the cosmology and beliefs of Stone Age hunter-gatherers, of Stone Age herders, and of Iron Age agriculturists. The Venetia Limpopo Nature Reserve (VLNR) contains rock art at places such as Hilda and Edmondsburg (Eastwood and Fish 1995). For example, the site of Hilda 1 contains red paintings depicting giraffe, baboon, fish, fat-tailed sheep and geometric abstracts (mainly Y-shapes). The paintings of a fat-tailed sheep are painted in the same style of as those of those at other sites in the area such as sheep shelter. The male figures at this site appear to be holding hands together or the Y-shapes between them. The style of the painted giraffe is very unusual (Eastwood 1995). Any proposed development must therefore consider potential impacts on this important resource.

iii. The Iron Age and historical period

The Limpopo Valley where the Mapungubwe Cultural Landscape is situated hosts a crucial history of the settlement of southern Africa by agriculturalists that made pottery, worked metal, practised crop agriculture, kept livestock and settled permanently in villages. The earliest evidence of occupation by farmers belongs to the Early Iron Age (AD200 – 900). The first farmers in the area made Happy Rest pottery and their remains were found at places such as Mapungubwe. These were followed by Zhizo farmers who had more extensive villages along rivers such as Limpopo. Schroda and Ratho are some of the best examples of this group. During the time of Schroda, the farmers were hunting ivory and exchanging it for exotic commodities such as glass beads. Because of its size and wealth of material, it is believed that Schroda was an important capital of a chiefdom based in the Limpopo valley.

Around AD 1000 (beginning of the Middle Iron Age), a new group of people archaeologically known as the Leopard's Kopje settled at K2 and other places. K2 was an important capital which also participated in long distance trade and elephant hunting. Around AD1220, power shifted from K2 to Mapungubwe Hill, which became an important capital controlling a territory that is approximately 30 000 square kilometres in extent. Mapungubwe participated in long distance trade and worked gold and bronze, a prestige metal and alloy respectively. There are many Zhizo, (EIA) and Leopard's Kopje (MIA) sites in and around Mapungubwe. The sites of Schroda, K2, Leokwe, and Mapungubwe are very important because apart from being National Heritage Sites, they are part of attributes that convey Mapungubwe's Outstanding Universal Value (Huffman 2007, Fatherley 2009). Not surprisingly, they are in the core of the listed property. Any proposed developments inside and outside the listed areas must not in any way affect the integrity of these sites.

Around AD1300, when Mapungubwe declined, settlement continued in the area with new groups coming in. A new group made ceramics that have been designated as Icon appeared on the landscape. The first site was recovered on the farm Icon which is adjacent to Regina 66MS. According to Huffman (2007), Icon people represent ancestral Sotho-Tswana peoples. By AD1450, Khami people established their settlements in the Limpopo valley and adjacent areas. As such Khami sites were found along the Limpopo and Kolope Rivers on farms such as Icon and Venetia 104MS. Khami people made platforms where houses were built. These Khami people are also ancestral Venda people. Settlement continued into the historical period such that by the 19th century, ancestral Bobirwa, Venda and Sotho-Tswana people were occupying the Mapungubwe cultural landscape as broadly defined. A number of settlements around Machete are testimony to this history (Huffman 2011). In the late 19th century, the Limpopo Valley was a great elephant hunting country which attracted European traders and hunters. After colonisation and with more European settlement, European sites became abundant for example there are also Anglo-Boer War sites. In the 20th century, the farm Greefswald was also used by the South African military (Figure 6).



Figure 6 shows military bunker used by the South African government in the 20th century

A detailed archaeological survey conducted by Professor Huffman from the late 1990s onwards on the South African side of the Shashi-Limpopo valley and by Professor Munyaradzi Manyanga on the Zimbabwean side (Manyanga 2007) and Dr Sarah Mothulatsipi (Mothulatshipi 2009) on the Botswana side yielded important information that has created our current understanding of the area. In particular, Huffman's work on the Venetia Limpopo Nature Reserve and adjacent areas identified many sites, few of which are on the south-western side of the farm Endora 66MS, along the Kolope River. Other sites were recovered on the farm Venetia 103 MS but none on Krone 104MS (Huffman 2011).

In conclusion, our current knowledge suggests that the Limpopo Valley has attracted farming communities who were also interacting with hunter-gatherers. Some of the sites of interaction were used for rain making and rain control. This landscape therefore is associated with scientific, historical, cultural, scientific and aesthetic values. This has been recognised through the declaration of important capitals and surrounding landscapes as National and World Heritage places. This means that extra care must be taken to ensure that any proposed development does not affect attributes that convey the value of the landscape.

12. Impact assessment results

In the first instance, all the information from the databases and published and unpublished sources was collated to produce a map showing the known distribution of archaeological resources in the area (Figure 7).

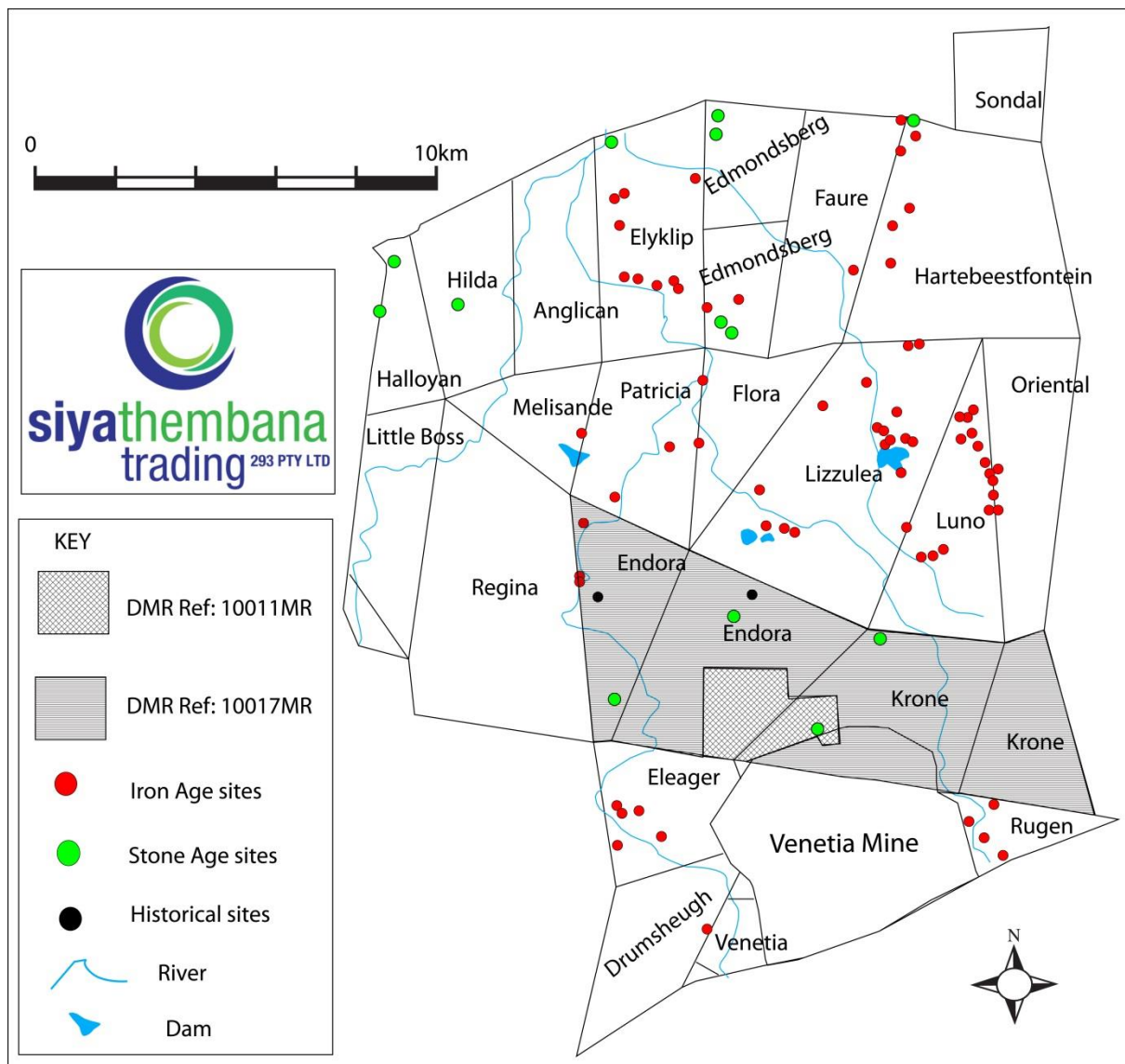


Figure 7 shows the distribution of sites around the proposed area for development.

Subsequently, a methodology that targeted Mining Right Area 1011MR and 10017MR was developed. The desktop study identified archaeological sites on the neighbouring Venetia Farm so it was thought prudent to walk 100 % of the Mining Right Area 10011MR. A fairly detailed walking was carried out in area 10017MR resulting in the location of sites mostly on deflated or eroded patches. The field walking is illustrated in Figure 8 below.

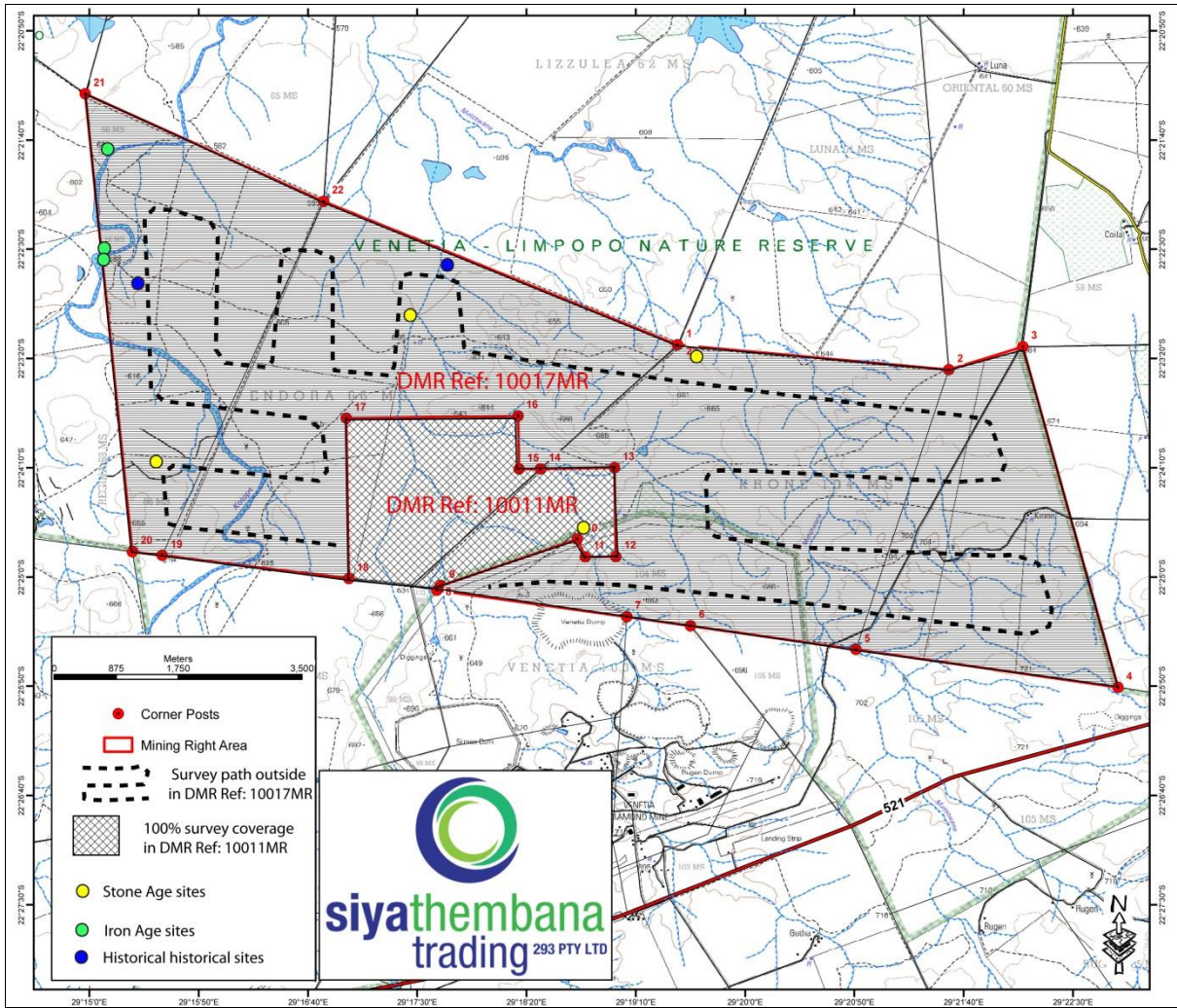


Figure 8 shows the survey results in the two areas proposed for development

Table 1 shows the sites that were discovered during the impact assessment process

Farm Name	Site Number	Site Type	Coordinates	Description
Endora 66 MS	1	MSA	S22 24 07.3 E29 15 06.0	Single MSA core on an eroded patch southwest of Kolope River. The area is characterised by scattered Mopane bush

Endora 66 MS	2	Historical	S22 22 33.7 E29 17 50.6	Remains of water reservoir, round foundation and a possible collapsed farm homestead
Krone 104 MS	3	MSA	S22 23 10.9 E29 17 25.2	MSA core, and flakes on a very wide area with a lot of quartz and isolated Mopane bush
Krone 104 MS	4	MSA	S22 23 14.3 E29 19 36.3	MSA core on eroded area next to pipeline supplying water to DMI from a borehole
Krone 104MS	5	MSA	S 22.41000° E 29.31422°	MSA scatter with no properly defined context (identified by G & A Associates 2012)
Endora 66MS	6	LIA	22 21 45.2 29 15 8.4	Midden (identified by Huffman 2011)
Endora 66MS	7	Historical	22 22 44.8 29 15 20.1	Historic Farm laborers quarters (identified by Huffman 2011)

13. Statement of significance

The general landscape on which the proposed development will be situated is associated with archaeological and heritage sites associated with numerous values ranging from cultural, scientific, spiritual, aesthetic and historical. As a result of sustained research and impact assessments, the archaeology and history of the area is now well known. However, the sites in the area proposed for development are of very low grade 3c value. Some of them lack a properly defined context while others are a scatters of a few tools. If we use sites such as Hackthorne, which are open air sites and have great information value as a benchmark, then these sites do not at all compare, further justifying the grade 3c.

No Iron Age sites were found in area 10011MR while a few were located on Endora 66MS, the portion to be potentially impacted in Mining Right 10017MR is exercised.

Table 2 shows the significance of the sites and the potential impacts, before and after mitigation.

Site No	Site Coordinates	Before Mitigation	After Mitigation
1	S22 24 07.3 E29 15 06.0	Low	low
2	S22 22 33.7 E29 17 50.6	low	low
3	S22 23 10.9 E29 17 25.2	low	low
4	S22 23 14.3 E29 19 36.3	Low	low
5	22.41000° S 29.31422° E	low	low
6	22 21 45.2 29 15 8.4	low	low
7	22 22 44.8 29 15 20.1	Low	low
	Cumulative	The archaeological resources falling within the project area are of low to medium significance since they are Grade 3 sites. Hundreds of similar sites exist on the landscape and are protected in the core area and in the VLNR.	

14. Conclusion and recommendation

In conclusion, a comprehensive desktop survey when combined to mapping and field walking considered the cumulative impact, of the development on the ensemble of sites on the landscape. No outstanding significant sites were reported in the area. Neither are there any provincial sites or burials. The following conclusions and recommendations apply:

Based on this study, the following conclusions were reached for Mining Rights Areas 10011MR and 10017MR:

1. No Iron Age sites were recorded in the area proposed for mining as part of Mining Rights Area 10011MR. Three Iron Age sites belonging to the Icon type (AD1300)

were located on the western corner of Mining Right Area 10017MR, along the Kolope River.

2. Only one MSA site was recorded in the area proposed for mining in 10011MR. This site is of low scientific value because there is no properly defined context.
3. Three Middle Stone Age sites and two historical sites were found in the area to be mined as part of Mining Right Application 10017MR. These also have a low significance consistent with Grade 3c.
4. No rock art sites were discovered in the two areas.
5. Due to unusually very high rainfall in Limpopo in late 2013 and early 2014, there is very high vegetation cover which limited ground visibility in many areas. This mainly affected sections of Mining Right Application 10017MR.
6. There is potential to encounter poorly marked historical graves of farm inhabitants.
7. The cumulative impact of the proposed mining in the two mining right areas, based on the density of sites, depth of deposits and material culture concentration is very low.

Based on the above conclusions, the following recommendations were made:

- i. Development may proceed in Mining Right Application Area 10011MR with a detailed recording of the scatter of MSA tools.
- ii. Should chance archaeological finds be discovered in the process of mining, they must be reported to the heritage authorities without delay.
- iii. The proposed development has potential to affect the few Stone Age, Iron Age, and historical sites inside Mining Right Application Area 10017MR. However, because no mining plan is available yet, such sites may not be affected.
- iv. It is strongly recommended that a full heritage impact assessment be carried out to assess potential impacts when mining plans are available and should mining be extended to Mining Right Application Area 10017MR.
- v. Should any grave or human remains be encountered during the development, work must be stopped immediately and the developer should alert SAHRA Limpopo or the SAHRA Head office.
- vi. The direct, indirect and cumulative impacts of the proposed development are very low. As such, the development must be authorised, subject to recommendations made in this report.

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