

# **McGregor Museum**

## **Department of Archaeology**



### **HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED EXTENSION OF SWARTBERG MINE ON BLACK MOUNTAIN MINE, AGGENEYS, NORTHERN CAPE PROVINCE**

David Morris and Abenicia Henderson assisted by  
Jani Louw

February 2019

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## **1. Introduction: background**

The McGregor Museum archaeology department was subcontracted by ERM Southern Africa (Pty) Ltd (contact: Mr. Brendon Solik, email: [Brendon.Solik@erm.com](mailto:Brendon.Solik@erm.com); web: [www.erm.com](http://www.erm.com) tel: 011 798 4300). The report gives input to the Heritage Impact Assessment for the proposed extension of the Swartberg mining operations on Black Mountain Mine (hereafter, referred to as BMM), portion 4 of farm Zuurwater 62.

The site of proposed development is approximately 11.28 km north west from the town of Aggeneys, Northern Cape.

### **1.1 Focus and Content of Specialist Report**

This archaeology and cultural heritage specialist report is focused on the proposed extension footprint.

This study outline:

- Introduction to the Specialist in terms of qualifications, accreditation and experience to undertake the study (1.2, below)
- Description of the affected environment (2)
- Description of heritage features of the region (2.1)
- Description of issues identified during the Scoping process (2.2)
- Methodology of determining the significance of the impacts and assumptions as well as scoping phase predictions (3)
- Observations and Assessment of impacts (4), including field observations (4.1); characterizing archaeological significance (4.2); and characterizing the overall significance of impacts as well as summary of significance of impacts (4.3).

- Recommended measures for draft Environmental Management Plane and site-specific mitigation (5)
- Conclusion (6)

## **1.2 Archaeology/heritage Specialists**

The authors (on staff at the McGregor Museum) are independent of the organization commissioning this specialist input, and provide this heritage assessment (archaeology and cultural heritage but not palaeontology) within the framework of the National Heritage Resources Act (No 25 of 1999).

The senior author is a professional archaeologist (PhD) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. He has worked as a museum archaeologist and has carried out specialist research and surveys in the Northern Cape and western Free State since 1985 (e.g. Beaumont & Morris 1990; Morris & Beaumont 2004; Morris 2018), having previously carried out surveys and fieldwork on sites in the Aggeneys area (e.g. Morris 1999a & b, 2000a,b & c, 2001, 2010, 2011, 2013). In addition, he has UCT-accredited training in architectural and urban conservation: researching and assessing local (built) environments (S. Townsend, UCT). He is also Chairman of the Historical Society Kimberley and the Northern Cape.

Junior author Abenicia Henderson a professional archaeologist (Hons) with a 6 year joint field experience in the Eastern and Northern Cape. Field assistant on the project Jani Louw is a qualified archaeologist (BA Honors, University of Cape Town; MA submitted), with archaeological fieldwork in the Northern Cape, working under supervision of Dr David Morris (senior author).

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites/places, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This means that a Heritage Impact Assessment should be performed, resulting in a specialist report as required by the relevant heritage resources authority/ies to assess whether

authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

Where archaeological sites and palaeontological remains are concerned, the South African Heritage Resources Agency (SAHRA) at national level acts on an agency basis for the Provincial Heritage Resources Agency (PHRA) in the Northern Cape. The Northern Cape Heritage Resources Authority (formerly called Ngwao Bošwa ya Kapa Bokone) is responsible for the built environment and other colonial era heritage and contemporary cultural values.

## **2. DESCRIPTION OF THE AFFECTED ENVIRONMENT**

The prospecting expansion area of interest is located on the BMM property, Khai-Ma Local Municipality and Namakwa District Municipality, Aggeneys, Northern Cape. The site is about 107km east from Springbok and 170 km west from Kakamas.

The environment in question is arid, comprising relatively flat drainage plains with inselbergs such as the Aggeneys Mountains, Black Mountain and Gamsberg rising above the plains in the wider landscape. In the immediate vicinity hills feature prominently. The landscape is sparsely vegetated, making any surface archaeological traces highly visible. The area investigated includes generally deflated lower slopes of the Swartberg hills, strewn with scree gravitating down-slope, and parts of adjacent dune fields and sandy plains.

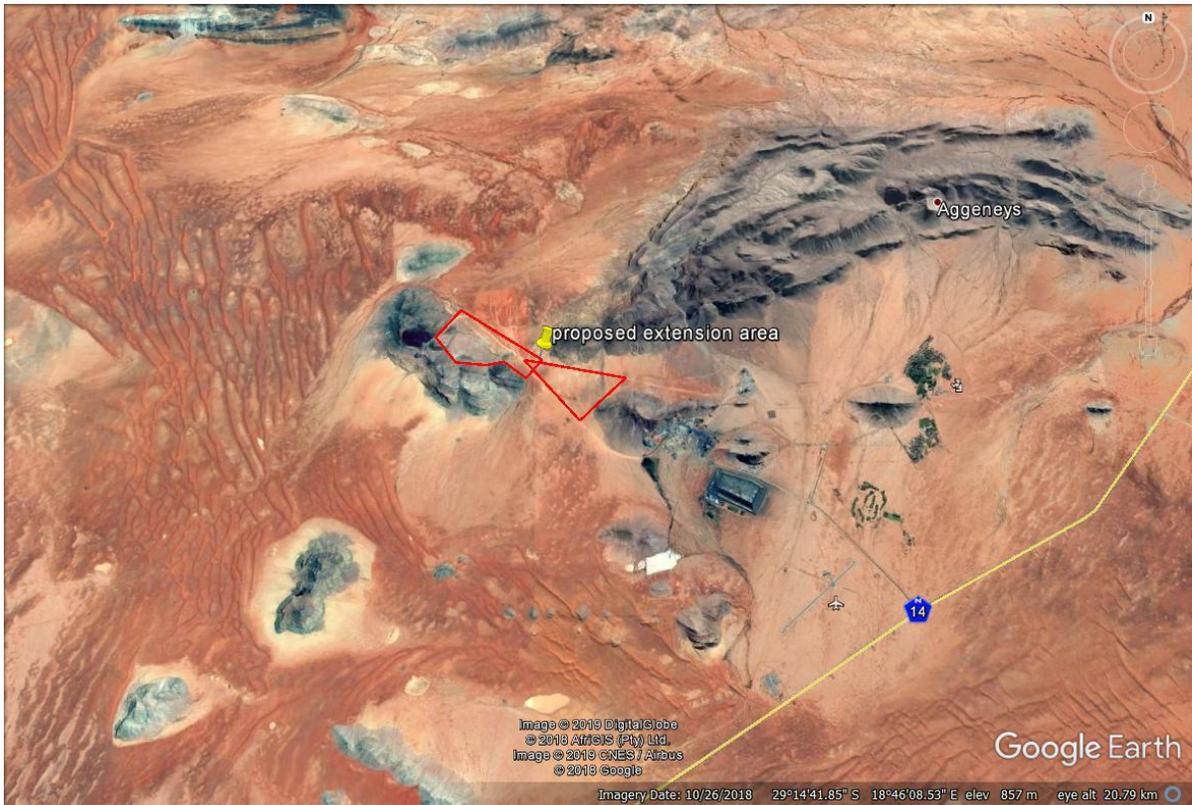


Figure 1a: Map of the area showing project area and proposed layout north west of Aggeneys.

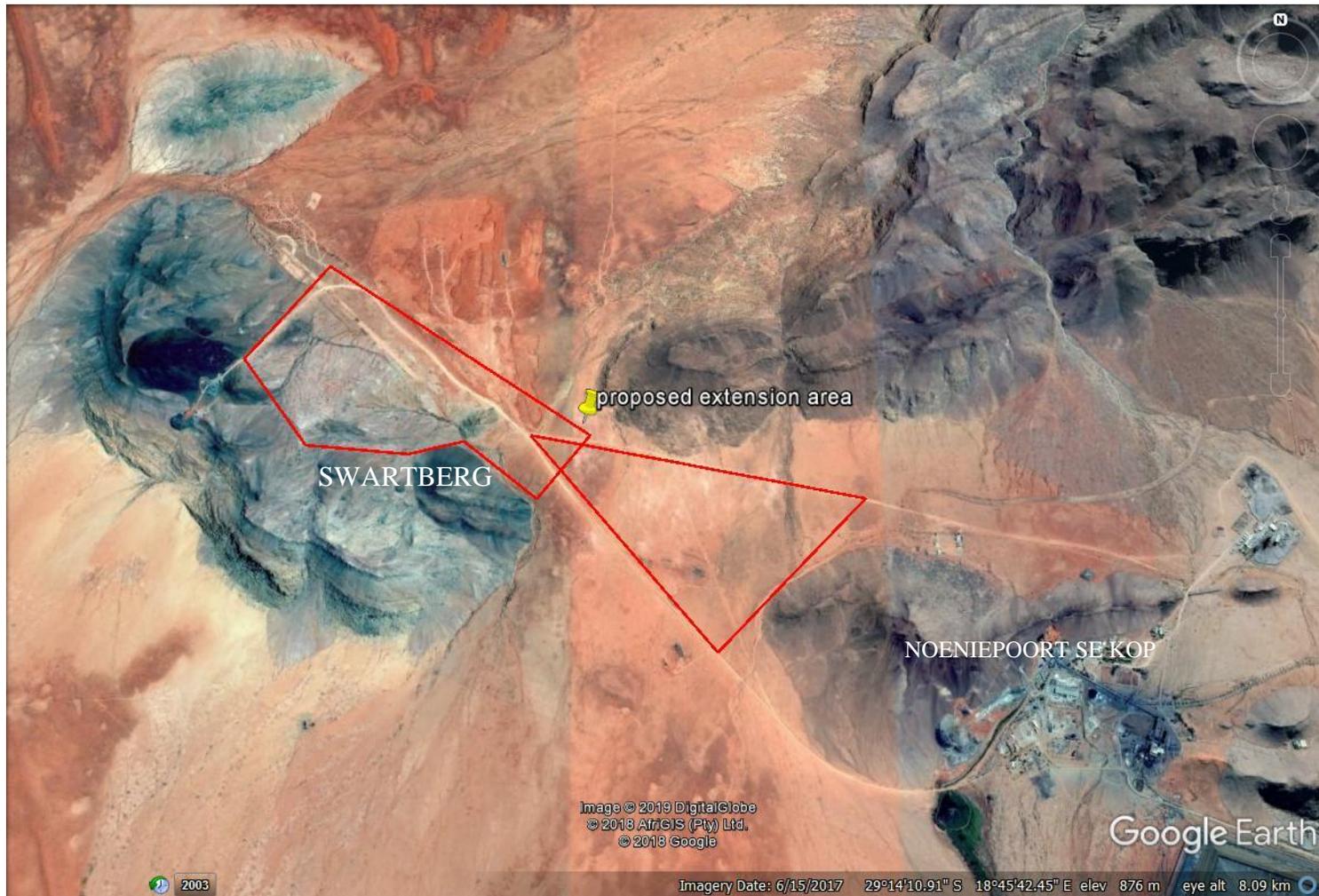


Figure 1b: Enlarged prospecting area, showing Swartberg and Noeniepoort se Kop

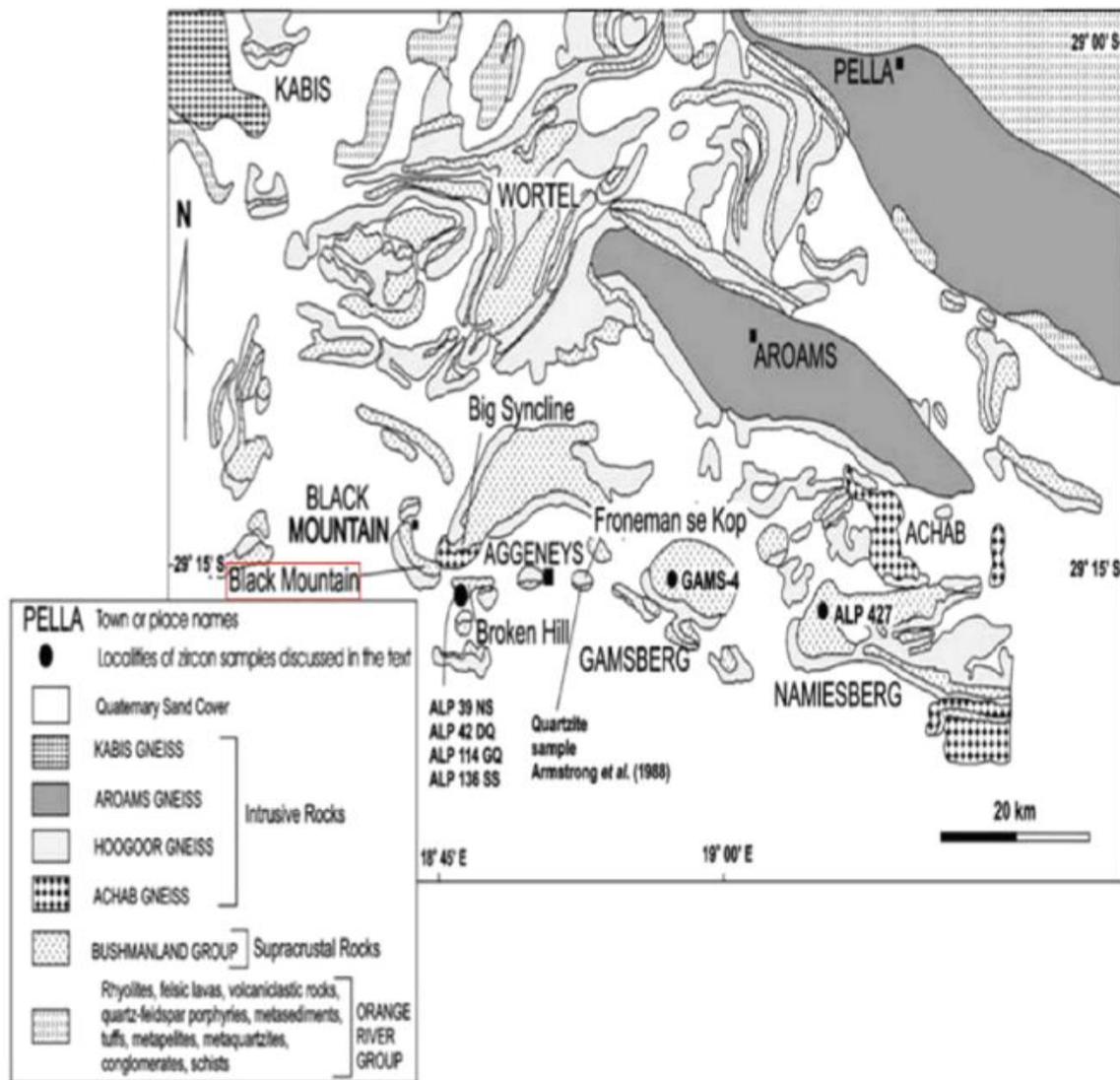


Figure 2: Geological map showing inselbergs and distribution of granitic gneisses of the Bushmanland Group supracrustal succession. (Source: Endemic Vision Environmental Consultants)

## 2.1 Description of heritage features of the region

Summary background information given in 2.1.1 to 2.1.3 is drawn from previous surveys locally by the lead author (including Morris 1999a-b, 2000a-c, 2001, 2010, 2011, 2012, 2013, 2016). Additional observations have been made inter alia by Orton (2016 and references cited therein), Webley & Halkett (2012, 2016 and references cited therein), and van Ryneveld (2017 and references cited therein).

### 2.1.1 Colonial frontier

As has been indicated in a similar survey of an area adjacent to Aggeneys (Morris 2011), the eighteenth- and nineteenth-century records for this region (Penn 2005) include the travelogues of George Thompson (1827) and E.J. Dunn (1931, Robinson 1978), who visited the area in 1824 and 1872 respectively. Place names were becoming fixed in this colonial frontier period (in a cadastral sense, on maps and in farm names), many such names having Khoe-San origins encapsulating vestiges of precolonial/indigenous social geography. A much more prominent appreciation is now emerging concerning the history of genocide against the Bushmen in this area (Anthing 1863), with certain mountainous areas (like Gamsberg and Namiesberg near Aggeneys) being likely massacre sites, referred to by Dunn in 1872 (Robinson 1978) and, more obliquely, by Anthing (1863; de Prada-Samper 2011). Actual massacre sites may ultimately be impossible to identify, other than in a general way, on the ground.

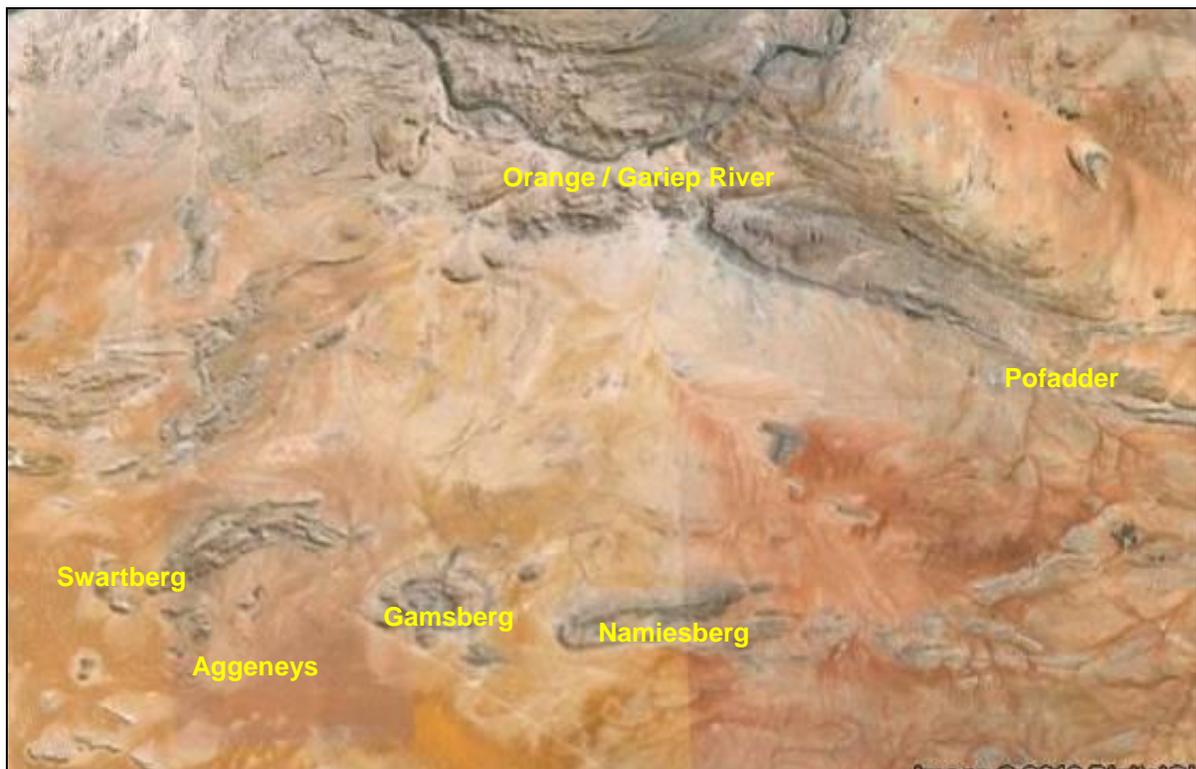


Figure 3: Regional focus: the study area relative to Aggeneys and some other places mentioned.

### **2.1.2 Later Stone Age**

Late Holocene Later Stone Age (LSA) sites are the predominant archaeological trace noted in past surveys in the Aggeneys-Pofadder region (Morris 1999a-b, 2000a-c, 2001, 2010, 2011, 2013). Beaumont *et al.* (1995) have shown, with reference to the LSA, that “virtually all the Bushmanland sites so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river” (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1990), which reflected the “much higher productivity and carrying capacity of these bottom lands.” “Given choice, the optimal exploitation zone for foragers would have been the Orange River.” The appearance of herders in the Orange River Basin, Beaumont *et al.* argue, led to competition over resources and ultimately to marginalisation of hunter-gatherers, some of whom then occupied Bushmanland, probably mainly in the last millennium, and focused their hunting and gathering activities around the limited number of water sources in the region. Surveys have located signs of human occupation mainly in the shelter of granite inselbergs, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *et al.* 1995:264). Possibly following good rains, herders moved into the Orange River hinterland, as attested archaeologically at sites with ample pottery near Aggeneys and, east of Pofadder, at Schuitdrift South – Morris 1999a). However, Thompson (1824) refers to herder groups settled at the stronger springs such as Pella dispersing during periods of drought to smaller springs in the region, which could equally well account for the traces referred to here. At such times competition between groups over resources and stress within already marginalised hunter-gatherer society, must have intensified.

Grinding grooves have been found on rock outcrops in the Aggeneys/Gamsberg area (Morris 2011) and rock paintings are known from a boulder site alongside the Aggeneys/Black Mountain aggregate quarry (Morris 2011). Important engraved cupule sites have been identified at two sites on Black Mountain Mining property, Aggeneys, and near the south western foot of the Swartberg on Zuurwater 62 (Morris 2013).

### **2.1.3 Pleistocene: Middle and Earlier Stone Age**

Beaumont *et al.* (1995:240-1) note a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka till. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and Maans Pannen, and east of Gamoep, could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA).

Beaumont *et al.* have shown that "substantial MSA sites are uncommon in Bushmanland" (1995:241): and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Smith 1995).

The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites (Morris 2018).

No substantial sites have been found previously in the survey area. Only very sparse localized scatters of stone tools have been seen in places, with limited traces in the hills (e.g. an MSA site at the top of Gamsberg) or at the bases of hills. ESA including a Victoria West core on quartzite and isolated handaxes at various locales has been noted within the Gamsberg basin (Morris 2010) and on surrounding plains (e.g. Morris 2011, 2012, 2016).

## **2.2 Description and evaluation of environmental issues and potential impacts identified**

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Developments such as those envisaged can have a

permanent destructive impact on these resources. The objective of the HIA is to assess the sensitivity of the site and the significance of potential impacts on these heritage resources, and to recommend no-go areas or measures for mitigating or managing the impacts if necessary.

Area impacts would occur in the case of the mining activity envisaged in this project.

### ***2.2.1 Direct, indirect and cumulative impacts (in terms of nature, magnitude and extent)***

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial mining/construction/waste rock dumping period. In the long term, the proximity of such operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

## **3. METHODOLOGY**

A site visit was undertaken to inspect the site on foot, focusing on areas of expected impact. Heritage traces were to be evaluated in terms of their archaeological significance (see tables below) and significance of impacts estimated in terms of standard criteria (4.3 below).

### **3.1 Assumptions and limitations**

It was assumed that, by and large in this landscape, with its sparse vegetation and shallow soil profiles, some sense of the archaeological traces to be found in the area would be readily apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features). It was not considered necessary to conduct excavations as part of the EIA to establish the potential of sub-surface archaeology. Dunes may mask sub-surface traces, but a number of erosion and deflation areas afforded opportunities to assess this possibility.

A proviso is routinely given, that should sites or features of significance be encountered during construction (this could include an unmarked burial, an ostrich eggshell water flask cache, or a high density of stone tools, for instance), specified steps are necessary (cease work, report to heritage authority).

This report does not address impacts on palaeontological material, other than to note that the bedrock underlying the site comprises ancient basement Bushmanland Group rocks which are unfossiliferous, regarded as “of no palaeontological interest”, while an opinion expressed concerning the palaeontological potential for Quaternary sand cover is “very low” (Pether 2012:4).

### **3.2 Predictions**

There was no explicit scoping phase to this particular heritage input other than the above overview on colonial and precolonial archaeology based on earlier surveys in the same general area. It was expected that features such as rock outcrops or the immediate footslopes of hills, places where water gathers (‘bakkes’) might be places where Stone Age and probably also colonial era traces would occur, if present. Dunes may also have been a focus of past human activity. Previous experience has shown that the plains away from such features are less likely to contain traces other than ‘background scatter’.

### **3.3 Potentially significant impacts to be assessed in the EIA process**

Any area or linear, primary and secondary, disturbance of surfaces in the development locales could have a destructive impact on heritage resources, where present. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by the Northern Cape Heritage Authority. Although unlikely, there may be some that could require preservation *in situ* and hence modification of intended placement of development features.

Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible). Without context, archaeological traces are of much reduced significance. It is the contexts as much as the individual items that are protected by the heritage legislation.

### **3.4 Determining archaeological significance**

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (nd) and Whitelaw (1997) for assessing archaeological significance has been developed for Northern Cape settings (Morris

2000a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

### *Estimating site potential*

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes *any* trace, even of only Type 1 quality, can be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

### *Assessing site value by attribute*

Table 2 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

**Table 1. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, National Monuments Council).**

Class	Landform	Type 1	Type 2	Type 3
L1	Rocky surface	Bedrock exposed	Some soil patches	Sandy/grassy patches
L2	Ploughed land	Far from water	In floodplain	On old river terrace
L3	Sandy ground, inland	Far from water	In floodplain or near feature such as hill	On old river terrace
L4	Sandy ground, Coastal	>1 km from sea	Inland of dune cordon	Near rocky shore
L5	Water-logged deposit	Heavily vegetated	Running water	Sedimentary basin
L6	Developed urban	Heavily built-up with no known record of early settlement	Known early settlement, but buildings have basements	Buildings without extensive basements over known historical sites

Class	Landform	Type 1	Type 2	Type 3
L7	Lime/dolomite	>5 myrs	<5000 yrs	Between 5000 yrs and 5 myrs
L8	Rock shelter	Rocky floor	Sloping floor or small area	Flat floor, high ceiling
Class	Archaeological traces	Type 1	Type 2	Type 3
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
A2	Shell or bones visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick; shell and bone dense
A3	Stone artefacts or stone walling or other feature visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick

**Table 2. Site attributes and value assessment (adapted from Whitelaw 1997)**

Class	Attribute	Type 1	Type 2	Type 3
1	Length of sequence/context	No sequence Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context High density of arte/ecofacts
2	Presence of exceptional items (incl regional rarity)	Absent	Present	Major element
3	Organic preservation	Absent	Present	Major element
4	Potential for future archaeological investigation	Low	Medium	High
5	Potential for public display	Low	Medium	High
6	Aesthetic appeal	Low	Medium	High
7	Potential for implementation of a long-term management plan	Low	Medium	High

#### **4. OBSERVATIONS AND ASSESSMENT OF IMPACTS**

The manner in which archaeological and other heritage traces or values might be affected by the proposed development may be summed up in the following terms: it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). The most obvious impact in this case would be land

surface disturbance through the expanded mining operation and associated infrastructure construction.

#### **4.1 Fieldwork observations**

The site was visited on 13-14 November 2018 when areas of anticipated impact were examined on foot. The area in question consists mostly of the lower and foot-slopes on the northern side of the Swartberg and associated outcrops, and adjacent dunes and sandy plains, characterised by rocky scree (gneiss, calcrete) and shallow red-brownish soils, sparsely vegetated. Visibility for archaeological traces is generally high. Observations may be summarised relative to predictions made in Section 3.2 above.



Figure 4a: Landscape setting of proposed mine extension

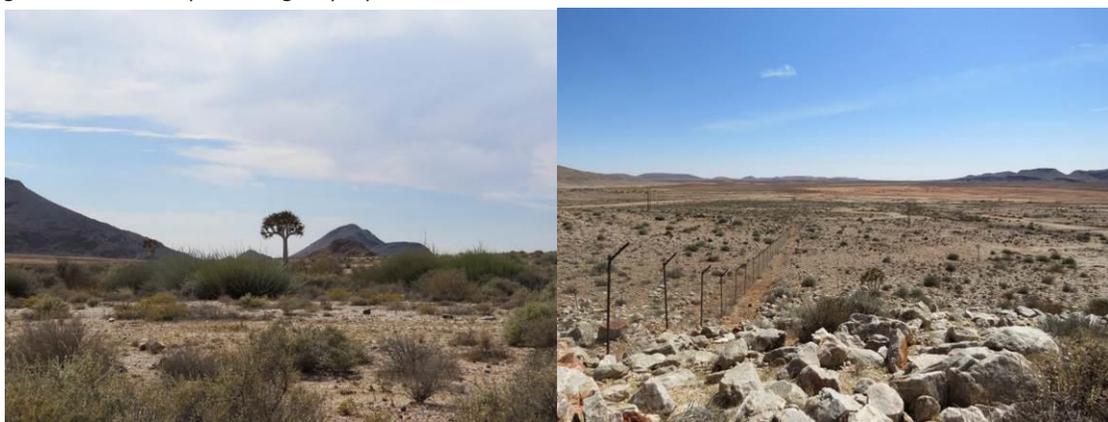


Figure 4b: Landscapes within the proposed mining extension footprint

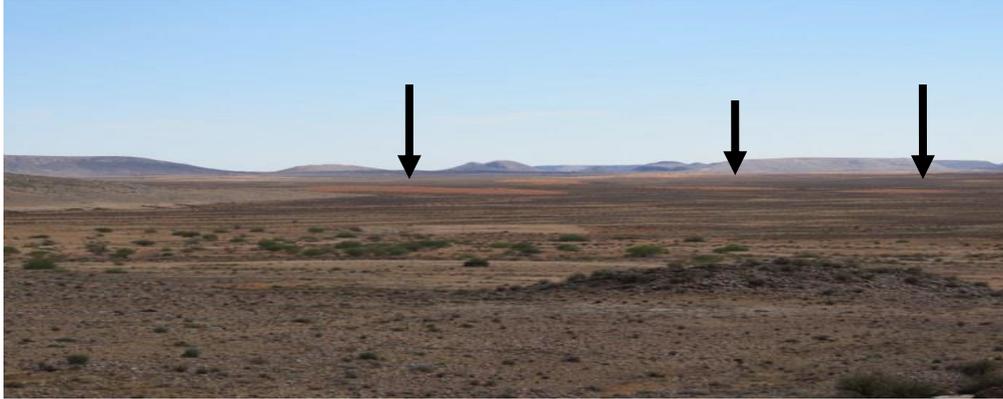


Figure 4c: Open plains north east of the proposed mining with dunes and paleo-dunes visible in the distance



Figure 4d View to the foot-slope north eastwards across the proposed mining area.



Figure 4e: View upslope from part of the proposed mining extension. The small rock shelter in this view contained no archaeological material

**Table 3 Plotted artefact scatters and observations made**

	<b>Latitude (S)</b>	<b>Longitude (E)</b>	<b>Comment</b>	<b>Significance</b>
1	29°13'40.4"	18°43'55.4"	Small flat area at south end of hill with small scatter of LSA quartz flakes	LOW
2	29°13'40.6"	18°43'55.1"	OES (LSA) on western talus of hill	LOW
3	29°13'40.4"	18°43'55.0"	OES (LSA) – near 20 <sup>th</sup> century prospecting evaporation pond	LOW
4	29°13'34.2"	18°43'48.6"	Possible MSA quartz flakes	LOW
5	29°13'34.1"	18°44'00.1"	Quartz flakes	LOW
6	29°13'30.4"	18°44'02.2"	LSA flakes, quartz and	LOW

			OES, exotic to the immediate vicinity at top of a low rocky hill.	
7	29°13'55.1"	18°44'03.1"	Large flaked quartz proximal end of handaxe	LOW
8	29°13'58.4"	18°44'18.4"	Handaxe	LOW
9	29°14'06.2"	18°44'11.4"	Large number of OES pieces scattered in a small area – perhaps one disintegrated eggshell.	LOW
10	29°14'05.9"	18°44'21.3"	Low density of flaked quartz on hilltop	LOW
11	29°14'12.0"	18°43'40.8"	[This site is outside the area of expected impact] Engraved cupule site in non-perennial waterfall; 3 lower grindstones nearby; fragments of pottery and jaspilite stone tools about 30 m away. The presence of the portable lower grindstones provides an association not noted at other cupule sites in the area.	HIGH
12	29°13'26.9"	18°45'57.5"	[This site is outside the area of expected impact] Colonial era stone walled dwelling structures. LSA stone artefacts in the vicinity are made on river-derived (rolled) raw material, along with OES.	MEDIUM
13	29°14'06.8"	18°44'54.0"	OES with a few LSA stone artefacts	LOW
14	29°14'13.0"	18°44'54.3"	Large ESA flakes occurring in relatively high density	MEDIUM
15	29°13'27.6"	18°44'56.2"	Isolated quartz biface, possibly Fauresmith – in palaeodune	LOW
16	29°13'28.7"	18°44'57.3"	Quartz and CCS flakes LSA, MSA in palaeodune	LOW
17	29°14'35.4"	18°45'46.2"	LSA flakes	LOW

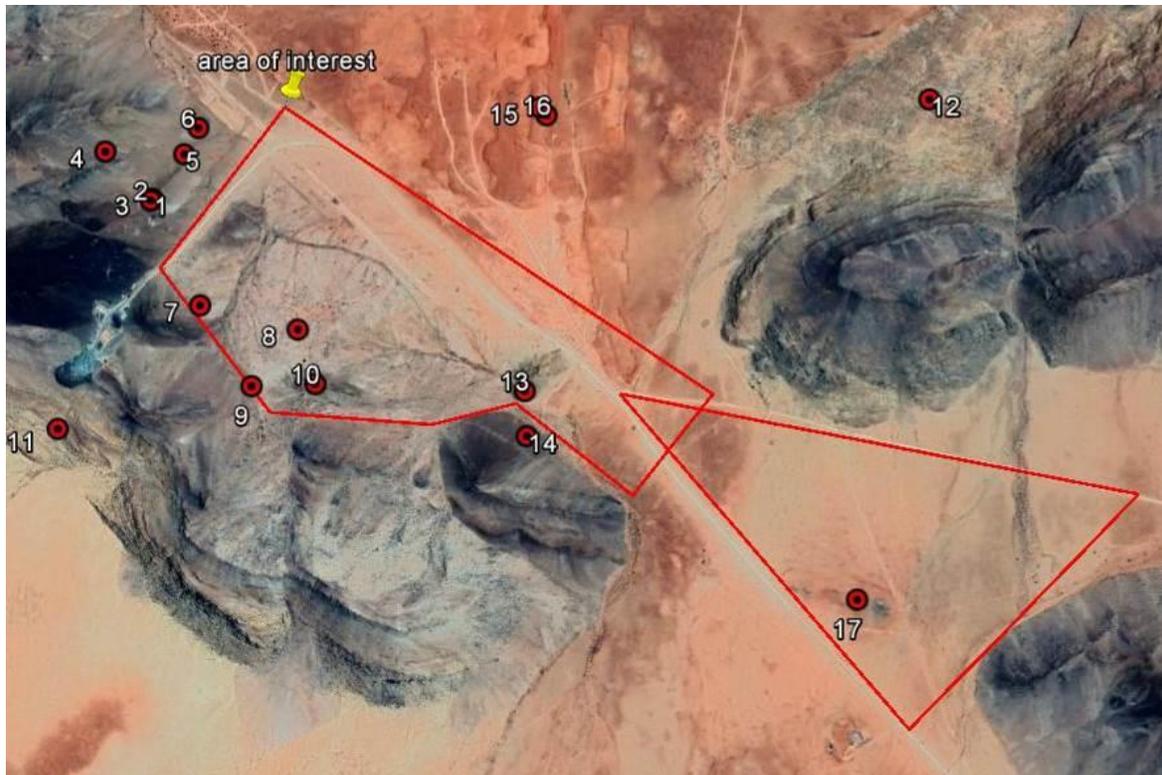


Figure 5: Archaeological observations as tabulated in Table 3.

**4.1.1.** A generally very low density of seemingly focused probably late Holocene Later Stone Age was found (mostly on rises/hilltops or at/near rock outcrops) while more dispersed Pleistocene Middle and Earlier Stone Age material was found. All occurrences were in isolated locales across the survey area. In one instance a relatively higher density than usual of ESA material was found just upslope (according to an accompanying geologist) from the zone of expected mining impact at  $29^{\circ}14'13.0''$  S  $18^{\circ}44'54.3''$  E (Fig 8 & 9; Observation 14). None of the occurrences noted (other than two sites [observations 11 and 12] outside of the mining extension or waste rock dumping areas) and the above-mentioned ESA scatter [observation 14] are regarded as being of more than LOW significance.

A slightly higher density of artefacts was found at  $29^{\circ}13'28.70''$  S  $18^{\circ}44'57.30''$  E in an exposed palaeodune but in a context already disturbed and lacking archaeological integrity. It points to the possibility of notable occurrences in the dunes.



Figure 6: Observation 1: Quartz flakes and OES fragments



Figure 7: Observation 8: Quartzite biface.



Figure 8. Observation 14: ESA cores and flakes.



Figure 9: Location of observation 14.



Figure 10: Observation 15: LSA and MSA quartz and CCS flakes exposed in disturbed at palaeodune.



Figure 11: Observation 16 Quartz biface



Figure 12: Observation 17: Very low LSA incidence near a rocky outcrop.

**4.1.2.** In the wider environment rock art sites occur (Morris 2011, 2013) including the engraved cupule site on the south western slope of Swartberg at 29°14'12.0"S

18°43'40.8" E. This highly significant site falls outside of the proposed mining footprint.



Figure 13: Observation 11: Engraved cupules in a waterfall.



Figure 14: Observation 11: Cupules and pottery fragment found in vicinity.



Figure 15: Observation 11: Lower grindstones adjacent to the cupule engravings.

**4.1.3.** Apart from 20<sup>th</sup> century prospecting evaporation ponds and construction worker camp debris [in the vicinity of Observation 5], colonial era traces were not found within the proposed extended mining footprint area. Observation 12, at 29°13'26.90S 18°45'57.50E, well to the east of the proposed mining area, provides insight into farmer/*veepos* settlement in the form of stone-walled dwellings and associated features and debris including bottle glass at least as old as the 1920s.



Figure 16: Observation 12: Two stone walled structures from the colonial period.



Figure 17 : Remains of a bakoond (oven) and other feature adjacent to the stone walling.



Figure 18: Observation 12: Remnants of ash midden and bottle glass (Old Brookes Lemon LTD, 1920s)

**4.1.4.** Historical and recent surface disturbance has occurred in places in the area, including the existing mine and associated road and other developments.



Figure 19 & 20: Recent infrastructure: roads (above), prospecting sites (below)



**4.1.5.** Industrial archaeological traces are of recent age (Figure 20).

## **4.2 Characterising the archaeological significance (Refer to 3.4 above)**

In terms of the significance matrices in Tables 1 and 2 under 3.4 above, all archaeological observations fall under Landform L1 Type 1. In terms of archaeological traces on areas of proposed development all Table 1 ascriptions reflect poor contexts and likely low significance for these criteria.

For site attribute and value assessment (Table 2), all of the observations noted fall under Type 1 for Classes 1-7, again reflecting low significance, low potential and absence of contextual and key types of evidence.

In summary, the archaeological and cultural heritage traces within the areas of proposed mining extension on portion 4 at Zuurwater 64 were found to be of generally low significance in terms of these criteria. They nevertheless constitute important archaeological observations with respect to past use of this landscape. Sites beyond the footprint include a highly significant cupule engraving site, an ESA accumulation that is richer than many found in the area and a circa century-old or older stone walled farming feature. Secondary impacts on the latter should be prevented and in the case of the ESA site which is closest to the mining edge minimised or mitigated if endangered.

## **4.3 Characterising the significance of impacts**

### **IMPACT ASSESSMENT**

#### ***Assessment Criteria***

The criteria for the description and assessment of environmental impacts derive from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the National Environmental Management Act, 1998 (Act No.107 of 1998).

The significance of all potential impacts (positive and negative) that would result from the proposed area extensions is determined in order to assist decision-makers. The significance rating of impacts is considered as follows:

- **INSIGNIFICANT:** the potential impact is negligible and will not have an influence on the decision regarding the proposed activity.
- **VERY LOW:** the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity.
- **LOW:** the potential impact may not have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM:** the potential impact should influence the decision regarding the proposed activity.

- HIGH: the potential impact will affect a decision regarding the proposed activity.
- VERY HIGH: The proposed activity should only be approved under special circumstances. The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur.

The impact may be summarized as follows:

Overall impact assessment (loss of heritage) based on observations of the planned extensions on BMM. The point of impact will be at the extension of the deep mine open pits and associated infrastructure, and will, as stated above, have permanent impact on the heritage/archaeological resources in the immediate area. These are however reckoned to be in themselves of generally low significance.

	<i>Extent</i>	<i>Intensity</i>	<i>Duration</i>	<i>Consequence</i>	<i>Probability</i>	<i>Significance</i>	<i>Status</i>	<i>Confidence</i>
Without mitigation	Local	Low	Long term	Low	Definite	LOW	-ve	High
Essential mitigation measures: <ul style="list-style-type: none"> <li>• Report any major subsurface finds made during any phase of the operation to the relevant heritage authority.</li> </ul> Best practice mitigation measures: <ul style="list-style-type: none"> <li>• N/A</li> </ul>								
With mitigation	Local	Low	Long term	Low	Definite	LOW	-ve	High

The following criteria are used in this Environmental Impact Assessment to characterise the significance of direct, indirect and cumulative impacts (Jodas 2010):

- » The **nature**, which shall include a description of what causes the effect, what will be affected, and how it will be affected.
- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional:
  - \* local extending only as far as the development site area – assigned a score of 1;
  - \* limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
  - \* will have an impact on the region – assigned a score of 3;
  - \* will have an impact on a national scale – assigned a score of 4; or
  - \* will have an impact across international borders – assigned a score of 5.

- » The **duration**, wherein it will be indicated whether:
  - \* the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - \* the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - \* medium-term (5–15 years) – assigned a score of 3;
  - \* long term (> 15 years) - assigned a score of 4; or
  - \* permanent - assigned a score of 5.
- » The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - \* 0 is small and will have no effect on the environment;
  - \* 2 is minor and will not result in an impact on processes;
  - \* 4 is low and will cause a slight impact on processes;
  - \* 6 is moderate and will result in processes continuing but in a modified way;
  - \* 8 is high (processes are altered to the extent that they temporarily cease); and
  - \* 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:
  - \* Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  - \* Assigned a score of 2 is improbable (some possibility, but low likelihood);
  - \* Assigned a score of 3 is probable (distinct possibility);
  - \* Assigned a score of 4 is highly probable (most likely); and
  - \* Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- » the **status**, which will be described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated*.

The **significance** is determined by combining the criteria in the following formula:

**S = (E+D+M) P**; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

***Impact tables summarising the significance of impacts (with and without mitigation)***

**The following matrix applies to all phases of operation.**

<b>Nature:</b> Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected).		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	1	Not needed
<b>Duration</b>	5	Not needed
<b>Magnitude</b>	10	Not needed
<b>Probability</b>	5	Not needed
<b>Significance</b>	<b>21</b>	
<b>Status (positive or negative)</b>	WEAKLY NEGATIVE	
<b>Reversibility</b>	No	No
<b>Irreplaceable loss of resources?</b>	Yes, where present – but occurrence is generally extremely low density and of low significance.	Not regarded as necessary
<b>Can impacts be mitigated?</b>	Yes – but not considered necessary.	Not regarded as necessary
<b>Mitigation:</b> Mitigation Measures: Artefact densities are very low over the development footprint areas in question. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the figures given in the “Without mitigation” column err on the side of caution. Even so, the criteria for significance indicated in this matrix give a Low significance weighting (<30 points). Mitigation measures are not considered necessary.		
<b>Cumulative impacts:</b> Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events.		
<b>Residual Impacts:</b> -		

**Extent of Impact**

Possible extent of impact following the expansion and construction activities will be locally restricted to potential damage or destruction as a result of excavations and extractions.

**Duration of Impact**

The proposed developments are considered long term. Damage or destruction of archaeological contexts is irreversible and hence permanent.

**Cumulative Impact**

There currently exists a well-established mining footprint within the proposed developments. The proposed developments will be carried out on a landscape where mining activities are a common feature. Sensitive sites beyond the existing and planned mining areas need to be protected.

The potential impacts for the different project stages of the proposed extensions are indicated below:

**Construction phase**

- disturbance of land surface at and in vicinity of construction site
- Staff to monitor for further possible impacts and reporting procedures

**Operational phase**

- Any additional disturbance such as roads and infrastructure
- Staff to monitor for further impacts and reporting procedures

**Decommissioning phase**

- Any additional disturbance such as roads and infrastructure
- Staff to monitor for further impacts and reporting procedures

Table 4: Assessment of significance of potential heritage/archaeological impacts associated with the proposed development extensions pre-mitigation.

Code	Impact	Pre-Mitigation						
		Duration	Extent	Intensity	Consequence	Probability	Intensity	
1	Disturbance of land surface at and in vicinity of construction site	Permanent	Footprint	Low positive	-	Slightly beneficial	Likely	Low positive
2	Any additional disturbance	Permanent	Footprint	Low positive	-	Slightly beneficial	Likely	Low positive
3	Any additional disturbance	Permanent	Footprint	Low positive	-	Slightly beneficial	Likely	Low positive

## 5. MEASURES FOR INCLUSION IN A DRAFT ENVIRONMENTAL MANAGEMENT PLAN

OBJECTIVE: Archaeological or other heritage materials that occur in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility.

<b>Project component/s</b>	Any road construction over and above what is necessary and any extension of other components addressed in this EIA.
<b>Potential Impact</b>	The potential impact if this objective is not met is that wider areas or extended linear developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects from their current context on the site.
<b>Activity/risk source</b>	Activities which could impact on achieving this objective include deviation from the planned lay-out of road/s and infrastructure without taking heritage impacts into consideration.
<b>Mitigation: Target/Objective</b>	A facility environmental management plan that takes cognizance of heritage resources in the event of any future extensions of roads or other infrastructure.  It is not regarded as necessary that any mitigation should take place for <i>most</i> of the areas identified for development.

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
<p>Provision for on-going heritage monitoring in a facility environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of construction/maintenance.</p> <p>Should unexpected finds be made (e.g. pre-colonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools; pottery; military remains), the relevant Heritage Authority should be contacted.</p>	<p>Environmental management provider with on-going monitoring role set up by BMM for the construction phase and for any instance of periodic or on-going land surface modification.</p> <p>The Environmental control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed (see next column)</p>	<p>Environmental management plan to be in place before commencement of railway construction.</p> <p>In the event of finding any features mentioned in column 1, reporting by the developer or relevant Heritage Authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr. Andrew Timothy 053-8312537/8074700</p>

<b>Performance Indicator</b>	Inclusion of further heritage impact consideration in any future extension of infrastructural elements. Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
<b>Monitoring</b>	Officials from relevant heritage authorities (National and Provincial) to be permitted to inspect the operation at any time in relation to the heritage component of the management plan.

## 6. CONCLUSIONS

Limited heritage traces were found in the development footprint areas associated with the deep mine expansion.

In all instances the impact, if any, would be Local. Impacts on heritage and archaeological resources may be mitigated and hence classed as 'short term' but the original in situ context is usually altered in a 'permanent' way. If the archaeological or heritage significance of the resources in question is considered to be low – which is the case here – then the significance of the permanent loss is low. Archaeological and heritage resources being non-renewable, the intensity of any direct impact would be high by definition but this evaluation would again be ameliorated by the significance attached to the particular resources in question – which is low given the general paucity of such resources. With regard to this project the probability of significant impacts on heritage including archaeological resources is Improbable. No 'Phase 2' mitigation work is regarded as necessary in terms of present development layout. Should the ESA site at Observation 14 be threatened it may be recommended that a surface collection be made to preserve a representative sample.

From an archaeological perspective the observed heritage resources are of low significance (including low density occurrence). Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

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