

**FIRST PHASE CULTURAL HERITAGE IMPACT
ASSESSMENT OF THE PROPOSED
REHABILITATION THREE CULVERTS ALONG
THE EXISTING P449 FROM KILOMETRE (KM) 0, 0
TO KM 6.0 IN JOZINI, KWAZULU-NATAL.**



ACTIVE HERITAGE cc.

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LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1820 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
IIA	Intermediate Iron Age
ISA	Intermediate Stone Age
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2006).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2000)
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

EXECUTIVE SUMMARY

A cultural heritage survey of the proposed rehabilitation of three culverts along the existing P449 from kilometre (km) 0, 0 to km 6.0 in Jozini, KwaZulu-Natal produced no heritage sites or features. The area is also not part of any known cultural landscape. There is no archaeological reason why further development may not proceed. However, attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act no 4 of 2008) which, requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

1 BACKGROUND INFORMATION ON THE PROJECT

Table 1. Background information

Consultant:	Frans Prins (Active Heritage cc) for Royal Haskoning (Pty) Ltd
Type of development:	The total length of the P449 is 11,3 km, however the applicant, the KZN DoT, proposes the rehabilitation of the first 6 km section of the road starting in the town of Jozini just off the P522 Road (km 0,0) and ends just past the T-junction with District Road D9 (km 6,0) (Fig 1). The existing road is surfaced from Jozini up to km 9,7, where after it becomes a gravel road. The road width is 6,8 m on average, varying in surfaced width due to severe edge distress due to the action of vehicles entering and exiting various forms of formal and informal accesses. Due to an elevation close to the surrounding ground surface severe damage has also been caused due to poor drainage conditions. The proposed rehabilitation comprises the bulk earthworks, layer works, surfacing, drainage, ancillary works and replacement of three (3) culverts required for the rehabilitation.
Rezoning or subdivision:	Rezoning
Terms of reference	To carry out a Heritage Impact Assessment as subcontracted by Royal Haskoning (Pty) Ltd.
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu-Natal Heritage Act, 1997 (Act No. 4 of 2008)

1.1. Details of the area surveyed:

The P449 is located approximately 2 km north of Jozini along the P522-1 between Jozini and Ingwavuma in the Umkhanyakude District Municipality, KwaZulu-Natal (Fig 1). The road starts at the intersection of the P522-1 and ends at the intersection of the P444 and serves as the main arterial road for the local community and farmers outside the town of Jozini (Figs 3 & 4). The rehabilitation of the first 6 km section of the P449 starts in the town of Jozini just off the P522 Road (km 0,0) and ends just past the T-junction with District Road D9 (km 6,0). Culverts 1 and 3 are situated adjacent to valley bottom wetlands. Culvert 2 is situated adjacent to an ephemeral river. The GPS coordinates of the three culverts situated along the P449 are as follows:

Culvert 1 (Fig 5)

Start: 27°25'52.48"S 32°05'29.80"E End: 27°25'51.45"S 32°05'30.18"E

Culvert 2 (Fig 6)

Start: 27°26'27.15"S 32°06'21.96"E End: 27°26'26.74"S 32°06'23.05"E

Culvert 3 (Fig 7)

Start: 27°26'40.57"S 32°06'34.05"E End: 27°26'29.43"S 32°06'34.68"E

BACKGROUND TO ARCHAEOLOGICAL HISTORY OF AREA

The greater Maputaland is endowed with heritage sites of various traditions and periods spanning the Stone Ages, Iron Ages and the historical period. However, the majority of these occur to the west of the Phongola River in the foothills of the Lebombo Mountains. A second large concentration occurs adjacent to and on the dune gordon along the coastline. The coastal plain, by contrast to the rest of Maputaland, is devoid of known archaeological sites. Oliver Davies, an archaeologist who conducted pioneered research and surveys in northern KwaZulu Natal in the 1960's and 1970's, commented that the coastal plain was unpromising for archaeological research due to its being covered by superficial sands and bush coverage which affect preservation and visibility (Avery 1980). By contrast, the foothills of the Lebombo in the vicinity of Jozini, in the near environs to the project area, is well endowed with archaeological sites. The provincial heritage data base of the KwaZulu-

Natal Museum lists twenty nine sites in the greater Jozini area. These include Early Stone Age, Middle Stone Age, Later Stone Age and Later Iron Age sites.

Based on typological criteria it can be speculated that the known Early Stone Age sites in the greater Jozini area most probably dates back to between 300 000 and 1.7 million years ago. Some of the stone tools have been identified as belonging to the Acheulian tradition and it is therefore possible that these sites were occupied by an early hominin such as *Homo erectus* or *Homo ergaster*. Middle Stone Age Sites dates back to ca. 40 000 - 200 000 BP. These sites relate to the first anatomically modern people in the world namely *Homo sapiens sapiens*. Most of the Middle Stone Age sites in the greater Maputaland are open air stone tool scatters with little archaeological context. However, some notable cave deposits do occur. The world renowned Border Cave Site, situated approximately 65km to the north of the town of Ingwavuma, is a good example. Humans lived at Border Cave over a period of 200 000 years. The human skeletal remains found in the cave are believed to be some of the oldest evidence of anatomically modern human beings. Various radiometric-dating techniques suggest that Middle Stone Age people were living at Border Cave more than 110 000 years ago. More than a million stone artefacts have been excavated in the cave and an enormous amount of animal material has been recovered from the site as well (Derwent 2006).

Only a handful of Later Stone Age sites have been recorded in the greater Maputaland. These relate to San hunter-gatherers or their immediate ancestors. The stone tool technology are smaller and more diverse and specialised than those made during the Middle Stone Age.

The Early Iron Age of the coastal zone in Maputaland contains ceramic fragments identified as belonging to the Matola phase. The Matola phase sites can be identified with the very first Bantu-speaking agriculturists that entered KwaZulu-Natal approximately 1 600 years ago from Eastern Africa (Maggs 1989). Although oral history indicate that the area was occupied in more recent centuries times by the Thembe-Thonga or their immediate ancestors. Archaeological sites belonging to this period have not yet been identified. Nevertheless the present African inhabitants of the area, the Thembe-Thonga and some Swazi, have a rich oral history and culture relating to their intimate relationship with the environment spanning many centuries.

Aspects of their cultural heritage identified by community representatives as being important include the following:

- Relationship of the local community with the physical environment
- Traditional fishing practises (fonya basket fishing)
- The indawo spirit possession cult
- Wild fruit utilisation
- The significance of the mothers brother in Thembe-Thonga social organisation
- Settlement rules and history
- Thonga language
- Issues relating to cross border identities
- Trade across the border
- History of various traditional authorities in the area
- Occupation of some areas by refugees of the Zulu wars
- The grave site of King Dingane
- Influence on local customs by refugees of the Mozambican War of 1975-1990

The conventional view is that that the historical occupants of Maputaland, the Tembe-Thonga, migrated from Karanga in the present day Zimbabwe in the middle of the seventeenth century Junod (1962:23). However, the theory that the African societies of south-east Africa migrated there in fixed ethnic units, as in the case of the Tembe-Thonga, has been questioned by archaeological research and recent research on oral traditions of Zululand and Natal (Maggs 1989). Instead of migrating there in fixed ethnic groups, it is now argued that the African societies of south-east Africa emerged locally from long established communities of diverse origins and diverse cultures and languages. Nevertheless, whether the Tembe came from Karanga to establish their authority over the people of south-east Africa, or whether they emerged locally, reports from Portuguese sailors indicate that a chief Tembe was in control of the ruling chiefdom in the Delagoa Bay hinterland in the mid-1600s (Wright & C. Hamilton 1989:46-64 and Kuper 1997:74). Tembe and his followers gradually established their authority over the people who lived in this hinterland including the area to the immediate east of the study area. Due to the abilities of their strong and charismatic leaders, the Tembe-Thonga remained a unified chiefdom and gradually extended their influence. This unity was upset in the middle of the eighteenth century when a split in the ruling lineage led to the fragmentation of the chiefdom. The division came after the death of Silamboya in 1746. The descendants of Silamboya's oldest son, Muhali, settled west of the Maputo River and north of the Usuthu River. This group, the senior

branch of the Tembe-Thonga, became known as the Mututwen-Tembe. The other part of the Tembe-Thonga followed a junior son of Silamboya, Mangobe, and settled east of the Maputo River. This branch would later become known as the Mabudu or Maputo (Bryant 1965:290). The imposed international border of 1875 bisected the area where the Mabudu branch settled. Being unable to control the vast area under his control, the chief of the junior branch, Mangobe, placed his sons in strategic positions so as to ensure his control. When Mangobe died, his first son, Nkupo, was named chief. However, his younger son, Mabudu, soon established himself as the stronger leader and took the chieftainship from his older brother (Hedges 1978:137). With the army now at his disposal Mabudu was able to dominate all trade between Europeans who landed at Delagoa Bay and local people living in the hinterland. Through this domination the Mabudu became, by the middle of the eighteenth century, the strongest political and economic unit in south-east Africa (Smith 1972:178-184). The people under his authority, which gradually increased, became known as the *abakwaMabudu* or the people of Mabudu's land (Webb and Wright 1979:157). By the early 1800s the Mabudu chiefdom stretched from the Maputo River in the west to the Indian Ocean in the east, and from Delagoa (Maputo) Bay in the north to as far south as Lake St. Lucia (Felgate 1982:1). This extensive area included the present-day Jozini.

During the early 1800s similar processes of political centralisation were taking place amongst the Mthetwa, Ndwandwe and later the Zulu chiefdoms to the immediate south east of Ingwavuma. The Zulu eventually defeated the other groups and established themselves as the dominant power in south-east Africa (Wright & Hamilton 1989:67 and Laband 1995). The Mabudu were never attacked by, nor directly involved in any war with the Zulu. They were, however indirectly affected by wars of conquest the Zulu waged in the northern part of Zululand in the first half of the nineteenth century (Omer-Cooper 1975:57). Various groups of refugees passed through the Mabudu chiefdom during the reign of Shaka. Many of them settled among the Mabudu. The people who crossed the southern boundary of the Mabudu chiefdom brought with them languages and customs foreign to the Mabudu. Over time, Mabudu identity became less distinctive as people adopted many customs of those living south of them (Bryant 1964:292). As more and more people from the southern chiefdoms crossed into the Mabudu chiefdom, an increasing amount of prestige was attached to being Zulu and speaking isiZulu, since the Zulu were the dominant political force. The Zulu cultural influence in the greater Jozini area was however not complete. People who fled the onslaught of the Zulu only stayed in the area for a short period before they moved on

(Felgate 1982:11). Furthermore, in exchange for tribute paid, the Zulu recognised the Mabudu as leaders of a vast territory. This, to an extent, secured their sovereignty (Bradley 1974). The relationship between the Mabudu and the Zulu differed markedly from that which the Zulu instituted with other chiefdoms. Ballard (1978) states that although the Mabudu 'paid tribute to the Zulu kings and cooperated on a military and economic level, they enjoyed much greater independence than the chiefdoms south of St. Lucia. Despite the Zulu influence, Maputaland, remained politically and culturally distinct from areas to the north, south and west. The people of the area spoke a unified language – xiRonga (Thonga). With some exceptions, notably the Ngubane and Khumalo, they accepted the rule of Mabudu chiefs (Felgate 1982:11). They practised customs that were unique to the area and differed from those of their Zulu, Swazi and Tsonga neighbours (Webster 1991:250). Nevertheless, many siSwati-speaking people crossed the nearby border and settled at Ingwavuma. Today a large percentage of the inhabitants in the immediate vicinity of Ingwavuma are Swazi people, or people with strong cultural and historical links with the Swazi such as the Nyawo Chiefdom. The footprint is situated near traditional Nyawo territory. The Nyawo also played a significant part in the history of the Zulu state situated further south during the reign of King Dingane.

After the defeat of the Zulu by the Voortrekkers during the battle of Blood River in 1838 King Dingane fled to the north and established a new homestead in the Hluhluwe River Valley. From this new location he launched an attack into Swaziland but this attack was repulsed. It was, however, to become a prime cause of his death. Mpande, the king's half-brother, fled southward in September 1839 with his followers to claim protection from the Voortrekker, fearing that Dingane was intending to have him killed. Mpande and the Boers eventually agreed to attack the king's forces and this led to the battle of Maquongqo, in which Dingane's forces were defeated. King Dingane then fled into the Lebombo mountains, in the close environs of the study area, where he built a homestead, called Esankoleni on the slopes of Hlatikulu hill. This hill was located in the territory of Silevana who was acting as regent for Sambane, heir to the Nyawo chieftainship. Silevana saw King Dingane's presence as a threat and notified a Swazi patrol, under Sonyezane Dlamini. In 1840 the Swazi, with Nyawo help, surrounded the homestead and King Dingane was stabbed by Silevana when he came out of his hut. He was buried at Esankoleni, but the Nyawo were fearful of the possible consequences of killing Zulu Royalty, and tried to brush over their part in the deed by keeping the location of the grave a closely-guarded secret for many years. Today King

Dingane's grave is a provincial monument. . A small commemorative plaque, which was unveiled by Dr Buthelezi of the Inkhatha Freedom Party, has been placed close to the actual site.

During the colonial period the greater Maputaland area was frequented by hunters, traders, and later missionaries (Bruton et al 1980). However, sites and structures associated with these activities need to be identified and placed in an inventory. Likewise during the more recent past many refugees of Mozambique crossed the international border and settled in the area (Klopper 2004). Sites belonging to this more recent "struggle era history" are also protected by national heritage legislation and needs to be surveyed and placed in an inventory.

Apart from human history the greater Maputaland also has extensive fossil deposits and geomorphology dating back to the Cretaceous, Tertiary and Quaternary periods. The Cretaceous fauna yielded by sequences includes ammonites, bivalves, gastropods, and nautiloids in abundance. Vertebrates are uncommon, only fish and reptiles being noted so far. Plant remains are relatively abundant in the form of logs and lignite chips. The Tertiary limestone deposits contain marine macro-fossils, calcareous nanno-fossils and planktic foraminifers (Avery 1980). Shell imprints have been found imprinted in concretions to the immediate south of Thembe Elephant Park and may therefore palaeontological significance (Anderson 2008).

2 BACKGROUND INFORMATION OF THE SURVEY

2.1 Methodology

A desktop study was conducted of the archaeological databases housed in the KwaZulu-Natal Museum. The SAHRIS website was consulted to obtain information on past heritage surveys in the area and on heritage site particulars. In addition, the available archaeological literature covering the greater Jozini area was also consulted. A ground survey of the P449 and associated culverts, following standard and accepted archaeological procedures, was conducted on the 10th August 2017. An area of 50m on either side of the P449 was covered during the survey.

2.2 Restrictions encountered during the survey

2.2.1 Visibility

Visibility was good.

2.2.2 Disturbance

No disturbance of any potential heritage features was noted.

2.3 Details of equipment used in the survey

GPS: Garmin Etrek

Digital cameras: Canon Powershot A460

All readings were taken using the GPS. Accuracy was to a level of 5 m.

3 DESCRIPTION OF SITES AND MATERIAL OBSERVED

3.1 Locational data

Province: KwaZulu-Natal

Town: Jozini

Municipality: Jozini Local Municipality within the uMkhanyakude District Municipality.

3.2 Description of heritage resources located during the survey.

The P449 is situated in a built-up area with numerous formal and informal developments adjacent to the road (Figs 3 & 4). It is unlikely that any heritage sites or features would have survived the ongoing developments and peri-urban pressure on the land. The existing data bases do not indicate any known heritage sites adjacent to the proposed development (Fig 2). The ground survey also did not locate any archaeological and heritage sites and features on and adjacent to the road reserve. No heritage sites or features were located within 50m from the P449. Informal graves do occur in the area but these are situated more than 50m from the P449 (Fig 8) and they are not threatened by the proposed development.

4 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

4.1 Field Rating

Not applicable, as no heritage sites or features occur at the footprint (Tables 2 & 3).

Table 2. Evaluation and statement of significance.

Significance criteria in terms of Section 3(3) of the NHRA		
	Significance	Rating
1.	Historic and political significance - The importance of the cultural heritage in the community or pattern of South Africa's history.	None.
2.	Scientific significance – Possession of uncommon, rare or endangered aspects of South Africa's cultural heritage.	None.
3.	Research/scientific significance – Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.	None.
4.	Scientific significance – Importance in demonstrating the principal characteristics of a particular class of South Africa's cultural places/objects.	None.
5.	Aesthetic significance – Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.	None.
6.	Scientific significance – Importance in demonstrating a high degree of creative or technical achievement at a particular period.	None.
7.	Social significance – Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.	None.
8.	Historic significance – Strong or special association with the life and work of a person, group or organization of importance in the history of South Africa.	None.
9.	The significance of the site relating to the history of slavery in South Africa.	None.

Table 3. Field rating and recommended grading of sites (SAHRA 2005)

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
Provincial (Grade II)	This site is considered to be of Provincial significance	Nominated to be declared by Provincial Heritage Authority
Local Grade IIIA	This site is considered to be of HIGH significance locally	The site should be retained as a heritage site
Local Grade IIIB	This site is considered to be of HIGH significance locally	The site should be mitigated, and part retained as a heritage site
Generally Protected A	High to medium significance	Mitigation necessary before destruction
Generally Protected B	Medium significance	The site needs to be recorded before destruction
Generally Protected C	Low significance	No further recording is required before destruction

5 RECOMMENDATIONS

The proposed development may proceed from a heritage perspective. There is no archaeological reason why the proposed developments of the P449 and associated culverts may not proceed as planned. The area is also not part of any known cultural landscape.

6 RISK PREVENTATIVE MEASURES ASSOCIATED WITH CONSTRUCTION

Maputaland has a rich archaeological history. Construction work and excavations may yield archaeological and/or cultural material. If any heritage features are exposed by construction work then all work should stop immediately and the provincial heritage agency, Amafa, should be contacted for further evaluation. Attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act no 4 of 2008) which, requires that operations that expose

archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agent.

7 MAPS AND PHOTOGRAPHS



Figure 2. Distribution of known heritage sites (purple polygons) near the P449. None occur closer than 1km to the footprint.



Figure 3. Northern section of the P449.



Figure 4. Southern section of the P449.



Figure 5. Culvert 1



Figure 6. Culvert 2



Figure 7. Culvert 3



Figure 8. Unmarked graves situated more than 50m from the P449.

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**DESKTOP PALAEOLOGICAL
ASSESSMENT AND FOR THE
PROPOSED UPGRADING OF THE
P449kk ROAD, JOZINI LOCAL
MUNICIPALITY, UMKHANYAKUDE
DISTRICT MUNICIPALITY,
KWAZULU-NATAL PROVINCE.**

**FOR
Royal Haskoning DHV (Pty) Ltd**

DATE: 8 August 2017

By

**Gideon Groenewald
Cell: 078 713 6377**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment Survey for the proposed Upgrading of the P449kk Road, Jozini Local Municipality, Umkhanyakude District Municipality, Kwazulu-Natal Province.

The development site applicable to the application for the proposed Upgrading of the P449kk Road, Jozini Local Municipality, Umkhanyakude District Municipality, Kwazulu-Natal Province is underlain by Jurassic aged volcanic rocks and dolerite.

No significant fossils are expected in the Jurassic aged rocks on site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Low Palaeontological sensitivity is allocated to the rocks underlying the development footprint.
- If any fossil are observed during the lifetime of the project, the HIA specialist must be informed for appropriate action.
- No further mitigation for Palaeontological Heritage is recommended for this project.

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INTRODUCTION

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment Survey for the proposed Upgrading of the P449kk Road, Jozini Local Municipality, Umkhanyakude District Municipality, Kwazulu-Natal Province (Figure 1).

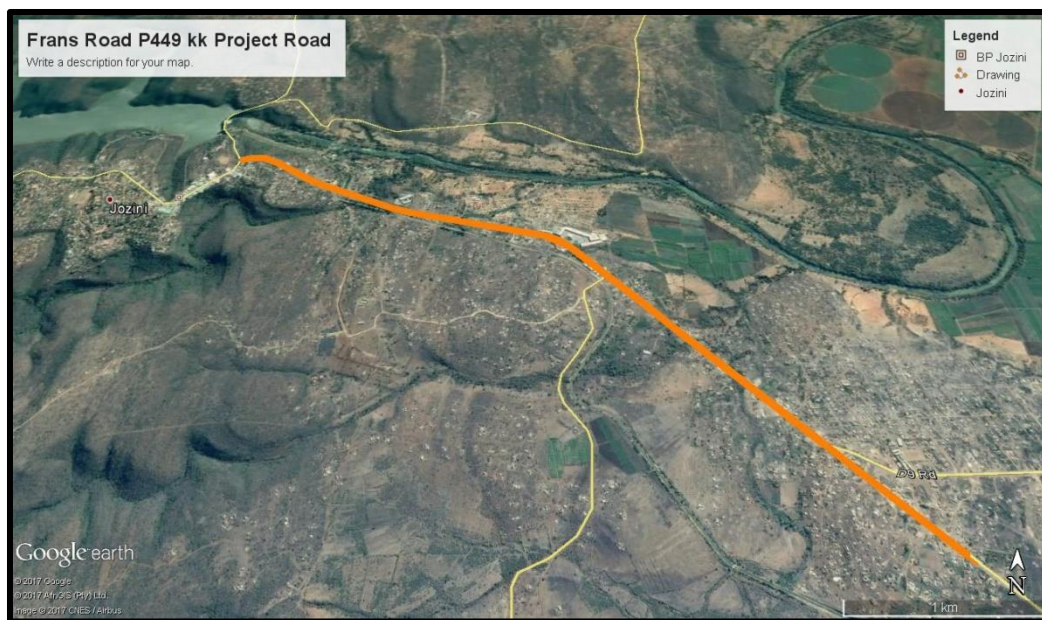


Figure 1 Locality of the P449kk Road upgrade route

Legal Requirements

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 as well as the KwaZulu-Natal Heritage Act No 4 of 2008 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to Palaeontological Heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and

- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A Desktop investigation is often the only opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the "SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

Prior to a field investigation a preliminary assessment (desktop study) of the topography and geology of the study area is made using appropriate 1:250 000 geological maps (2632 Kosibaai) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) are identified within the study area and the known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas are identified within the development footprint to focus the field investigator's time and resources. The aim of the desktop survey is to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the minimal extent of fresh bedrock excavation

envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a

	<p>professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.</p>
<p>BLUE</p>	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and “Chance Find Protocol” is compulsory. The Chance Find Protocol must be included in the EMPr for the project.</p>

GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMP of the project.</p>
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When rock units of Moderate to Very High Palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. All projects falling on Low to Very Low Palaeontological sensitivity geology must be discussed in terms of the likelihood of Cretaceous age cover and cleared for development by a suitably qualified Palaeontologist.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

Locality and Proposed Development

The P449kk Road Development is situated to the southeast of Jozini in the rural parts of KwaZulu-Natal. The development falls in undulating terrain underlain by clayey soils of mainly weathered rocks of the Jozini Formation of the Lebombo Group.

Karoo Supergroup

Lebombo Group

Jozini Formation (Jj)

The Jurassic aged Jozini Formation is a dominantly an interbedded group of rhyodacite, flow breccias and vitreous tuff with associated Jurassic aged dolerite that was extruded in volcanoes in this part of Gondwanaland (Johnson et al, 2009).

Dolerite (Jdo)

Jurassic aged dolerite represents the intrusion of magma into the volcanic Lebombo Group of rocks in the study area.

PALAEONTOLOGY

Karoo Supergroup

Lebombo Group

Jozini Formation (Jj)

The Jurassic Jozini Formation contains some tuff layers that might contain micro-fossils of some kind. No fossils have been described from this formation to date and if any fossils are found it will be a first. The nature of this project (road building) will not have any impact on the Palaeontological Heritage of this group of rocks as the project will not involve any detailed studies of the rock units.

Dolerite (Jdo)

The dolerite is an igneous rock and it will not contain any fossils.

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop investigation confirms that the study area is underlain by relatively deep (>2m) clay soil associated with the Lebombo Group and volcanic rocks of the Karoo Supergroup.



Figure 4 Palaeontological sensitivity of the rocks underlying the route of P449kk road upgrade. For explanation of colours see Table 1

The areas underlain by the volcanic rocks and dolerite will not yield any fossils that can be observed with the naked eye and it is unlikely that this project will have any impact on the Palaeontological Heritage of the study area.

CONCLUSION

The development site applicable to the application for the proposed Upgrading of the P449kk Road, Jozini Local Municipality, Umkhanyakude District Municipality, Kwazulu-Natal Province is underlain by Jurassic aged volcanic rocks and dolerite.

No significant fossils are expected in the Jurassic aged rocks on site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Low Palaeontological sensitivity is allocated to the rocks underlying the development footprint.
- If any fossil are observed during the lifetime of the project, the HIA specialist must be informed for appropriate action.
- No further mitigation for Palaeontological Heritage is recommended for this project.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



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