

Proposed establishment of Borrow-pits for  
the Preventative Maintenance of D192 road,  
Mogalakwena Local Municipality, Waterberg  
District Municipality, Limpopo Province.

**DESKTOP STUDY REPORT  
PALAEOLOGY**

Compiled by: Dr JF Durand (Sci.Nat.)

For:

Vhufa Hashu Heritage Consultants  
25 Rood Street  
Sonheuwel Central  
Nelspruit, 1200  
Cell: 083 357 3669  
Email: richard@vhhc.co.za

15 January 2023

## **Table of Contents:**

1. Executive Summary.....	3
2. Introduction.....	4
3. Terms of reference for the report.....	5
4. Details of study area and the type of assessment.....	8
5. Geological setting of the study area .....	9
6. Palaeontological assessment.....	11
7. Conclusion and Recommendations.....	13
8. Declaration of independence.....	14

## **List of Figures:**

Figure 1: Google Earth photo indicating the study area.....	8
Figure 2: Geological Map of the study area and surroundings. Adapted from the PIETERSBURG 2328 1: 250 000 Geology Map (Geological Survey, 1985).....	9
Figure 3: Palaeontological sensitivity map of the study area and surroundings (SAHRA, 2023).....	11

# 1. Executive Summary

The study area is underlain by sedimentary rocks and Quaternary-aged soil, sand and alluvium that are considered to be of Moderate Palaeontological Sensitivity.

The rocks of the Makgabeng Formation may contain some of the oldest freshwater stromatolites that formed in playa lakes 1.8 Billion years ago.

The Quaternary-aged soil, sand and alluvium may contain mammal and tortoise bones and ostrich shells.

If fossils are discovered, the Chance Find Procedure (p. 13) should be followed by the ECO.

## 2. Introduction

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area that may be impacted by the proposed development.

The purpose of this document is to detail the probability of finding fossils in the study area and whether, if indeed there are fossils, what the impact of the development of the site will be on the fossils and fossil sites.

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in inter alia the origin of dinosaurs, mammals and humans. Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and played a crucial role in the discovery of Gondwanaland and the formulation of the theory of plate tectonics. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa has the longest record of palaeontological endeavour in Africa. South Africa was even one of the first countries in the world in which museums displayed fossils and palaeontologists studied earth history. South African palaeontological institutions and their vast fossil collections are world-renowned and befittingly the South African Heritage Act is one of the most sophisticated and best considered in the world.

Fossils and palaeontological sites are protected by law in South Africa. Construction in fossiliferous areas may be mitigated in exceptional cases but there is a protocol to be followed.

This is a Palaeontological Desktop Report that was prepared in line with Regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involved an overview of the literature on the palaeontology and associated geology of the area and a visit to the study sites for a field assessment.

### 3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(4)** No person may, without a permit issued by the responsible heritage resources authority-
  - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
  - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
  - 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
  - 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.
- **Subsection 35(5)** When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may-
  - serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
  - carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
  - if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
  - recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the

impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports.

The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them.

The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

**Scoping stage** in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A **Palaeontological Desktop Study** – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial photos , etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A **Phase 1 Palaeontological Impact Assessment** is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are

planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A **Phase 2 Palaeontological Mitigation** involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

#### 4. Details of study area and the type of assessment:

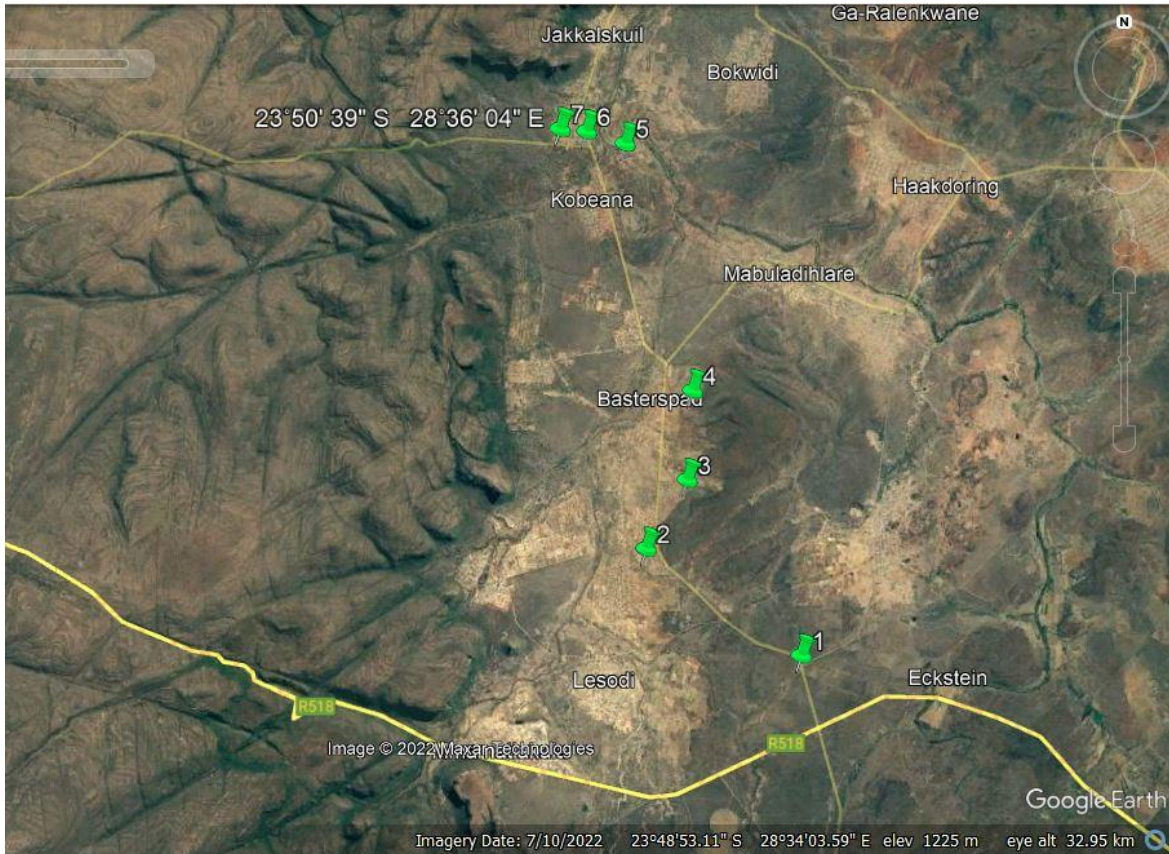


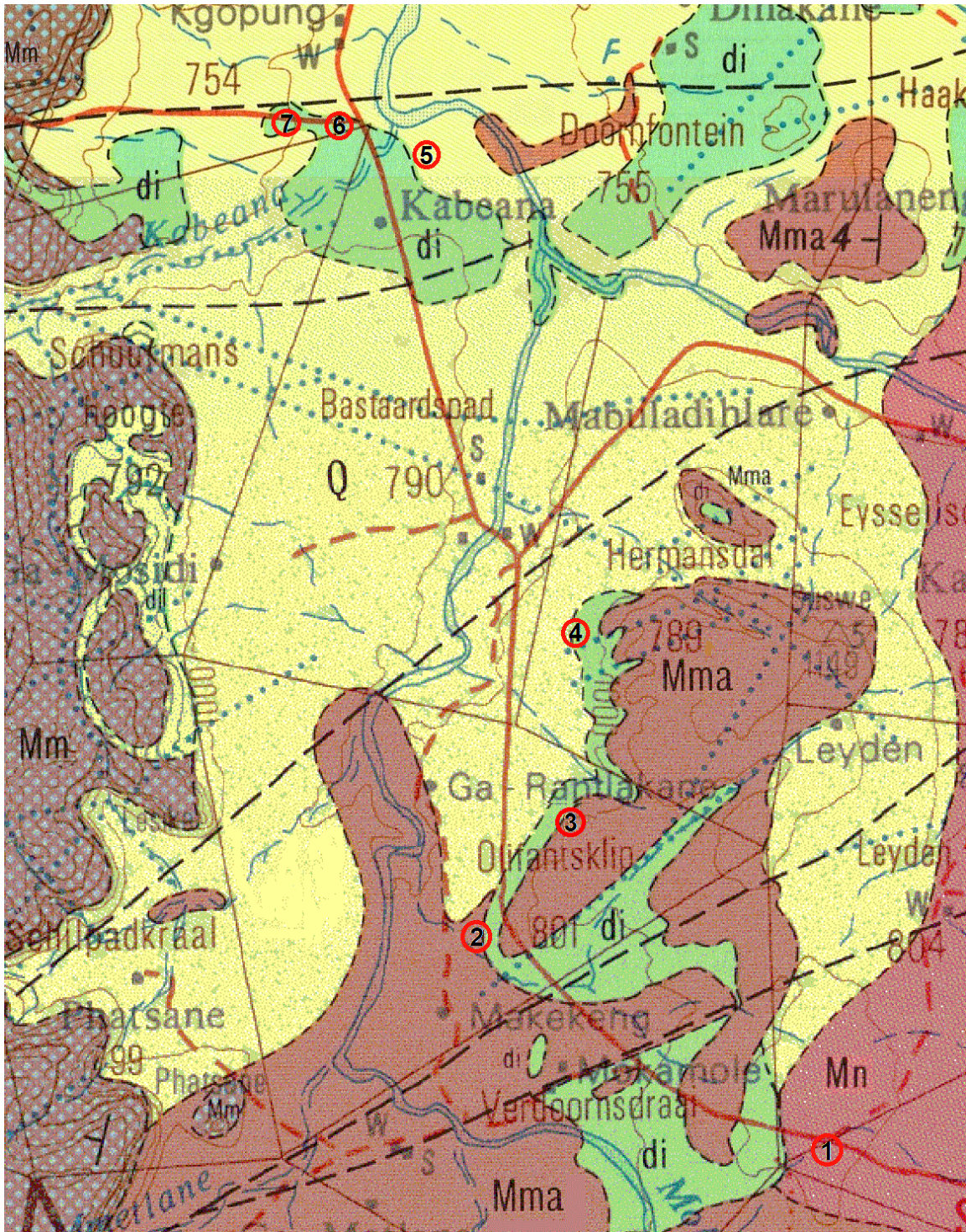
Figure 1: Google Earth photo indicating the study area

The proposed maintenance of road D192 starting from road R518 to Jakkalskuil Village within Mogalakwena Local Municipality of Limpopo Province will be done from aggregate from the proposed 7 borrow pits located alongside the D192 road. Aggregate material for maintenance will be obtained from 5 Burrow pits approximately 5 ha each, and located on farms Farm Verdoornsdraai, 803LR Portion 0, Farm Lyden, 804LR Portion 0, Farm Appingeddam 805 Portion 0, Farm Eckstein 806LR Portion 4 (Fig. 1).

The relevant literature and geological maps for the study area, in which the development is proposed to take place, have been studied for a Palaeontological Desktop Report.



## 5. Geological setting of the study area



(The study sites are indicated by the red circles with numbers)

Figure 2: Geological Map of the study area and surroundings. Adapted from the PIETERSBURG 2328 1: 250 000 Geology Map (Geological Survey, 1985)

**LEGEND:**

	<b>Lithology</b>	<b>Stratigraphy</b>		<b>Age</b>
Q	Soil, sand, alluvium			Quaternary
di	Diabase			Mokolian
Mm	Course-grained purplish-brown sandstone	Mogalakwena Formation	Waterberg Group	
Mma	Medium-grained, yellowish, laminated sandstone	Makgabeng Formation		
Mn	Nebo Granite	Lebowa Suite	Bushveld Igneous Complex	

Borrow Pit 1 is situated on Nebo Granite of the Lewowa Suite of the Bushveld Igneous Complex.

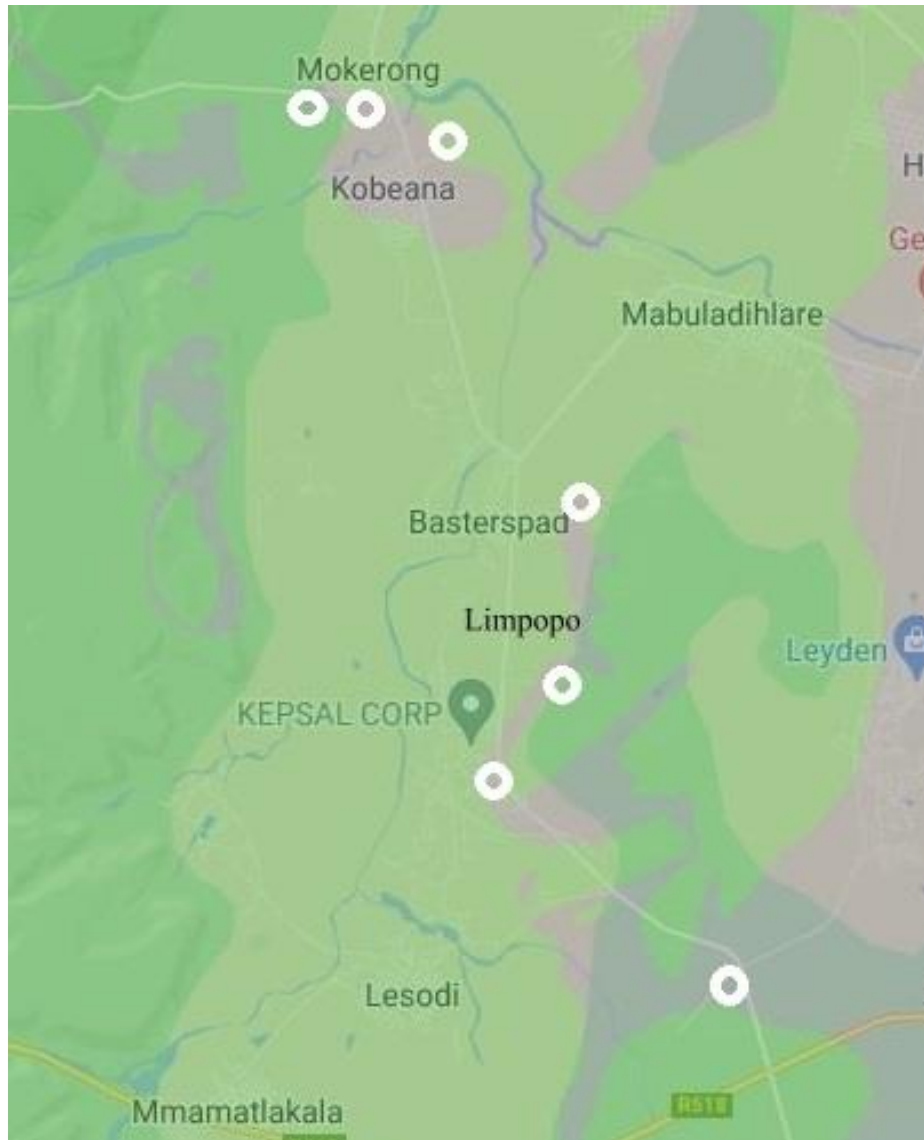
Borrow Pits 2 and 3 are situated on the Makgabeng Formation of the Waterberg Group. The Makgabeng Formation consists of fine to medium grained sandstone. The subrounded to well-rounded grains of these sandstones were originally set down as desert dunes 1.8 Billion years ago. There are also sandstones that formed from sand that were deposited between the dunes and in playa lakes (Barker et al. 2009).

Borrow Pit 5 is situated on Quaternary deposits that comprise of sand, soil and alluvium.

Borrow Pits 4, 6 and 7 are situated on diabase.



## 6. PALAEOONTOLOGICAL ASSESSMENT



(The study sites are indicated by the white circles)

**Figure 3: Palaeontological sensitivity map of the study area and surroundings (SAHRA, 2023)**

Colour	Palaeontological Significance	Action
GREEN	MODERATE	Desktop study is required.
GREY	INSIGNIFICANT / ZERO	No palaeontological studies are required.

Borrow Pit 1 is situated on Nebo Granite of the Lewowa Suite of the Bushveld Igneous Complex. Granite, being igneous rock, is non-fossiliferous and therefore of no palaeontological concern.

Borrow Pits 4, 6 and 7 are situated on diabase. Diabase, being igneous rock, is non-fossiliferous and therefore of no palaeontological concern.

Borrow Pits 2 and 3 are situated on the Makgabeng Formation of the Waterberg Group that is considered to be of Moderate Palaeontological Sensitivity (see Fig. 3). The earliest known terrestrial cyanobacterial mats that were dated at 1.8 Billion years, were discovered from playa lake deposits in the Makgabeng Formation (Waterberg Group) on the Makgabeng Plateau in the Waterberg Mountains (Groenewald & Groenewald, 2014).

Borrow Pit 5 is situated on Quaternary deposits that comprise of sand, soil and alluvium. These deposits are also considered to be of Moderate Palaeontological Sensitivity because there is a possibility of finding range of fossils including mammal bone, tortoise bones and carapaces, ostrich eggs, etc. (Groenewald & Groenewald, 2014).

#### References:

Barker, O.B.; Brandt, G.; Callaghan, C.C.; Eriksson, P.G. & Van der Neut, M. (2009). The Soutpansberg and Waterberg Groups and the Blouberg Formation. In: Johnson, M.R.; Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria, pp.301-318.

Geological Survey (1985) PIETERSBURG 2328 1: 250 000 Geology Map.

Groenewald, G. & Groenewald, D. (2014). *Palaeontological heritage of Limpopo*. SAHRA Palaeotechnical Report.

SAHRA (2023). *Palaeosensitivity Map* <http://www.sahra.org.za/sahris/map/palaeo>

## **7. Conclusion and recommendations:**

The fossils in the Makgabeng Formation and in the Quaternary deposits are scarce. In spite of these fossils being considered to be of Moderate Palaeontological Sensitivity, it is always possible that an important new discovery be made during excavations, in the event of this occurring, the ECO should follow the Chance Find Procedure as stipulated below:

### **PROCEDURE FOR CHANCE PALAEOLOGICAL FINDS**

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during construction of the road:

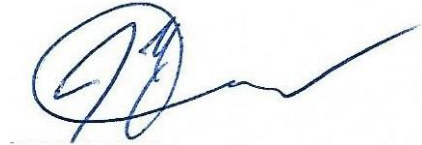
1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

- a. The material is of no value so development can proceed, or:
  - b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:
  - c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.
7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

## 8. Declaration of Independence:

I, Jacobus Francois Durand declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Palaeontological specialist:

**Dr JF Durand (Sci. Nat.)**

BSc Botany & Zoology (RAU), BSc Zoology (WITS), Museology Dipl. (UP),  
Higher Education Diploma (RAU), PhD Palaeontology (WITS)