

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE  
PROPOSED TWEEFONTEIN 463 KR PROJECT AT BELA  
BELA, BELA BELA LOCAL MUNICIPALITY, WATERBERG  
DISTRICT MUNICIPALITY, LIMPOPO PROVINCE.**

**For:**

**HIA CONSULTANTS**

**APELSER ARCHAEOLOGICAL CONSULTING CC  
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**DATE: 19 October 2015**

**By**

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## EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Apelser Archaeological Consulting CC to undertake a desktop survey, assessing the potential palaeontological impact of the proposed Agricultural development on the farm Tweefontein 463 KR, at Bela Bela, Bela Bela Local Municipality, Waterberg District Municipality, Limpopo Province.

This report forms part of the Basic Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

The proposed Tweefontein 463 KR development is underlain by Triassic aged Aeolian sandstone of the Clarens Formation. The area is however covered in deep sandy soils and it is unlikely that fossils will be observed unless bedrock is exposed during excavation for foundations, as can be determined from geotechnical reports. Recording of Triassic aged fossils from the site will contribute significantly to our understanding of the palaeo-environments of the area.

### Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Clarens Formation sediments is Highly significant for fossil remains of vertebrates, including the dinosaurs.
2. If bedrock will be exposed during excavation for foundations, a qualified palaeontologist must be appointed to inspect the excavations for the presence of fossils. If excavations will not expose bedrock, no further mitigation for palaeontological heritage is recommended.
3. These recommendations should form part of the EMP of the project.

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## 1. INTRODUCTION

### 1.1. Background

Gideon Groenewald was appointed by Apelser Archaeological Consulting CC to undertake a desktop survey, assessing the potential Palaeontological impact of the proposed Agricultural development on the farm Tweefontein 463 KR, at Bela Bela, Bela Bela Local Municipality, Waterberg District Municipality, Limpopo Province.

This report forms part of the Basic Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

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

### 1.2. Aims and Methodology

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 identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess 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.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc.) represented within the study area are determined from geological maps (2428 NYLSTROOM). The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

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 extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

**Table 1.1 Palaeontological sensitivity classification and colour coding**

<b>PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS</b>	
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).	
<b>RED</b>	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.
<b>ORANGE</b>	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.
<b>GREEN</b>	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 professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
<b>BLUE</b>	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.

<b>GREY</b>	<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.</p>
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### 1.3. 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. 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.).

## 2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

Humphries Boerdery proposes the development of further agricultural activities on the farm Tweefontein 463 KR near Bela-Bela in the Limpopo Province (Figure 1)

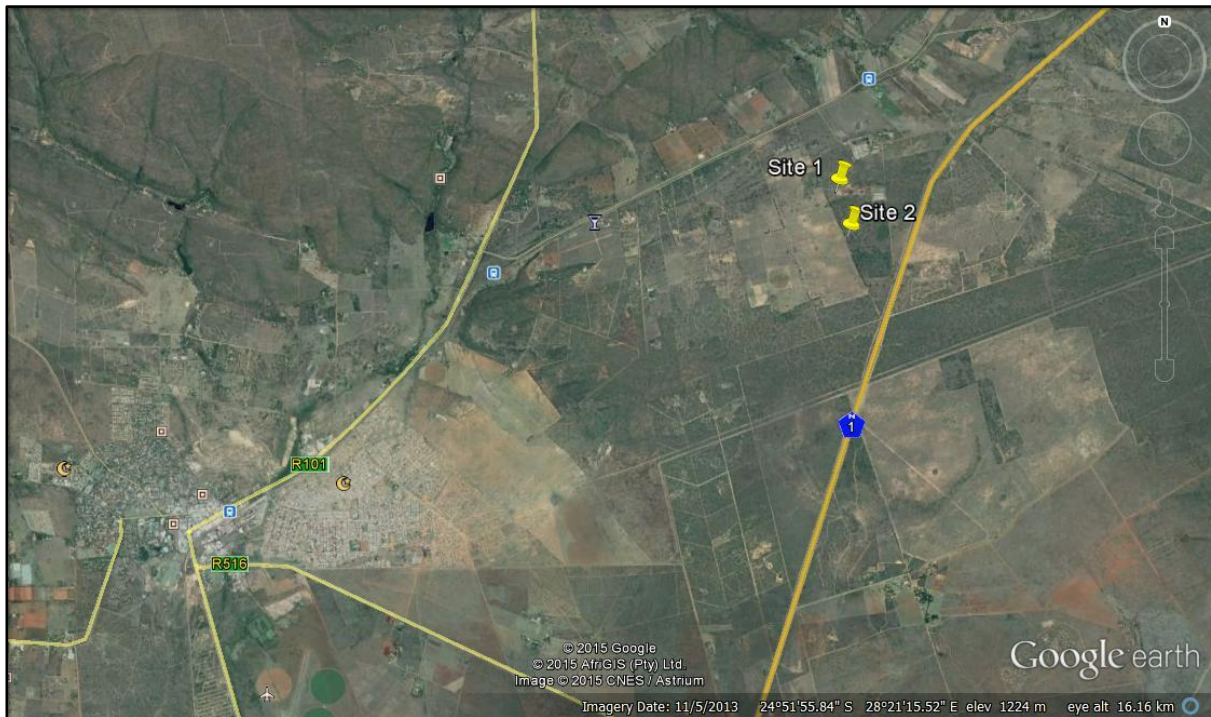


Figure 1 Locality of the proposed development sites north of Bela-Bela

## 3. GEOLOGY

The study area is underlain by Triassic aged Aeolian sandstone of the Clarens Formation, Karoo Supergroup (Figure 2).

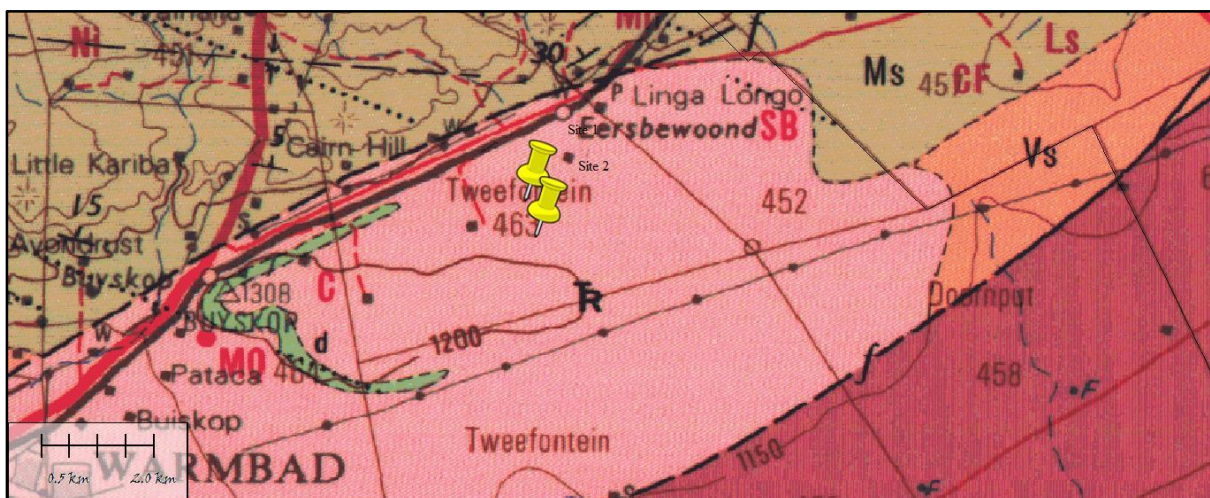


Figure 2 Both proposed sites are underlain by rocks of the Clarens Formation (Tr)

### 3.1. Clarens Formation

The Clarens Formation consists of fine-grained Aeolian sandstone. Most of the area is known to be underlain by thick sandy soils and most of the geological information on the map is provided from borehole information.

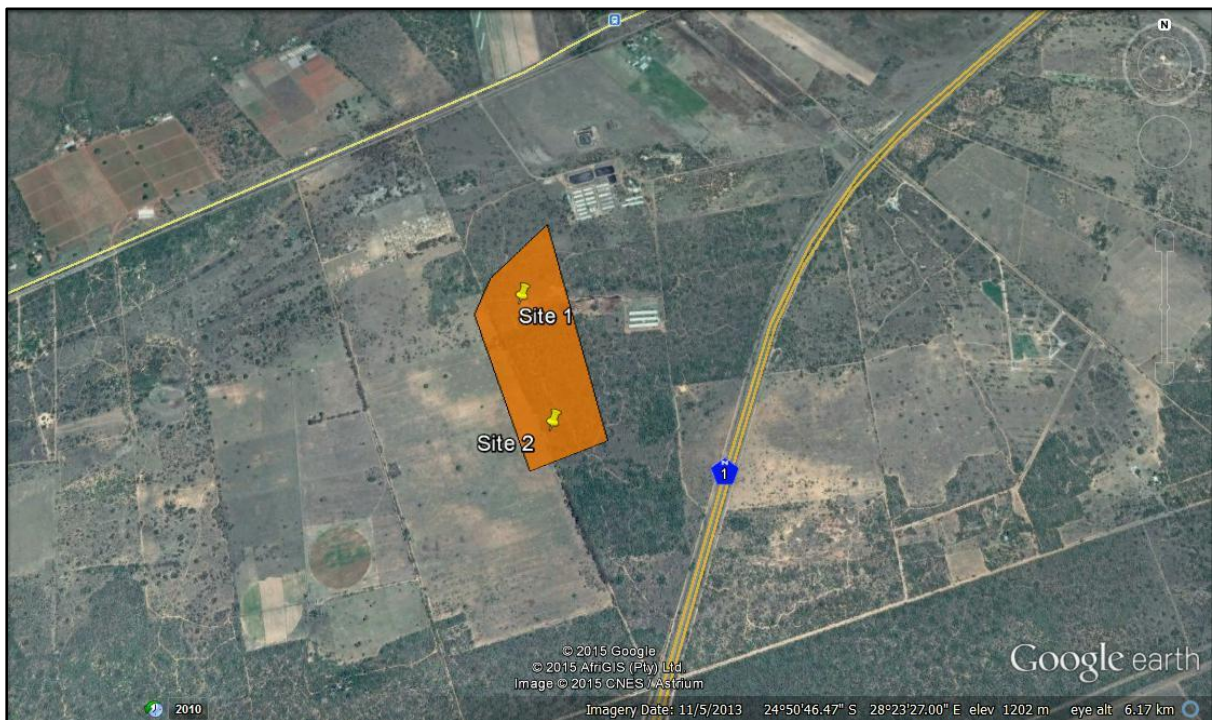
## 4. PALAEOLOGY OF THE AREA

### Clarens Formation

The Clarens Formation is known for the presence of vertebrate fossil remains of mostly dinosaur fossils. Due to the deep soil cover in the study area little information is available on the fossils of this region.

## 5. PALAEOLOGICAL SENSITIVITY

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 extent of bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 above.



**Figure 3 Palaeosensitivity of the study sites is high**

Due to deep soils in this region, little information on the palaeontological heritage of the sites is known. Recording of fossils during excavation for foundations will contribute significantly to our understanding of the palae-environments of the region and the High Palaeontological Sensitivity for the sites are retained.

## 6. CONCLUSION AND RECOMMENDATIONS

The proposed Tweefontein development is underlain by Triassic aged Aeolian sandstone of the Clarens Formation. The area is however covered in deep sandy soils and it is unlikely that fossils will be observed unless bedrock is exposed during excavation for foundations, as can be determined from



geotechnical reports. Recording of Triassic aged fossils from the site will contribute significantly to our understanding of the palaeo-environments of the area.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Clarens Formation sediments is Highly significant for fossil remains of vertebrates, including the dinosaurs.
2. If bedrock will be exposed during excavation for foundations, a qualified palaeontologist must be appointed to inspect the excavations for the presence of fossils. If excavations will not expose bedrock, no further mitigation for palaeontological heritage is recommended.
3. These recommendations should form part of the EMP of the project.

## 7. REFERENCES

**Johnson MR, Anhausser CR and Thomas RJ. 2006.** The Geology of South Africa. Geological Society of South Africa.

**Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014.** *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces.* Internal Palaeotechnical Reports, SAHRA.

## 8. 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 palaeoecological 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).

## 9. 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.



**Dr Gideon Groenewald**  
**Geologist**