PHASE 1 *PALAEONTOLOGICAL IMPACT ASSESSMENT REPORT*

Realignment of National Road N8 Section 12 (km 52.96) to section 13 (km 11.12)

Free State Province of South Africa
Mantsopa Local Municipality

Consultant:

Enviroworks

7 March 2013

By:

Gideon Groenewald

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Enviroworks Environmental Consultants to undertake a Phase 1 Palaeontological Field Investigation, assessing the potential palaeontological impact of the proposed Realignment of National Road N8 Section 12 (km 52.96) to section 13 (km 11). The purpose of this Palaeontological Impact Assessment is to identify exposed and potential palaeontological heritage on the site of the proposed project, to assess the impact the project may have on this resource, and to make recommendations as to how this impact might be mitigated.

This report forms part of the full environmental impact assessment and complies with 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.

A basic assessment of the topography and geology of the area was made by using appropriate geological (1:250 000, 2926-Bloemfontein) maps in conjunction with Google Earth. A review of the literature on the geological formations exposed at the surface in the development site and the fossils that have been associated with these geological strata was undertaken. A site field investigation was conducted on 7 March 2013, with the aim 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 study area is mainly underlain by Triassic sedimentary rocks of the Karoo Supergroup. These Triassic sedimentary rocks are classified as the Elliot Formation of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas are dominated by recent Quaternary Alluvium deposits

During the desktop survey, a significant palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the abundance of Triassic fossils including remains of dinosaurs, mammal-like reptiles and mammals known to occur within the Elliot Formation.

During the field investigation it was confirmed that the study area is mainly underlain by Triassic sedimentary rocks of the Elliot Formation of the Karoo Supergroup. Jurassic Dolerite sills dominate the high laying areas while recent Quaternary Alluvium deposits occur in the river valleys.

There is little possibility that fossils could be encountered during shallow excavation of the deeply weathered Elliot Formation as well as colluvial deposits.

Recommendation:
The palaeontological sensitivity will be low with no significant palaeontological heritage impact The ECO must be informed of the possibility of fossils in deeply excavated sediments of the Elliot Formation. If fossils are recorded, a qualified palaeontologist must be notified and the fossils removed according to SAHRA specifications.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by Enviroworks Environmental Consultants to undertake a Phase 1 Palaeontological Field Investigation, assessing the potential palaeontological impact of the proposed Realignment of National Road N8 Section 12 (km 52.96) to section 13 (km 11.12) This report complies with 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.

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

A Phase 1 investigation is often the last 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 were:

- 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 the field investigation a preliminary assessment (desktop study) of the topography and geology of the study area was made using appropriate 1:250 000 geological maps (2926 Bloemfontein) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigator's time and resources. The aim of the fieldwork was 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 was 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 1.1 below.

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. The developer should be made aware of the potential for finding fossils. If fossil material is later discovered it must be appropriately protected and the discovery reported to the appropriate Heritage Authority so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in outcrops and exposed bedrock. The chances of finding fossils during excavations by a professional palaeontologist are high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan. The mitigation should involve the comprehensive recording and collection of surface and embedded fossils along and close to the development footprint by a professional palaeontologist.

Table 1 Palaeontological sensitivity analysis outcome classification

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

1.3. Scope and Limitations of the Phase 1 Investigation

The scope of a phase 1 Investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, location and examination of any fossil collections from the study area (e.g. museums).
- do an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation should focus on the sites where bedrock excavations would definitely require palaeontological monitoring.

The results of the field investigation are then used to predict the potential of buried fossil heritage within the development footprint. In some investigations this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The development entails the Realignment of National Road N8 Section 12 (km 52.96) to section 13 (km 11.12). This development will result in the shortening of the access between Bloemfontein and Maseru by approximately 9km as well as resulting in a straighter alignment of the N8 highway (Figure 2.1). Details and final road alignments, river crossings etc. still need to be finalised by the consulting engineers.

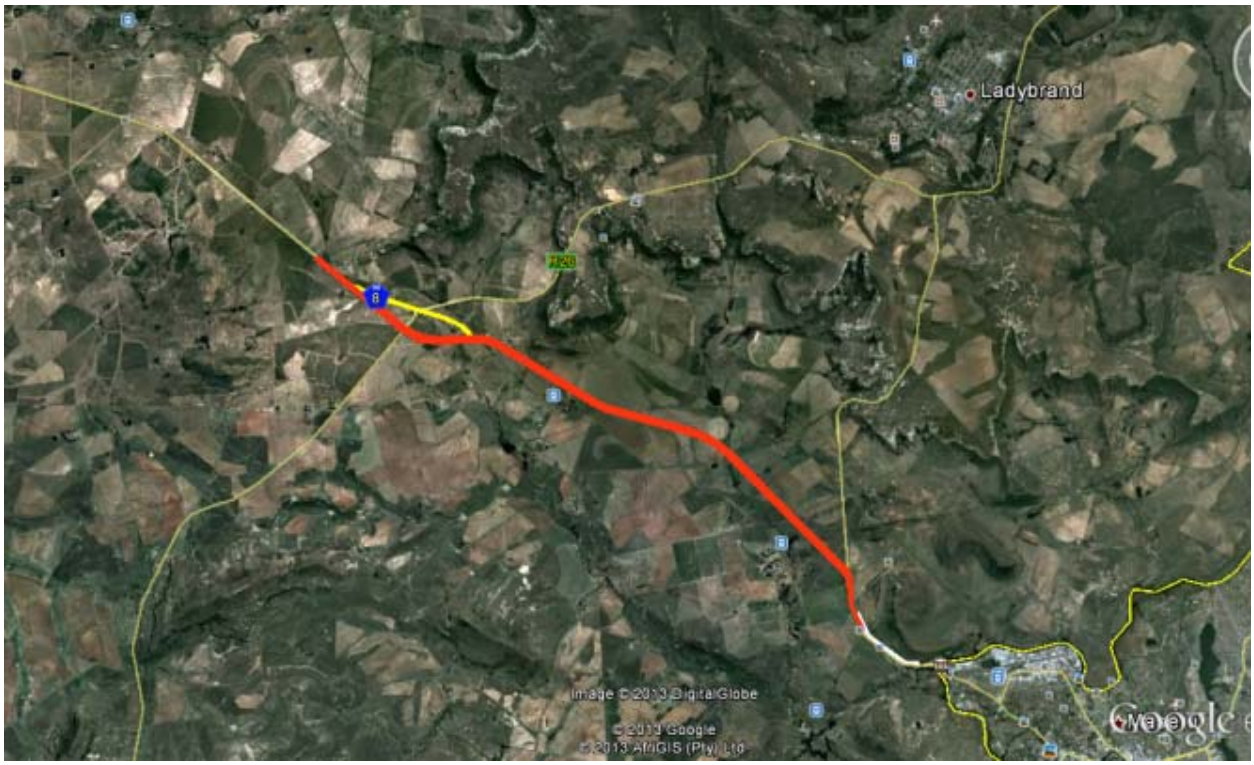

Figure 2.1 Locality of the Proposed Access Road

3. GEOLOGY OF THE AREA

The study area is mainly underlain by Triassic sedimentary rocks of the Karoo Supergroup (Figure 3.1). These Triassic sedimentary rocks are classified as the Elliot Formation of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas consist of recent Quaternary Alluvium deposits (not shown on the map).

Figure 3. 1 Geology of the study area at Ladybrand (Geo Maps 2926 Bloemfontein)

3.1. The Elliot Formation

The Elliot Formation (K4r) is interpreted as fluvial sediments with channel sandstones (meandering rivers), thin mudflake conglomerates interbedded with floodplain mudrocks (red, purplish), pedogenic calcretes, playa lake and pond deposits and occasional reworked volcanic ashes (Johnson et al, 2006 and Almond & Pether, 2008).

3.2. Karoo Dolerite

Dolerite (Jd, mapped as red polygons on map) is a very hard igneous rock that intruded the sedimentary layers and can occur either as sills or dykes. Sills can be from a few meters to tens of meters thick. Good examples of weathered dolerite were observed in the borrow-pit which falls on the proposed alignment of the new route (Figure 6.2).

3.3. Quaternary Deposits (not shown on map)

The Quaternary Deposits consist of alluvial deposits, deposited by rivers in the valley floors.

4. PALAEONTOLOGY OF THE AREA

4.1. The Elliot Formation

In general, the Elliot Formation is globally recognized for the abundance of early dinosaur remains, most notably *Massospondylus.* This includes fossilised dinosaur eggs containing embryos. Mammal-like reptiles as well as fossils of mammals are also well known from this formation.

4.2. Karoo Dolerite

Due to the igneous character of Karoo Dolerite it will not contain fossils.

4.3. Quaternary Deposits

No fossils are expected in the alluvial deposits of recent rivers.

5. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the abundance of Triassic fossils including remains of dinosaurs, mammal-like reptiles and mammals known to occur within the Elliot Formation.

6. FIELD INVESTIGATION

Dr Gideon Groenewald, Sue Groenewald and David Groenewald, experienced fieldworkers, visited the site of the proposed Realignment of National Road N8 Section 12 (km 52.96) to section 13 (km 11.12) on Thursday 7 March 2013. The topography of the area is flat with extensive colluvial deposits (Figures 6.1 to 6.7). Outcrops of the Elliot Formation are localised and deeply weathered, mainly restricted to one or two road cuttings. No fossil remains were observed during the field investigation.

Figure 6.2 View towards the West across the existing borrow pit (GPS S29.23894 E 27.36743

Figure 6.1 Starting point of realignment of N8 from existing N8 route looking towards the East. (GPS S 29°14'0.69" E 27°20'45.70")

Figure 6.4 No significant outcrops of the Elliot Formation were observed. Looking West along main road alignment. (GPS S 29,24210 E 27.36907)

Figure 6.3 Looking towards the East along new road alignment, no outcrop recorded

(GPS S 29,24749 E 27.37724)

Figure 6.6 Study area dominated by arable land and no significant outcrops were observed (GPS S 29.25679 E 27.40008

Figure 6.5 Proposed point of intersection of realignment with existing N8 (GPS S 29.27826 E 27.43521)

Figure 6.7 Outcrop of Elliot Mudstone, metamorphosed to grey colour by dolerite intrusion. (GPS S 29.27315 E 27.43476)

7. PALAEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE

The desktop study suggests that the area underlain by the Elliot Formation will be highly sensitive for palaeontological heritage. However, the field investigation results indicate that due to the colluvial deposits the potential for finding fossils is extremely limited. The development of a road with shallow excavations is not likely to uncover any fossil material. Therefore, the palaeontological sensitivity will be low with no significant heritage impact as illustrated in Figure 7.1.

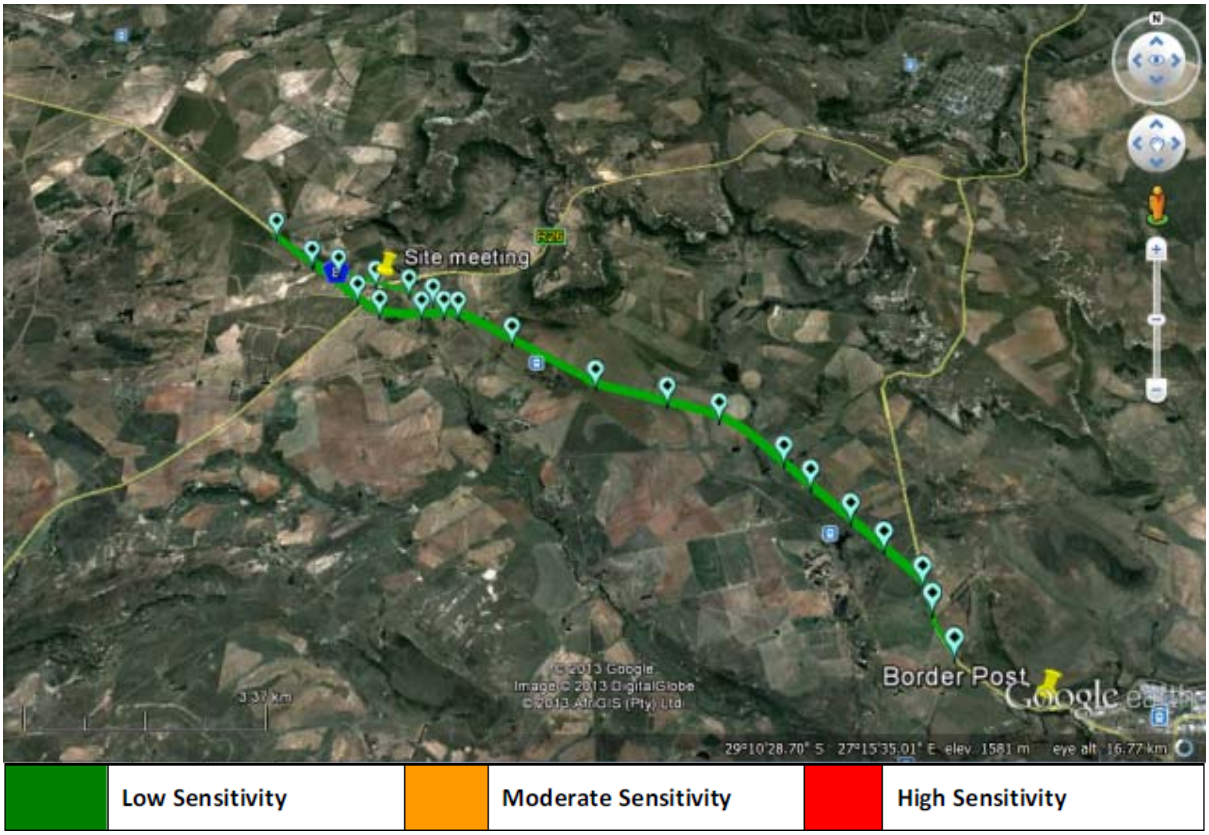

Figure 7.1 Palaeontological sensitivity is rated low due to deep weathering of Elliot Formation

8. CONCLUSION AND RECOMMENDATIONS

The study area is mainly underlain by Triassic sedimentary rocks of the Elliot Formation of the Karoo Supergroup. Jurassic Dolerite sills and dykes dominate the high laying areas while recent Quaternary Alluvium deposits occur in the river valleys.

There is little possibility that fossils could be encountered during shallow excavation of the Elliot Formation as well as colluvial deposits. Therefore, the palaeontological sensitivity will be low with no significant heritage impact. The ECO must be informed of the possibility of fossils in deeply excavated sediments of the Elliot Formation. If fossils are recorded, a qualified palaeontologist must be notified and the fossils removed according to SAHRA specifications.

9. REFERENCES

Groenewald GH.1996. Stratigraphy and Sedimentology of the Tarkastad Subgroup, Karoo Supergroup, South Africa. Unpubl PhD Thesis, University of Port Elizabeth.
Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA,Council for Geoscience, Pretoria.
Rubidge BS (ed) 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup), South Africa. South African Committee for Stratigraphy.

10. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University ofPort 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).

11. 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

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

REALIGNMENT OF NATIONAL ROUTE 8 SECTION 12 (KM 52.96) TO SECTION 13 (KM 11.12) BETWEEN THE R26/N8 INTERSECTION AND MASERU BRIDGE

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4.2 The specialist appointed in terms of the Regulations_

I, Gideon Groenewald , declare that --

General declaration:

I act as the independent specialist in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company (if applicable):

27 March 2013

Date: