

# PROPOSED DEVELOPMENT OF NHLEZI BRIDGE, KWAZULU/NATAL

## **SCOPING REPORT PALAEOLOGY**

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

For:  
**Gaigher & Associates**  
PO Box 522  
Louis Trichardt  
0920  
South Africa

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# 1. Introduction

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in *i.a.* the origin of life, mammals, dinosaurs and humans. Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and to study evolutionary relationships, sedimentary processes and palaeoenvironments. The Ecca Group of the Karoo Supergroup contains a vast amount of fossil leaf imprints of plants that occurred in Southern Gondwana during the Permian. These lacustrine deposits contained plant matter which turned into coal in certain parts of the Ecca Group. The resulting coal fields form a very important mineral resource for the country.

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 which may be impacted by the proposed development. The impact of the development can be ameliorated in several ways in the areas where fossils are common.

## 2. 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-
  - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
  - (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
  - (c) 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
  - (d) 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-
  - (a) 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;
  - (b) 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;
  - (c) 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
  - (d) 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.

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

The relevant literature and geological maps for the region in which the development is proposed to take place, have been studied for this Scoping Report.

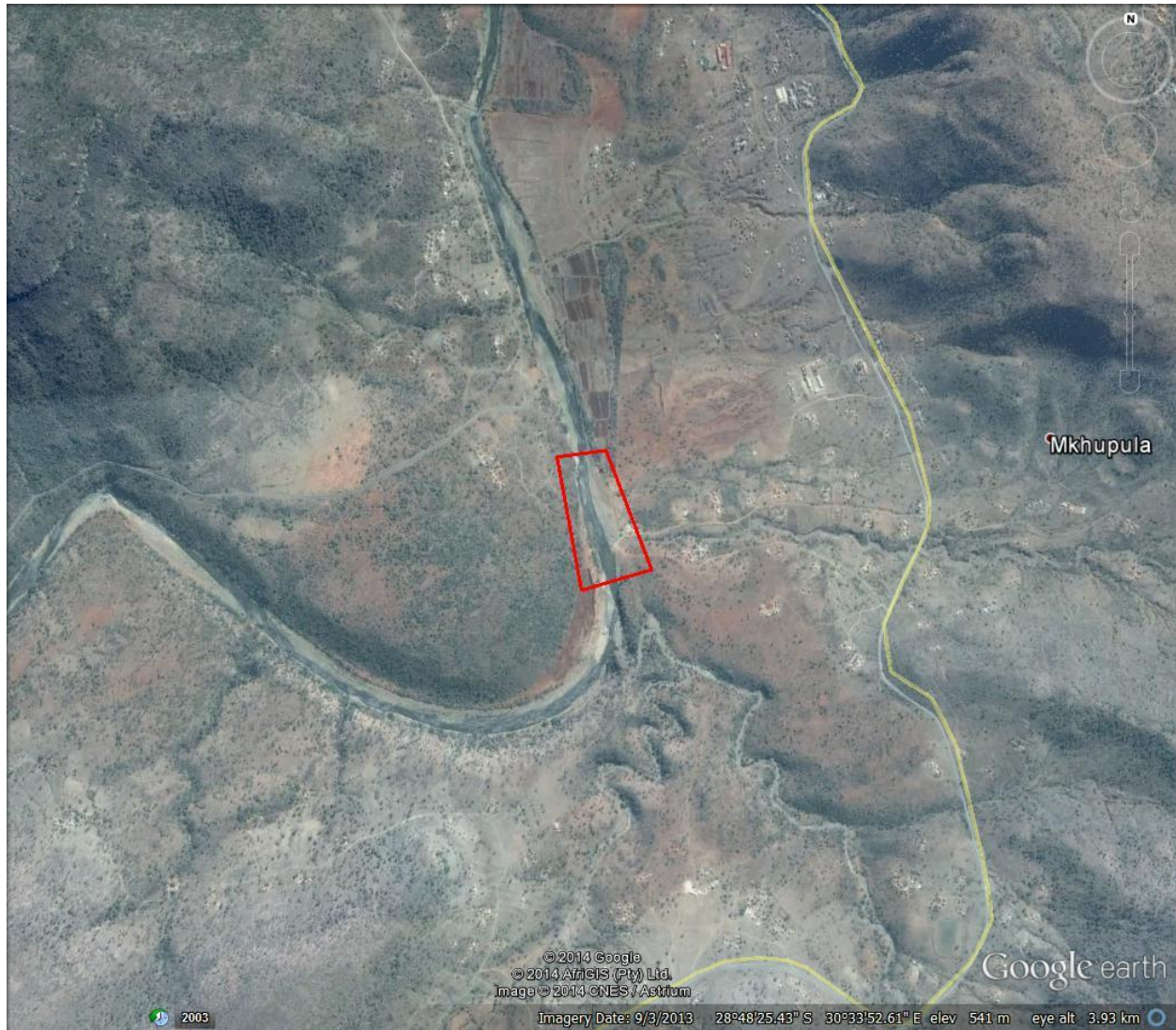


Figure 1: Google Earth photo indicating the study area (red polygon)

The study site is situated in rural KwaZuluNatal approximately 30km north of Greytown on a dirt road crossing a river. The site is located on a tributary of the Tugela River in a valley flanked on the western side by mountains. Vegetation is sparse adjacent to the river and the bedrock is exposed in places due to erosion.

## 4. Geological setting



Figure 2: Geology of the study area (indicated with the red polygon) (adapted from the Dundee 2830 1: 250 000 Geology Map (Geological Survey, 1988))

### LEGEND:

Age		Formation	Description
Quaternary		Masotcheni	Basal boulder bed and yellow-brown sandy clay
Jurassic	Jd		Dolerite intrusions
Permian	Karoo Supergroup	Vryheid	Medium to coarse-grained sandstone, micaceous shale, coal
		Pietermaritzburg	Dark-grey shale
		Dwyka	Tillite, minor shale, varved shale and sandstone
Namaquan	Tugela	Manyane	Sedimentary and volcanic rocks, amphibolite



The study site falls within the Quaternary aged Masotcheni Formation, the Jurassic aged dolerite of the Karoo Supergroup and the Namibian aged Manyane Formation (see Fig.2). The geology of the study area is dominated by dolerite.

The Masotcheni Formation consists of palaeosol stratigraphic units or pedoderms comprising of colluvium, debris and alluvium. These unconsolidated colluvial deposits were set down during four geomorphic cycles during the Late Pleistocene and Holocene (Rienks *et al.*, 2000).

The area surrounding the study site is dominated by dolerite. Dolerite intruded into the sedimentary rocks of the Karoo Supergroup approximately 190-195 million years ago (Johnson *et al.*, 2006).

The Manyane Formation as part of the Tugela Group formed during the formation of oceanic arcs by subduction away from the Kaapvaal Craton and the deposition of supracrustal rocks in arc basins on the margin of the Kaapvaal Craton approximately 1235 Ma (McCourt *et al.*, 2006).

## 5. Palaeontology of the study area

The approximately 1235 Ma igneous rocks and metamorphosed sedimentary rocks of the Tugela Group and 190-190 Ma dolerites are non-fossiliferous. The Masotcheni Formation consists mostly of unconsolidated hillslope scree and therefore it is improbable that it contains fossils and is of little to no palaeontological concern.

### References:

Geological Survey (1988) Dundee 2830 1: 250 000 Geology Map.

Johnson, M.R.; Van Vuuren, C.J.; Visser, J.N.J.; Cole, D.I.; Wickens, H. De V.; Christie, A.D.M.; Roberts, D.L. & Brandl, G. (2006). Sedimentary rocks of the Karoo Supergroup, pp. 461-499. *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.

McCourt, S.; Armstrong, R. A.; Grantham, G. H. & Thomas, R. J. (2006). Geology and evolution of the Natal belt, South Africa. *Journal of African Earth Sciences*, 46(1-2):71-92.

Rienks, S.M.; Botha, G.A. & Hughes, J.C. (2000). Some physical and chemical properties of sediments exposed in a gully donga in northern KwaZulu-Natal, South Africa and their relationship to the erodibility of the colluvial layers. *Catena* 39:11–31.

## 6. Conclusion and Recommendations:

Due to the improbability of fossils occurring in the study area it is recommended that the project should be exempted from further palaeontological studies.



Palaeontological specialist:

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

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

Experience:

Palaeontological assessments:

- Urban development in Cradle of Humankind World Heritage Site (Gauteng):  
Letamo, Honingklip, Windgat, Sundowners, Ekutheni
- Urban development at Goose Bay, Vereeniging, Gauteng
- Urban development on Portions 98, 99, 179, 236, 284 and 364 of the farm  
Waterkloof 306 JQ, Rustenburg, North West Province
- Upgrade of R21 between N12 and Hans Strydom Drive, Gauteng
- Vele Colliery, Limpopo Province
- De Wildt 50 MW Solar Power Station, Gauteng
- 10 MW PV Plant Potchefstroom, North West Province
- Omega 342 50MW Solar Power Station, Viljoenskroon, Free State
- Springfontein wind and solar energy facility, Free State
- Solar power plant, Bethal, Mpumalanga
- Diamond mine on Endora, Limpopo Province
- Development at Tubatse Ext.15, Limpopo Province
- Manganese mine south of Hotazel, Northern Cape
- Wind energy facility at Cookhouse, Eastern Cape
- Energy facility at Noupoot, Northern Cape
- Fluorspar mine near Wallmannsthal, Gauteng
- ESKOM power line, Dumo, KwaZulu-Natal
- ESKOM Gamma-Omega 765KV transmission line, Western Cape
- ESKOM 44KV power line at Elandspruit near Middelburg, Mpumalanga
- ESKOM Makopane Substation, Limpopo Province
- ESKOM Platreef Substation and power lines to Borutho MTS Substation,  
Limpopo Province
- Marang B - a 3 x 500MVA 400/132kV Main Transmission Substation east of  
Rustenburg, North West Province

- Upgrading of storm water infrastructure in Valencia, Addo, Sundays River Valley Municipality, Eastern Cape
- Development of a 10 MW Solar Energy facility on the Farm Liverpool 543 KQ Portion 2 at Koedoeskop, Limpopo Province
- Development of a fluorspar mine at Wallmannsthal, North of Pretoria
- Extension of limestone mine on the farms Buffelskraal 554 KQ Portion1 and Krokodilkraal 545 KQ, Limpopo Province
- Lesego Platinum Mine, Sekhukhune Area, Steelpoort, Limpopo Province
- Proposed mine at Hotazel, Northern Cape
- Pollution control dams at Transalloys in Clewer near Emalaheni (Witbank), Mpumalanga
- Erection of spill points on the Farm Kwikstaart 431 KQ Portion 2, Thabazimbi, Limpopo Province
- Proposed dam at Ethemba, Swaziland
- Proposed bridge at Busingatha, KwaZulu Natal
- Water Reticulation System between Kei Road and Berlin General, Eastern Cape

Palaeontological research:

- Gauteng: Wonder Cave
- KwaZulu/Natal: Newcastle, Mooi River, Rosetta, Impendle, Himeville Underberg, Polela & Howick Districts, Sani Pass
- Eastern Cape: Cradock District, Algoa Basin
- Western Cape: Clanwilliam District
- Free State: Memel & Warden Districts
- Limpopo Province: Nyalaland (KNP), Vhembe Reserve, Pont Drift
- Zimbabwe: Sentinel Ranch, Nottingham