

**PALAEONTOLOGICAL ASSESSMENT OF  
SUNNY SOUTH HOUSING FACILITY,  
BUFFALO CITY METROPOLITAN MUNICIPALITY,  
EASTERN CAPE**

**FOR  
Environmental Impact Management Services (Pty) Ltd**

**DATE: 16 May 2013**

**By**

**Gideon Groenewald  
Cell: 082 829 4978**

## **TABLE OF CONTENTS**

INTRODUCTION .....	4
SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999.....	5
METHODOLOGY.....	6
GEOLOGY .....	7
PALAEONTOLOGY .....	8
DISCUSSION.....	9
MANAGEMENT PLAN.....	9
CONCLUSION.....	10
REFERENCES .....	11
QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR .....	12
DECLARATION OF INDEPENDENCE .....	12

## **TABLE OF FIGURES**

Figure 1 Image and map of the Sunny South Housing Development .....	5
Figure 2 Map showing the geology of the study area.....	8
Figure 3 Google image showing the palaeosensitivity of the study area.....	10

## **LIST OF TABLES**

Table 1 Palaeontological sensitivity analysis outcome classification .....	6
Table 2 Palaeontological significance of geological units on site.....	9

## EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Environmental Impact Management Services (Pty) Ltd to undertake a desktop survey, assessing the potential palaeontological impact of the Sunny South Housing Development, a project of the Buffalo City Metropolitan Municipality (BCMM).

The study site is located approximately 32.2 km south west from the East London Central Business District (CBD) via the R346 and Woolwash Road, and 39.0 km via the R72 and R347 on the way to King Williams Town. The project is proposed to take place on BCMM owned land with an area of approximately 92.8 ha. The area has already been rezoned from agricultural to residential land use.

The potential fossiliferous rock units represented within the study area were determined from the relevant geological maps and Google Earth imagery. 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.

A significant part of the study area proposed for the development of the Sunny South Housing Development is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Adelaide Subgroup. Fossils are expected in the Permian and Triassic sediments, cutting the significant Permian Extinction zone.

The Permian Adelaide Subgroup is interpreted as a meandering river deposit grading upwards into a lacustrine environment and is well known for containing fossils.

It is recommended that:

- A palaeontological site inspection be done by a qualified palaeontologist once the vegetation has been cleared during the early stages of construction in areas with a Moderate sensitivity rating for the occurrence of fossils.
- The EAP of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

## INTRODUCTION

Gideon Groenewald was appointed by Environmental Impact Management Services (Pty) Ltd to undertake a desktop survey, assessing the potential palaeontological impact of the Sunny South Housing Development, a project of the Buffalo City Metropolitan Municipality (BCMM).

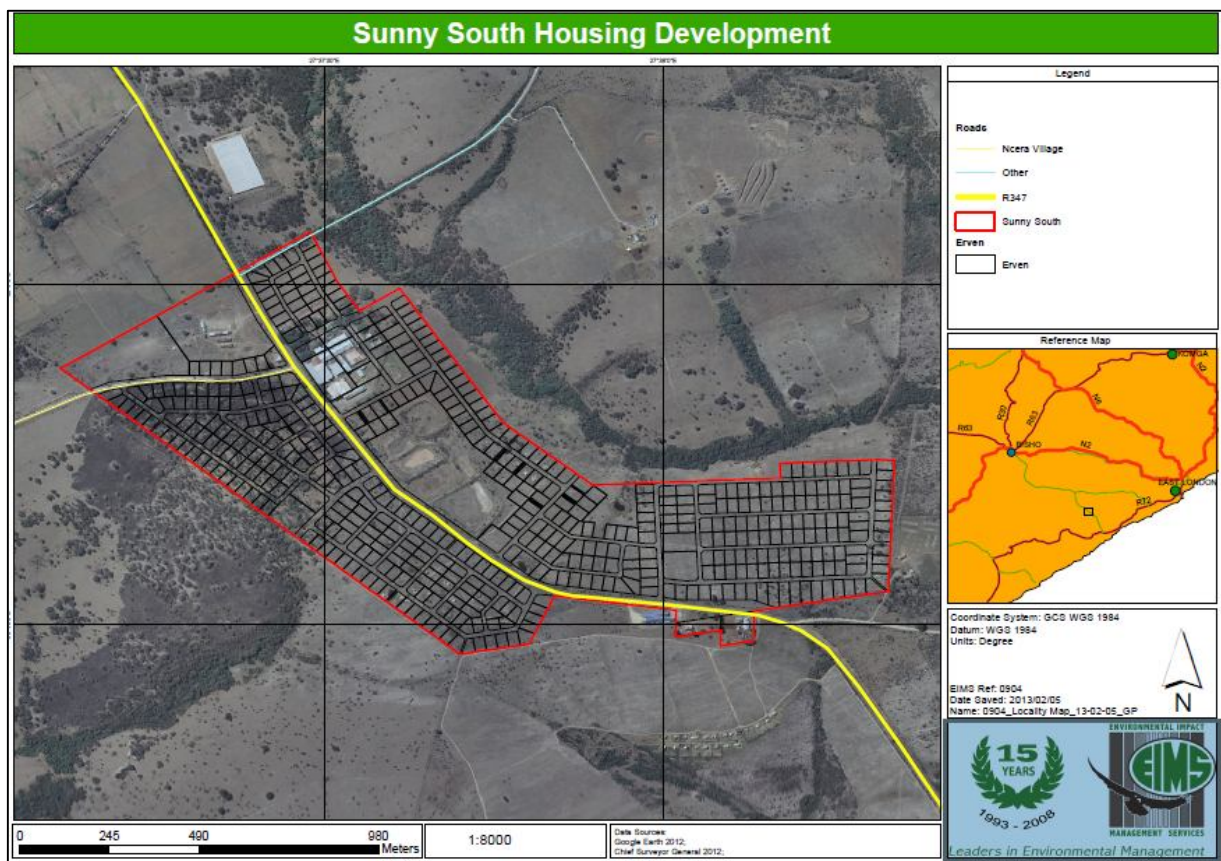
The study site is located approximately 32.2 km south west from the East London Central Business District (CBD) via the R346 and Woolwash Road, and 39.0 km via the R72 and R347 on the way to King Williams Town.

The project is proposed to take place on BCMM owned land with an area of approximately 92.8 ha (The centre coordinates are 33°04'19.66"S 27°37'38.50"E). The project proposes to provide suitable beneficiaries with formal housing units (with basic services infrastructure such as adequate sanitation, water and electricity). The area has been rezoned from agricultural to residential land use due to the BCMM's need for providing formal housing infrastructure to growing communities which currently reside in informal dwellings.

The project is proposed to involve the following main components:

- Construction of housing units;
- Installation of electrical, water and sanitation services; and
- Construction of internal roads.

The site ranges in height from 190 - 230 m above sea level and general slopes at gradients of less than 1:10. The preferred site has several existing direct access points that provide adequate access to the development site, with the R347 providing the main access to the site (Figure 1).



**Figure 1 Image and map of the Sunny South Housing Development**

### **SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999**

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. In accordance with Section 38 (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;
- objects with the potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage.

## 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 the relevant geological maps (1:250 000 3326 Grahamstown) and Google Earth imagery. 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.

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 below.

**Table 1 Palaeontological sensitivity analysis outcome classification**

<b>Sensitivity</b>	<b>Description</b>
<b>Low Sensitivity</b>	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.
<b>Moderate Sensitivity</b>	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. A field-based assessment by a professional palaeontologist is usually warranted.
<b>High Sensitivity</b>	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 all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop 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 are also inadequate database for fossil heritage for much of South Africa, due to the small number of professional palaeontologists carrying out fieldwork in South Africa. Many proposed development study areas have thus never been studied before by a professional 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, this 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 tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

## **GEOLOGY**

The study area is mainly underlain by Permian aged sedimentary rocks of the Karoo Supergroup (Figure 2). The Permian sedimentary rocks belong to the Balfour Formation of the Adelaide Subgroup, Beaufort Group. Jurassic aged dolerite sills and dykes also occur sporadically across the development area.

The Adelaide Subgroup consists mainly of grey mudstone, shale and sandstone and is interpreted as a mixed fluvial and lacustrine deposit with major meandering river systems (Johnson et al 2006). The upper part of the Adelaide Subgroup is known as the Balfour Formation with a prominent red mudstone unit known as the Palingkloof Member (Groenewald, 1996). The Palingkloof Member is interpreted as a lacustrine deposit.

Dolerite is a very hard igneous rock that intruded the sedimentary layers and can occur either as sills or as dykes. Sills can be from a few meters to tens of meters thick.

There is a fault that runs through the middle of the development and the bed dips at an angle of 30°.

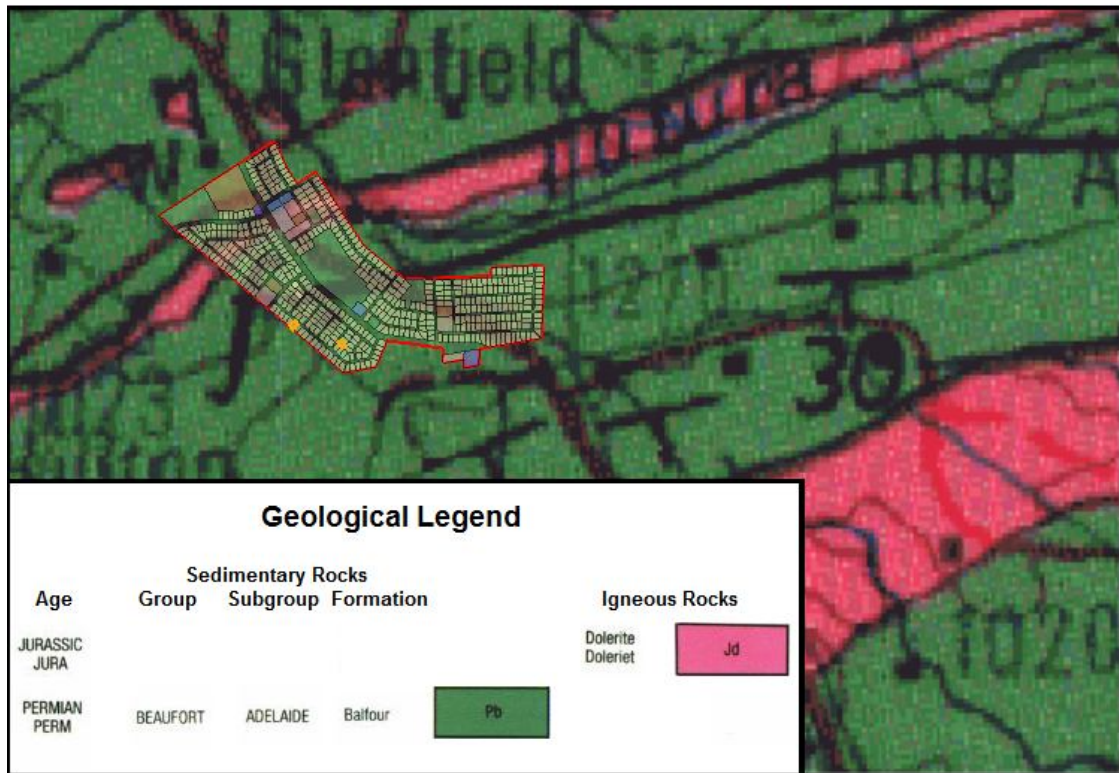


Figure 2 Map showing the geology of the study area

## PALAEONTOLOGY

The Permian Adelaide Subgroup is interpreted as a meandering river deposit grading upwards into a lacustrine environment and is well known for containing fossils. The subgroup is known to contain very good examples of *Glossopteris* flora. The upper Balfour Formation correlates with the *Dicynodon* Assemblage zone which is known as a productive fossil bearing strata (Rubidge et al, 1995). The upper part of the Balfour Formation is known as the Palingkloof Member, which in turn is associated with the *Lystrosaurus* Assemblage zone (Groenewald, 1996). This sequence of rock also represents the major Permian Extinction Event and can contain important palaeontological information related to the event that eradicated up to 85% of life on earth.

Dolerite is an igneous rock type and will not contain any fossils.



## DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. Using image information from Google Earth remote sensing, the study area seems to be a well vegetated grassland and it was not possible to assess the extent of outcrops or the depth of weathering, which will have an impact on the palaeontological sensitivity. The palaeontological significance is summarised in Table 2.

**Table 2 Palaeontological significance of geological units on site**

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup	Red and Grey Mudstone & Sandstone PERMIAN	Vertebrate fossils of the <i>Therapsids</i> group e.g. <i>Gorgonopsian</i> and <i>Dicynodonts</i> . Plant fossils e.g. <i>Glossopteris</i> trees and leaves.	<i>Lystrosaurus</i> and <i>Dicynodon</i> assemblage zones	Moderate sensitivity

There is a possibility that fossils could be encountered during excavation of non-doleritic bedrock within the development footprint and these fossils would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would have a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

## MANAGEMENT PLAN

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 above. The study area has a Moderate sensitivity rating (Figure 3).

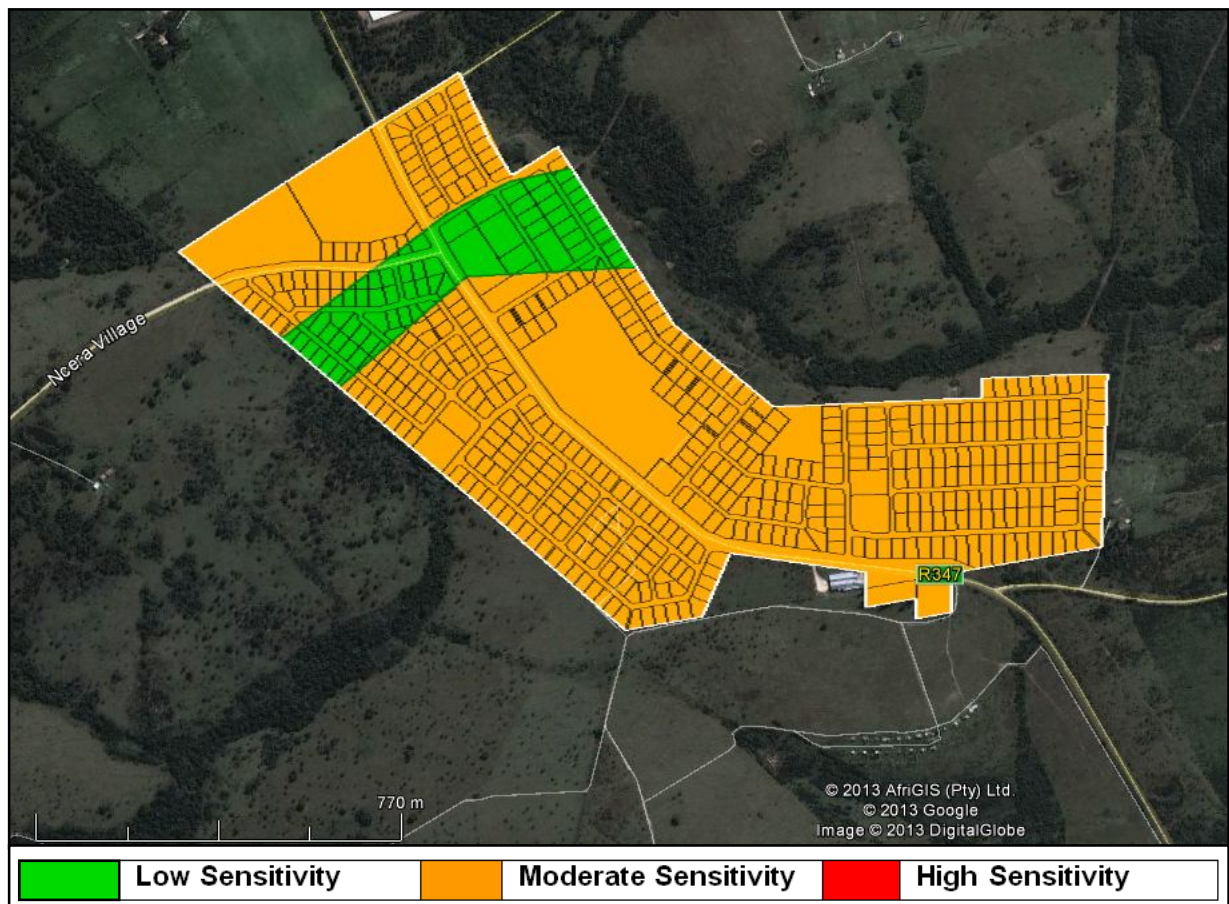


Figure 3 Google image showing the palaeosensitivity of the study area

## CONCLUSION

A significant part of the study area proposed for the development of the Sunny South Housing Development is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Adelaide Subgroup. Fossils are expected in the Permian and Triassic sediments, cutting the significant Permian Extinction zone.

It is recommended that:

- A palaeontological site inspection be done by a qualified palaeontologist once the vegetation has been cleared during the early stages of construction in areas with a Moderate sensitivity rating for the occurrence of fossils (Figure 3).
- The EAP of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

## 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.

## **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).

## **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**