

**DESKTOP PALAEOLOGICAL IMPACT ASSESSMENT FOR THE  
PROPOSED ESTABLISHMENT OF A 15 ha MIXED-USE DEVELOPMENT ON  
PORTIONS 1-7 OF ERF 234 NEW ENGLAND (220 MURRAY ROAD), MSUNDUZI  
LOCAL AND uMGUNGUNDLOVU DISTRICT MUNICIPALITY,  
PIETERMARITZBURG, KWAZULU-NATAL**

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**Declaration of Consultants independence**

I, Gary Trower, am an independent consultant and have no business, financial, personal or other interest in the proposed development project in respect of which I was appointed to do a palaeontological assessment other than fair remuneration for work performed. There are no circumstances whatsoever that compromise the objectivity of this specialist performing such work.

A handwritten signature in black ink, appearing to read 'G. Trower', with a large, stylized flourish above the name.

Gary Trower

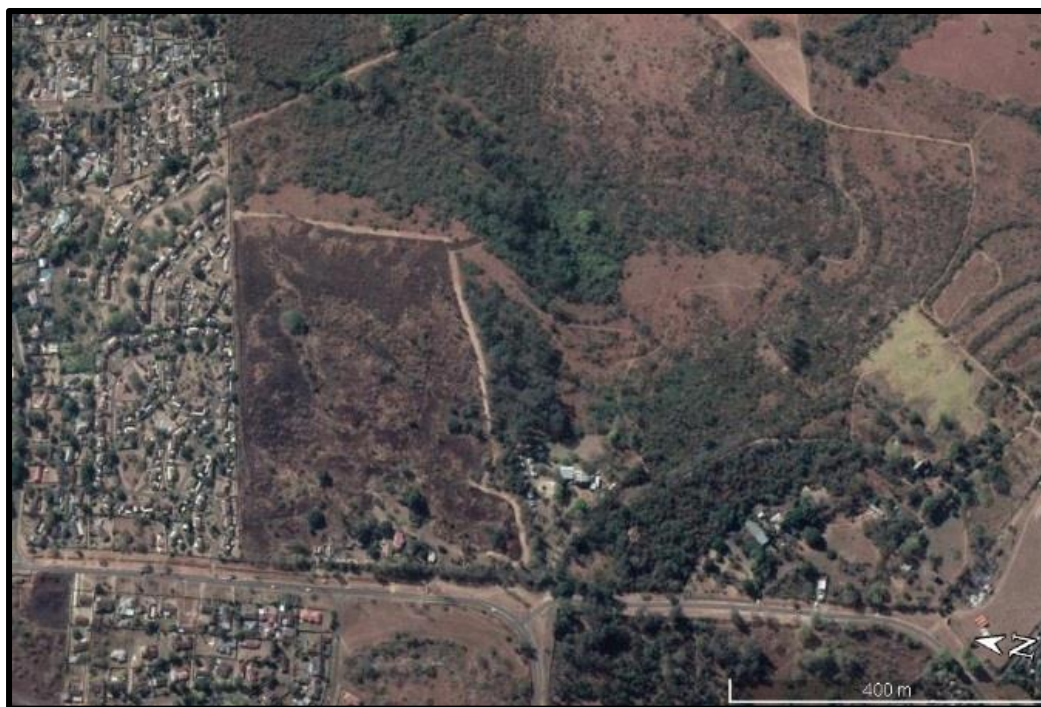
## **Introduction**

In terms of the National Environmental Management Act 107 of 1998 and Section 38 (8) of the National Heritage Resources Act 25 of 1999 (sections 34-36), all aspects of heritage are protected. Proposed developments that are likely to impact on heritage resources (i.e. historical, archaeological, palaeontological & cosmological) require a desktop and/or field assessment to gauge the importance of such resources in order to ensure that such sites are not damaged or destroyed by developments which could endanger them. Identified heritage resources should be recorded through detailed documentation, mitigation measures applied if resources are threatened, or collection and/or a rescue excavation carried out if necessary.

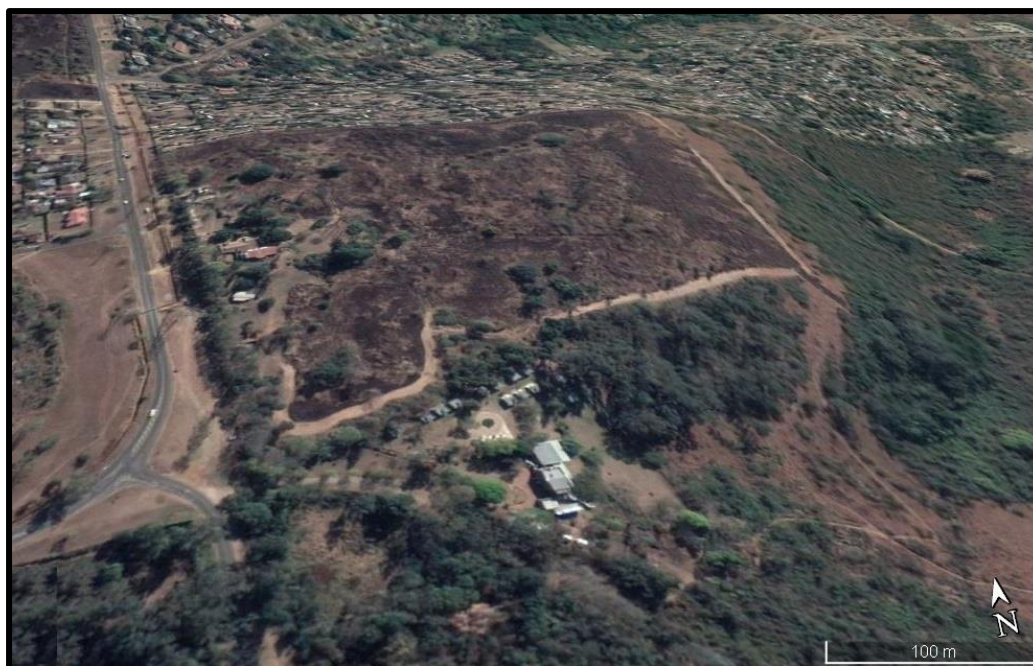
Shanbar Property Development CC is proposing a construction project comprising of a 15 ha mixed-use development for Erf 234 of New England (220 Murray Road), Pietermaritzburg (Msunduzi Municipality), KwaZulu-Natal (Figure 1 & 2). The site footprint is located in Hayfields, to the east of the intersection of Murray Road and Hesketh Drive, of which an extension is planned for the latter. The development will include an educational facility in terms of a school of about 5 ha in extent (Portion 1); a shopping centre of approximately 3.5 ha in extent (Portion 2); a residential estate of approximately 5 ha in extent (Portions 3-5); a filling station with shop, restaurant and drive-thru of roughly 0.5 ha in extent; and new road servitudes (Portion 6 & 7).

The proposed development is situated within an area where the underlying geology is given a moderate palaeo-sensitivity rating on the South African Heritage Resources Agency map ([www.sahra.org.za/sahris/map/palaeo](http://www.sahra.org.za/sahris/map/palaeo)), and these deposits may contain some palaeontological material. A desktop palaeontological assessment was thus necessary to gauge the likelihood of fossil material being present within the boundaries of the proposed development, as well as

within the buffer zone surrounding the site footprint, as well as to gauge the potential impact of such a development on fossil resources.



**Figure 1:** Satellite image of the site footprint, as viewed from the west. The T-junction in the bottom of the image shows Hesketh Road merging into Murray Road. Modified from Google Earth, AfriGIS 2020

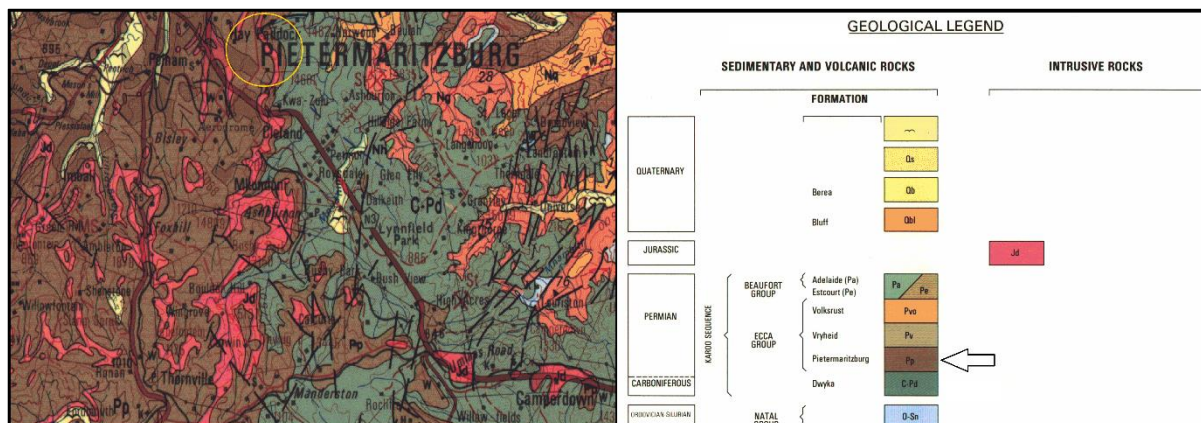


**Figure 2:** Satellite image of the site footprint, as viewed from the south. The drainage line is visible on the right hand side of the image, but is more than 100 m from the site footprint. North is at the top of the page, elevation is exaggerated to 3. Modified from Google Earth, AfriGIS 2020

## Geology

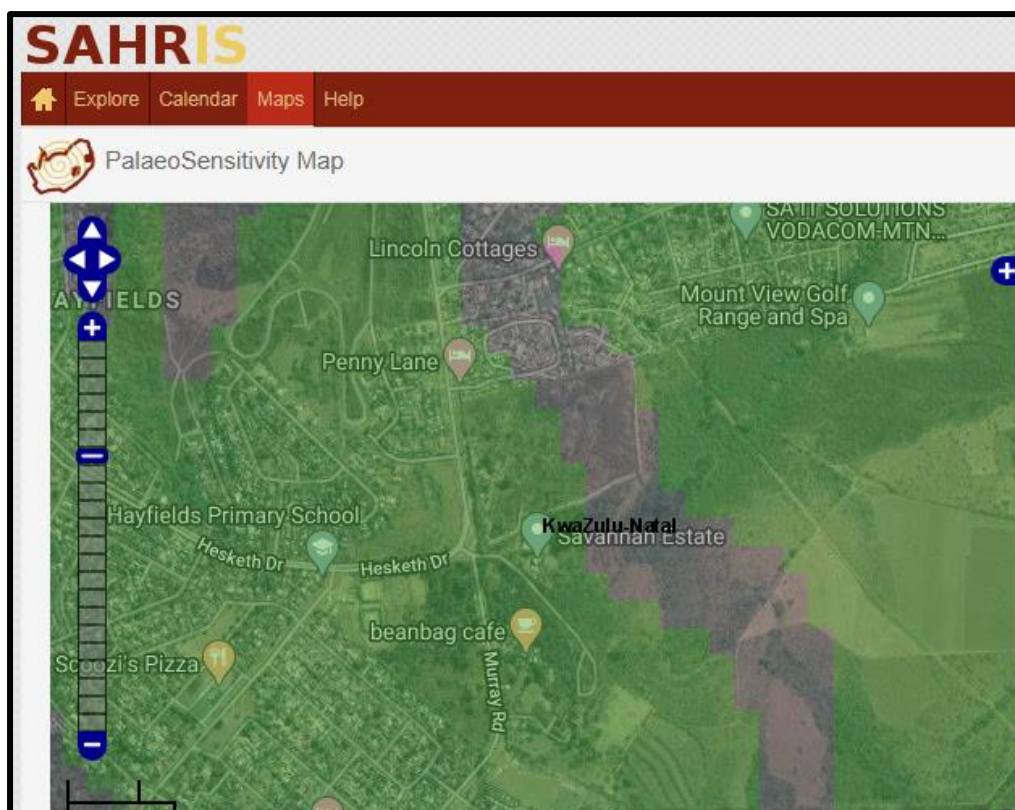
Rocks of the Karoo Basin are rich repositories for palaeontological material, necessitating measures to minimize activities which may disturb or destroy fossils preserved in underlying beds. The geology in the area of the proposed development consists of early Permian deposits of the Ecca Group, more specifically the Pietermaritzburg Formation. This fine to medium-grained sedimentary package accumulated as the basal deposits within a giant inland sea and comprises of dark grey shale, siltstone and subordinate sandstone (Figure 3).

These deposits form an important component and subdivision of the stratigraphy of the Karoo Supergroup, an extensive inland basin which preserves a rich array of tetrapod fauna which existed through the Permian and Triassic of southern Gondwana (Rubidge 2005, Smith *et al.* 1993). The existence of a depositional environment in this palaeo-landscape means that an array of fossil lifeforms which flourished during the early Permian may be present within this geological unit, and this is also the reason why it has a moderate palaeo-sensitivity rating of green (Figure 4).



**Figure 3:** Map showing the geology of the region, with the site footprint falling within the yellow circle. The proposed development will take place on top of early Permian-aged deposits, namely the Pietermaritzburg Formation of the Ecca Group, a geological unit with a moderate palaeo-sensitivity. Modified from 2930 Durban, 1:250 000 Geological Series, Council for Geoscience, 1988)





**Figure 4:** Map of how the geology in Fig.3 translates into palaeo-sensitivity. The geological unit which occurs beneath the site footprint has a ranking of green and corresponds to the Ecca Formation, a rock type which forms some of the earliest deposits of the Karoo Basin. Modified from the SAHRIS map, [www.sahra.org.za/sahris/map/palaeo](http://www.sahra.org.za/sahris/map/palaeo)

## Site observations

An aerial survey of the study site was carried out using Google Earth, Google Street Maps, the relevant geology map of the area (2930 Durban) and SAHRIS palaeo-sensitivity map, which were all used in combination to gain an understanding of the underlying bedrock along the route, and how it is ranked in terms of possible fossil occurrences.

The site occurs on a moderately sensitive strip of the Ecca Formation (Figure 4). This geological unit is given a palaeo-sensitivity rating of green on the SAHRIS map, and this sedimentary package could contain fossils. Most of these deposits reflect fine to medium-grained alluvial material from riverine and estuarine environments, which would have been

densely vegetated in the past. Therefore most fossils found in this unit are plant fossils. Although important scientifically, the sequence is only given a moderate palaeo-sensitive rating as it lacks good fossil material of terrestrial vertebrates found in subsequent depositional sequences.

There is a drainage line to the east of the site where one could expect surface finds of pottery fragments and stone tools, but this is over 100 m from the site footprint. Quaternary fossils are unlikely to be preserved adjacent to this stream as there is little evidence (in the satellite images) of significant channel or overbank deposition. In addition, the soil chemistry in this area is generally unsuitable for Pleistocene fossil preservation.

The two tables below summarize the palaeontological impact significance and the identified heritage resources at the site.

### Assessing Impact Significance

Criteria	without mitigation	with mitigation
Extent/spatial scale of impact	local	local
Duration of impact	permanent	permanent
Intensity/severity of impact	low	low
Probability of impact	improbable	improbable
Consequence	low	low
Confidence	medium	medium
Significance	low	low
Reversibility	irreversible	
Loss of resource	very low	
Mitigation potential	very low	

### Identified heritage resources (NHRA status)

Formal protections	
National Heritage site (Section 27)	none
Provincial Heritage site (Section 27)	none
Provisional Protection (Section 29)	none
Place listed in heritage register (Section 30)	none
General protections	
Palaeontological site or material (Section 35)	none

### Contingency plan for possible palaeontological discoveries:

#### CHANCE FIND PROTOCOL

Based on the work of Almond *et al.* (2009) and Groenewald *et al.* (2014) and summarised on the SAHRIS website ([www.sahra.org.za/sahris/map/palaeo](http://www.sahra.org.za/sahris/map/palaeo)), if a development occurs within a red zone a desktop study is required, as well as a phase 1 Palaeontological Impact Assessment (PIA) comprising a field survey and recording of fossils. A phase 2 PIA is also required, which entails the rescue of fossil material during construction activities, as well as the compulsory application for a collection and destruction permit. If the development occurs in an orange zone, a desktop survey as well as a phase 1 PIA comprising of a field survey and collection of fossils is compulsory. A prior application for a collection permit is therefore recommended and a phase 2 PIA may be necessary during the construction phase of the project. If the development occurs in a green zone, a desktop survey as well as phase 1 PIA comprising a field survey is recommended. Lastly developments which occur in a blue or grey zone may require a desktop survey, based on the known heritage sites in the area as well as the nature of surrounding geological units.



The normal procedure for recovering palaeontological material would be to identify areas which show investigative potential through a concentration of fossils and whose recovery and preparation could address certain scientific questions. The process would then entail obtaining permission from the landowner/s and applying to SAHRA (South African Heritage Resources Agency) or another provincial heritage agency for a collection permit to excavate or remove blocks of bedrock for preparation in the lab. This is a slow and time-consuming process which requires the skills of a field archaeologist/palaeontologist to spot worthy material within geological/stratigraphic exposures, and skilled fossil excavators and/or preparators who can successfully recover fossils from sediment or slabs of bedrock.

But in the case of developments fossils may be exposed which were not being targeted as a part of a formal scientific investigation, which then requires intervention to ensure that such heritage resources are documented and evaluated, and possibly recovered. In this way, construction activities can provide an opportunity for scientists in that sediments or bedrock and other heritage related material will be exposed which otherwise would have gone unnoticed as it was hidden from view and would have been costly to excavate.

Heritage consultants such as palaeontologists are required to evaluate proposed development sites in the hope of recording and/or recovering important objects and artefacts before they are damaged or destroyed, but during the entire timeline of a project a PIA consultant is generally only on site for a few hours. Having a palaeontologist on site to examine every scoop of a back actor/JCB would be very costly and impractical, so additional site visits may be required for certain large-scale projects, or developments in highly sensitive areas. If fossils are unearthed during the rest of the project timeline when no palaeontologist is on site, they may be difficult for the on-site layman to identify as many geological formations superficially resemble palaeontological material. Pseudo-fossils and certain mineral deposits

often form into a variety of shapes which may closely resemble plant and animal fossils, making it more difficult for laypersons to positively identify chance finds in the field.

It is not the responsibility of site workers to keep an eye out for heritage objects neither are they likely to have had the appropriate training on what to look for but they are on the ground witnessing and observing, which is a helpful tool when there is a flow of information from on-site staff to management and protocol dictates that you convey when something unusual or out of the ordinary is observed during work operations. The probability of on-site foremen or construction workers operating heavy earth moving equipment and working to a strict time schedule spotting heritage objects amongst tons of bedrock or sediment is unlikely but nonetheless possible. In South Africa many important archaeological and palaeontological discoveries have been made during construction projects, and companies can play their part by following the law and making the effort to report heritage resources which have been unearthed during digging operations. In so doing, developers can improve their public image and potentially contribute to a rare fossil or object reaching a museum or tertiary institution where it can be studied and eventually displayed to the public as heritage belongs to the entire nation and should be preserved as best as possible.

If by chance fossils or any other heritage-related material were to be discovered which was not anticipated in this desktop report, construction would need to cease immediately and a protocol should be followed whereby the relevant provincial or national heritage custodians in the relevant province would need to be informed. Developers would also need to acquire the services of a suitably qualified palaeontologist to rank the significance of the discoveries. If anything relevant is observed, mitigation measures may be necessary and an application for a collection permit may be required. A site visit (Phase 1) may be necessary so that scientists can be given the opportunity to record and/or recover fossil material if it is ranked as significant and likely to make a positive contribution to the field of science.

## **Assumptions and limitations**

According to the amended 2017 EIA regulations, various assumptions and limitations need to be stated when reporting on proposed developments. A key assumption for this report is that the kml/kmz file sent to the heritage specialist accurately conveys the layout and nature of the development, which is not always the case as plans are often revised or the site layout has not been accurately drawn in Google Earth. A further assumption is that the geological maps used in this assessment are accurate and up to date, which may not be the case as there is a continuous refinement and revision of the geological model through new scientific research, some of which may still need to become incorporated into available maps.

A limitation with large scale maps (1:250 000) is that smaller outcrops of fossiliferous bedrock may not be indicated within the represented geological model. In addition, several potentially fossiliferous outcrops may have been weathered and eroded over millennia, buried under younger deposits such as alluvial and colluvial sediments, or capped by topsoil. Palaeontologically-sensitive bedrock may have also been metamorphosed through its contact with intrusive lavas, damaging or destroying fossil specimens along the contact zone.

The professional opinion given in this PIA report is based on the results of a thorough desktop study which was used to gauge the fossiliferous potential of the bedrock likely to be exposed during the proposed development, and the impact significance. This process involved careful scrutiny of the best available maps and data sets and all attempts were made to take a holistic, informed decision. Yet in spite of this, it is possible that fossils may be present somewhere along the route of the proposed development but are not regarded as significant enough to warrant a site visit. Moreover, certain predictions about the likelihood of encountering fossils was based on all available evidence and may prove to be less or more likely than anticipated.

As a general rule direct field observations are the best method to gauge the degree to which palaeontological material may be present on site, whether eroding out or visible on the surface. As many developments require a degree of digging down into the soil and/or underlying stratigraphy, fossils will be hidden from view due to their buried nature and will only be exposed by the action of a back-actor or once they have started eroding out from the stratigraphy they are preserved in.

Lastly, it is assumed that the developers will respect the guidelines set out in the laws of South Africa with regards to good environmental management practices and policies, and will immediately cease all construction if any fossiliferous material is discovered. It is also assumed that developers will practice integrity and embrace an unwavering mind-set with regards to respecting and protecting all aspects of heritage, including due consideration for the fact that such objects cannot simply be sacrificed to meet project deadlines.

## **Conclusion and recommendations**

Pipelines and canals will need to be laid for this development, and the bedrock where these trenches will be dug has the potential to yield some plant fossils. Drainage systems for such a development need to be robust, efficient and watertight in order to reduce the possibility of ground and surface water contamination via seepage or leakage into the bedrock and/or adjacent watercourse where heritage-related material may be present. Sewerage has a low pH, and when it comes into contact with fossil material it can chemically strip away the minerals that preserve it, after which fossils will rapidly start to decompose.

The proposed development is likely to have little to no impact on palaeontological resources and no further palaeontological investigation is required. The rock outcrops which occur beneath the site footprint are moderately-sensitive deposits, comprising Ecca rocks which have a low possibility of containing highly significant fossil material. From a

palaeontological perspective there is no reason why the project cannot proceed. If any palaeontological or heritage-related material were to be unearthed during construction activities developers are reminded that according to the National Heritage Resources Act 1999 (Act No. 25) and KwaZulu-Natal Heritage Act 2008 (Act No. 4), work should immediately cease and the **Chance Find Protocol** outlined above should be followed to ensure that developments comply with the law, and to ensure that a rare object/fossil stands a good chance of being recorded and/or relocated before likely destruction.

## References

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- 2) Environmental Impact Regulations of 2014, amended 2017
- 3) Evolutionary Studies Institute fossil collection database
- 4) Groenewald, G.H., Groenewald, D.P. & Groenewald, S.M., 2014. *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West provinces*. Internal Palaeotechnical Reports, SAHRA
- 5) Rubidge, B.S. 2005. Re-uniting lost continents - fossil reptiles from the ancient Karoo and their wanderlust. *South African Journal of Geology* 108 (1): 135-172
- 6) Smith, R.M.H., Eriksson, P.G. and Botha, W.J. 1993. A review of the stratigraphy and sedimentary environments of the Karoo-aged basins of Southern Africa. *Journal of African Sciences* 16: 143-169

