

Palaeontological Desktop Assessment of Erf 1/22011 and Remainder of Erf 22011, Farm 654, Bloemfontein, FS Province.

Report prepared by Dr L. Rossouw, National Museum PO Box 266 Bloemfontein.

28 April 2017

Summary

The study area is underlain by potentially fossil-bearing sedimentary strata of the Late Permian Adelaide that are capped by superficial deposits of low to very low palaeontological sensitivity. Visibility of Adelaide Subgroup outcrop is most likely low given the generally low topography terrain and well-developed Quaternary overburden, so it will be difficult to determine the potentially adverse effect of excavations into potentially fossil-bearing bedrock sediments underlying the area other than to emphasize that such impacts on fossil heritage are generally irreversible. As far as palaeontological heritage is concerned, any excavation > 1 m² and exceeding depths of >1 m into unweathered/fresh bedrock will need monitoring by a professional palaeontologist. It is therefore advised that, as part of a Phase 1 Palaeontological Impact Assessment, a professional palaeontologist should monitor unweathered/fresh sedimentary bedrock when geotechnical sampling are to be conducted and where large scale excavations into unweathered/fresh sedimentary bedrock are to be conducted during the construction phase of the development.

Introduction

The report is a preliminary assessment of potential palaeontological impact with regard to planned residential and commercial development on Erf 1/22011 and Remainder of Erf 22011, situated at the junction of the R64 provincial road and N1 national road in Bloemfontein, Free State Province. The proposed footprint covers a 27 ha area located on open, low relief terrain (**Fig. 2**).

Central coordinates of the study area: 29°5'27.35"S; 26°10'36.89"S

Methodology

The assessment was carried out in accordance with National Heritage Resources Act 25 of 1999 with the aim to assess the potential impact on palaeontological heritage resources that

may result from the proposed development. The palaeontological significance of the affected areas were evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

Assumptions and Limitations

The assessment provided within this report is based upon a desktop study without the benefit of a site visit. As such, the presentation of geological units present within the study area is derived from 1:250 000 geological maps that may vary in their accuracy. It is also assumed, for the sake of prudence, that fossil remains are always uniformly distributed in fossil-bearing rock units, although in reality their distribution may vary significantly.

Geology

The geology of the Bloemfontein area has been described by Theron (1963). According to the 1:250 000 scale geological map of the area the site is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), primarily represented by late Permian, Balfour Formation sedimentary rocks, which are made up of alternating and potentially fossil-bearing sandstone and mudstone layers. Outcrops of intrusive Jurassic dolerites (Karoo Dolerite Suite) and associated contact metamorphic metasediments are prevalent around the margins of the study area. (**Fig. 3**). As a result of the topography, overlying Quaternary overburden (superficial, residual deposits) largely represent surface lag deposits made up of well-developed, residual soils of varying depth.

Background

The palaeontological footprint around Bloemfontein is primarily represented by Late Permian Karoo vertebrate fauna and Late Cenozoic (Quaternary) macrofossils (Broom 1909 a, b; Kitching 1977, 1995; Churchill *et al* 2000; Rossouw 1999, 2006). The sedimentary bedrock in the region are assigned to the *Dicynodon* Assemblage Zone (AZ) (Kitching 1995; **Fig. 3**). This biozone is characterized by the presence of a distinctive and fairly common dicynodont genus. Therapsids and other vertebrate fossils from this biozone are usually found as dispersed and isolated specimens in mudrock horizons, associated with an abundance of calcareous nodules. Plant fossils (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) are also present. The sediments assigned to the *Dicynodon* AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel

sandstones. Except for a one therapsid fossil exposure located south of the proposed development footprint, there are currently no records of Karoo palaeontological sites situated within the 2926 AA map sheet area (**Fig. 4**). Quaternary-age surface deposits in the region can be highly fossiliferous in places, especially those that are directly related to fluvial environments along major river courses, or near spring areas and pans. Fossil assemblages, individual specimens and fossilized hyena burrows have been found preserved in Late Pleistocene alluvial sediments of the nearby Modder River and its tributaries (**Fig 4**).

Dolerite, in the form of dykes and sills are not palaeontologically significant and can be excluded from further consideration in the present palaeontological evaluation. It is however moderately significant from an archaeological point of view as many Stone Age quarry sites (knapping sites) are found at the foot of dolerite hills where hornfels outcrop occur as a result of contact metamorphism following the intrusion of dykes and sills. The incidence of surface scatters usually decreases away from localized areas such as alluvial contexts and dolerite-shale contact zones when stone tools largely occur as contextually derived individual finds in the open veld. Stone tools are mostly made of hornfels, a fine-grained isotropic rock found in the hot-contact zone between the dolerites and mudstones in the area.

Impact Statement and Recommendations

The desktop investigation indicates that the proposed study area is underlain by potentially fossil-bearing sedimentary strata of the Late Permian Adelaide that are capped by superficial deposits of low to very low palaeontological sensitivity. The impact area is not situated within or near pan alluvial or spring deposits (considered to be potentially fossiliferous in the region). Visibility of Adelaide Subgroup outcrop is most likely low given the generally low topography terrain and well-developed Quaternary overburden, so it will be difficult to determine the potentially adverse effect of excavations into potentially fossil-bearing bedrock sediments underlying the area other than to emphasize that such impacts on fossil heritage are generally irreversible. Conversely, the recovery of new fossils as a result of industrial excavation activities can also be considered a positive impact, but only if the process is accompanied by appropriate scientific recording and retrieval methods. As far as palaeontological heritage is concerned, any excavation $> 1 \text{ m}^2$ and exceeding depths of $>1 \text{ m}$ into unweathered/fresh bedrock will need monitoring by a professional palaeontologist. It is therefore advised that, as part of a Phase 1 Palaeontological Impact Assessment,

- a professional palaeontologist should monitor unweathered/fresh sedimentary bedrock when geotechnical sampling are to be conducted and
- where large scale excavations into unweathered/fresh sedimentary bedrock are to be conducted during the construction phase of the development.

The palaeontologist must apply for a valid collection / removal permit from SAHRA if fossil material are found.

References

Broom, R. 1909 a. On a large extinct species of Bubbalus. *Annals of the South African Museum* 7:219 - 280

Broom, R. 1909 b. On the evidence of a large horse recently extinct in South Africa. *Annals of the South African* 7.281 -282.

Churchill, S.E., Brink, J.S., Berger, L.R. Hutchison, R.A., Rossouw L., *et. al.* 2000. Erfkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. *South.African Journal of Science* 96: 161 – 163.

Johnson, M.R. *et. al.* 2006. Sedimentary Rocks of the Karoo Supergroup. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.

Kitching, J.W. 1977. The distribution of Karoo Vertebrate Fauna. Bernard Price Institute for Palaeontological Research. Memoir 1, 1 – 131.

Kitching, J.W. 1995. Biostratigraphy of the Dicynodon AZ. **In:** B.S. Rubidge, *Biostratigraphy of the Beaufort Group*. Biostrat. Ser. S.Afr. Comm. Strat. 29 – 34.

Rossouw, L. 1999. Palaeontological and archaeological survey of the Riet River, Modder River and certain sections of the Gariiep River Unpublished Report, Palaeo-Anthropological Research Group. University of the Witwatersrand.

Rossouw, L. 2006. Florisian mammal fossils from erosional gullies along the Modder River at Mitasrust farm, central Free State, South Africa. *Navorsinge van die Nasionale Museum* 22(6): 145-162.

Rubidge, B. S. 1995. (ed.) *Biostratigraphy of the Beaufort Group*. Biostrat. Ser. S.Afr. Comm. Strat. 1, 1 – 45.

Theron, J.C. 1963. Geology of Bloemfontein area. Dept. of Mines. Government Printer, Pretoria.

DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project and have no conflicting interests in the undertaking of the activity.

A handwritten signature in black ink, appearing to read 'L Rossouw', is written in a cursive style.

28 / 04 / 2017

FIGURES:

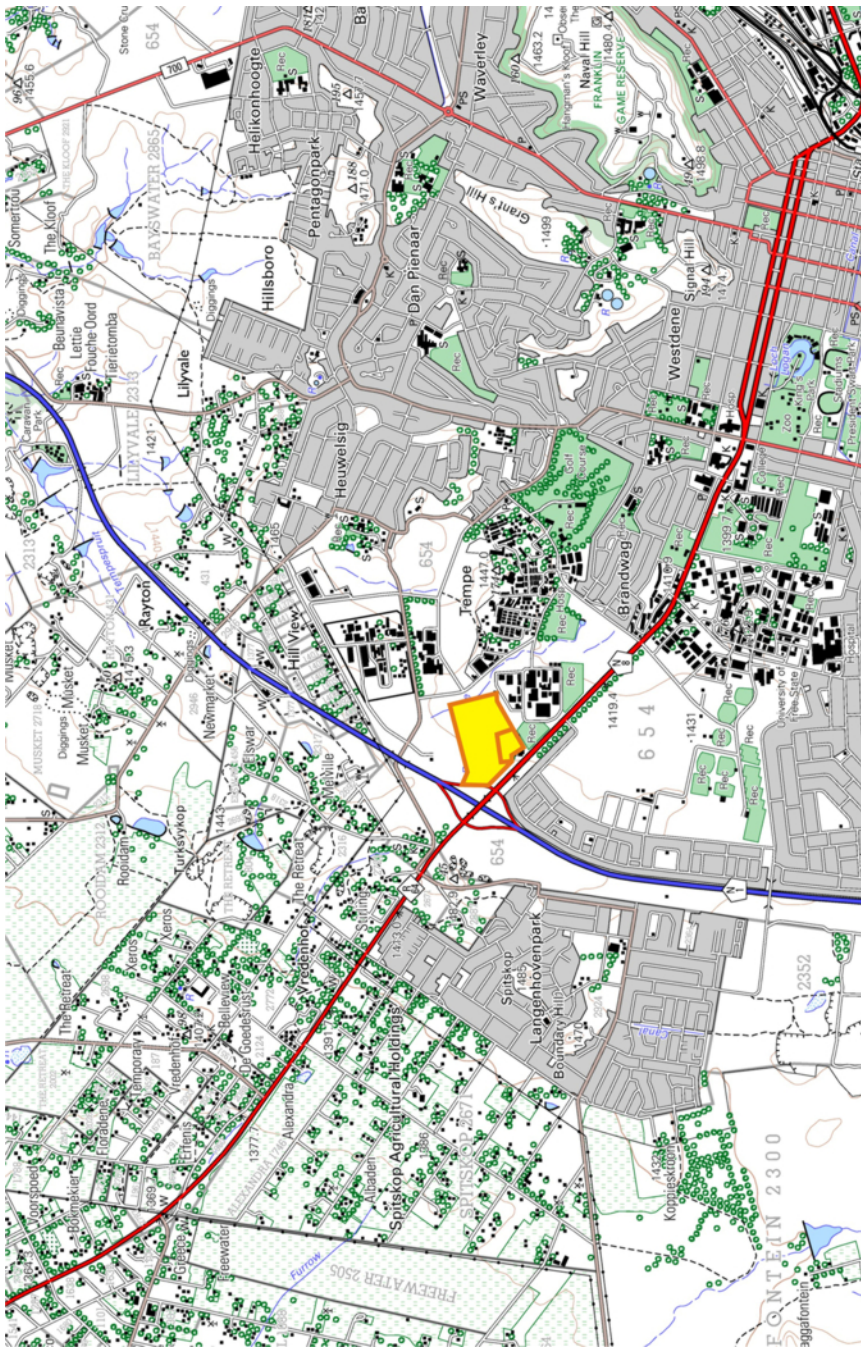


Figure 1. Map of the proposed development footprint (portion of 1:50 000 scale topographic 2926 AA Bloemfontein).



Figure 2. Aerial view of the study area.

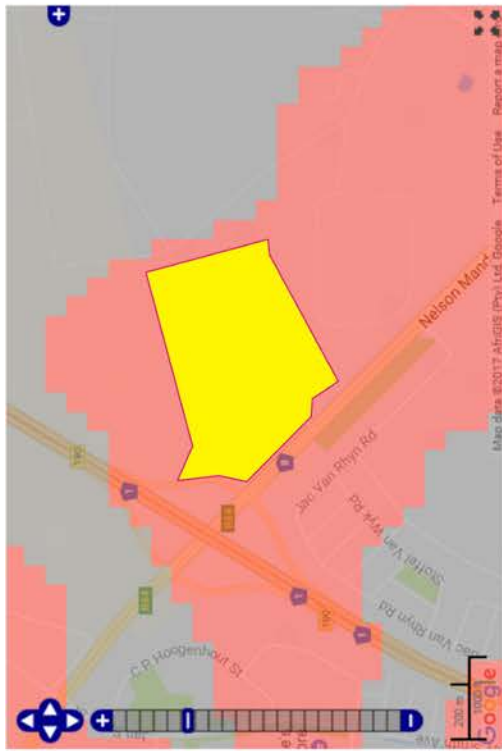
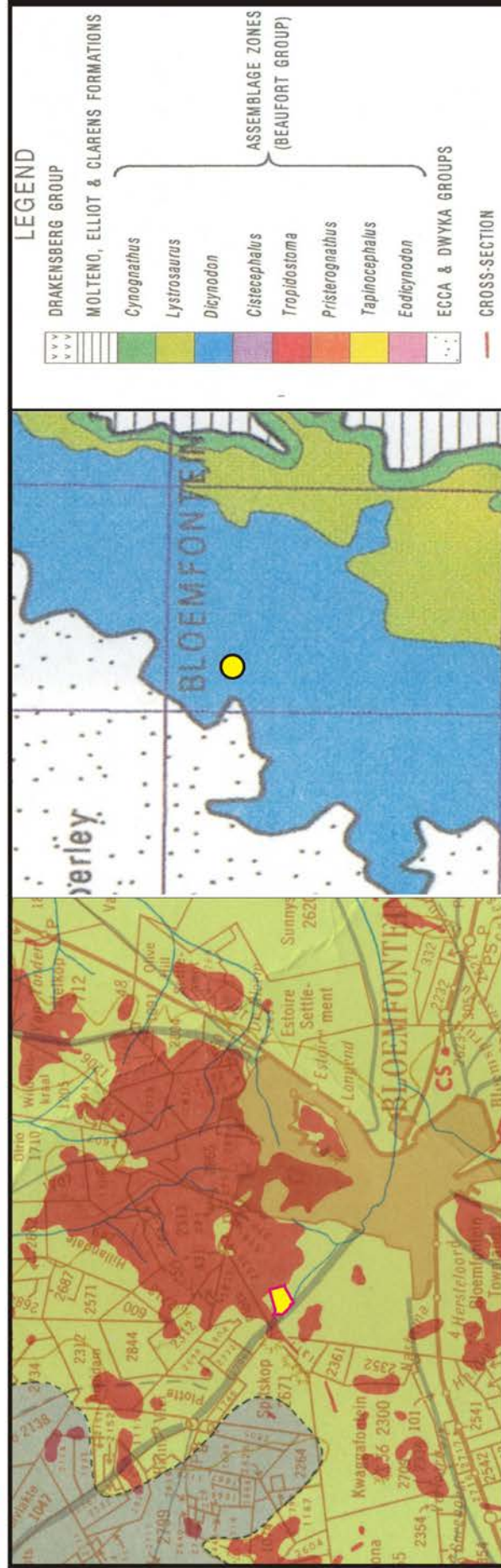


Figure 3. According to the online SAHRIS palaeo-sensitivity map, the site is located within an area considered to be of high palaeontological sensitivity (pink areas, see portion of 1:250 000 scale geological map 2926 Bloemfontein, bottom left, green areas), with sedimentary strata assigned to the Dicyonodon Assemblage Zone (map bottom center). Distribution of vertebrate biozones of the Beaufort Group around Bloemfontein after Rubidge 1995.



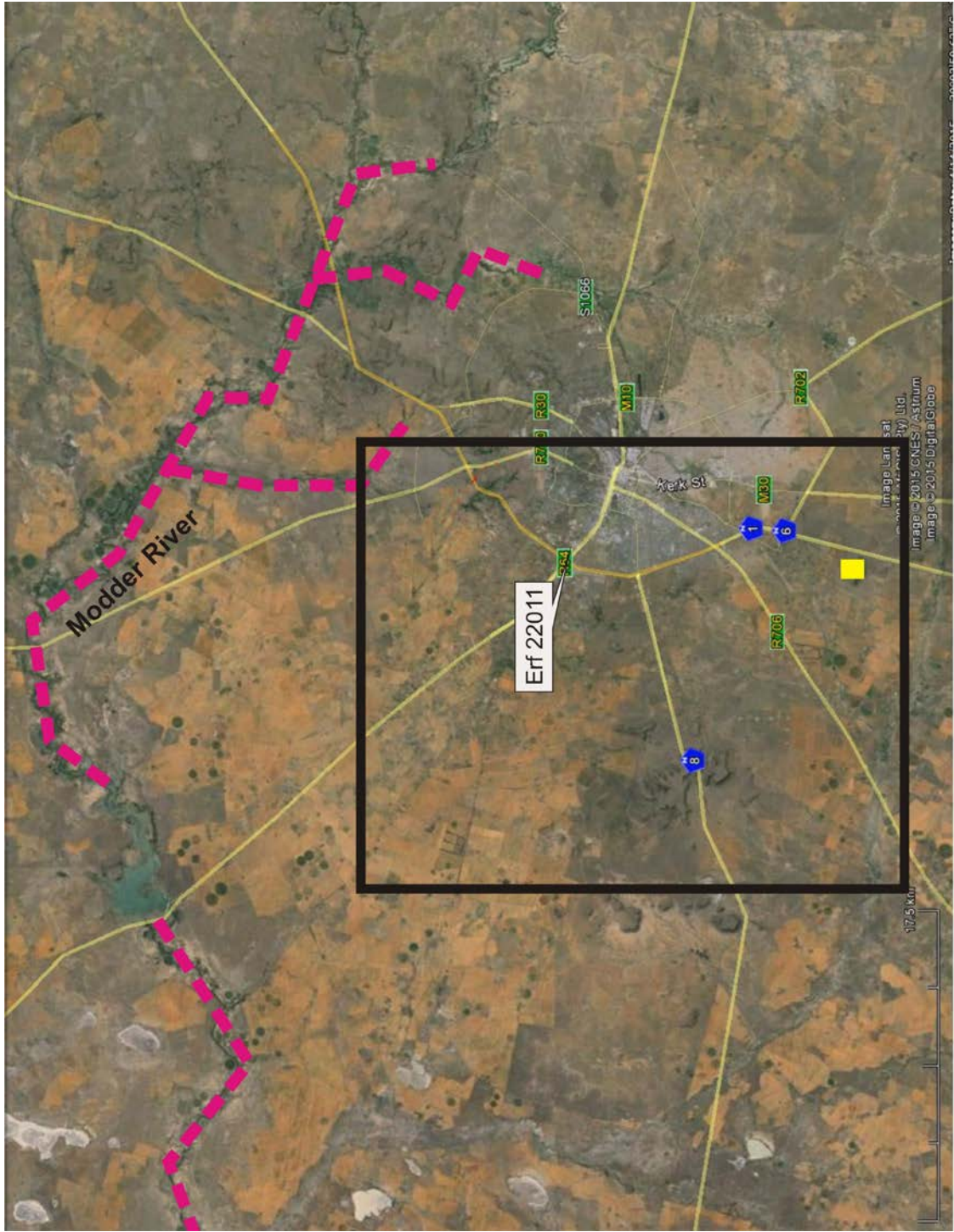


Figure 4. Position of a therapsid fossil exposure (yellow square) situated within the 2926 AA map sheet area (black square) and located 18 km to the south of the proposed development footprint.