RECOMMENDED EXEMPTION FROM FURTHER PALAEONTOLOGICAL STUDIES:

PROPOSED ACCESS ROADS FOR THE ZEERUST PV PLANT ON REMAINDER OF PORTION 5 OF HAZIA 240JP & PORTION 15 OF KAMEELDOORN 271JP NEAR ZEERUST, NORTHWEST PROVINCE

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EXECUTIVE SUMMARY

The footprint of the proposed PV solar facility access road near Zeerust, Northwest Province, is underlain by sediments of the Rooihoogte and Timeball Hill Formations (Pretoria Group, Transvaal, Supergroup). Most of these ancient Precambrian bedrocks are of low palaeontological sensitivity and any original fossil content (*e.g.* microbial stromatolite mounds, microfossils) has probably been compromised or destroyed by later dolerite intrusion causing baking of the surrounding country rocks. Given the very small footprint of the proposed access road, it is concluded that the proposed development is very unlikely to have significant impacts on local palaeontological heritage resources. There is no preference on palaeontological heritage grounds for any one of the three access road routes under consideration.

It is recommended that, pending the discovery of significant new fossils remains (*e.g.* stromatolites) during construction of the proposed solar facility access road, exemption from further specialist palaeontological studies and mitigation be granted for this project.

1. OUTLINE OF THE PROPOSED DEVELOPMENT

The proposed development concerns the widening of an access road to an approved 75 MW PV solar energy facility near Zeerust in the Ramotshere Moiloa Local Municipality, Northwest Province (Fig. 1). Three access road route options to the solar facility on the Remainder of Portion 5 of Hazia 240JP & Portion 15 of Kameeldoorn 271JP are under consideration (Fig. 2):

- The **Alternative 1** (preferred option, *c*. 880 m long) is to upgrade and utilise the existing farm access that starts at the end of Furguson Street (at the intersection between Furguson and Rois St). From the end of Furguson Street, the proposed access road will follow the existing farm access track over Remainder of Portion 5 of the Farm Hazia 240 into Portion 15 of The Farm Kameeldoorn No. 271 *via* the existing farm gate. It will then run along the Eastern boundary of Portion 15 of The Farm Kameeldoorn No. 271 to within the authorised footprint of the proposed development.

- **Alternative 2** access road (*c*. 820 m long) also starts at the end of Furguson road (at the intersection between Furguson and Rois St). It then utilises Rois Street in a southerly

direction to the intersection of Rois and Reitz Street. From this intersection, it follows an existing gravel track on Remainder of Portion 5 of the Farm Hazia 240 (along the western boundary) and enters Portion 15 of The Farm Kameeldoorn No. 271 within the authorised footprint.

- **Alternative 3** access road (*c*. 730 m long) starts at the end of Kop Street (at the intersection of Kop and Spruit Street.) From this intersection, it follows an existing gravel track on Remainder of Portion 5 of the Farm Hazia 240 and enters Portion 15 of The Farm Kameeldoorn No. 271 within the authorised footprint.

The current Basic Assessment for the access roads is considering 50 m-wide access corridors along these alignments to allow for minor deviations that may come as a result of detailed design. The 75 MW solar facility itself was the subject of a brief desktop palaeontological assessment by Bamford (2013). A further palaeontological desktop study has been requested for the access road project by the SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit (Interim Comment 7 June 2017, Case ID: 11074). The present palaeontological heritage assessment comment has accordingly been commissioned as part of a Basic Assessment process for the proposed access road development by Cape EAPrac (Contact details: Mr Dale Holder. Cape EAPrac. 17 Progress Street, George. Tel: 044 874 0365. Fax: 044 874 0432. E-Mail: dale@cape-eaprac.co.za).

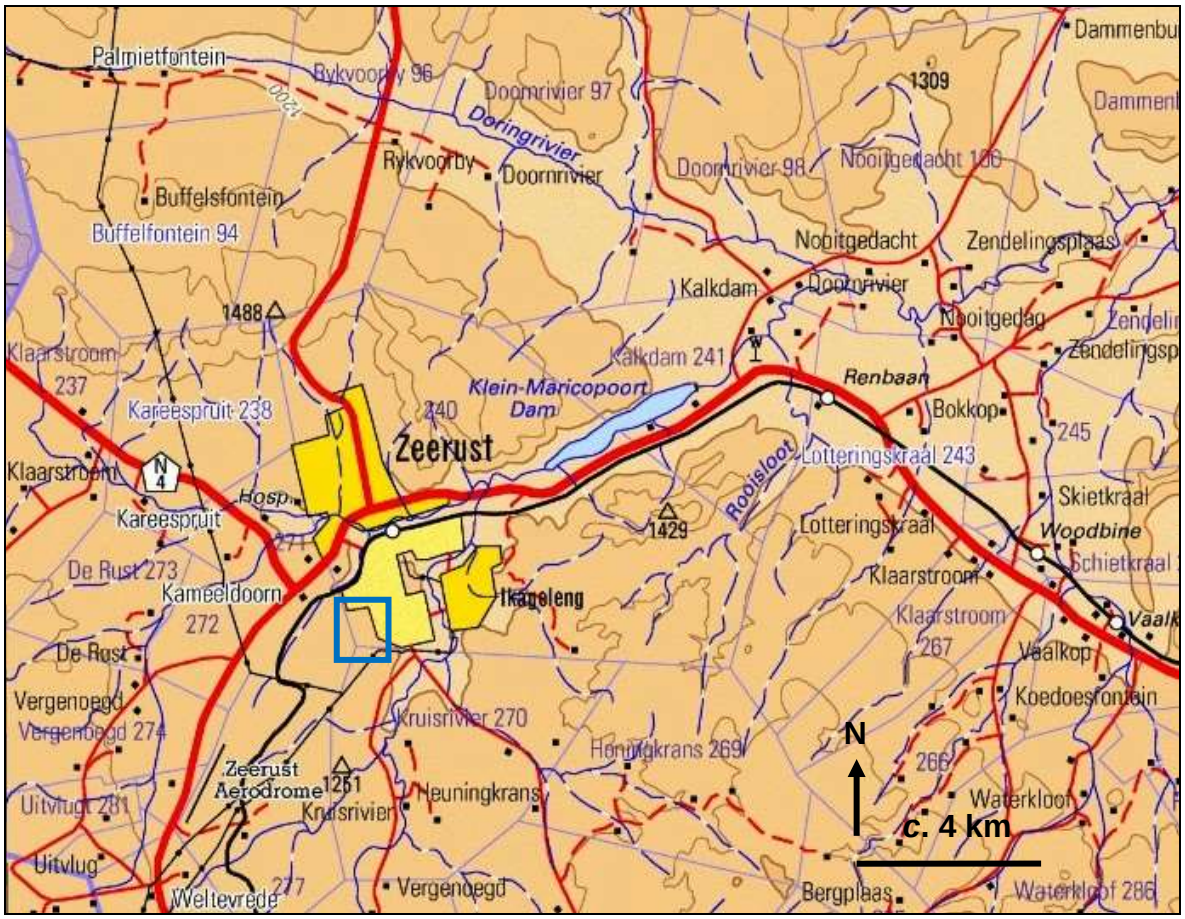

Figure 1. Extract from 1: 250 000 topographical sheet 2526 Rustenburg showing the approximate location (blue rectangle) for the present solar facility access road study area on the south-western outskirts of Zeerust, Northwest Province (Image courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray).

Figure 2. Google earth© satellite image of the study area on the south-western outskirts of Zeerust showing 50 m-wide corridors for the three access route options to the approved solar energy facility: Alternative 1 (preferred, yellow), Alternative 2 (red), Alternative 3 (blue). Note the highly disturnbed terrain and low level of bedrock exposure here.

2. GEOLOGICAL BACKGROUND

The access road study area on the Outskirts of Zeerust comprises gently hilly terrain at *c*. 1220-1250 m amsl that is already highly disturbed by numerous existing tracks, agricultural activity as well as dumping of refuse (Pelser 2013, 2016) (Fig. 2). Satellite images show that the levels of bedrock exposure in the area are very low due to soil, surface rubble and vegetation cover although rocky outcrops are present in the broader region (*ibid.*). There are no substantial water courses in the area.

The geology of the Zeerust area is shown on 1: 250 000 geology sheet 2526 Rustenburg with a brief explanation by Walraven (1981) (Fig. 3) (Council for Geoscience, Pretoria). The study area is underlain by ancient Precambrian (Palaeoproterozoic) bedrocks of the **Pretoria Group** (Transvaal Supergroup; Eriksson *et al.* 2006) that are mantled here by colluvial (slope) deposits such as scree and hillwash. The Early Proterozoic Pretoria Group succession consists of a wide range of rock types, including mudrocks, quarztites and andesites with subordinate diamictites, conglomerates, carbonates and iron formation. In contrast to the underlying Chuniespoort Group, the sediments are predominantly clastic rather than chemical in nature. Depositional environments included alluvial fans and floodplains, delta complexes, coastal settings as well as deep marine basins (Eriksson *et al.* 1991, 1993, 1995, 1999, 2006). The degree to which the depository was a closed, lacustrine system *versus* an epicontinental sea, or a combination of both, remains unresolved. The access road study area is underlain by the Rooihoogte Formation and the overlying Timeball Hill Formation at the base of the Pretoria Group succession towards the western edge of its outcrop area (Fig. 4).

The continental, siliciclastic **Rooihoogte Formation** (Vrs, pale brown with coarse stipple in Fig. 3) at the base of the Pretoria Group comprises a complex, laterally-varying range of sediments overlying a major karstified unconformity. The basal beds include thick cherty residual breccias that have since been transferred to the underlying Chuniespoort Group by recent authors (Catuneanu & Eriksson 2002). Younger conglomerates of alluvial fan and/or fluvial genesis are overlain in the western outcrop area by thick mudrocks and subordinate immature sandstones that were probably deposited in a lacustrine setting (Catuneanu & Eriksson 2002, Eriksson *et al.* 2006 and refs. therein).

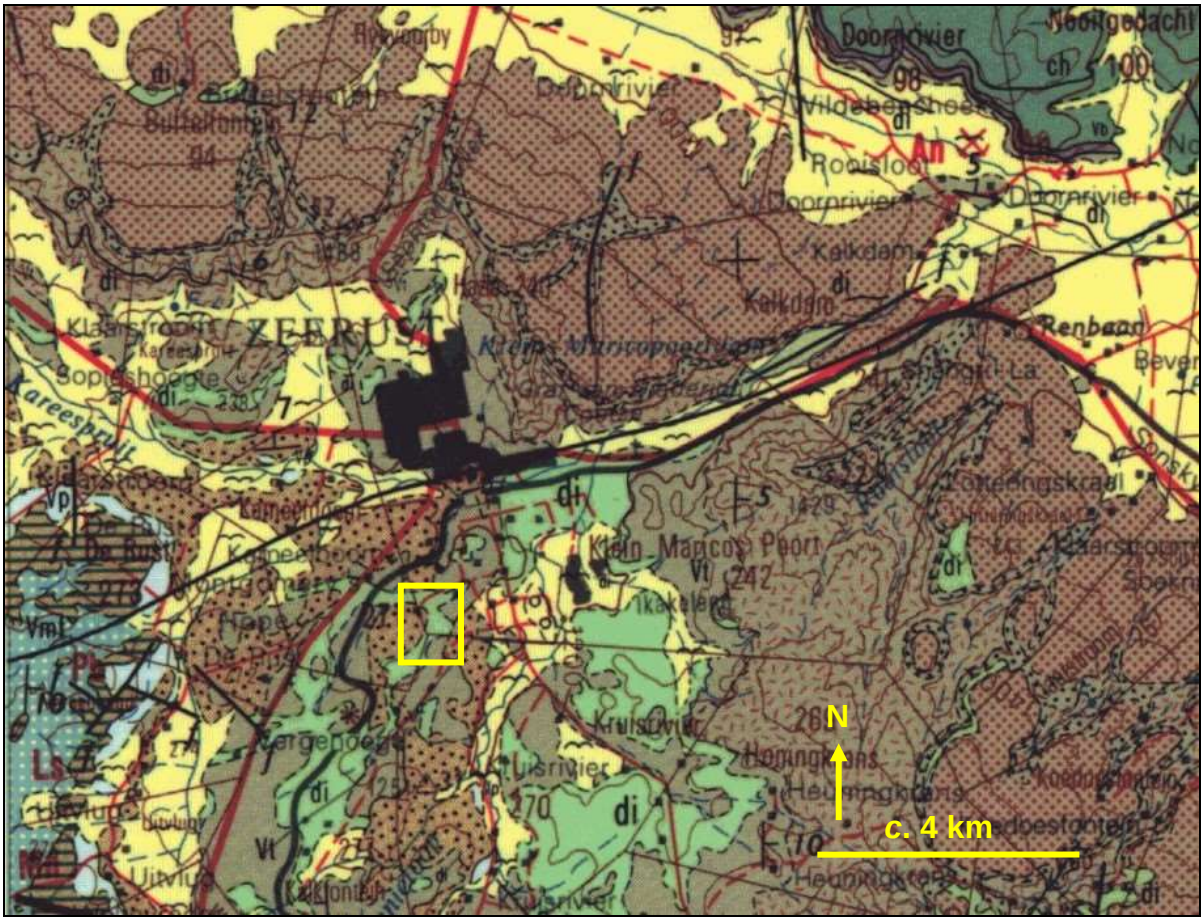

Figure 3. Extract from the 1: 250 000 geology sheet 2726 Rustenburg (Council for Geoscience, Pretoria) showing the *approximate* location of the solar energy facility access road study area on the south-western outskirts of Zeerust, Northwest Province (yellow rectangle). The sedimentary bedrocks underlying this area comprise the Rooihoiogte Formation (Vrs brown with coarse stipple) and the overlying Timeball Hill Formation (Vt, grey) of the Proterozoic Pretoria Group (Transvaal Group). These sediments are intruded and baked by dolerite bodies (di, green) of an ill-defined, younger age. Late Caenozioic superficial deposits such as colluvium, stream alluvium and soils are not mapped at this scale.

In the Rustenburg 1: 250 000 sheet area the **Timeball Hill Formation** (Vt, grey in Fig. 3) comprises two successions of shale with an intercalated package of ferruginous quartzite (Walraven 1981) (Fig. 4). The sedimentology and sequence stratigraphy of the lithologically-varied Timeball Hill Formation has recently been reviewed by Catuneanu & Eriksson (2002). These authors consider that deposition of this unit occurred within a deep marine basin as a result of

suspension sedimentation, turbidity currents and fluvio-deltaic processes under the influence of widespread fumarolic activity. There was in addition extrusion of basic lavas towards the base and evidence of short-lived glacial influence towards the top. The Klapperkop Quartzite Member arenites are probably of fluvio-deltaic origin with some tidal influence (Catuneanu & Eriksson 2002, Eriksson *et al.* 2006 and refs, therein).

In the Zeerust area the Pretoria Group sedimentary rocks are extensively intruded, and locally metamorphosed, by laterally persistent sills of **diabase / altered dolerite** of ill-defined age (di, green in Fig. 3). Pervasive cover by Late Caenozoic superficial sediments - such as stream alluvium, colluvium, surface gravels and soils – is not shown on the 1: 250 000 scale geological map.

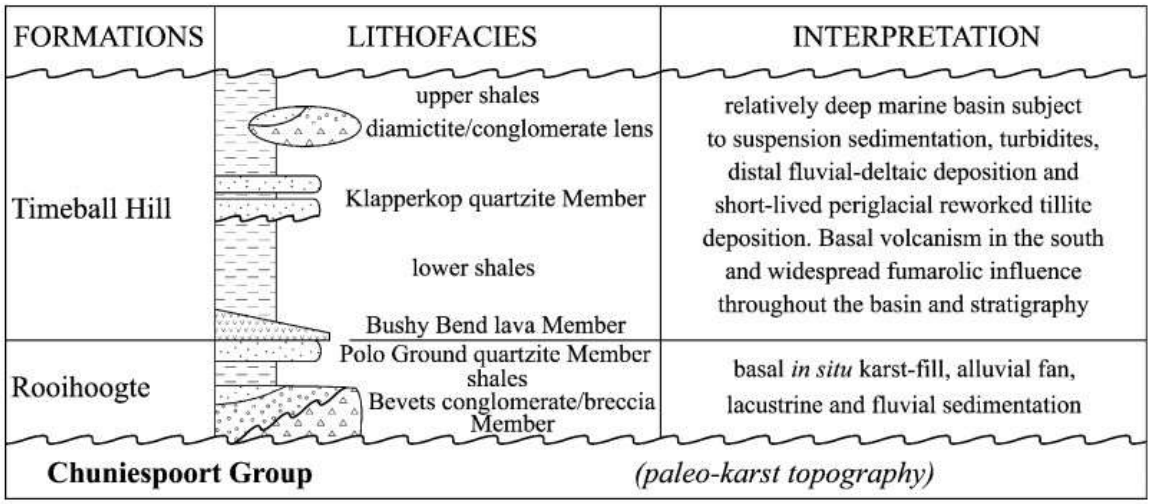

Figure 4. Revised stratigraphy and depositional settings of the Rooihoogte and Timeball Hill Formations at the base of the Pretoria Group succession (From Catuneanu & Eriksson 2002).

3. PALAEONTOLOGICAL HERITAGE

To the author's knowledge, no fossil remains have been recorded hitherto from the non-marine Rooihoogte Formation succession. Minor carbonate as well as shale facies might yield lacustrine stromatolites and organic-walled microfossils respectively. Stromatolites (microbial mounds) have been recorded from several younger subunits within the Pretoria Group including lacustrine facies of the Timeball Hill Formation, marine facies in the Daspoort Formation (especially in the eastern outcrop area) and Silverton Formation, as well as the mudrock-dominated Vermont Formation (Button 1971, Catuneanu & Eriksson 2002, Eriksson *et al.* 2006). Pretoria Group subunits with stromatolites probably also contain organic-walled microfossils. This may well also apply to carbonaceous mudrocks. Microbial mat structures (desiccated mats sometimes resemble trace fossils) are known from paralic sandstones of the Magaliesberg Formation.

The stromatolites recorded from the Timeball Hill Formation are associated with thin carbonate interbeds within turbidite successions in the lower part of the formation ("lower mudstones"), implying deposition within the photic zone (Catuneanu & Eriksson 2002). Stromatolites are not recorded from the overlying fluvio-deltaic Klapperkop Quartzite Member.

The Precambrian dolserite / diabase units are igneous rocks without fossil remains that may have compromised fossil preservation in the adjacent country rocks through thermal metamorphism. The Late Caenozoic superficial sediments (soils, rock rubble *etc*) are generally of very low palaeontological sensitivity.

4. CONCLUSIONS & RECOMMENDATIONS

The study area for the proposed solar facility access road near Zeerust is underlain by ancient Precambrian non-marine cherty beds and quartzites as well as lacustrine and marine shales of the Rooihoogte and Timeball Hill Formations (Pretoria Group, Transvaal, Supergroup). Most of these rocks are of low palaeontological sensitivity and any original fossil content has probably been compromised by later dolerite intrusion causing baking of the surrounding country rocks. Stromatolitic carbonates are known within the lower part of the Timeball Hill Formation elsewhere, but have not been recorded in the present study area. Late Caenozoic superficial sediments (*e.g.* soils, surface rock rubble) mantling the Precambrian bedrocks in the area are of very low palaeontological sensitivity. Given the very small footprint of the proposed access road, it is concluded that the proposed development is very unlikely to have significant impacts on local palaeontological heritage resources. There is no preference on palaeontological heritage grounds for any one of the three access road routes under consideration.

It is therefore recommended that, pending the discovery of significant new fossils remains (*e.g.* stromatolites) during construction of the proposed solar facility access road, exemption from further specialist palaeontological studies and mitigation be granted for this project.

Should any substantial fossil remains (*e.g.* well-preserved stromatolites, mammalian bones and teeth) be encountered during excavation, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, *i.e.* The South African Heritage Resources Authority, as soon as possible (Contact details: Ms Natasha Higgitt, SAHRA, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: nhiggitt@sahra.org.za). This is so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. These recommendations should be included in the Environmental Mangement Programme (EMPr) for the proposed development.

5. KEY REFERENCES

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6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest and the

Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

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