Phase 1 Palaeontological Impact Assessment of the Boundary PV solar facility on farm Karreeboom 1716, Boshof District, FS Province.

Report prepared for
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Executive Summary

- At the request of Savannah Environmental Consultants, a Phase 1 Palaeontological Assessment was carried out at the proposed new 75MW Boundary Photovoltaic (PV) facility located on farm Karreeboom 1716 in the Boshof district in the western Free State Province.
- The field assessment indicates that construction will primarily impact on Quaternary-age surface deposits.
- The likelihood of palaeontological impact on **superficial Quaternary sediments** resulting from the construction of the photovoltaic panels and associated infrastructure at farm Karreeboom 1716 is considered extremely **low.**
- The terrain is not considered palaeontologically vulnerable and there are no major palaeontological grounds to suspend the proposed development.

Contents

Introduction

At the request of Savannah Environmental Consultants, a Palaeontological Desktop Assessment was carried out at the proposed new 75MW Boundary Photovoltaic (PV) facility located in the Boshof district in the western Free State Province (**Fig.1**). The development involves the construction of a photovoltaic solar facility and associated infrastructure that will connect to the ESKOM grid via the Boundary Substation that is situated on-site (**Fig 2**).

Terms of Reference

The survey is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act 25 of 1999. The task involved identification of possible paleontological sites or occurrences in the proposed zone, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant. The site visit and subsequent assessment took place during November 2013.

Methodology

The palaeontological significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature (*Palaeontological Desktop Evaluation of the Boundary PV solar facility, Boshof District, FS Province. September 2013*). This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes.

Description of the Affected Area

Locality data

The site is located on the farm Karreeboom 1716, about 10 kilometres north-east of Kimberley on the R64 road leading to Boshof. The construction area for the proposed infrastructure mostly comprises relatively flat terrain, punctuated by dolerite hills towards the east (**Fig. 3**). The photovoltaic solar facility (photovoltaic panels) and associated infrastructure will be constructed on approximately 365 ha of farmland along the south-eastern boundary of the farm (coordinates below) (**Fig. 3 & 4**):

A) 28°43'52.68"S 24°51'37.31"E

B) 28°44'23.76"S 24°52'56.58"E

C) 28°44'51.76"S 24°52'50.92"E

D) 28°44'59.20"S 24°52'7.91"E

E) 28°44'28.56"S 24°51'2.31"E

Geology

The geology of the region has been described by Bosch (1993). The area in question is underlain by sediments of widely different geological ages (**Fig. 5**, portion of 1: 250 000 scale geological map 2824 Kimberley, Council for Geoscience, Pretoria, 1991). From oldest to youngest, the geology in and around the affected area is made up of Permian Ecca shales (Tierberg Formation., *Pt*), Jurassic dolerite intrusions (*Jd*, Karoo Dolerite Suite), Quaternary calcretes, surface limestones, calcified pandunes (*Qc*) and aeolian sands (*Qs*) (Kalahari Group). The wind-blown sands represent the latest geological phase and are made up of the characteristically red-brown Kalahari sands (Hutton sands).

Field Assessment

The affected terrain is made up of flat, open veld with no visible outcrop. There are no springs or alluvium within the confines of the area where the photovoltaic solar facility and associated infrastructure will be constructed; however there is a pan present next to where the layout is proposed. In the absence of some of the above erosional features, common intrusive features like springhare hollows and aardvark dugouts were investigated for tell-tale signs of excavated palaeontological material (**Fig. 6**). Pedestrian survey indicates that the photovoltaic panels, associated buildings and access roads will be constructed on Quaternary-aged residual soils largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands, *Qs*) (**Fig. 7**). There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (unconsolidated topsoils). Impact on Quaternary sediments within the footprint will be extensive, but impact on potential *in situ* Quaternary fossils, within the confines of the affected area is considered unlikely.

Discussion and Conclusion

Potential impacts of power lines (Table 1)

The likelihood of palaeontological impact resulting from overhead power lines is extremely **low** as the facility will connect to the ESKOM grid via the Boundary Substation and existing powerlines located on-site (shown in **Fig. 3**).

Potential impacts of access roads (Table 2)

The field assessment indicates that construction of access roads will primarily impact on residual surface deposits (*Qs*). The likelihood of palaeontological impact resulting from the construction of access roads is considered extremely **low.**

Potential impacts of the solar facility and its infrastructure (Table 3)

It is expected that infrastructure development will involve installation of multiple photovoltaic panels, underground cables and new buildings, resulting in construction activities extending over a relatively large surface area. The field assessment indicates that construction will primarily impact on Quaternary-age surface deposits (*Qs*). There is a **low probability** that Quaternary fossil remains will be adversely impacted during the construction phase of the photovoltaic panels and associated infrastructure. Basement rocks, made up Ecca Group shales (Tierberg Formation), are generally considered to be of low palaeontological sensitivity.

The terrain is not considered palaeontologically vulnerable and there are no major palaeontological grounds to suspend the proposed development.

References

Bosch, P.J.A. 1993. Die geologie van die gebied Kimberley. Toeligting van Blad 2824. *Geologiese Opname*, Pretoria 60 pp.

Palaeontological Desktop Evaluation of the Boundary PV solar facility, Boshof District, FS Province. *Paleo Field Services*, September 2013

Tables and Figures

Table 1. **Potential impacts of power lines.**

Nature of impact: Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments. Possible disturbance of Ecca Group bedrock.		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (2)
Duration (D)	Permanent (5)	Permanent (5)
Magnitude (M)	Minor (2)	Low (4)
Probability (P)	Probable (4)	Improbable (2)
Significance	**Medium (36)**	**Low (22)**
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on basement rocks, generally considered to be of low palaeontological sensitivity.		
Residual impacts: Disturbance of *in situ* Quaternary soils.		

Table 2. **Potential impacts of access roads.**

Nature of impact Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments.		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (2)
Duration (D)	Permanent (5)	Permanent (5)
Magnitude (M)	Moderate (6)	Low (4)
Probability (P)	Probable (4)	Improbable (2)
Significance **(S = E+D+M)*P**	**Medium (52)**	**Low (22)**
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on palaeontological resources if road construction activities go beyond area demarcated for development.		
Residual impacts: Disturbance of *in situ* Quaternary soils.		

Table 3. **Potential impacts of the solar facility and its infrastructure**

Nature of impact: **P**ossible loss of Quaternary soils (topsoil resources), disturbance of intact sediments.		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (2)
Duration (D)	Permanent (5)	Permanent (5)
Magnitude (M)	High (8)	Moderate (6)
Probability (P)	Probable (4)	Improbable (2)
Significance **(S = E+D+M)*P**	**Medium (60)**	**Low (26)**
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on palaeontological resources if construction activities go beyond area demarcated for development. Possible impact on basement rocks, generally considered to be of low palaeontological sensitivity.		
Residual impacts: Disturbance of *in situ* Quaternary soils.		

Figures

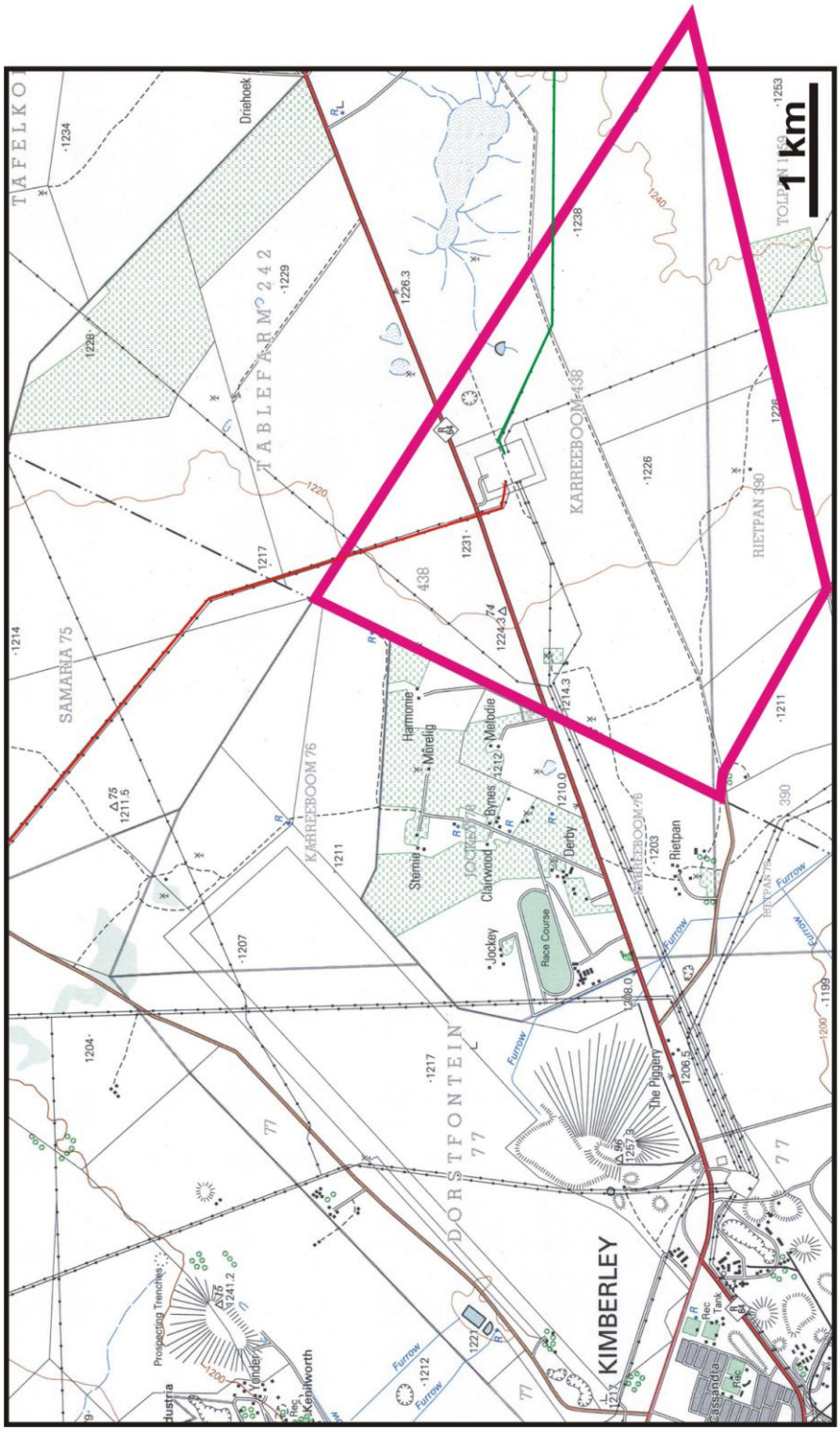

Figure 1. The farm Karreeboom 438 and Rietpan 390(portion of 1:50 000 scale topographic map 2824 DB Kimberley).

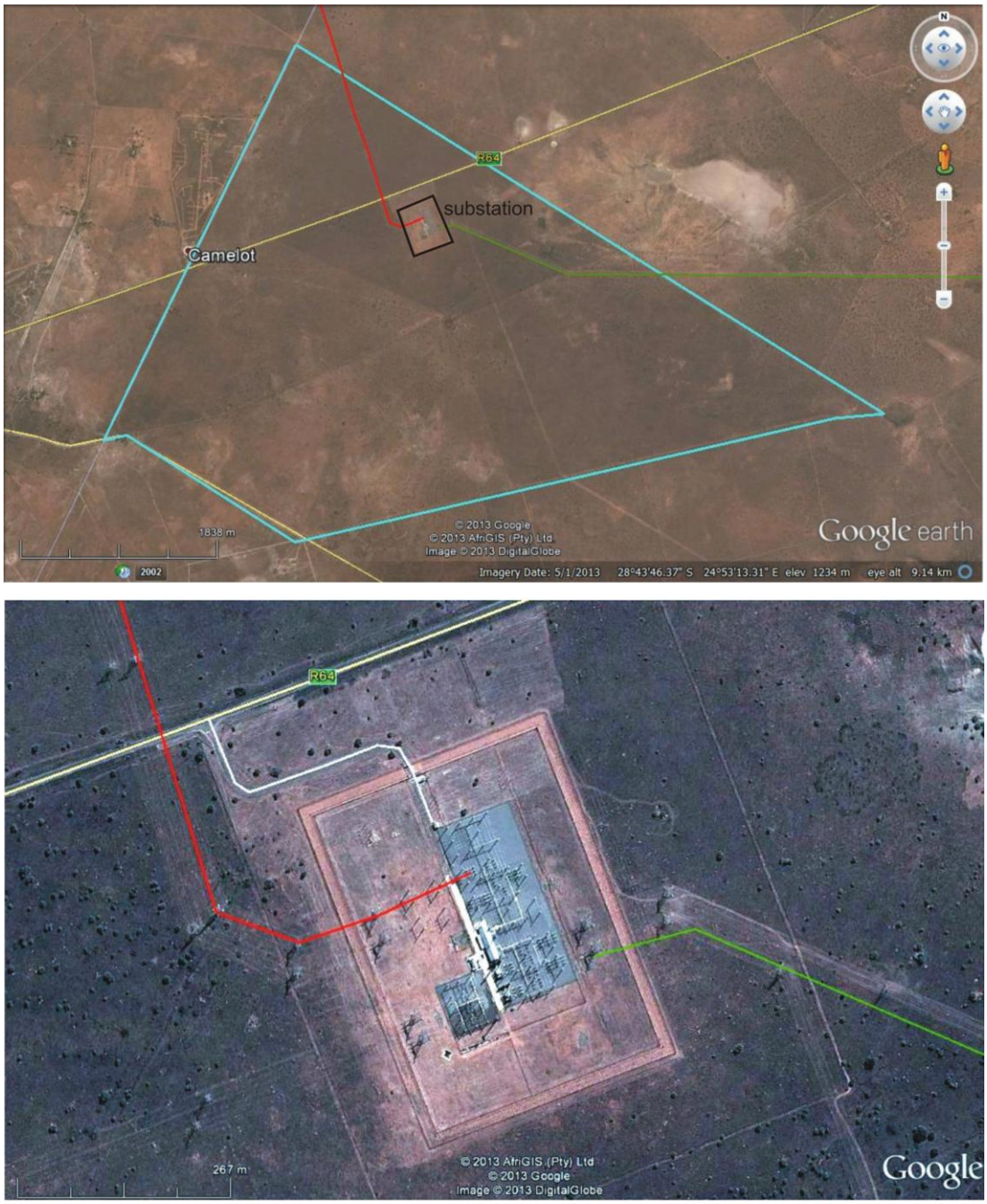

Figure 2. Aerial view of the affected area and substation.

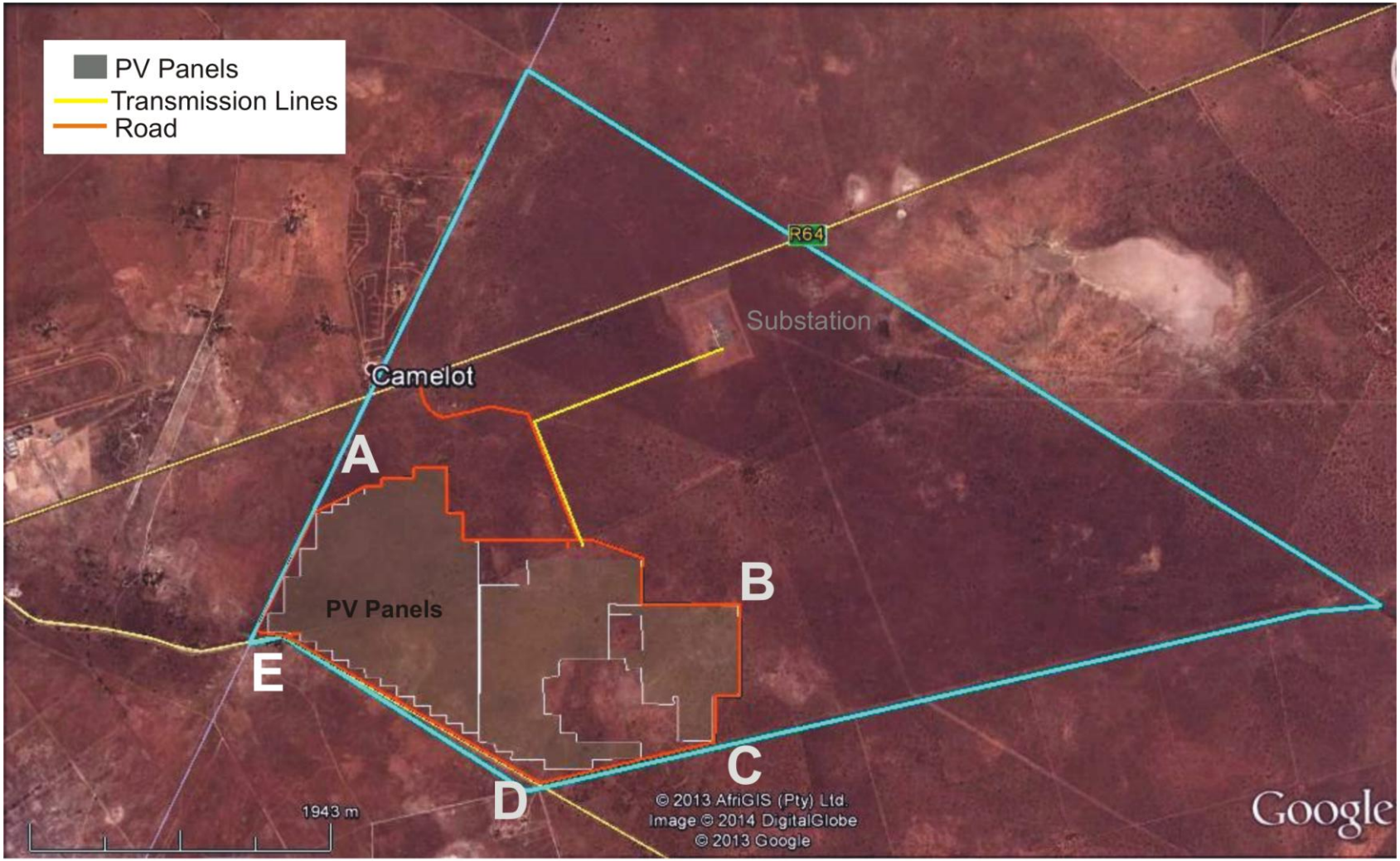

Figure 3. Aerial view of the affected area with the proposed infrastructure and existing substation.

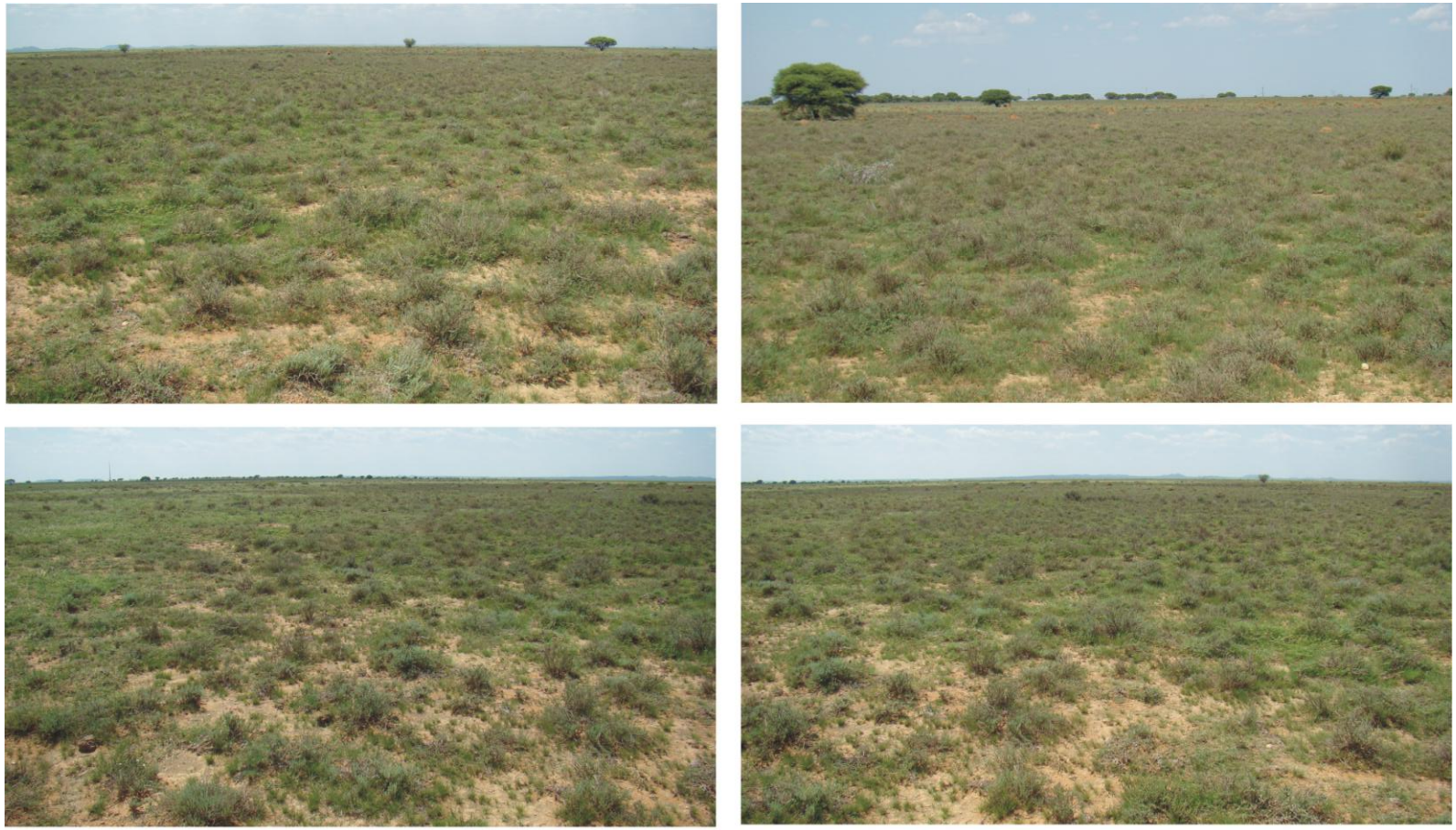

Figure 4. The affected terrain is made up of flat, open veld with no visible outcrop, looking north, east, south and west.

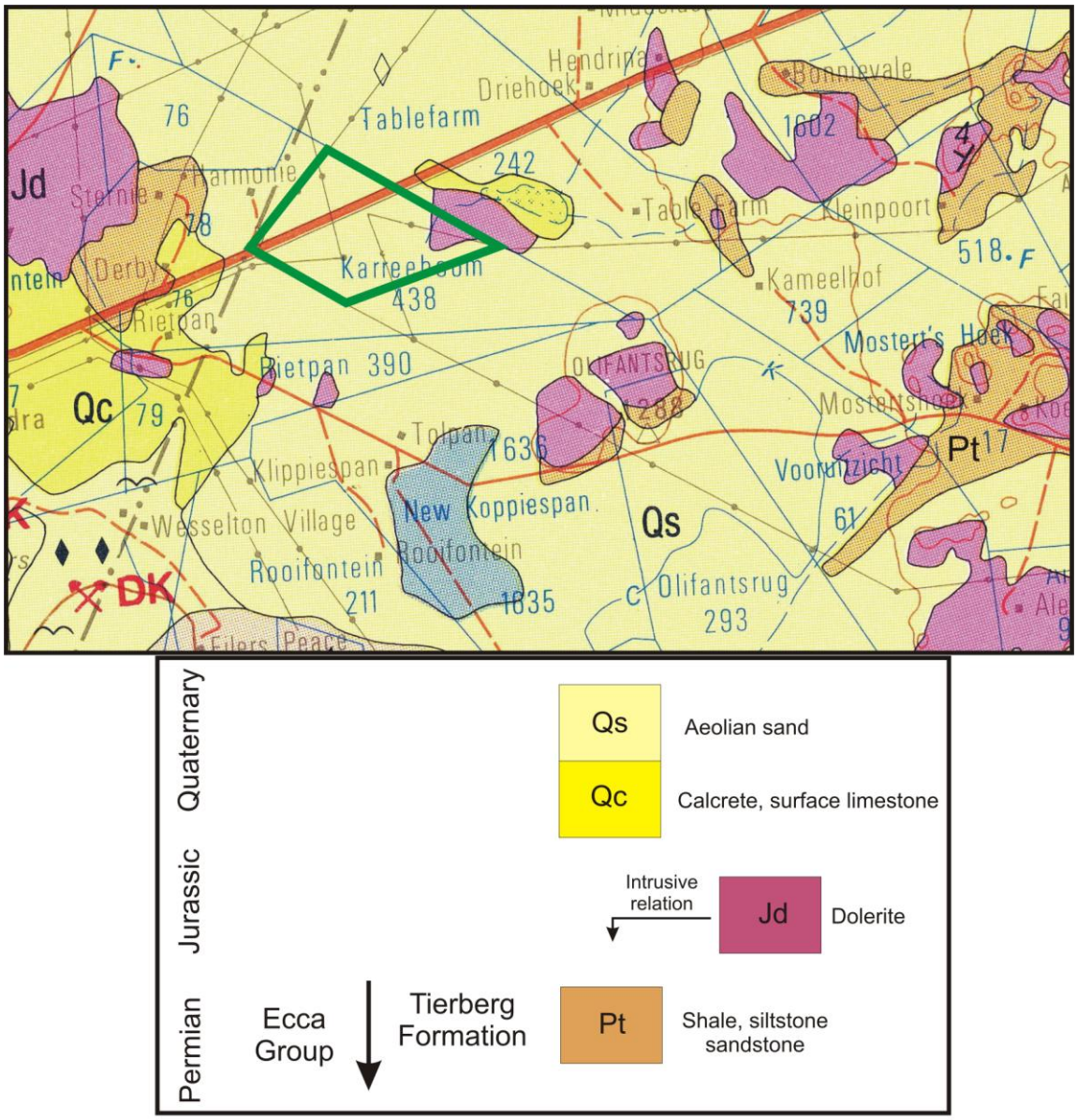

Figure 5. Portion of 1 : 250 000 scale geological map of the study area. From oldest to youngest, the geology in and around the affected area is made up of Permian Ecca shales (Tierberg Formation, *Pt*), Jurassic dolerite intrusions (*Jd*, Karoo Dolerite Suite), Quaternary calcretes, surface limestones, calcified pandunes (*Qc*) and aeolian sands (*Qs*) (Kalahari Group).

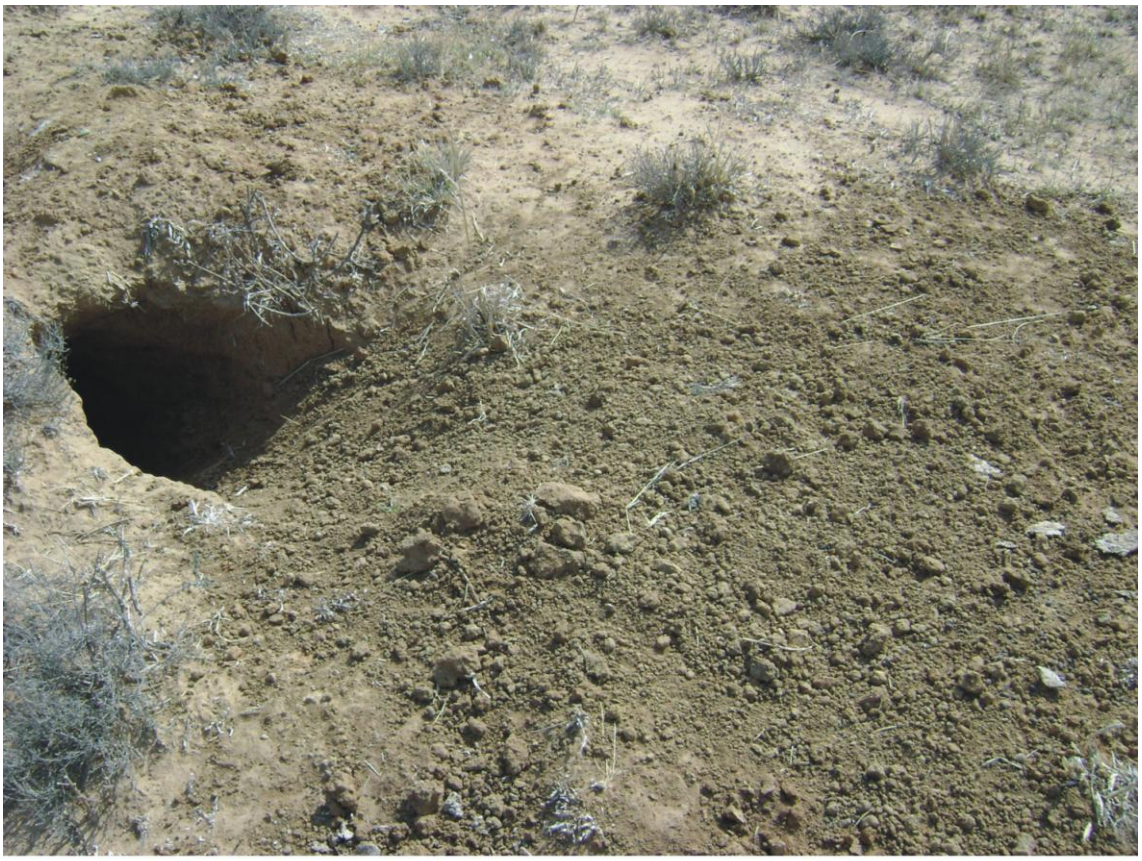

Figure 6. When found, intrusive features like springhare hollows and aardvark dugouts were investigated for tell-tale signs of excavated palaeontological material.

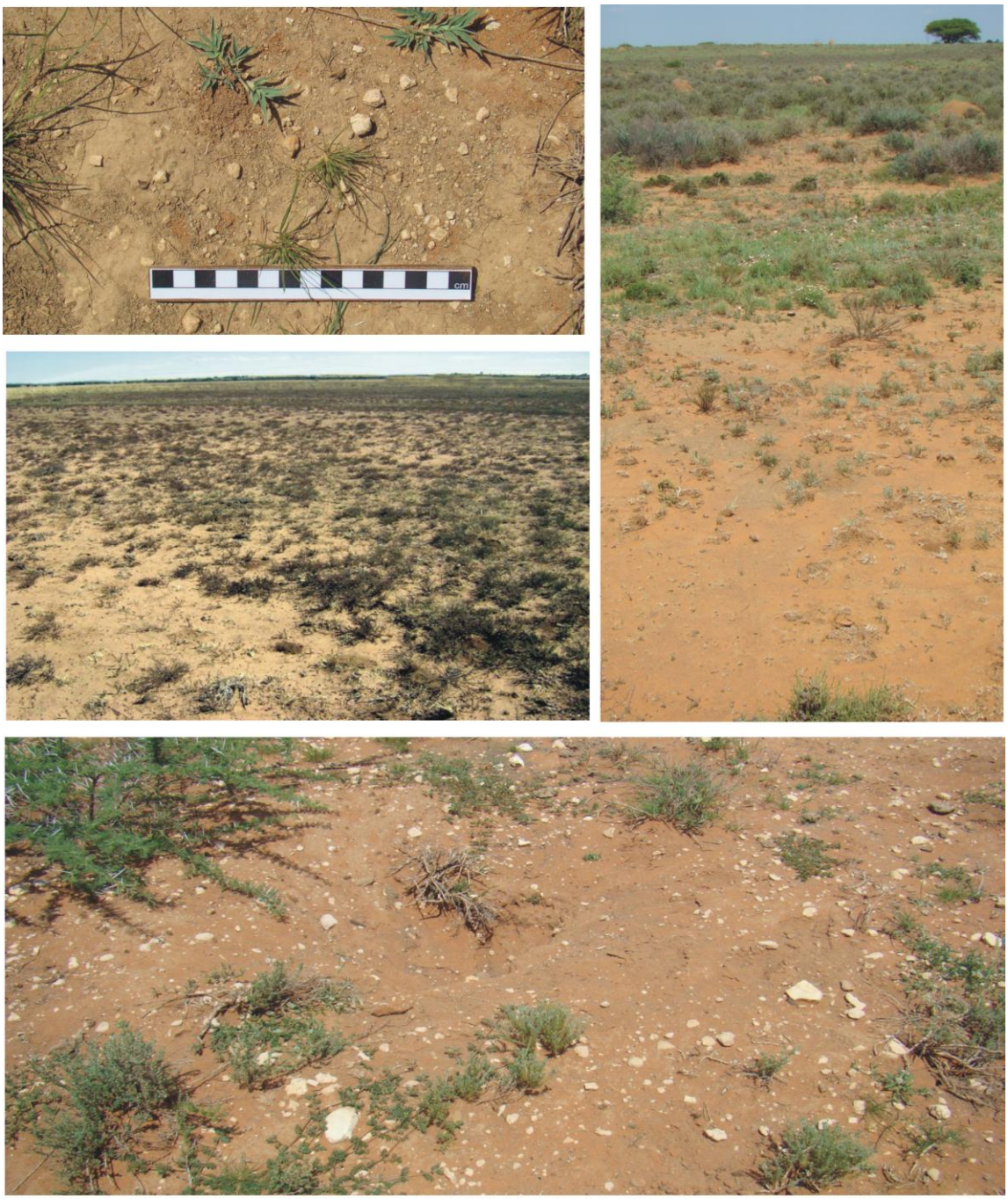

Figure 7. The affected area is underlain by Quaternary-aged residual soils largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands).