

Phase 1 Palaeontological Impact Assessment of the Blackwood PV solar facility on farm Pandamsfontein 1598, Boshof District, FS Province.

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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 Blackwood Photovoltaic (PV) facility located on the farm Pandamsfontein 1598 situated between Kimberley and Boshof 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**.
- There is a **moderate probability** that Permian fossil remains may be adversely impacted if widespread excavations are conducted into bedrock during the construction phase of the photovoltaic panels and associated infrastructure. It is advised that in the event of excavations into sedimentary bedrock, regular palaeontological monitoring of fresh exposures is included as part of the overall site management plan during the construction phase of the project.

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Introduction

At the request of Savannah Environmental Consultants, a Phase 1 Palaeontological Impact Assessment was carried out at the proposed new 75MW Blackwood 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 a turn in and out configuration on the site, or alternatively, via a power line to the Boundary Substation, situated approximately 20 km away to the north (**Fig 2**).

The palaeontological sensitivity of the area is considered high according to the SA National Fossil Sensitivity Map (SAHRIS). A preliminary desktop evaluation indicated that construction activities could impact on Quaternary-age aeolian deposits, including pan sediments (*Qs*), surface calcretes (*Qc*), dolerite outcrop (*Jd*), as well as older Ecca sediments of the Prince Albert Formation (*Ppt*). While dolerites are not palaeontologically significant, the likelihood of palaeontological impact resulting from excavations and ground moving activities into surface calcretes and Ecca sediments during the construction phase of the solar facility and its associated infrastructure, is considered moderate to high without on-site inspection of the affected area. Following the findings, a site visit (Phase 1 Impact Assessment) was recommended to substantiate the findings of the desktop study.

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 field assessment was carried out 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. Relevant palaeontological data, aerial photographs and site records were consulted and integrated with data acquired during the on-site inspection.

Description of the Affected Area

Locality data

1:50 000 topographical map 2824 DD Beaconsfield

1:250 000 geological map 2824 Kimberley

Site coordinates (**Fig. 3**):

A) 28°52'24.30"S 24°56'57.59"E

B) 28°53'44.97"S 24°58'25.52"E

C) 28°55'10.42"S 24°57'42.41"E

D) 28°54'35.90"S 24°56'9.81"E

E) 28°52'52.31"S 24°55'16.63"E

F) 28°52'56.78"S 24°56'16.96"E

The site is located on the farm Pandamsfontein 1598, about 10 kilometres southeast of Kimberley on the N8 national road leading to Petrusburg (**Fig. 3**). The area mostly comprises relatively flat terrain, punctuated by dolerite hills towards the east of the site (**Fig. 4 & 5**). A large pan is situated near, but outside the south-eastern boundary of the development footprint (**Fig. 6**). The geological map indicates that, accept for dolerite intrusions, the affected area lies within an outcrop area of the Prince Albert Formation (Ecca Group) that is mainly covered by Quaternary-age surface deposits made up of surface calcretes and a thick mantle of aeolian sand (**Fig. 7 & 8**).

Field Assessment

The foot survey indicates that the photovoltaic panels, power lines, associated buildings and access roads will be constructed on Quaternary-aged residual soils that are largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands, *Qs*), and that are primarily underlain by Ecca bedrock sediments. Visibility of Ecca Group outcrop are for the most part hampered by a capping of Quaternary-aged residual soils. There is no

evidence of potentially fossil-bearing erosional features such as pans and alluvial dongas within development footprint of the proposed infrastructure. 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 a loop in loop out into the existing power lines located on-site or alternatively to the Boundary or KDS Substations using the footprint of the existing power line (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 pv 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.

Fossils are not evenly distributed in their occurrence in hardrock sedimentary strata, so the probability of finding fossil exposures on the landscape is generally low. However, the affected area is underlain by hardrock sedimentary strata known for its palaeontological record, and considering the scale of the area in question, it is probable that fossils may occur within the Prince Albert Formation strata underlying the project area. Excavations into sedimentary bedrock may affect potentially fossil-bearing rocks,

which are generally considered to be of moderate to high palaeontological significance. There is a **moderate probability** that Permian fossil remains may be adversely impacted if widespread excavations are conducted into bedrock during the construction phase of the photovoltaic panels and associated infrastructure. It is advised that in the event of excavations into sedimentary bedrock, regular palaeontological monitoring of fresh exposures is included as part of the overall site management plan during the construction phase of the project.

References

Palaeontological Desktop Evaluation of the Blackwood PV solar facility, Boshof District, FS Province. Unpublished report prepared by *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?	Yes	
Mitigation: None required		
Cumulative impacts: Low impact on bedrock sediments where new pylons/power line supports are erected.		
Residual impacts: Disturbance of <i>in situ</i> 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?	Yes	
<p>Mitigation:</p> <p>It is recommended that thorough examination of the planned access roads be made by a palaeontologist prior to the commencement of the project</p>		
<p>Cumulative impacts: Possible impact on palaeontological resources if road construction activities go beyond area demarcated for development.</p>		
<p>Residual impacts: Disturbance of <i>in situ</i> Quaternary soils.</p>		

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

Nature of impact: Possible loss of Quaternary soils (topsoil resources), disturbance of intact bedrock 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)	Medium (52)
Status (positive, neutral or negative)	Negative	Positive (the discovery of otherwise unobservable fossil material discovered as a result of the proposed development, can be seen as beneficial to the scientific community).
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: The recorded features are located on the periphery of the study area and can be preserved in situ.		
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 moderate to high palaeontological sensitivity.		
Residual impacts: Disturbance of <i>in situ</i> Quaternary soils.		