

NATURA VIVA cc
Palaeontological Impact Assessments & Heritage Management,
Natural History Education, Tourism, Research

Attn: Ms Nicole Holland
Holland & Associates
P O Box 31108
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7966

Date: 16 November 2017

**Addendum to Specialist Paleontological Impact Assessment:
2017 Amendment of the DEA Environmental Authorisation (as amended) for the
Authorised Maanhaarberg Wind Energy Facility near De Aar, De Aar District,
Northern Cape Province.**

Dear Ms Holland,

This letter serves as an Addendum Report to the Palaeontology Impact Assessment conducted for the Maanhaarberg wind energy facility (WEF) near De Aar, prepared for DJ Environmental Consultants (Pty) Ltd, and compiled in 2010 (Almond, 2010).

This Addendum Report confirms that there are no paleontological heritage impact implications for any of the proposed amendments to the Environmental Authorisation (including amendments to the project description) and Environmental Management Programme (EMPr) and Final Layout Plan as described in your email dated 30th October 2017.

The proposed amendments are discussed below and a re-assessment of significance provided in the manner required by your Terms of Reference dated 30th October 2017.

1. Substantive Proposed Amendments

The proposed relevant¹ amendments to the Environmental Authorisation include:

- Hardstanding areas will be 50m x 50m rather than 40m x 20m.
- 33kV (and not 22kV) internal electrical reticulation lines would connect the turbines to the on-site substation. There is no material difference between the 22kV and 33kV infrastructure (in terms of footprint, height etc.). All internal reticulation lines shall be over-head in a manner that minimises additional surface disturbance.
- Above-ground internal reticulation lines and internal access roads shall be aligned as much as possible along existing infrastructure to limit damage to vegetation and watercourses.

The proposed relevant² amendments to the approved Environmental Management Programme (EMPr) (May, 2015) and the Amended Final Layout Map (April 2017) include:

- The approved access road onto the Swartekopjes Mountain has been re-aligned as a significant amount of cut and fill would have been required to create this road.
- Amendment to internal reticulation line routes.

¹ Relevant to paleontological heritage aspects e.g. development footprint.

² Relevant to paleontological heritage aspects e.g. development footprint.

- Amendment to internal road routes.
- Amendment to construction camp position.
- Micro-siting of turbine 21.

Certain changes listed above have resulted in infringements on buffers (i.e. heritage, botanical and freshwater).

2. Assessment of Proposed 2017 Amendments on Palaeontological Heritage

2.1 Findings of the 2010 Palaeontological Impact Assessment (PIA) on Authorised Project

The majority of the development footprint (wind turbines as well as ancillary gravel road construction) is underlain by unfossiliferous Karoo dolerite. Non-marine sediments of the Mid Permian Ecca and Lower Beaufort Groups (Karoo Supergroup) crop out on the slopes of the Karoo koppies. The Tierberg, Waterford and Abrahamskraal Formations represented here have a moderate to high palaeontological sensitivity. However, they are largely obscured by Neogene (Late Tertiary) to Recent drift deposits – notably dolerite scree and alluvium - and their fossil potential has been compromised through baking (thermal metamorphosis) by the adjacent major dolerite intrusions (Almond, 2010).

The inferred palaeontological sensitivity of fossil heritage within each rock unit found in the Maanhaarberg study area near De Aar is summarized in **Table 1**.

The Ecca and Beaufort Group sediments generally have a moderate to high palaeontological sensitivity. However, with the exception of some ancillary road construction, the greater part of the proposed WEF development is situated on the dolerite plateaux of the Maanhaarberg and Swartkoppies that are not paleontologically sensitive. Furthermore, Karoo Supergroup sediments beneath and adjacent to these major dolerite intrusions are extensively baked, considerably reducing their original fossil potential (Almond, 2010).

Table 1: Assessment of Impact Significance for Paleontological Heritage (2010 PIA).

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONTOLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
Superficial deposits ("drift")	Alluvium, Colluvium (scree), pan sediments <i>etc.</i> QUATERNARY TO RECENT	Sparse remains of mammals (bones, teeth), reptiles, ostrich egg shells, molluscs shells, trace fossils, plant remains, palynomorphs, diatoms stone artefacts.	LOW	Any substantial fossil finds to be reported by ECO to SAHRA.
Calcretes (T-Qc)	Pedogenic limestones NEOGENE TO QUATERNARY	Calcretised trace fossils (termitaria, rhizoliths <i>etc.</i>) Possible vertebrate bones, teeth, mollusc shells	LOW	Any substantial fossil finds to be reported by ECO to SAHRA.
Karoo Dolerite Suite (Jd)	Intrusive dolerite sills & dykes. EARLY JURASSIC	NONE	ZERO	None.
Abrahamskraal Formation (Pa) BEAUFORT GROUP	Floodplain Mudrocks with lenticular channel Sandstones, Minor playa lake sediments. MIDDLE PERMIAN	Rich terrestrial vertebrate fauna (esp. therapsids), petrified wood, plant remains, freshwater molluscs, trace fossils (trackways, burrows, coprolites).	HIGH	Any substantial fossil finds to be reported by ECO to SAHRA.
Waterford (= Carnarvon) Formation (Pc) ECCA GROUP	Storm-deposited shallow shelf sandstones with interbedded mudrocks. MIDDLE PERMIAN	Abundant trace fossils, petrified wood, rare fish & amphibian remains, possible stromatolitic limestones, palynomorphs.	MEDIUM	Any substantial fossil finds to be reported by ECO to SAHRA.
Tierberg Formation (Pt) ECCA GROUP	Dark basinal, prodelta and submarine fan mudrocks with minor sandstones. EARLY TO MIDDLE PERMIAN	Locally abundant trace fossils, petrified wood, plant debris, microvertebrates, Palynomorphs.	MEDIUM	Any substantial fossil finds to be reported by ECO to SAHRA.

2.2 Assessment of the Proposed 2017 Amendments on Palaeontological Heritage

This re-assessment aligns itself with the requirements of the Terms of Reference dated 30th October 2017 and the 2014 NEMA EIA Regulations, as amended.

Potential Impacts:

The main cause of impacts to paleontological sites is the physical disturbance/destruction of fossil material and the context of the area in which it is found. This may result in an indirect impact of irredeemable loss to science and public heritage resources. The (1) loss of paleontological material is usually considered to be negative; however, (2) opportunities for the advancement of science and knowledge can result through development, provided that professional assessment and mitigation is carried out. Without mitigation, the overall significance of the impact will be low negative, but medium positive with successful mitigation.

Assessment:

For this proposed project and its amendments, the significance of the impact will be localised unless a scientifically important find is made, in which case it would be understood as high (regional or national). There is a chance that the excavations for turbine bases could potentially impact buried fossil material. Similarly, excavation of cable trenches and clearing for access roads could impact upon fossil material that lies buried in the surface. Potential impacts caused by power lines and proposed access roads are also likely to be limited and local. Refer to **Table 2** for the assessment of the significance of impacts.

The operational and decommissioning phases of the WEF will not involve further significant adverse or other impacts on palaeontological heritage.

Table 2: Assessment of Impact Significance for Paleontological Heritage (2017 PIA).

Nature of Impact: Construction – Direct loss of or damage to fossils in the area due to excavation for turbine foundations and other WEF infrastructure. If mitigation is applied, chance fossil finds (of which there is a low probability) would be adequately dealt with.								
	Extent	Duration	Intensity	Consequence	Status	Significance	Probability	Confidence
Without Mitigation	L (localized)	H (permanent loss)	L (minor loss of resource, as resource is limited in this area)	Medium	Negative	L	L	H
With Mitigation	H (regional or national chance fossil find)	H (permanent, widespread)	H (important resource)	High	Positive	M	L	H
Can the impact be reversed?			No. The loss of paleontological heritage resources would be irredeemable and key contextual data for fossils (sedimentology, taphonomy) is difficult to reconstruct following disturbance.					
Will impact cause irreplaceable loss or resources?			Unlikely – well-preserved, scientifically valuable fossils are scarce within the project area. The fossils concerned are of widespread occurrence.					
Can impact be avoided, managed or mitigated?			Yes. Effective mitigation of chance fossil finds by the ECO and a professional paleontologist is possible.					
Mitigation measures:								
<ol style="list-style-type: none"> No specialist paleontological monitoring is recommended, unless there is a discovery of significant new fossil material during construction (e.g. well-preserved vertebrate bones, teeth and trackways, concentrations of petrified wood and/ or other plant fossils). This is however, unlikely. Safeguarding of chance fossil finds (preferably <i>in situ</i>) during the construction phase by the responsible ECO, followed by reporting of finds to the SAHRA (See Fossil Finds Procedure outlined in Table 3). Should a chance fossil find occur, it would need to be recorded and sampled by a qualified paleontologist, together with its pertinent contextual data (stratigraphy, sedimentology, and taphonomy) (See Fossil Finds Procedure outlined in Table 3). The fossil material would need to be curated within an approved repository (museum/university fossil collection) by a qualified paleontologist. All paleontological specialist work would have to conform to international best practice for paleontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 paleontological studies developed by the SAHRA. 								
Can any residual risk be monitored/managed?			Yes, through the ongoing application of the fossil chance finds procedure by an ECO.					

2.3 Cumulative Impacts

Given the overall low palaeontological sensitivity of the area near De Aar, and the widespread occurrence elsewhere in the Great Karoo of most of the fossils so far recorded there, the development of this WEF with its proposed amendments does not pose a significant cumulative impact on local fossil heritage.

2.4 Statement Summary

- The proposed amendments will not result in a change to the significance of the impact assessed for the original EIA.
- The proposed amendments will not result in an increased level or change in the nature of impact.
- There are no advantages nor disadvantages associated with the proposed amendments in terms of palaeontological heritage, when compared to the original assessment.
- The proposed amendments will not require any changes or additions to the recommended mitigation (These have been clarified but not changed in **Table 3** appended below).
- The proposed changes to the EMPr will not result in changes to the impact management outcomes of the EMPr in terms of palaeontological heritage.

There are thus no significant implications of the proposed amendments in terms of the potential impacts on palaeontological heritage or the significance of those impacts. The findings and recommendations of the PIA conducted in 2010 remain unchanged.

Yours sincerely,



John Almond
(Palaeontologist)
Natura Viva cc

REFERENCES

ALMOND, J.E. 2010. Proposed Wind Farm at Maanhaarberg near De Aar, Northern Cape Province proposed by Mulilo Renewable Energy (Pty) Ltd. Paleontological specialist study: desktop assessment, 22 pp. Natura Viva cc, Cape Town.

Table 3: CHANCE FOSSIL FINDS PROCEDURE: MAANHAARBERG WIND ENERGY FACILITY NEAR DE AAR, DE AAR DISTRICT, NORTHERN CAPE PROVINCE.

Province & region:	DE AAR DISTRICT, NORTHERN CAPE	
Responsible Heritage Management Authority	SAHRA, P.O. Box 4637, Cape Town 8000. Contact: Dr Ragna Redelstorff. Tel: 021 202 8651. Email: rredelstorff@sahra.org.za or Ms Natasha Higgitt. Tel: 021 462 4502. Email: nhiggitt@sahra.org.za	
Rock unit(s)	Ecca Group, Abrahamskraal Formation (Lower Beaufort Group), Pleistocene alluvium, calcretes	
Potential fossils	Vertebrate bones & teeth, vertebrate and other burrows, plant compressions, petrified wood, non-marine shells	
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.	
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering) 	
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation • Ensure fossil site remains safeguarded until clearance is given by the Heritage Management Authority for work to resume 	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation
	4. If required by Heritage Management Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.	
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Management Authority	
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Management Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Management Authority minimum standards.	