Palaeontological Impact Assessment for the proposed Overhead Powerline from Springhaas Collector Substation A to the Authorised Artemis Substation, Near Dealesville, Bloemfontein, Free State (Line 1)

Desktop Study (Phase 1)

For

GIBB Environmental

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf
Experience: 33 years research and lecturing in Palaeontology
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Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by GIBB Environmental, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Date: 02 October 2022

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed grid connection corridor from the Springhaas Collector Substation A to the Artemis Substation. The corridor will contain two powerlines each up to 275kV in capacity. The grid connection corridor would connect the Springhaas Solar PV facilities to the national grid. This report covers an overhead powerline up to 275kV in capacity which connects the Springhaas Solar Facilities/y from Collector Substation A to the Artemis substation (Line 1). Line 1 is located southwest of Dealesville, Free State Province.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed Line 1 route lies on the non-fossiliferous Jurassic dolerite and the highly sensitive Quaternary calcrete. Therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, environmental officer or other designated responsible person once excavations, drilling or mining activities have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

The palaeontological significance pre-mitigation is very low negative, and post-mitigation is very low positive.

Cumulative impacts are the same as the individual impacts

There are no No-Go Areas.

Structure	Geology	Palaeontology	Action
Line 1	Jurassic dolerite, Tierberg Fm Quaternary sands and calcrete	No fossils; Trace fossils No pans; transported fragments	Fossil Chance Find Protocol

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1. Background

Project description
ABO Wind energy renewables (Pty) Ltd, the proponent, intends to register the proposed Grid Connection Corridor and associated powerlines therein from the Springhaas Solar PV Cluster to the Artemis Substation, near Dealesville, Bloemfontein, Free State Province (Corridor). The Corridor is wholly located in the Kimberley renewable energy development zone (REDZ) and the Central Strategic Transmission Corridor. Therefore, the registration process for the Powerlines is being undertaken in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) the Standard for the Development and Expansion of Power Lines and Substation within Identified Geographical Areas Revision 2 (the Standard).

The Corridor is required to allow the solar power generated by the Springhaas Solar PV facilities to be evacuated to the national grid. In order for the Springhaas Solar PV facilities to evacuate the generated solar power to the national grid, a connection must be established between the solar PV facilities and the Artemis substation.
Details of the two lines are as follows:

- **Line 1:** An overhead powerline up to 275kV in capacity located in acorridor approximately 21.5km in length and up to 410m in width at the widest point (noting that the final corridor will be kept within the limits of the Standard).
- Line 2: An overhead powerline up to 275kV in capacity located in a corridor approximately 16.0km in length and up to 410m in width at the widest point.

The entire extent of the grid connection corridor is within the Kimberley REDZ as well as within a Strategic Transmission Corridor.

This PIA assesses **Line 1**. Line 2 will be assessed in a separate PIA.

Access to Line 1 would be via a service road which would be a jeep track (up to 4m wide) within the development footprint/ servitude of each line (underneath the line).

Table 1: *Details of Line 1*

Name	Proposed overhead powerline up to 275kV in capacity from Collector Substation A to Artemis Substation
Location	Farm Teneriffe No. 755, Remainder of Farm Corneliasdal No. 45, Portion 1 (Olimpia) of the Farm Corneliasdal No. 45, , Remaining Extent of the Farm De Hoop No. 171, Portion 0 of the Farm Alsace No. 1181, Portion 0 of the Farm Lorraine No. 1182, Portion 0 (Remaining Extent) of the Farm Braambosch No. 198, Remainder of the Farm Braklaagte No. 149, Portion 0 (Remaining Extent) of Farm Doornrandjes No. 546, Portion 1 of the Farm Walvischkuil No. 749, Portion 0 of the Farm Leliehoek No. 748, Portion 0 (Remaining Extent) the Farm Klipfontein No. 305
Connection	Will connect Springhaas Solar PV Facility/ies via Collector Substation A to the Artemis Substation on Portion 0 (Remaining Extent) the Farm Klipfontein No. 305
Capacity	Up to 275kV
Length	Up to approximately 21.5km

Corridor	Within the corridor which is up to 410m in width at its widest point, noting that the final corridor would be kept to the limits of the Standard
Height	Up to approximately 40m
Servitude	Up to 60m wide
Access	Service road - There would be a jeep track (up to 4m wide) within the development footprint/ servitude of the line (underneath the line), where possible/ required.

Affected properties

Line 1 1 traverses 12 farms/ farm portions. Details are provided below.

Table 2: *List of farms to be traversed by Line 1*

Farm name	SG 21 digits code
Teneriffe No. 755	F00400000000075500000
Remainder of Farm Corneliasdal No. 45	F00400000000004500000
Portion 1 (Olimpia) of Farm Corneliasdal No. 45	F00400000000004500001
Remaining Extent of Farm De Hoop No. 171	F00400000000017100000
Portion 0 of the Farm Alsace No. 1181	F00400000000118100000
Portion 0 of Farm Lorraine No. 1182	F00400000000118200000
Portion 0 (Remaining Extent) of the Farm Braambosch No. 198	F00400000000019800000
Remainder of Farm Braaklaagte No. 149	F00400000000014900000
Portion 0 (Remaining Extent) of Farm Doornrandjes No. 546	F00400000000054600000
Portion 1 of Farm Walvischkuil No. 749	F00400000000074900001
Portion 0 of the Farm Leliehoek No. 748	F00400000000074800000
Portion 0 (Remaining Extent) of Farm Klipfontein No. 305	F00400000000030500000

Identification of alternatives

The following alternatives are assessed in this process:

1. The no-go alternative.

No location alternatives are under consideration as a preliminary site sensitivity verification has been undertaken to avoid sensitive habitat.

A Palaeontological Impact Assessment was requested for the overhead powerline which forms part of the Grid Connection for the Dealesville Springhaas Collector Substation A to the Artemis Substation (Line 1). To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein. No fieldwork was deemed necessary for the PIA because the sites were not "very highly sensitive" according to the coding by SAHRA and so do not require a site visit (see SAHRIS palaeosensitivity map and codes https://sahris.sahra.org.za/map/palaeo and Figure 4). A site visit and walkthrough was however undertaken by the Archaeologist.

Table 3: *National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6)*

Section	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
ai	Details of the specialist who prepared the report,	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cB	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A. As the site is located in an area of low sensitivity no site visit was deemed necessary.
e	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 0
f	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4
g	An identification of any areas to be avoided, including buffers	N/A. No sensitive area to be avoided were identified.
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A. The entire site was rated as low sensitivity.
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Section 4
k	Any mitigation measures for inclusion in the EMPr	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion whether the proposed activity, activities or portions thereof should be authorised	Section 6
niA	Regarding the acceptability of the proposed activity or activities; and	Section 7

Section	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
nii	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Sections 6, 8
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

In addition to complying with the requirements of NEMA, the PIA also needs to fulfil the requirements of the Standard. These are detailed in Table 4 – Table 7.

Table 4: *Procedural Requirement that must be followed when planning a powerline or sub-station. Note, only those applicable to the PIA are listed.*

No.	Requirement	Comment
7	The proponent must ensure that the EAP and specialists identify through their specialist knowledge and site verifications/walkthrough as necessary, a proposed route and/or the substation location/s (where a substation or substations are relevant) within the *preliminary corridor* based on: a) consideration and implementation of the mitigation hierarchy, b) environmental sensitivity identified using the methodologies or processes as stipulated in Chapter 3 of this Standard, and c) engineering constraints.	The specialist has considered the location of the site through site verifications and archaeological walkthroughs. a) The mitigation hierarchy has been considered: • Avoid: The route of Line 1 avoids sensitive palaeontological resources. Avoidance of high sensitivity areas has been achieved. • Minimise: The specialist has provided recommendations to minimise the impact of the development on palaeontological resources at all stages of the development. These measures have been incorporated into the generic EMPr. • Rehabilitate: No specific rehabilitation measures, in relation to palaeontological impacts, have been deemed necessary. • Offset: No offsets are required as no high sensitivity palaeontological resources are impacted by Line 1. b) Sensitivities were identified using methodologies as stipulated in Chapter 3, General Environmental Processes. This is demonstrated in **Error! Reference source not found.** below. c) Engineering constraints were considered. The overall grid connection corridor and Line 1 is considered appropriate.
10. (e)	A discussion by the specialists and/or EAP of the process used to confirm that the proposed route and/or substation location has applied the principles stipulated in Chapter 3, and the process used to confirm that the site sensitivity of the proposed route and/or	Confirmed. Furthermore, **Error! Reference source not found.** below lists the principles stipulated in Chapter 3 and confirms that the process of confirming the proposed route, and the site sensitivity, has considered the General environmental Principle stipulated in Chapter 3.

No.	Requirement	Comment
	substation location is of low or medium environmental sensitivity.	

Table 5: *General Environmental Principles that must be adhered to when planning a powerline.*

Standard No.	Requirement	Comment
22	There must be no removal of threatened plant species.	Not applicable to the palaeontological assessment
23	There must be no impact on Tier 1 plant species identified through the screening process and site verification process	Not applicable to the palaeontological assessment
24	Clear-cutting during construction must be kept to a maximum of 8 m.	Not applicable to the palaeontological assessment
25	Wetlands must be avoided or, where wetland crossing is unavoidable, the power line should be routed over the narrowest part of the wetland. For the most part, wetlands and rivers can be traversed by the power line with little to no impact by placing the pylons outside of the wetland	Not applicable to the palaeontological assessment
26	Avoid all known Blue Swallow breeding habitat by a 2.5 km buffer. Should the full extent of the buffering not be practically possible, a thorough investigation must be conducted by a suitably experienced avifaunal specialist with experience of Blue Swallows to identify any potential nesting holes, which must then be appropriately buffered, in consultation with Ezemvelo KwaZulu-Natal Wildlife and BirdLife South Africa to prevent destruction of the nest holes.	Not applicable to the palaeontological assessment
27	Avoid Cape Vulture and White-backed Vulture breeding colonies by a 5 km buffer. In addition, it would require management of the potential impacts on the breeding birds once construction commences, which would necessitate the involvement of the avifaunal specialist and the environmental control officer (ECO).	Not applicable to the palaeontological assessment
28	Avoid Lappet-faced Vulture and Bearded Vulture restaurants by a 5 km buffer. Should the full extent of the buffering at vulture restaurants not be practically possible, the vulture restaurant should be relocated in consultation with the owner of the restaurant	Not applicable to the palaeontological assessment
29	The power line alignment or substation footing shall not be located within 500m of the edge of waterbodies found to be suitable for Greater Flamingo, Black Stork, Blue Crane, Great White Pelican, Lesser Flamingo and African Marsh-harrier	Not applicable to the palaeontological assessment
30.	The power line alignment or substation shall not be located within 1 km of major piggeries and poultry farms.	Not applicable to the palaeontological assessment

Table 6: *Specifications required i.t.o. of the Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Area (DFFE, 2022)*

Standard No.	Specification	Comment
18	Where required, a heritage impact assessment (HIA) will be undertaken in compliance with Section 38(1) to 38(4) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) as well as any Minimum Standards or Guidelines published in relation to Section 38(3) 31.	A HIA has been undertaken by a specialist (ASHA Consulting). A Palaeontological Impact Assessment (Phase 1) was undertaken by a specialist (Prof Bamford).
19	The HIA must be submitted to the South African Heritage Resources Agency and applicable Provincial Heritage Authorities for decision making procedures.	The HIA report, together with the Palaeontological Impact Assessment (Phase 1) report will be submitted to the South African Heritage Resources Agency and applicable Provincial Heritage Authorities for decision making procedures.
20	The applicable recommendations or requirements from the South African Heritage Resources Agency and applicable Provincial Heritage Authorities must be documented in the final environmental sensitivity report.	The applicable recommendations from these authorities are to be documented in the final environmental sensitivity report.

Table 7: *Confirming Statement by specialist*

Standard No.	Requirement	Comment
51	A description of the affected environment in terms of heritage resources and palaeontology, and an indication of existing heritage and palaeontological impacts within the preliminary corridor based on the site verification inspection and walk through.	Addressed in specialist report (see section 3)
52	Identification of heritage resources and palaeontological areas to be avoided within the preliminary corridor, including buffers;	Addressed in specialist report (see section 4.1)
53	A heritage sensitivity map overlaid with the proposed development footprint (i.e. pylon placement and power line route, as well as supporting infrastructure) based on most recently obtainable and available desktop data, such as the information on the screening tool and the South African Heritage Resources Information System, site verification inspection and walk through (where necessary);	Addressed in specialist report (see section 3, Figure 4)
54	Where required, a written comment or letter of no objection from the South African Heritage	Addressed in specialist report (see section 4)

Standard No.	Requirement	Comment
	Resources Agency and/or applicable provincial heritage authority confirming that there is no unacceptable impact on heritage resources and palaeontology;	
55	Confirmation that any recommendations as required by the South African Heritage Resources Agency and/or applicable provincial heritage authority have been incorporated and considered;	These are to be incorporated once/if received.
56	A description on how the identified environmental sensitivity pertaining to heritage resources and palaeontology has been considered in determining the proposed route;	Addressed in specialist report (see section 2)
57	A description of the implementation of the mitigation hierarchy in order to determine the proposed route and/or substation location;	See Table 1
58	How the inputs of I&APs were considered when determining the final pre-negotiated route and/or substation location; and	To be updated post Public Participation Process.
59	A statement confirming that: a. impact management actions as contained in the pre-approved Generic EMPr template are sufficient for the avoidance, management and mitigation of impacts and risks; or b. where required, specific impact management outcomes and actions are required and have been provided as part of the site specific EMPr.	a. Confirmed b. Confirmed

Figure 1: *Site layout plan (provided by GIBB Environmental)*

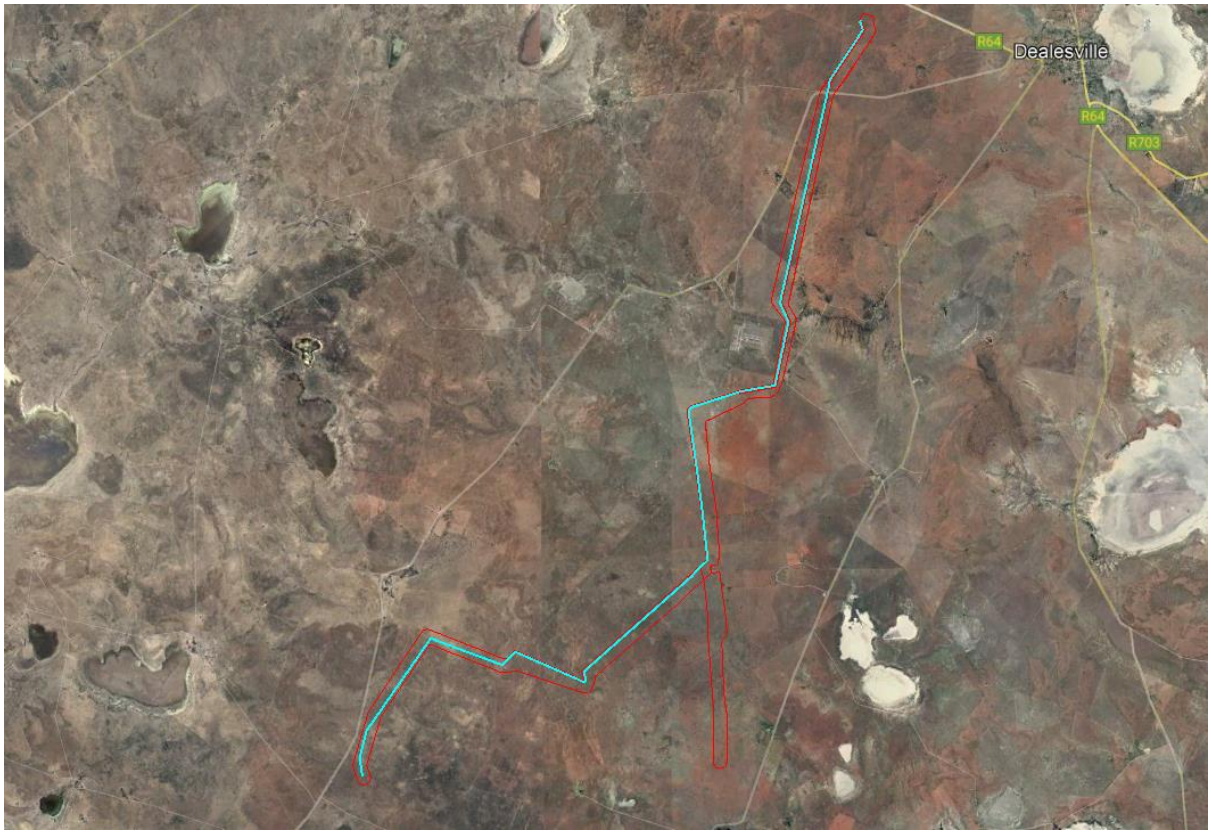

Figure 2: *Google Earth Map of the proposed Line 1 for the grid connection from Springhaas Collector Substation A to the Artemis Substation (grid connection corridor – red, line 1 turquoise)***Methods and Terms of Reference**

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment as the site was rated as low sensitivity in terms of palaeontology*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

2. Geology and Palaeontology

i. Project location and geological context

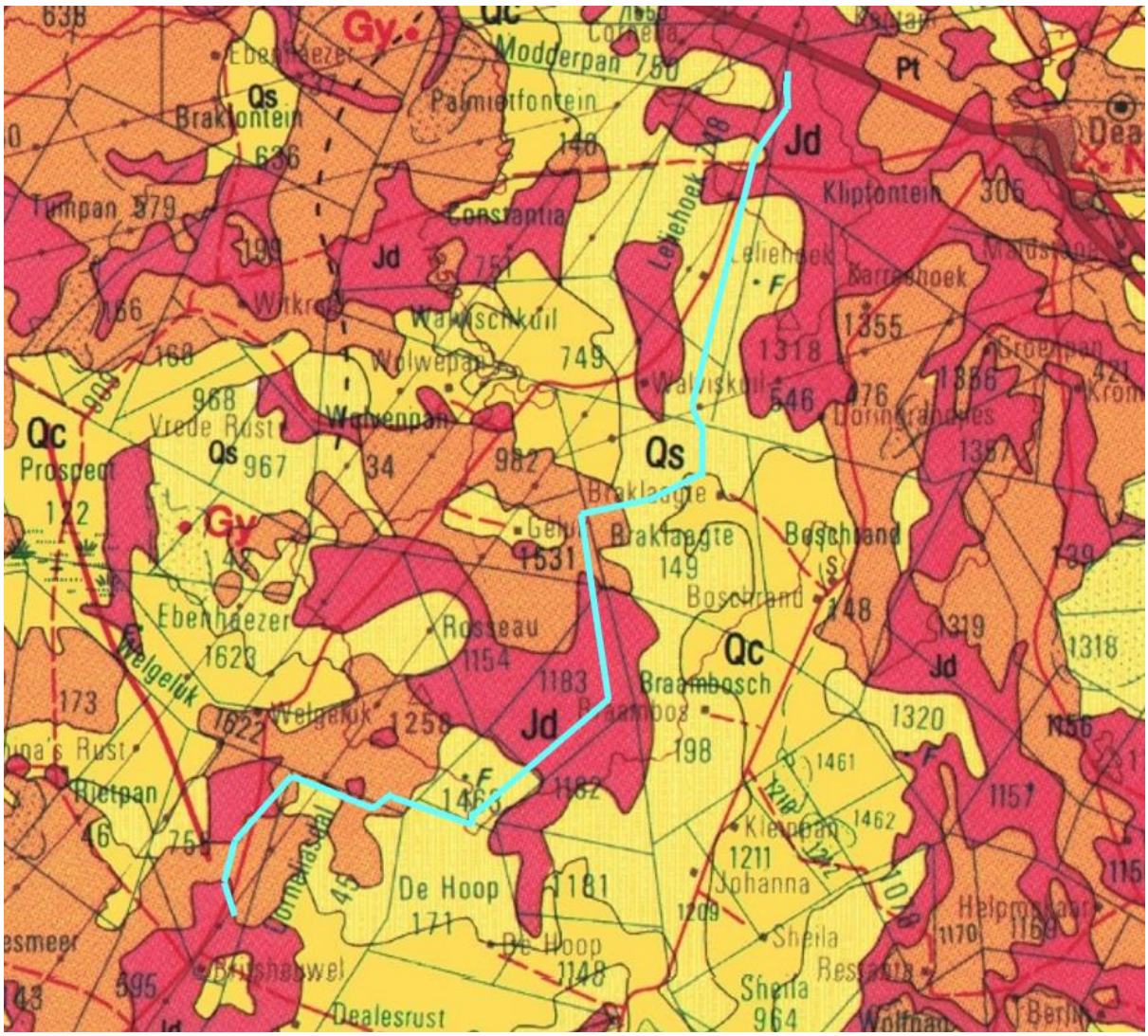

Figure 3: G*eological map of the area around the Dealesville Springhaas study area. Turquoise line indicates the approximate route of Line 1. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2824 Kimberley.*

Table 8: *Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; shading for the formations corresponds to the SAHRIS Palaeosensitivity coding in Figure 3.*

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary	Alluvium, sand,	Quaternary, ca 1.2 – 1.0 Ma
Qc	Kalahari sands	Calcrete. Calcified pan dune	Quaternary, ca 1.2 – 1.0 Ma
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pt	Tierberg Fm, Ecca Group, Karoo SG	Shales, siltstones, sandstone,	Early Permian, ca 290 Ma

The project is located in the north central part of the Karoo Basin where Karoo Supergroup rocks cover a very large proportion of South Africa and have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa. Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the Dwyka Group. They comprise tillites, diamictites, mudstones, siltstones and sandstones that were deposited as the basin filled (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the west and central part are the following formations, from base upwards: Prince Albert Formation, Whitehill Formation, Collingham Formation, Laingsburg / Ripon Formations, **Tierberg** / Fort Brown Formations, and Waterford Formation. In the eastern Free State and KwaZulu Natal, from the base upwards are the Pietermaritzburg Formation, Vryheid Formation and the Volksrust Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

Overlying the Ecca Group are the rocks of the Beaufort Group that have been divided into the lower Adelaide Subgroup for the Upper Permian strata, and the Tarkastad Subgroup for the Early to Middle Triassic strata. As with the older Karoo sediments, the formations vary across the Karoo Basin.

Large exposures of **Jurassic dolerite** dykes occur throughout the area. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption.

The **Quaternary Kalahari sands** form an extensive cover of much younger deposits over much of Botswana, the Northern Cape Province and the Free State Province. Haddon and McCarthy (2005) proposed that the Kalahari basin formed as a response to down-warp of the interior of the southern Africa, probably in the Late Cretaceous. This, along with possible uplift along epeirogenic axes, back-tilted rivers into the newly formed Kalahari basin and deposition of the Kalahari Group sediments began. Sediments included basal gravels in river channels, sand and finer sediments. A period of relative tectonic stability during the mid-Miocene saw the silcretisation and calcretisation of older Kalahari Group lithologies, and this was followed in the Late Miocene by relatively minor uplift of the eastern side of southern Africa and along certain epeirogenic axes in the interior. More uplift during the Pliocene caused erosion of the sand that was then reworked and redeposited by aeolian processes during drier periods, resulting in the extensive dune fields that are preserved today.

There are numerous pans in the Kalahari Group sediments, generally 3–4 km in diameter (Haddon and McCarthy, 2005). According to Goudie and Wells (1995) there are two conditions required for the formation of pans. Firstly, the fluvial processes must not be integrated, and second, there must be no accumulation of aeolian material that would fill the irregularities or depressions in the land surface. Favoured materials or substrates for the formation of pans in South Africa are Dwyka and Ecca shales and sandstones (ibid).

New cosmogenic burial ages obtained from a 55 m section of Kalahari Group sediments (Matmon et al., 2015) indicate that in the southern Kalahari, the majority of deposition occurred rapidly at 1.0–1.2 Ma. All earlier sediments in this region were eroded during previous sedimentary cycles. In summary, they showed that the stratigraphy, sedimentology, and cosmogenic nuclide data indicate:
1) the existence of a stable, shallow and low-energy water body over the southern Kalahari for at least 450 ka prior to 1–1.2 Ma;
2) rapid sediment accumulation that filled up the basin at 1–1.2 Ma; and
3) the establishment of the Kalahari sand cover shortly thereafter.
The authors acknowledge that this timeframe is far younger than expected from the conventional estimates for the Kalahari Group sediments (Haddon and McCarthy, 2005). The significant hiatus between the Pleistocene sequence and the underlying Archaean basement implies that evidence of earlier cycles of deposition and erosion are no longer preserved in the sedimentary record.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 5. The site for development is in the Tierberg Formation, Jurassic dolerite, Quaternary calcrete and Quaternary sands. Line 1 lies on Jurassic dolerite and Quaternary calcrete.

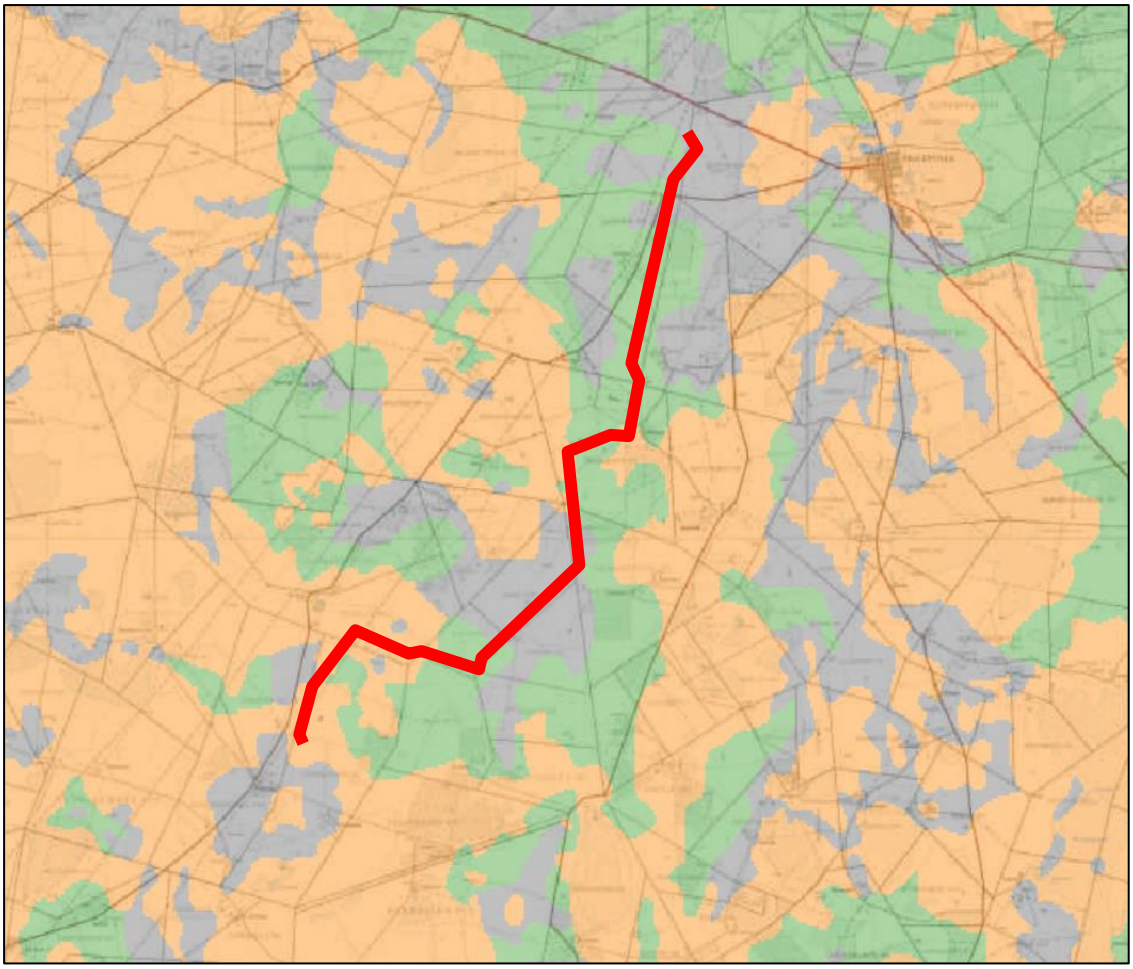

Figure 4: *SAHRIS Palaeosensitivity map for the site for the proposed Line 1, red. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.*

From the SAHRIS map above the area is indicated as highly sensitive (orange) for the Tierberg Formation and Quaternary sands, moderately sensitive (green) for the Quaternary calcrete and on no sensitivity (grey) for the Jurassic dolerite.

The palaeontological sensitivity of the area under consideration is presented in Figure 4. In the westernmost part of the basin the Tierberg Formation is predominantly argillaceous. In the northwest of its occurrence where it is in contact with the Collingham or Whitehill Formations, it grades up into the arenaceous overlying Waterford Formation (Johnson et al., 2006). Trace fossils of *Nereites, Planolites* and *Zoophycus* can be found in the fine mudstones (Johnson et al., 2006).

The Tertiary calcretes can trap fossils and artefacts when associated with palaeo-pans and dunes or palaeo-springs (Partridge et al., 2006). Where deflation has occurred, for example along the west coast of South Africa, any trapped materials in the different levels can be concentrated in the depo-centre of the pan or dune and thus it can be challenging to interpret the deposit (Felix-Henningsen et al., 2003; Netterberg, 1969).

The aeolian sands of the Gordonia Formation do not preserve fossils because they have been transported and reworked, but in some regions these too may have covered pan or spring deposits and these can trap fossils, and more frequently archaeological artefacts. Usually these geomorphological features can be detected using satellite imagery. Several pans are in the project area so they were surveyed by Dr Jayson Orton.

3. Site Sensitivity

A Screening Tool Report for the proposed Line 1 was generated using the online DFFE Screening Tool in December 2022.

The Screening Tool Report rated the palaeonotological theme as high sensitivity. Following the desktop assessment the site was deemed to be of low sensitivity.

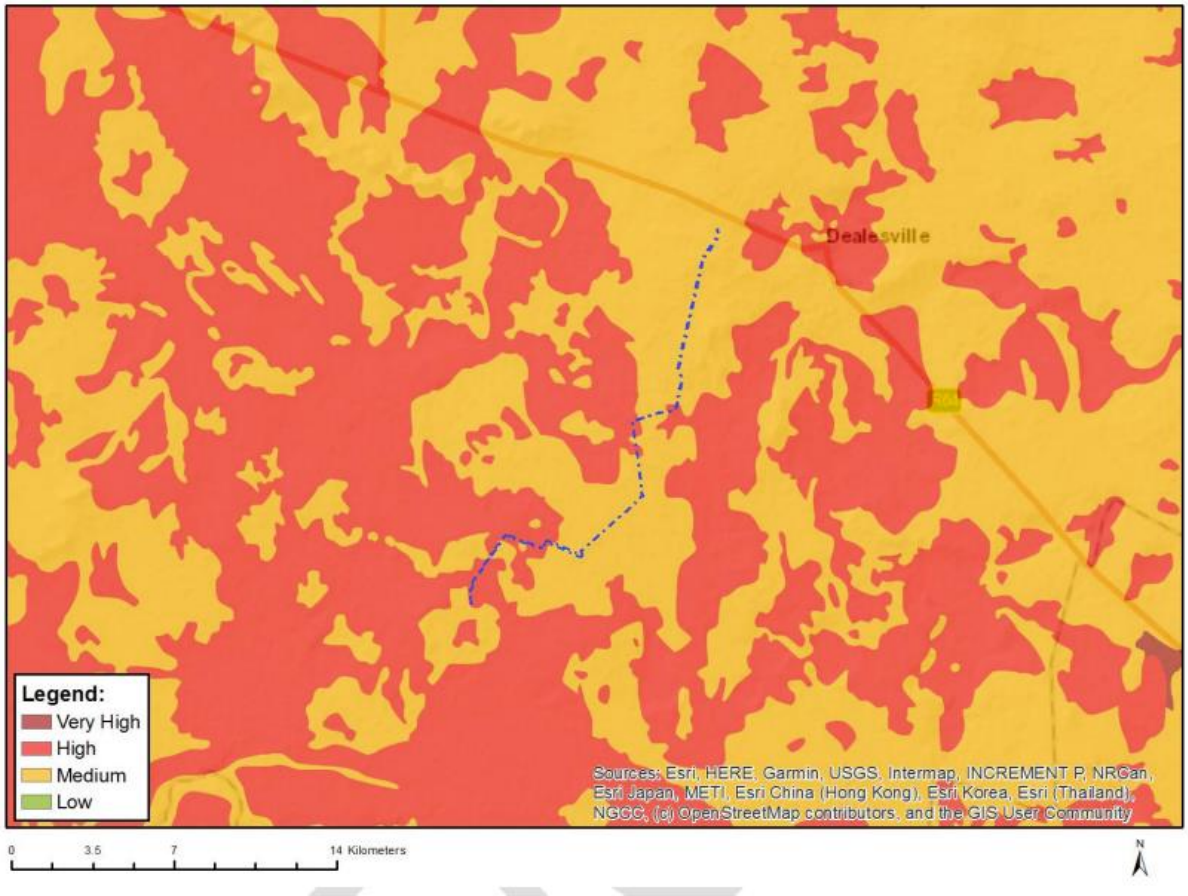

Figure 5: *Map of palaeontology sensitivity for Line 1 from Springhaas Collector Substation A to the Artemis Substation*

4. Impact assessment

The objective of the assessment of potential impacts is to identify and assess all the significant, potential impacts that may arise as a result of the project.

For each of the main project phases the existing and potential future impacts and benefits (associated only with the project) will be described using the criteria listed below. The

assignment of ratings has been undertaken based on past experience of the team, as well as through research. Subsequently, mitigation measures will be identified and considered for each impact and the assessment repeated in order to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented).

The following alternatives are assessed in this process:

1. The no-go alternative.

Since the potential impact on the palaeontology is on the ground only, i.e. the footprint and not the structure above ground, all the infrastructure can be treated the same in the assessment table.

Furthermore, there are no palaeontologically very highly sensitive areas in footprint so there are no no-go areas to be considered.

Table 9: *Impact Assessment Criteria*

Criteria	Rating Scales	Notes
Nature	Positive	An evaluation of the effect of the impact related to the proposed development
	Negative	
Extent	Footprint	The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur
	Site	The extent of the impact is rated as site as it will affect only the development area
	Local	The extent of the impact is rated as Local as it affects the development area and adjacent properties
	Regional	The extent of the impact is rated as Regional as the effects of the impact extends beyond municipal boundaries
	National	The extent of the impact is rated as National as the effects of the impact extends beyond more than 2 regional/ provincial boundaries
	International	The extent of the impact is rated as International as the effect of the impact extends beyond country borders
Duration	Temporary	The duration of the activity associated with the impact will last 0-6 months and as such is rated as Temporary
	Short term	The duration of the activity associated with the impact will last 6-18 months and as such is rated as Short term
	Medium term	The duration of the activity associated with the impact will last 18 months-5 years and as such is rated as Medium term
	Long term	The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term
Severity	High negative	The severity of the impact is rated as High negative as the natural, cultural or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected.
	Moderate negative	The severity of the impact is rated as Moderate negative as the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected
	Low negative	The severity of the impact is rated as Low negative as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected
	Low positive	The severity of the impact is rated as Low positive as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally improved
	Moderate positive	The severity of the impact is rated as Moderate positive as the affected environment is altered but natural, cultural and social functions and

Criteria	Rating Scales	Notes
		processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are positively affected
	High positive	The severity of the impact is rated as High positive as the natural, cultural or social functions and processes are altered to the extent that valued, important, sensitive or vulnerable systems or communities are substantially positively affected.
Potential for impact on irreplaceable resources	No	No irreplaceable resources will be impacted.
	Yes	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental	A combination of extent, duration, intensity and the potential for impact on irreplaceable resources
	Highly detrimental	
	Moderately detrimental	
	Slightly detrimental	
	Negligible	
	Slightly beneficial	
	Moderately beneficial	
	Highly beneficial	
	Extremely beneficial	
Likelihood of the impact occurring	Unlikely	It is highly unlikely or less than 50 % likely that an impact will occur.
	Likely	It is between 50 and 75 % certain that the impact will occur.
	Definite	It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.
Significance	Very high - negative	A function of Consequence and Likelihood
	High - negative	
	Moderate - negative	
	Low - negative	
	Very low	
	Low - positive	
	Moderate - positive	
	High - positive	
	Very high - positive	

4.1 Pre-Construction Phase

There will be no significant impacts on palaeontological resources during the pre-construction phase.

4.2 Construction Phase, Operations Phase and Decommissioning Phase

Palaeontological resources may be impacted during excavation and earthworks in the construction phase.

Table 10: *Construction phase impacts*

IMPACT ON POSSIBLE PALAEONTOLOGICAL RESOURCES	
PROJECT PHASE	*Construction phase*
DIRECT IMPACT	*Destruction of fossils in the footprint*

INDIRECT IMPACT	*N/A*			
CUMULATIVE IMPACT	*Loss of fossil heritage and scientific knowledge*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*2*	*The duration of the activity associated with the impact will last 6-18 months and as such is rated as Short term*	*-3*	*3*
EXTENT	*1*	*The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur*		
SEVERITY	*-1*	*The severity of the impact is rated as Low negative as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected*	***Negligible***	***Definite***
IMPACT ON IRREPLACEBALE RESOURCES	*0*	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	***-9***	***Very Low Negative***		
PROPOSED MITIGATION MEASURES				
If fossils are found once excavations for foundations and amenities have commenced then they should be photographed, removed and put in a safe place. Photographs should be sent to a palaeontologist to assess their scientific value. If the fossils are important the palaeontologist must obtain a permit from SAHRA, visit the site and remove the fossils for curation and storage in a recognised facility such as a museum or palaeontology department in a university				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such is rated as Short term*	*3*	*3*
EXTENT	1	*The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur*		
SEVERITY	1	*The severity of the impact is rated as Low positive as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally improved*	***Negligible***	***Definite***
IMPACT ON IRREPLACEABLE RESOURCES	0	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	**9**	**Very Low Positive**		
CONFIDENCE LEVEL				
High				

4.3 Operations Phase

Palaeontological resources may be impacted during excavation and earthworks in the operational phase.

Table 11**:** *Operations phase impacts*

IMPACT ON POSSIBLE PALAEONTOLOGICAL RESOURCES	
PROJECT PHASE	*Operations phase*
DIRECT IMPACT	*Destruction of fossils in the footprint*

INDIRECT IMPACT	*N/A*			
CUMULATIVE IMPACT	*Loss of fossil heritage and scientific knowledge*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term*	*-5*	*3*
EXTENT	*1*	*The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur*		
SEVERITY	*-1*	*The severity of the impact is rated as Low negative as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected*	***Negligible***	***Definite***
IMPACT ON IRREPLACEBALE RESOURCES	*0*	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	***-15***	***Very Low Negative***		
PROPOSED MITIGATION MEASURES				
If fossils are found once excavations for foundations and amenities have commenced then they should be photographed, removed and put in a safe place. Photographs should be sent to a palaeontologist to assess their scientific value. If the fossils are important the palaeontologist must obtain a permit from SAHRA, visit the site and remove the fossils for curation and storage in a recognised facility such as a museum or palaeontology department in a university				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term*	*5*	*3*
EXTENT	1	*The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur*		
SEVERITY	1	*The severity of the impact is rated as Low positive as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally improved*	***Negligible***	***Definite***
IMPACT ON IRREPLACEABLE RESOURCES	0	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	**15**	**Very Low Positive**		
CONFIDENCE LEVEL				
High				

4.1 Decommissioning Phase

The impacts associated with the decommissioning phase are the same as those identified for the construction phase. The impact assessment in Table 10.

4.2 Cumulative Impacts

Cumulative impacts were assessed at two levels:

1. Level 1: Within the grid corridor – the cumulative impact of all development within the grid corridor (to include Line 2 to the Artemis substation)

2. Level 2: Within a 30km radius of the site.

There was no difference between level 1 and level 2 cumulative impacts.

The pre-and post-mitigation ratings of cumulative impacts are the same because every potential fossil discovery has its own scientific value.

Table 12: *Cumulative impacts*

Impact	Pre-mitigation	Post-mitigation
Destruction of fossils (level 1, grid corridor)	Very low negative	Very low positive
Destruction of fossils (level 2, 30km radius of the site)	Very low negative	Very low positive

4.1 No-Go Impacts

No-Go Impact – none (all sites and surrounds have an equal chance of fossils being found/absent)

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either the wrong type to contain fossils (dolerite) or might only trap fossils in palaeo-pans, palaeo-dunes or palaeo-springs. Since there is an extremely small chance that fossils from the pans or the shales of the Tierberg Formation may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low for the whole study site and there are no no-go areas.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and only some contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Tierberg Formation or the sands and calcrete of the Quaternary. There is a very small chance that fossils may occur in the below ground shales of the early Permian Tierberg Formation or trapped in pans but the pans in the region are being avoided for other reasons. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr (contained in Section 8). If fossils are found by the environmental officer, or other responsible person once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

The impact on the palaeontological heritage would be low, so as far as the palaeontology is concerned, the project should be registered.

Table 13: *Summary of palaeontological impact and recommendation*

Component	***Geology***	***Palaeontology***	***Action***
Corridor (Line 1)	Jurassic dolerite, Quaternary sands and calcrete, Tierberg Fm, Ecca Group, Karoo SG	No fossils; No pans; transported fragments; trace fossils in shales	Fossil Chance Find Protocol

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Goudie, A.S., Wells, G.L., 1995. The nature, distribution and formation of pans in arid zones. Earth Science Reviews 38, 1–69.

Felix-Henningsen, P., Kandel, A.W., Conard, N.J., 2003. The significance of calcretes and paleosols on ancient dunes of the Western Cape, South Africa, as stratigraphic markers and paleoenvironments. In: G. Füleky (Ed.) Papers of the 1st International Conference on Archaeology and Soils. BAR International S1163, pp. 45-52.

Haddon. I.G., McCarthy, T.S., 2005. The Mesozoic–Cenozoic interior sag basins of Central Africa: The Late-Cretaceous–Cenozoic Kalahari and Okavango basins. Journal of African Earth Sciences 43, 316–333.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Matmon, A., Hidy, A.J., Vainer, S., Crouvi, O., Fink, D., 2015. New chronology for the southern Kalahari Group sediments with implications for sediment-cycle dynamics and early hominin occupation. Quaternary Research. 84 (1), 118–132. http://dx.doi.org/10.1016/j.yqres.2015.04.009.

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Partridge, T.C., Botha, G.A., Haddon, I.G., 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 585-604.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavation commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 6). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

9. Appendix A – Examples of fossils from the Quaternary calcrete

Figure 6: Photographs of transported and fragmentary fossils from the Quaternary sands and calcrete as might be seen in the field.

Figure 7: Photographs of trace fossils that could occur in the shales of the Tierberg Formation.

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
July 2022

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.
NRF Rating: C-2 (1999-2004); B-3 (2005-2015); B-2 (2016-2020); B-1 (2021-2026)

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+

PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees
All at Wits University

Degree	Graduated/completed	Current
Honours	13	0
Masters	13	3
PhD	13	6
Postdoctoral fellows	15	2

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 45 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 12-20 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Associate Editor Open Science UK: 2021 -
Review of manuscripts for ISI-listed journals: 30 local and international journals
Reviewing of funding applications for NRF, PAST, NWO, SIDA, National Geographic, Leakey Foundation

x) Palaeontological Impact Assessments

Selected from the past five years only – list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for EnviroPro

- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for EnviroPro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

xi) Research Output

Publications by M K Bamford up to July 2022 peer-reviewed journals or scholarly books: over 165 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 30; Google scholar h-index = 35; -i10-index = 92
Conferences: numerous presentations at local and international conferences.

11. Appendix C – Specialist Declaration

DECLARATION BY THE SPECIALIST

I, __Marion Kathleen Bamford_____, declare that –

- I act as the independent specialist in this Standard registration process;
- I have performed the work relating to the specialist assessment and/or route or substation location confirmation in an objective manner;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist input and confirming statement relevant to this request for registration, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the proponent all material information in my possession that reasonably has or may have the potential of influencing compliance with the Standards registration process; and
- all the particulars furnished by me in this form are true and correct.

Signature of the Specialist:

_____

Name of Company: Marion Bamford Consulting

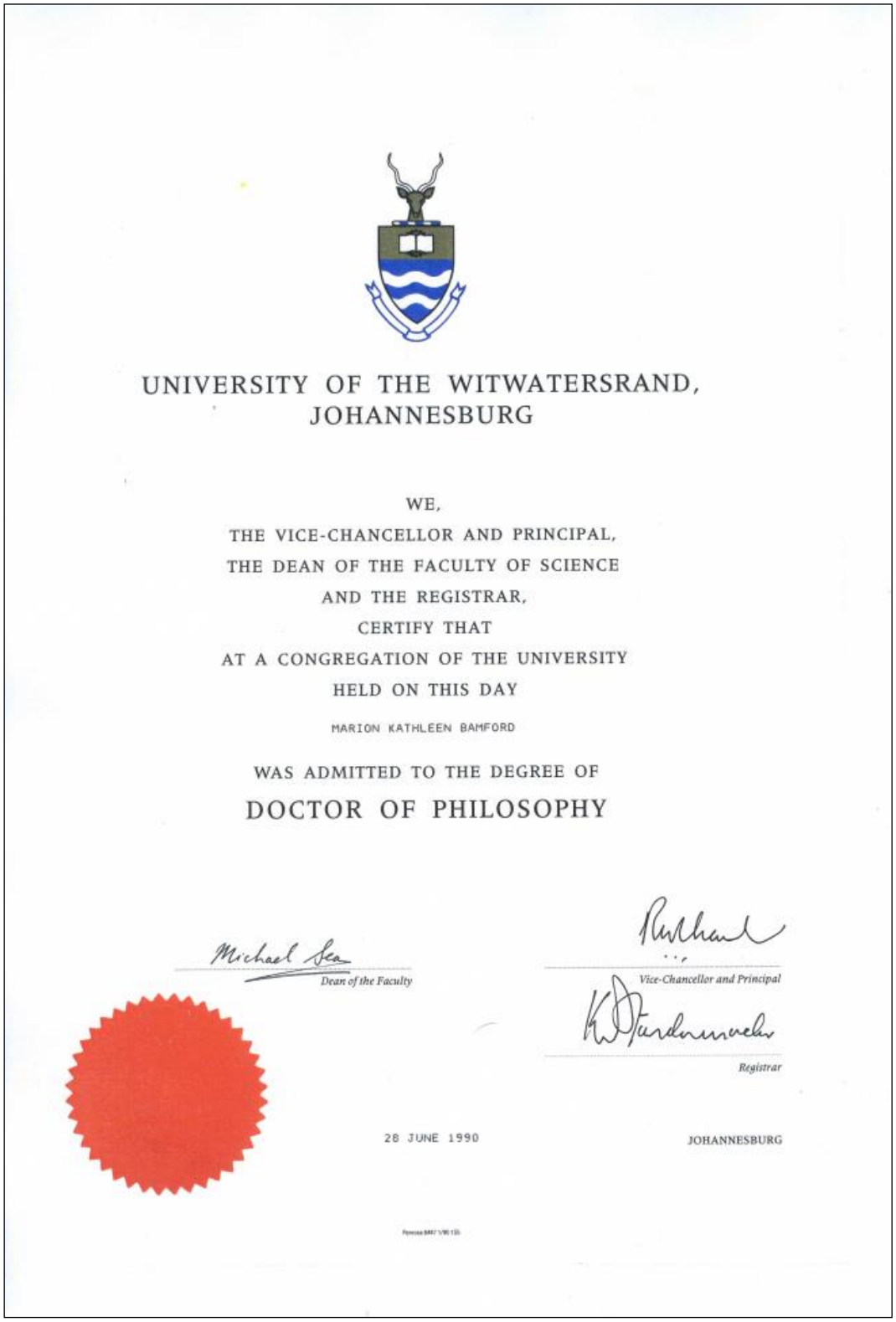
_____

Date: 26 August 2022

_____

[32] A copy of the most recent registration certificate must be appended to this declaration

Note that the Palaeontological Society of SA does not have any form of accreditation. Proof of PhD certificate is presented



UNIVERSITY OF THE WITWATERSRAND,
JOHANNESBURG

WE,
THE VICE-CHANCELLOR AND PRINCIPAL,
THE DEAN OF THE FACULTY OF SCIENCE
AND THE REGISTRAR,
CERTIFY THAT
AT A CONGREGATION OF THE UNIVERSITY
HELD ON THIS DAY

MARION KATHLEEN BAMFORD

WAS ADMITTED TO THE DEGREE OF

DOCTOR OF PHILOSOPHY

Michael Sea
Dean of the Faculty

Vice-Chancellor and Principal

Registrar

28 JUNE 1990

JOHANNESBURG

12. Appendix D – Compliance with the Standard

Table 14: *Procedural Requirement that must be followed when planning a powerline or sub-station. Note, only those applicable to the PIA are listed.*

No.	Requirement	Comment
7	The proponent must ensure that the EAP and specialists identify through their specialist knowledge and site verifications/walkthrough as necessary, a proposed route and/or the substation location/s (where a substation or substations are relevant) within the *preliminary corridor* based on: d) consideration and implementation of the mitigation hierarchy, e) environmental sensitivity identified using the methodologies or processes as stipulated in Chapter 3 of this Standard, and f) engineering constraints.	A walkdown was not deemed necessary for the PIA. The project Archaeologist has inspected the larger pans in the broader study area for fossils previously. d) The mitigation hierarchy has been considered: • Avoid: The footprint of Line 1 avoids sensitive palaeontological resources. Avoidance of high sensitivity areas has been achieved. • Minimise: The specialist has provided recommendations to minimise the impact of the development on palaeontological resources at all stages of the development. These measures have been incorporated into the generic EMPr. • Rehabilitate: No specific rehabilitation measures, in relation to palaeontological impacts, have been deemed necessary. • Offset: No offsets are required as no high sensitivity palaeontological resources are impacted by Line 1. e) Sensitivities were identified using methodologies as stipulated in Chapter 3, General Environmental Processes. This is demonstrated in **Error! Reference source not found.** below. f) Engineering constraints were considered. The overall grid connection corridor and Line 1 are considered appropriate.
10. (e)	A discussion by the specialists and/or EAP of the process used to confirm that the proposed route and/or substation location has applied the principles stipulated in Chapter 3, and the process used to confirm that the site sensitivity of the proposed route and/or substation location is of low or medium environmental sensitivity.	Confirmed. Furthermore, **Error! Reference source not found.** below lists the principles stipulated in Chapter 3 and confirms that the process of confirming the proposed route, and the site sensitivity, has considered the General environmental Principle stipulated in Chapter 3.

Table 15: *General Environmental Principles that must be adhered to when planning a powerline.*

Standard No.	Requirement	Comment
22	There must be no removal of threatened plant species.	Not applicable to the palaeontological assessment
23	There must be no impact on Tier 1 plant species identified through the screening process and site verification process	Not applicable to the palaeontological assessment
24	Clear-cutting during construction must be kept to a maximum of 8 m.	Not applicable to the palaeontological assessment
25	Wetlands must be avoided or, where wetland crossing is unavoidable, the power line should be routed over the narrowest part of the wetland. For the most part, wetlands	Not applicable to the palaeontological assessment

Standard No.	Requirement	Comment
	and rivers can be traversed by the power line with little to no impact by placing the pylons outside of the wetland	
26	Avoid all known Blue Swallow breeding habitat by a 2.5 km buffer. Should the full extent of the buffering not be practically possible, a thorough investigation must be conducted by a suitably experienced avifaunal specialist with experience of Blue Swallows to identify any potential nesting holes, which must then be appropriately buffered, in consultation with Ezemvelo KwaZulu-Natal Wildlife and BirdLife South Africa to prevent destruction of the nest holes.	Not applicable to the palaeontological assessment
27	Avoid Cape Vulture and White-backed Vulture breeding colonies by a 5 km buffer. In addition, it would require management of the potential impacts on the breeding birds once construction commences, which would necessitate the involvement of the avifaunal specialist and the environmental control officer (ECO).	Not applicable to the palaeontological assessment
28	Avoid Lappet-faced Vulture and Bearded Vulture restaurants by a 5 km buffer. Should the full extent of the buffering at vulture restaurants not be practically possible, the vulture restaurant should be relocated in consultation with the owner of the restaurant	Not applicable to the palaeontological assessment
29	The power line alignment or substation footing shall not be located within 500m of the edge of waterbodies found to be suitable for Greater Flamingo, Black Stork, Blue Crane, Great White Pelican, Lesser Flamingo and African Marsh-harrier	Not applicable to the palaeontological assessment
30.	The power line alignment or substation shall not be located within 1 km of major piggeries and poultry farms.	Not applicable to the palaeontological assessment

Table 16: *Specifications required i.t.o. of the Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Area (DFFE, 2022)*

Standard No.	Specification	Comment
18	Where required, a heritage impact assessment (HIA) will be undertaken in compliance with Section 38(1) to 38(4) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) as well as any Minimum Standards or Guidelines published in relation to Section 38(3) 31.	A HIA has been undertaken by a specialist (ASHA Consulting). A Palaeontological Impact Assessment (Phase 1) was undertaken by a specialist (Prof Bamford).
19	The HIA must be submitted to the South African Heritage Resources Agency and applicable Provincial Heritage Authorities for decision making procedures.	The HIA report, together with the Palaeontological Impact Assessment (Phase 1) report will be submitted to the South African Heritage Resources Agency and applicable Provincial Heritage Authorities for decision making procedures.
20	The applicable recommendations or requirements from the South African Heritage Resources Agency	The applicable recommendations from these authorities are to be documented in the final environmental sensitivity report.

Standard No.	Specification	Comment
	and applicable Provincial Heritage Authorities must be documented in the final environmental sensitivity report.	

Table 17: *Confirming Statement by specialist*

Standard No.	Requirement	Comment
51	A description of the affected environment in terms of heritage resources and palaeontology, and an indication of existing heritage and palaeontological impacts within the preliminary corridor based on the site verification inspection and walk through.	Addressed in specialist report (see section 3)
52	Identification of heritage resources and palaeontological areas to be avoided within the preliminary corridor, including buffers;	Addressed in specialist report (see section 4.1)
53	A heritage sensitivity map overlaid with the proposed development footprint (i.e. pylon placement and power line route, as well as supporting infrastructure) based on most recently obtainable and available desktop data, such as the information on the screening tool and the South African Heritage Resources Information System, site verification inspection and walk through (where necessary);	Addressed in specialist report (see section 3, Figure 4)
54	Where required, a written comment or letter of no objection from the South African Heritage Resources Agency and/or applicable provincial heritage authority confirming that there is no unacceptable impact on heritage resources and palaeontology;	Addressed in specialist report (see section 4)
55	Confirmation that any recommendations as required by the South African Heritage Resources Agency and/or applicable provincial heritage authority have been incorporated and considered;	These are to be incorporated once/if received.
56	A description on how the identified environmental sensitivity pertaining to heritage resources and palaeontology has been considered in determining the proposed route;	Addressed in specialist report (see section 2)
57	A description of the implementation of the mitigation hierarchy in order to determine the proposed route and/or substation location;	See Table 1
58	How the inputs of I&APs were considered when determining the final pre-negotiated route and/or substation location; and	To be updated post Public Participation Process.

Standard No.	Requirement	Comment
59	A statement confirming that: a. impact management actions as contained in the pre-approved Generic EMPr template are sufficient for the avoidance, management and mitigation of impacts and risks; or b. where required, specific impact management outcomes and actions are required and have been provided as part of the site specific EMPr.	c. A chance find protocol has been added to the EMPr d. Confirmed