Palaeontological Impact Assessment for the proposed Manyeding-Mothibistad 22 kV power lines, east of Kuruman, Northern Cape Province

Site Visit (Phase 2) Report

For

Eskom

30 October 2021

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by 1World Consultants, Durban, 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:

Executive Summary

A site visit (phase 2) palaeontological impact assessment was requested by SAHRA (Case ID: 16496) for the proposed Manyeding Mothibistad 22 kV powerline. The proposed powerline length is 9,671 km, in the Kuruman area, Ga-Segonyana Local Municipality, Northern Cape Province.

Eskom has submitted an application in terms of section 38(1) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) for a proposed 22kv powerline to be constructed from West Derby to Mothibistad in the Northern Cape Province. The proposed powerline will have a section adjacent to the N14 and another section through undisturbed areas along a water course. The proposed development is located in an area of low and very high palaeontological sensitivity as per the SAHRIS Palaeosensitivity map.

The site visit was carried out in October 2021. The proposed route lies on previously disturbed land alongside the Thlabane Road (N14 to Mothibistad), parts of the N14 highway and in the towns. The sections of these routes that lie on dolomites, cherts and limestones of the Campbellrand Subgroup (Ghaap Group, Transvaal Supergroup) that could preserve trace fossils of algal colonies, stromatolites were surveyed. From the site visit and walk through there was only one surface exposure of stromatolites, but not in the project footprint. It is unknown what lies below the soils, but it would only be stromatolites or dolomite. Therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that if stromatolites are disturbed once excavations for pole foundations have commenced, they should be put aside and left on site. They should not be removed more than a few metres. No further palaeontological site visit is required and, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

1. Background

Eskom has submitted an application in terms of section 38(1) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) for a proposed 22kv powerline to be constructed from West Derby to Mothibistad in the Northern Cape Province. The proposed powerline will have a section adjacent to the N14 and another section through undisturbed areas along a water course. The proposed development is located in an area of low and very high palaeontological sensitivity as per the SAHRIS Palaeosensitivity map.

A site visit (phase 2) palaeontological impact assessment was requested by SAHRA (Case ID: 16496) for the proposed Manyeding Mothibistad 22 kV powerline. The proposed powerline length is 9,671 km, in the Kuruman area, Ga-Segonyana Local Municipality, Northern Cape Province.

A Palaeontological Impact Assessment is required for the powerline project because the proposed route lies on very highly sensitive rocks according to the SAHRIS palaeosensitivity map. In order 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 site visit and survey (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed project and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	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
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Page 1
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A for fossils
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2

f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	Section 6
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;	Sections 1, 6
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, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	Section 8
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Sectioned 6
nii	If the opinion is that the proposed activity 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	Section 6
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 if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

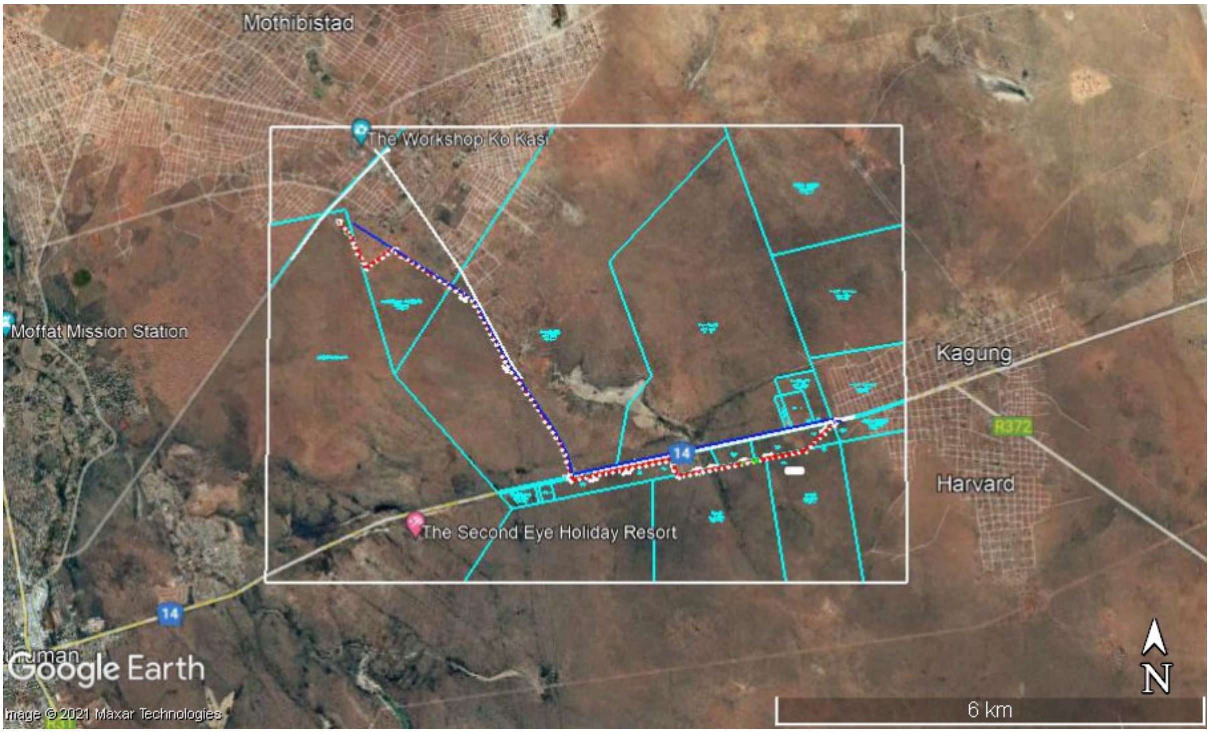

Figure 1: Google Earth map of the proposed Manyeding-Mothibistad 22 kV powerlines shown by the blue lines. Map supplied by Eskom.

2. 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 (as reported herein, and collect or rescue fossils if required);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*as indicated in section 4 below)*; and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a just a representative sample collected and housed in a recognised repository.

3. Geology and Palaeontology

i. Project location and geological context

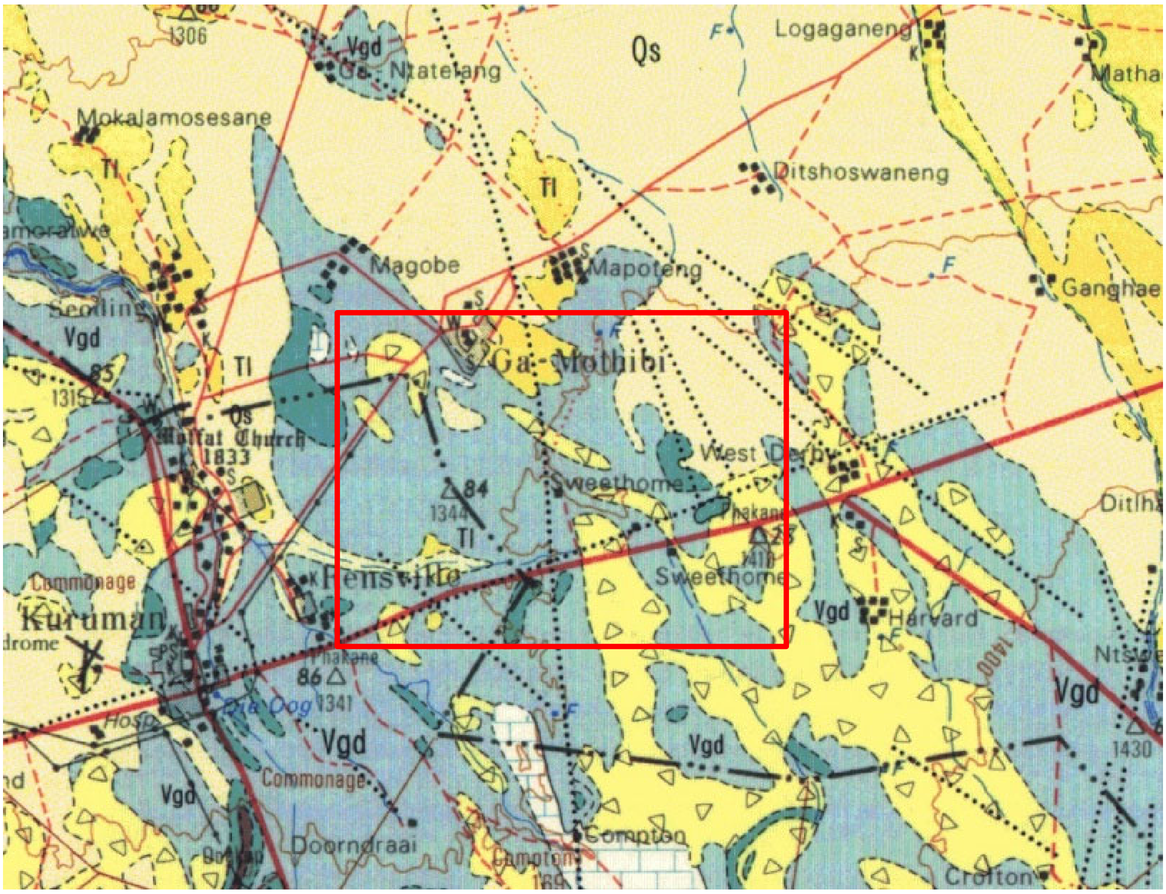

Figure 2: Geological map of the area around the Manyeding-Mothibistad project. The location of the proposed project is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2722 Kuruman.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Johnson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Group/Formation	Lithology	Approximate Age
Quaternary sand	Aeolian sand	Neogene, ca 2.5 Ma to present
Quaternary sand	Aeolian sand, with gravelly areas (triangles)	Neogene, ca 2.5 Ma to present
Tertiary limestone	Limestone	Tertiary, last 60 Ma
Cambellrand Subgroup, Ghaap Group, Transvaal SG	Banded iron formation and manganese formation at top; limestone and dolomite	Ca 2590 – 2500 Ma

The Late Archaean to early Proterozoic **Transvaal Supergroup** is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

The Monteville Formation of the Campbell Rand Subgroup in the Ghaap Plateau Sub-basin overlies the Clearwater Formation and is composed of up to 200m thickness of stromatolitic domes, then microbial laminites (laminated stromatolitic carbonate rocks)with fenestrae and carbonate argillites, all with intercalated shales and siltstones (Eriksson et al., 2006).

The Neoarchean shallow marine Campbellrand-Malmani carbonate platform (CMCP) represents the lower Transvaal Supergroup and was deposited between ~2.58 and 2.50 Ga (Sumner and Beukes, 2006) on the Kaapvaal Craton in southern Africa (Fig. 1a). The Malmani Subgroup mainly consists of peritidal dolomitic stromatolites, which show varying degrees of silicification and are interbedded with siliciclastic mudrock layers. The Campbellrand Subgroup shows stromatolitic structures reflecting shallow subtidal depositional conditions.

Unconformably overlying the Transvaal Supergroup rocks are **Quaternary** aged sands of the Kalahari Group. Other sands in the region are younger and are windblown from areas farther to the northwest. The Quaternary Kalahari sands form an extensive cover of much younger deposits over much of the Northern Cape Province and Botswana.

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, 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).

Tertiary calcretes cover large parts of the Northern Cape but they are difficult to date and there are several schools of thought (see Partridge et al., 2006). Nonetheless, it is accepted that calcretes form under alternating cycles humid and arid climatic conditions in strata that have calcium carbonate (Netterberg, 1969). More recent research using geophysical techniques to measure uplift of the continent during the Cretaceous and tertiary, combined with the fossil record (Braun et al., 2014) suggest that there were two predominant humid periods during the Tertiary. The whole of the Eocene (56-33 Ma) and a short period during the early Miocene (ca 20-19 Ma) were humid according to their estimation. It is possible that the Northern Cape calcretes formed during one of these periods.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The site for development is in the Griqualand West Basin of the Transvaal Supergroup so the very highly sensitive rocks (red) are those of the Campbellrand Subgroup. Tertiary limestones are indicated as highly sensitive (orange) and moderately sensitive rocks (green) are those of the Quaternary (Kalahari) aeolian sands.

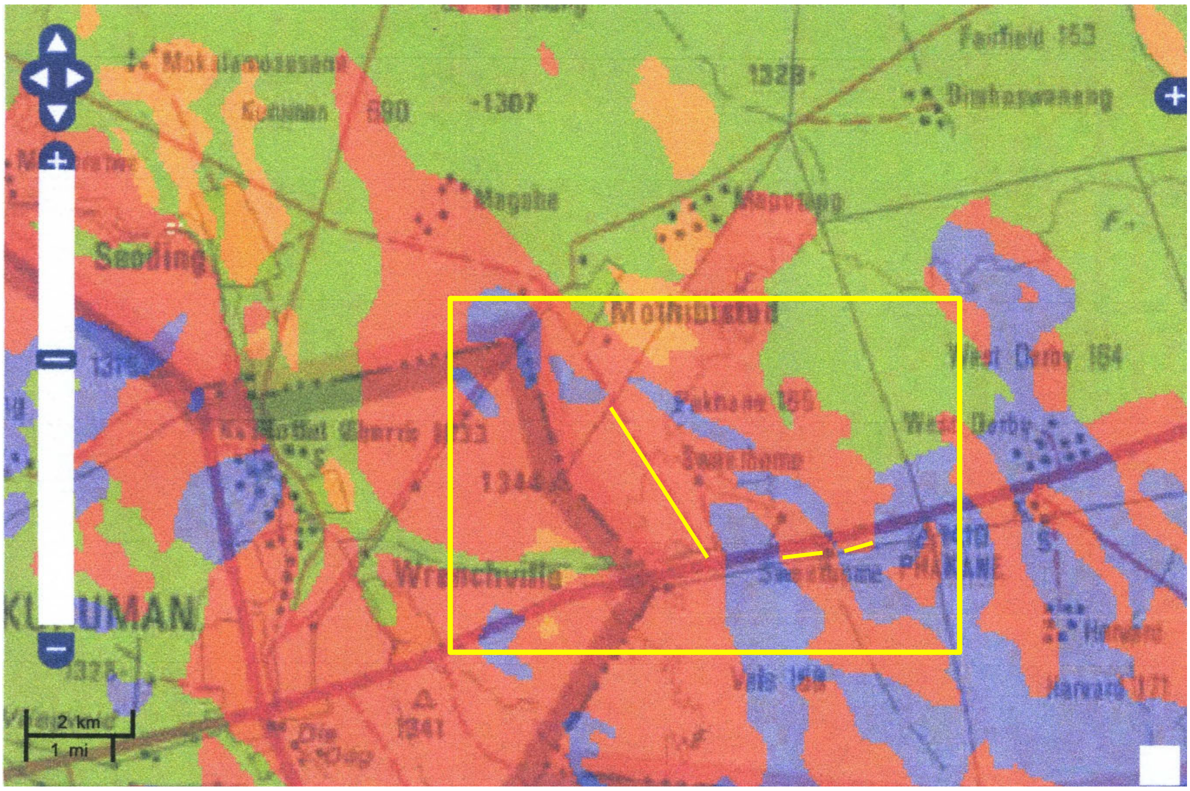

Figure 3: SAHRIS palaeosensitivity map for the site for the proposed Manyeding-Mothibistad power lines shown within the yellow rectangle. Powerline routes that required a site walk through are shown by the lighter-weight yellow lines. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The Campbellrand Subgroup is divided into 6-8 formations depending on the authors. Nonetheless, apart from the banded iron formation of the Kamden Formation/Member, the rest of the subgroup is composed of carbonate platform deposits in the form of dolomites, cherts, stromatolites or stromatolitic dolomites.

Stromatolites are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.

Iii **Site visit observations**

A site visit and survey of the project area was completed and the route sections that occur on very highly sensitive rocks (light-weight yellow lies in Figure 3) were walked. Photographs and observations with reference to photographs are presented in Table 3. Photographs in Figures 4-5 were taken by Dr Jaco van der Walt.

Table 3: Site visit observations (refer to Figure 3) and relevant site photographs as indicated.

Route	Observations	Figure
Thlabane road from N14 towards Mothibistad	Generally flat topography, thin vegetation cover, no rocks and no rocky outcrops. No fossils or trace fossils	4A-D
Along N14 highway – western red section (Fig 3)	Generally flat topography, thin vegetation cover, no rocks and no rocky outcrops. No fossils or trace fossils. Existing substation	5A, B
Along N14 – eastern red section (Fig 3)	Generally flat topography, thin vegetation cover, no rocks and no rocky outcrops. No fossils or trace fossils	5C
Near N14	Stromatolite seen in surface section, note concentric circles. Found and photographed but is not in the project footprint.	5D

Figure 4: Site photographs for the Manyideng-Mothibistad powerlines. A-B along Thlabane Road. C-D along N14, western section.

Figure 5: Site photographs for the Manyideng-Mothibistad powerlines. Views along the N14 section of the powerline route.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 4:

TABLE 4A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 4B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Sands and soils do not preserve fossils. Dolomites of the Campbellrand Subgroup could preserve traces fossils such as stromatolites; so far there are no records of fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be trace fossils such as stromatolites in the dolomites, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	-
	M	-
	L	It is extremely unlikely that any fossils would be found in the loose sand and soils that will be excavated for pole foundations. Nonetheless, a Fossil Chance Find Protocol should be added to the eventual EMPr.

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 the correct age and type to contain fossils, namely the dolomites of the Campbellrand Subgroup. Much of the area is covered by souls and thin vegetation. Since there is a small chance that trace fossils such as stromatolites may occur below the soils and 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.

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 some of the dolomites might contain trace fossils such as stromatolites. No stromatolites were seen in the proposed powerline route but it is not known what lies beneath the soil covering. The aeolian sands of the Quaternary period would not preserve fossils unless there were pans or springs.

6. Recommendation

Based on the site visit walk through, experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. NO FOSSILS were found in the proposed powerline routes. One stromatolite exposure was seen but not on the route. There is a very small chance that fossil stromatolites might occur beneath the soils but this will not be evident until excavations for the pole foundations have commenced. If stromatolites are discovered during excavations, it is recommended that they be put aside, near their original place, and not removed from the site. Removal will require a relevant SAHRA permit. Stromatolites are of very limited interest and no institution has the space to house more stromatolites. If their occurrence is recorded on GPS, then the stromatolites can be relocated in the future should any researcher want to collect and study them. As far as the palaeontology is concerned, the project can be authorised.

7. References

Beukes, N.J., 1987. Facies relations, depositional environments and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbellrand Subgroup, Transvaal Supergroup, southern Africa. Sedimentary Geology 54, 1-46.

Eriksson, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. 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 237-260.

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

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.

Netterberg, F., 1969. The interpretation of some basic calcrete types. South African Archaeology Bulletin 24, 117-122.

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.

Sumner, D.Y., Beukes, N.J., 2006. Sequence stratigraphic development of the Neoarchean Transvaal carbonate platform, Kaapvaal Craton, South Africa. S. Afr. J. Geol. 109, 11–22.

Zeh, A., Wilson, A.H., Gerdes, A., 2020. Zircon U-Pb-Hf isotope systematics of Transvaal Supergroup – Constraints for the geodynamic evolution of the Kaapvaal Craton and its hinterland between 2.65 and 2.06 Ga. Precambrian Research 345, 105760. https://doi.org/10.1016/j.precamres.2020.105760

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 excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (stromatolites) should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants 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 it must be put aside, near the site of its origin, the GPS recorded. The stromatolites should be removed any distance as this would require a SAHRA permit.
6. Fossil stromatolites can be viewed or studied at a later date by any bona fide researcher.
7. A list of stromatolite sites should be given to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of stromatolites

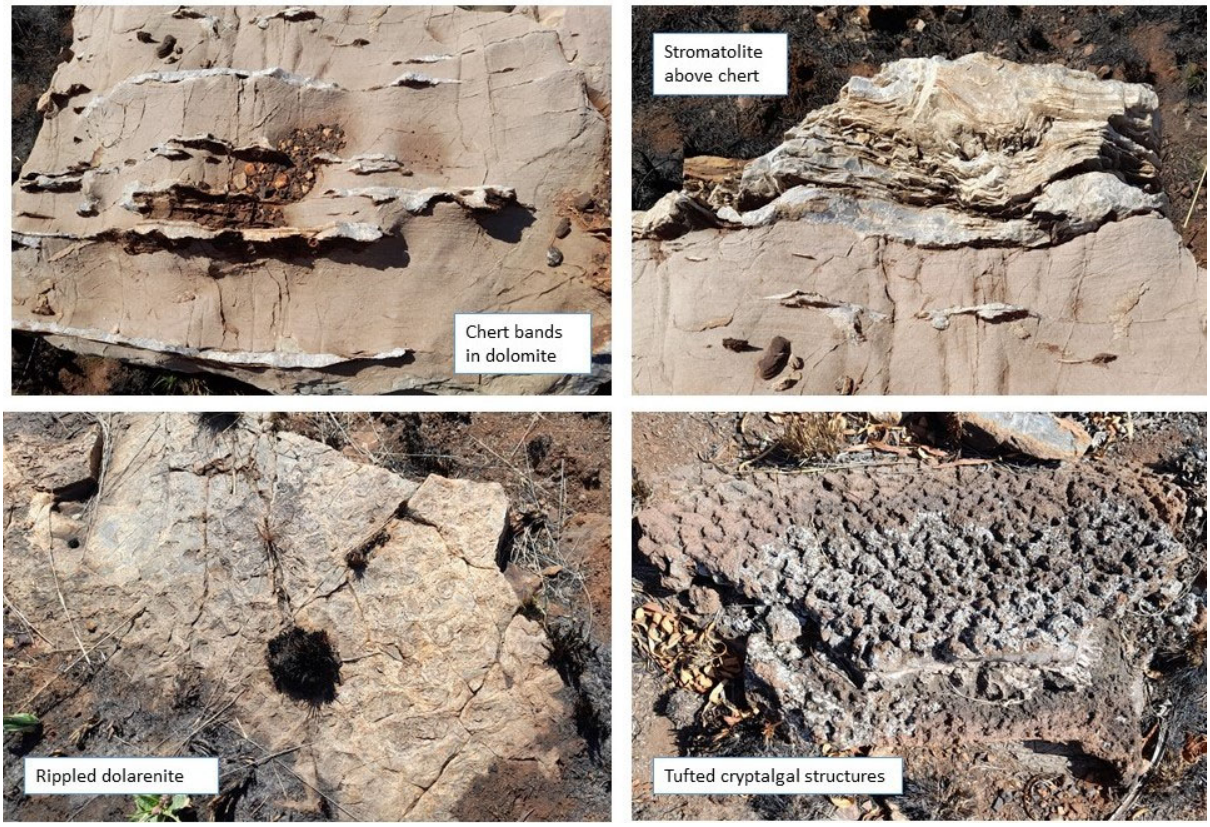

Figure 6: Dolomite and different forms of stromatolites

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
July 2021

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.

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	11	2
Masters	10	5
PhD	11	4
Postdoctoral fellows	10	4

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 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 –
Cretaceous Research: 2014 –

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting

- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- 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

xi) Research Output

Publications by M K Bamford up to July 2021 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 29; Google scholar h index = 36;
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)