Palaeontological Impact Assessment for the proposed Kudu – Elders power line from Komati Kudu Substation to Elders Substation (new), Mpumalanga Province

Site Visit Report (Phase 2)

For

Beyond Heritage

21 August 2022

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 33 years research; 25 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Beyond Heritage, Modimolle, 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 Palaeontological Impact Assessment was requested for the proposed powerline from the existing Kudu Substation near Komati to the proposed new substation farther south, the Elders Substation, Mpumalanga. This approximately 26 km long overhead power line is part of the Eskom Self Build policy.

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 (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed route lies mostly along the existing powerline but the southern part is along farm boundaries. In the northern section is in the Vryheid Formation shales (Ecca Group, Karoo Supergroup) that could have fossil plants of the Glossopteris flora. The southern section is on non-fossiliferous rocks of the Selons River Formation (Rooiberg Group). The site visit and walk through in July - August 2022 confirmed that the route is either currently under cultivation or on fallow fields or cleared land. The vegetation is thick and on deep soils and some areas are waterlogged so have become inaccessible. There were no potentially fossiliferous rocky outcrops and NO FOSSILS were seen on th eland surface. Nonetheless, because some parts were not visible, 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, developer, environmental officer or other designated responsible person once excavations for pole foundations or infrastructure have commenced. Since the impact will be low to moderate, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

1. Background

Setala Environmental has been appointed as the independent environmental assessment practitioner (EAP) to apply for Environmental Authorisation (EA) for the construction of a ± 26km overhead line between Kudu Substation and the Proposed Elders substation as well as for the construction of Elders substation. The applicant is Eskom Holdings SOC LTD.

An application for authorisation of the project is submitted to the National Department of Forestry, Fisheries and the Environment (DFFE), in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations of 2017.

The proposed project is a listed activity in terms of Sections 24(2) and 24(d) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (as amended). The Environmental Impact Assessment (EIA) Regulations, 2017 promulgated in terms of Chapter 5 of the NEMA provide for the control of certain activities that are listed in Government Notice Regulation (GN R.) No. 327, 325 and 324. Activities listed in these notices must comply with the regulatory requirements listed in GN R. 326, which prohibits such activities until written Authorisation is obtained from the Competent Authority. Such Environmental Authorisation (EA), which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations of 2017. GN R. No. 326 sets out the procedure and documentation that need to be compiled with undertaking a Basic Assessment Process.

WHERE IS THE PROJECT LOCATED?

The proposed project is located ± 34kms to the south east of Emalahleni and ± 24km north of Bethal. The project is proposed on Komati 56-IS Remainder; Goedehoop 46-IS R/3, Portions 8, 2, Re, 4; Kleinfontein 49-IS Portions 10, 4, 12, 8; Middelkraal 50-IS 15, R/3, 8 in the jurisdiction of Steve Tshwete Local Municipality (Nkangala DM) and Govan Mbeki Local Municipality (Gert Sibande DM), Mpumalanga Province. Eskom has an existing servitude for approximately half of the route. (The final power line route alignment to be confirmed).

Under the Eskom Self-Build Policy, this application is for the supply of bulk electricity. The proposed infrastructure, the overhead powerline and the substation will remain Eskom's property. A section of the proposed power line route has been authorised on 24 October 2011, Ref DEAT/EIA/0000159/2011 and Eskom holds a servitude on this portion of the route. Subsequently, an amendment to the above project was authorised on 02 October 2014. DEA Ref 12/12/20/2144. The amendment addressed the alignment of the power line route. The mentioned existing Eskom servitude constitutes approximately half of the current proposed/ preferred route.

The current Application for Authorisation is for the construction of the following:

- Construct a ± 26km Kingbird overhead 132kV line outside an urban area from Kudu Substation (at Komati Power Station) to the proposed Elders substation.

- Construct 2 x 20MVA 132/11kV Elders Substation.
- Clearance of an area of 1 hectares for the Elders Substation site.
- Construct Power line structures/ stayed monopole steel poles within 32 meters of a waterbody along the 132kV feeder line and excavate more than 10 cubic metres of soil and rock from a watercourse.
- Construct masts or towers for telecommunication broadcasting or radio transmission purposes where the mast or tower is to be placed on a site not previously used for this purpose; and will exceed 15 metres in height.
- Develop access roads of wider than 4 metres to construct the power line .
- Clear more than 300 square metres of indigenous vegetation to construct a temporary laydown area.

A Palaeontological Impact Assessment was requested for the proposed Kudu-Elders power line project. 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 walkthrough (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: 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).

	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	Yes
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
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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
g	An identification of any areas to be avoided, including buffers	none
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;	Section 3
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	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	Sections 7, 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	Section 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	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

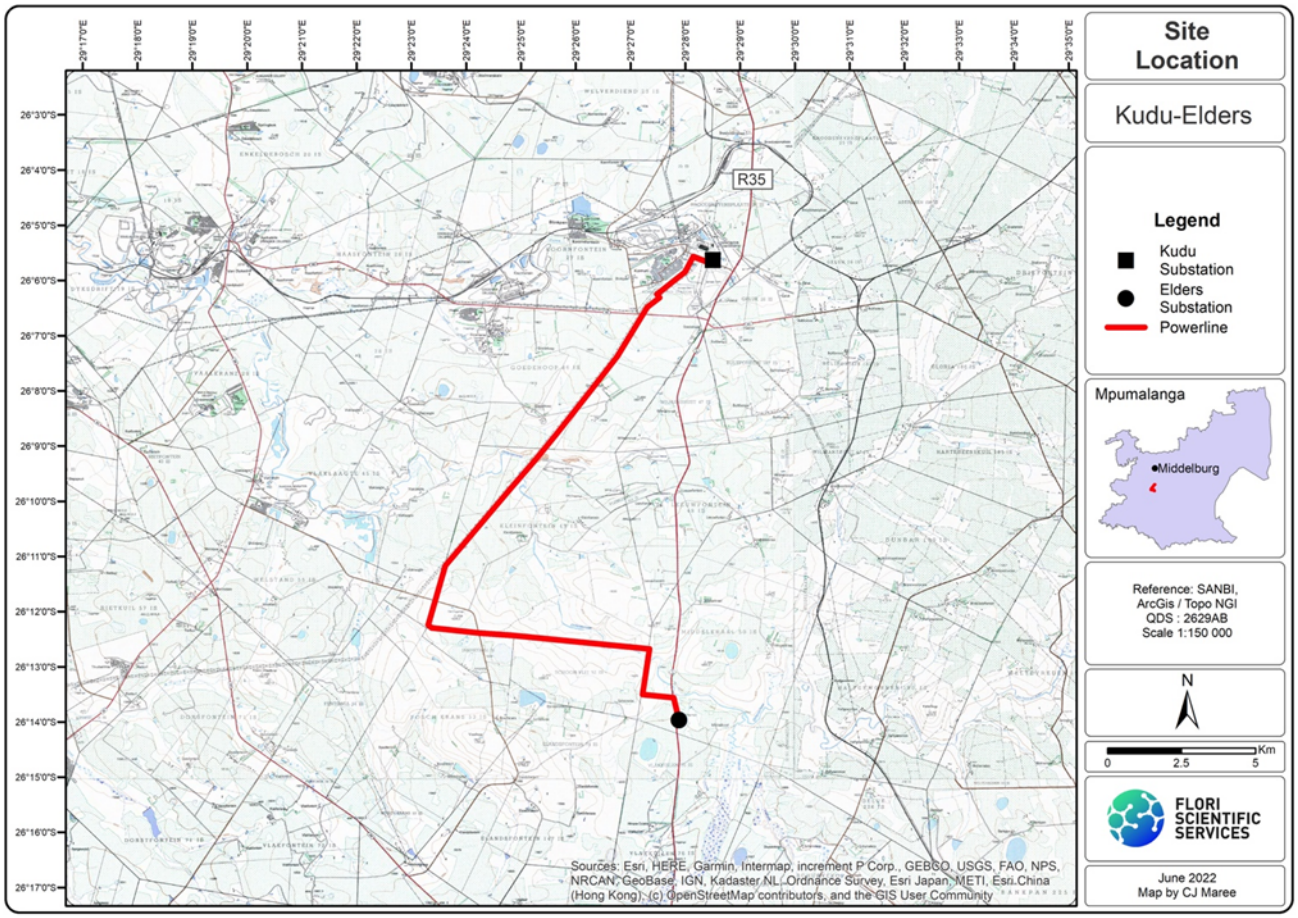

Figure 1: Topographic map with the proposed powerline route indicated by the red line. Northern black square is the existing Kudu Substation at Komati. Southern black circle is the proposed new Elders substation. Map provided by Setala Environmental.

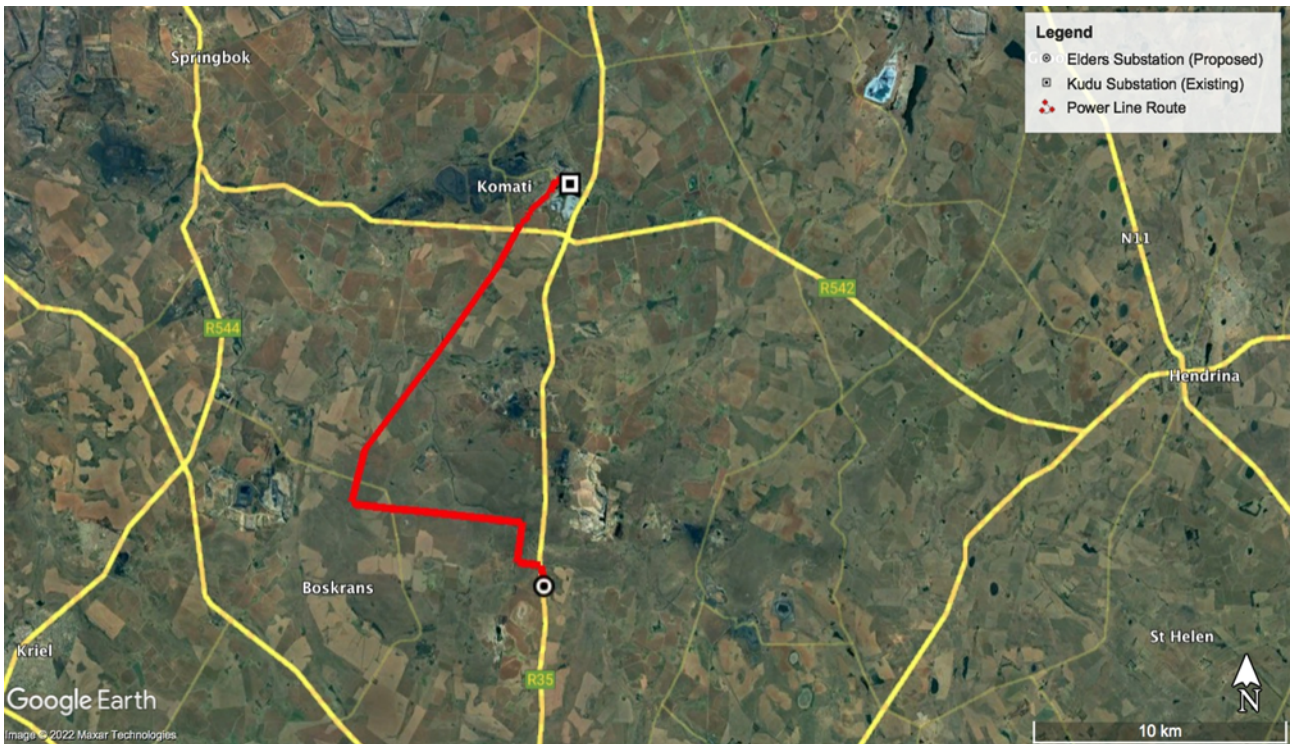

Figure 2: Google Earth map for the proposed powerline route from Kudu Substation to the prosed new Elders Substation (south).

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 is the case here;
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*).

3. Geology and Palaeontology

i. Project location and geological context

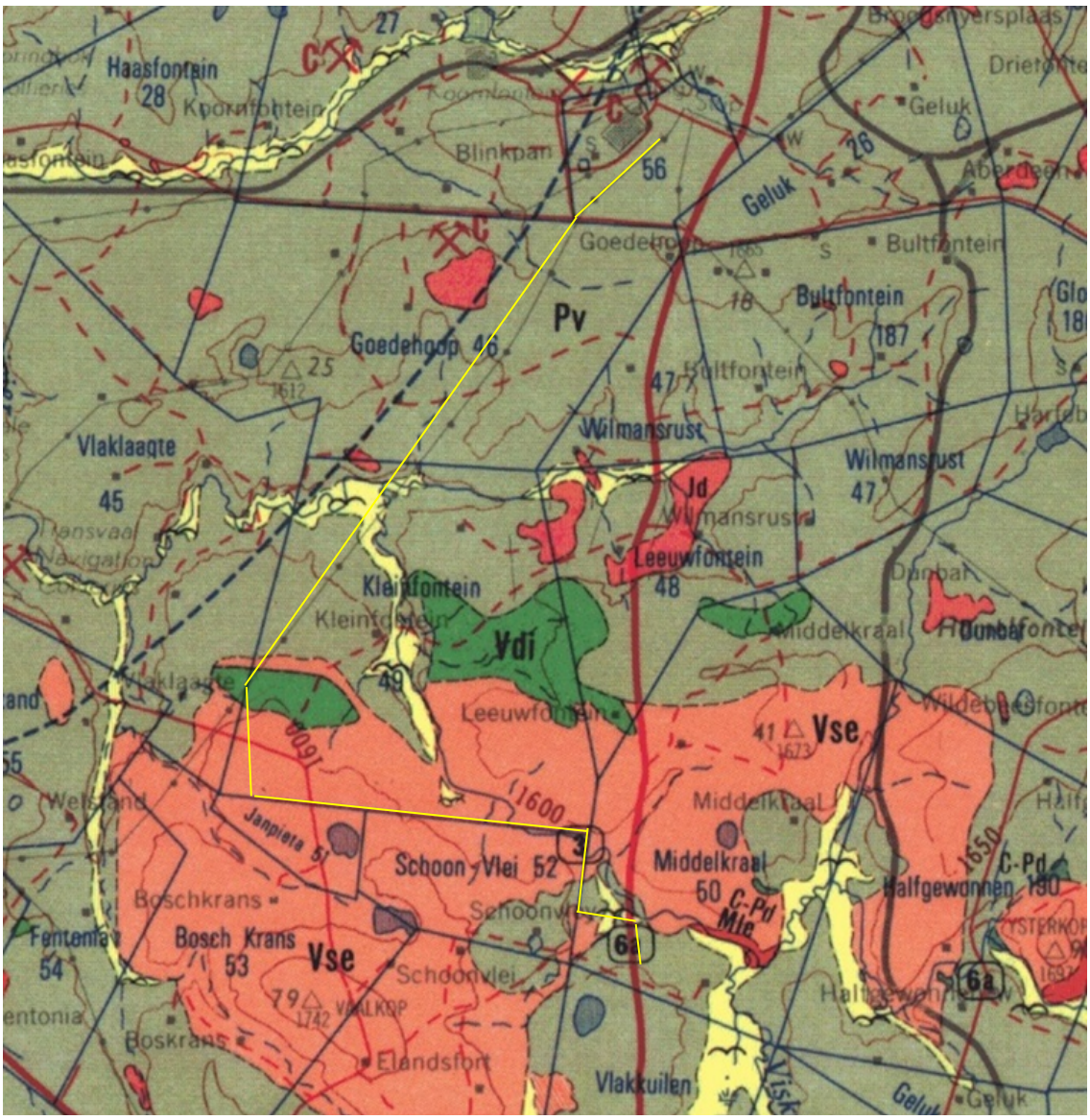

Figure 3: Geological map of the area around the proposed Kudu-Elders powerline route. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Buchanan, 2006; Johnson et al., 2006; Zeh et al., 2020). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
(white)	Recent	Alluvium and debris	Last few millenia
Qc	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm, Ecca Group, Karoo SG	Sandstone, shale, siltstone, coal seams	Early Permian
Vdi	Diabase	Intrusive volcanic rocks	Palaeoproterozoic

Symbol	Group/Formation	Lithology	Approximate Age
Vse	Selons River Fm, (now Schrikkloof Fm), Rooiberg Group	Flow-banded rhyolite, quartzitic lenses; felsic lava	Palaeoproterozoic 2056 Ma

The site lies in the northeastern part of the Karoo basin where the lower Karoo Supergroup strata are exposed. It is unconformably underlain by the volcanic rocks of the Rooiberg Group. Along the rivers and streams much young reworked sands and alluvium overly the older strata.

According more recent publications the Rooiberg Group is divided into four formations based on the proportions of various volcanic rocks that are present (Buchanan, 2006) with the upper Selons River Formation now called the Kwaggasnek and Sckhrikkloof Formations. Dated at 2056 Ma (Zeh et al., 2020) these volcanic rocks do not preserve any fossils.

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks 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 (Visser, 1986, 1989; Isbell et al., 2012). These are the oldest rocks in the system and are are known as the Dwyka Group. (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 central and east part are the following formations, from 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 and the Stormberg Group that complete the Karoo sequence. They are not present in this part of the basin. Large exposures of Jurassic dolerite dykes occur throughout the area but more to the south. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption (Johnson et al., 2006).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Vryheid Formation and non-fossiliferous volcanic rocks of the Rooiberg Group.

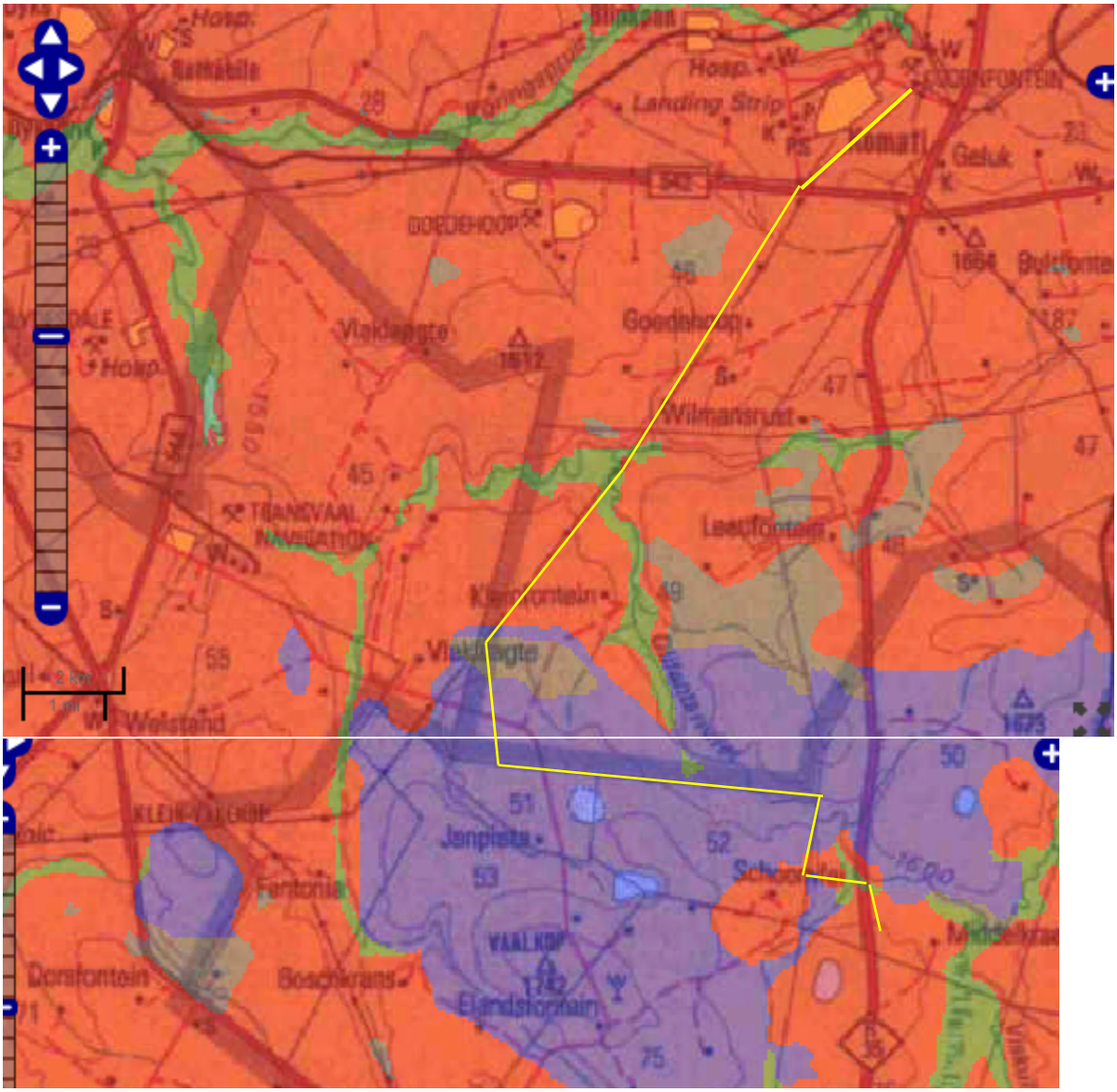

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Kudu-Elders powerline shown by the yellow line. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

Volcanic rocks do not preserve fossils, only sedimentary rocks might preserve fossils if there were organisms present at the time of their deposition. At the time of deposition of the Vryheid Formation there were extensive deltas and floodplains with vegetation growing on the banks and in the flooded areas, or swamps. Overtime these became peats and were buried in the sediments that gradually filled the Karoo inland sea. With increased pressure from the overburden and increased geothermal temperatures, the peats were altered over time to form coal seams. These coal seams of varying thickness, depth and extent are exploited today for coal.

The coal itself does not preserve any recognisable plant material because the organic matter has been compressed, devolatilised and altered, however, in the carbonaceous shales or siltstones between coal seams it is possible to find impressions or compressions

of the plants that originally formed the peats (Plumstead, 1969). The extinct seed fern glossopteris was the dominant plant in all Gondwana floras. It was a deciduous shrub to large tree with long tongue-shaped leaves. Other woody plants growing in the swamps were the cordaitaleans, a groups of extinct early gymnosperms (Plumstead, 1969; Gastaldo et al., 2020). Many other plants made up this rich flora including lycopods, sphenophytes, ferns, mosses and early gymnosperms, as well as a variety of plants known only from their spores.

No vertebrates are known to occur with the *Glossopteris* flora because different conditions are required for the preservation of plants and animals. In general, plants require a reducing environment such as burial in an anoxic mud, while bones can survive exposure and an oxidising environment (Cowan, 1995). Moreover, in the Early Permian there were very few vertebrates but fish and invertebrates were present. In some depositional environments it is possible to find fish bones and traces of the invertebrates in the form of burrows and trackways (Cowan, 1995).

Although when present, the plants of the *Glossopteris* flora are abundant, but their distribution is difficult to predict (Kovacs-Endrody, 1976, 1991). This has resulted in known sites being well studied while the greater distribution remains unknown.

iii. Site visit observations

The powerline route from Kudu Substation near Komati, south-westwards along the existing powerline was surveyed for parts of its route where accessible. Less attention was given to the non-fossiliferous southern section except for the southernmost part that is “new” for the infrastructure (see figures 1-4). All photographs are courtesy of Jaco van de Walt.

The northern section alongside the existing powerline from Kudu Substation to the first deviation is on flat land that has been cleared for the powerline servitude or is ploughed for agriculture (Figures 5-7). In rare sections the powerline goes through grasslands (Figure 8) and other sections are along ploughed fields (Figure 9).

The west-east deviation is on the Rooiberg Group volcanic rocks so was not surveyed in detail for fossils but was checked (blue in Figure 4). This includes the various crossings over the Olifants River (Figures 10-11). The southern-most section near the proposed Elders Substation is on cleared land (previously used for agriculture or grazing) that has been flooded so was not accessible (Figure 12). Surface water would destroy any fossils in previously dry shales so even if they were present they would be of minimal scientific value.

Figure 5: near Komati SS, existing powerline over cleared fields and with servitude. Photo credit for all: JvdW

Figure 6: farther southwest along powerline with overgrown servitude.

Figure 7: burned grassland shows no rocky outcrops and no potential fossils

Figure 8: densely vegetated grassland alongside small road, no rocky outcrops and no fossils.

Figure 9: ploughed field below powerline. No rocky outcrops and no fossils present

Figure 10: along one of the Olifants River crossings. Rocks are the felsic lavas of the Rooiberg Group so no fossils would be present.

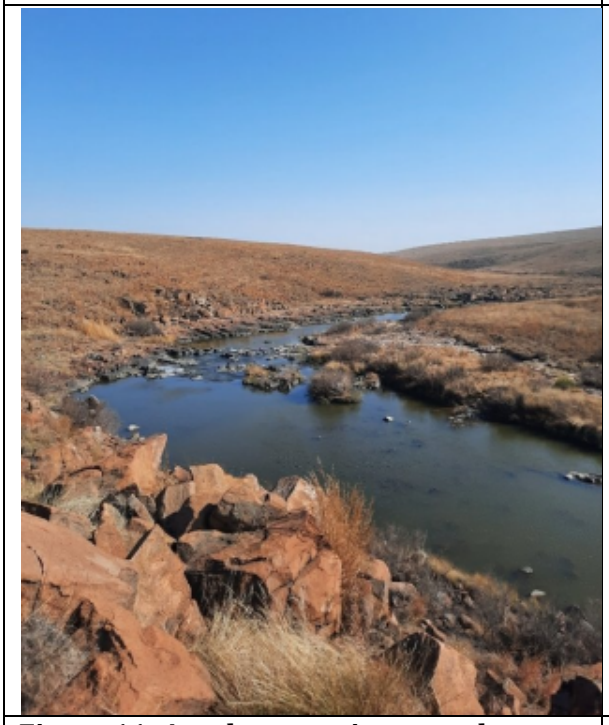

Figure 11: Another crossing over the Olifants River with non-fossiliferous volcanic rocks

Figure 12: southern section in the vicinity of the proposed Elders Substation. Grassland has been flooded so access was not possible. Nonetheless there were No potential rocky outcrops.

4. Impact assessment

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

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	Soils and volcanic rocks do not preserve plant fossils; so far there are no records from the Vryheid formation of plant or animal fossils exposed in this region so it is unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-

PART B: Assessment		
	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 fossil plants from the *Glossopteris* flora in the shales, 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 that will be excavated but fossils might occur below the surface in the Vryheid Fm. Therefore, 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 preserve fossils. The site visit and walk through confirmed that there were NO FOSSILS in the project footprint. Furthermore, the material to be excavated for foundations and this does not preserve fossils. Since there is an extremely small chance that fossils from the Vryheid Formation may occur below ground and 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.

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 do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through in July and August confirmed that there are NO FOSSILS visible on the surface along the existing powerline and proposed new powerline routes. The sands and soils of the Quaternary period would not preserve fossils.

6. Recommendation

Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS of the *Glossopteris* flora visible on the surface even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the

Vryheid Formation, but not in the Rooiberg Group felsic lavas. Therefore, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the contractor, environmental officer, or other responsible person once excavations and drilling have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample.

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.

Buchanan, B.C., 2006. The Rooiberg Group. 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 283 – 289.

Gastaldo, R.A., Bamford, M., Calder, J., DiMichele, W.A., Ianuzzi, R., Jasper, A., Kerp, H., McLoughlin, S., Opluštil, S., Pfefferkorn, H.W., Roessler, R., and Wang, J., 2020, The non-analog vegetation of the Late Paleozoic icehouse–hothouse and their coal-forming forested environments: in Martinetto, E. Tschopp, E., and Gastaldo, R.A., (eds), Nature Through Time: Springer Nature Switzerland, Cham, Switzerland, p. 291-316. ISBN 978-3-030-35057-4.
https://doi.org/10.1007/978-3-030-35058-1

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.

Kovacs-Endrody, E., 1976. Notes on some Glossopteris species from Hammanskraal (Transvaal). Palaeontologia africana 19, 67-95.

Kovacs-Endrody, E. 1991. On the Late Permian age of Ecca Glossopteris floras in the Transvaal Province with a key to and descriptions of twenty five Glossopteris species. Memoir of the Geological Survey of South Africa, 77, 111pp.

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 drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) 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 13). 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 Vryheid Formation

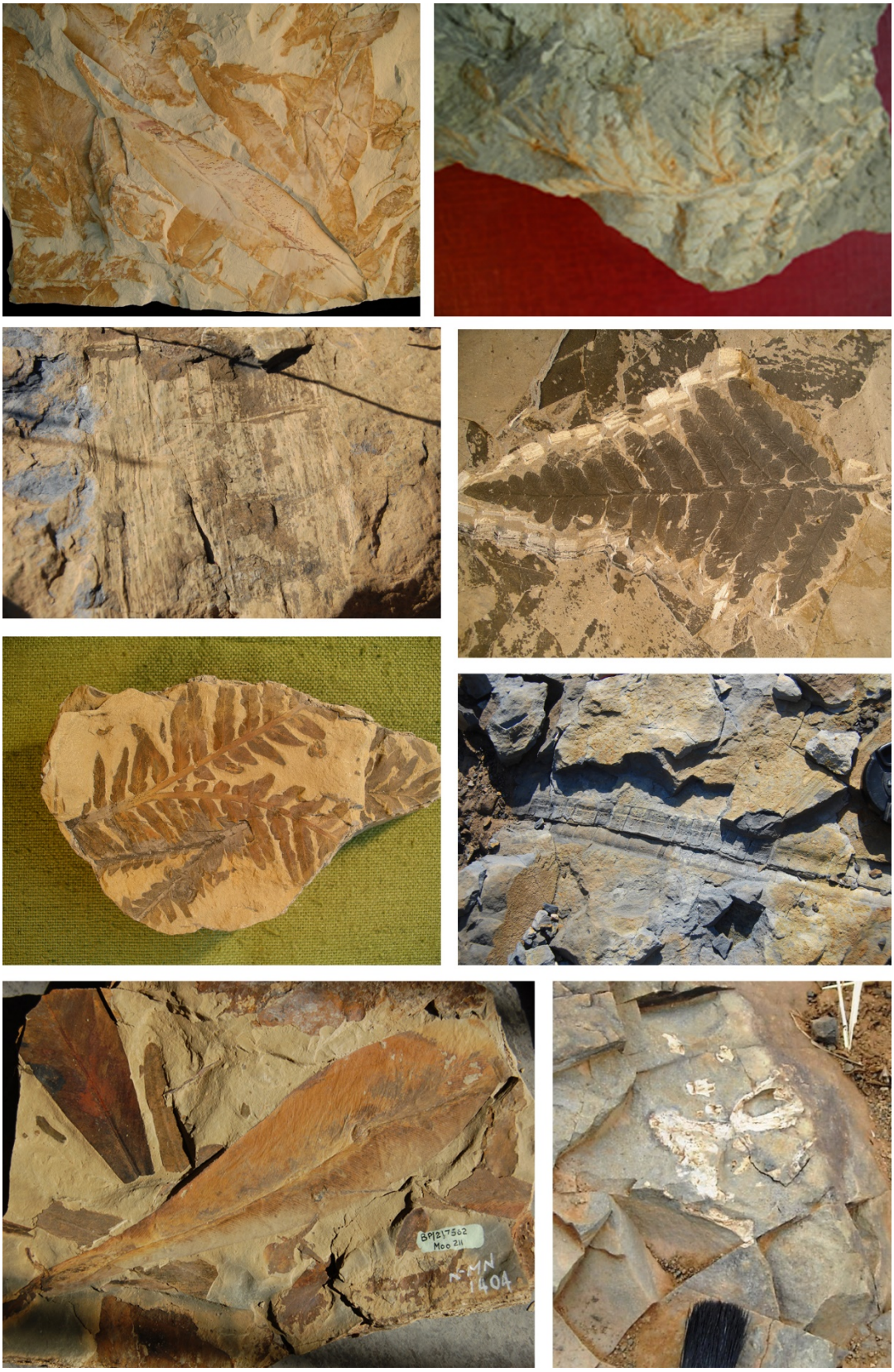

Figure 13: Photographs of plants of the *Glossopteris* flora. Bottom left is an example of fossil bones partially exposed in the field.

10. Appendix B – Details of specialists

Marion Bamford (PhD)

Short CV for PIAs – Jan 2022

I) **Personal details**

Present employment: Professor; Director of the Evolutionary Studies Institute. Member of the Management Committee of the NRF/DST Centre of Excellence in Palaeosciences, University of the Witwatersrand,
Johannesburg, South Africa

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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	0
Masters	14	1
PhD	11	6
Postdoctoral fellows	12	2

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 12 - 20 students per year.

ix) **Editing and reviewing**
Editor: Palaeontologia africana: 2003 to 2013; 2014 – present: Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Associate Editor: Cretaceous Research: 2018-2020
Associate Editor: Royal Society Open: 2021 -
Review of manuscripts for ISI-listed journals: 25 local and international journals

x) **Palaeontological Impact Assessments**

Selected from recent project 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
- Glosam Mine 2021 for AHSA

Xi) **Research Output**
Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 160 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 30; Google Scholar h-index = 36; -i10-index = 95
Conferences: numerous presentations at local and international conferences.