Palaeontological Impact Assessment for the proposed Merensky-Uchoba 132kV powerline deviation, Limpopo Province

Desktop Study (Phase 1)

For

Archaetnos

11 January 2022

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Checklist of required items in the Heritage report for Electricity Grid Infrastructure

	Requirement	Page / Section
a	An EMPr template	Table i; see also Section 8, Appendix A
b	A confirming statement	Table ii
c	Specialist Declaration of Independence ;	Table iii
d	Confirmation that the environmental sensitivity is low or medium per the sensitivity identified by the screening tool	**Palaeontological Sensitivity is LOW** Sections 3, 4
e	Method for how the mitigation hierarchy was implemented for the theme;	Sections 2, 4
f	Statement on whether identified route is considered to be optimal based on the specialist confirmation of low or medium environmental sensitivity and walkthrough	Desktop study – site has low/medium sensitivity Route/substation is optimal Walkthrough – not required by SAHRA / completed and no fossils found/some fossils found

Table i: Generic Environmental Management programme (EMPr) template as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and amended for Substations and Powerlines (Government Gazette No: 42323, March 2019).

GENERIC EMPr TEMPLATE	
Implementation	
Responsible person	Environmental Control Officer (ECO) or other person designated by the Competent Authority (CA)
Method	Check the rocks being excavated for fossil plant impressions or bones. Photographs of typical fossils are included in Appendix A.
Timeframe	When excavations commence
Monitoring	
Responsible person	Environmental Control Officer (ECO) or other person designated by the Competent Authority (CA)
Frequency	Once when the excavations are in progress only
Evidence of compliance	Photographs of excavated material; written statement

Confirming Statement by Palaeontology Specialist

The confirming statement must be prepared by suitably qualified specialist in the field of heritage resources (archaeology, marine and built environment) and palaeontology, and must contain, as a minimum, the following information:

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.	Sections 3, 4 Desktop study only required by SAHRA
52	Identification of heritage resources and palaeontological areas to be avoided within the *preliminary corridor*, including buffers;	Section 6 No no-go area and no buffer
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);	Screening tool palaeontology map – Figure 6. SAHRIS Palaeosensitivity Map – Figure 5. Low to zero sensitivity
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;	This report was submitted to SAHRA and their comment or letter of no objection will be included in the Final Environmental Sensitivity Report (ESR) which will be submitted to DFFE for decision making.
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;	Recommendations made by SAHRA will be incorporated into the Final ESR which will be submitted to DFFE for decision making
56	A description on how the identified environmental sensitivity pertaining to heritage resources and palaeontology has been considered in determining the proposed route;	The proposed route and 100m corridor have a Low palaeontological sensitivity and therefore does not impact on route planning. Further detail can be obtained in Section 3.

57	A description of the implementation of the mitigation hierarchy in order to determine the proposed route and/or substation location;	The mitigation hierarchy includes the following steps in the order of decreasing desirability: Avoid, Minimise, Rehabilitate, and Offset. In the case of this project, the following applies:
		• Avoid
		  ○ There are no high sensitive palaeontological areas that should be avoided.
		• Minimise
		  ○ Impact to possible palaeontological resources is minimised by the

		inclusion of the "Chance Find Procedure" into the EMPr. • Rehabilitate ○ Rehabilitation of palaeontological resources is not applicable to this project • Offset ○ Offsets are not applicable to this project
58	How the inputs of I&APs were considered when determining the *final pre-negotiated route* and/or substation location; and	This AIA is being distributed together with the Draft Environmental Sensitivity Report (ESR) for public comment. Should any input from the public / SAHRA change the content / outcome of this report, amendments will be made and submitted with the Final ESR. The Final ESR will be submitted to DFFE for decision making and registration of the project.
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.	The Eskom Generic EMPr is sufficient for the avoidance, management and mitigation of impacts and risks, however site specific mitigation measures should also be included in the EMPr. These mitigation measures are included under Section 8 and Appendix A and include a Fossil Chance Find Protocol as well as photographs of examples of fossils from the Quaternary sands that should accompany the Fossil Chance Find Protocol into the Site Specific EMPr.
	Specialist Details	Prof Marion Bamford PhD Palaeontology, Wits 1990 P O Box 652, WITS 2050 Johannesburg

APPENDIX D – SPECIALIST DECLARATION

Company Name	Marion Bamford Consulting		
Specialist Name	Prof Marion Bamford		
Specialist Qualifications	PhD Palaeontology (Wits, 1990)		
Specialist Affiliations/Registration	FRSSAf, mASSAf, PSSA (Palaeontological Society of southern Africa), SASQUA, IOP, IAWA		
Physical Address	24A Eighth Avenue, Parktown North, 2193		
Postal Address	P O Box 652, WITS		
Postal Code	2050	Cell:	082 555 6937
Telephone	011 717 6690	Fax:	--
Email	Marion.bamford@wits.ac.za ; marionbamford12@gmail.com		

DECLARATION BY THE SPECIALIST

I, __Marion 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:

___11 January 2023_____

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed deviation of the Merensky-Uchoba 132kV powerline, along the R555 road and the river valley, north of Steelpoort, Limpopo Province. The southern part of the deviation lies within the International Strategic Corridor (STC) and the whole route is within the National Electricity Grid Infrastructure (EGI) corridor.

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 routes lie on the Quaternary river sands and gravels that have a very low of preserving fossils because they reworked by the river flow and so the conditions are not conducive for preservation. The surrounding rocks of the Rustenburg Layered Suite are volcanic so do not preserve any fossils. Nonetheless, 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 have commenced. **Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised**.

Table of Contents

1. Background

Eskom is proposing to make some short deviations along the present Merensky-Uchoba 132 kV powerline that runs along the R555 in the river valley, north of the town of Steelpoort, Limpopo Province(Figures 1-2). This is a highly industrialised area with chrome mines and other platinum group elements being mined and refined. Retail and residential developments are also within this area.

The southern part of the proposed deviation lies within the International Strategic Development Infrastructure (STC) and the whole area is within the national Electricity Grid Infrastructure (EGI) corridor. In addition, according to the government screening tool, the route lies on rocks of moderate palaeosensitivity. Therefore, a desktop study is required according to the new Standard procedure outlined in Government Gazette No 42323 of March 2019 and developed for the Department of Forestry, Fisheries and Environment (DFFE) by the CSIR and collaborators (Appendix C).

A Palaeontological Impact Assessment was requested for the Merensky-Uchoba 132 kV line deviation 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 desktop 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 **Error! Bookmark not defined.**
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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
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	N/A
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
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	N/A
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

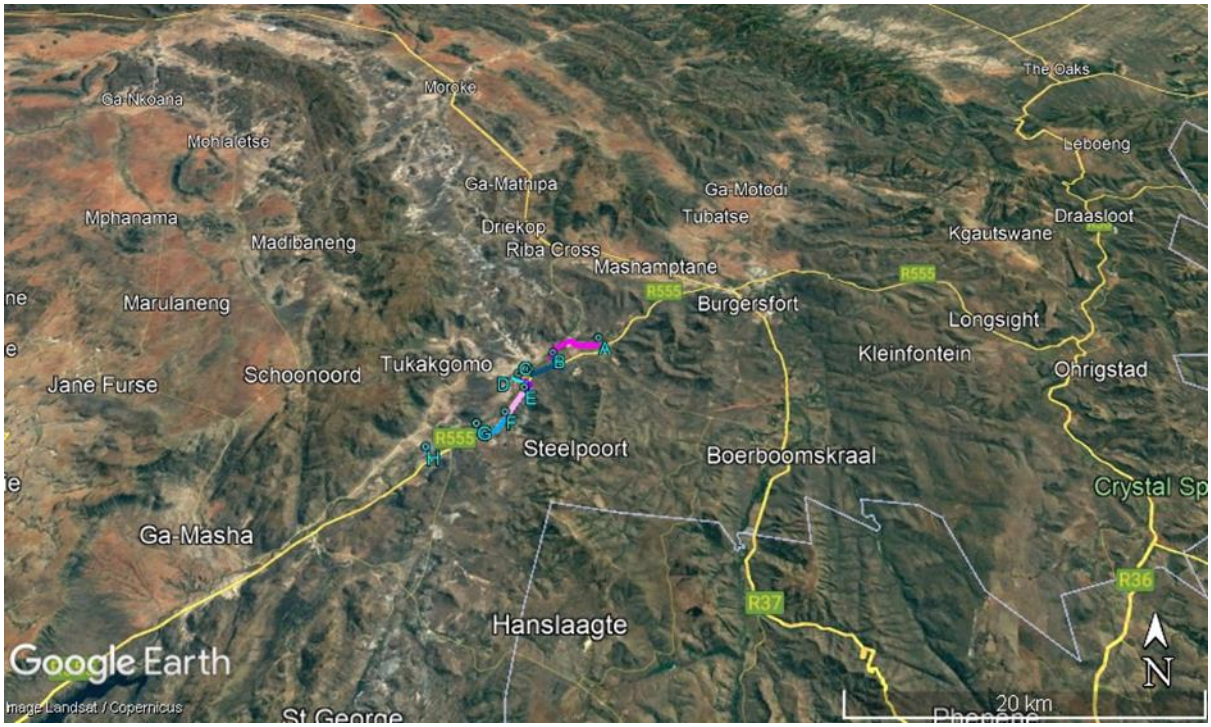

Figure 1: Google Earth map of the general area to show the relative landmarks. The proposed deviation route area for the Merensky-Uchoba powerline, Limpopo Province, is shown in the centre.

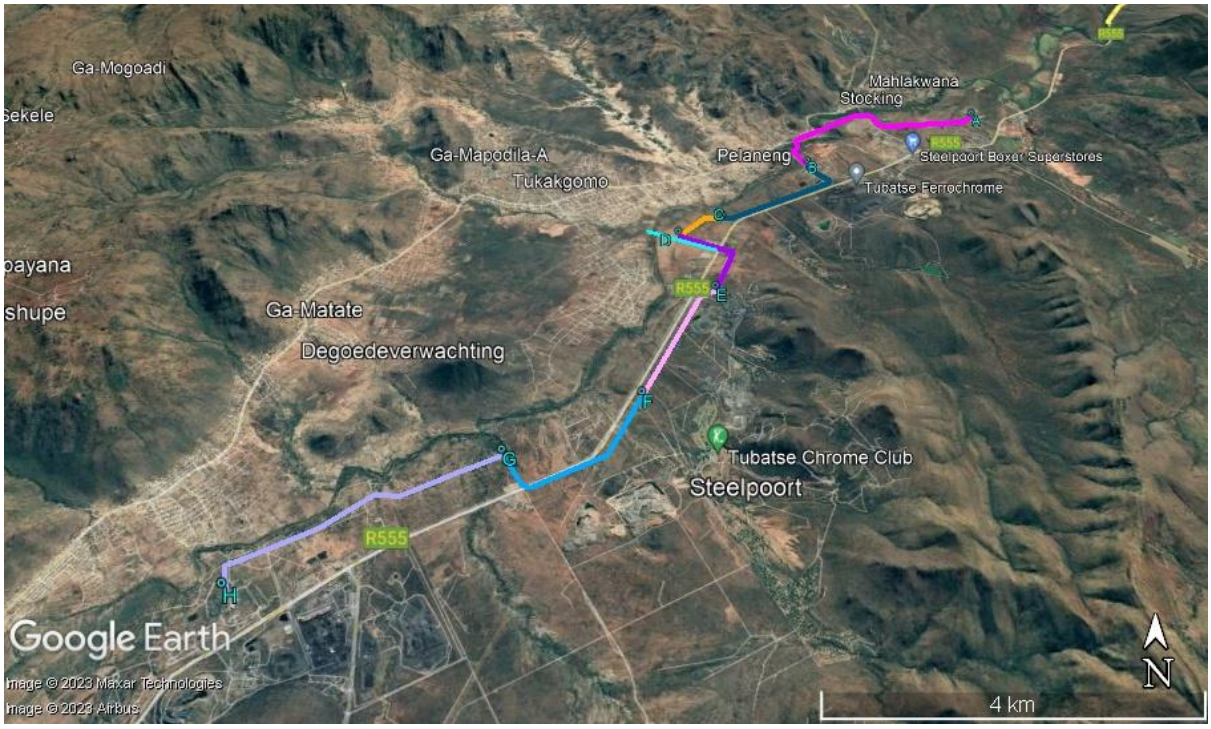

Figure 2: Google Earth Map of the proposed route for the deviation of the 132kV line between Merensky and Uchoba with the sections shown by the different coloured lines.

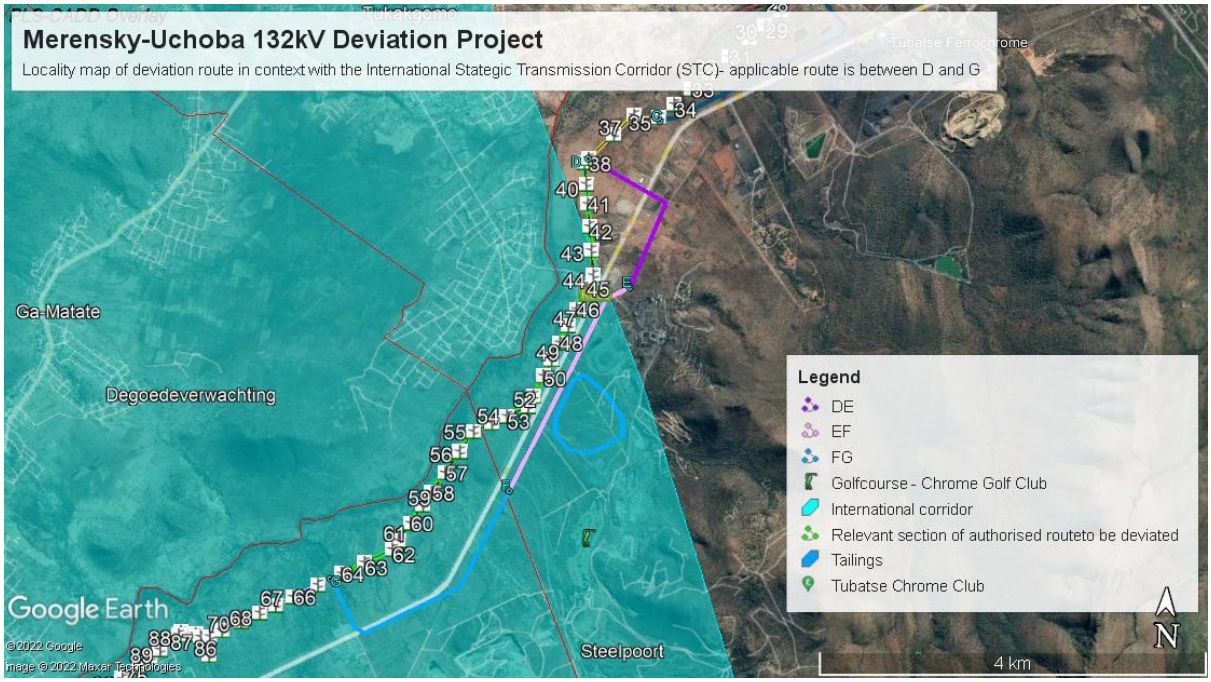

Figure 3: Annotated Google Earth map to show the proposed deviation in relation to the International Strategic Corridor (STC; blue shading).

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 include 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*);
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

The project lies in the eastern limb of the Bushveld Igneous Complex (Figure 4) where these volcanic rocks have intruded through the Pretoria Group (upper Transvaal Supergroup). The ancient rocks are overlain by Quaternary sands and soils that have

been derived from the weathering of the older rocks and have accumulated in the lower-lying parts.

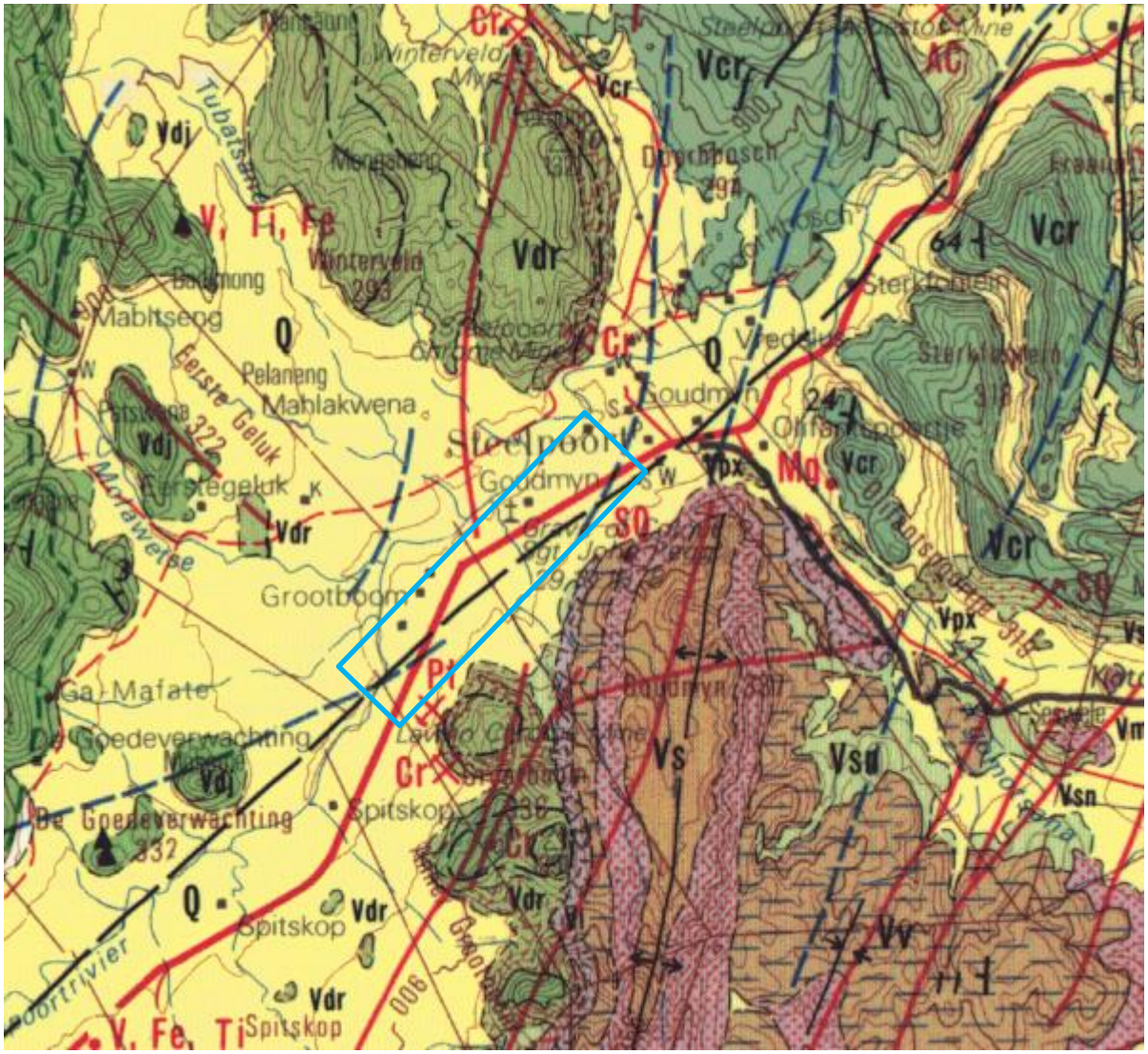

Figure 4: Geological map of the area around the Merensky-Uchoba power line. The location of the proposed project is indicated within the turquoise rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2430 Pilgrims Rest.

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

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Quaternary ca 1.0 Ma to Present
Vse	Schrikkloof Fm, Rooiberg Group, Transvaal SG	Volcanic rocks; quartzite xenoliths; sandstone and quartzite	Palaeoproterozoic

Symbol	Group/Formation	Lithology	Approximate Age
Vv	Vermont Fm, Pretoria Group, Transvaal SG	Hornfels, minor quartzite, limestone, chert	<2112 Ma
Vdj	Dsjate Subsuite, Rustenburg Layered Suite, Bushveld Igneous Complex (Main Zone)	Gabbro and anorthosite	Palaeoproterozoic Ca 2056-2055 Ma
Vdr	Dwars Rivier Subsuite, Rustenburg Layered Suite, Bushveld Igneous Complex (Critical Zone)	Norite and anorthosite	Palaeoproterozoic Ca 2056-2055 Ma
Vcr	Croyden Subsuite, Rustenburg Layered Suite, Bushveld Igneous Complex (Lower Zone)	Pyroxenite and feldspathic pyroxenite	Palaeoproterozoic Ca 2056-2055 Ma
Vm	Magaliesberg Fm, Pretoria Group, Transvaal SG	Quartzite; minor hornfels	Palaeoproterozoic Ca 2080 Ma
Vs	Silverton Fm, Pretoria Group, Transvaal SG	Shale, carbonaceous in places, hornfels, chert	Palaeoproterozoic Ca 2202 Ma

The mafic rocks of the Bushveld Complex make up the most voluminous preserved mafic layered intrusion in the world (Cawthorn et al., 2006). With a maximum vertical thickness of almost 8km, these rocks underlie an area of about 65 000 km^2 in South Africa. It stretches from Zeerust in the west to Burgersfort in the east, and from Villa Nora in the north to Bethal in the south. This complex contains the largest ore reserves of platinum group elements chromium and vanadium. These economically important reserves are being exploited and the literature on this deposit is also extensive. Felsic volcanic rocks are associated with the mafic rocks, namely the Rashoop Granophyre Suite and the Lebowa Granite Suite (Cawthorn et al. 2006).

The lower member of the Bushveld Complex, the Rustenburg Layered Suite, intruded through the layers of the Pretoria Group of the Transvaal Supergroup. Five zones are recognised in the Rustenburg Layered Suite and from the base upwards they are the Marginal Zone, Lower Zone, Critical Zone, Main Zone and Upper Zone. In the three regions of the Bushveld Complex (Eastern Limb, Western Limb and Northern Limb), the Zones are given local Subsuite names and the Subsuites are divided further according to the major rocks in the layer (Cawthorn et al., 2006).

In the Eastern Limb the Lower Zone is represented by the Croyden Subsuite, the Critical Zone is represented by the Dwars Rivier Subsuite and the Main Zone is represented by the Dsjate Subsuite (Figure 4, Table 2).

The heat from these intruding rocks also altered the host layers of the Transvaal Supergroup and resulted in metamorphism, for example alteration of sandstone to quartzites.

All the rocks of the Bushveld Complex, the mafic Rustenburg Layered Suite as well as the felsic rocks, the Rashoop Granophyre Suite and Lebowa Granite, are igneous (volcanic) rocks and do not preserve any fossils.

There were two large basins dominating southern Africa during the Cenozoic, with the Kalahari Basin to the west and the **Bushveld basin** to the east. Both basins are bounded along their southern extent by the more or less west-east trending Griqualand-Transvaal Axis (Partridge et al., 2006). These sediments are not easy to date but recent attempts are gradually filling in the history of the sands, sand dunes and inter-dunes (Botha, 2021).

In the north-eastern part of South Africa, the Cenozoic Bushveld Basin has undergone up to 400m of displacement (Partridge et al., 2006, fig 2). The sediments here are different from those of the Kalahari basin having been deposited under more fluvial conditions. These fluvial sediments are known as the Rooibokkraal Formation and are best developed in low-lying areas between the Crocodile and Marico Rivers, the upper valley of the Limpopo River and sporadically in the Springbok Flats area (Botha and Hughes, 1992; Partridge et al., 2006). These sediments consist mainly of calcified and/or weakly silicified fluvial gravels and sandstones.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figures - 6. The site for development is in the Quaternary sands that are of low sensitivity according to the more accurate SAHRIS palaeosensitivity map (Figure 5).

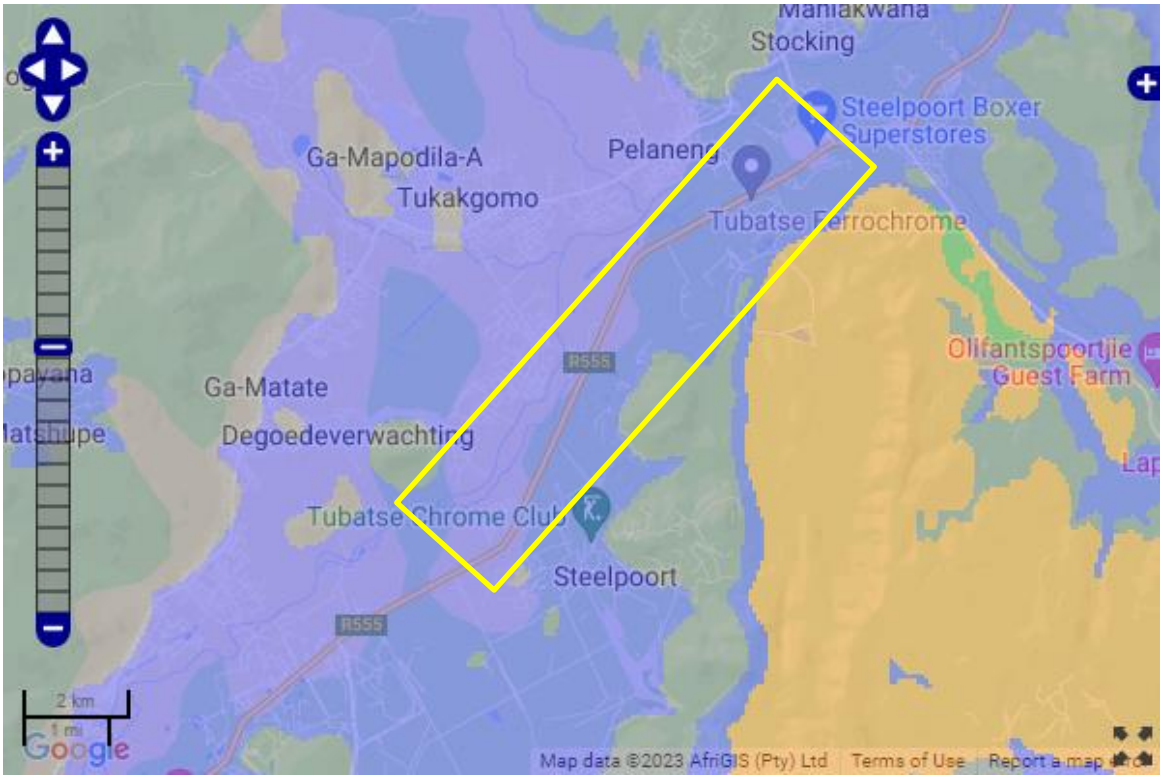

Figure 5: SAHRIS palaeosensitivity map for the deviation route for the Merensky-Uchoba 132kV powerline shown within the yellow rectangle. Background colours indicate the

following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

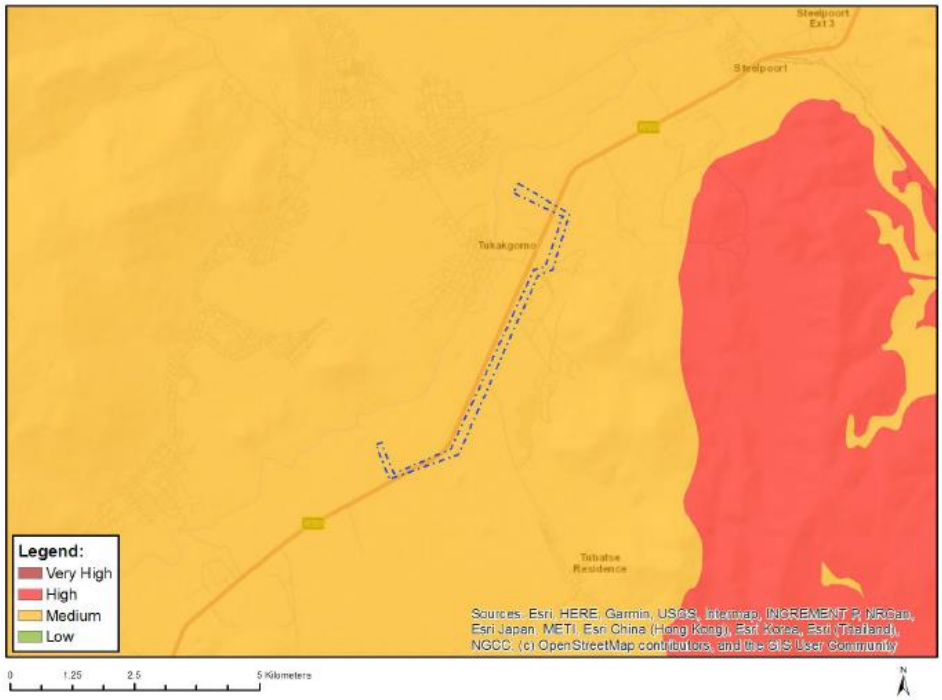

Figure 6: Palaeosensitivity map from the Government screening tool that incorrectly indicates the Quaternary sands and the non-fossiliferous Rustenburg Layered Suite (volcanic rocks) as having medium sensitivity.

Quaternary calcretes and sands may preserve fragments of transported bone, wood, rhizoliths and invertebrate shells but these would be out of context and very small. Only under special conditions such as palaeo-pans and palaeo-springs would younger and more complete fossils be likely to form or be trapped. These would include Quaternary aged plants, wood, mammals, rodents and invertebrates (Partridge et al., 2006; Goudie and Wells, 1995). Pans do occur in the more northwestern arid region of central South Africa (Goudie and Wells, 1995, Fig. 2) but are not common in Limpopo and KwaZulu Natal that have a much higher rainfall.

It is well accepted by palaeontologists and geologists that volcanic rocks do not preserve fossils. Preservation requires sedimentary rocks and a low energy environment (Cowan, 1995; Briggs, 2016; Groenewald et al., 2014). A source for the fossils is required, either reworked from older sediments, or life forms that are buried in fine-grained sediments and not disturbed, such as in pans, oxbow lakes or abandoned streams. Neither condition is present. The volcanic rocks do not have fossils, and the river sands and gravels are part of an active river system with no sites for deposition. It is therefore highly unlikely that any fossils would occur in the valley along which the powerline might be re-routed.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

Table 3a: 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 3b: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	**H**	-
	M	-
	L	Volcanic rocks and river sands do not preserve fossils; so far there are no records from the Quaternary of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be negligible
	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 very young and transported fossils in the river sands and alluvium, 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 sands ad gravels of the river valley that cover the area 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 wrong kind to contain fossils. Furthermore, the material to be excavated is sand and this does not preserve fossils. Since there is an extremely small chance that young and transported fossils may occur in the river sands 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 not contain fossil plant, insect, invertebrate and vertebrate material. The river 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 river sands, gravel and alluvium of the Quaternary. There is a very small chance that transported fossils may occur in the river sands so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer or other responsible person once excavations for pole foundations 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 very low to zero, so as far as the palaeontology is concerned, the Merensky-Uchoba 132 kV line deviation, anywhere along the valley and

adjacent volcanic rocks, should be authorised. There is no no-go area and no buffer zone required.

7. References

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Groenewald, G., Groenewald, D., Groenewald, S., 2014. SAHRA Palaeotechnical Report. Palaeontological Heritage of Limpopo. 22 pages.

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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 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 (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 7). 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 contractor or 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 sands.

Figure 7: Field photographs of fragmentary plant, wood and bone fossils that might be trapped in the Quaternary river sands.

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2023

Present employment: Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DSI Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa
Telephone : +27 11 717 6690
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

v) **Supervision of Higher Degrees**

All at Wits University

Degree	Graduated/completed	Current
Honours	13	0
Masters	13	3
PhD	13	7
Postdoctoral fellows	14	4

vi) **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.

vii) **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: Cretaceous Research: 2018-2020
Associate Editor: Royal Society Open: 2021 -
Review of manuscripts for ISI-listed journals: 30 local and international journals

viii) **Palaeontological Impact Assessments**
25 years' experience in PIA site and desktop projects

- Selected from recent projects only – list not complete:
- 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 2022 for AHSA
- Wolf-Skilpad-Grassridge OHPL 2022 for Zutari
- Iziduli and Msenge WEFs 2022 for CTS Heritage
- Hendrina North and South WEFs & SEFs 2022 for Cabanga
- Dealesville-Springhaas SEFs 2022 for GIBB Environmental
- Vhuvhili and Mukondelei SEFs 2022 for CSIR
- Chemwes & Stilfontein SEFs 2022 for CTS Heritage
- Equestria Exts housing 2022 for Beyond Heritage
- Zeerust Salene boreholes 2022 for Prescali
- Tsakane Sewer upgrade 2022 for Tsimba
- Transnet MPP inland and coastal 2022 for ENVASS
- Ruighoek PRA 2022 for SLR Consulting (Africa)
- Namli MRA Steinkopf 2022 for Beyond Heritage

ix) **Research Output**
Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 170 articles published; 5 submitted/in press; 14 book chapters.
Scopus h-index = 30; Google Scholar h-index = 39; -i10-index = 116 based on 6568 citations.
Conferences: numerous presentations at local and international conferences.

11. APPENDIX C - Legislation

Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas (CSIR, June 2022)*

*Full reference citation: Department of Forestry, Fisheries and the Environment, 2022. Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas Revision 2. Prepared by the CSIR and SANBI for the Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure Corridors in South Africa.

1.1 Context of the Standard

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) promotes the integrated environmental management of activities that may have a significant impact (positive or negative) on the environment. Section 24(1) of the NEMA states that "*in order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential consequences for or impacts on the environment of listed activities or specified activities must be considered, investigated, assessed and reported on to the competent authority or Minister responsible for Mineral Resources, as the case may be, except in respect of those activities that may commence without having to obtain environmental authorisation in terms of this Act.*".
Section 24(2)(c) - (e) provides the ability of the Minister, or MEC in concurrence with the Minister to identify activities and geographical areas within which activities may be excluded from the requirement to obtain environmental authorisation and section 24(2)(d) provides the additional ability to link such exclusions with compliance with prescribed norms or standards.

This Standard, entitled "Standard for the Development and Expansion of Power lines and Substations within Identified Geographical Areas" (the Standard) has been adopted in terms of section 24(10)(a) of NEMA to allow for the exclusion, in terms of section 24(2)(d) of NEMA, of activities which relate to the development and expansion of electricity transmission and distribution infrastructure as identified in Listing Notices 1 and 2 of the Environmental Impact Assessment (EIA) Regulations, promulgated under section 24(5) of NEMA as well as any listed or specified activities necessary for the realisation of such infrastructure which includes substations, as described in the scope of this Standard.

This Standard has been developed based on two Strategic Environmental Assessment (SEA) processes undertaken for the development of Electricity Grid Infrastructure (EGI) in South Africa as listed below:

- SEA completed in 2016 for the identification and assessment of five (5) EGI Corridors; and
- SEA initiated in 2017 and completed in 2019 for the identification and assessment of two (2) expanded EGI Corridors.

The SEA processes identified geographical areas which are of strategic importance for the rollout of electricity transmission and distribution infrastructure in terms of Strategic Integrated Project 10: Electricity Transmission and Distribution for all. These geographical areas consist of seven strategic transmission corridors for the development of transmission and distribution infrastructure (Figure 1) that have been pre-assessed for environmental sensitivities.

- 2016 EGI SEA:
  - Central Corridor;
  - Eastern Corridor;
  - International Corridor;
  - Northern Corridor; and
  - Western Corridor.
- 2019 Expanded EGI SEA:

- Expanded Eastern Corridor; and
- Expanded Western Corridor.

The study areas of the SEAs (i.e. the corridors) were investigated by specialists through desktop geographic information system (GIS) analysis. These strategic transmission corridors have been gazetted as identified geographical areas in Government Notice No. 113 published under Government *Gazette* No. 41445 of 16 February 2018 and Government Notice No. 1637 published under Government *Gazette* No. 45690 of 24 December 2021.

The Final SEA Reports for the 2016 EGI SEA and 2019 EGI Expansion SEA can be accessed at: https://gasnetwork.csir.co.za/ and https://egis.environment.gov.za/

1.4 Exclusions

This Standard and exclusions do not apply in the following instances:
Where any part of the infrastructure occurs on an area for which the environmental sensitivity for a relevant environmental theme is identified as being very high or high by the screening tool and confirmed to be such by the EAP or the relevant specialist for the identified environmental theme;
Where the site verification for a specific theme identifies that the low or medium sensitivity rating of the screening tool is in fact high or very high; or
Where the greater part of the proposed infrastructure fall outside of any strategic transmission corridor.

Where this Standard* does not apply, either the requirements of the EIA Regulations, or the requirements of Government Notice No. 113 in Government *Gazette* No. 41445 of 16 February 2018, read with the NEMA EIA Regulations, where relevant, will apply to the relevant environmental theme for which the very high or high sensitivity has been identified, in respect of the portion of the development which occurs on the area where the environmental sensitivity is confirmed to be very high or high, or to the entire development where the greater part of the infrastructure falls outside of the strategic transmission corridor.

1.5 Applicability of the Generic Environmental Management Programme

As part of the 2016 EGI SEA, a Generic Environmental Management Programme (EMPr) was compiled for the development and expansion of: (a) overhead electricity transmission and distribution infrastructure; and (b) substation infrastructure for the transmission and distribution of electricity. The two Generic EMPrs were gazetted for implementation in Government Notice No. 435 published under Government *Gazette* No. 42323 of 22 March 2019. The Generic EMPrs apply within South Africa as a whole, and need to be applied for the development of all overhead and substation electricity transmission and distribution infrastructure (as contained in the EIA Regulations Listing Notices 1 – 3 published in Government Notices R9827, R9838, R9849 and R98510). These Generic EMPrs consist of the following:

- Part A - Includes definitions, acronyms, roles and responsibilities and documentation and reporting requirements.

- Part B – Section 1: Pre-Approved Generic Template that must be completed by the contractor prior to commencement of construction. This section does not need to be submitted to the competent authority.
- Part B – Section 2: Provision of preliminary infrastructure layout and a declaration that the applicant/holder of the environmental authorisation will comply with the pre-approved Generic EMPr template contained in Part B: Section 1 and understands that the impact management outcomes and impact management actions are legally binding.
- Part C – Site Specific Sensitivities and Attributes: If any specific environmental sensitivities or attributes are present on the site which require site specific impact management outcomes and actions that are not included in the pre-approved generic EMPr (Part B – Section 1), these specific impact management outcomes and actions must be included in Part C and must be submitted to the competent authority for approval.

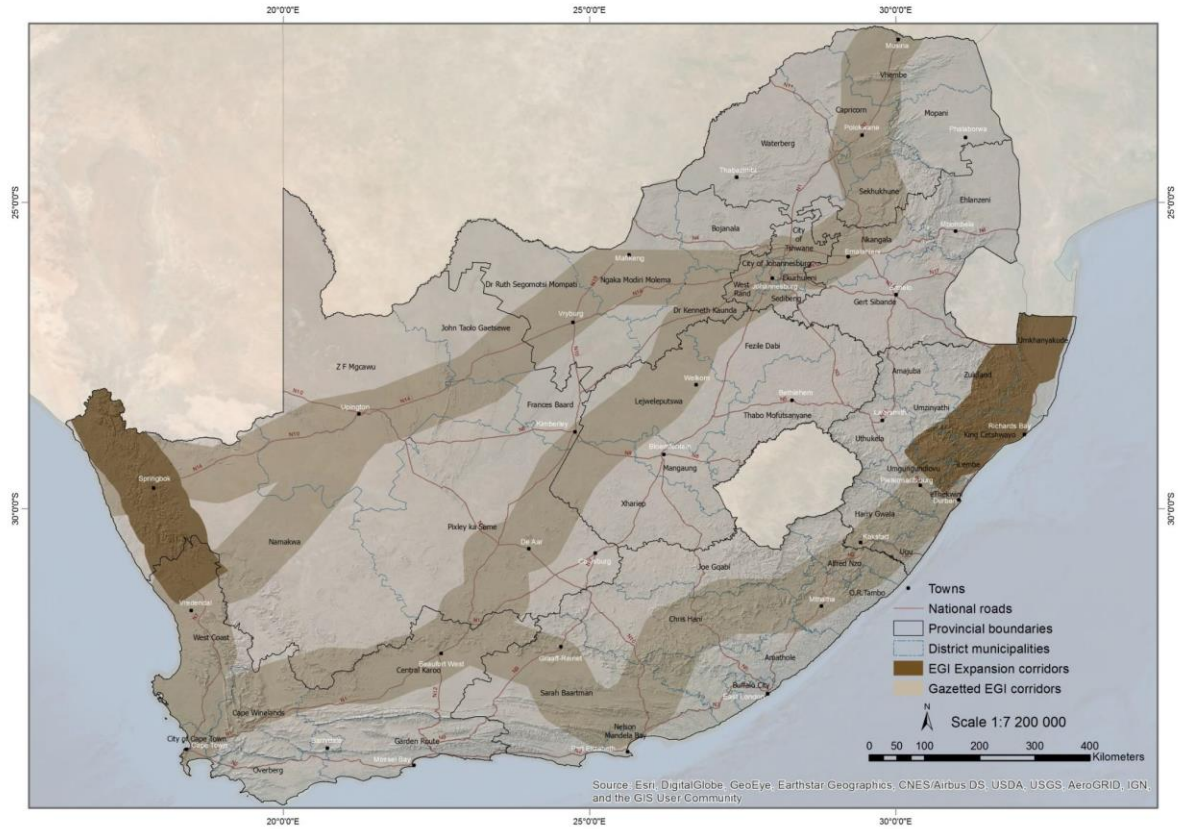

Figure 1: Electricity Grid Infrastructure (EGI) corridors based on Strategic Environmental Assessment processes (SEA areas (from Standard Document p 8)

SAHRA legislation and Minimum Standards

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 (phase 1) or site visit and walk-through (Phase 2) Palaeontological Impact Assessment (PIA), must be completed for the proposed development and is reported as part of the EIA process. The report must comply with the SAHRA Minimum Standards (Table 1 below).

The most reliable resource to determine the sensitivity of a site for palaeontology is the SAHRIS Palaeosensitivity Map that is based on the 1:250 000 Geological maps of South Africa together with the various Palaeosensitivy Reports for each province. These can be found at https://sahris.sahra.org.za/map/palaeo

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:
ai	Details of the specialist who prepared the report,
aii	The expertise of that person to compile a specialist report including a curriculum vitae
b	A declaration that the person is independent in a form as may be specified by the competent authority
c	An indication of the scope of, and the purpose for which, the report was prepared
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
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment
e	A description of the methodology adopted in preparing the report or carrying out the specialised process
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure
g	An identification of any areas to be avoided, including buffers
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;
i	A description of any assumptions made and any uncertainties or gaps in knowledge;
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
k	Any mitigation measures for inclusion in the EMPr
l	Any conditions for inclusion in the environmental authorisation
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised
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
o	A description of any consultation process that was undertaken during the course of carrying out the study
p	A summary and copies of any comments that were received during any consultation process

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:
q	Any other information requested by the competent authority.
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.