Palaeontological Impact Assessment for the proposed Mercury PV cluster and Grid Connection, Viljoenskroon, Free State Province

CTS21_232_Landscape Dynamics

Desktop Study (Phase 1)

For

CTS Heritage

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf
Experience: 33 years research and lecturing in Palaeontology
25 years PIA studies and over 300 projects completed

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by CTS Heritage, Cape Town, 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 Mercury PV cluster and Grid Connection near Viljoenskroon, south of the Vaal River, Free State. The Farms affected are 189, 369, 276, 173, 441 and 443. The seven PV facilities are: Zaaiplaats PV 1, Kleinfontein PV 1, Biesiesfontein PV 1 and Vlakfontein PV 1 in the north and Hormah PV 1 and Ratpan PV 1 and PV 2 in the southern part.

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 site lies on the moderately sensitive Quaternary sands and alluvium which might have trapped transported and fragmentary fossils if there are such features as palaeo-pan and palaeo-springs. The land has been cultivated or grazed for decades and no such feature is visible in the satellite imagery. Due to inconsistency in the geological maps it appears that the northernmost part of Zaaiplaats PV 1 and Biesiesfontein PV 1 are on very highly sensitive rocks of the Vryheid Formation that are most likely covered by Quaternary sands and alluvium. 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 for foundations have commenced. As far as the palaeontology is concerned, the project should be authorised.

Table of Contents

i. Background

Mulilo Renewable Project Developments appointed Landscape Dynamics to obtain Environmental Authorisation for the following project:
The Mercury Cluster Project involves the following project components:

- 100MW Photo Voltaic Solar Farms with associated infrastructure
- 132kV grid connection(s) to connect the solar farms with the existing Mercury Main Transmission Substation

The assessment area involves approximately 4 300ha. A Site Screening Investigation with relevant key specialists was undertaken to confirm the obvious no go areas associated with the proposed project site. The outcome would be to provide Mulilo with an area map with land potentially suitable and viable for solar farm development.
The key specialist report for Palaeontology is presented here.

The area under consideration is a group of adjacent farms southeast of Viljoenskroon and Orkney and comprise the following farms (Figures 1 and 2):

Vlakfontein 15 Portion 0
Biesiesfontein 173 Portions 0, 1
Fraai Uitzicht 189 Portions 0, 1, 2, 3. 4, 5,
Zaaiplaats 190 RE
Hoekplaats 190 1
Mizpah 274 RE
Hormah 276 Portions 1, 2
Gerar 278 RE
Moab 279 RE
Kleinfontein 369 RE, 1
Ratpan 441 RE
Jackalsfontein 443 RE
Uitval 457 RE

The current plan is to establish seven PV clusters on parts of these farms and a grid connection (Figure 2).

A Palaeontological Impact Assessment was requested for the Mercury PV Cluster 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 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section i.
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 ii.
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 vii.
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 vi.
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	Sections 6, 8

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
	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	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 land marks. The Mercury PV Cluster land parcels are indicated in grey.

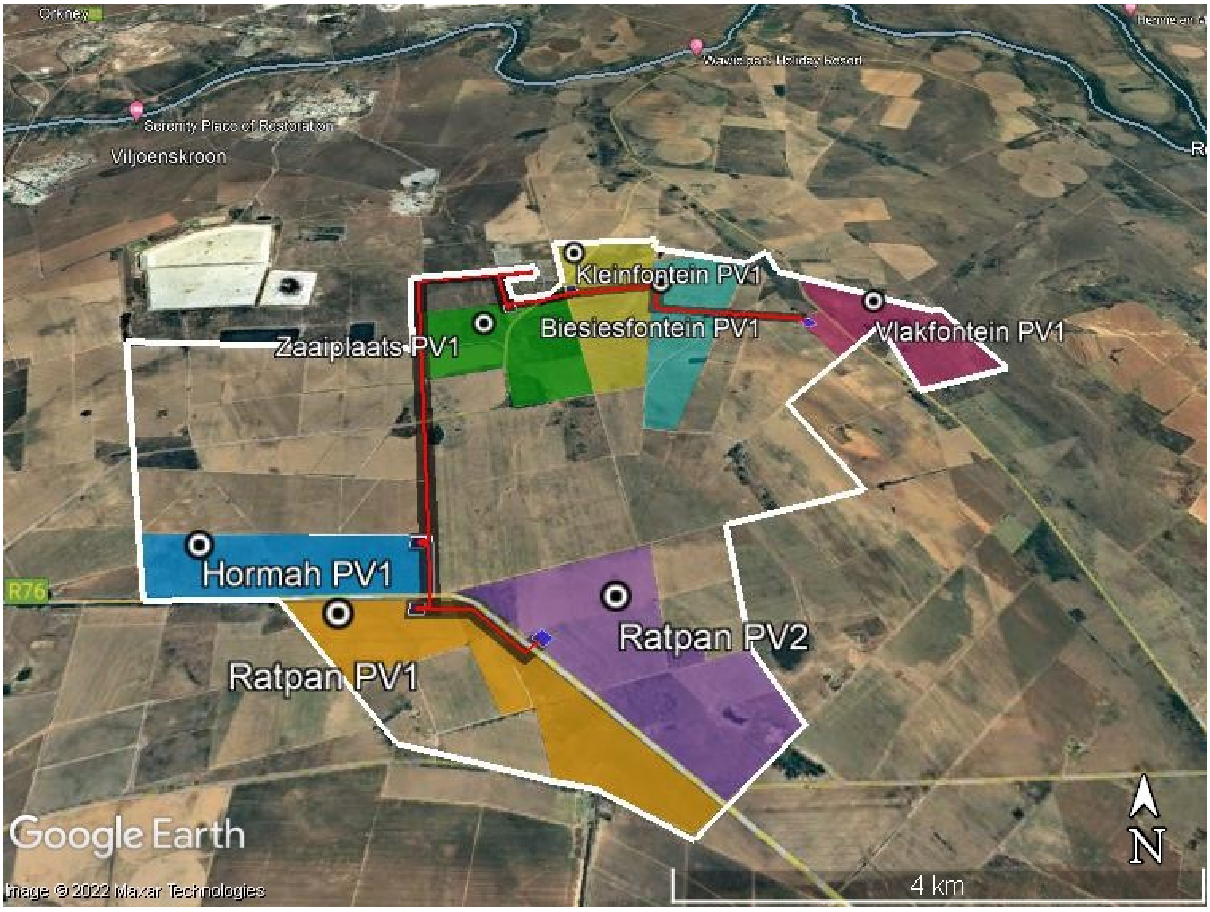

Figure 2: Google Earth Map of the proposed Mercury PV Cluster names and farms as labelled and the Grid Connection (red line).

ii. Methods and Terms of Reference

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

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
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*).

iii. Geology and Palaeontology

iv. Project location and geological context

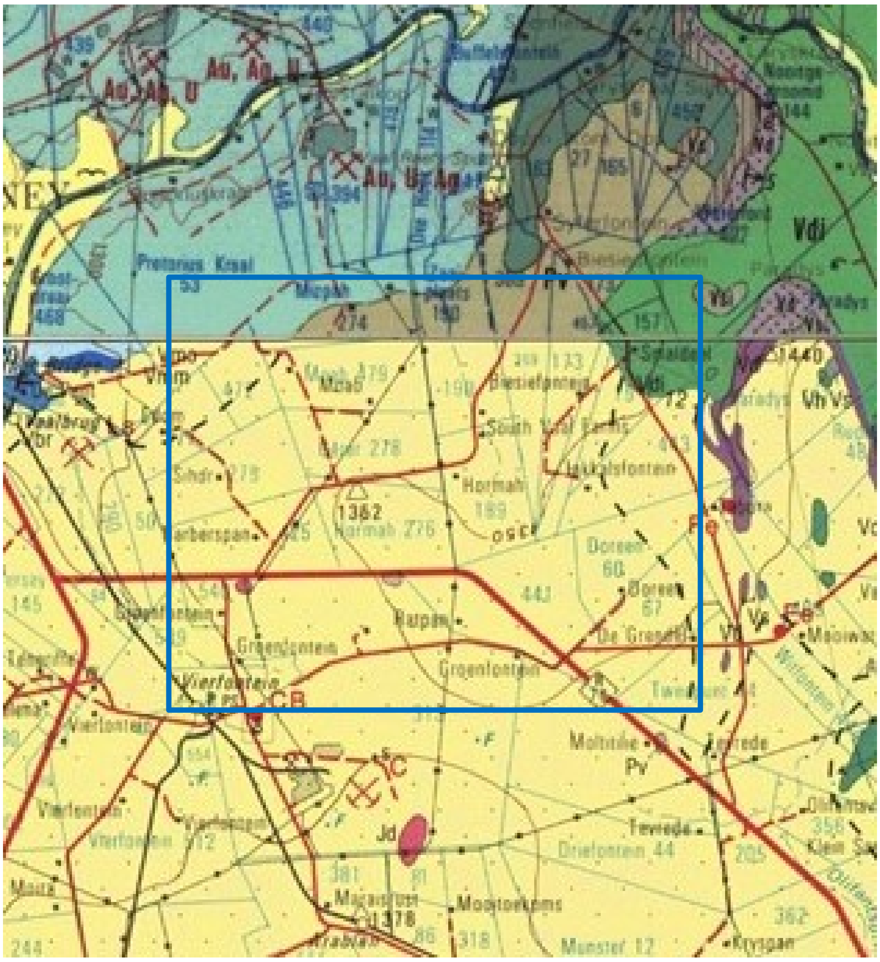

Figure 3: Geological map of the area around the Mercury PV Cluster. The location of the proposed project is indicated within the blue rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand (top) and 2726 Kroonstad (bottom).

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.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary sand	Alluvium, aeolian sand	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm, Ecca	sandstone;	Early Permian

Symbol	Group/Formation	Lithology	Approximate Age
	Group, Karoo SG	mudstone, shale, coal	
Vdi	Diabase	Intrusive diabase into the Transvaal SG	Palaeoproterozoic
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert, stromatolitic dolomite	Palaeoproterozoic, ca 2500 Ma

The project lies in the north-western part of the main Karoo Basin where the sediments of Ecca Group are hardly exposed. They are overlain by the much younger Quaternary sands, alluvium and soils. To the north is the southern margin of the Transvaal Supergroup.

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.

Overlying the basal Dwyka Group glacigene 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. 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 (Johnson et al., 2006). Only very small outcrops of the Vryheid Formation occur in this area but it likely underlies the Quaternary sands.

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

The **Quaternary Kalahari sands** form an extensive cover of much younger deposits over much of the Northern Cape Province and Botswana, and extend to the Free State. Based on the early works of Leicester King, Partridge and Maud (1987, 2000) developed a model of three African Erosion Surfaces for southern Africa, from the Cretaceous to the Pliocene. During the Cretaceous Africa was very high, averaging about 2500-2000m above sea level but the rifting apart of Gondwanaland and formation of the Atlantic and Indian Oceans, coastal erosion was rapid and the escarpment rapidly receded about 120km inland along the east and south coasts, but only 50km along the west coast. The newly exposed surface was called the African Erosion Surface. Their model has been challenged and modified by a number of researchers (Burke, 2011; Braun et al., 2014) who propose that mantle plumes caused uplift of the continent during the late Cretaceous, followed by erosion and further uplift about 30-20 million years ago, The newer interpretations have been followed here.

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).

Most pans in the Kalahari Basin are filled by a layer of clayey sand or calcareous clays and are flanked by lunette dunes formed as a result of deflation of the pan floor during arid periods (Lancaster, 1978a, b; Haddon and McCarthy, 2005). At some localities in the south western Kalahari spring-fed tufas have formed at the margins of pans during periods where groundwater discharge was high (Lancaster, 1986). These tufas may contain evidence of algal mats and stromatolites and may also be associated with calcified reed and root tubes (Lancaster, 1986). Many of the pans are characterised by diatomaceous earth, diatomite or kieselguhr, a white or grey, porous, light-weight, fine-grained sediment composed mainly of the fossilised skeletons of diatoms. Associated with some palaeo-pans and palaeo-springs are fossil bones, root casts, pollen and archaeological artefacts. Well-known sites are Florisbad and Deelpan in the Free State, Wonderkrater in Limpopo and Bosluispan in the Northern Cape.

The Tertiary calcretes can trap fossils and artefacts when associated with palaeo-pans or palaeo-springs (Partridge et al., 2006). Where deflation has occurred, for example along the west coast of South Africa, any trapped materials in the different levels can be concentrated in the depocentre of the pan or dune and thus it can be challenging to interpret the deposit. Pans and calcrete occur in the Free State too, for example Deelpan and Florisbad (spring).

The aeolian sands of the Gordonia Formation do not preserve fossils because they have been transported and reworked. Conditions required for the preservation of organic material and formation of fossils are burial in a low energy, anoxic environment such as overbank deposits, lake muds or clays (Briggs and McMahon, 2016). Aeolian sands are high energy, well oxygenated environments. In some regions the sands may have covered pan or spring deposits and these can trap fossils, and more frequently archaeological artefacts. Usually these geomorphological features can be detected using satellite imagery. No such features are visible.

Exploration and research along the palaeo-rivers of Southern Africa, now only present as abandoned palaeochannels, or captured by the present day rivers, the Vaal and Orange Rivers in this case, the gravels and sands might include transported robust and fragmentary fossils. Examples of these are heavy bone fragments and silicified wood fragments, as well as diamonds (de Wit, 1999; de Wit et al., 2000).

v. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figures 4 and 5. The project site for development is almost entirely in the Quaternary aeolian sands and soil (green). The northern-most part apparently is on very highly sensitive rocks (red) but if one looks carefully at the geological map (on which the SAHRS maps is based), there appears to be horizontal contact between the northern Malmani Subgroup and the southern Quaternary sands. This is not a natural feature and coincides with the two maps, the northern 2626 (West Rand) and southern 2627 (Kroonstad) map. The northern map is based on the PhD work by Stepto (1979) who used drill core and palaeomagnetics to map the rocks below ground. In contrast the southern map was based more on fieldwork and focused on the surface rocks. Since this project will be on the land surface and not underground, the interpretation from the southern map should be applied to the adjacent part of the northern map. In other words, the northern part of the Mercury PV cluster will be on moderately fossiliferous Quaternary sands and alluvium.

Quaternary sands may have fragments of transported bone and silicified wood that are out of context, with their source unknown. If there are palaeo-pans or palaeo-springs present they might trap fossils but these tend to be fragmentary and small, and only from more robust fossils such as bone or silicified wood. No such features is visible in the satellite imagery. In addition the land has been cultivated and grazed for decades and any fossils would have been further degraded.

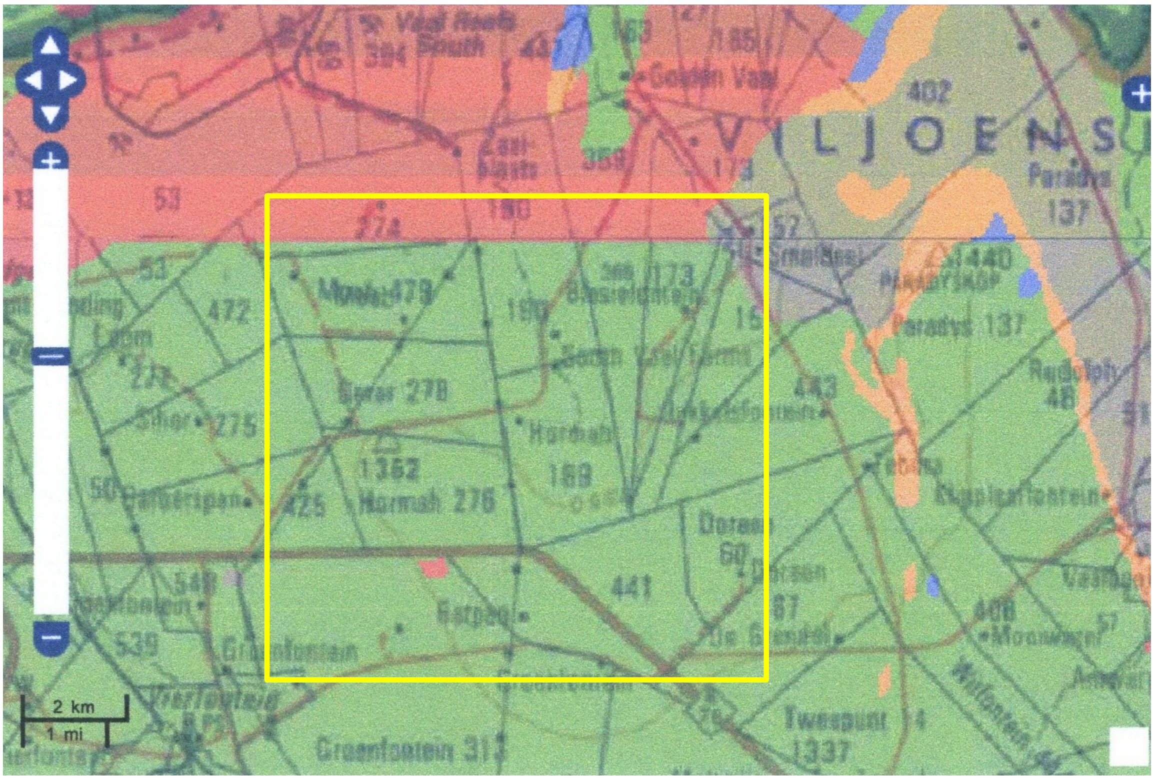

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Mercury PV Cluster shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero. Note the horizontal line of contact between the red and green colouration – this is a mapping error and not a geological feature.

Figure 5: SAHRIS palaeosensitivity map (from the CTS Grid Screener report) to show the route of the grid connection.

vi. 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	**L**	Quickly reversible. Less than the project life. Short term

DURATION of impacts	**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	Soils and sands do not preserve fossils; so far there are no records from the Quaternary sands 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 +	-
	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 transported and fragmented fossil vertebrates and plants above ground. Well below ground in the shales of the Vryheid Fm there might be plants of the Glossopteris flora. 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 soils and sands that cover the area or in the shales below ground because foundations are not deep. 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 right age and type to contain fossils but the area is covered in deep cultivated soils. 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.

vii. 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, mudstones, shales and sands are typical for the country and might contain fossil plant, insect, invertebrate and vertebrate material. The sands and soils of the Quaternary period would not preserve fossils. The inconsistency between the adjacent maps 2626 and 2726 with the former focused on the rocks below ground and the latter on the surface rocks should be noted.

viii. 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 overlying deep soils and sands of the Quaternary. In the northern most section (Kleinfontein PV1 and Biesiesfontein PV1, only north of the grid connection) there is a very small chance that fossils may occur in the shales below ground of the early Permian Vryheid Formation so a Fossil Chance Find Protocol should be added to the EMPr. The Grid Connection Route is entirely on moderately sensitive Quaternary sands, as are all the other PVs. If fossils are found by the contractor, environmental officer, or other responsible person once drilling of the well or construction of the access road have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low, therefore, as far as the palaeontological is concerned, the project should be authorised.

ix. References

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Briggs, D.E.G., McMahon, S., 2016. The role of experiments in the taphonomy of exceptional preservation. Palaeontology 59, 1-11.

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x. 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 must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone fragments) 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 Figures 6, 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/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.

Appendix A – Examples of fossils from the Permian and Quaternary

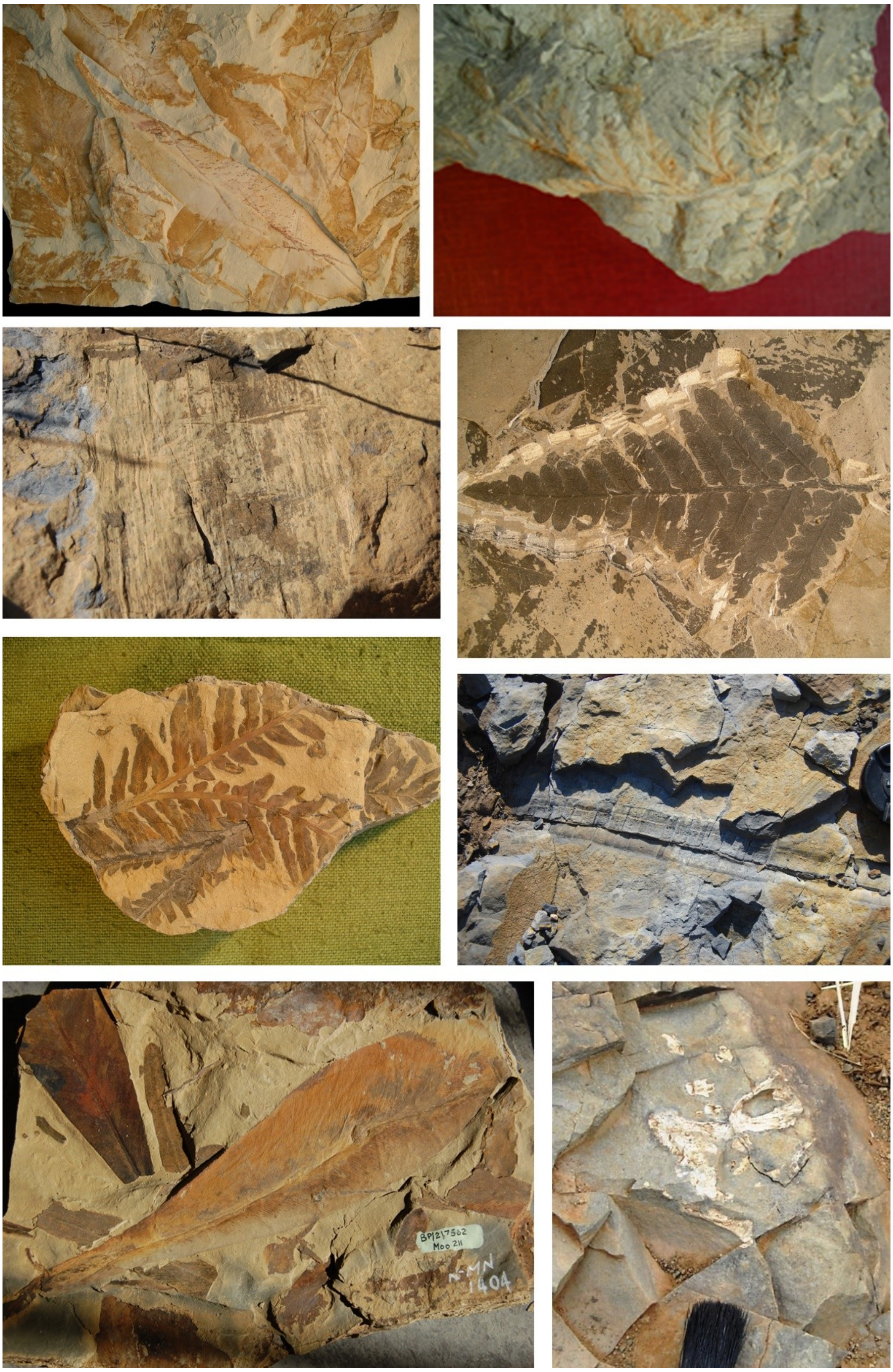

Figure 6: Photographs of fossils of the Glossopteris flora – Vryheid Fm, below ground

A – leaf impression in sandstone; B – silicified wood fragments in a stream bed; C – fossil bone fragments in the shales.

Figure 7: Photographs of a selection of fossil plants from the Quaternary alluvium and pans.

xi. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD

January 2022

I) Personal details

Surname : **Bamford**
First names : **Marion Kathleen**
Present employment : Professor; Director of the Evolutionary Studies Institute.
Member Management Committee of the NRF/DST Centre of
Excellence Palaeosciences, University of the Witwatersrand,
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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.
NRF Rating: C-2 (1999-2004); B-3 (2005-2015); B-2 (2016-2020); B-1 (2021-2026)

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

iv) Membership of professional bodies/associations
Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees
All at Wits University

Degree	Graduated/ completed	Current
Honours	13	0
Masters	11	3
PhD	11	6
Postdoctoral fellows	15	1

viii) Undergraduate teaching

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

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

x) Palaeontological Impact Assessments

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

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for EnviroPro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for EnviroPro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage

- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

xi) Research Output

Publications by M K Bamford up to 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 = 35; -i10-index = 92
Conferences: numerous presentations at local and international conferences.