Palaeontological Impact Assessment for the proposed development of the Vetlaagte and Wag ‘n Bietjie infrastructure associated with the authorised PV Facilities near De Aar, Northern Cape Province

Desktop Study (Phase 1)

For

CTS Heritage
Project No: CTS21_231

04 December 2021

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Expertise of Specialist

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

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by 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 Vetlaagte and Wag ‘n Bietjie infrastructure and grid connections, southeast of De Aar, Northern Cape Province.

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

The proposed sites and routes lie on the non-fossiliferous Jurassic dolerite, moderately sensitive Quaternary alluvium highly sensitive Tierberg Formation (Ecca Group, Karoo Supergroup, with plants and silicified wood fragments, and the very highly sensitive Adelaide Subgroup (Beaufort Group, Karoo Supergroup with possible vertebrate bones). This desktop study supports the recommendation of John Almond’s earlier assessment that the fossils are sporadic, not very significant. However, 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 developer/ environmental officer/ other designated responsible person once excavations/drilling activities have commenced. As far as the palaeontology is concerned, the project should be authorised.

Table of Contents

i. Background

There are two proposed areas for development of Solar Facilities to the southeast of De Aar in the Northern Cape Province and just north of the existing Helios substation (Figure 1). The Vetlaagte PV facility has been approved except for one portion, and the Wag ‘n Bietjie PV area is still to be assessed. The grid connections and new Main Transmission substations (MTS) have yet to be approved. This report is, therefore, required for the proposed development of supplementary infrastructure associated with the Wag ‘n Bietjie and the Vetlaagte Solar Energy Facilities located east of De Aar in the Northern Cape. The farms are in the Emthanjeni Local Municipality of the Pixley ka Seme District Municipality

Wag ‘n Bietjie Project components and areas for assessment

- MTS
- LILO (Loop in Loop Out) lines connecting the new MTS to an existing 400kV power line
- A grid connection that connect the Wag ‘n Bietjie MTS and the Vetlaagte MTS

The area proposed for development is located immediately adjacent to the approved Vetlaagte Solar Energy Facility (SAHRIS Case ID 192). The studies completed for the
Vetlaagte Solar Energy Facility are referred to below in order to provide heritage context to the proposed development area. The palaeontology assessment (Almond, 2012 SAHRIS ID 49843) is referred to extensively in the Palaeontology section.

Vetlaagte Project and connections

Background

- Vetlaagte Farm consists of 3x PV farms of which Environmental Authorisation was obtained in 2012/14
- The 3x PV farms will each have a Switching Station as well as a grid connection connecting the PV farm to the new MTS
- The new MTS will connect via Loop In Loop Out (LILO) power lines to an existing 400kV power line

Project components and areas for assessment

- 3x grid connections WITH A 200M CORRIDOR
- 3x switching stations (note that the Switching Stations fall within the 200m corridor)
- Main Transmission Substation – note that there are two site alternatives within the assessment area. These alternative sites need to be assessed and other sites
  recommended should these sites not be suitable.
- LILO lines to connect the MTS to the existing 400kV lines
- The entire assessment area (as per info provided for quoting purposes) needs to be investigated and no go areas demarcated.

General

● The grid connections connecting PV1 and PV2 are running adjacent to each other and to the direct east of an existing 132kV line (the existing line is in red in the
map below)
● The PV3 grid connection and switching station are situated within the assessment area.

The two Solar facilities are close together and the proposed new infrastructure is applicable to both so one PIA report is presented here for the whole project.

A Palaeontological Impact Assessment was requested for the Solar projects. 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: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 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	N/A

	avoided, including buffers;	
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 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 if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed development of the Vetlaagte and Wag ‘n Bietjie Solar facilities and grid infrastructures southeast of De Aar with the section shown within the yellow and orange polygons respectively.

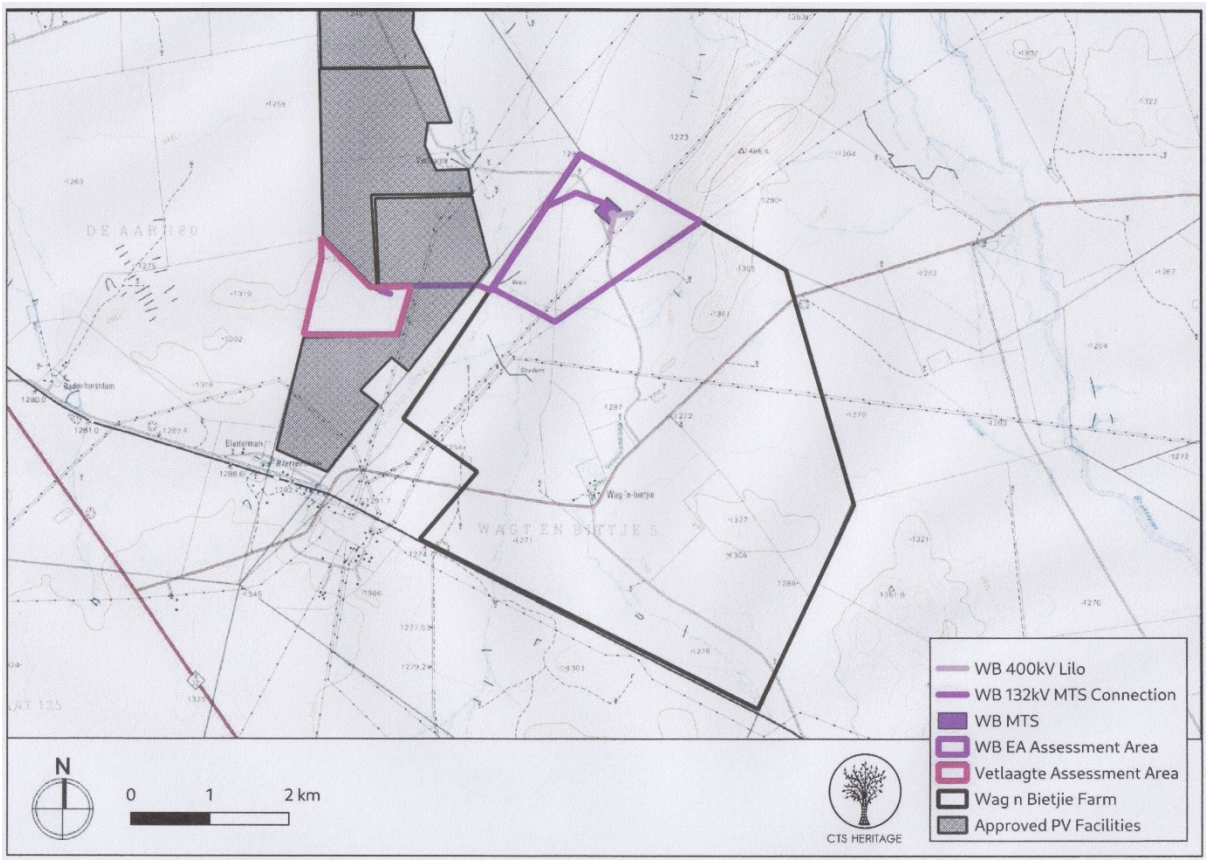

Figure 2: Topographic map to show the two Solar PV facilities and the grid connections as per legend on the map.

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

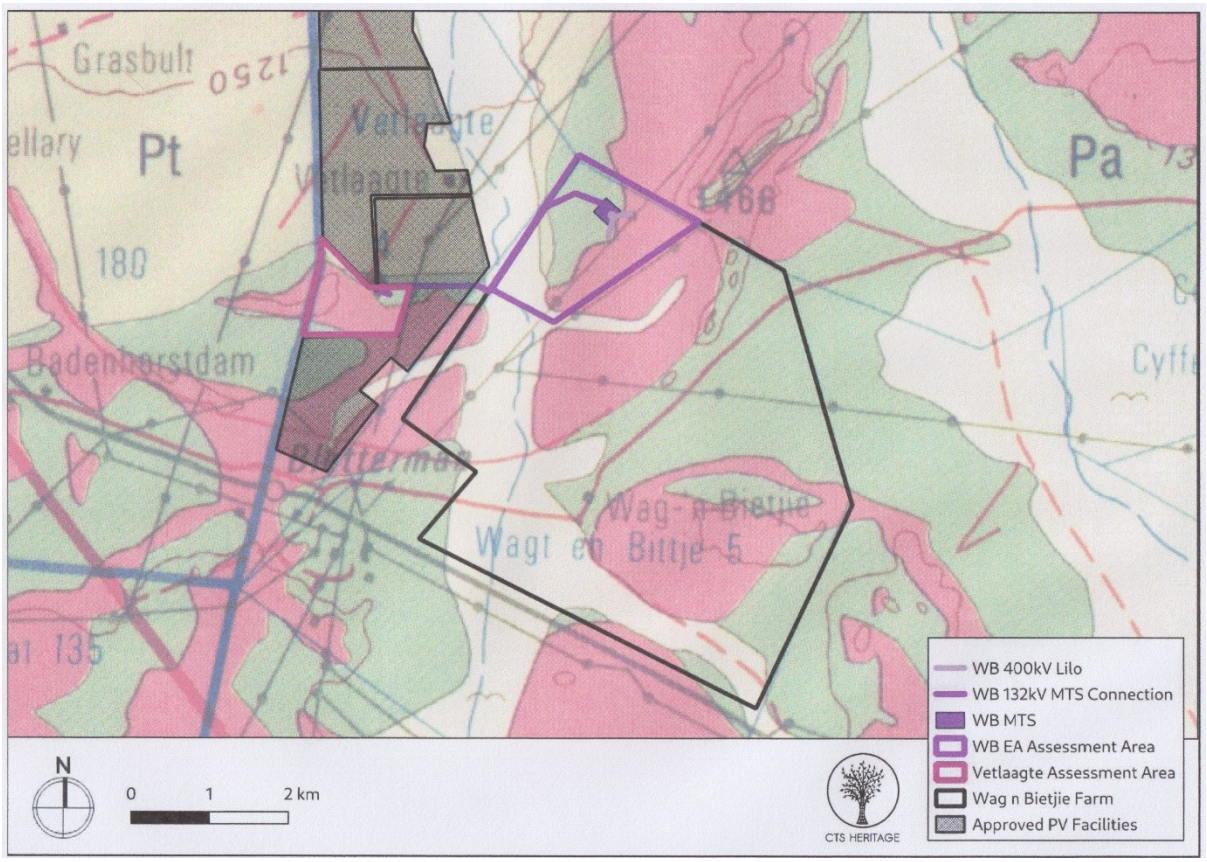

Figure 3: Geological map of the area around the Farms Vetlaagte and Wag ‘n Bietjie southeast of De Aar. The location of the proposed project features as indicated by the legend on the map. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 3024 Colesburg.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006; Smith et al., 2020). 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	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pa	Adelaide Subgroup, Beaufort Group, Karoo SG	Shales, mudstone, sandstone	
Pt	Tierberg Fm, Ecca Group, Karoo SG		

The Karoo Supergroup rocks cover a very large proportion of South Africa and represent 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 the Dwyka Group tillites, diamictites and mudstones were deposited as the ice sheets melted. Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the west and central part are the following formations, from base upwards: Prince Albert Formation, Whitehill Formation, Collingham Formation, Laingsburg / Ripon Formations, Tierberg / Fort Brown Formations, and Waterford Formation (Johnson et al., 2006). All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

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

There are only two formations in this part of the Karoo Basin, the basal Abrahamskraal Formation and the Teekloof Formation. The latter has been divided into four members, from the base upwards they are the Poortje, Hoedemaker, Oukloof and Steenkampsvlakte Members. There are no younger strata in this part of the basin.

During the Jurassic there were massive basalt outpourings that formed the Drakensberg Mountains but at the same time numerous dykes and sills intruded through the Karoo Basin sediments. These igneous rocks are known as the Jurassic dolerites and they not preserve fossils. Much younger, weathered sediments, sols and sands cover large parts of South Africa and they are of Quaternary age (Partridge et al., 2006). Only in some parts are they divided into groups and formations.

v. Palaeontological context

According to the SAHRIS Palaeosensitivity Maps (Figures 4, 5), the area proposed for development is underlain by sediments of moderate, high and very high paleontological
sensitivity. Moderately sensitive sediments are the Quaternary sands, high sensitivity sediments are the Tierberg Formation shales and the very highly sensitive rocks are the Adelaide Subgroup mudstones and

sandstones. The dolerite has no fossils. The formations will be considered chronologically from oldest to youngest.

The Tierberg Formation does not have a significant vertebrate fauna but may preserve fossil leaves of the *Glossopteris* flora and fragments of silicified wood (Plumstead, 1969; Johnson et al., 2006). According to the site visit reported by Almond (2012) for the Tierberg Formation on Farm Vetlaagte, there were some fragments of plant fossils and wood that he considered of minimal importance and the PV facility was approved by SAHRA. Therefore, the same can be said for the proposed 132 kV

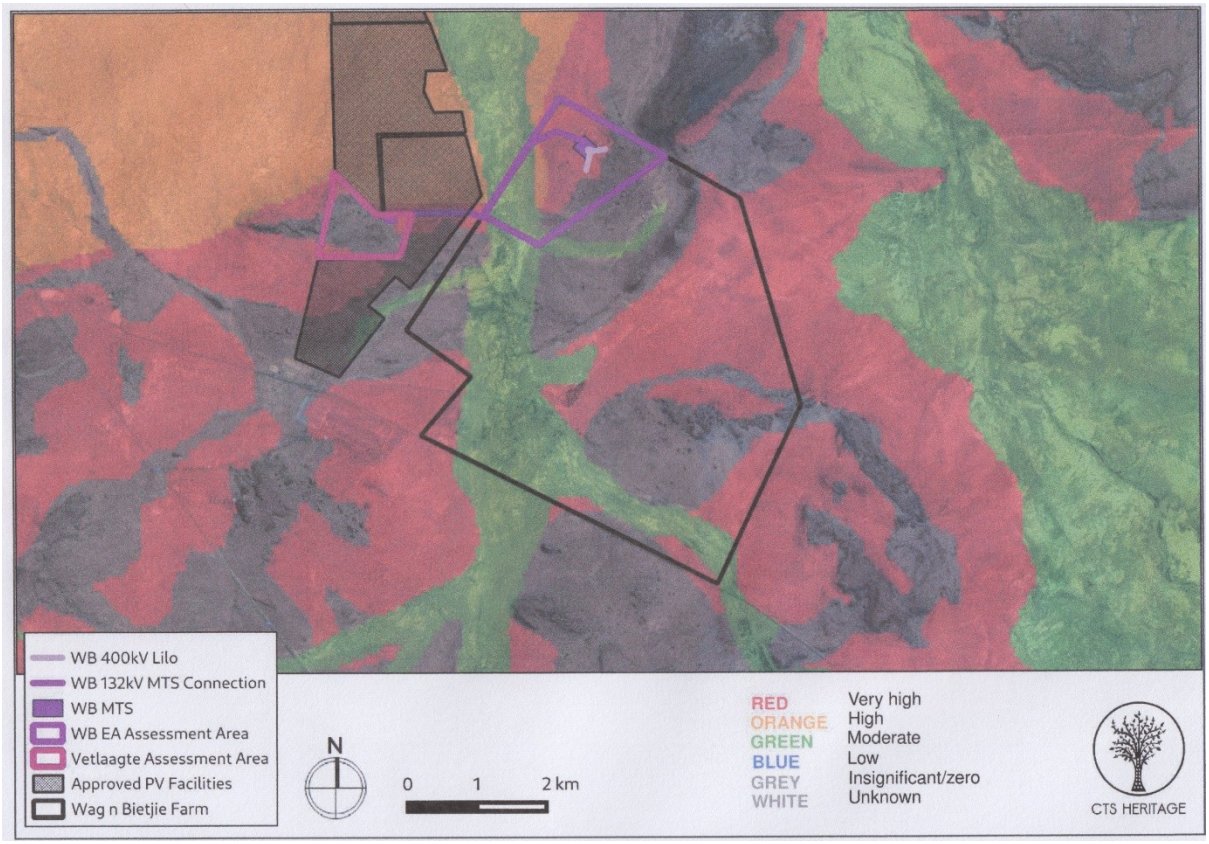

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Wag ‘n Bietjie Assessment are and grid infrastructure (see legend on map). Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

grid connection on Vetlaagte that runs N-S through the approved PV area (Figure 5), and for the narrow exposure of Tierberg Formation in the Wag ‘n Bietjie Assessment area (Figure 4).

The Adelaide Subgroup is very highly sensitive as it has a variety of vertebrate fossils in some areas. According to the recent Biostratigraphy for South Africa (Smith et al., 2020), De Aar is in the Eodicynodon and the Tapinocephalus Assemblage Zones, i.e. in the lower part of the Adelaide Subgroup, of the Abrahamskraal Formation. Index fossils would have to be

found to support this. The northern part of Farm Wag ‘n Bietjie lies on the Adelaide Subgroup. According to Almond (2012), trace fossils, silicified wood and rare vertebrate remains (therapsids, parareptiles) of the Middle Permian Pristerognathus Assemblage Zone have recently been recorded from this succession in the De Aar region. Note that the Pristerognathus Assemblage Zone (Rubidge et al., 1995) is now called the Endothion Assemblage Zone (Smith et al., 2020). Almond id not consider this stratum to be very highly sensitive. The Wag ‘n Bietjie assessment area including the 132 kV line, LILO and MTS, are on the Adelaide Subgroup rocks.

Jurassic dolerite does not preserve fossils so the new assessment area for Vetlaagte (Figure 5) that lies on dolerite does not need any palaeontological impact assessment.

Quaternary alluvium, especially when associated with valleys and river or stream channels, would only have transported robust and fragmentary fossils. These are of minimal palaeontological significance as they are out of primary context, and the fragments are difficult to identify. The south western part of the Wag n’ Bietjie assessment area and the 132 kV line are on this alluvium (Figure 4).

Almond did not consider the impact on fossils by the proposed developments to be high, and the literature does not contradict him. In addition, fossils are more easily see where there is rocky outcrop and not on flat land. Nonetheless, a Fossil Chance find Protocol should be followed (see Section 8, Appendix A).

Figure 5: SAHRIS palaeosensitivity map for the site for the proposed Vetlaagte Assessment are and grid infrastructure (see legend on map). Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

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	Dolerites and alluvium do not preserve fossils. The Tierberg Fm might have fossil plants and wood. The Adelaide Subgroup might have vertebrates but they are sporadic. It is very unlikely that fossils occur on the site surface. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be fossil plants from the *Glossopteris* flora in the Tierberg Fm or vertebrate bones in the Adelaide Subgroup mudstones, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**There is a small chance that fossil plants occur in the Tierberg Fm or bones in the Adelaide Subgroup and these should be collected when excavations commence.**
	L	It is extremely unlikely that any fossils would be found in the loose soils and sand of the Quaternary that will be excavated. Nonetheles,s 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 type and age to contain fossils. 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 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, shales and sands are typical for the country and some do contain fossil plant, insect, invertebrate and vertebrate material. The

sands of the Quaternary period would not preserve fossils. Almond (2010) found no fossils of significance during his site visit to Vetlaagte, and the Wag ‘n Bietjie farm has the same lithology. It is unknown what lies below the surface.

viii. Recommendation

Based on experience, other reports and the lack of any significant previously recorded fossils from the area, it is unlikely that any fossils would be preserved in the Tierberg Formation or Adelaide Subgroup. Nonetheless, 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 foundations, infrastructure and amenities have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample (See Section 8 and Appendix A).

Table 4: Summary of potential fossils and recommended action for each of the Solar sites and the infrastructure.

Structure and location	Palaeosensitivity	Action required
Wag ‘n Bietjie Assessment – N and central, 132 kV line MTS, LILO	Adelaide sG Very high	FCFP - bones
Wag ‘n Bietjie Assessment - west	Quaternary alluvium Moderate	FCFP – any fragments
Vetlaagte Assessment area – all	Jurassic dolerite No sensitivity	No action
Vetlaagte 132 kV grid connection	Tierberg Fm High	FCFP – plants and wood
Vetlaagte LILO, MTS Alt 1	Adelaide sG Very high	FCFP – bones
Vetlaagte MTS Alt 2 (east)	Jurassic dolerite	No action
Switching station	Jurassic dolerite	No action

ix. References

Almond, J.E. 2012. Palaeontological specialist study combined desktop and field-based assessments: Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern, Cape Province

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.

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.

Rubidge, B.S. (Ed), 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). Biostratigraphy Series 1, South African Commission for Stratigraphy. Council for Geoscience, 46 pp.

Smith, R.M.H., Rubidge, B.S., Day, M.O., Botha, J., 2020. Introduction to the tetrapod biozonation of the Karoo Supergroup. South African Journal of Geology 123, 131-140.
doi:10.25131/sajg.123.0009

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/mining 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, 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 Figures 6, 8). 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.

Appendix A – Examples of fossils from the Karoo Supergroup ad Quaternary.

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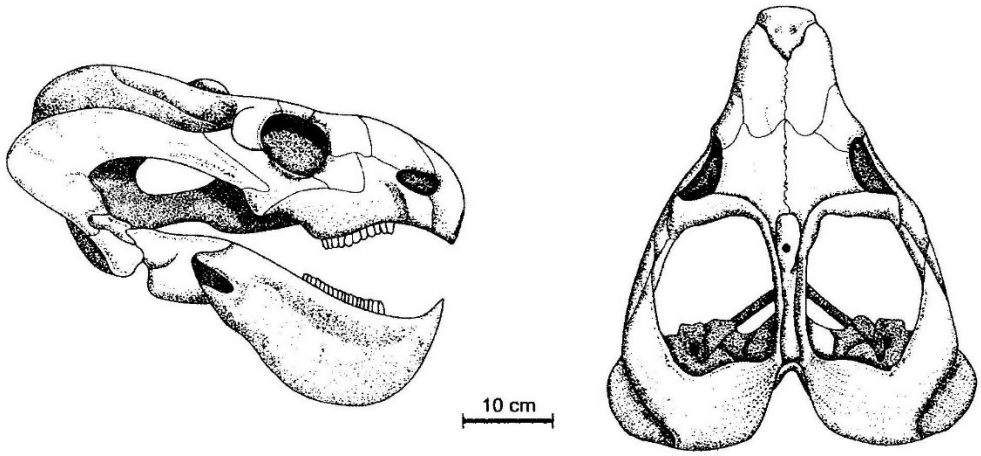

Figure 5: Diagrams of the index fossil *Endothiodon* from the lower Adelaide subgroup (From Rubidge, 1995).

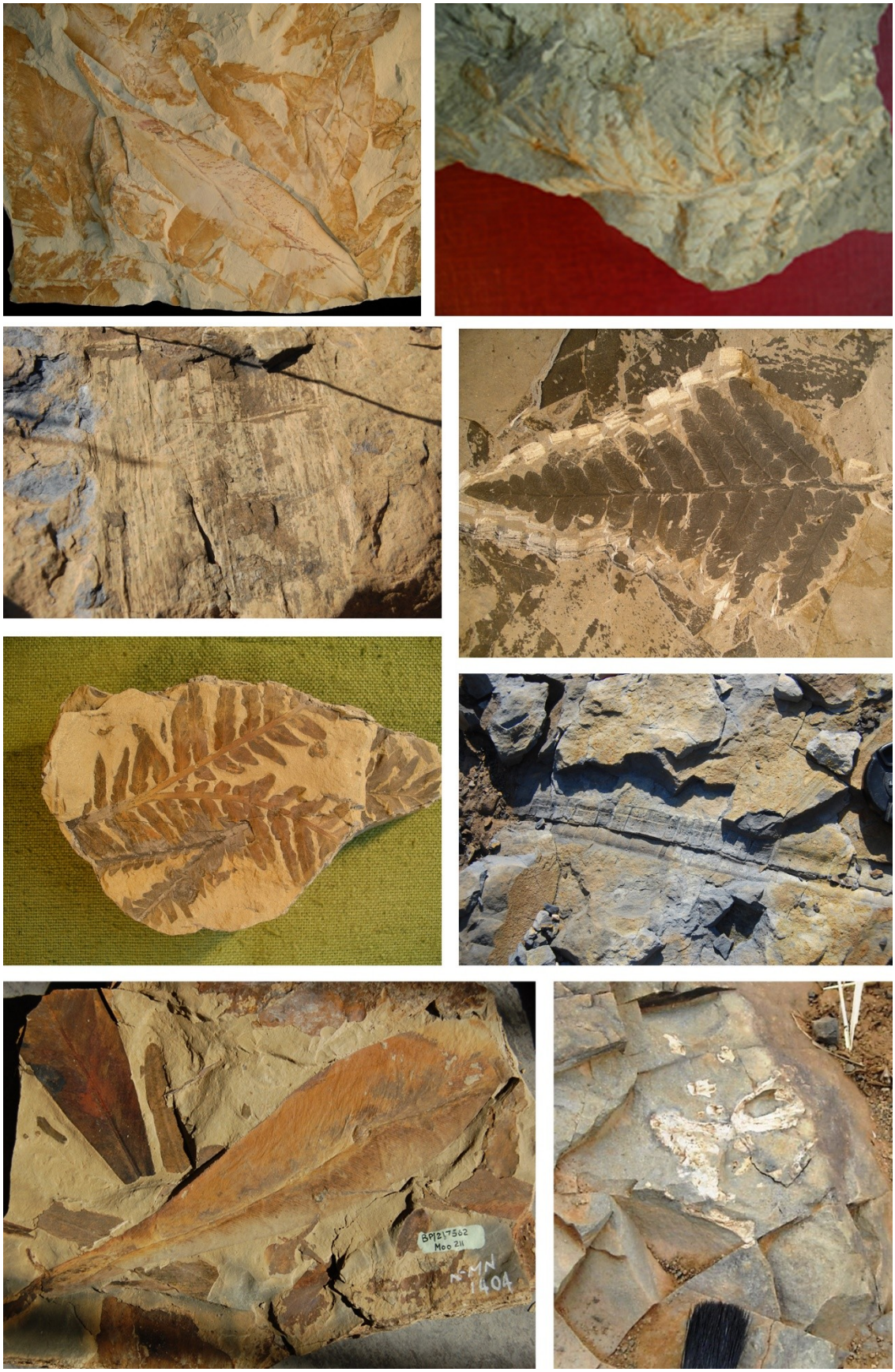

Figure 6: Selection of Glossopteris flora plants from the Vryheid formation. Note bottom right photograph is an example of what fossil bones look like in the field.

Figure 8: Quaternary fossils, bones and wood fragments.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD July 2021

I) Personal details

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

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

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

iv) Membership of professional bodies/associations

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

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/ completed	Current
Honours	11	0
Masters	10	4
PhD	11	4
Postdoctoral fellows	10	5

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year

Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –

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

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells

- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for EnviroPro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for EnviroPro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

xi) Research Output

Publications by M K Bamford up to July 2021 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 29; Google scholar h-index = 35; -i10-index = 92
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

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