APPENDIX F6: Palaeontology Impact Assessment

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED GROOTVLEI 600MW SOLAR PLANT, BATTERY ENERGY STORAGE SYSTEMS & GRID CONNECTION PROJECT NEAR VENTERSDORP, DR KENNETH KAUNDA AND NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITIES, NORTH WEST PROVINCE

October 2026

COMPILED for: Nemai Consulting

Version 02

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

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SIGNATURE: 

The Palaeontological impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and **Appendix 1**	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix 1**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3 – Terms of Reference and scope of work	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 5 and 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Sections 1.3, 8 & 9	-
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Sections 4, 7 & 10 – Methods and Assessment Methodology	-
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or	Sections 1.3, 5 & 9	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;		
(g) An identification of any areas to be avoided, including buffers	Sections 9 & 11	-
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	-
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(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	Sections 10 and 11	-
(k) Any mitigation measures for inclusion in the EMPr	Sections 11 & 12	-
(l) Any conditions for inclusion in the environmental authorisation	Sections 11 & 12	-
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Sections 11 & 12	-
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Executive Summary & Section 11	-
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	Executive Summary & Section 11	-
(n)(ii) If the opinion is that the proposed activity, activities 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 11 and 12	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
		consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	Executive Summary; Section 11	I&AP comment on palaeontology (Scoping CRR, Item 89) addressed in this PIA.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice 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.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental (Pty) Ltd was appointed by Nemai Consulting CC to conduct the Palaeontological Impact Assessment (PIA) for the proposed Grootvlei 600 MW Solar PV Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project, located northwest of Ventersdorp within the Dr Kenneth Kaunda and Ngaka Modiri Molema District Municipalities, North West Province. In accordance with the National Environmental Management Act No. 107 of 1998 (NEMA) and Section 38 of the National Heritage Resources Act No. 25 of 1999 (NHRA), this PIA was undertaken to determine the potential occurrence of palaeontological heritage resources within the proposed development area, assess the potential impacts of the proposed development on such resources, and recommend appropriate mitigation measures where required.

The proposed Grootvlei Solar PV Facility is entirely underlain by Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The Malmani Subgroup is well known for its stromatolitic carbonate rocks and associated Precambrian palaeontological resources. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS), the Malmani Subgroup has Very High palaeontological sensitivity (Almond et al., 2013; SAHRIS website), while the palaeontological technical report for the North West Province (Groenewald et al., 2014) assigns a High sensitivity to the same geological unit. Consistent with these assessments, the DFFE National Web-Based Environmental Screening Tool identifies areas within the broader study area as having Very High palaeontological sensitivity.

The Very High sensitivity indicated by the SAHRIS PalaeoMap and the DFFE Screening Tool warranted a site investigation, which was conducted on foot and by motor vehicle on 31 May 2023. During the field investigation, weathered stromatolitic material was identified within the proposed development footprint. Although these stromatolites are generally weathered and poorly preserved, their occurrence confirms the potential for palaeontological heritage resources within the underlying Malmani Subgroup. The mapped Very High sensitivity, combined with the nature and extent of potential ground disturbance and the documented stromatolitic material, supports the Very High pre-mitigation palaeontological impact significance assigned in the impact matrix to the construction phase of the Project, based on the Very High palaeontological sensitivity of the underlying geological unit, the nature of the proposed development, and the identification of stromatolitic material within the footprint. The observed stromatolitic fragments had been displaced and piled in heaps during historical agricultural land clearance, rather than being documented as in-situ horizons. Long-term agricultural disturbance has reduced the visibility of surface exposures elsewhere within the footprint; this does not imply an absence of fossiliferous bedrock.

With the implementation of appropriate mitigation measures, including the Chance Find Protocol, the palaeontological impact is expected to be reduced to Low. The generally poor preservation of the stromatolitic material observed during the field investigation is also taken into consideration in the assessment. It is recognised, however, that better-preserved stromatolitic horizons may occur elsewhere within the broader area and that previously concealed palaeontological material may be exposed during construction.

A Very High palaeontological significance has therefore been assigned to the construction phase prior to mitigation, reducing to Low following implementation of the recommended mitigation measures. Construction is the only development phase anticipated to result in a direct impact on palaeontological heritage resources, primarily through vegetation clearance, site preparation, excavation, trenching and other ground-disturbing activities. No significant impacts are anticipated during the operational or decommissioning phases. The No-Go Alternative would maintain the existing status quo and would therefore have a neutral impact on palaeontological heritage resources. The cumulative impact associated with other developments in the broader Ventersdorp area is considered Low both before and after mitigation and is regarded as being within acceptable limits.

It is therefore considered that, provided the recommended mitigation measures are implemented, the proposed development is unlikely to result in significant adverse impacts on palaeontological heritage resources. Construction may proceed across the proposed development footprint, subject to implementation of the Chance Find Protocol and the recommendations contained in this report. The specialist confirms that the field investigation was adequate for the proposed development, including the revised project footprint, and no additional pre-construction palaeontological field investigation is required. The Chance Find Protocol is considered an appropriate mechanism to manage any previously concealed fossil material exposed during construction. However, should previously unidentified or better-preserved fossil material be exposed during construction, the Chance Find Protocol must be implemented and the appropriate specialist mitigation undertaken.

If significant well-preserved fossil remains are discovered during construction, whether exposed on the surface or uncovered during excavation, the Chance Find Protocol must be implemented by the Environmental Control Officer (ECO) or designated site manager. The recommended palaeontological mitigation measures, including the Chance Find Protocol, must be incorporated into the Environmental Management Programme (EMPr) for the Grootvlei Project and implemented throughout the construction phase. Any significant well-preserved discovery must be protected in situ where possible and reported immediately to the South African Heritage Resources Agency (SAHRA) for assessment and appropriate mitigation by a qualified palaeontologist. SAHRA can be contacted at 111 Harrington Street, Cape Town; PO Box 4637, Cape Town, 8000, South Africa; Tel: 021 462 4502; Fax: +27 (0)21 462 4509; Website: www.sahra.org.za. No fossil material may be collected without the required SAHRA permit, and any recovered material must be curated in an accredited repository.

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GLOSSARY OF TERMS

Fossil

A fossil is the preserved remains or traces of an organism that lived in the distant past, typically millions of years ago. Fossils may include mineralised skeletal structures, shells, or other durable components of ancient flora and fauna, as well as impressions, moulds, and casts formed in sedimentary rock as a result of the decomposition of the organism's remains. These preserved remains provide important evidence for understanding the evolution, biodiversity and environments of the geological past.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act No 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures, and equipment of cultural significance.
- places to which oral traditions are attached or which are associated with living heritage.
- historical settlements and townscapes.
- landscapes and natural features of cultural significance.
- geological sites of scientific or cultural importance.
- archaeological and palaeontological sites.
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past (other than fossil fuels or fossiliferous rock intended for industrial use) and any site which comprises of fossilised remains or traces of past life.

The term palaeontology derives from the modern Latin palaeontologia, which in turn originates from the Greek words palaios (παλαιός), meaning “ancient,” and ontos (ὄντος), meaning “being” or “creature,” combined with the suffix -logia, meaning “study of.” The literal translation is therefore “the study of ancient beings.” In English usage, the British and South African spelling is palaeontology, while the American spelling omits the a after the p, rendering paleontology. In this report the English and South African spelling of Palaeontology will be used.

LIST OF ABBREVIATIONS

BA	Basic Assessment
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	Competent Authority
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
Ma	Millions of years ago
MISS	Microbially induced sedimentary structures
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PDA	Palaeontological Desktop Assessment
PIA	Palaeontological Impact Assessment
PSSA	Palaeontological Society of South Africa
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference
TSF	Tailings Storage Facility

1. INTRODUCTION

South Africa's continued reliance on coal-fired electricity generation, and the associated need for a secure and diversified energy supply, has driven the development of renewable energy projects across the country. LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the "Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project" (the "Project"), located north west of Ventersdorp within the JB Marks and Ditsobotla Local Municipalities, North West Province.

The Department of Forestry, Fisheries and the Environment (DFFE) granted Environmental Authorisation (EA) for the Project (reference number 14/12/16/3/3/2/2386) on 13 December 2023. Subsequent optimization of the facility layout showed that the land secured under this authorisation would not accommodate the planned generation capacity. To avoid incremental decision-making, and as guided by DFFE, the Applicant had the existing EA lapsed; the amendment was granted on 7 April 2026 (reference number 14/12/16/3/3/2/2386/AM1). The Applicant is now applying for a new EA covering the Project's full extent, comprising both the originally authorised area and the additional expansion area.

The Project's transmission infrastructure comprises an on-site 132/33kV collector substation and 132kV switching station, installed at both distribution (132kV) and transmission (2 x 275kV) levels. Three 132kV overhead lines link the switching station to a new 400/132kV substation approximately 18km north-west of the site, on Portion 1 of the farm Houtkop 152 IP; two 275kV tie-in lines then connect this substation to the existing Pluto – Watershed 275kV line. Together, this infrastructure will facilitate connection to the national grid, with potential for electricity wheeling to off-site offtakers.

The Grid Connection Capacity Assessment (GCCA) presents the available generation connection capacity of transmission substations across South Africa's supply areas; the Project falls within the North West Supply Area. The GCCA released by Eskom in October 2023 confirms that this supply area currently has 1660MW of generation connection capacity available. The Project Site itself lies approximately 14km from the Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line, and 2.8km from the Makokskraal Substation.

The Applicant intends to bid into current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) windows, and/or other renewable energy markets within SA (Figures 1 and 2).

1.1 Technical details

The Project comprises the following systems, sub-systems and components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);

- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Transmission infrastructure with an installed capacity at both distribution (132kV) and transmission (2 x 275kV) levels, comprising an on-site 132/33kV collector substation, an on-site 132kV switching station, three 132kV overhead lines linking the switching station to a new 400/132kV Main Transmission Substation (MTS) located approximately 18km north-west of the site on Portion 1 of the farm Houtkop 152 IP, and two 275kV tie-in lines connecting to the existing Pluto – Watershed 275kV line;
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

An overview of the Project's life-cycle, together with the resources required for its execution, is provided in the Scoping Report.

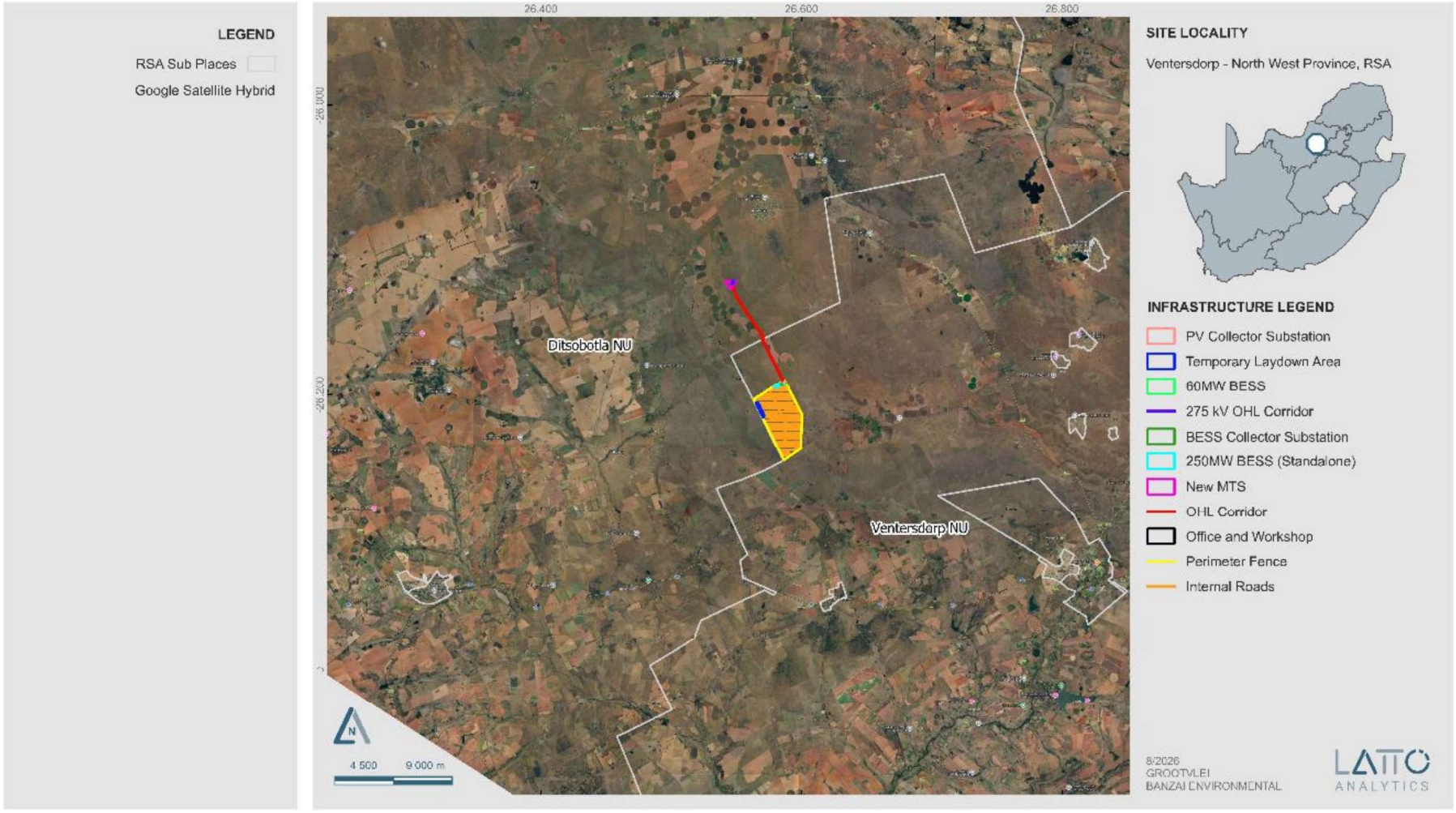

Figure 1: Regional locality of the proposed Grootvlei 600MW Solar Plant, BESS & Grid Connection Project in North West Province.

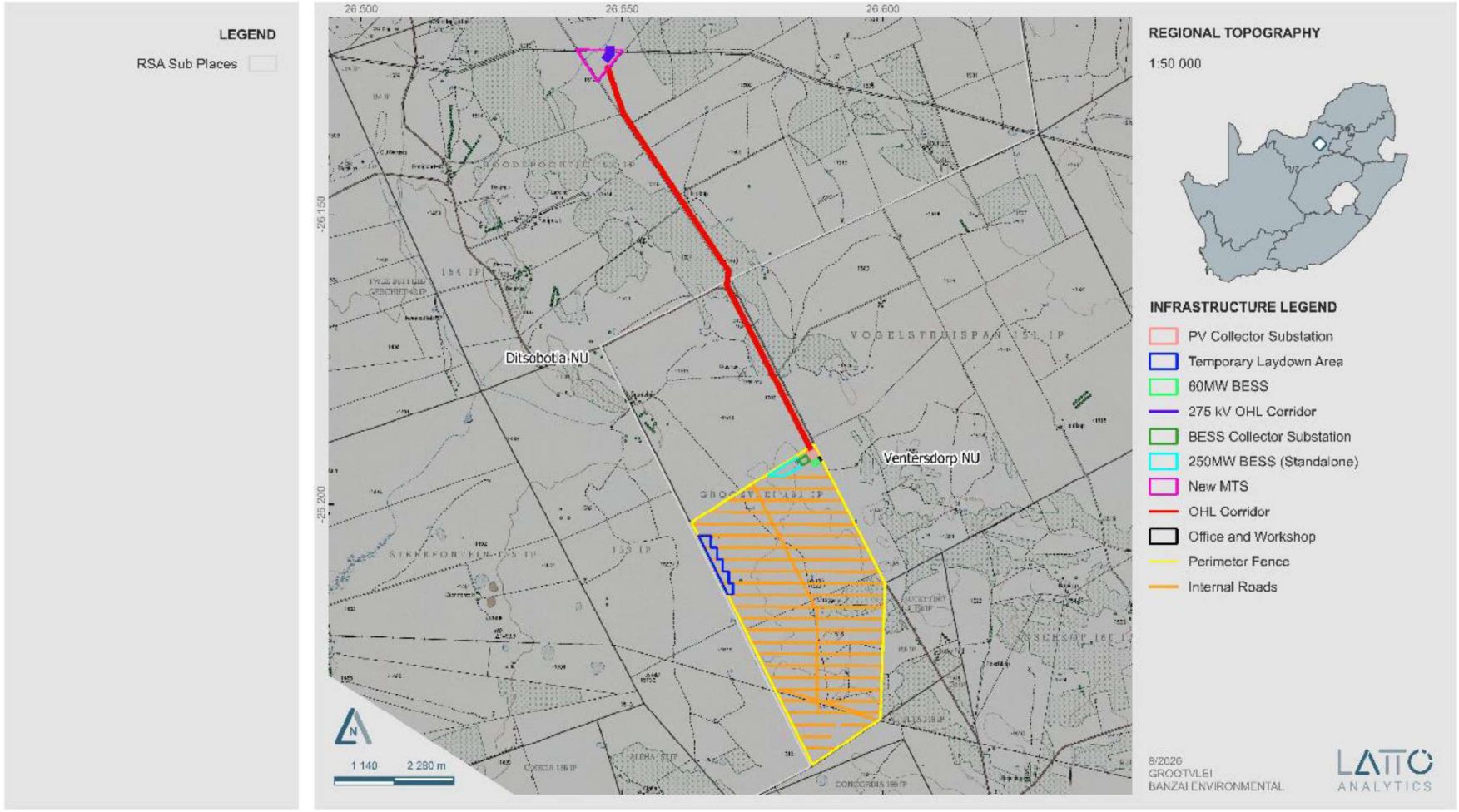

Figure 2: Locality map of the proposed Grootvlei 600MW Solar Plant, BESS & internal Grid Connection Project in North West Province.

The Project's main infrastructure components, comprising the Solar Plant, the New Main Transmission Substation and the Powerline Route, are situated across several farm portions within the study area. Table 2 below sets out these farm portions together with their corresponding Surveyor-General (SG) numbers, per Project component.

Table 2: Location of the proposed Project.	
Solar Plant	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
New Main Transmission Substation	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Powerline Route	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Portion number 9 of the Farm Houtkop 152	T0IP00000000015200009
Portion number 11 of the Farm Houtkop 152	T0IP00000000015200011
Portion number 12 of the Farm Houtkop 152	T0IP00000000015200012
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Portion number 1 of the Farm Roodepoortje 154 IP	T0IP00000000015400001

In addition to its location, the Project is defined by a range of key technical parameters relating to its physical footprint, generation capacity, and associated infrastructure components. These parameters, which inform the scope and scale of the palaeontological assessment, are summarized in Table 3 below.

Table 3: Technical details of the proposed Solar Plant		
No.	Component	Description / Dimensions
1.	Height of PV panels	4.5m (at maximum tilt)
2.	Facility generation capacity (MW)	662.4MWp / 600MWac
3.	Total area of Project (ha)	1 300 ha
4.	Area of PV Array	1 060 ha
5.	Area and capacity of substations	• PV Collector Substation: 1.67 ha / 640 MVA

		• MTS: 4.00 ha / 1000 MVA
6.	Area occupied by both permanent and construction laydown areas	19.8 ha
7.	Area and Capacity of BESS	• 60MW BESS – Area: 1.15 ha; Capacity: 60MW / 240MWh • 250MW BESS – Area: 9.2 ha; Capacity: 250MW / 1000MWh; Collector Substation: 2.12 ha / 300 MVA
8.	Area occupied by buildings	• Office & Workshop: 0.29 ha • Guard House: 0.02 ha
9.	Length of internal roads	77.2 km
10.	Width of internal roads	6m
11.	Proximity to grid connection	Transmission infrastructure with an installed capacity at both distribution (132kV) and transmission (2 x 275kV) levels: an on-site 132/33kV collector substation, an on-site 132kV switching station, three 132kV overhead lines linking the switching station to a new 400/132kV Main Transmission Substation (MTS) located approximately 18km north-west of the site on Portion 1 of the farm Houtkop 152 IP, and two 275kV tie-in lines connecting to the existing Pluto – Watershed 275kV line.
12.	Height of fencing	Up to 3m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing

1.2 Alternatives

Alternatives are the different ways in which the Project can be executed to achieve its objectives; examples include carrying out a different type of action, choosing an alternative location, or adopting a different technology or design.

The sub-sections below present the Project's alternatives as identified during the Scoping Phase. A detailed comparative analysis of the feasible alternatives, from both environmental (including specialist input) and technical perspectives, is undertaken in the current EIA Phase.

This comparative analysis allows the Best Practicable Environmental Option (BPEO) to be selected on sound technical and environmental grounds. Münster (2005) defines BPEO as the alternative that "*provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

1.2.1 Site alternatives

No site alternatives are proposed for this Project. Favourable location factors for the PV Site include suitable solar irradiation levels, a short distance to the grid connection point, flat topography, suitable site access, and land availability.

1.2.2 Layout / Design Alternatives

An initial layout for the Solar Plant was developed and granted Environmental Authorisation (EA) in December 2023. Specialist delineation work later showed that the authorised site was not large enough to both avoid the identified wetland areas and fit the number of PV modules the Project needs, so the EA was allowed to lapse and the site was subsequently expanded. Specialists visited the expanded site to map its sensitive features before the layout was finalised, so those areas could be avoided by design rather than assessed afterwards. As a result, no alternative site layouts are presented here – the current layout is itself the product of that iterative, specialist-led process. Should further sensitivities come to light during the EIA Phase, the layout may still be refined.

1.2.3 Technology Alternatives

Solar PV Technology

Solar PV technology consists of Monofacial or bifacial solar panels mounted on either a fixed or a tracking system.

BESS Technology

BESS technology falls into two broad types – solid-state and flow battery systems – and the Project may use a single technology or a combination of both. The EIA Report weighs up the advantages and disadvantages of each.

No-go Option

As standard practice, and to satisfy regulatory requirements, the option of not proceeding with the Project is included in the evaluation of alternatives. The no-go alternative serves as the baseline against which the Project's impacts are assessed: it takes the current status and conditions of the Project footprint as the benchmark for measuring any changes the Project would bring. Should the Project not proceed, any potentially significant environmental issues would simply not arise, and the status quo of the local

receiving environment would remain unaffected. The no-go alternative is assessed in the EIA Phase, taking into consideration the findings of the specialist studies and the outcomes of public participation, amongst others.

1.3 Terms of Reference and scope of work

A site sensitivity verification report is required to be undertaken to comply with "Part A - General Protocol for the Site Sensitivity Verification and Minimum Report Content Requirements where a Specialist Assessment is required but no specific Environmental Theme Protocol has been prescribed" (GG 43110 / GNR 320, 20 March 2020).

A site-specific field survey was conducted on 31 May 2023. The specialist considers this investigation adequate for assessment of the proposed development, including the revised footprint, to verify the site sensitivity assigned to the Grootvlei site, and to validate the sensitivity and land use prescribed by the DFFE Screening Tool (see Appendix 2). The Screening Tool indicates that the proposed development has a Very High palaeontological sensitivity; this assessment is confirmed here, as weathered stromatolites were identified during the palaeontological site investigation, consistent with a Very High palaeontological sensitivity for the study area. Should palaeontological heritage be uncovered during surface clearing or excavation, the attached Chance Find Protocol should be implemented immediately, and these recommendations incorporated into the EMPr and applied throughout the construction phase. The development may accordingly be permitted in its entirety, with no further palaeontological heritage studies, ground-truthing, or specialist mitigation required, pending the discovery of any new fossil material.

2. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Please refer to Appendix 1 (Specialist CV).

This study has been conducted by Mrs. Elize Butler of Banzai Environmental (Pty) Ltd. She has conducted approximately 900 palaeontological impact assessments (PIA) for developments in the Free State, KwaZulu-Natal, Eastern, Northern and Western Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than thirty years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of Paleontological Society of South Africa (PSSA) since 2006.

3. LEGISLATIVE FRAMEWORK

3.1 Review of the National Heritage Resources Act (Act 25 of 1999) and Section 38

Cultural and palaeontological heritage in South Africa is safeguarded through a robust legal framework that ensures the protection, management, and sustainable use of heritage resources. The National Heritage Resources Act (Act 25 of 1999) (NHRA) forms the cornerstone of this system and defines heritage resources as part of the national estate, encompassing cultural, historical, archaeological, palaeontological, and geological materials of significance. According to Section 3 of the NHRA, heritage resources include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites, and rare geological specimens."

The NHRA is administered by the South African Heritage Resources Agency (SAHRA) at the national level and Provincial Heritage Resources Authorities (PHRAs) at the provincial level. This three-tier system of heritage management mirrors South Africa's cooperative governance structure and promotes the identification, protection, and conservation of heritage resources for the benefit of present and future generations.

3.2 Legislative Context and Associated Frameworks

The identification and assessment of cultural and fossil heritage in South Africa are governed by a combination of interrelated legislation, including:

- National Environmental Management Act (NEMA) 107 of 1998
- National Heritage Resources Act (NHRA) 25 of 1999
- NEMA Protocols, particularly the *General requirements for site sensitivity verification and minimum report content requirements* (Government Notice 320 of 20 March 2020)
- Environmental Impact Assessment (EIA) Regulations, 2014 (GN R982, Government Gazette 38282 of 4 December 2014), covering:
    - Basic Assessment – Regulations 19 & 20
    - EIA Process – Regulation 23
    - Scoping Report – Regulation 21
    - EMPr – Regulations 19 & 23

Section 23(2)(b) of NEMA states that integrated environmental management must "identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions, and cultural heritage." This embeds heritage management within the broader environmental assessment process and promotes responsible, sustainable development.

3.3 The National Heritage Resources Act

The NHRA provides the legislative framework for managing South Africa's heritage resources. Sections 34 to 36 protect historical buildings, archaeological and palaeontological resources, and burial grounds, while Section 38 governs heritage resource management in relation to development. Palaeontological

heritage is non-renewable and enjoys specific protection under Section 35, which prohibits the disturbance, destruction, or removal of fossils without a valid permit issued by SAHRA or the relevant PHRA. Fossil material must be collected and curated in an accredited institution, and all work must comply with SAHRA's minimum standards. These provisions ensure the responsible conservation of fossil heritage for scientific and educational benefit.

3.4 Section 38: Heritage Impact Assessments (HIA)

Section 38 mandates that certain categories of development or land-use change require a Heritage Impact Assessment (HIA) to identify and mitigate potential impacts on heritage resources.
An HIA is required for:

- Construction of a road, wall, power line, pipeline, canal, or other linear development exceeding 300 m;
- Construction of a bridge or similar structure exceeding 50 m;
- Developments changing a site's character, including those exceeding 5 000 m², involving three or more erven, or rezoning exceeding 10 000 m².

Once triggered, SAHRA or the relevant PHRA must be notified, and a heritage assessment, including archaeological or palaeontological studies, may be required. A complete HIA should:

- Identify and describe heritage resources in the affected area;
- Assess their significance and potential impacts;
- Consider feasible alternatives; and
- Recommend appropriate mitigation and management measures.

This ensures that heritage resources are evaluated and safeguarded through informed planning and mitigation.

3.5 Integration with Environmental Assessment

Section 38(8) of the NHRA allows the heritage assessment process to be integrated with the National Environmental Management Act (NEMA) when both Acts are triggered. This integrated process prevents duplication and ensures that heritage management is fully incorporated into environmental authorisation.
For palaeontological assessments, this means that the Palaeontological Impact Assessment (PIA) can form part of the HIA within the broader EIA framework, promoting early identification and protection of fossil heritage during development planning.

3.6 Conclusion

The National Heritage Resources Act (Act 25 of 1999) remains the foundation of heritage protection in South Africa. Through Section 35 on archaeological and palaeontological resources and Section 38 on heritage impact assessments, the Act ensures that development proceeds in harmony with the conservation of the country's irreplaceable natural and cultural heritage.

Together with the National Environmental Management Act (Act 107 of 1998) and its associated regulations, the NHRA provides a coherent, legally robust framework for heritage resource management. Compliance with these legislative requirements ensures that palaeontological resources are identified, documented, and preserved in accordance with national standards, supporting both scientific knowledge and sustainable development.

4. METHODS AND TERMS OF REFERENCE

This Palaeontological Assessment is part of the HIA Report. The PIA's goals are to: 1) identify the palaeontological significance of the rock formations in the footprint; 2) evaluate the palaeontological magnitude of the formations; 3) clarify the impact on fossil heritage; and 4) make recommendations for how the developer might protect and minimize potential harm to fossil heritage, according to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports".

Calculations of the palaeontological state of each rock segment and the potential impact of development on fossil history take into account the palaeontological status of the rocks, the type of development, and the amount of bedrock removed.

The Provisional DFFE Screening Tool, the SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports for the same area, Google Earth images, topographical and geological maps, as well as academic articles about specimens from the development area and Assemblage Zones, are all used to create scoping reports.

When the development footprint has a moderate to high palaeontological sensitivity, a field-based assessment is necessary. A desktop or field assessment of the exposed rock is used to evaluate the significance of the proposed development's impact, and recommendations for more research or mitigation are made. Excavations for the project often only take place during the building phase, changing the terrain and destroying or permanently encasing fossils at or below the ground surface. Then, access to Fossil Heritage will no longer be available for academic study.

When doing a site investigation, a palaeontologist examines the local development as well as the quantity and variety of fossils found there. This can be demonstrated by looking at representative fossiliferous rock exposures (most igneous and metamorphic rocks are not fossiliferous, whereas sedimentary rocks contain fossil heritage). Examined rock exposures frequently contain a sizeable portion of the stratigraphic unit, which is primarily made up of recently exposed (unweathered) rock. These exposures may be man-made (such as quarries, open building excavations, even railway and road cuttings) or natural (such as cliffs, and dongas as well as rocky outcrops along stream or river banks). It is usual practice for palaeontologists to record well-preserved fossils (GPS, and stratigraphic data) during field assessment examinations.

Although mitigation is often done prior to construction, it may take place if potentially fossiliferous bedrock is revealed. Where a significant, well-preserved fossil find is encountered, it must, where possible, be protected and left in situ; fossil collection and documentation are undertaken as mitigation only where in-situ preservation is not feasible. A permit from SAHRA must be obtained before beginning any fossil excavation, and any material that is collected must be stored at an authorized facility. When mitigation is properly used, it is possible to have a positive impact by raising awareness of the palaeontological past of the area.

By physically evaluating bedrock outcrops to determine their lithology and fossil richness and crisscrossing the development footprint, one can assess an area's fossil potential. Because the presence of fossils at the surface is so unexpected, an average sample size of the region is investigated. To be clear, however, the lack of fossils in a development footprint does not automatically suggest that there is no palaeontologically important material present on the site (on or below the ground surface).

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Describe of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Describe location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area;
- Identify sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluate the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.

- Fair assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Detail the implications of specialist findings for the proposed development (such as permits, licenses etc).

5. GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Grootvlei Solar Plant PV Project near Ventersdorp in North West is depicted on the 1: 250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria). This study area is underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) (**Figure 3, Table 4**). The PalaeoMap of the South African Heritage Resources Information System (Almond *et al*, 2013; SAHRIS website; **Figure 4**) as well as the the DFFE Screening tool (**Figure 5**) indicates that the Palaeontological Sensitivity of the proposed development is Very High while the Palaeotechnical Report of the North West Province (Groenewald et al, 2014) indicates that the Palaeontological Sensitivity is High (**Table 5**).

The Malmani Subgroup is divided into five formations (**Figure 6**), classified according to the amount of chert, stromatolitic morphology, erosion surfaces, and intercalated shales they contain. The Malmani Subgroup overlies the Black Reef Formation. The oldest formation in the Malmani Subgroup is the Oaktree Formation, which consists of stromatolitic dolomites, carbonaceous shales, and locally developed quartzites. This formation is overlain by the Monte Christo Formation, comprising stromatolitic and oolitic platform dolomites as well as erosive breccia. The Lyttleton Formation overlies the Monte Christo Formation and consists of stromatolitic dolomites as well as shale and quartzites. The Eccles Formation follows, comprising erosional breccias, while the youngest formation, the Frisco Formation, mostly comprises stromatolitic dolomites.

The Malmani Subgroup carbonates of the Transvaal Basin (**Figure 6**) comprise an assortment of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and large subtidal domes (Eriksson et al., 2006). Stromatolites are layered mounds, columns, and sheet-like sedimentary rocks (Figure 6), originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesising microbe. Cyanobacteria are prokaryotic cells, the simplest form of modern carbon-based life. Stromatolites are first found in Precambrian rocks and are recognised as among the earliest

known fossils. These cyanobacteria are photosynthetic bacteria, not algae, and contributed to microbial mat development and stromatolite formation through the trapping and binding of sediment and biologically influenced carbonate precipitation, rather than simple deposition of sulphate minerals. Researchers have examined and classified stromatolite structures, but seldom find preserved algal cells. The oxygen atmosphere on which we depend today was generated by numerous cyanobacteria photosynthesising during the Archaean and Proterozoic eras.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Buick, 2001; Schopf, 2006). The Malmani stromatolite literature includes works by Truswell and Eriksson (1972), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner and Beukes (2006), and Schopf (2006).

The Malmani Subgroup succession is approximately 2km thick and consists of a series of formations of oolitic and stromatolitic carbonates (limestones and dolomites), black carbonaceous shales, and minor secondary cherts. The Malmani dolomites also host historic lime mines and palaeocave fossil deposits. Dolomite is a carbonate rock composed predominantly of the mineral dolomite (CaMg(CO3)2); the Malmani carbonate platform was deposited in shallow-marine environments and subsequently underwent diagenetic modification, including dolomitisation. Dolomites of the Malmani Subgroup have a higher magnesium content than other limestones; these materials contain high levels of calcium carbonate and are often referred to as carbonates.

Very few palaeontologists currently study stromatolites, though geologists find them of interest as the Malmani carbonate succession provides important evidence for reconstructing Precambrian marine environments and redox conditions during a period of major atmospheric and oceanic change preceding and overlapping broader developments associated with the Great Oxidation Event (Eroglu et al., 2017).

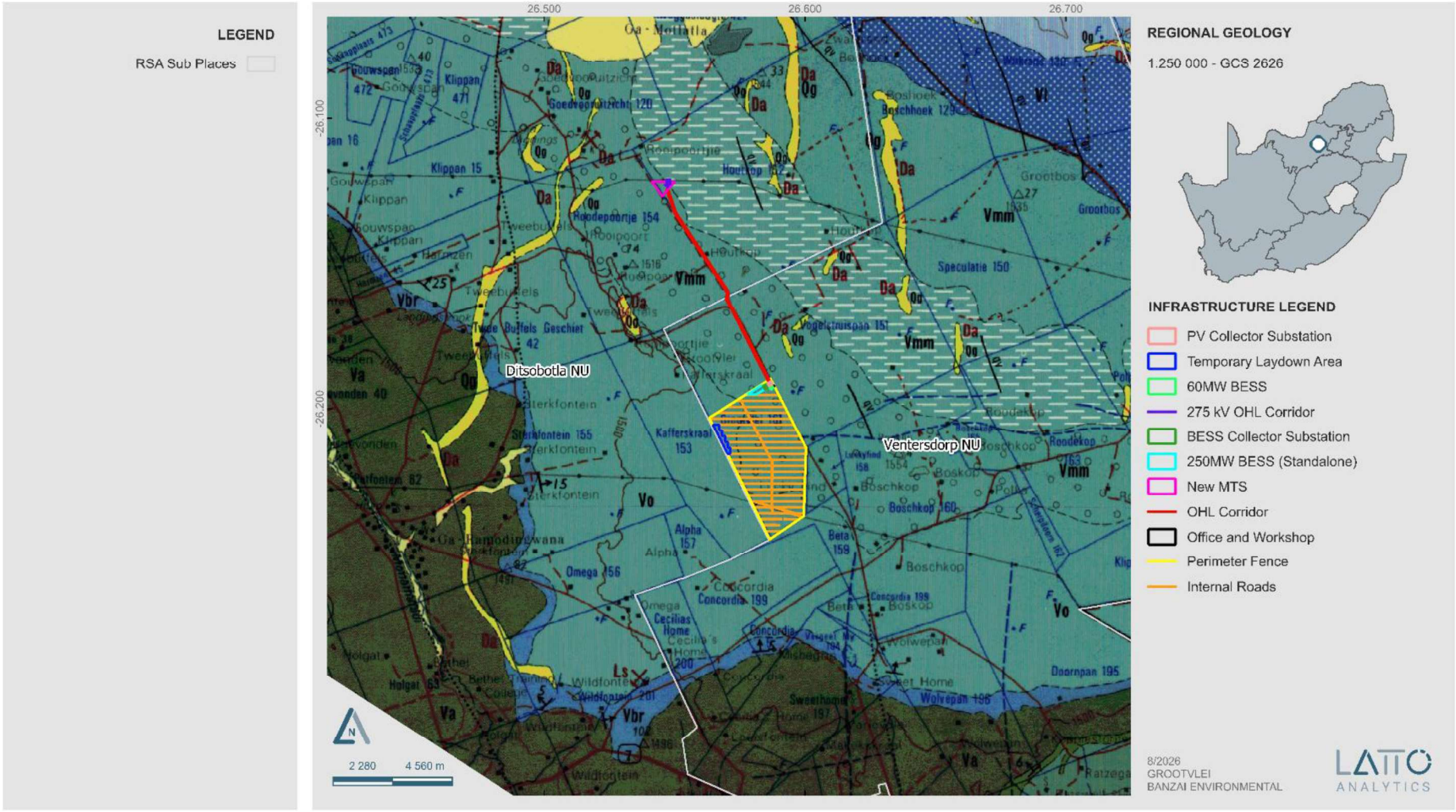

Figure 3: Extract of the 1:250 000 West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria) indicating the Grootvlei PV and grid Project in North West Province. The proposed development is entirely underlain by the Malmani Subgroup (Vmd), Chuniespoort Group, Transvaal Supergroup.

Table 4: Legend to the West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria) indicates that the study area is underlain by the undifferentiated Malmani Subgroup (Vmd) of the Chuniespoort Group, Transvaal Supergroup.

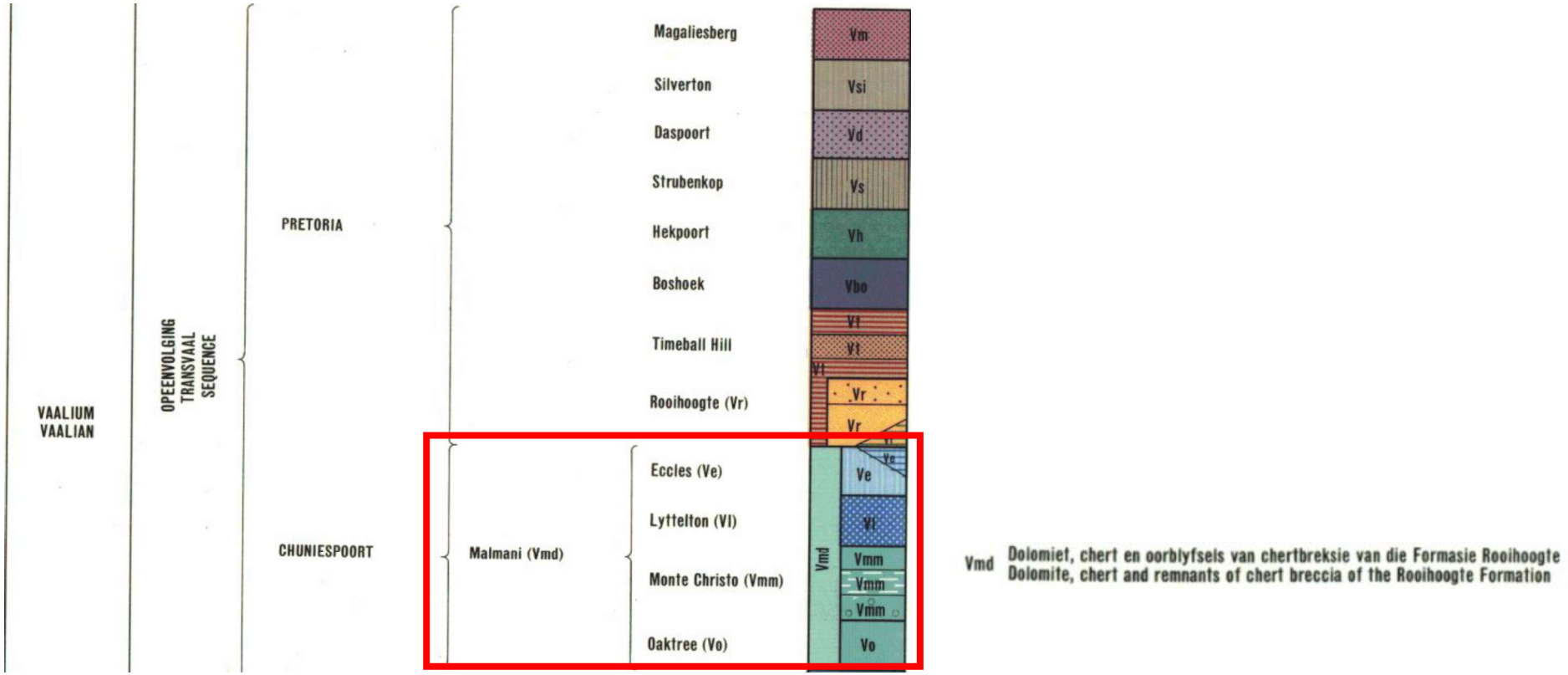

Table 5: Extract of the Palaeotechnical Report of the North West Province (Groenewald, et al., 2014).

CHUNIESPOORT			Penge (Vp; Vla; Qd; Vda; Vk; Vpe)		Banded ironstone	Stromatolites
	Malmani (Vm; Vma)		Mma; Vmm; Vmo; Vmo1; Vmo2; Vmf; Vme; Ve; Ve1; Vml; Va1; Va2; Va3; Vmd; Vm; Vc; Vb; Vf; Vfr; Vfr1; Vfr2; Ve; Vl; Vmo1; Vmo2; Vmo3; Vo; Voa		Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils

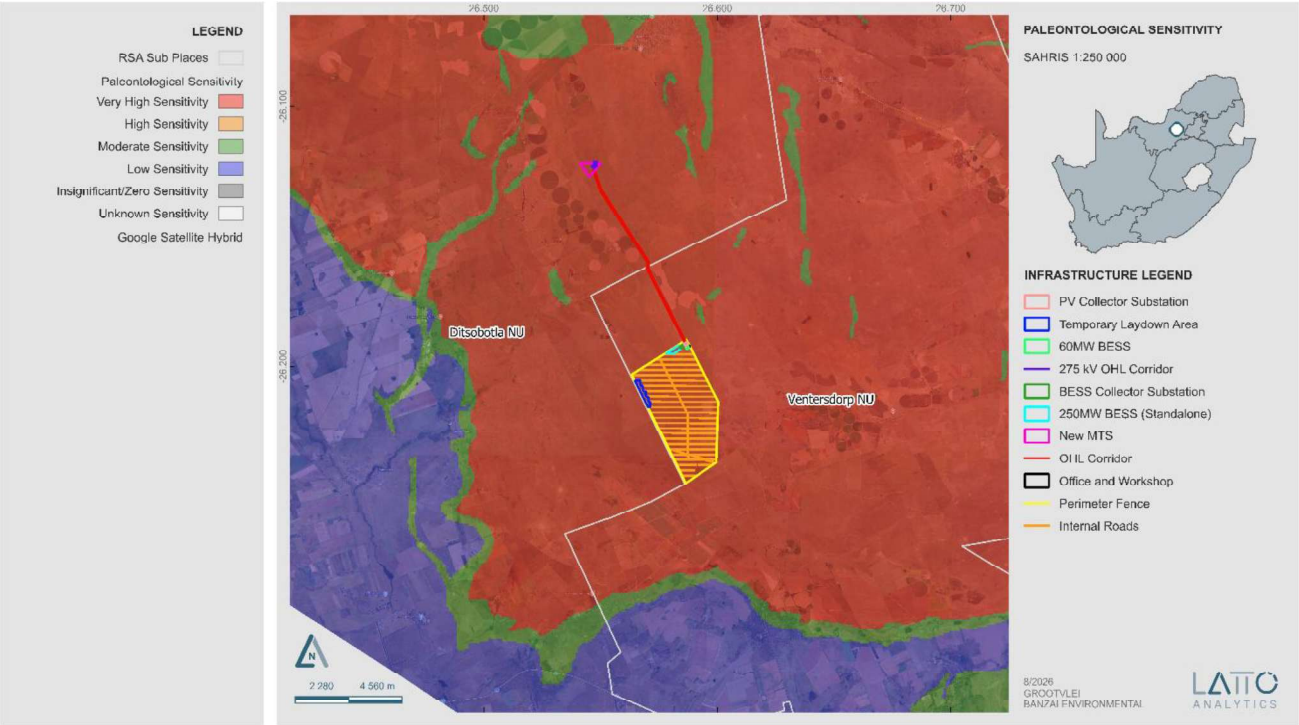

Figure 4: Extract of the SAHRIS PalaeoMap (Almond et al., 2013; SAHRIS website) indicating that the proposed Grootvlei Solar Project in the North West Province is underlain by sediments of Very High (red) palaeontological sensitivity.

Table 6: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website.		
Colour	**Sensitivity**	**Required Action**
RED	**VERY HIGH**	**Field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS Palaeosensitivity map (Figure 4) the proposed development is underlain by sediments with a Very High (red) Palaeontological Significance.

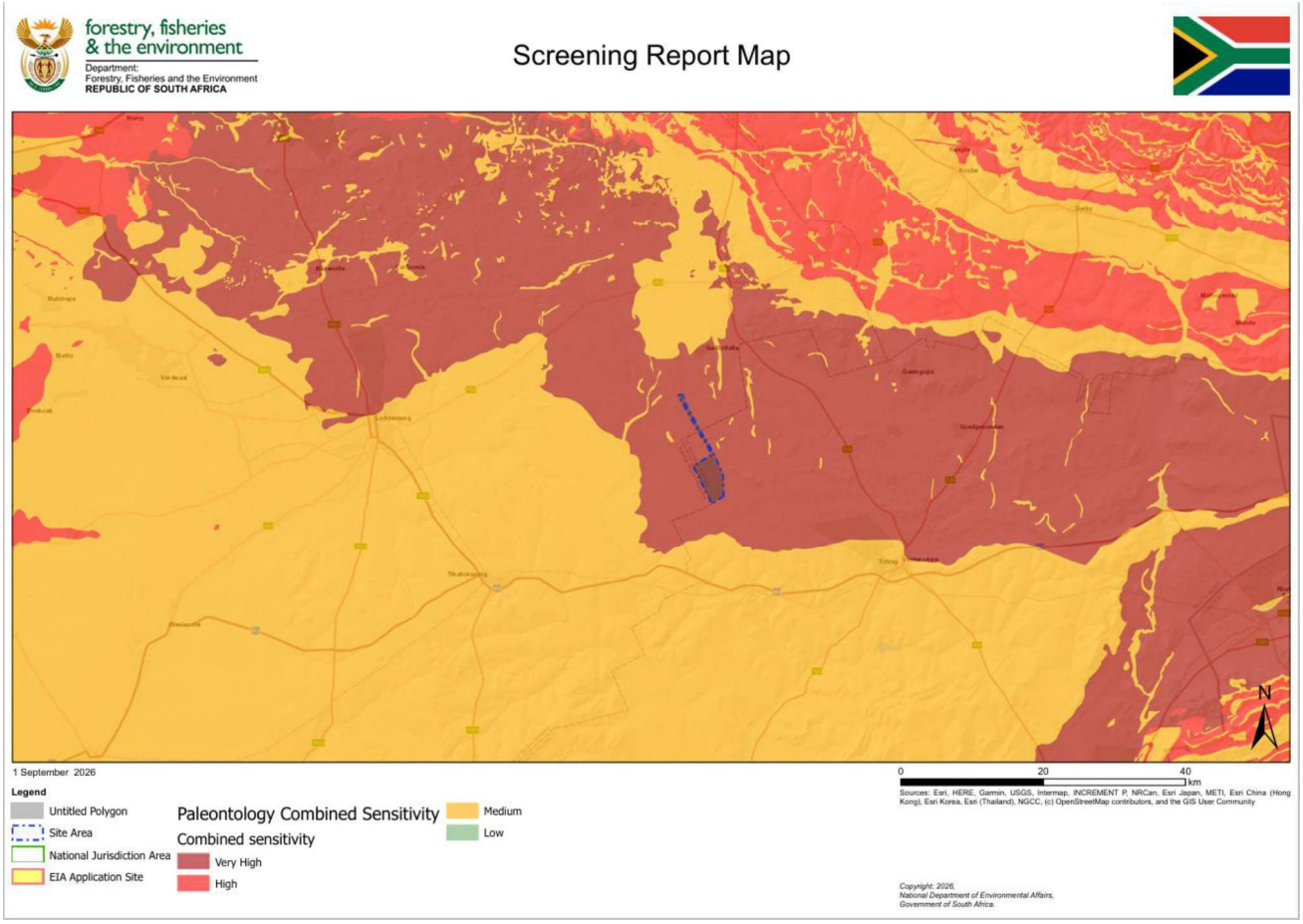

Figure 5: Palaeontological Sensitivity of the Grootvlei Solar PV facility by the National Environmental Web-bases Screening Tool indicates a Very High Palaeontological Sensitivity.

The PalaeoMap of SAHRIS (Figure 4) indicates that the Palaeontological Sensitivity of the assessment area is Very High (red), which is supported by the DFFE Screening Report (Figure 5). Due to the Palaeontological Sensitivities, a site investigation was triggered. A one-day site investigation was conducted on 31 May 2023 during which several weathered stromatolitic fossiliferous outcrops were detected. The Very High Palaeontological Sensitivity of the SAHRIS Palaeomap (Figure 4) and DFFE Screening Tool Report (Figure 5) is thus supported with actual findings in the field.

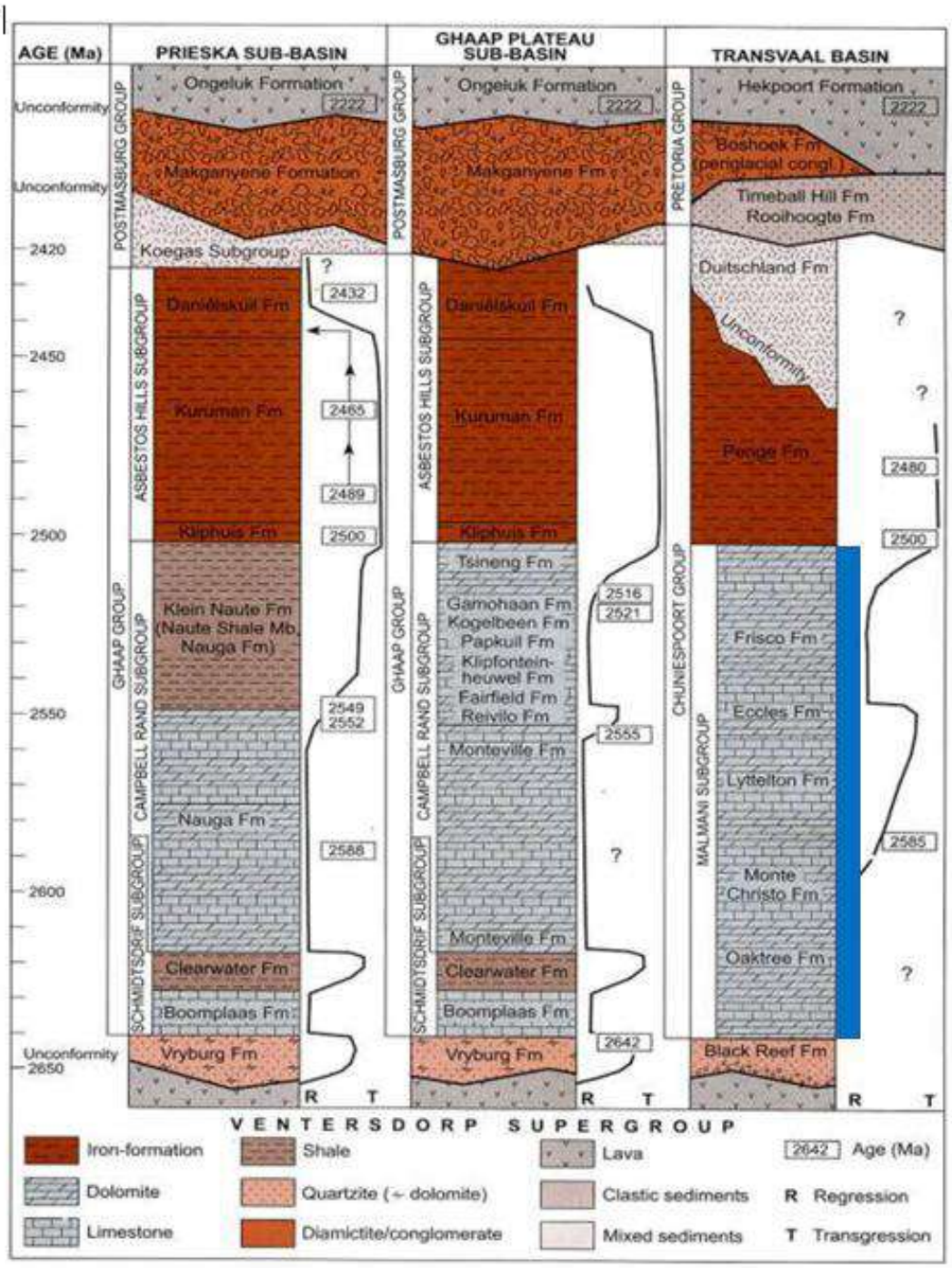

Figure 6: Stratigraphic column of the Transvaal Supergroup, Transvaal Basin, showing the Malmani Subgroup (indicated in blue) within which the proposed development is situated (Eriksson, et al. 2006).

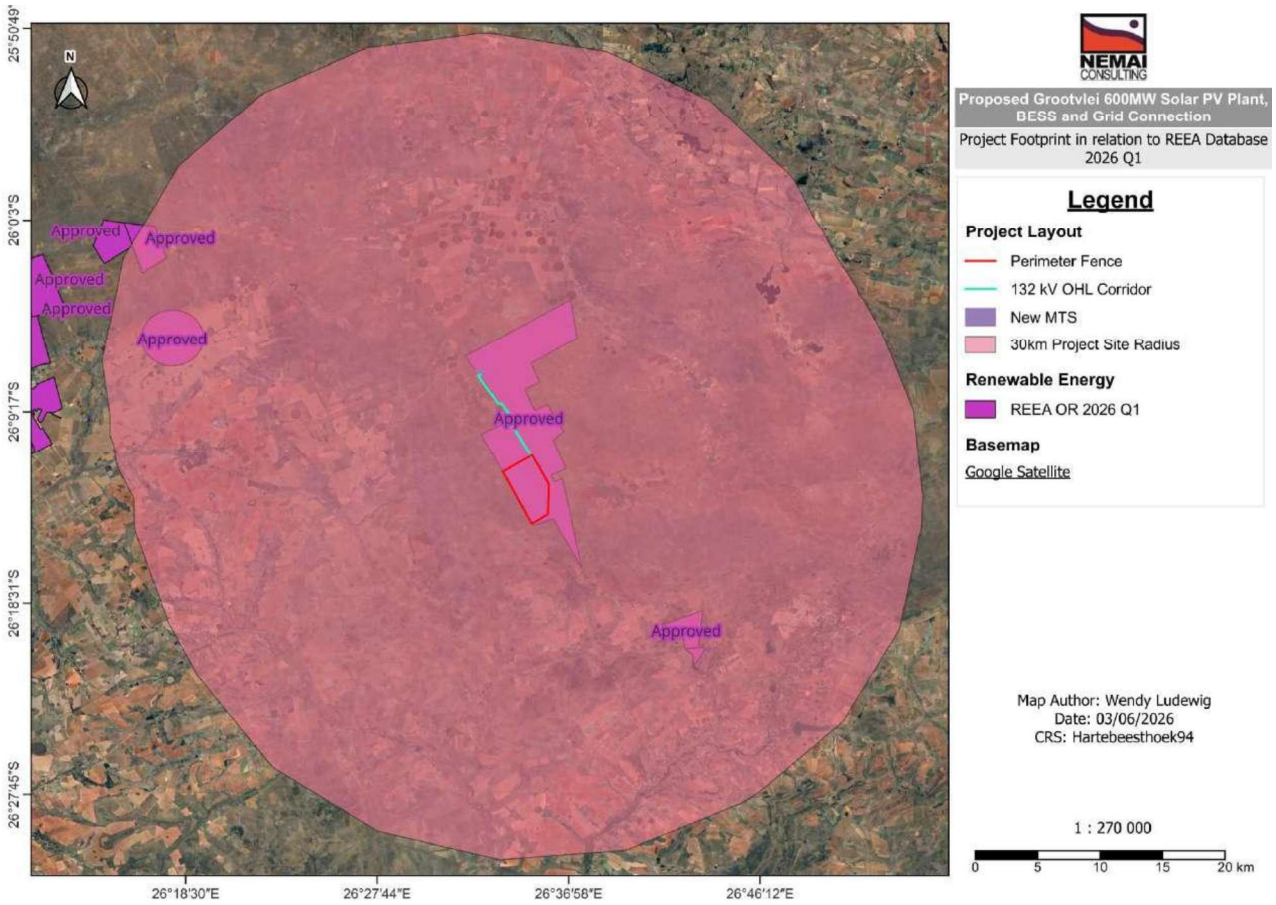

Figure 7:Renewable energy applications in relation to the Project within a 30 km radius (REEA Database).

According to Section 6.6 of the Final Scoping Report (Nemai Consulting, 2026), which draws on the DFFE Renewable Energy EIA Application (REEA) Database (Quarter 1 of 2026), several approved renewable energy applications are registered for properties within a 30 km radius of the Project (Figure 7). These include the Kiara PV1 to PV7 Solar PV Facilities (DFFE reference numbers 14/12/16/3/3/2/2171 to 14/12/16/3/3/2/2177) and a biochemical refinery plant with an associated 130 MW solar PV plant within the JB Marks Local Municipality (14/12/16/3/3/2/2184). No other approved PV project lies within the current Project footprint. Where these developments are underlain by the Malmani Subgroup, they will likewise be of Very High palaeontological sensitivity (Figure 4). However, it is important to note that the quality of preservation is likely to vary between sites, making it difficult to allocate a cumulative sensitivity rating to the projects collectively. Should all mitigation measures be carried out, the cumulative impact on fossil heritage is considered Low, consistent with the Executive Summary.

6. GEOGRAPHICAL LOCATION OF THE SITE

The Project is located approximately 20km to the north-west of Ventersdorp and falls within Ward 34 of the JB Marks Local Municipality (LM) and Ward 17 of the Ditsobotla LM, in the North West Province. The N14 runs approximately 10km to the south of the Project site, with the R53 approximately 15km to the east; site access is via an unnamed gravel road off the N14 and/or R53. The property earmarked for the Solar Project covers a combined area of approximately 1 300 hectares (ha) (Figure 1-2).

7. METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development, including all trace fossils as well as body fossils within the footprint. All available information is consulted in compiling the desktop study, including all Palaeontological Impact Assessment reports for the same area, aerial photographs and Google Earth imagery, and topographical and geological maps.

7.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area; the accompanying sheet explanations were not intended to address palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists, and the available data is generally based on aerial photographs alone. Locality and geological information held in museum and university databases has not always been kept up to date, and data collected in the past has not always been accurately documented.

Comparable Assemblage Zones in other areas are also used to provide information on the likely presence of fossils in an area that has not previously been documented. When similar Assemblage Zones and geological formations are used for desktop studies, it is generally assumed that exposed fossil heritage is present within the footprint. To address this limitation, a site-specific field assessment of the development footprint was undertaken on foot and by motor vehicle on 31 May 2023 (Section 9). The field assessment improved the accuracy of the desktop assessment and confirmed the presence of weathered stromatolites within the footprint.

8. ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984);
- A Google Earth map with polygons of the proposed development was obtained from Nemai Green;

- The geology of the proposed Grootvlei Solar Plant PV Project, near Ventersdorp in the North West, is depicted on the 1:250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria).
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website;
- National Environmental Web-based Screening Tool;
- Published geological and palaeontological literature as well as
- Relevant PIAs in the area;
- A comprehensive site-specific field survey of the development footprint for the project was conducted on foot and motor vehicle in May 2023.

9. SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 31 May 2023. Weathered stromatolitic fragments were observed in heaps along the margins of land previously cleared for agricultural use. These fragments had been displaced from their original geological context during historical agricultural land clearance and should not be described as in-situ stromatolitic outcrops. Prolonged agricultural activity and repeated land clearance have disturbed, displaced or obscured surface exposures across much of the site, contributing to the limited visibility of stromatolitic material elsewhere in the footprint. The displaced fragments are consistent with the mapped Malmani Subgroup, but their original stratigraphic position cannot be established from the heaps alone. Limited surface visibility does not demonstrate an absence of fossiliferous bedrock or justify lowering the Very High mapped palaeontological sensitivity. Previously concealed stromatolitic horizons may be encountered during ground disturbance.



Figure 8:General view of the Project footprint, showing the low-relief topography and grassveld vegetation cover typical of the site, with no surface rock exposure visible in this area.



Figure 9:Small, discontinuous dolomite outcrops exposed at surface within the grassveld of the development footprint, partially obscured by vegetation.



Figure 10: Weathered stromatolite fragments displaced and piled at the field margin during historical land-clearance for agriculture, identified during the site visit (GPS -26.217702, 26.599928).



Figure 11: General view of the powerline servitude, showing scrubland vegetation cover with no dolomite or stromatolitic outcrops observed along this section of the footprint.

10. ASSESSMENT METHODOLOGY

10.1 Method of Environmental Assessment

The environmental assessment aims to identify the various possible environmental impacts that could result from the proposed activity. These impacts need to be evaluated in terms of their significance, highlighting the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics, including the context and intensity of an impact. Context refers to the geographical scale (i.e., site, local, national, or global), while intensity is defined by the severity of the impact – for example, the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact, and the overall probability of occurrence. Significance is calculated as shown in the table below.

Significance indicates the importance of the impact in terms of both physical extent and time scale, and therefore the level of mitigation required. The total number of points scored for each impact indicates its level of significance.

10.2 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 7:The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.

2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.

CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity

Table 8: Summary of Impacts

PALAEONTOLOGICAL								
NATURE	LOSS OF FOSSIL HERITAGE BY DESTRUCTION, MOVEMENT OR SEALING IN OF FOSSIL HERITAGE IN OR BELOW THE EARTH'S SURFACE							
	SITE(S):							
CONSTRUCTION PHASE	Extent	1	1	**Negative Very High impact**	Negative low impact	Chance Find Protocol	NO	YES
	Probability	4	2					
	Reversibility	4	4					
	Irreplaceabil-ity	4	4					
	Duration	4	4					
	Cumulative Effect	2	1					
	Magnitude	4	1					
	Impact Sig-nificance	76	16					
	Probability							
	Reversibility							
	Irreplaceabil-ity							
	Duration							
	Cumulative Effect							
	Magnitude							
	Impact Sig-nificance							

11. FINDINGS AND RECOMMENDATIONS

Findings

The proposed Grootvlei Solar PV Facility is underlain by the Precambrian Malmani Subgroup, which has Very High palaeontological sensitivity according to the SAHRIS PalaeoMap. The DFFE Screening Tool also identifies areas within the broader study area as having Very High palaeontological sensitivity. A field investigation undertaken on 31 May 2023 identified weathered stromatolitic material within the development footprint. The observed weathered stromatolitic fragments were accumulated in heaps during historical agricultural land clearance. Their displaced context limits interpretation of their original stratigraphic position. Long-term agricultural activities have reduced the visibility of surface exposures, but the underlying Malmani Subgroup retains its mapped Very High palaeontological sensitivity.

The construction phase is therefore assigned a Very High pre-mitigation palaeontological significance. With implementation of the recommended mitigation measures, including the Chance Find Protocol, the residual impact is expected to be reduced to Low. No significant palaeontological impacts are anticipated during normal operations. Any new ground disturbance during decommissioning must remain subject to the Chance Find Protocol

Recommendations

The recommended palaeontological mitigation measures must be incorporated into the Environmental Management Programme (EMPr) for the Grootvlei Project. The 31 May 2023 site investigation is considered adequate for the revised footprint, and no further routine palaeontological field survey is recommended. Construction may proceed, provided that the Chance Find Protocol is implemented and any newly exposed fossil material is assessed by a qualified palaeontologist. The historical agricultural clearance and limited surface exposure have been considered in interpreting the field evidence. The completed field investigation is regarded as adequate; previously concealed finds arising during construction will be managed through the EMPr Chance Find Protocol, including work stoppage and specialist assessment where warranted.

Should fossil material be discovered, work in the immediate area must cease where necessary, the material must be protected in situ where possible, and the discovery must be reported to SAHRA. No fossil material may be collected without the required SAHRA permit, and recovered material must be curated in an accredited repository.

SAHRA: 111 Harrington Street, Cape Town; PO Box 4637, Cape Town, 8000; Tel: 021 462 4502; Fax: +27 (0)21 462 4509; Website: www.sahra.org.za.

12. CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Legislation

Cultural heritage in South Africa, including all heritage resources, is protected by the **National Heritage Resources Act (Act No 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable, is protected by the NHRA, and is the property of the State; it is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Resources Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.

- Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be adequately protected in situ, no person may remove or collect the material unless authorised under the required heritage permit. The area must remain secured until a suitably qualified palaeontologist has assessed the find and, where necessary, undertaken permitted mitigation and collection.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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APPENDIX 1

CURRICULUM VITAE

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	University of the Orange Free State
	B.Sc Botany and Zoology, 1988
	University of the Orange Free State
	B. Sc (Hons) Zoology, 1991
	University of the Free State
	M. Sc. *Cum laude* (Zoology), 2009

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle.

EMPLOYMENT HISTORY

Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant	National Museum, Bloemfontein
and Collection Manager	1998–2022
Banzai Environmental	2016 to present

Elize Butler has conducted approximately 900 Paleontological Impact Assessments for developments in the Free State, KwaZulu-Natal, Eastern, Northern and Western Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa. She has experience in locating, collecting, and curating fossils. She has been a member of the Paleontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

MEMBERSHIP

Paleontological Society of South Africa (PSSA) 2006-currently.

A full CV is available on request.

APPENDIX 2

PALAEONTOLOGICAL SITE VERIFICATION REPORT

Grootvlei 600 MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp, in the North West Province

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1. INTRODUCTION

LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks and Ditsobotla Local Municipalities in the North West Province (the "Project").

The Project includes transmission infrastructure with an installed capacity at both distribution (132kV) and transmission (2 x 275kV) levels, comprising an on-site 132/33kV collector substation, an on-site 132kV switching station, three 132kV overhead lines linking the switching station to a new 400/132kV substation located approximately 18km north-west of the site on Portion 1 of the farm Houtkop 152 IP, and two 275kV tie-in lines connecting to the existing Pluto – Watershed 275kV line, thereby facilitating connection to the national grid with potential for electricity wheeling to off-site offtakers.

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA (Figures S1 and S2).

Table S1: Details of properties	
Solar Plant	
Portion number 0 of the farm Grootvlei 161 IP	**T0IP00000000016100000**
New Main Transmission Substation	
Portion number 1 of the Farm Houtkop 152	**T0IP00000000015200001**
Powerline Route	
Portion number 1 of the Farm Houtkop 152	**T0IP00000000015200001**
Portion number 9 of the Farm Houtkop 152	**T0IP00000000015200009**

Portion number 11 of the Farm Houtkop 152	**T0IP00000000015200011**
Portion number 12 of the Farm Houtkop 152	**T0IP00000000015200012**
Portion number 0 of the farm Grootvlei 161 IP	**T0IP00000000016100000**
Portion number 1 of the Farm Roodepoortje 154 IP	**T0IP00000000015400001**

2. TECHNICAL DETAILS FOR THE PROPOSED DEVELOPMENT

Technical details

The Project comprises the following systems, sub-systems and components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Transmission infrastructure with an installed capacity at both distribution (132kV) and transmission (2 x 275kV) levels, comprising an on-site 132/33kV collector substation, an on-site 132kV switching station, three 132kV overhead lines linking the switching station to a new 400/132kV Main Transmission Substation (MTS) located approximately 18km north-west of the site on Portion 1 of the farm Houtkop 152 IP, and two 275kV tie-in lines connecting to the existing Pluto – Watershed 275kV line;
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

An overview of the Project's life-cycle, together with the resources required for its execution, is provided in the Scoping Report.

The alternatives under consideration for the Project comprise design/layout alternatives, technology alternatives and the no-go option. The EIA Phase will provide a detailed comparative analysis of the Project's feasible alternatives arising from the Scoping exercise, incorporating both environmental (with specialist input) and technical evaluations.



Figure S1: Regional locality of the proposed Grootvlei 600MW Solar Plant, BESS & Grid Connection Project in North West Province.

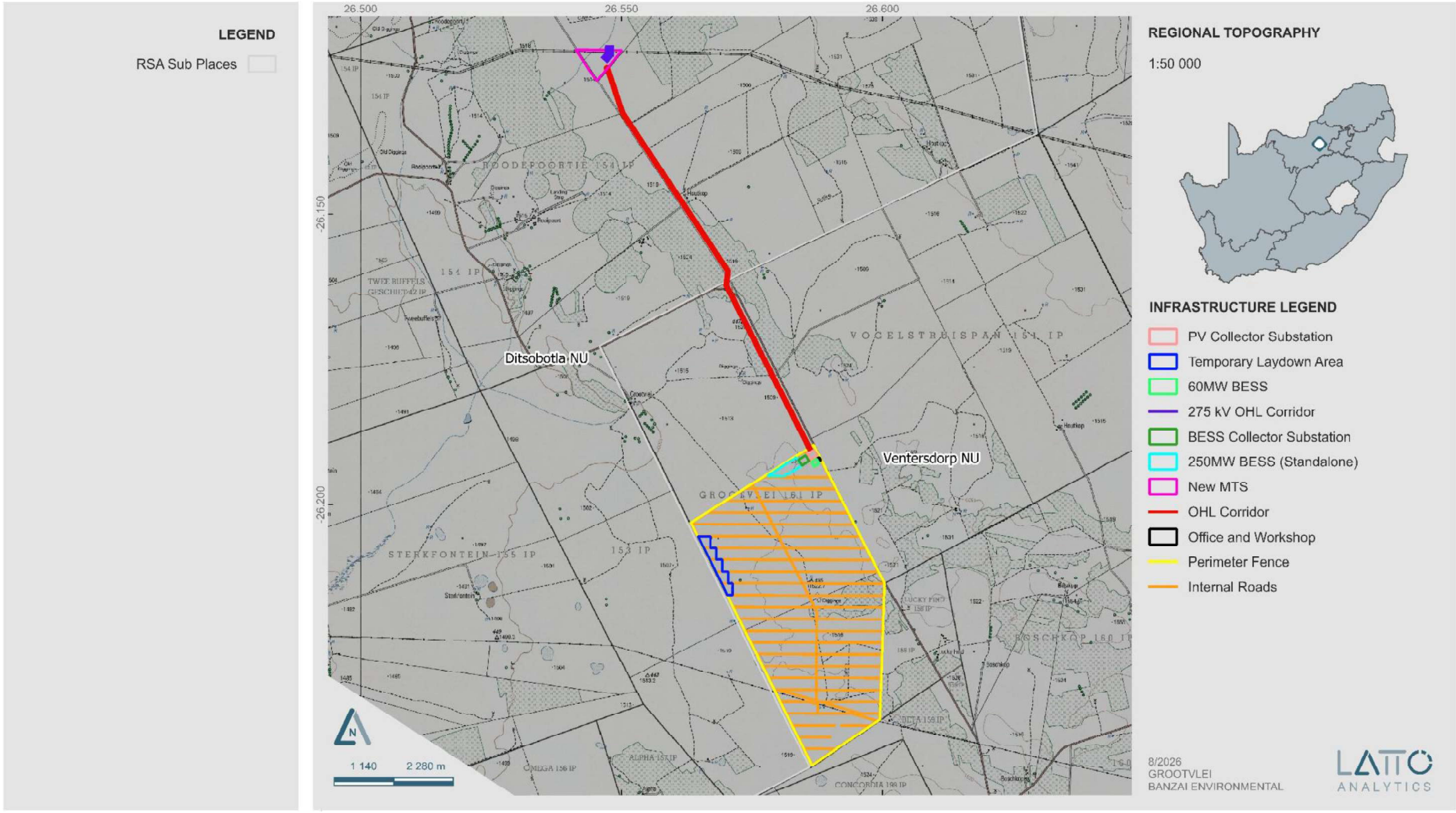

Figure S2: Locality map of the proposed Grootvlei 600MW Solar Plant, BESS & internal Grid Connection Project in North West Province.

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require environmental authorisation (EA) from the Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof.

In accordance with GN 320 of 20 March 2020 and GN 1150 of 30 October 2020[1] (i.e., "the Protocols") of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Elize Butler, as Palaeontology Specialist, has been commissioned to verify the sensitivity of the Grootvlei Solar PV Plant and associated infrastructure site under these specialist protocols.

3. SITE SENSITIVITY VERIFICATION METHODOLOGY

The Palaeontology Sensitivity Verification was undertaken by the following methodology:

- The site sensitivity is established through the National Environmental Web-Based Screening Tool
- The Site is mapped on the relevant Geological Map to determine the underlying geology of the development
- Then the site is mapped on the South African Heritage Resources Information System (SAHRIS) PalaeoMap, and the Sensitivity of the proposed development established.
- Other information is obtained through satellite imagery, and
- Palaeontological Impact Assessments and Desktop Assessments of projects in the same area are studied.
- A comprehensive site-specific field survey of the development footprint was conducted on foot and by motor vehicle by Banzai Environmental in May 2023.

4. OUTCOME OF SITE SENSITIVITY VERIFICATION

Grootvlei Solar Plant PV Project near Ventersdorp in North Westis depicted on the 1: 250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria). This study area is underlain by the Precambrian dolomites and associated marine sedimentary rocks of the undifferentiated Malmani

[1] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

Subgroup (Chuniespoort Group, Transvaal Supergroup) (**Figure S3, Table S2**). The PalaeoMap of the South African Heritage Resources Information System (Almond *et al*, 2013; SAHRIS website; **Figure S4**) as well as the the DFFE Screening tool (**Figure S5**) indicates that the Palaeontological Sensitivity of the proposed development is Very High while the Palaeotechnical Report of the North West Province (Groenewald et al, 2014) indicates that the Palaeontological Sensitivity is High (**Table 5**). Updated geology (Council of Geosciences, Pretoria) is depicted in **Figure 6** and indicates that the Grootvlei Solar Power Plant is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).

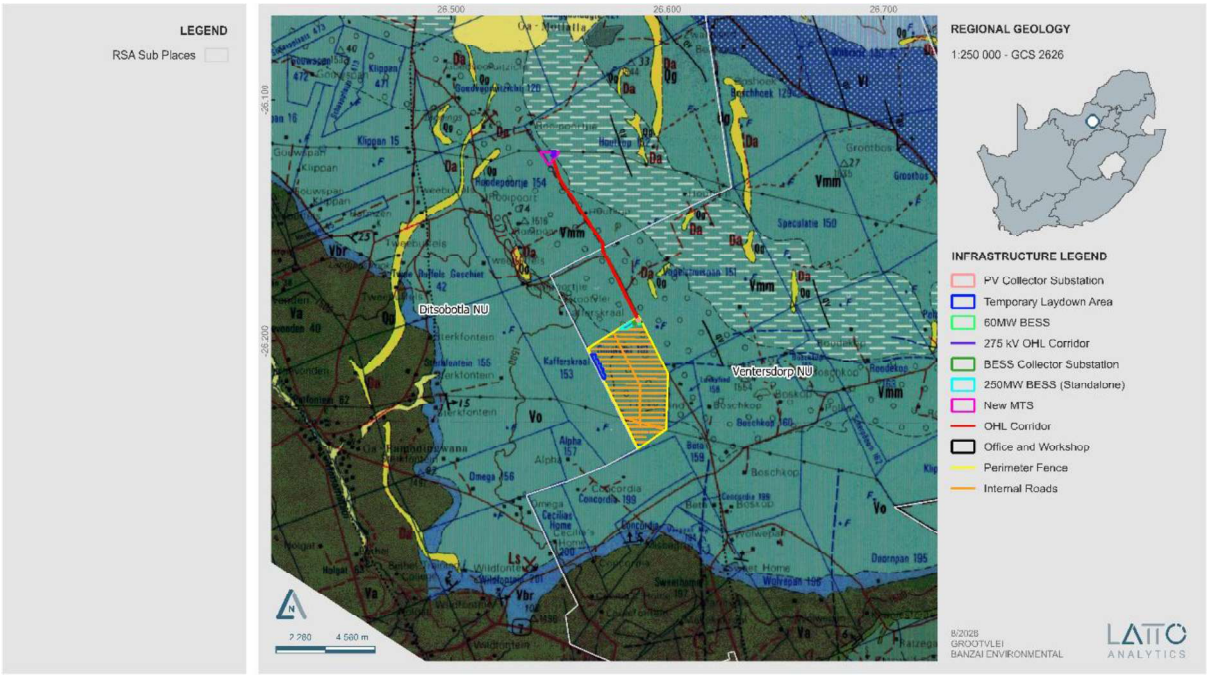

Figure S3: Extract of the 1: 250 000 West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria) indicating that the Grootvlei Solar PV development and associated infrastructure is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).

Table S2: Legend to the West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria).

Relevant sediments are indicated in a red square

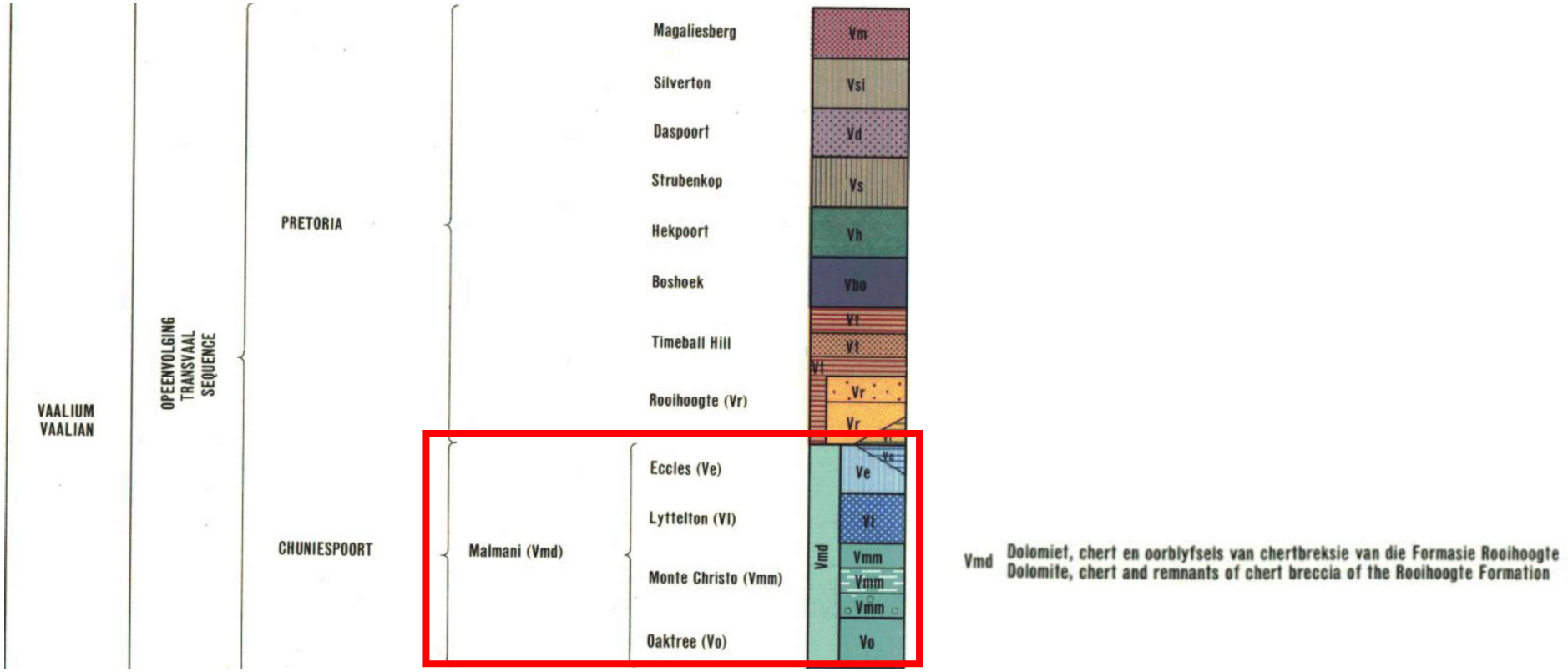

Table S3: Extract of the Palaeotechnical Report of the North West Province (Groenewald, et al., 2014).

CHUNIESPOORT			Penge (Vp; Vla; Qd; Vda; Vk; Vpe)		Banded ironstone	Stromatolites
	Malmani (Vm; Vma)		Mma; Vmm; Vmo; Vmo1; Vmo2; Vmf; Vme; Ve; Ve1; Vml; Va1; Va2; Va3; Vmd; Vm; Vc; Vb; Vf; Vfr; Vfr1; Vfr2; Ve; Vl; Vmo1; Vmo2; Vmo3; Vo; Voa		Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils

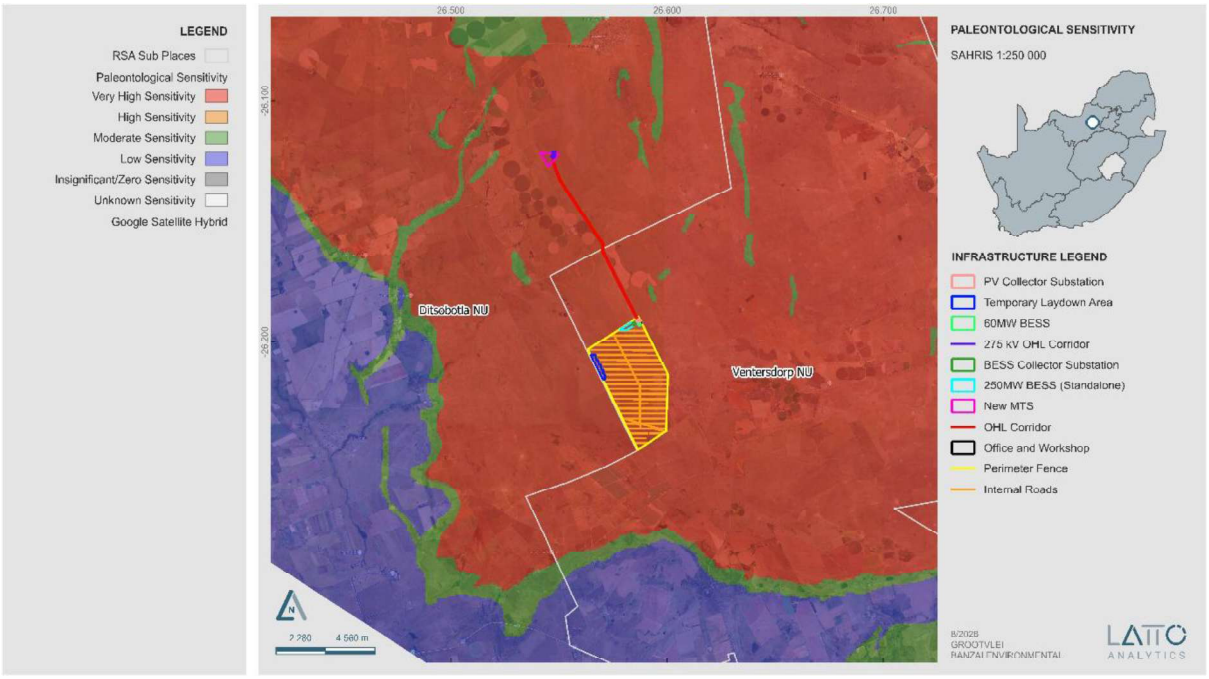

Figure S4: Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicating that the proposed Grootvlei Solar Project in the North West Province is underlain by sediments with a Very High Palaeontological Sensitivity.

Table S4: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).		
Colour	**Sensitivity**	**Required Action**
RED	**VERY HIGH**	**field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The PalaeoMap of the South African Heritage Resources Information System (Figure S4, Table S3) indicates that the Palaeontological Sensitivity of the Grootvlei Solar Plant PV development is Very High (red), (Almond and Pether, 2009; Almond *et al*., 2013).

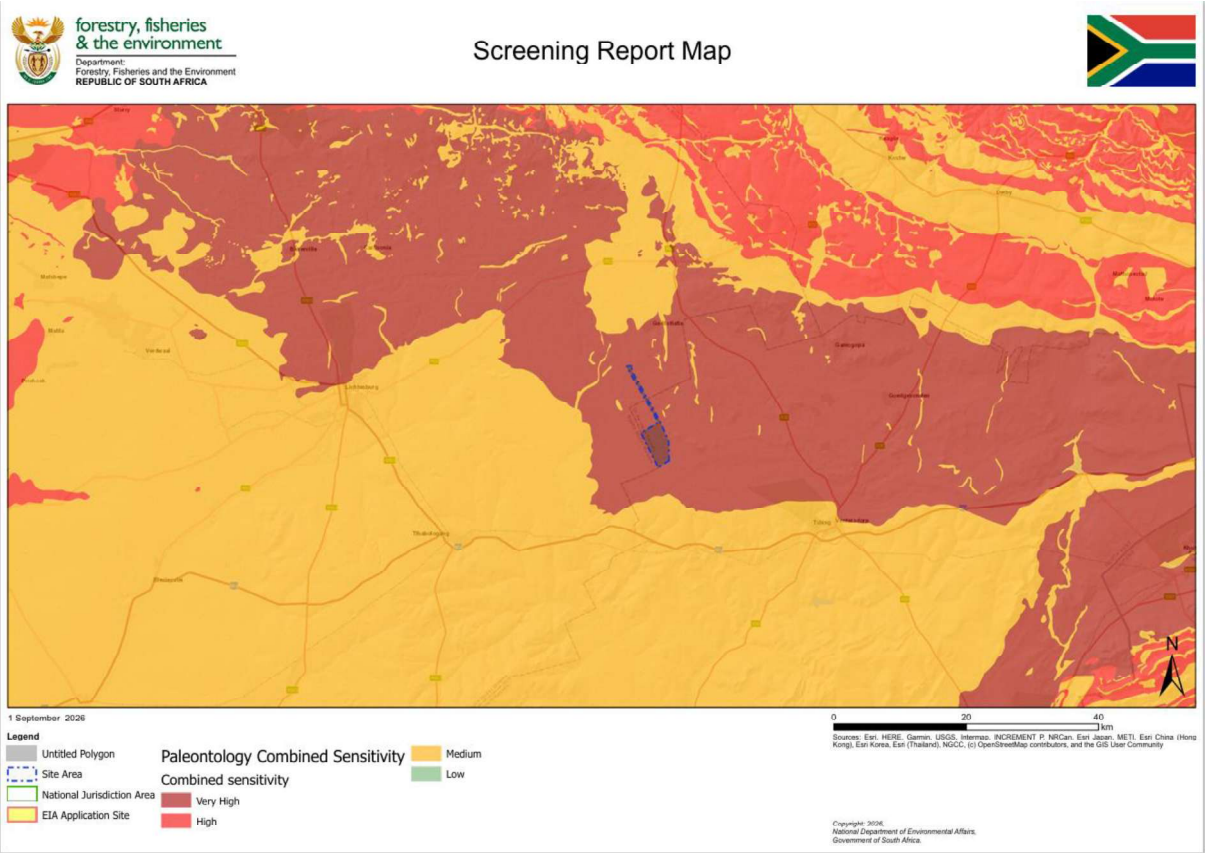

Figure S5: Palaeontological Sensitivity of the Grootvlei Solar PV facility by the National Environmental Web-bases Screening Tool indicates a Very High (dark red) Palaeontological Sensitivity.

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Very High (dark red).

5. CONCLUSION

The Site Sensitivities of the proposed Grootvlei PV Project have been verified, and it was found that:

The SAHRIS Palaeosensitivity map indicates that the Palaeontological Sensitivity of the development is Very High.

And

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Very High.

The SAHRIS PalaeoMap and DFFE Screening Tool both indicate Very High palaeontological sensitivity, consistent with the mapped Malmani Subgroup. During the site investigation on 31 May 2023, weathered stromatolitic fragments were identified in heaps formed by historical agricultural land clearance, rather than documented as undisturbed in-situ fossil horizons. Prolonged agricultural activity has disturbed, displaced or obscured surface exposures across much of the site; the limited visibility of stromatolites

does not indicate low fossil potential in the underlying dolomitic bedrock. The completed field investigation is considered adequate for the proposed development, including the revised footprint. No additional routine palaeontological field investigation is recommended. The Chance Find Protocol must be incorporated into the EMPr and implemented during construction. Any significant newly exposed fossil material must be protected and reported to SAHRA for assessment and, where required, permitted specialist mitigation.

forestry, fisheries & the environment
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Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

GROOTVLEI 600MW SOLAR PLANT, BATTERY ENERGY STORAGE SYSTEMS & GRID CONNECTION PROJECT NEAR VENTERSDORP, DR KENNETH KAUNDA AND NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITIES, NORTH WEST PROVINCE

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Palaeontologist
Specialist Company Name	Banzai Environmental (Pty) Ltd
Specialist Name	Elize Butler
Specialist Identity Number	[redacted]
Specialist Qualifications:	MSc
Professional affiliation/registration:	
Physical address:	14 Eddie de Beer, Bloemfontein
Postal address:	14 Eddie de Beer, Bloemfontein
Postal address	14 Eddie de Beer, Bloemfontein
Telephone	[redacted]
Cell phone	
E-mail	info@banzai-group.com

2. DECLARATION BY THE SPECIALIST

I, Elize Butler declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations 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 applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
    - any decision to be taken with respect to the application by the competent authority; and;
    - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.



Signature of the Specialist

Elize Butler

Name of Company:

03 Nov 2026

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Elize Butler_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.



Signature of the Specialist

Banzai Environmental

Name of Company

03-11-2026

Date



Signature of the Commissioner of Oaths

03 Nov 2026

Date