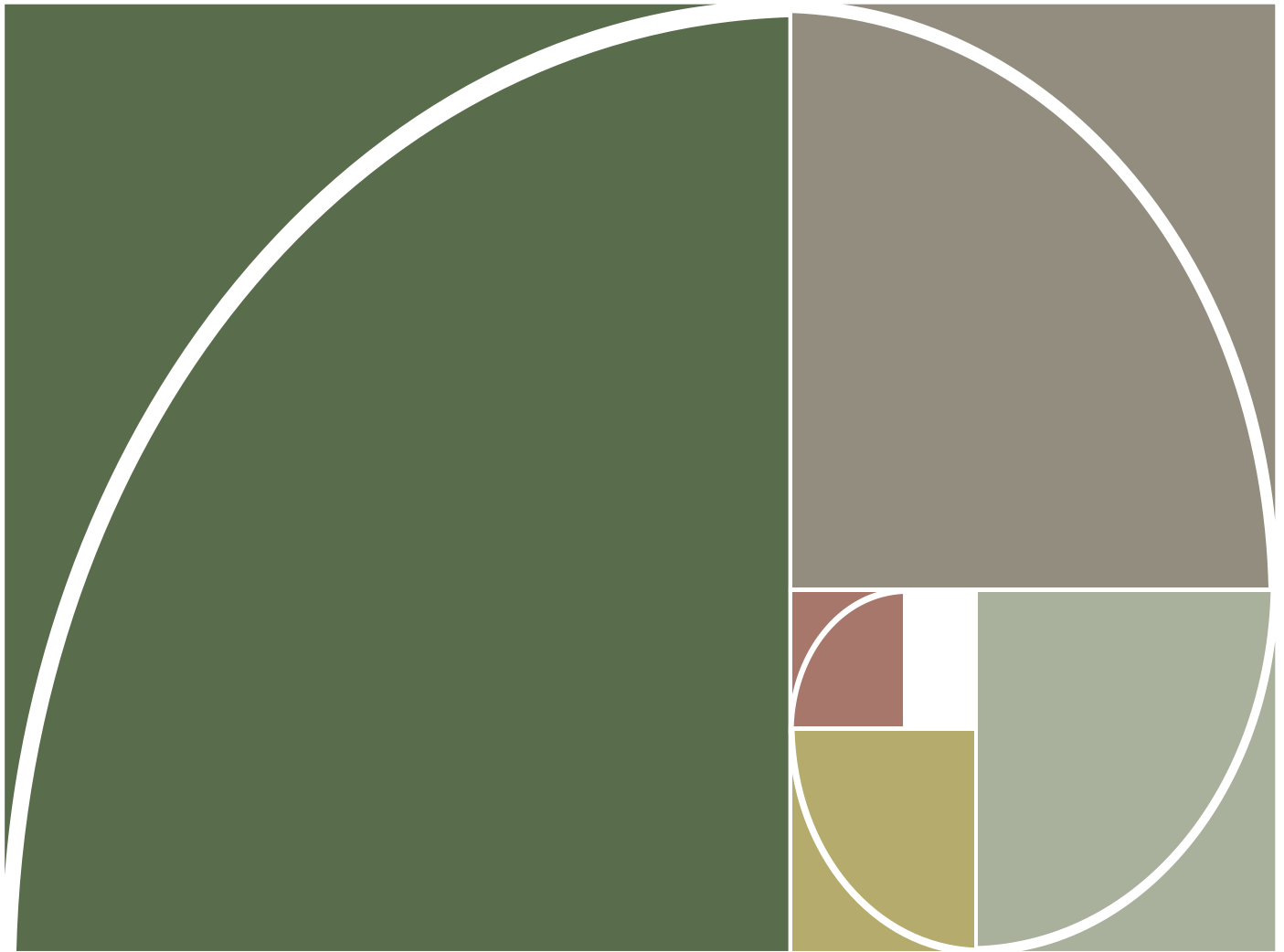




D6: Palaeontological Impact Assessment



BANZAI
ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED CARPE DIEM SOLAR
PHOTOVOLTAIC PLANT AND ASSOCIATED
INFRASTRUCTURE ON THE FARMS
VARKENSLAAGTE 119 IQ AND DOORNFONTEIN
118 IQ, NEAR CARLETONVILLE, GAUTENG
PROVINCE.

MAY 2025

COMPILED FOR: PGS Heritage (Pty) Ltd



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 favorable 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 favorable 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.

PALAEONTOLOGICAL CONSULTANT:

Banzai Environmental (Pty) Ltd

CONTACT PERSON:

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SIGNATURE:



The heritage 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	Relevant section in 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 A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vitae	Section 2 – refer to Appendix A	-
(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 4 – Methods and Terms of Reference	-
(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;	Section 8	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 7 and 9	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 8 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to	Executive Summary and 9	



Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
the proposed activity or 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	Executive Summary and 9	No buffers or areas of sensitivity identified
(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 4.1 – 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	Executive Summary and 9	
(k) Any mitigation measures for inclusion in the EMPr	Section 10	
(l) Any conditions for inclusion in the environmental authorisation	Section 10	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 10	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Executive Summary and 9	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance,	Executive Summary and 9	-



Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
management and mitigation measures that should be included in the EMP, and where applicable, the closure plan		
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.	N/A	
(2) Where a government notice 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	



EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Impact Assessment (PIA) to assess the Palaeontology of the proposed Carpe Diem Solar Photovoltaic Plant (SPP) and associated infrastructure on the Farms Varkenslaagte 119 IQ and Doornfontein 118 IQ, Merafong City Local Municipality, Gauteng. PGS Heritage (Pty) Ltd was appointed by Legacy Environmental Management Consulting (Pty) Ltd (Legacy EMC), on behalf of JUWI Renewable Energies (Pty) Ltd (JUWI), to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) process for the proposed Carpe Diem Solar Photovoltaic Plant (SPP). In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The Proposed Carpe Diem Solar Photovoltaic Plant (SPP) and associated infrastructure is largely underlain by the Vaalian aged Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) with a small portion in the south underlain by the Timeball Hill Formation and Rooihoogte Formations of the Pretoria Group (Transvaal Supergroup). A very small portion in the south is underlain by unfossiliferous diabase). The Malmani Subgroup is undifferentiated in this area. The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while areas with a High, Low and Zero is also crossed (Almond and Pether, 2009; Almond et al., 2013, Groenewald et al 2014). However, the Palaeotechnical report of the Gauteng province indicates that the Palaeontological Sensitivity of the Malmani Subgroup is High (Groenewald et al, 2014). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DFFE Screening Report. Updated geology (Council for Geosciences, Pretoria) indicates that the study area is underlain by the Malmani Subgroup (anml) as well as the Timeball Hill and Rooihoogte Formations of the Pretoria Group.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12 May 2024. No fossiliferous outcrop was detected in the proposed development. Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the development footprint is rare. This is in contrast with the Very High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. **A medium to high Palaeontological Significance has been allocated for the construction phase of the PV development pre-mitigation and a moderate significance post mitigation.** The construction phase will be the only development phase impacting Palaeontological Heritage and **no significant impacts are**



expected to impact the Operational and Decommissioning phases. The No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, will have a Neutral impact on the Palaeontological Heritage of the development. The **Cumulative impacts of the development is considered to be medium pre-mitigation and Low post mitigation and falls within the acceptable limits for the project.** It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. **The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager must report to 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) so that mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.



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GLOSSARY OF TERMS

Fossil

A fossil is the preserved remnants or vestiges of a long-dead organism, generally from millions of years ago. Fossils can be mineralized skeletons, shells, or other hard pieces of ancient animals and plants, as well as impressions, moulds, and casts left in sedimentary rock when the organism's remains decomposed and left an impression. Fossils provide valuable insights into the evolution and biodiversity of ancient species, allowing scientists to study and understand their evolution and biodiversity.

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.



LIST OF ABBREVIATIONS

BA	Basic Assessment
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
JUWI	JUWI Renewable Energies (Pty) Ltd
Legacy EMC	Legacy Environmental Management Consulting (Pty) Ltd
Ma	Millions of years ago
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PSSA	Palaeontological Society of South Africa
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SPP	Solar Photovoltaic Plant
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference



1 INTRODUCTION

The proposed study area is located about 9km south-west of Carletonville, in the Merafong City Local Municipality and the West Rand District Municipality, within the Gauteng Province (Error! Reference source not found. 1-2). The properties are situated within proximity of the Carmel Distribution Centre (Eskom Power). The study area is excluded from any promulgated Renewable Energy Development Zones (REDZs).

The following information was provided by JUWI.

Capacity of the facility	200MW
Type of technology	Solar photovoltaic (PV) technology (monofacial or bifacial) with fixed, single or double axis tracking mounting structures, as well as associated infrastructure, which will be made up of: ▪ Facility Substation; ▪ Inverter-stations, transformers and internal electrical reticulation (underground cabling); ▪ Battery Energy Storage System (BESS) ▪ Access road and Internal Road network ▪ Laydown areas ▪ Auxiliary buildings ▪ Staff lockers, 33kV switch room, gatehouse security, control centre, office, warehouse, canteen & visitors centre ▪ Rainwater Tanks/Conservancy Tank ▪ Septic Tanks ▪ Construction Camp with ablution facilities ▪ Hazardous Store ▪ Cement Batching Areas ▪ Boreholes (to be determined depending on the water availability – to be determined) ▪ Perimeter fencing and security infrastructure ▪ Overhead Powerline of up to 132kV to the Carmel substation which is located on adjacent land.
Structure height	Solar panels with a maximum height of 5m above the ground
Structure Orientation Fixed or tilt	▪ North-facing at a defined angle of tilt. ▪ The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun



	moves from east to west; or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun. ▪ Double axis tracking: mounted in a north-south orientation, tracking from east to west. ▪ Crystalline silicon or thin film technology (to be determined at a later stage)
PV Panels Dimensions	Approximate width: 1000mm; Approximate height: 2000mm
Laydown area Dimensions	▪ Approximately 4 ha laydown area will be required for the PV facility (the laydown areas will not exceed 4 ha and will be situated within the assessed footprint). ▪ Permanent and temporary laydown areas are required. The laydown area at the substation will remain permanent laydown area.
Fencing	For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.
Boreholes and Storage Tanks	Not confirmed at this stage, but can it be included in the application at this point until it is established whether we would need a new borehole. Conservancy tanks will be required. Water for the proposed development will most likely be obtained from ground water resources, or alternatively from the local municipality. The Department of Water and Sanitation must still be engaged to confirm the water resource availability in the relevant catchment management area. The estimated maximum amount of water required during construction is 1200m³ per month during the 12 - 18 months of construction. The estimated maximum amount of water required during the facility's 20 years of production is 4200m³ per annum. The majority of this usage is for the cleaning of the solar panels. Since each panel requires approximately 2 litres of water for cleaning, the total amount of ~500 000 panels will require 1 000 000 litres per wash. It is estimated that the panels may only need to be washed twice per annum, but provision is made for quarterly cleaning (March, May, July, and September). This totals approximately 4,000,000 litres per annum for washing, and allows 200,000 litres per annum (or 548 litres per day) for toilet use, drinking water, etc. This total to approximately 4 200m³ of water required per annum.



Storage Solution: Battery Energy Storage System (BESS)	Area: up to 1 ha Capacity: Unspecified (500MWh) Technology: solid-state/ non-liquid type batteries.
Grid Connection	Size and capacity of on-site substation – 1Ha area Eskom side and Facility Side substation with a footprint, not exceeding 1ha (separate from IPP S/S) – effectively 2 substations side by side. Substation via a single or double circuit overhead powerline up to 132 kV, within a 100m wide corridor and up to 700 meters long for Carpe Diem. The facility will contain inverter-stations, transformers, switchgear and internal electrical reticulation (underground cabling may be required) and lightning conductors.
Additional Infrastructure	▪ Auxiliary buildings of no more than 1 ha, including (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre. Rainwater tanks; and Electrified perimeter fencing not exceeding 6 m in height. ▪ O&M Office Buildings with toilets, including septic tanks and all infrastructure and activities associated, will be permanent infrastructure. ▪ There will also be a site office and site construction camp with sanitation and canteen facilities, waste separation and storage areas on site.
Details of access roads	▪ The access road will comprise of a new road, as well as the expansion of sections of the existing farm road. The access roads will range from 5 -8m in width.
Details of internal roads	▪ Internal access roads, each with a width of range from 5 -8m, will be constructed to provide access to the various components of the facility. ▪ At this point it is not certain if the existing roads must be upgraded (the roads activity will be triggered, but has to be ascertained through EAP site visits) ▪ Footprint not available at this time, to be determined for new roads. EAP to calculate.



Extent of areas required for laydown of materials and equipment	Approximately 4 ha of temporary laydown areas will be required (laydown areas will not exceed 4 ha). A permanent laydown area of a maximum of a 1 ha will remain for operations.
Alternatives	A single preferred location alternative to be assessed, which has been identified through the optimization of the area considering the sensitivities identified in the O&C mapping.

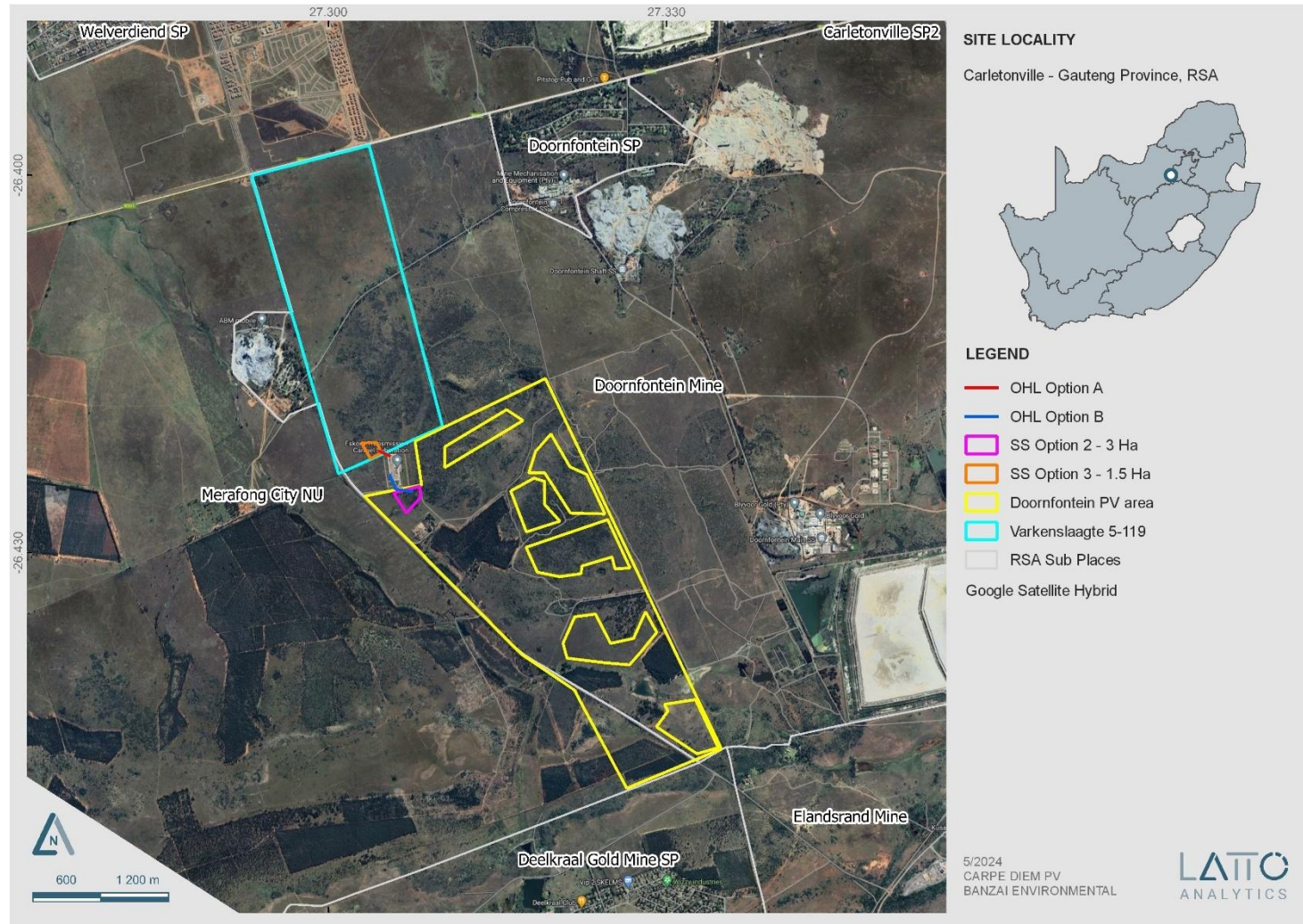


Figure 1: Regional locality of the proposed Carpe Diem SPP and infrastructure in Gauteng.

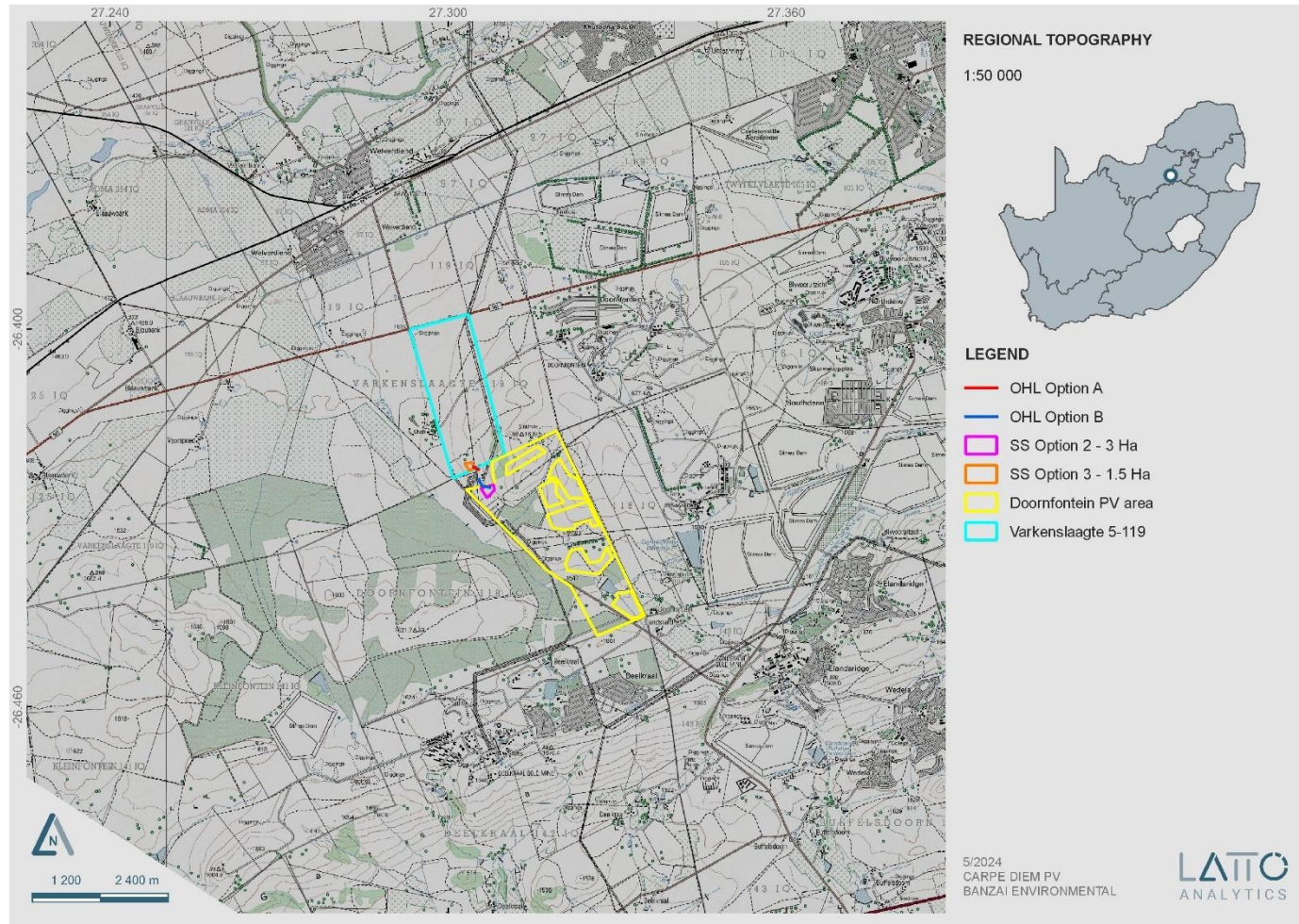


Figure 2: Locality of proposed Carpe Diem SPP and infrastructure in Gauteng.



2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 700 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern and Northern 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 twenty-nine 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 the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act 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 identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

Protection of Heritage Resources – Sections 34 to 36

Heritage Resources Management – Section 38



MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

Contents of scoping report – Regulation 49

Contents of environmental impact assessment report – Regulation 50

Environmental management programme – Regulation 51

Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) “...*identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*”.

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, 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.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m² in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 METHODS AND TERMS OF REFERENCE

This PIA assesses the development's potential impact on the fossil heritage. 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. Fossil collection and documentation are examples of mitigation. A permit from SAHRA must be obtained before beginning any fossil excavation, and the material 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:
 - a. **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.
 - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
 - c. **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).

4.1 Assumptions and Limitations

The geology of the area is the focal point of geological maps, and the sheet explanations of the Geological Maps were not intended to focus on palaeontological heritage. Many inaccessible areas of South Africa have never been examined by palaeontologists, and data is typically dependent solely on aerial pictures. Locality and geological information in museums and university databases is out of date, and data acquired in the past is not always adequately documented.



Comparable Assemblage Zones in other places are also used to provide information on the existence of fossils in areas that have not before been recorded. When similar Assemblage Zones and geological formations are used for Desktop studies, it is commonly assumed that exposed fossil exists within the footprint. As a result, the field assessment **conducted for this study** will improve the accuracy of a desktop evaluation.

5 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The proposed Carpe Diem Solar Photovoltaic Plant (SPP) and associated infrastructure in Gauteng is depicted on the 2626 West-Rand (1986) Geological map (Council of Geoscience, Pretoria) (**Figure 3, Table 2**). This map indicates that the study area is largely underlain by the Vaalian aged Malmani Subgroup (Vmd, Chuniespoort Group, Transvaal Supergroup) with a small portion in the south underlain by the Timeball Hill Formation (Vt) and Rooihoogte Formations (Vr) of the Pretoria Group (Transvaal Supergroup). A very small portion in the south is underlain by unfossiliferous diabase (di). The Malmani Subgroup is undifferentiated in this area. The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High (red), while areas with a High (orange), Low (blue) and Zero (grey) is also crossed (Almond and Pether, 2009; Almond et al., 2013, Groenewald et al 2014) (Figure 4, Table 3). However, the Palaeotechnical report of the Gauteng province indicates that the Palaeontological Sensitivity of the Malmani Subgroup is High (orange) (Groenewald et al, 2014). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DFFE Screening Report, as seen in **Figure 5**. Updated geology (Council for Geosciences, Pretoria) indicates that the study area is underlain by the Malmani Subgroup (anml) as well as the Timeball Hill and Rooihoogte Formations of the Pretoria Group (**Figure 6**).

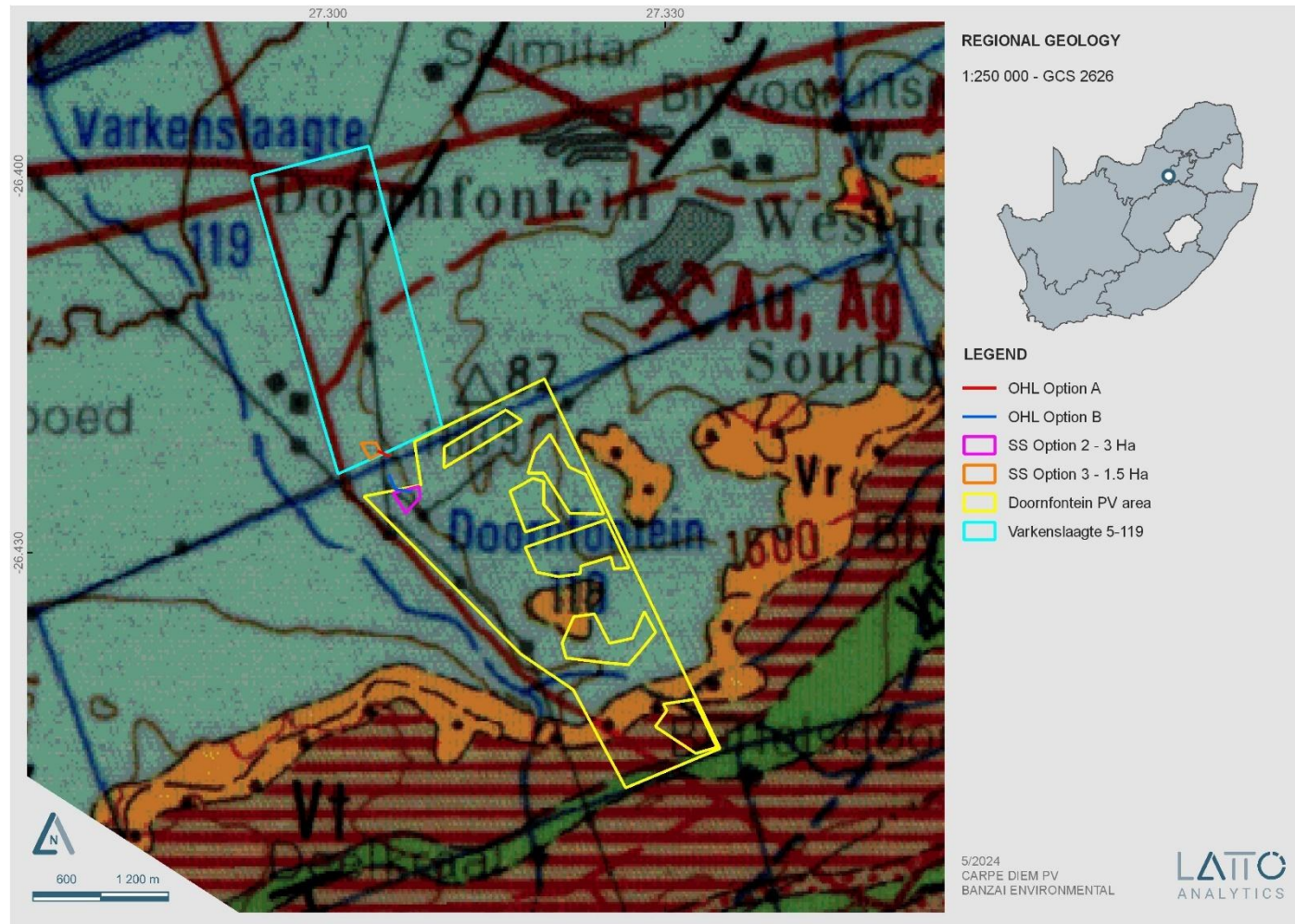
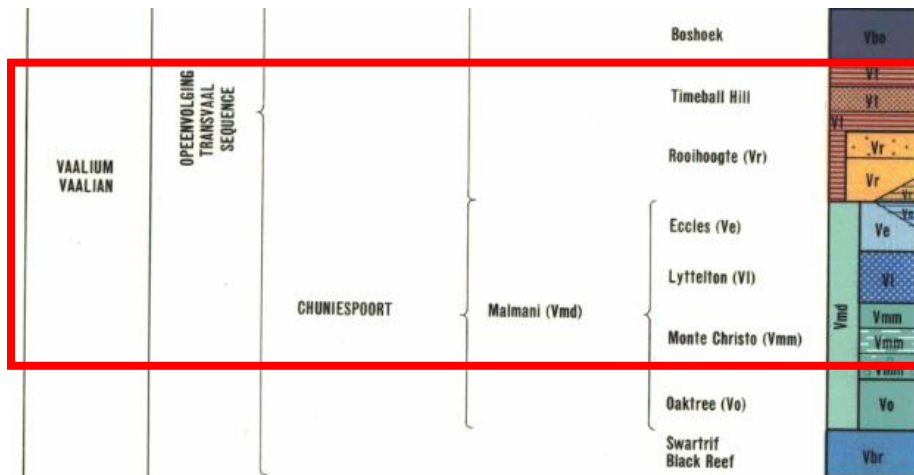


Figure 3: Extract of the 1:250 000 West Rand 2626 (1986) (Council for Geosciences, Pretoria) indicates that Carpe Diem SPP study area is largely underlain by the Malmani Subgroup (Vmd, blue; Chuniespoort Group, Transvaal Supergroup) while the southern portion is also underlain by the Hekpoort and Rooihoogte Formations of the Pretoria Group as well as unfossiliferous diabase.



Table 2: Legend of the West Rand 2626 (1986) (Council for Geosciences, Pretoria).

Relevant sediments are indicated in a red polygon.



LEGEND

- Vdi** Diabaas
Diabase
- Vt** Ysterhoudende skalie, horingfels (); ysterhoudende kwartsiet ();
Ferruginous shale, hornfels (); ferruginous quartzite ()
- Vr** Kwartsiet (); skalie (); chertbreksie, konglomeraat ();
Quartzite (); shale (); chert breccia, conglomerate ()
- Vmd** Dolomiet, chert en oorblyfsels van chertbreksie van die Formasie Rooihoogte
Dolomite, chert and remnants of chert breccia of the Rooihoogte Formation

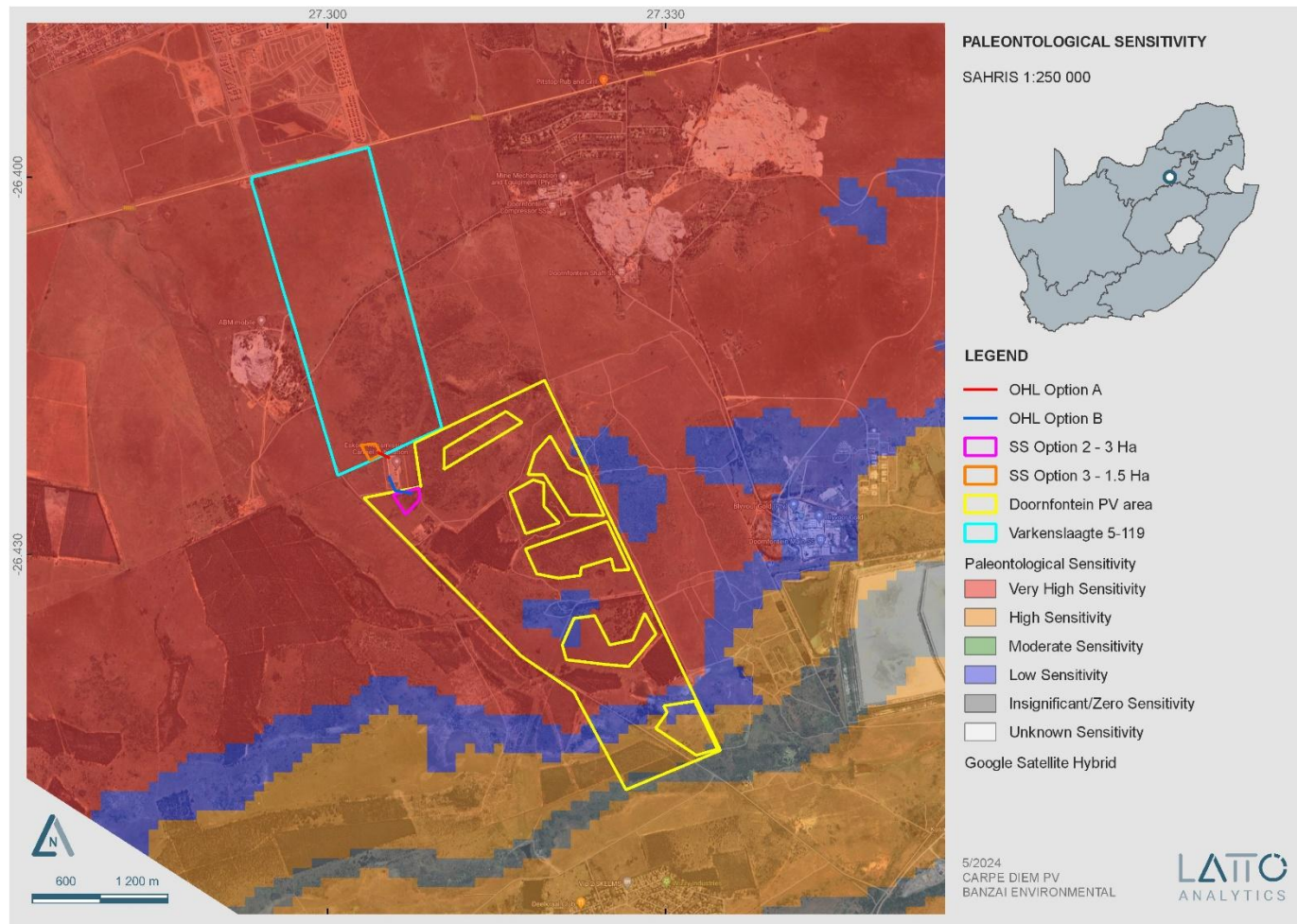
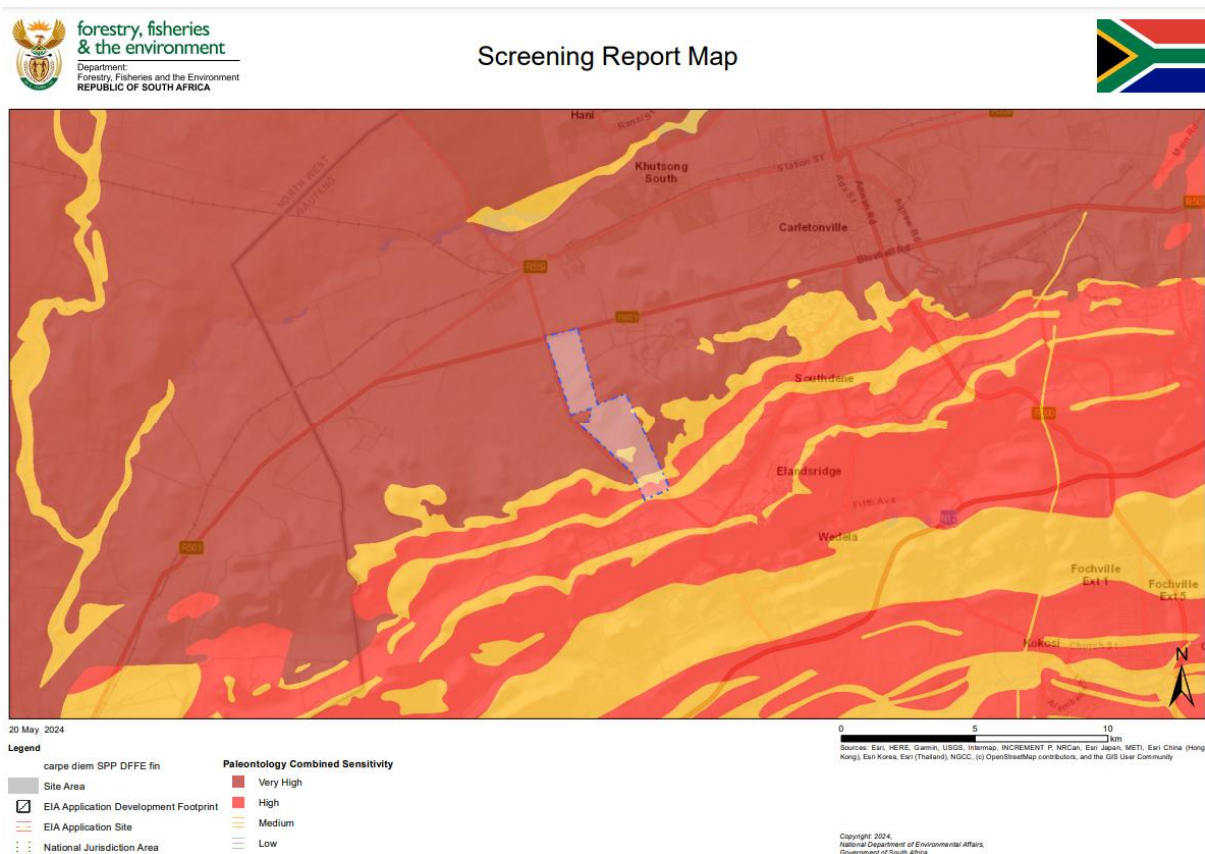


Figure 4: Extract of the 1: 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the Very High (red) Palaeontological Sensitivity of the proposed Carpe Diem SPP in Gauteng. Areas with a High (orange), Low (blue) and Zero (grey) is also crossed.

**Table 3: 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.

**Figure 5: Palaeontological Sensitivity of the study area by the National Environmental Web-based Screening Tool indicates a Very High Palaeontological Sensitivity.**

The SAHRIS PalaeoMap (**Figure 4**) indicates a Very High Palaeontological Sensitivity which is in agreement with the DFFE Screening Tool (**Figure 5**). However, during a site investigation conducted on 12 May 2024 NO fossiliferous outcrops were detected. **The Very High Palaeontological Sensitivity is thus contested with the actual findings in the field.**

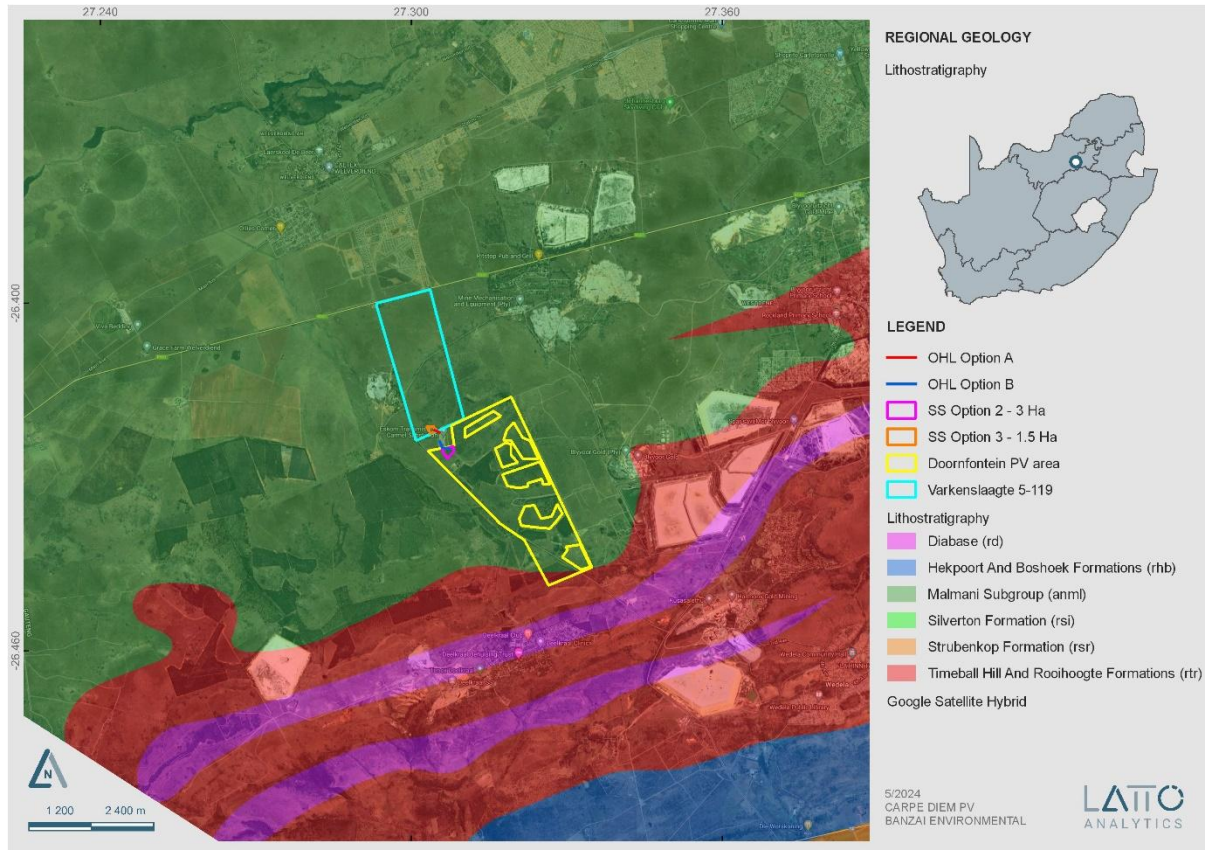


Figure 6: Updated Geology (Council of Geosciences, Pretoria) of the proposed Study area indicates that the development is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) as well as the Timeball Hille Formation of the Pretoria Group.

The Pretoria Group sedimentary rocks in and near the study area are extensively intruded, and locally metamorphosed, by sills of diabase (di, green in **Figure 3**). The diabase has no palaeontological significance. However, the existence of the diabase rocks would have had a thermal metamorphic effect on the Pretoria Group and would decrease the chance of fossil preservation.

The Timeball Hill Formation comprises of conglomerates, diamictite, quartzite, minor lavas with lacustrine and fluvio-deltaic mudrocks, while the overlying Klapperkop Member of the Timeball Hill Formation consist of conglomerate, quartzite, shale and siltstone (Groenewald 2014). Catuneanu & Eriksson (2002) is of the opinion that the Timeball Hill Formation was deposited within a deep marine basin (Figure 4).

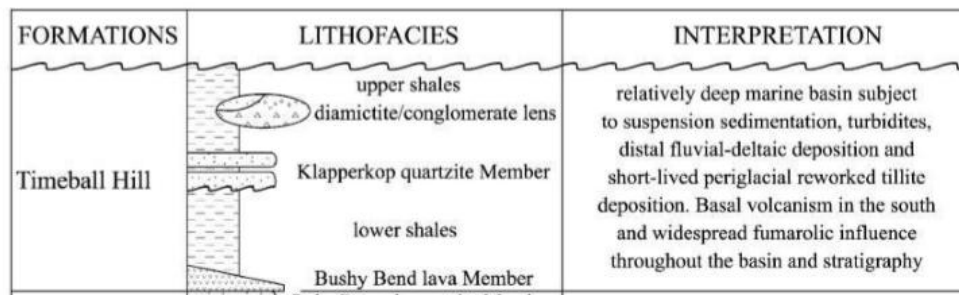


Figure 7: Stratigraphy and depositional settings of the Timeball Hill Formation at the base of the Pretoria succession (Catuneanu and Eriksson 2002).

The Timeball Hill Formation (Figure 7) is known to contain stromatolites and are associated with thin carbonate interbeds within turbidite sequences in the lower part of the formation (Catuneanu & Eriksson 2002). Stromatolites have not been recorded from the overlying fluvio-deltaic Klapperkop Quartzite Member. Other subunits in the Pretoria Group comprising stromatolites possibly also contain organic-walled microfossils.

The Malmani Subgroup is divided into five formations (Table 5) that are classified by the amount of chert, stromatolitic morphology, erosion surfaces and intercalated shales in them. The Malmani Subgroup overlies the Black Reef Formation and comprises of stromatolitic carbonates. The oldest Formation in the Malmani Subgroup is the Oaktree Formation that consists of stromatolitic dolomites, carbonaceous shales, and locally developed quartzites. This formation overlies the (Monte Christo Formation that comprises of 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 quartzites. The Eccles Formation follows and comprises of erosional breccias while the youngest Formation is the Frisco Formation that mostly comprises of stromatolitic dolomites.

The Malmani Subgroup succession is about 2 km-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 consist of historic lime mines, and palaeocave fossil deposits. Dolomite (limestone rock) forms in warm, shallow seas from slow gathering remainders of marine microorganisms and fine-grained sediment. Dolomites of the Malmani Subgroup has a higher magnesium content than other limestones. These materials contain high levels of calcium carbonate and are often referred to as *carbonates*.

The carbonates of the Transvaal Basin comprise of 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. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites



are first found in Precambrian rocks and are known as the earliest known fossils (**Figure 8**). These algae photosynthesised in the low oxygen atmosphere and deposited layer upon layer of calcium sulphate, magnesium sulphate and calcium carbonate as well as other compounds to form these domes. Researchers have examined and classified the stromatolite structures but seldomly find preserved algal cells. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

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; and Schopf, 2006). The Malmani stromatolites literature includes articles by Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

Currently very few palaeontologists study stromatolites but geologists find the stromatolites interesting because they reveal the change from a reducing environment (that is an oxygen-poor) to an oxidizing environment (oxygen-rich). This transition is known as the Great Oxygen Event (Eroglu et al., 2017).



Figure 8: Example of a well-preserved stromatolite from the Archaean Era.

6 SITE INVESTIGATION

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12 May 2024. No Fossiliferous outcrops were detected during the site investigation.



Figure 9: General view over the study area indicating the absence of Malmani stromatolite outcrops and the presence of vegetation.



Figure 10: Pretoria Group outcrops in the southern portion of the study area (unfossiliferous).

7 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 the JUWI.
- 1: 250 000 West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria)
- Palaeotechnical report of the Gauteng (Groenewald et al, 2014)
- The site sensitivity is established through the National Environmental Web-Based Screening Tool (DFFE)
- The site is mapped on the South African Heritage Resources Information System (SAHRIS) PalaeoMap, to established the Palaeontological Sensitivity
- Palaeontological Impact Assessments and Desktop Assessments of projects in the same area are studied.
- A one day-comprehensive site-specific field survey of the development footprint for the project was conducted on foot and motor vehicle by Banzai Environmental on 12 May 2024.

8 IMPACT ASSESSMENT METHODOLOGY

The following methodology has been applied to the prediction and assessment of impacts. Potential impacts have been rated in terms of the direct, indirect, and cumulative nature of the impact:

- **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. These impacts are usually associated with the



construction, operation or maintenance of an activity and are generally obvious and quantifiable;

- **Indirect** impacts – of an activity are indirect or induced changes that may occur because of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place because 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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The significance of each potential impact, with and without the implementation of the proposed mitigation measures, will be assessed based on the following variables (evaluation components):

- Spatial extent – The size of the area that will be affected by the impact;
- Intensity (or Magnitude) – The anticipated severity of the impact;
- Duration – The timeframe during which the impact will be experienced;
- Probability – The probability of the impact occurring;
- Reversibility – The “reversibility” of the environmental impacts of the proposed development after project cessation or decommissioning; and
- Irreplaceability – The “irreplaceability” of natural characteristics in the area that may be impacted upon by the proposed development.

Using the criteria above, the impacts will further be assessed with the use of quantifiable values as described below:

Table 4: Evaluation of criteria, by means of quantitative ratings and descriptions.

Criteria	Description	Quantitative Rating
Duration	Temporary (less than a year)	1
	Short term (1 to 6 years)	2
	Medium term (6 to 15 years)	3
	Long term (the impact will cease after the operational life of the activity)	4
	Permanent (mitigation will not occur in such a way or in such a time span than the impact can be considered transient)	5
Spatial extent	Site specific	1



Criteria	Description	Quantitative Rating
Intensity / Magnitude Applicable to Negative Impacts (at indicated spatial extent)	Local (less than 2 km from the site);	2
	Regional (within 30 km of the site)	3
	National (beyond Provincial boundaries and within National boundaries)	4
	International / Transboundary (Beyond National boundaries)	5
	None (Biophysical and/or social functions and/or processes will remain unaltered)	0
	Very Low (Biophysical and/or social functions and/or processes might be negligibly altered)	2
	Low (Biophysical and/or social functions and/or processes might be slightly altered)	4
	Medium (Biophysical and/or social functions and/or processes might be notably altered)	6
	High (Biophysical and/or social functions and/or processes might be considerably altered)	8
	Very High (Biophysical and/or social functions and/or processes might be severely altered)	10
Intensity / Magnitude Applicable to Positive Impacts (at indicated spatial extent)	None (Biophysical and/or social functions and/or processes will remain unaltered)	0
	Very Low (Biophysical and/or social functions and/or processes might be negligibly enhanced)	2
	Low (Biophysical and/or social functions and/or processes might be slightly enhanced)	4
	Medium (Biophysical and/or social functions and/or processes might be notably enhanced)	6
	High (Biophysical and/or social functions and/or processes might be considerably enhanced)	8
	Very High (Biophysical and/or social functions and/or processes might be substantially enhanced)	10
Probability	Improbable (5% to no chance of occurring)	1
	Probable (5% - 25% chance of occurring)	2
	Medium Probability (25% - 75% chance of occurring)	3
	Highly probable (75% - 95% chance of occurring)	4
	Definite (greater than 95% chance of occurring)	5
Reversibility	No impact	0
	Impact will be reversible	1
	High potential that impact might be reversed	2
	Moderate potential that impact might be reversed	3
	Low potential that impact might be reversed	4
	Impact cannot be reversed	5
Irreplaceability	None	0
	Very low potential for loss of irreplaceable resources	1



Criteria	Description	Quantitative Rating
	Low potential for loss of irreplaceable resources	2
	Moderate potential for loss of irreplaceable resources	3
	High potential for loss of irreplaceable resources.	4
	Definite loss of irreplaceable resources	5
CUMULATIVE impact	High: The activity is one of several similar pasts, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.	
	Medium: The activity is one of a few similar pasts, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.	
	Low: The activity is localised and might have a negligible cumulative impact.	
	None: No cumulative impact on the environment.	

Once the evaluation components have been ranked for each impact, the significance of the potential impact is assessed (or calculated) using the following formula:

$$SP \text{ (significance points)} = (\text{intensity} + \text{duration} + \text{spatial extent} + \text{irreplaceable} + \text{reversibility}) \times \text{probability}.$$

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each environmental impact should be rated as per the table below (Table 8).

Table 5: Definition of significance ratings (positive and negative)

Significance Points	Environmental Significance	Description
125 – 150	Very high (VH)	An impact of high or very high significance could influence a decision about whether or not to proceed with the proposed Project, regardless of available mitigation options.
100 – 124	High (H)	Cumulative Impacts: The activity is one of several similar pasts, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
75 – 99	Moderate-High (MH)	If left unmanaged, an impact of moderate-high significance could influence a decision about whether or not to proceed with the proposed Project. Mitigation options should be re-evaluated.
40 – 74	Moderate (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with the proposed Project. Cumulative Impacts: The activity is one of a few similar pasts, present or future activities in the same geographical area, and might have a combined



Significance Points	Environmental Significance	Description
		impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
<40	Low (L)	An impact of low significance is likely to contribute to positive decisions about whether or not to proceed with the proposed Project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. Cumulative Impacts: The activity is localised and might have a negligible cumulative impact.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect and is likely to contribute to positive decisions about whether or not to proceed with the proposed Project.

Table 6: Impact Summary

	Intensity	Duration	Extent	Irreplaceable Loss	Reversibility	Probability	SP
Pre-mitigation	8	5	1	5	5	3	72
Post-mitigation	4	5	1	5	5	2	40

7.1 Summary of Impact Tables

Loss of fossil heritage will be a negative impact. However, if fossils are recovered it could have a positive impact as the fossils will be available for scientific research. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially Permanent. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase is medium probable pre-mitigation and probable post-mitigation. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be Moderate to High (72) pre-mitigation and Moderate (post-

**Table 7: Impacts and the mitigation measures during the planning phase.**

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
<i>Palaeontology</i>	<i>Impact on Palaeontological Heritage</i>	No Impact	No Impact	No Impact

Table 8: Impacts and the mitigation measures during the construction phase.

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
<i>Palaeontology</i>	<i>Impact on Palaeontological Heritage</i>	Negative Medium	Negative Low	CHANCE FIND PROTOCOL - 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, who should then immediately report the find to the ECO. The ECO 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 coordinates. - 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



SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
				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 ECO whether a rescue excavation or rescue collection by a palaeontologist is necessary. The ECO will communicate the need for a rescue excavation or rescue collection by a palaeontologist to the ESO or site manager. 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. In the event that the fossil cannot be stabilized, the fossil may be collected with extreme care by the ECO. Fossils finds must be stored in tissue paper and in an appropriate box, while due care must be taken to remove all fossil material from the rescue site. Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

**Table 9: Impacts and the mitigation measures during the operational phase.**

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
<i>Palaeontology</i>	<i>Impact on Palaeontological Heritage</i>	No Impact	No Impact	No Impact

Table 10: Impacts and the mitigation measures during the decommissioning phase.

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
<i>Palaeontology</i>	<i>Impact on Palaeontological Heritage</i>	No Impact	No Impact	No Impact



9 CONCLUSION AND SUMMARY

9.1 Summary of findings

The Proposed Carpe Diem Solar Photovoltaic Plant (SPP) and associated infrastructure is largely underlain by the Vaalian aged Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) with a small portion in the south underlain by the Timeball Hill Formation and Rooihoochte Formations of the Pretoria Group (Transvaal Supergroup). A very small portion in the south is underlain by unfossiliferous diabase). The Malmani Subgroup is undifferentiated in this area. The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while areas with a High, Low and Zero is also crossed (Almond and Pether, 2009; Almond et al., 2013, Groenewald et al 2014). However, the Palaeotechnical report of the Gauteng province indicates that the Palaeontological Sensitivity of the Malmani Subgroup is High (Groenewald et al, 2014). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DFFE Screening Report. Updated geology (Council for Geosciences, Pretoria) indicates that the study area is underlain by the Malmani Subgroup (anml) as well as the Timeball Hill and Rooihoochte Formations of the Pretoria Group.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12 May 2024. No fossiliferous outcrop was detected in the proposed development. Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the development footprint is rare. This is in contrast with the Very High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. **A Medium to High Palaeontological Significance has been allocated for the construction phase of the PV development pre-mitigation and a low significance post mitigation.** The construction phase will be the only development phase impacting Palaeontological Heritage and **no significant impacts are expected to impact the Operational and Decommissioning phases.** The No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, will have a Neutral impact on the Palaeontological Heritage of the development. **The Cumulative impacts of the development is considered to be medium pre-mitigation and Low post mitigation and falls within the acceptable limits for the project.** It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. **The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager



must report to 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) so that mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

9.2 Conclusion and Impact Statement

The site investigation as well as desktop research (National Database and published data) concluded that fossil heritage of scientific and conservational interest in the development area is relatively rare and of low conservational and scientific value. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. **The construction of the PV development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.**

The significance of the impact occurring will be negative medium before mitigation. The post mitigation Significance of the Impact will be low.

10 MITIGATION AND EMPR REQUEMENTS

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past 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, with the guidance of the Environmental Control Officer (ECO), 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.

The following procedure will only be followed if fossils are uncovered during excavation.

10.1 Legislation



Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 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 and is protected by the NHRA, and are 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.**

10.2 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, who should then immediately report the find to the ECO. The ECO 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 coordinates.
- 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 ECO whether a rescue excavation or rescue collection by a palaeontologist is necessary. The ECO will communicate the need for a rescue excavation or rescue collection by a palaeontologist to the ESO or site manager.
- 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.
- In the event that the fossil cannot be stabilized, the fossil may be collected with extreme care by the ECO. Fossils finds must be stored in tissue paper and in an appropriate box, while due care must be taken to remove all fossil material from the rescue site.
- 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 A – Elize Butler CV

PROFESSION: Palaeontologist
YEARS' EXPERIENCE: 30 years in Palaeontology
EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

B. Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

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

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–2022

TECHNICAL REPORTS

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farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Savannah South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday's River valley Local Municipality, Eastern Cape Province. Bloemfontein.

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