

**PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED PV SOLAR
FACILITY AT THE HEINEKEN SEDIBENG BREWERY, NEAR VEREENIGING,
GAUTENG**

Issue Date: 17 October 2019

Revision No.: v0.1

Client: Savannah

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;

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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.

NEMA Regs (2014) - Appendix 6	Relevant section in report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii of Report – Contact details and company and Appendix B
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4 – Objective
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 – Geological and Palaeontological history
(B) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10
d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1 and 9
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modeling used;	Section 7 Approach and Methodology
f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 11

NEMA Regs (2014) - Appendix 6	Relevant section in report
g) an identification of any areas to be avoided, including buffers;	Not identified, Section 9
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 or activities;	Section 11
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorization;	Section 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorization;	N/A
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorized; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable.

NEMA Regs (2014) - Appendix 6	Relevant section in report
q) any other information requested by the competent authority.	Not applicable.
2) Where a government notice <i>gazetted</i> 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 was appointed by Savannahsa (Pty) Ltd to conduct the **Palaeontological Field Assessment** (PIA) to assess the proposed Heineken Sedibeng Solar Plant, which is located on Graceview EXT 3, Erf 244, near Vereeniging in Gauteng. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to the discovery of fossil material within the planned development. This PIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The development footprint is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond and Pether 2008, SAHRIS website). As seen on Google Earth History, the proposed development footprint has been disturbed by agricultural activities and the southern portion is utilized as a truck depo. Groenewald and Groenewald 2014 allocated a high Sensitivity to the Malmani Subgroup. He noted that additionally to the stromatolites, potentially fossiliferous Late Caenozoic Cave breccias within the "Transvaal dolomite" outcrop area could be present. These breccias are not individually mapped on geological maps.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 30 October 2019. One loose stromatolite fossil has been discovered 25 m north of the development boundary and there is thus a chance that other stromatolite fossils could be present just below the surface of the development footprint. **The site manager must take special care that this fossil is not damaged prior to removal by a palaeontologist.** As impacts on fossil heritage typically only occur during the excavation phase no further impacts on fossil heritage are probable during the operation and decommissioning phases. Mitigation is thus recommended and involves the collection and recording of fossils in the development footprint. By implementing mitigation measures the significance of the impact will be reduced to low. Mitigation should take place after initial vegetation is cleared away but *before* the ground is levelled for construction. Preceding excavation of any fossils, the palaeontologist needs to apply for a collection permit from SAHRA. Fossil material must be housed 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. These recommendations should be included in the Environmental Management Plan for the Heineken Sedibeng PV plant.

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 EC in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the EC 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 correct mitigation (recording and collection) can be carry out by a paleontologist.

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. However, it is recommended that the mitigation measures below are fully implemented.

Impact Summary

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	-16	Negative low impact

The construction and operation of the Heineken Sedibeng Solar PV Facility Power Project is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area **once** mitigation recommendations have been fully complied with.

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1 INTRODUCTION

Solink Power Procurement (Pty) Ltd (Solink) proposed the development of a small-scale solar photovoltaic (PV) facility to supplement processing power requirements for the adjacent Heineken Sedibeng Brewery, located within Sedibeng in the Gauteng Province. The Heineken Sedibeng Brewery is accessible directly off the R550, where it forms part of the Kliprivier Business Park. The PV facility will be 19.9 ha in size and will be located on Graceview EXT 3, Erf 244 (Title Deed: T20324/2018), with the power line of the project connecting with an onsite substation located on Graceview Ext 1, Erf 243 (Title Deed: T716/2019). Most of the PV project is located on Erf 244, with the powerline extending onto Erf 243. The project aims to reduce the plant's reliance on the national Eskom power grid and reduce operational costs through utilising a sustainable energy solution. The project is being designed to fall below the thresholds for a Basic Assessment process, and to rather be conducted under the Gauteng Province Environmental Management Framework (GPEMF) registration process, on the assumption that the non-exempted triggering activities may be made redundant through design optimisation.

Solink is considering the installation of a phased PV facility, with the following specifications:

Phase I

- 2.5ha surface area with maximum generation capacity;
- 1MW PV plant;
- 11 kV distribution line;
- Completed without submission of an environmental authorisation (by ensuring no listed activities are triggered through adaptive design).

Phase II

- 17.4 ha surface area and 19.9 MW nominal generation capacity;
- 11kV distribution line; and
- Expand the Phase I facility to the maximum permitted size and generation capacity under the Basic Assessment process (conducted in parallel with the construction of Phase I);

Ultimately, the facility is to connect to the Heineken-owned substation (Erf 243), located within the Heineken Sedibeng brewing facility, in order to supply that facility with power for operations¹.

¹Information provided by Savannah

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive 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 for 13 years. She has been conducting PIAs since 2014.



Figure 1: Google Earth Image (2019) of the location of the proposed Heineken Sedibeng Solar Plant and powerline, near Vereeniging, Gauteng.

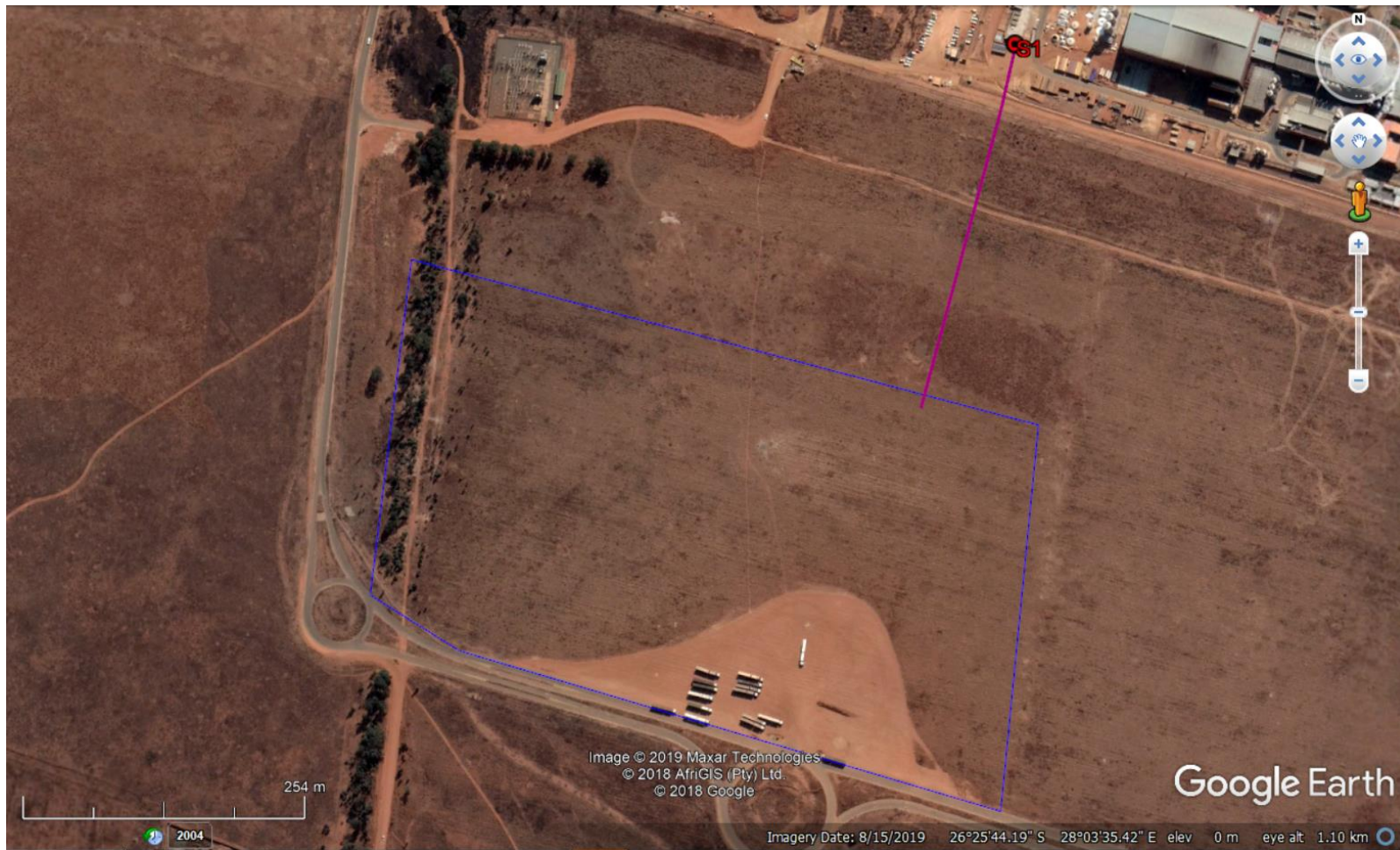


Figure 2: Close-up Google Earth Image (2019) of the proposed Heineken Sedibeng Solar Plant location indicated in blue and powerline in purple, near Vereeniging, Gauteng.

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”**.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources 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 PDIA 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 OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

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;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of 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
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

5 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The development footprint is totally underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup (Figure 3-6).

The Malmani Subgroup platform carbonates of the Transvaal Basin comprise of an assortment of stromatolites (microbial laminites), 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 4). 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. The oxygen atmosphere that we depend on 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 Button (1973), Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

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*.

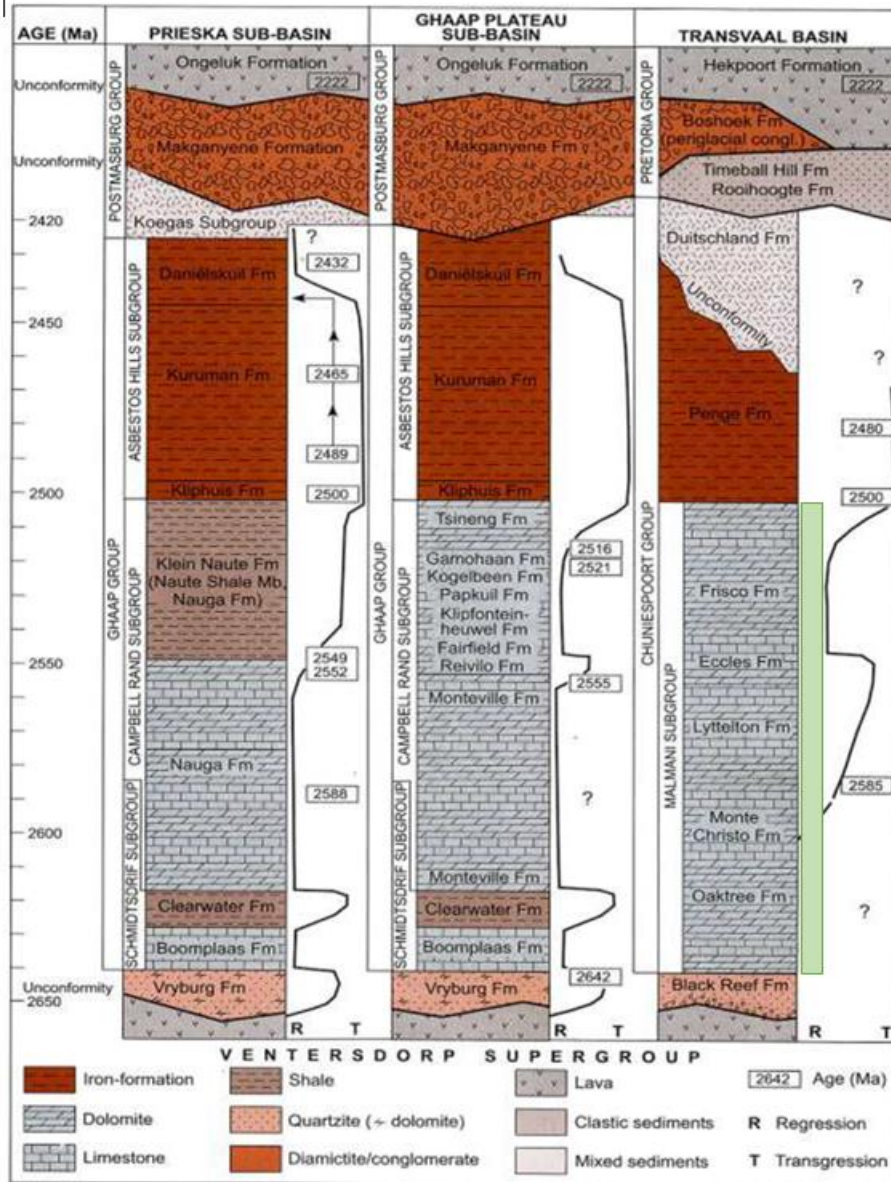


Figure 3: Stratigraphy of the Transvaal Supergroup of the Ghaap Plateau Basin. The proposed development is indicated in green (Eriksson, et al. 2006).



Figure 4: Example of a well-preserved stromatolite from the Archaean Era.

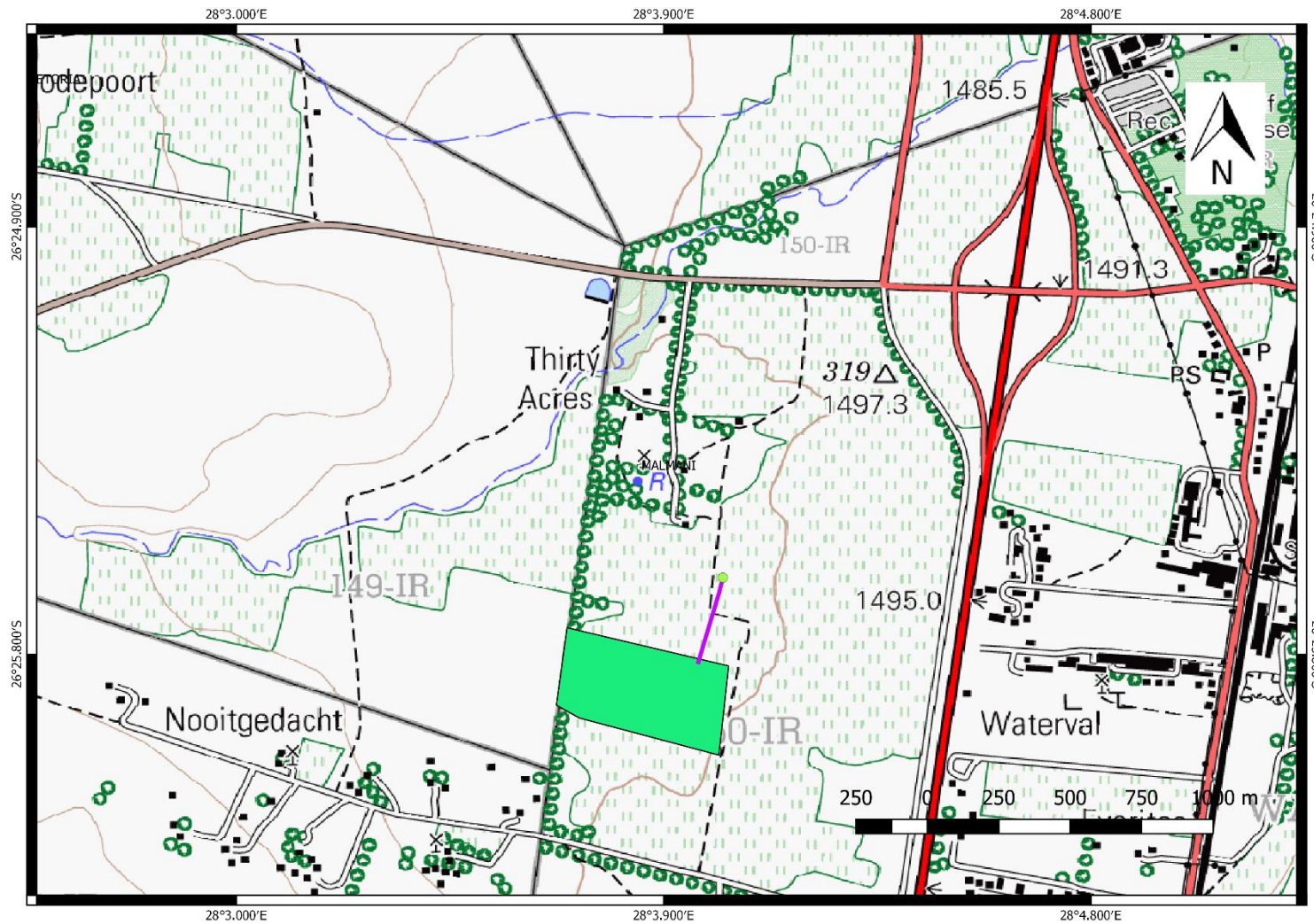


Figure 5: Extract of the 1: 50 000 2628 AC topographical map indicating the location of the proposed Heineken Sedibeng Brewery Solar development and powerline. The proposed PV development is indicated in green and the powerline in purple. Map drawn by QGIS 2.18.28.

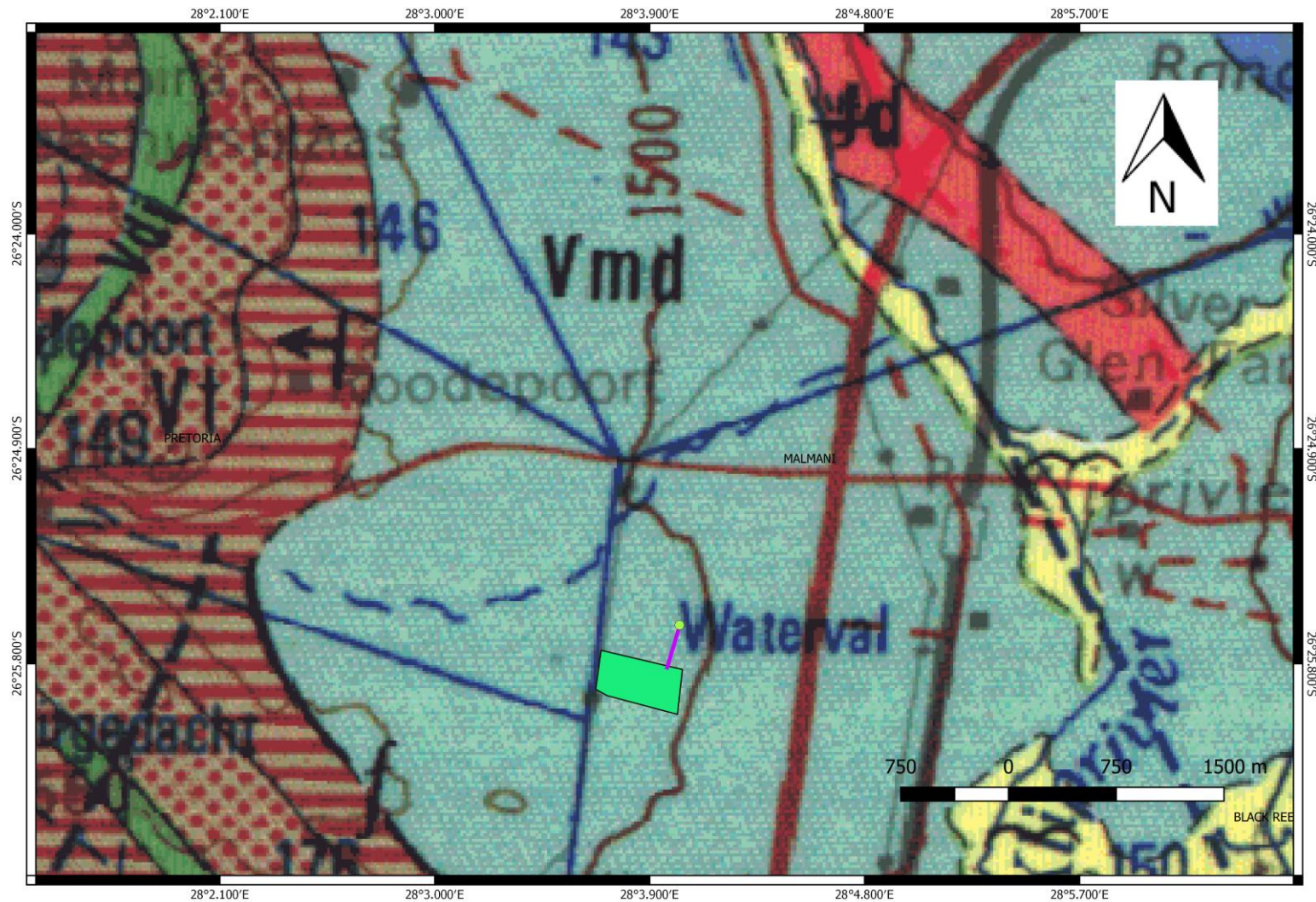
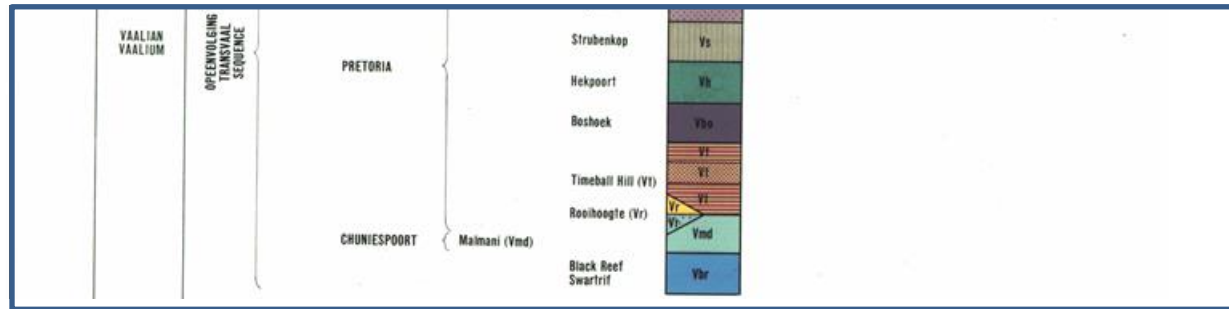


Figure 6: Extract of the 1:250 000 2628 EastRand Geological map (Council of Geoscience) of the proposed Heineken Sedibeng Brewery Solar development (indicated in green) and powerline (indicated in purple) near Vereeniging in Gauteng. The proposed development is underlain by the by Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup. Map drawn by QGIS 2.18.28.

LEGEND



Vmd - Malmani Subgroup of the Chuniespoort Group (Transvaal Group)
Dolomite, Chert.

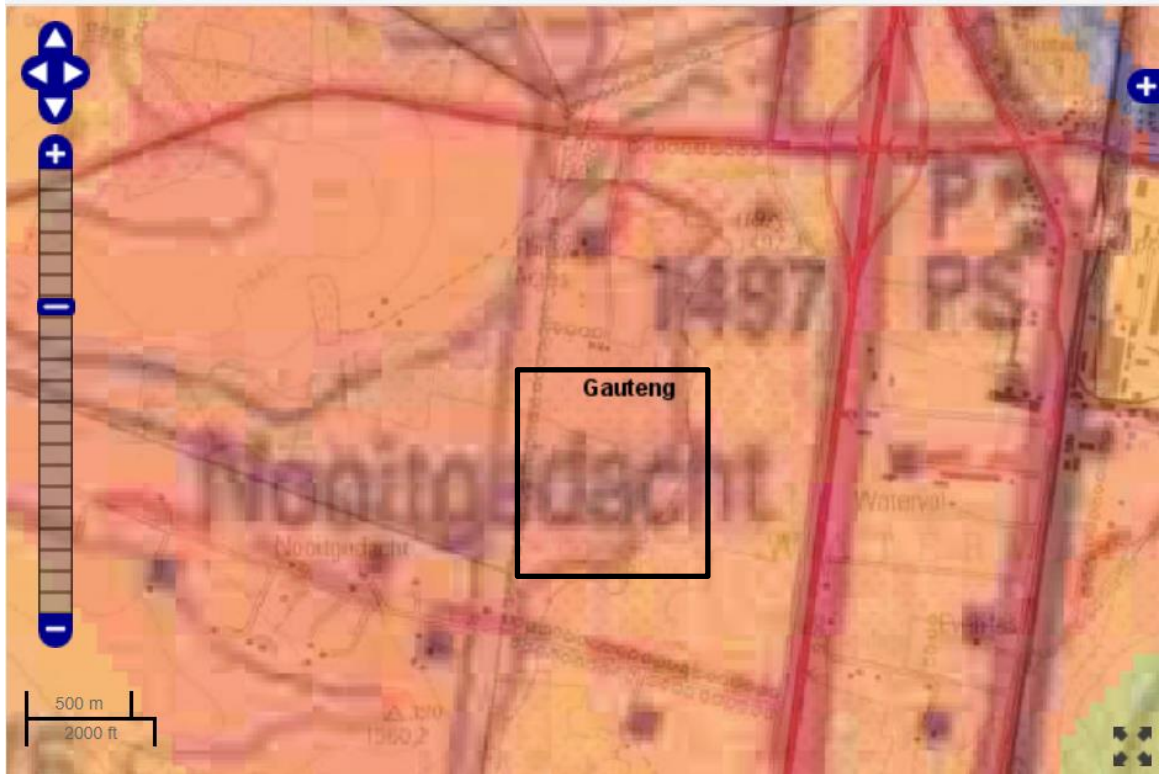


Figure 7: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the proposed development is indicated in black.

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 7) there is a very high chance of finding fossils in this area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The Heineken Sedibeng Brewery is accessible directly off the R550, where it forms part of the Kliprivier Business Park. The PV facility is situated on Graceview EXT 3, Erf 244, portion 0, and Graceview Ext 1, Erf 243 (portion 0) (for the power line) and will be 19.9 ha in extent.

7 METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This include all trace fossils as well as all fossils in the proposed footprint. All possible information is consulted to compile a desktop study, and this includes the following: all Palaeontological impact assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurate documented.

Comparable Assemblage Zones in other areas is sourced to provide information on the existence of fossils in an area which was not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

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)
- 1: 250 000 2628 East Rand Geological map (Council of Geoscience)

- A Google Earth map with polygons of the proposed development was obtained from PGS Consultants.
- 1:50 000 Topographical Map 2628 AC.
- PIA near the development site consulted include Bamford 2018; Rubidge 2008. See references.

9 SITE VISIT

A one-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 30 October 2019. The following photographs were taken during the site visit to the proposed development. One stromatolite was recovered 25 north of the development boundary during the field visit. Well-preserved fossils may thus be found during excavations and due care must be taken to preserve them- see protocol for finds.



Figure 8: Outcrop in middle of property, runs south-north



Figure 9: Outcrop consisting of mostly chert



Figure 10: Stromatolite found just north of the development. GPS Coordinates - 26.4302 28.0669

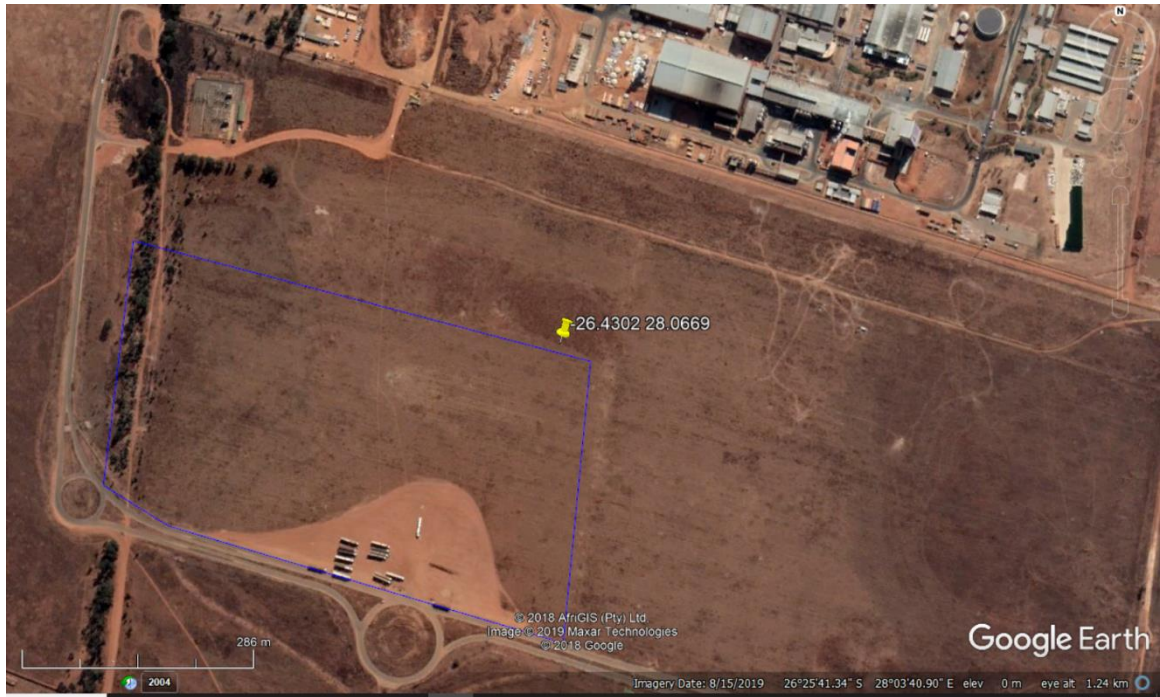


Figure 11: Location of the loose stromatolite (-26.4302 28.0669) located 25 m from the northern boundary of the development.

10 IMPACT ASSESSMENT METHODOLOGY

Direct, indirect and cumulative impacts of the impacts identified above will be assessed according to the following standard methodology:

- The **nature** which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The **duration** wherein it will be indicated whether:
 - The lifetime of the impact will be of very short duration (0 - 1 years) – assigned a score of 1;
 - The lifetime of the impact will be of short duration (2 - 5 years) – assigned a score of 2;
 - Medium-term (5 - 15 years) – assigned a score of 3;
 - Long-term (> 15 years) – assigned a score of 4; or
 - Permanent – assigned a score of 5.
- The **magnitude** quantified on a scale from 0 - 10 where 0 is small and will have no effect on the environment, 2 is minor and will result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very

high and results in complete destruction of patterns and permanent cessation of processes.

- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 - 5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **significance** which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The **status**, which is described as positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E + D + M) \times P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area);
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated); and
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

10.1 IMPACT ASSESSMENTS

An assessment of the impact significance of the Heineken Sedibeng Solar Plant near Vereeniging in Gauteng is presented here:

10.1.1 Nature of the impact

The excavations and site clearance of the Heineken Sedibeng Solar Plant will involve extensive excavations into the superficial sediment cover as well as into the underlying bedrock. These excavations will change the existing topography and may destroy or permanently seal-in fossils at or below the ground surface that will no longer be available for research. According to the Geology of the project site there is a Very High possibility of finding fossils during construction.

10.1.2 Sensitive areas

The development footprint is totally underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond and Pether 2008, SAHRIS website). (5)

10.1.3 Geographical extent of impact

The impact on fossil heritage will be restricted to the construction phase when new excavations into potentially fossiliferous bedrock take place. The extent of the area of potential impact is thus restricted to the project site and therefore categorised as **local**. (1)

10.1.4 Duration of impact

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**. (5)

10.1.5 Potential significance of the impact

Should the project progress without due care to the possibility of fossils being present at the proposed development site the resultant damage, destruction or inadvertent relocation of any affected fossils will be **permanent and irreversible**. Thus, any fossils occurring within the development area are potentially scientifically and culturally significant and any negative impact on them would be of **high significance**.

10.1.6 Severity / benefit scale

The development will be **beneficial** on a local level, but regional and national level as well. The facility will provide a long-term benefit to the Heineken Sedibeng Brewery.

A potential **secondary advantage** of the construction of the project would be that the excavations may uncover fossils that were hidden beneath the surface exposures and, as such, would have remained unknown to science.

10.1.7 Intensity

Probable significant impacts on palaeontological heritage during the construction phase are high.

10.1.8 Probability of the impact occurring

Since the Palaeontological Sensitivity ranges from high to very high the probability of significant impacts on palaeontological heritage during the construction phase are high.

10.1.9 Damage mitigation, reversal and potential irreversible loss

Mitigation

If fossil material occurs within the proposed development any negative impact upon it may be mitigated by description and collecting of well-preserved fossils. These actions should take place after vegetation clearance but *before* the ground is levelled for construction. Excavation of fossil heritage will require a permit from SAHRA, and the material must be housed in a permitted institution.

10.1.10 Degree to which the impact can be mitigated

Recommended mitigation of the damage and destruction of fossil heritage within the proposed footprint would comprise the collection and describing of fossils. These actions would take place after initial vegetation clearance but *before* the ground is levelled for construction.

10.1.11 Degree of irreversible loss

Impacts on fossil heritage are irreversible. From a scientific point of view all well-documented records and palaeontological studies of any fossils exposed during construction would represent a positive impact. A negative impact on the palaeontological heritage can be reduced by the application of adequate damage mitigation procedures. If damage mitigation is properly undertaken the impact may be regarded as beneficial.

10.1.12 Degree to which the impact may cause irreplaceable loss of Resources

Stratigraphic and geographical distribution of fossils in the Malmani Subgroup is expected to be of high palaeontological sensitivity.

Table 1: Impact table of the construction phase of the Heineken Sedibeng Solar Plant

<p>Nature: The excavations and clearing of vegetation during the construction phase of the Heineken Sedibeng Solar Plant and associated infrastructure will consist of digging into the superficial sediment cover as well as underlying deeper bedrock. These excavations will change the existing topography and may possibly damage, destroy or even permanently close-in fossils at or below the surface of the ground. These fossils will then be lost for research.</p> <p>Impacts on Palaeontological Heritage are only likely to happen within the construction phase. No impacts are expected to occur during the operation phase or decommissioning phase.</p>		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term/permanent (5)	Long term/permanent (5)
Magnitude	High(8)	Moderate (2)
Probability	High (4)	Improbable (2)
Significance	MEDIUM (56)	LOW (16)
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
<p>Mitigation procedure: See Chance find protocol</p> <p>Chance Find Procedure</p> <ul style="list-style-type: none"> • If a chance find is made the person responsible for the find must immediately stop working and all work 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 Environmental Officer (EO) (if appointed) or site manager. The EO must report the find to the relevant Heritage Agency (South African Heritage Research 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 EO (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 stabilized the fossil may be collected with extreme care by the EO (or site manager). 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 Heritage Agency has issued the written authorization, the developer may continue with the development.

Residual Risk: *Loss of Fossil Heritage*

10.2 Summary of Impact Tables

The development footprint is totally underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond and Pether 2008, SAHRIS website). The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**. Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as having a high possibility. The significance of the impact occurring pre-mitigation will be medium, whereas it will be low following implementation of mitigation measures.

11 FINDINGS AND RECOMMENDATIONS

The development footprint is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group) within the Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond and Pether 2008, SAHRIS website). As seen on Google Earth History, the proposed development footprint has been disturbed by agricultural activities and the southern portion is utilized as a truck depo. Groenewald and Groenewald 2014 allocated a high Sensitivity to the Malmani Subgroup. He noted that additionally to the stromatolites, potentially fossiliferous Late Caenozoic Cave breccias within the "Transvaal dolomite" outcrop area could be present. These breccias are not individually mapped on geological maps.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 20 October 2019. One loose stromatolite fossil has been recovered and there is thus a chance that other stromatolite fossils could be present just below the surface of the development footprint. **The EO/site manager must take special care that this fossil is not damaged prior to removal by a palaeontologist.** As impacts on fossil heritage typically only occur during the excavation phase no further impacts on fossil heritage are probable during the operation and decommissioning phases. Mitigation is thus recommended and involves the collection and recording of fossils in the development footprint. By implementing mitigation measures the significance of the impact will be reduced to low. Mitigation should take place after initial vegetation is cleared away but *before* the ground is levelled for construction. Preceding excavation of any fossils, the palaeontologist needs to apply for a collection permit from SAHRA. Fossil material must be housed 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. These recommendations should be assimilated into the Environmental Management Plan for the Heineken Sedibeng PV plant

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

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. However, it is recommended that the mitigation measures detailed in this report are fully implemented.

12 CHANCE FINDS PROTOCOL

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

12.1 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.

12.2 Background

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.

12.3 Introduction

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 Officer (EO) 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 EO, 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.

12.4 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 EO or site manager. The EO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research 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 EO (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.

- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). 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 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

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION: Palaeontologist
YEARS' EXPERIENCE: 26 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

Registered as a PhD fellow at the Zoology Department of the UFS
2013 to
current

Dissertation title: A new gorgonopsian from the uppermost *Daptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

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–currently

TECHNICAL REPORTS

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