



**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED MATJHABENG
SOLAR PV WITH BATTERY ENERGY STORAGE SYSTEMS PROJECT: PHASE 1 AND
PHASE 2 SITES, ODENDAALSRUS, FREE STATE**

SAHRA CaseID: 15041

Compiled for:

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Prepared by

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1 November 2020

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:

A handwritten signature in black ink, appearing to read 'Elize Butler', with a period at the end.

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

Table 1 - NEMA Table

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 – Objective	-
(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 9	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Desktop Assessment	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific 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 10	
(g) An identification of any areas to be avoided, including buffers	Section 1 and 10	
(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	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
(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	Section 1 and 10	
(k) Any mitigation measures for inclusion in the EMPr	Section 1 and 10	
(l) Any conditions for inclusion in the environmental authorisation		None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation		None required
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 10	
(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, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 1 and 10	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(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	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be	Section 3 compliance with SAHRA guidelines	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
applied to a specialist report, the requirements as indicated in such notice will apply.		

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Nema Consulting to conduct the Palaeontological Desktop Assessment (PDA) assessing the proposed Matjhabeng Solar PV with Battery Energy Storage Systems Project: Phase 1 and Phase 2 Sites. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is necessary to determine if fossil material is present within the planned development. This study is therefore necessary to evaluate the effect of the construction on the palaeontological heritage. SAHRA commissioned this study as no previous palaeontological studies were conducted for this site.

Phase 1 and Phase 2 PV Sites are primarily underlain by Caenozoic Superficial Sediments as well as a very small portion of the Bothaville Formation (Ventersdorp Supergroup, Ecca Group, Karoo Supergroup) in the north of Phase 2 Site. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments and Bothaville Formation is moderate (Almond and Pether 2008, SAHRIS website). For this reason, it is considered that the proposed Solar development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. 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 the Environmental Control Officer (ECO) in charge of these developments must be informed immediately. These discoveries ought to be protected (if possible, *in situ*) and the ECO 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.

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1 INTRODUCTION

The following information was provided by Nema Consulting

Electricity generation sources need to be diversified to ensure security of supply and reduction in the carbon footprint created by the current heavy reliance of South Africa on coal to produce electricity.

SunElex Energy (Pty) Ltd (the Applicant) has proposed the development of the Matjhabeng 400 MW Solar Photovoltaic (PV) Plant with 80 MW (320 MWh) Battery Energy Storage System (BESS), which is located north and south of the town of Odendaalsrus in the Free State Province (Figure 1-3). The proposed Project will be developed to serve the Matjhabeng Local Municipality's energy requirements and will generate power for delivery to the local/national grid.

This project is divided into the two PV Solar Plants and as well as a grid connection from the PV solar plants to existing Eskom 132 kV distribution system. Please note that this desktop study is for the Palaeontological Assessment in the two PV Solar Plants.

The proposed utility-scale Project will be developed in the following two (2) phases:

- **Phase 1:** 200MW PV with 40 MW (160 MWh) BESS on the Project site located south of Odendaalsrus (hereinafter referred to as "Phase 1 Site"); and
- **Phase 2:** 200MW PV with 40 MW (160 MWh) BESS on the Project site located north of Odendaalsrus (hereinafter referred to as "Phase 2 Site").

Nema Consulting (Pty) Ltd was appointed by SunElex as the independent Environmental Assessment Practitioner (EAP) to apply for Environmental Authorisation for the proposed Project in terms of NEMA.

Two layout alternatives for each phase have been proposed for the Matjhabeng PV Project

Table 2: Layout alternatives

Phases	Project Components	Alternatives	
Phase 1	PV Sites with BESS	Battery Option 1	Battery Option 2
		BESS Technology	BESS Technology
Phase 2	PV Sites with BESS	Realigned road Option 1	Realigned road Option 2
		BESS Technology	BESS Technology

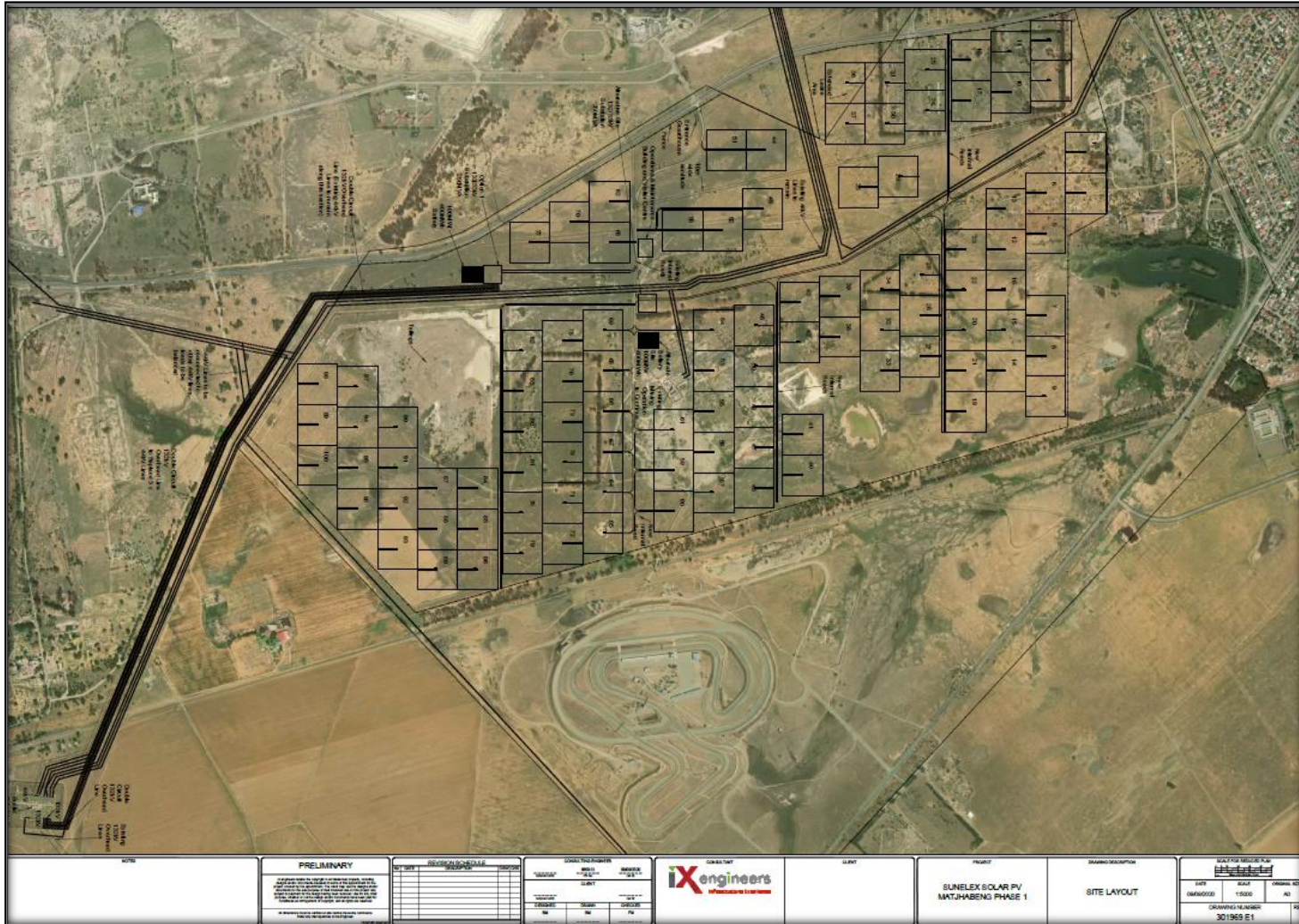


Figure 1: Matjhabeng Solar Phase 1 Layout

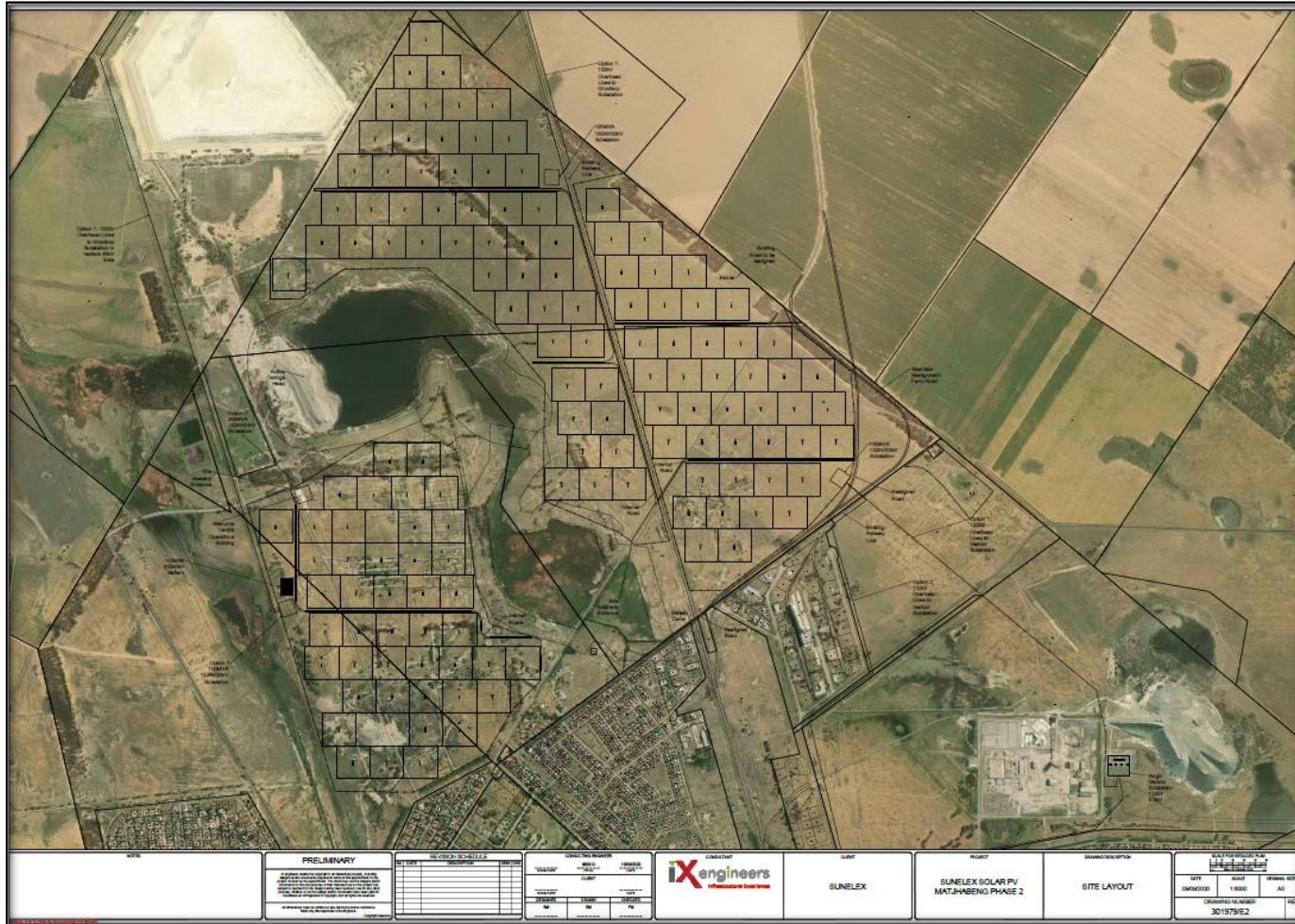


Figure 2: Matjhabeng Solar Phase 2 Layout

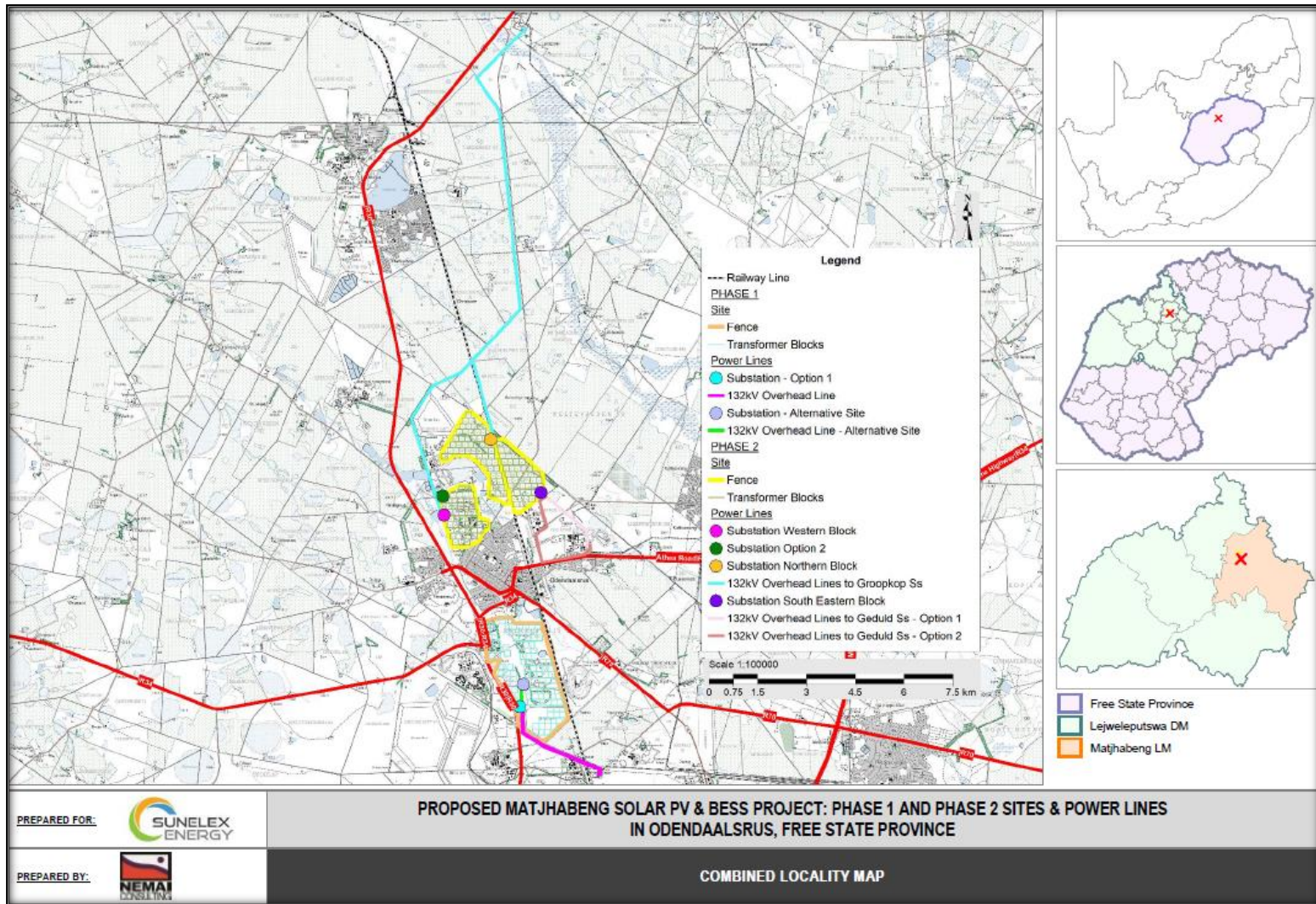


Figure 3: Combined Locality Map- site and power lines

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The current study has been conducted by Mrs Elize Butler. She has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, 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-five 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”**.

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 Palaeontological Impact Assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, a 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 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity which will change the character of a site—
 - a. (exceeding 5 000 m² in extent; or
 - b. involving three or more existing erven or subdivisions thereof; or
 - c. involving three or more erven or divisions thereof which have been consolidated within the past five years; or

- d. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- e. the re-zoning of a site exceeding 10 000m² 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 surface geology of the proposed Matjhabeng PV Solar Project is depicted on the 1:25 000 2726 Kroonstad (2000) Geological Map (Council for Geosciences). Phase 1 and Phase 2 PV Sites are primarily underlain by Caenozoic Superficial Sediments as well as a very small portion of the Bothaville Formation (Ventersdorp Supergroup, Ecca Group, Karoo Supergroup) in the north of Phase 2 Site. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments and Bothaville Formation is moderate (Almond and Pether 2008, SAHRIS website).

The Quaternary superficial deposits are the youngest geological deposits formed during the most recent geological period (approximately 2.6 million years ago to present). The rocks and sediments are found at or near the Earth's surface. Most of the superficial deposits are unconsolidated sediments and consist of clay, gravel, sand, silt, that form relatively thin, discontinuous patches of sediments or larger spreads onshore. These sediments comprise of beach sand, channel, floodplain and stream deposits, talus gravels and glacial drift sediments.

The Quaternary deposits are of most importance due to the palaeoclimatic changes that are reflected in the different geological formations (Hunter et al., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa were formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits cut by dongas. In the past palaeontologists did not focus on Caenozoic

superficial deposits although they sometimes comprise of significant fossil deposits. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn cores, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/mounds) and rhizoliths (root casts).

The best exposures of the Ventersdorp Supergroup are in the North West Province, Northern Cape Province as well as Gauteng and southern Botswana. This Supergroup consists of the Kliprivierberg Group (oldest) which is overlain by the Platberg Group, followed by the sedimentary Bothaville Formation and the volcanic Allanridge Formation (uppermost Ventersdorp unit, youngest Formation). The Klipriviersberg Group consist of Basic and acid volcanics with subordinate siliciclastic sediments.

The Bothaville formation consists of conglomerate and quartzites. The conglomerates are found at the base of the formation and consists of rounded boulders and pebbles of chert, banded iron formation granite, quartz, quartzite, tuff lava and quartz porphyry of Ventersdorp and older formations. The ancient basement rocks, including the Bothaville Formation, are not known to be fossiliferous.

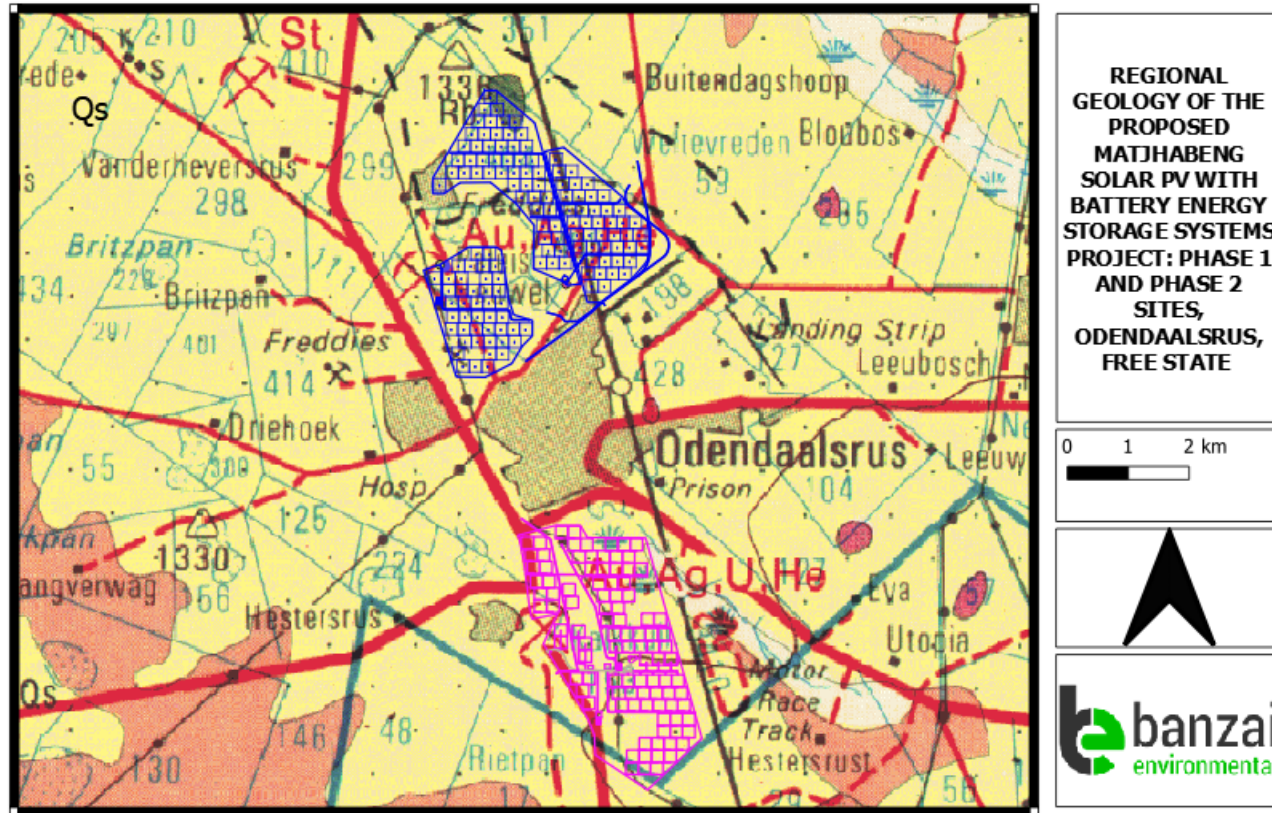
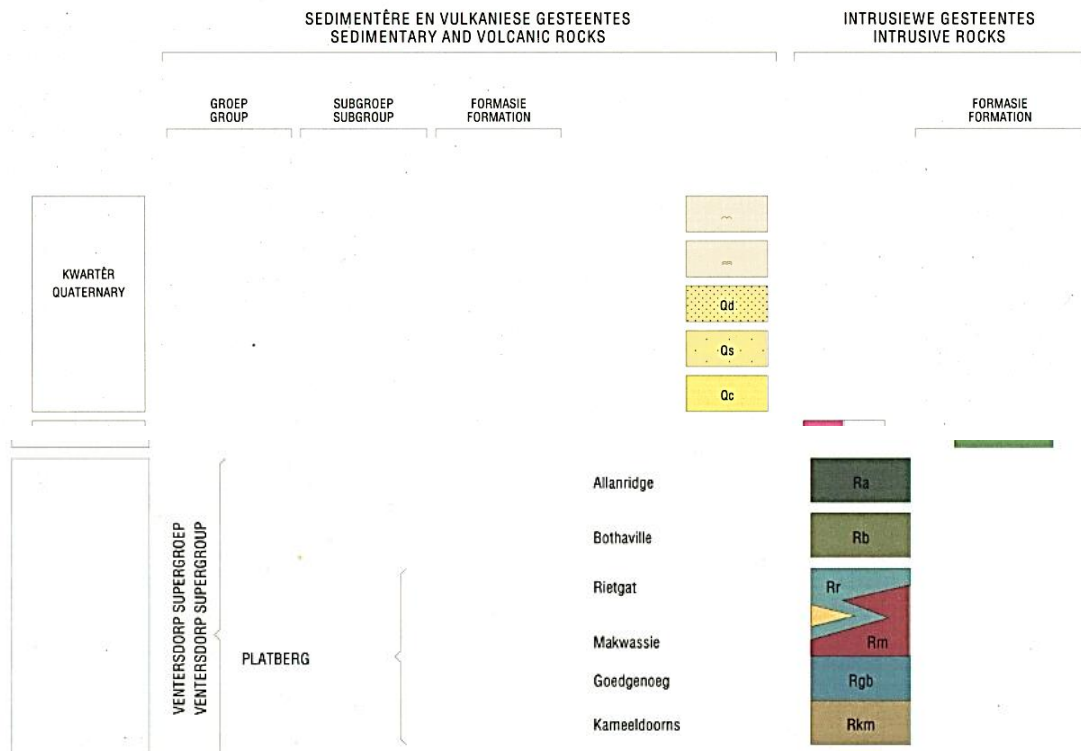


Figure 4: Extract of the 1:250 000 2724 Kroonstad Geological Map (Council of Geoscience) indicating the proposed development. Surface geology indicates that the development footprint is underlain by the Late Cenozoic Superficial Sediments as well as a small portion of the Bothaville Formation (Ventersdorp Supergroup, Ecca Group, Karoo Supergroup). Map drawn by QGIS 2.18



Legend to Map and short explanation.

Qs -Yellow - Quaternary Superficial Sediments- aeolian sand

Rb- Dark Green- Quartzite Conglomerate and greywacke

Mining activity

Au Gold

Ag Silwer

U Uranium

He Helium

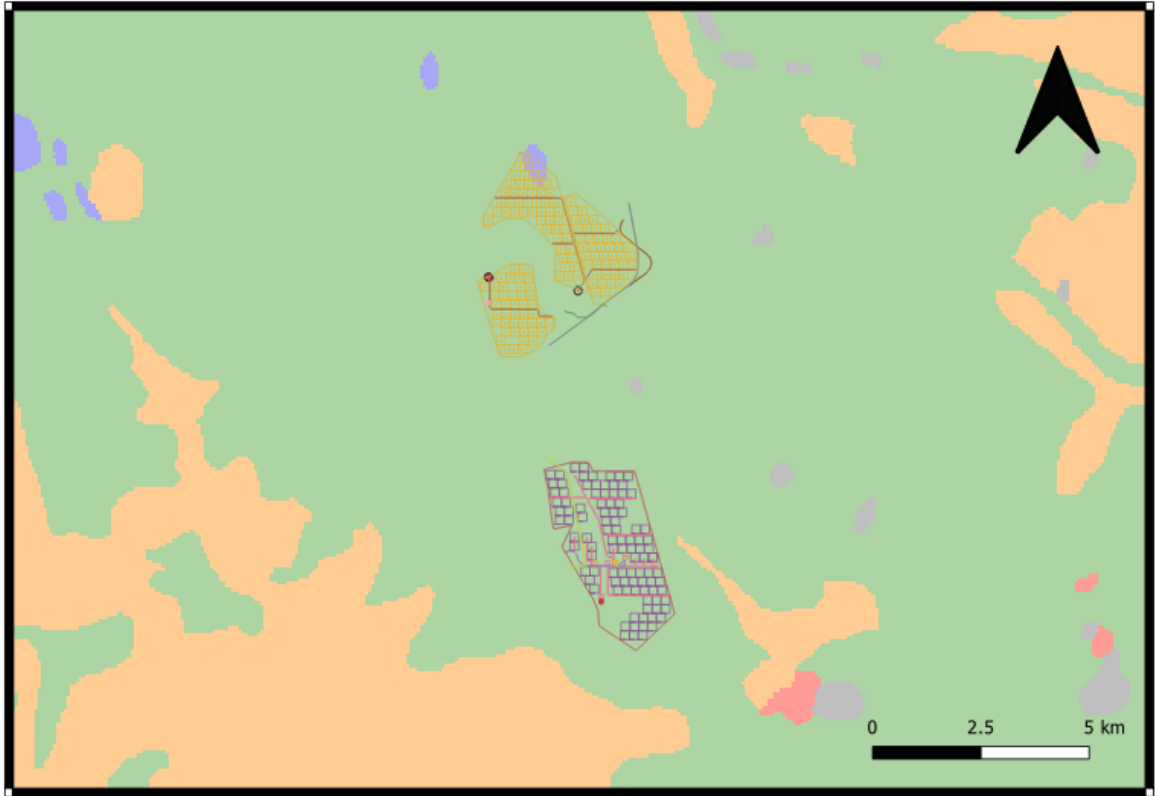


Figure 5: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences).
Approximate location of the proposed development is indicated in red.

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 5) there is a moderate chance of finding fossils in the green area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The Project is situated in the north-western part of the Free State Province and falls within the Matjhabeng Local Municipality and Lejweleputswa District Municipality. Phase 1 is located south of Odendaalsrus and is situated on Portion 2 of the Farm Kalkkuil 153. Phase 2 is situated north of Odendaalsrus and located on Portion 0 of the Farm Dolly 404, Portion 0 of the Farm Ophir 405, Remaining Extent of the Farm Paleis-Heuvel 323, Portion 3 of the Farm Paleis-Heuvel 323, in the Free State.

The sites are accessible from the south and north via the R30 arterial road (crossing both sites) and from the east and west via the R34 arterial road.

Phase 1 and Phase 2 Sites are situated on municipal ground previously used for mining. Matjhabeng Local Municipality has entered into a Long-Term Land Lease Agreement with the Applicant. There is an existing mining right by Harmony Gold Mining Company Ltd on the study area but, a consent letter was received from the mining company. There is similarly a Tripartite and Rehabilitation Agreement between the Applicant, Harmony Gold and Matjhabeng Local Municipality which is related to the rehabilitation commitments.

7 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This include all trace fossils and fossils. All available information is consulted to compile a desktop study and includes: 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 accurately 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 2724 Kroonstad Geological Map (Council of Geoscience);
- A Google Earth map with polygons of the proposed development was obtained from Nemaï Consulting.

9 IMPACT ASSESSMENT METHODOLOGY

9.1 Impact Rating System

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

- Construction
- Operation
- Decommissioning

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

Table 3: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.

PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

Table 1 Continues

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

Table 1 Continues

REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.

2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

Table 1 Continues

SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:</p> <p>(Extent (1) + probability (2) + reversibility(4) + irreplaceability (4) + duration (4) + cumulative effect (2)) x magnitude/intensity (2).</p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

9.2 Summary of Impact Tables

Phase 1 and Phase 2 PV Sites are primarily underlain by Caenozoic Superficial Sediments as well as a very small portion of the Bothaville Formation (Ventersdorp Supergroup, Ecca Group, Karoo Supergroup) in the north of Phase 2 Site. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments and Bothaville Formation is moderate (Almond and Pether 2008, SAHRIS website).

Loss of fossil heritage will be a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. 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 could potentially occur but are regarded as having a medium probability. The significance of the impact occurring will be medium.

10 FINDINGS AND RECOMMENDATIONS

Phase 1 and Phase 2 PV Sites are primarily underlain by Caenozoic Superficial Sediments as well as a very small portion of the Bothaville Formation (Ventersdorp Supergroup, Ecca Group, Karoo Supergroup) in the north of Phase 2 Site. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments and Bothaville Formation is moderate (Almond and Pether 2008, SAHRIS website). For this reason, it is considered that the proposed mining development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. 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 the Environmental Control Officer (ECO) in charge of these developments must be informed immediately. These discoveries ought to be protected (if possible, *in situ*) and the ECO 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.

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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

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

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Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and decommissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

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- E. Butler. 2019.** Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province
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- E. Butler. 2019.** Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.
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- E. Butler. 2019.** Palaeontological Impact Assessment for the proposed Sace Lifex Project, Near Emalahleni, Mpumalanga Province
- E. Butler. 2019.** Palaeontological Desktop Assessment for the proposed Rehau Fort Jackson Warehouse Extension, East London
- E. Butler. 2019.** Palaeontological Desktop Assessment for the proposed Environmental Authorisation Amendment for moving 3 Km Of the Merensky-Kameni 132KV Powerline
- E. Butler. 2019.** Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape
- E. Butler. 2019.** Palaeontological Desktop Assessment for six proposed Black Mountain Mining Prospecting Right Applications, without Bulk Sampling, in the Northern Cape.

E. Butler. 2019. Palaeontological field Assessment of the Filling Station (Rietvlei Extension 6) on the Remaining Portion of Portion 1 of the Farm Witkoppies 393JR east of the Rietvleidam Nature Reserve, City of Tshwane, Gauteng

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- E. Butler.** 2019. Palaeontological Phase 1 Field Assessment of the proposed Summerpride Residential Development and Associated Infrastructure on Erf 107, Buffalo City Municipality, East London.
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- E. Butler.** 2019. Palaeontological Field Assessment for the Proposed Nigel Gas Transmission Pipeline Project in the Nigel Area of the Ekurhuleni Metropolitan Municipality, Gauteng Province
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Attended the Society of Vertebrate Palaeontology 73th Conference in Los Angeles, America. October 2012.

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Butler, E., and J. Botha-Brink. Cranial skeleton of *Galesaurus planiceps*, implications for biology and lifestyle. University of the Free State Seminar Day, Bloemfontein. South Africa. November 2007.

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INTERNATIONAL VISITS

Natural History Museum, London

July 2008

Paleontological Institute, Russian Academy of Science, Moscow

November 2014