PALAEONTOLOGICAL DESKTOP ASSESSMENT

ESTABLISHMENT OF BLACK ROCK SOLAR PV FACILITY, HOTAZEL, NORTHEN CAPE PROVINCE

December 2022

COMPILED FOR ESCIENCE ASSOCIATES (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: Elize Butler
Tel: +27 844478759
Email: info@banzai-group.com

SIGNATURE: 

This Palaeontological Desktop Assessment as part of 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 in accordance 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 3 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 5 – 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 7 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 8 – 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 12	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Desktop Study	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 10 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 13	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
(g) An identification of any areas to be avoided, including buffers	Section 6	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 8 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 10.1 – 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 13	
(k) Any mitigation measures for inclusion in the EMPr	Section 14	
(l) Any conditions for inclusion in the environmental authorisation		None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 14	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 13	
(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 13	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
(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 6 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by EScience to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed Black Rock Solar PV Facility. 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 PDA is necessary to confirm if fossil material could potentially be present in the planned development area, and to evaluate the potential impact of the proposed development on the Palaeontological Heritage.

The proposed new solar PV Facility, near Hotazel, Northern Cape is underlain by the Cenozoic Kalahari Group, Tertiary surface limestones with underlying Griqualand West Basin rocks of the Transvaal Supergroup. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Kalahari Group is moderate while that of surface limestones is High (Almond and Pether, 2009; Almond *et al*., 2013). Alternatives have been considered for the project. As the geology of these alternatives are the same there is no preferred alternative from a Palaeontological point of view.

It is therefore considered that the Black Rock Solar PV Facility will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the new mine may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to 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) so that mitigation (recording and collection) can be carried out.

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. These recommendations should be incorporated into the Environmental Management Plan for the proposed development.

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Appendix A:

Curriculum Vitae

1 INTRODUCTION[1]

Assmang (Pty) Ltd mines manganese ore in the Black Rock area of the Kalahari, in the Northern Cape Province. The ore is mined from the Kalahari Manganese field. The Black Rock Mine Operations (BRMO) are approximately 60 km north-west of the town of Kuruman, in close proximity to the town of Hotazel (Figure 1-3).

EScience Associates (Pty) Ltd has been appointed to assist BRMO with environmental permitting requirements for a proposed Solar PV Facility, hereafter referred to as the Black Rock Solar PV Facility, and associated infrastructure.

The proposed facility will provide power to BRMO's operations, and will have a maximum generating capacity of 100MW. The project will be built in phases with the first phase being 44MW, which will include:

- A solar PV plant.
- 2 substations and electrical distribution infrastructure.
- Battery storage facilities.

Future phases will be scheduled as applicable after completion and commissioning of the first phase.

The proposed solar facility is to be located on the Remaining Extent of Farm Klipling 271 and will have a development footprint of approximately 450ha in extent, with additional infrastructure for distributing the electricity to the BRMO's operations. This infrastructure will tie in to BRMO's existing infrastructure.

BRMO is the owner of all the properties on which the proposed project will occur. Although overhead distribution will span the Gamagara River, there will be no physical construction or activities within the flood plain of the river or a 32m buffer measured from the edge of the river.

The climate, relief, the size of the affected property, and the availability of land for the development, are favourable for the establishment of a solar facility.

The proposed development includes activities listed in terms of the National Environmental Management Act (Act 107 of 1998), and thus BRMO has applied for an Environmental Authorisation in terms of the National Environmental Management Act. A scoping and environmental impact assessment (EIA) process must be undertaken, in accordance with the environmental impact assessment regulations GN. R 982 of 2014 as amended, to authorise the proposed activities.

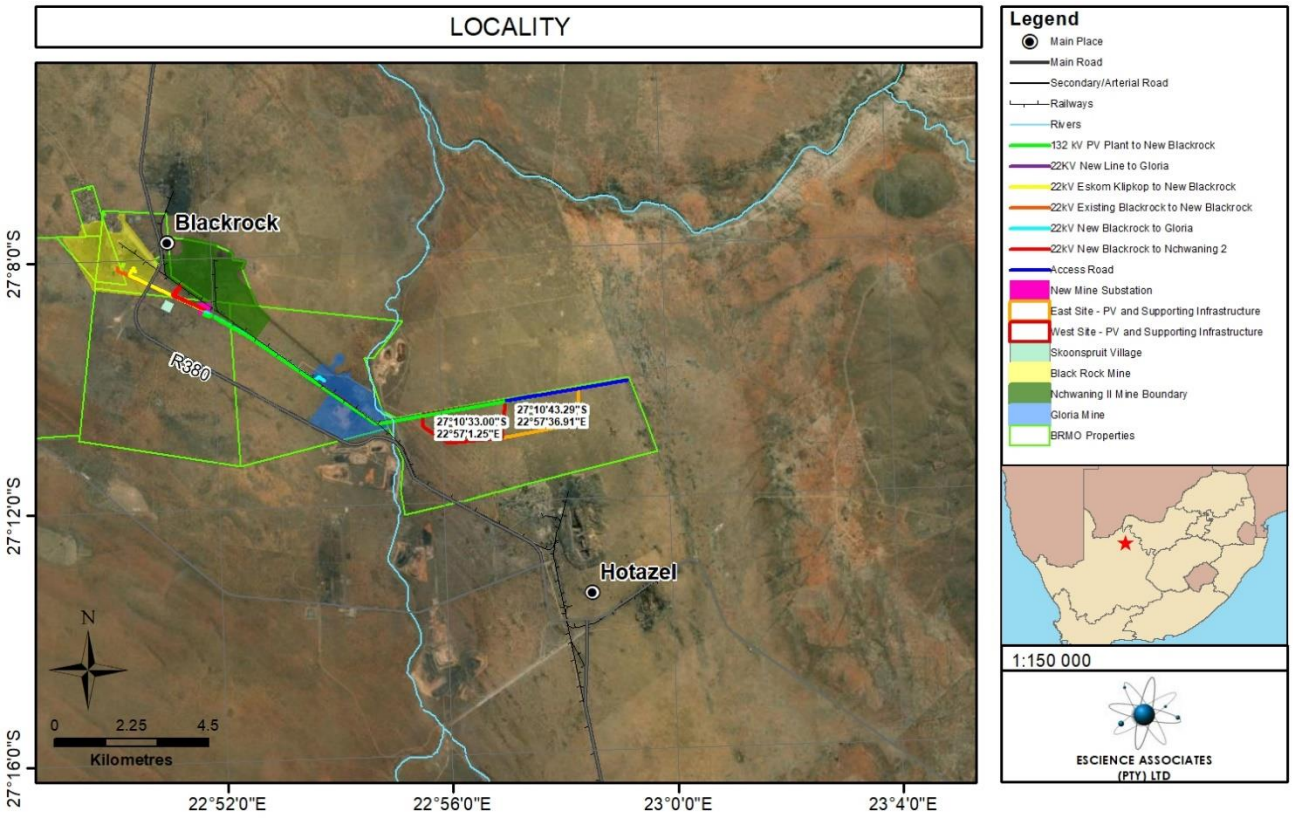

***Figure 1**: Location of Black Rock Solar PV Facility.*

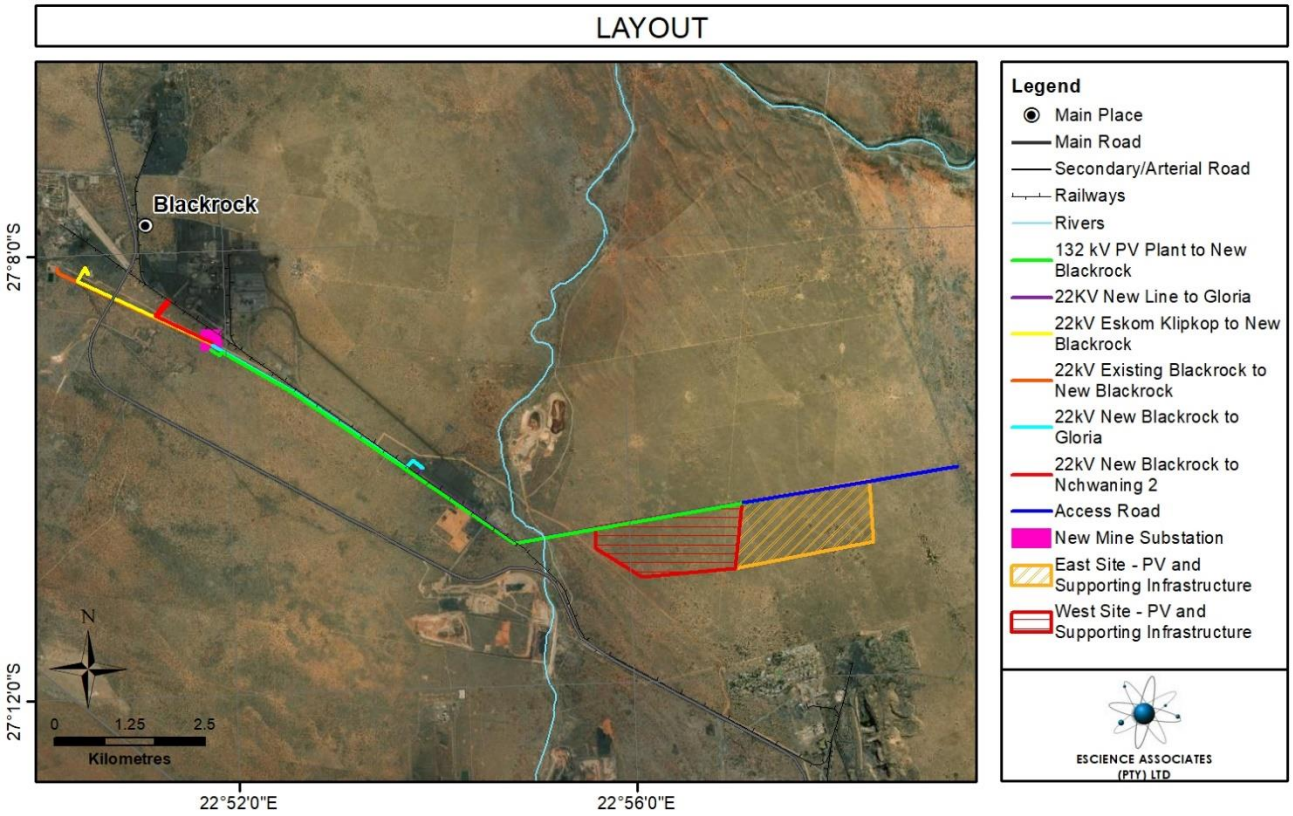

***Figure 2**: Layout of Black Rock Solar PV Facility.*

1.1 ADMINISTRATIVE INFORMATION

Table 2:Name and Address of Solar Facility	
Owner and Name of Mine	Assmang (Pty) Limited, Black Rock Mine Operations
Company Registration	1935/007343/06
Physical Address	Black Rock Mine Operations, Santoy, Northern Cape
Postal Address	PO Box 187, Santoy, Northern Cape, 8491
Telephone	053 751 5260
Fax	053 751 5555
Senior General Manager	Wilhemina Ngcobo

Table 3: Details of EAP	
Name of Company	EScience Associates (Pty) Ltd.
EAP	Lehlogonolo Prudence Chuene EAPASA Registered EAP
Contact Person	Abdul Ebrahim
Postal Address	PO Box 2950, Saxonwold, Johannesburg, 2132,
Physical Address	9 Victoria Street, Oaklands, Johannesburg, 2192
Telephone	011 718 6380
Fax	072 268 1119
Email	abdul@escience.co.za

Table 4: Project Applicable Servitudes Relevant to this application		
Mine	**Servitude Type**	**Servitude No.**
Gloria	Rail	K38/83S
Gloria	Water pipeline (Sedibeng Water Vaal-Gamagara Supply)	K36/1978S

1.2 DESCRIPTION OF CURRENT LAND USE AND ACTIVITIES

The affected properties where the Black Rock solar PV facility and associated distribution infrastructure will be established are owned by the applicant (Assmang (Pty) Ltd). The region surrounding the proposed development is dominated by mining, and agricultural (generally livestock production) land uses (Figure 3).

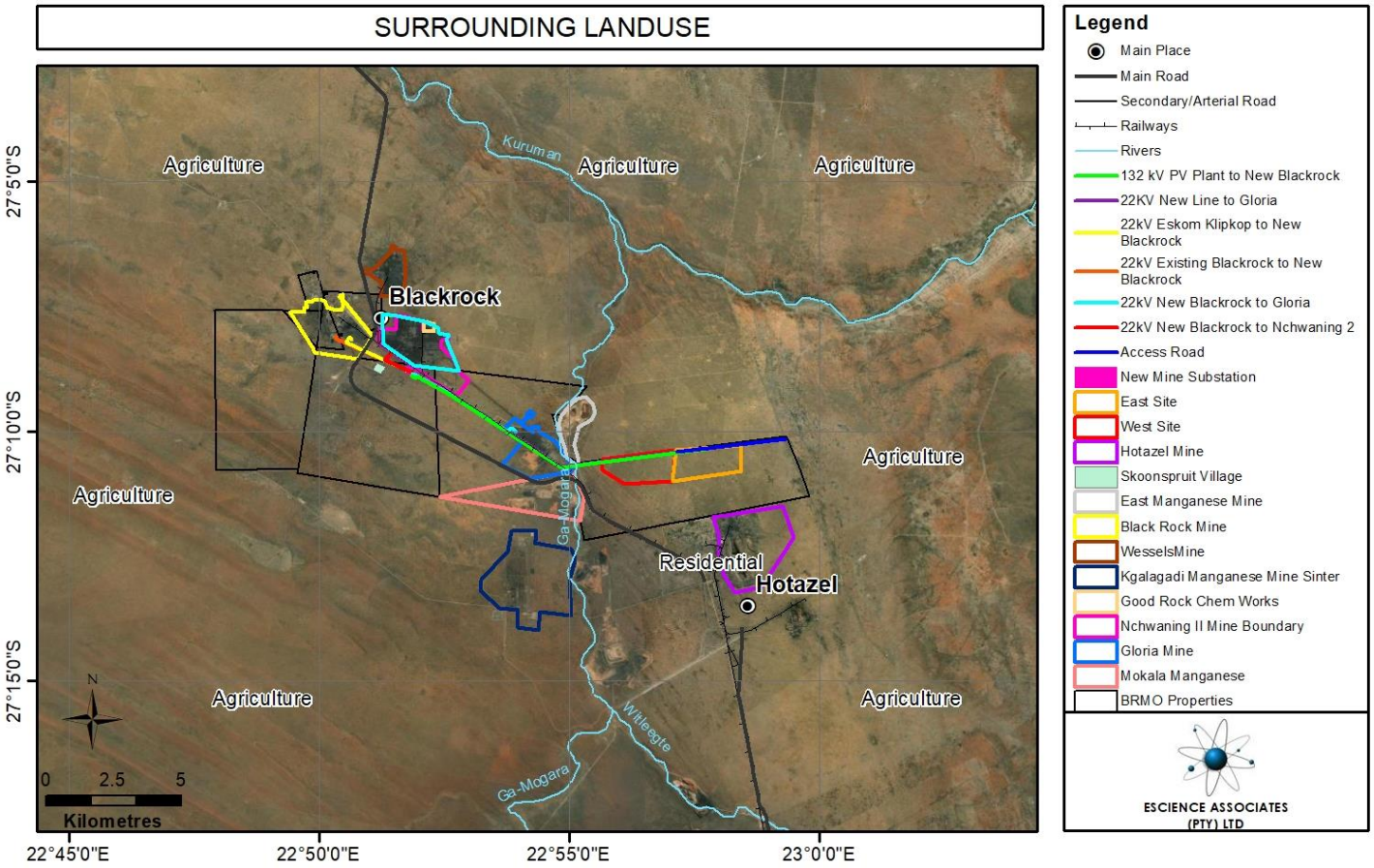

***Figure 3**: Surrounding land-use.*

2 DESCRIPTION OF CURRENT AND PROPOSED ACTIVITIES

The general descriptions herein are intended to convey a broad understanding of the activities associated with the proposed Block Rock Solar Facility development.

2.1 Scope of the proposed activities

BRMO proposes to construct and operate a solar power generation facility to supply its operations, with the primary aims of:

- Offsetting electricity grid supply risks and escalating costs.
- Reducing BRMO's carbon footprint with a long-term view to net carbon neutrality.

The project will be built in phases with the first phase being 44MW, which will include:

- A solar PV plant.
- 2 substations and electrical distribution infrastructure.
- Battery storage facilities.

Future phases will be scheduled as applicable after completion and commissioning of the first phase. The total generation capacity applied for is 100MW.

The proposed solar facility is to be located on the Remaining Extent of Farm Klipling 271 and will have a development footprint of approximately 450ha in extent, with additional infrastructure for distributing the electricity to the BRMO's operations. This infrastructure will tie in to BRMO's existing electrical distribution infrastructure.

The project will include the following:

- Surveying and assessment of the proposed footprint;
- Vegetation clearance and establishment of access roads;
- Site establishment and laydown areas;
- Erection of fencing and access control;
- Stripping of topsoil to be stockpiled where necessary;
- Transporting of materials to site;
- Excavations and erection of the proposed infrastructure;

- Establishment and connection of overhead distribution lines substations;
- Establishment of Battery Energy Storage System (BESS)

The general proposed layout is illustrated in Error! Reference source not found. Error! Reference source not found..

2.1.1 Construction Phase

The construction phase will broadly consist of:

- Erection of fences and access control;
- Clearing of vegetation and establishment of roads, contractor laydown areas and project service facilities;
- Stripping and stockpiling of topsoil where required;
- Excavations of foundations for support where required;
- Erection of solar PV generation and distribution facilities (including panels and collector substations);
- Erection of overhead lines;
- Establishment of a new substation to tie in overhead lines and existing distribution infrastructure;
- Establishment of a battery storage facility;
- Removal of construction facilities and rehabilitation of disturbed areas, where applicable, at the end of construction phase.

2.1.2 . Operational Phase

The operational phase will consist of:

- Operation of the facilities;
- Security and access control;
- Periodic maintenance and inspection of the panels;
- Cleaning of panels;
- Administrative functions.

2.1.3 Closure and Decommissioning Phase

The current life of mine is expected to exceed 25 years. The PV installations are anticipated to have an operational life of at least 25 years before panels may need to be replaced.

Replacement of the PV panels, after 25 years or more of operational life, will entail:

- Removal of the panels and replacement.
- Transporting of the panels to a recycling facility where the recyclable components can be recycled, and disposal of those components which are not recyclable.

Decommissioning of the facilities at end of life of the mine will entail:

- Removal of the panels and replacement.
- Transporting of the panels to a recycling facility where the recyclable components can be recycled, and disposal of those components which are not recyclable.
- Disassembly of supporting infrastructure and recycling of the recyclable components (e.g. steel and electrical cabling);
- Following the removal of all onsite components, the site will need to be rehabilitated.
- Removal of foundations and disposal or recuse of rubble;
- Ripping and scarifying of roads, and other compacted footprints;
- Depositing of subsoil and topsoil, on the exposed surfaces; and
- Rehabilitation and aftercare.

2.2 Alternatives considered

The EIA regulations require that alternatives be considered. The regulations define "alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity;

and includes the option of not implementing the activity;

A summary of alternatives considered is set out in the ensuing sub-sections.

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2.2.1 Location alternatives

Two sites have been identified within the affected property for placement of the renewable energy facility. These preferred locations for the solar PV facility have been selected due to site specific characteristics such as the solar resource, land availability, topographical considerations, and environmental features, as well as the environmental sensitivity identified by the DFFE Screening Tool. The project site is ~1900ha in extent which is considered to be sufficient for the development of a Solar PV facility with a contracted capacity of up to 100MW. Both sites are considered suitable.

2.2.2 Type of activities to be undertaken

Given the status of South African electricity at the moment and the need to promote renewable energy and sustainability, BRMO only considers constructing a facility for renewable energy. Due to the affected property's location, the need for electricity for the mines, and the availability of the solar and wind resource, the Applicant is looking into developing solar and wind energy facilities there. The EIA processes will be separate and take place at different stages for the two proposed developments.

2.2.3 Design layout

The projected area needed for the development footprint and facility layout is 450ha (for the 100MW PV facility and all associated infrastructures). The development area is bigger than the area required for the footprint of a 100MW PV facility, which allows for the infrastructure to be placed in the best possible location while avoiding any significant environmental sensitivities or limits discovered during the scoping and EIA processes.

3 TECHNOLOGY TO BE USED IN THE ACTIVITY

3.1 Wind Power

A wind energy facility is a potential renewable energy facility that may be considered in the future in the area. However, the flat landscape which receives extensive solar irradiation is more conducive to solar energy at the current time as opposed to wind energy which would have a large visual impact.

3.2 Solar Energy

Solar energy is regarded as the preferred option for the development of a renewable energy facility within the preferred project site because it is a readily accessible natural energy resource (solar irradiation) and because there are currently significant restrictions placed on other natural resources, such as water.

A concentrated solar power (CSP) plant is a solar energy technology that uses solar irradiation to convert solar energy into heat though mirror configurations. It can store large volumes of energy through Thermal Energy Storage technologies (TES) which allow the use of the energy even on days when solar irradiation is low. In terms of energy storage and efficiency, it outperforms solar PV systems. However, it needs large amounts of land for the TES and also a regular supply of water for the cooling systems, which makes it not ideal for the current project.

Solar PV, on the other hand, is the preferred alternative as solar energy is readily available at the site, there is a lower construction cost as well as operation and management costs, and has a lower environmental impact.

3.3 Mounting alternatives

The solar panels could be mounted on fixed tilt mounting or single axis tracking systems. With fixed tilt systems, the PV panels are installed at a set angle and cannot move, while with single axis tracking, the panels follow the sun's movement. The tracking systems are the best option in regard to energy generation, but are expensive and require substantial structures.

3.4 Management alternatives

For the construction phase, there are alternatives to construction with the go-to management method being construction activities occurring during daylight hours. However, an alternative to this is construction activities occurring for only 3-4 hours daily, either in the morning or evening.

3.5 No-Go Alternative

The 'Do-Nothing' alternative is the option of not constructing Black Rock Solar PV Facility. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with a solar PV facility. It is therefore necessary to consider the no-go alternative on the basis of the findings of the environmental impact assessment when it has been completed.

3.6 Need and Desirability

This project is in support of conventions, protocols, and agreements that have been signed and recognized internationally. The Sustainable Development Goals (SDGs) of the United Nations Development Programme (UNDP) are one of the international agreements and programs that South Africa has signed. The United Nations has established 17 global goals as part of the SDGs. The construction of the Black Rock Solar PV Facility would generate up to 100MW (generated capacity) of affordable and sustainable energy, which would help achieve Goal 7 of the SDGs. Since there are no emissions produced during the operation of PV technology, it is one of the cleanest methods of generating electricity.

Existing deficiencies in the South Africa's electricity grid supply resulting in power outages frequently cause operations to be halted. The proposed solar plant is a way for the BRMO to maintain mining operations without

interruption while utilizing more environmentally responsible source of electrical power than the grid supply which is largely derived from fossil fuel combustion.

The Black Rock Solar PV Facility has the potential to create some limited short- and medium-term (6 months to 18 months) employment during the project's development phase for residents of the local community (where available skills allow), the larger region, as well as nationally.

[1]Information provided by EScience

4 POLICY AND LEGISLATIVE CONTEXT

This section summarises relevant environmental legislation applicable to the proposed development in respect of anticipated environmental permitting requirements. This is not a complete review of the applicable environmental legislation but rather a synopsis of those which are crucial to the Environmental Authorisation process and the assessments required thereto.

4.1 Constitution of South Africa

Section 24 of the Constitution provides the following rights:

"Everyone has the right -

a. *to an environment that is not harmful to their health or well-being; and*
b. *to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -*
    i. *prevent pollution and ecological degradation;*
    ii. *promote conservation; and*

secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Accordingly, legislative measures as summarised in ensuing sections have been promulgated.

4.2 National Environmental Management Act (Act 107 of 1998)

The National Environmental Management Act (NEMA), 1998 (Act 107 of 1998, as amended) is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in section 24 of the Constitution. Section 2 of NEMA contains environmental principles that form the legislated foundation for sustainable environmental management in South Africa.

4.3 EIA & Environmental Authorisation

NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the competent authority, in this case the Department of Mineral Resources and Energy (DMRE). Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called EIA regulations (currently GN. R 982:2014 amended by GN. R 326:2017).

The Regulations identify specific activities that are either subject to a Basic Assessment process, or Scoping and EIA process (GN R. 983, GN R. 984 and GN R. 985; 4 December 2014, as amended by GN R.324, GN. R325, GN R.326 and GN R.327 of 2017 respectively). The listed activities relevant to the proposed development are presented in Error! Reference source not found.. This is a preliminary list and may be amended as more detailed information becomes available; however, the list must be finalised prior to submission of the application for environmental authorisation. A conservative approach has been taken in identifying the relevant listed activities, and some of these may be confirmed too not be relevant.

***Table 5**:NEMA Listed Activities*
GN.R 327 – Listing Notice 1, as amended
Activity No. 11(i): The development of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV or more. **REASON:** A 132kV overhead line is also proposed to connect the Black Rock solar PV facility from the onsite collector substation to the proposed new Mine Substation.
Activity No. 14: The development and related operation of facilities and infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. **REASON:** The development of the Black Rock solar PV facility may require the construction and operation of facilities and infrastructures for the storage and handling of dangerous chemicals (combustible and flammable liquids, such as oils, lubricants, etc).
Activity No. 24(ii): The development of a road – (ii) with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m.

***Table 5**:NEMA Listed Activities*
REASON: The facility will require construction of new access and maintenance roads in areas where no road reserve exists to provide access to the facility. These may exceed 8m in width.
Activity No. 56(ii): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres. **REASON:** Upgrades of existing roads may be required.
GN.R 325 – Listing Notice 2, as amended
Activity No. 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs: (a) within an urban area; or (b) on existing infrastructure. *REASON: The Black Rock Solar PV Facility is situated outside urban area and will use solar power technology and have a maximum generating capacity of 100MW.*
Activity No. 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan. *REASON: The proposed activity is expected to require the clearance of land exceeding 20ha of indigenous vegetation.*

A Scoping and EIA Process is therefore required.

5 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This present 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. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

6 LEGISLATION

6.1 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 m^2 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.

7 OBJECTIVE

The aim of a Palaeontological Impact Assessment (PIA) is to decrease the effect of the development on potential fossils at the development site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the purpose of the PIA is: 1) to identify the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the

formations; 3) to clarify the impact on fossil heritage; and 4) to suggest how the developer might protect and lessen possible damage to fossil heritage.

The palaeontological status of each rock section is calculated as well as the possible impact of the development on fossil heritage by a) the palaeontological importance of the rocks, b) the type of development and c) the quantity of bedrock removed.

When the development footprint has a moderate to high palaeontological sensitivity a field-based assessment is necessary. The desktop and the field survey of the exposed rock determine the impact significance of the planned development and recommendations for further studies or mitigation are made. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

Mitigation usually precedes construction or may occur during construction when potentially fossiliferous bedrock is exposed. Mitigation comprises the collection and recording of fossils. Preceding excavation of any fossils a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact is possible because our knowledge of local palaeontological heritage may be increased

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 of sensitive areas to be avoided (providing shapefiles/kml's) 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 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).

8 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed Black Rock Solar PV Facility in the Northern Cape Province is depicted on the 1: 250 000 Kuruman 2722 (1979) Geological Map (Council of Geosciences, Pretoria) (Figure 4; Table 6). The study area is underlain by Kalahari Formation (Qs, pale yellow), Tertiary surface limestone (Tl, dark yellow) with underlying Griqualand West Basin rocks of the Transvaal Supergroup (Figure 4-5; Table 6-7).

The Geology has recently been updated (Council of Geosciences, Pretoria) and this map indicates that the proposed development is underlain by the Kalahari Group (Figure 6). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Quaternary sediments is Moderate, while that of surface limestones are High (Figure 7; Table 8-9; Almond and Pether, 2009; Almond *et al*., 2013).

Studies has shown that the Kalahari Group sediments that overlies the Precambrian rocks are about 80 m thick (Haddon, 2005). In the southern Kalahari surface limestones (calcretes; (Ql) are pedogenic limestone deposits reflecting seasonally arid climates in the region over about the last five million years (Truter et al., 1938; Visser, 1958; Bosch, 1993). Surface limestone assemblages may be thin but could reach a thickness of over 20 m. These assemblages locally conglomeratic with clasts of exotic pebbles and reworked calcrete. These limestones may be secondarily silicified including blocks of the underlying Precambrian carbonate rocks. The Pliocene - Pleistocene calcretes in the Kalahari, generally includes calcretised conglomerates and sandy limestones, representing the Mokalanen Formation of the Kalahari Group. These sediments are possibly correlated to a globally arid time period (2.8 to 2.6 million years ago, known as late Pliocene (Partridge et al. 2006)

The earliest Kalahari beds are assigned to the Wessels Formation (basal gravels) and Budin Formation (calcareous clays) and is probably Late Cretaceous in age (Partridge *et al.* 2006). The top 15 m of the Kalahari sediments consist of clays, calcretised siltstones, and pebbly horizons with the occurrence of solution hollows along joint surfaces (10 m from the surface) (Table 7). Calcretised silcretes with *in situ* brecciation are present close to the surface. Thick pedogenic calcretes (Plio-Pleistocene Mokalanen Formation) are mapped along the Ga-Mogara drainage line and underlies the Kalahari sands in this region. These deposits indicate the seasonally

arid climates over the last five million years (Truter *et al.* 1938; Boardman and Visser 1958). Surface limestones may be up to 20 m thick and are locally conglomeratic with clasts of reworked calcrete and foreign pebbles.

Pleistocene Kalahari sands (Gordonia Formation) has been described to mantle thick calcretes and downwasted surface gravels (Almond 2013). Almond described a range of calcrete types namely gravelly, brecciated, silicified, honeycomb and karstified facies, the latter with an associated sand- or gravel-infilled solution hollows. Older terrace gravels are described from the banks of the Ga-Mogara drainage line. Unconsolidated, reddish-brown aeolian sands of the Quaternary Gordonia Formation are present. These sands are Late Pliocene / Early Pleistocene to Recent in age due to the Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291) found in them. Recent studies have dated the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma and placed the Gordonia Formation almost completely within the Pleistocene Epoch.

The fossil assemblages of this Group are generally low in diversity, but locally high and occur over a wide range. Quaternary deposits are especially important when in fluvial environments along water courses. Fossil assemblages include diatoms, gastropod shells, bivalves, ostracods and trace fossils. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil remains include mammalian bones and teeth as well as coprolites, freshwater molluscs and plant microfossils). Fossils in these areas occur over large areas in erosion gullies. Stone artefacts from the earlier part of the Middle Stone Age and the Later Stone Age have also been uncovered and are sometimes associate with bones (Churchill et al. 2000). The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter.

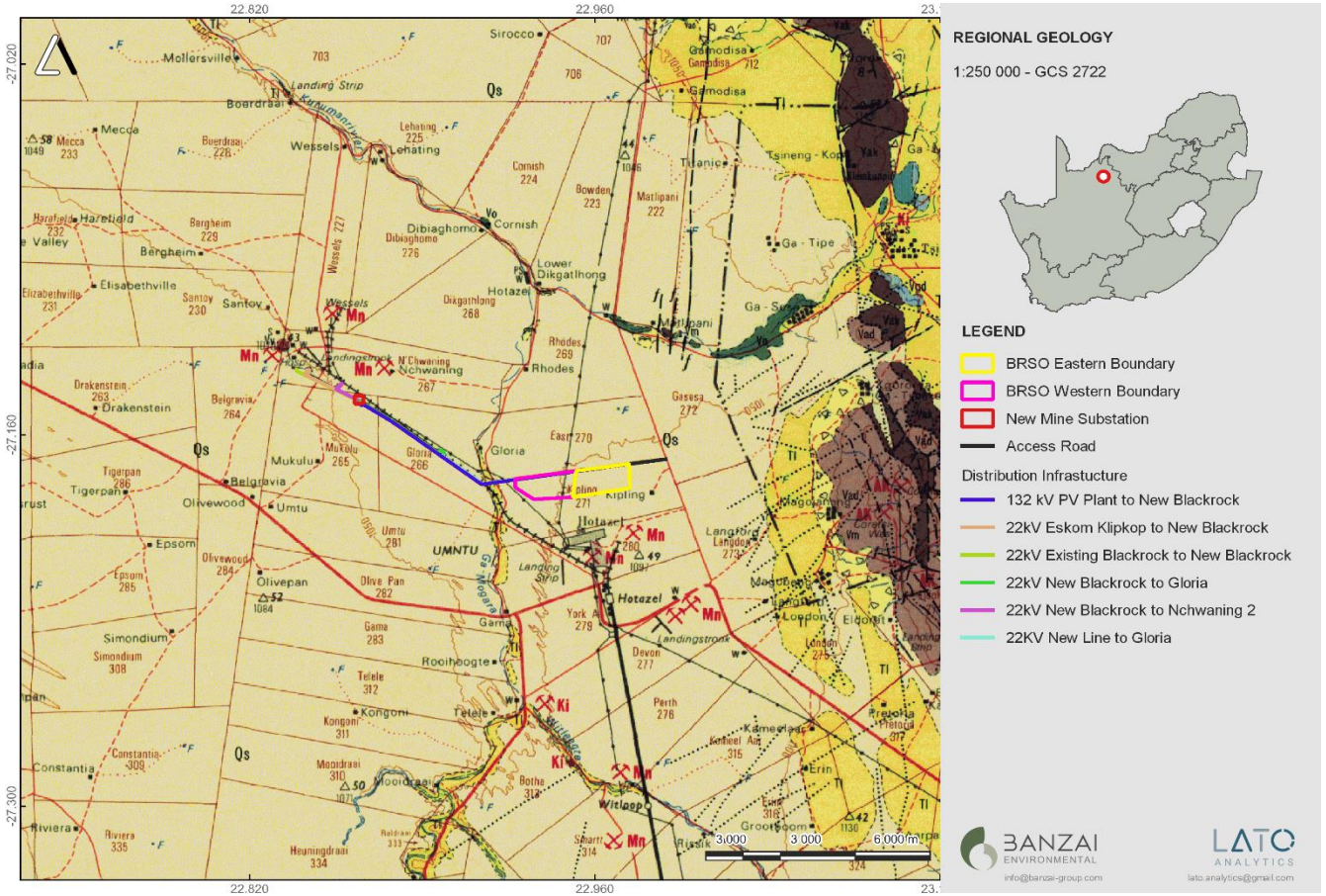

***Figure 4**: Extract of the 1: 250 000 Kuruman 2722 (1979) Geological Map (Council of Geosciences, Pretoria) indicating the geology of the proposed Black Rock Solar PV Facility in the Northern Cape Province.*

Table 6: Legend (modified) of the 1: 250 000 *Kuruman 2722 (1979) Geological Map (Council of Geosciences, Pretoria)*.

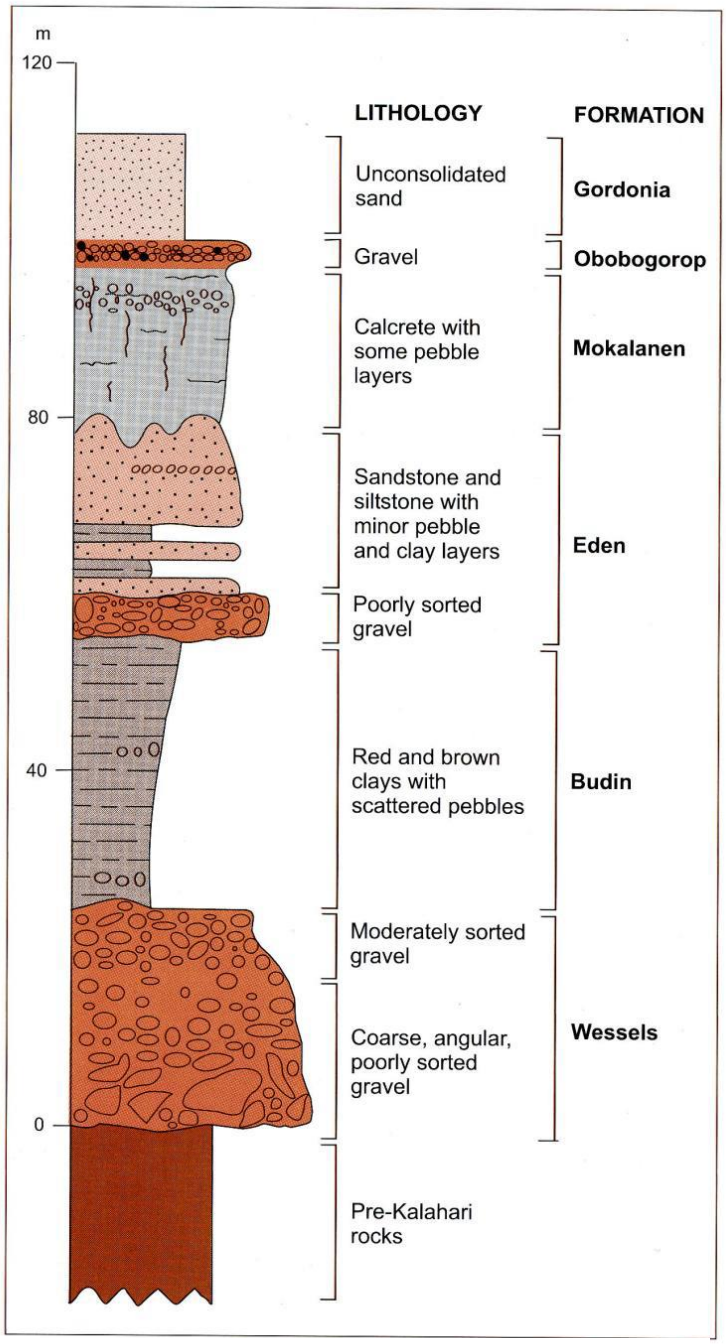

Figure 5: Stratigraphy of the Kalahari Group (Image taken from Partridge et al., 2006). Calcretes and aeolian sands of the Gordonia Formation possibly corresponds to the Mokalanen Formation.

Table 7: Generalised Stratigraphic Column study area				
Stratigraphy			Lithology	
Kalahari Formation (Qs and Q)			Clay, limestone and sand	
Tertiary Surface Limestone (Tl)				
Transvaal Supergroup	Postmansburg Group	Voëlwater Subgroup	Hotazel Formation	Iron Formation
				Upper Mn ore body
				Middle Mn ore body
				Iron Formation
				Lower Mn ore body
				Mn-rich iron formation
				Iron Formation
			Ongeluk Formation	Basaltic lava

Table 8: Extract of the Palaeotechnical Report (Almond and Pether 2009) indicating possible fossil Heritage of the study area.

Subgroup/ sequence	**Group**	**Formation**	**Fossil Heritage**	**Comment**
Tertiary-Quaternary	Kalahari	-	Terrestrial organisms	Trace fossils, ostracods, bivalves, gastropod shells, diatoms
Griqualand West Super Group	Campbell	Ghaapplato (Vgh)	Stromatolites	Cyanobacterial microfossils
-	Griquastad	Asbestos Hills	Stromatolites	Cyanobacterial microfossils

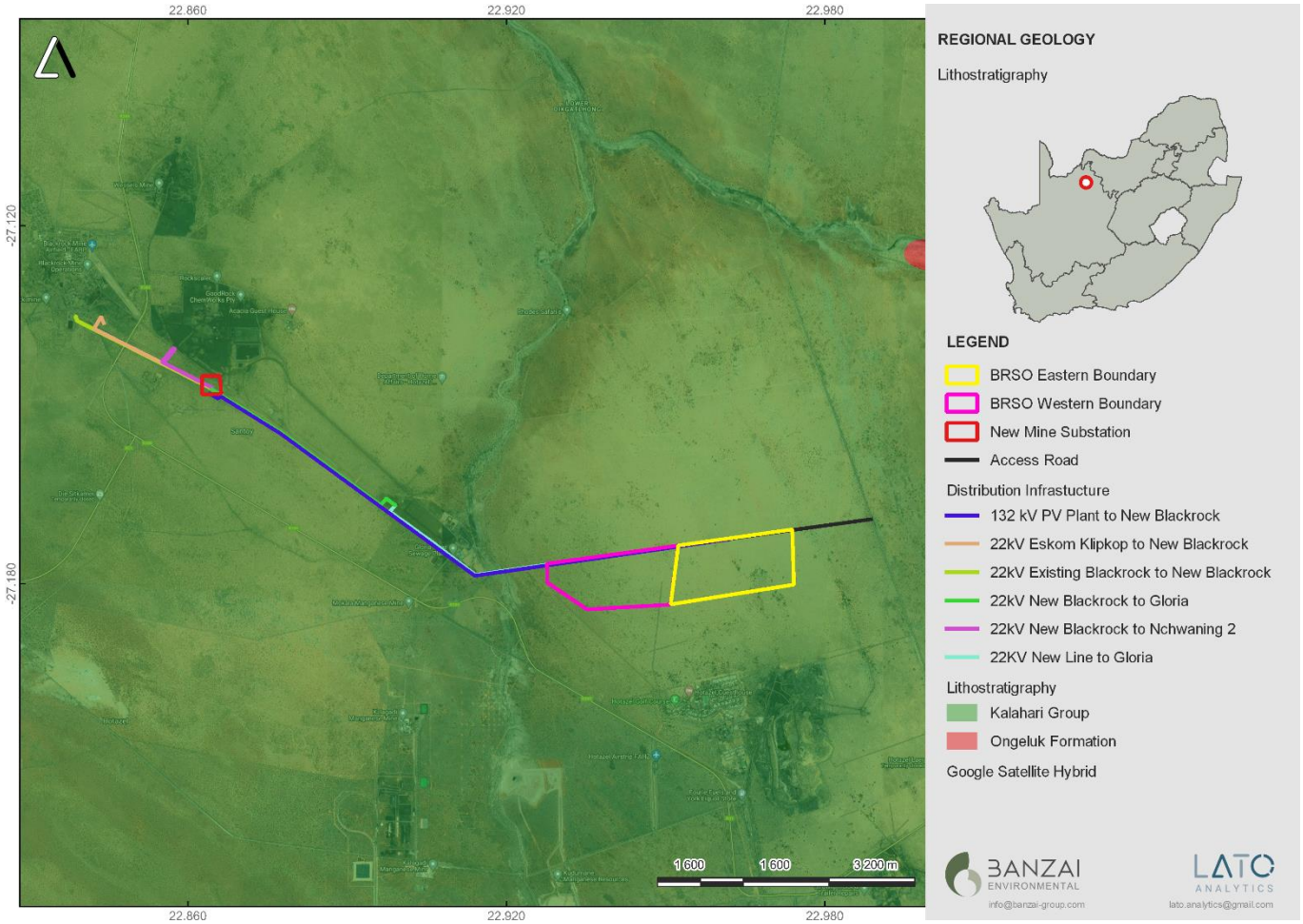

***Figure 6**: Updated Geology (Council for Geosciences, Pretoria).*

According to this map the development is underlain by the Kalahari Group.

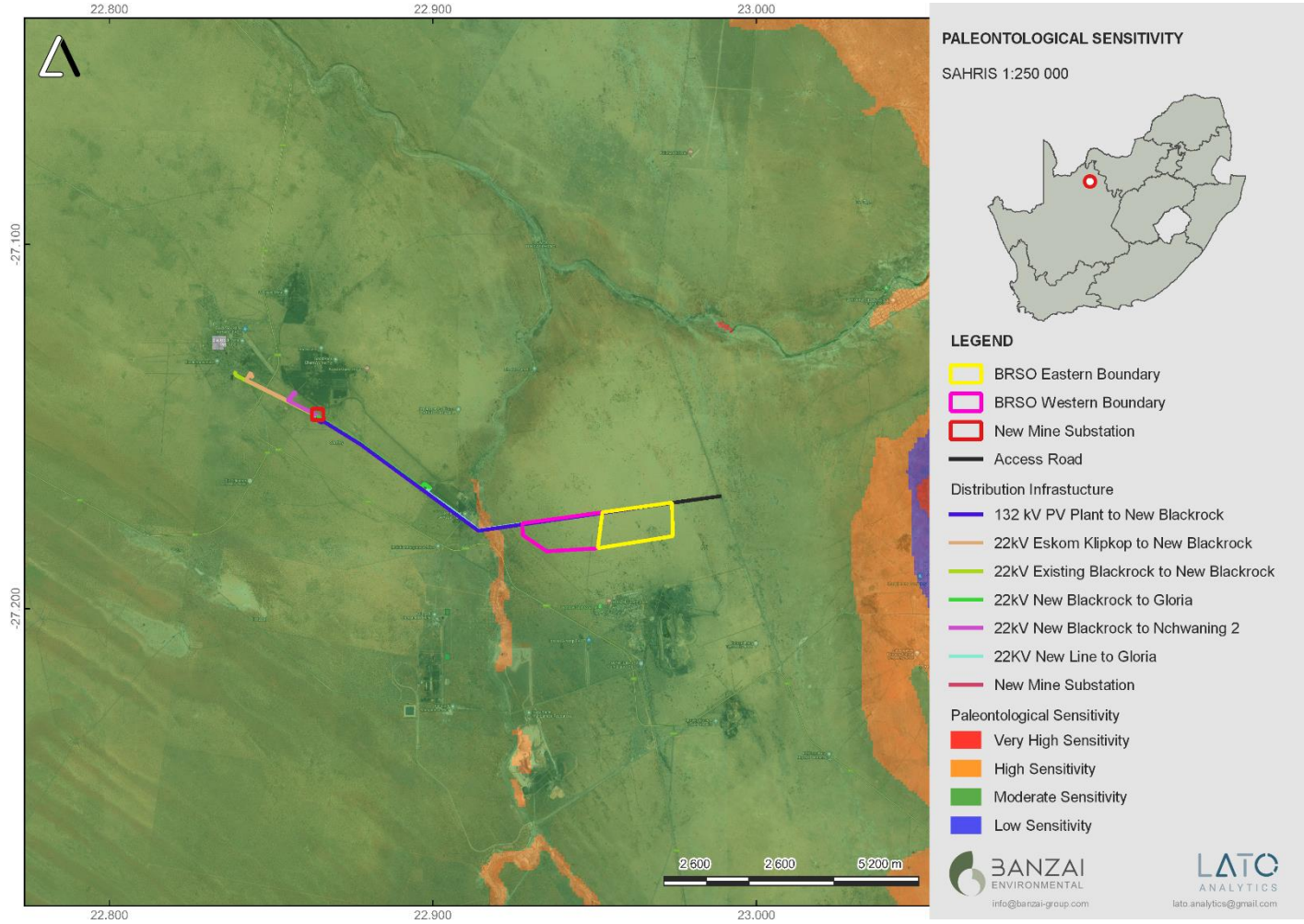

***Figure 7** : Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development.*

According to the SAHRIS Palaeosensitivity map (Figure 9) the proposed development is underlain by sediments with a Moderate (green) Palaeontological Sensitivity.

Table 9 : Palaeontological Sensitivity on SAHRIS		
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.

9 GEOGRAPHICAL LOCATION OF THE SITE

BRMO is located approximately 60 km north-west of the town of Kuruman and 1.5 kilometres north of the town of Hotazel (Error! Reference source not found.). The proposed site for the Black Rock Solar PV Facility will be located on the Remaining Extent of Farm Klipling 271. The site proposed boundary is approximately 1.5 km north west from the nearest Hotazel infrastructure, and approximately 2.5km from centre to centre from the Hotazel town. District Municipality, and the Joe Morolong Local Municipality[1].

[1]Information provided by EScience

10 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes 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. Scientific research articles of research conducted in the area is also sourced and included in the Impact Assessment.

10.1 Assumptions and Limitations

When conducting a PIA several factors can affect the accuracy of the assessment. 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 not been reviewed by palaeontologists and data is generally based on aerial photographs. 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 used to provide information on the existence of fossils in an area which was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally assumed that exposed fossil heritage is present within the footprint.

11 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 Kuruman, 2722 (Moen 1979).) Geological Map (Council of Geosciences, Pretoria)
- A Google Earth map with polygons of the proposed development was obtained from ESCIENCE Associates.
- Shape files produced by the Council of Geosciences (Pretoria).

12 IMPACT ASSESSMENT METHODOLOGY

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; and
- 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 10**:* The rating system

NATURE
The Nature of the Impact is the possible destruction of fossil heritage
GEOGRAPHICAL EXTENT

This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be

		mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.

2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:		

(**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity = X.** The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

12.1 Summary of Impact Tables

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 and are regarded as having a high probability. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be medium pre-mitigation and low post-mitigation.

Table 11: Summary of Impact Tables								
	Site	Probability	Duration	Magnitude	Reversibility	Irreplicable Loss	Cumulative Effect	Significance
Pre-mitigation	1	2	4	2	4	4	2	34
Post-mitigation	1	2	4	1	4	4	2	17

13 FINDINGS AND RECOMMENDATIONS

The proposed Black Rock Solar PV, near Hotazel, Northern Cape is completely underlain by the Cenozoic Kalahari Group, Tertiary surface limestones as well underlying Griqualand West Basin rocks of the Transvaal Supergroup. The PV structures will not penetrate into the latter. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Kalahari Group is moderate, while that of the surface limestones is high (Almond and Pether, 2009; Almond *et al*., 2013).

It is therefore considered that the PV development will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the solar facility be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to 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) so that mitigation (recording and collection) can be carried out.

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.

These recommendations should be incorporated into the Environmental Management Plan for the proposed development.

14 CHANCE FINDS PROTOCOL

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

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.

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 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.

14.1 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately stop working and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage 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 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 ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (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

CURRICULUM VITAE ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 29 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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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.

Butler, E. 2016. Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape Province. Savannah South Africa. Bloemfontein.

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Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of a railway siding on a Portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

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Butler, E. 2017. Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

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Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

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Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

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Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

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Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

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 de-commissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

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Butler, E. 2018. Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein

Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.

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