



PGS HERITAGE

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED DER BROCHEN AMENDMENT PROJECT, NEAR LYDENBURG, LIMPOPO

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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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ACKNOWLEDGMENT OF RECEIPT

Report Title	Palaeontological Desktop Assessment of the proposed Der Brochen Amendment project, near Lydenburg, Limpopo		
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Author	Elize Butler		Palaeontologist
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Client			

CLIENT:

SRK Consulting (SA) (Pty) Ltd.

CONTACT PERSON:

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

NEMA Regs (2014) - Appendix 6	Relevant section in report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii of Report – Contact details and company and Appendix A
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4 – Objective
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 – Geological and Palaeontological history
(B) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A Desktop Study
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modeling used;	Section 7 Approach and Methodology
f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 9
g) an identification of any areas to be avoided, including buffers;	Not identified, Section 9
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history

NEMA Regs (2014) - Appendix 6	Relevant section in report
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 9
k) any mitigation measures for inclusion in the EMPr;	N/A
l) any conditions for inclusion in the environmental authorization;	N/A
m) any monitoring requirements for inclusion in the EMPr or environmental authorization;	N/A
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorized; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable.
q) any other information requested by the competent authority.	Not applicable.
2) Where a government notice <i>gazetted</i> by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines

EXECUTIVE SUMMARY

SRK Consulting (South Africa) (Pty) Ltd (SRK) has been appointed by Anglo American Platinum (AAP) - Rustenburg Platinum Mines Limited (RPM) to undertake the integrated environmental authorisation process for its proposed Der Brochen Amendment Project. Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the **Palaeontological Desktop Assessment** (DIA) to assess the proposed Der Brochen Amendment Project. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to detect the presence of fossil material within the planned development footprint. This DIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed Der Brochen Amendment Project, near Lydenburg, Limpopo Province is completely underlain by the Dwars River and Dsjate Subsuite, Rustenburg layered Suite, Bushveld Complex. These mafic rocks of the Bushveld Complex is igneous in origin and thus unfossiliferous. The Palaeomap of SAHRIS also indicates that these rocks has a palaeontological significance of zero.

It is therefore considered that the construction and operation of the proposed Der Brochen Amendment Project near Lydenburg, Limpopo Province is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

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Appendix A: CV

TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artifacts, human and hominid remains, and artificial features and structures;
- rock art is any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures, and artifacts associated with a military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influences its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Fossil

Mineralized bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

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

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

Holocene

The most recent geological time period which commenced 10 000 years ago.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Abbreviations	Description
AAP	Anglo American Platinum
ASAP	Association of South African Professional Archaeologists
BRMO	Black Rock Mining operations
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DIA	Desktop Impact Assessment
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age

Abbreviations	Description
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
RPM	Rustenburg Platinum Mines Limited
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

SRK Consulting (South Africa) (Pty) Ltd (SRK) has been appointed by Anglo American Platinum (AAP) - Rustenburg Platinum Mines Limited (RPM) to undertake the integrated environmental authorisation process for its proposed Der Brochen Amendment Project in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) and National Water Act, 1998 (Act No. 36 of 1998) (NWA).

1.1 Background to the project

The Der Brochen Mine is a Platinum Group Metals Project owned by Rustenburg Platinum Mines Limited (RPM), a wholly owned subsidiary of Anglo American Platinum (AAP), and is located approximately 25 km south-west of the town of Steelpoort, and 40 km west of Mashishing (Lydenburg), in the Limpopo Province. The mine falls within the Greater Tubatse Local Municipality, under the jurisdiction of the Greater Sekhukhune District Municipality. ¹

The Der Brochen Mine's mining right falls on the following farms:

- Richmond 370 KT;
- St George 2 JT;
- Hermansdal 3 JT;
- Hebron 5 JT;
- Helena 6 JT; and
- Der Brochen 7 JT.

In addition to the above-mentioned farms, RPM also holds the surface right to Portion 7 of the farm Mareesburg 8 JT on which the Mareesburg tailings storage facility (TSF), associated return water dams (RWDs) and tailings-return water pipeline are located, which forms part of the Der Brochen Mine operation.

The following activities and infrastructure are associated with the Der Brochen Mine, as authorised through the Der Brochen Mine's approved Environmental Management Programmes (EMPrs) and Water Use Licences (WULs):

- **Existing facilities and activities:**
 - Mototolo Concentrator;

¹ Information provided by SRK Consulting (Pty) Ltd

- Helena TSF and two associated Return Water Dams (RWDs);
 - Raising of the Helena Tailings Storage Facility (TSF);
 - Mine offices (old farmhouse) and access roads;
 - In-stream surface water monitoring weirs (five) with four of the weirs up and downstream within the Groot- and Klein Dwars Rivers supporting monitoring of the two authorised wellfields;
 - Prospecting activities comprising of site preparation, drilling of prospecting boreholes, site rehabilitation and monitoring;
 - Trial mining area on the Richmond farm (activity is completed, and the soil stockpile and waste rock dump are well vegetated);
 - Abstraction of groundwater in support of mining from the Helena and Richmond licensed wellfields;
 - Abstraction from Der Brochen Dam based on an existing lawful industrial allocation; and
 - Monitoring of surface and groundwater.
- **Activities previously authorised, but which has not yet commenced:**
 - The Helena and Richmond wellfields (only two of the authorised boreholes per wellfield currently in use);
 - Helena and Richmond shafts and associated waste rock dumps;
 - Two Open Pits (Northern and Southern Pits) and associated waste rock/overburden dumps and pollution control dam;
 - Re-routing of a 132 kV powerline; and
 - A Co-Disposal Facility (tailings disposal with a rock embankment in the north pit).
- **Authorised activities under construction:**
 - Mareesburg TSF and associated Return Water Dams (RWDs); and
 - Mareesburg tailings-return water pipeline system to Mototolo Concentrator.

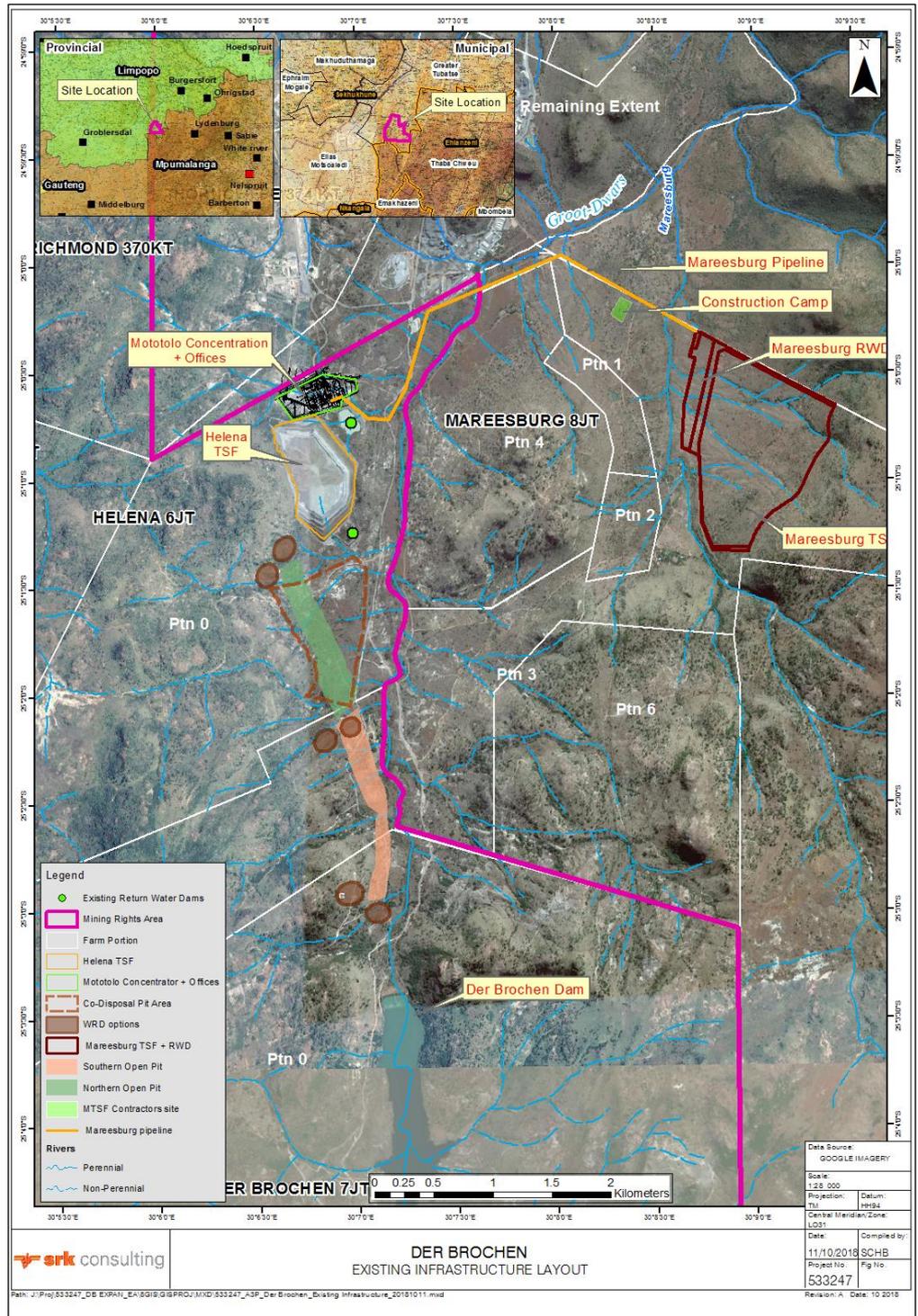


Figure 1 – Regional location of the Der Brochen Mine. Figure supplied by SRK Consulting.

1.1. Der Brochen Amendment Project – Project Description

It is the intention of RPM to amend the Der Brochen Mine's approved EMPr and associated Environmental Authorisation (EA) including updating their WUL to include the following:

- The construction of a buttress wall at the existing Helena TSF under emergency circumstances as well as the development of an additional filter press plant at the existing Mototolo Concentrator Plant;
- The Der Brochen Mine's updated topsoil management procedures;
- The development and operation of the following additional mining related infrastructure as part of the mine's development strategy:
 - Two new decline shafts to access new underground mining operation areas that will be mined through the implementation of the bord-and-pillar mining method. It is the intention of RPM to locate the North decline shaft within the previously approved footprint area associated with the North open pit, and the South decline shaft to be located in close proximity to the previously approved South pit area.
 - Three up-cast ventilation shafts that will be associated with each decline shaft – in total six up-cast ventilation shafts will be required;
 - A central ventilation area consisting of an up-cast ventilation system that will service both decline shafts;
 - A Dense Medium Separation (DMS) Plant to be located next to the existing Mototolo Concentrator Plant;
 - An additional Chrome Plant to be located near the Mototolo Concentrator Plant;
 - A Run of Mine (RoM) stockpile and silos;
 - A DMS Stockpile area and associated pollution control dam (PCD);
 - A change house and office complex to be located at the new North and South Shafts;
 - Reverse osmosis plant(s) (RO Plant(s)) – the mine is currently undertaking a feasibility study in respect of the proposed RO Plant technology. If viable the mine will develop either one central RO Plant at South Shaft or an RO Plant at each shaft;
 - Linear infrastructure:
 - Conveyor systems;
 - Access and haul roads;
 - Watercourse crossings and diversions associated with the linear infrastructure and DMS Stockpile; and
 - Staff accommodation facilities at the Der Brochen Dam.

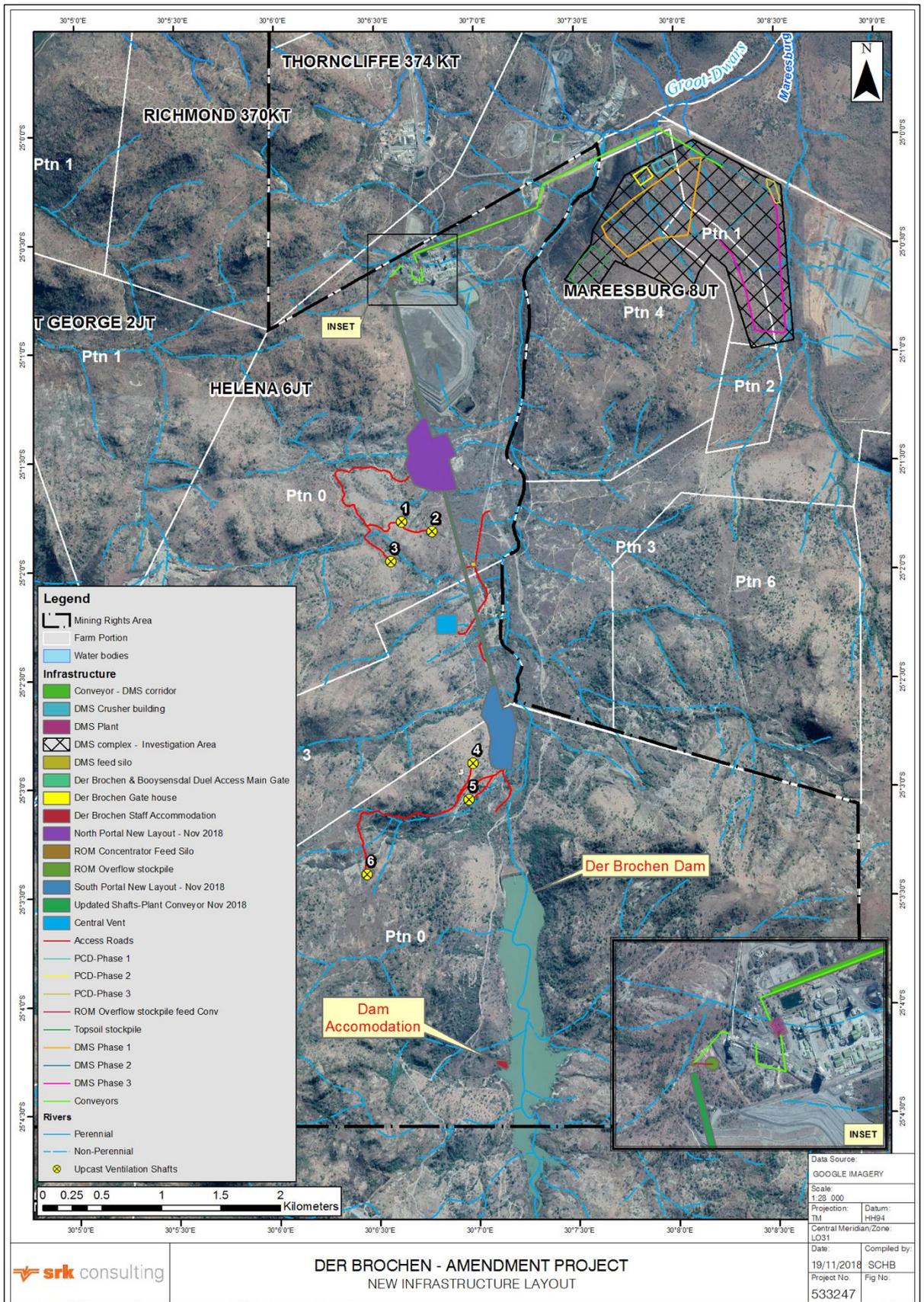


Figure 2 – Required infrastructure for the Der Brochen Mine Amendment Project. Figure supplied by SRK Consulting.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 12 years. She 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 DIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

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

Palaeontological Desktop Assessment of the proposed Der Brochen Amendment project, near Lydenburg, Limpopo

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- 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 Desktop Assessment is to determine the impact of the development on potential palaeontological material at the site.

“SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” stipulates that 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 assess 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.

When a palaeontological desktop study is compiled, 1:250 000 geological maps are utilized to establish the potentially fossiliferous rocks present within the development. 1:50 000 topography maps and Google Earth Images is used to identify the topography of the development. The PalaeoMap from SAHRIS, previous palaeontological impact studies in the same region and the databases of institutions identifying fossils found close to the development is used to detect the fossil heritage in the area. The palaeontological status of each rock section is calculated and the possible impact of the development on fossil heritage is firstly predicted by the palaeontological importance of the rocks secondly the quantity of bedrock removed and lastly by the type of development.

A field-based assessment by a palaeontologist is required when the development footprint has a **moderate to high sensitivity**. By using a combination of the desktop and the field survey the impact significance of the planned development is predicted and recommendations for additional studies or mitigation are made. Destructive impacts on palaeontological heritage generally only occur during the construction phase and the excavations will change the current topography and may destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

It is best when mitigation occur during construction when possible fossiliferous bedrock is exposed but in some cases mitigation may precede construction. Mitigation consists of the collection and recording of fossils on site. It is important to apply for a permit from SAHRA preceding the excavation of **any** fossil heritage, and arrangements must be made with a permitted institution to house the material. Knowledge of local palaeontological heritage may be increased when mitigation is applied correctly and a positive impact is possible.

5 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The proposed Der Brochen Mine Amendment Project is underlain by the Dwars River (Critical Zone) and Dsjate Subsuite (Main Zone) of the Rustenburg layered Suite, Bushveld Complex (Figure 3 -6).

The mafic rocks of the Bushveld Complex is the largest intrusion in the world and underlie an area of almost 65 000 km². The maximum thickness of these rocks is almost 8 km while individual layers can be followed for about 150 km. **This intrusion is world renowned for the ore reserves of platinum-group elements, chromium and vanadium.**

The Bushveld Complex is divided in 4 groups namely the Lebowa Granite Suite, Rashedoop Granophyre Suite, Rustenburg Layered Suite and Rooiberg Group (Figure 5). The latter Group of felsic and minor volcanic rocks may be provisional and possibly genetically closer related to the Bushveld event as to the Transvaal Supergroup (Hutton and Schweitzer, 1995).

The Rustenburg Layered Suite demonstrates a complete differentiation sequence of magma and is made up of various rock layers ranging from dunite, gabbro, norite, and pyroxenite, and anorthosite to magnetite and apatite- rich diorite.



Figure 3: The surface geology of the proposed Der Brochen Mine Amendment Project near Lydenburg, Limpopo Province. The proposed Project is underlain by the Dwars River and Dsjate Subsuite of the Rustenburg layered Suite, Bushveld Complex. Map drawn QGIS Desktop 2.18.14.

LEBOWA GRANITE SUITE	Nebo, Makhutso, Klipkloof, Bobbejaankop and Verena Granites
RASHOOP GRANOPHYRE SUITE	Stavoren and Diepkloof Granophyres, Rooikop Porphyritic Granite, Zwartbank Pseudogranophyre
RUSTENBURG LAYERED SUITE	Upper Zone Subzone C (Ol-Ap diorite) Subzone B (Ol-Mt gabbronorite) Subzone A (Mt gabbronorite)
	Main Zone Upper Subzone (gabbronorite) Lower Subzone (gabbronorite, norite)
	Critical Zone Upper Subzone (norite, anorthosite, pyroxenite) Lower Subzone (pyroxenite)
	Lower Zone Upper Pyroxenite Subzone Harzburgite Subzone Lower Pyroxenite Subzone
	Marginal Zone (norite)
ROOIBERG GROUP	Schrikkloof Formation (flow-banded rhyolite) Kwaggasnek Formation (massive rhyolite) Damwal Formation (dacite, rhyolite) Dullstroom Formation (basaltic andesite)

Figure 4: Current acceptable subdivisions and nomenclature of the Bushveld Complex. (Figure modified from (Eriksson, et al. 2006).

Standard zonal subdivision (informal)		Nomenclature recommended by SACS (1980), including subsequent additions					
All areas		Eastern limb		Western limb		Northern limb	
Upper Zone	Subzone C	Roosenekal Subsuite ¹	Luipershoek Olivine Diorite	Bierkraal Magnetite Gabbro	Molendraai Magnetite Gabbro ¹		
	Subzone B		Ironstone Magnetite Gabbro				
	Subzone A		Magnet Heights Gabbro Gabbro norite				
Main Zone	Upper Subzone ⁴	Dejate Subsuite ¹	Mapoch Gabbro norite	Pyramid Gabbro norite	Mapela Gabbro norite ¹		
	Lower Subzone		Leolo Mountain Gabbro norite				
			Winnarshoek Norite- Anorthosite				
Critical Zone	Upper Subzone	Dwars River Subsuite ¹	Winterveld Norite- Anorthosite	Schilpadnest Subsuite ¹	Mathiagame Norite- Anorthosite	Grasvalley Norite- Anorthosite ¹	
	Lower Subzone		Mooihoek Pyroxenite				Ruighoek Bronzite
Lower Zone ¹	Upper Pyroxenite Subzone	Croydon Subsuite ¹	Serokolo Bronzite	Viekfontein Subsuite ¹	Tweelaagte Bronzite	Zoetveld Subsuite ¹	Moordrift Harzburgite- Pyroxenite ²
	Harzburgite Subzone		Jagdlust Harzburgite		Groenfontein Harzburgite		Drummondlea Harzburgite ²
	Lower Pyroxenite Subzone		Rostock Bronzite		Makgope Bronzite		Volspruit Pyroxenite ²
			Clapham Bronzite		Eerlyk Bronzite		
Marginal Zone			Shelter Norite		Kroondal Norite Kolobeng Norite		

¹Wairaven (1986)

²Hulbert and Von Gruenewaldt (1982)

³Teigler and Eales (1996) suggested that the top of the Lower Zone be taken at the top of the Harzburgite Subzone

⁴Kruger (1994) proposed, on the basis of initial Sr isotopic ratios, that the Upper Subzone of the Main Zone should be included in the Upper Zone

Figure 5: Formal lithostratigraphic classification of the Rustenburg Layered Suite adopted by SACS (1980). The informal zonal subdivisions are generally used (Figure modified from (Eriksson, et al. 2006).

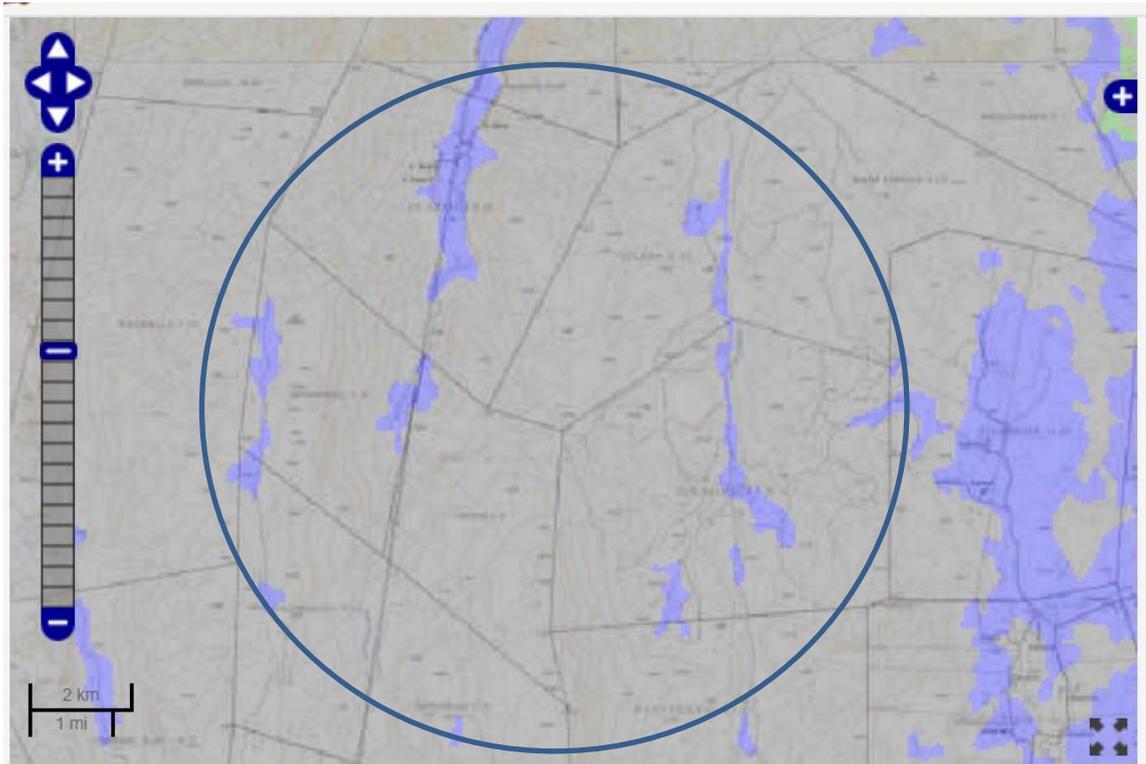


Figure 6: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the proposed Der Brochen Mine Amendment Project near Lydenburg, Limpopo Province is indicated in blue.

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 6) there is no chance of finding fossils in this area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The Der Brochen Mine is located approximately 25 km south-west of the town of Steelpoort, and 40 km west of Mashishing (Lydenburg), in the Limpopo Province. The mine falls within the Greater Tubatse Local Municipality, under the jurisdiction of the Greater Sekhukhune District Municipality.

The proposed Der Brochen Mine development is situated on the following farms Richmond 370 KT; St George 2 JT; Hermansdal 3 JT; Hebron 5 JT; Helena 6 JT; and Der Brochen 7 JT.

RPM also holds the surface right to Portion 7 of the farm Mareesburg 8 JT on which the Mareesburg tailings storage facility (TSF), associated return water dams (RWDs) and tailings-return water pipeline are located, which forms part of the Der Brochen Mine operation.

7 METHODS

A desktop study was assembled to evaluate the possible risk to palaeontological heritage (this includes fossils as well as trace fossils) in the proposed development area. In compiling the desktop report aerial photos, Google Earth 2018, topographical and geological maps and other reports from the same area as well as the author's experience were used to assess the proposed development footprint.

7.1 Assumptions and Limitations

The accuracy of DIA is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information were not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentrate on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas is used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally **assume** that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- The Palaeosensitivity Map from the SAHRIS website.
- 2530 AA, 2430 CC Topographical maps
- Geological Map 1: 250 000 3025 Baberton.
- A Google Earth map with polygons of the proposed development was obtained from SRK Consulting.
- Technical and background Information provided by Anglo American Platinum (AAP) - Rustenburg Platinum Mines Limited (RPM)

9 FINDINGS AND RECOMMENDATIONS

The proposed Der Brochen Amendment Project, near Lydenburg, Limpopo Province is completely underlain by the Dwars River and Dsjate Subsuite, Rustenburg layered Suite, Bushveld Complex. These mafic rocks of the Bushveld Complex is igneous in origin and thus unfossiliferous. The Palaeomap of SAHRIS also indicates that these rocks has a palaeontological significance of zero.

It is therefore considered that the construction and operation of the proposed Der Brochen Amendment Project near Lydenburg, Limpopo Province is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

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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 for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

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Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the H2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

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 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.

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 authorization and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

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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 decommissioning 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.

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CONFERENCE CONTRIBUTIONS

NATIONAL

PRESENTATION

Butler, E., Botha-Brink, J., and F. Abdala. A new gorgonopsian from the uppermost *Dicynodon Assemblage Zone*, Karoo Basin of South Africa. 18th the Biennial conference of the PSSA 2014. Wits, Johannesburg, South Africa.

INTERNATIONAL

Attended the Society of Vertebrate Palaeontology 73th Conference in Los Angeles, America. October 2012.

CONFERENCES: POSTER PRESENTATION

NATIONAL

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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Butler, E., and J. Botha-Brink. The biology of the South African non-mammaliaform cynodont *Galesaurus planiceps*. 15th Conference of the PSSA, Howick, South Africa. August 2008.

INTERNATIONAL VISITS

Natural History Museum, London

July 2008

Paleontological Institute, Russian Academy of Science, Moscow

November 2014