PALAEONTOLOGICAL FIELD ASSESSMENT OF THE PROPOSED PROSPECTING RIGHT APPLICATION FOR THE PROSPECTING OF DIAMONDS (ALLUVIAL & GENERAL) BETWEEN DOUGLAS AND PRIESKA ON PORTION 12, REMAINING EXTENT OF PORTION 29 (PORTION OF PORTION 13) AND PORTION 31 (PORTION OF PORTION 29) ON THE FARM READS DRIFT 74, REGISTRATION DIVISION; HERBERT, NORTHERN CAPE PROVINCE

(NC 30/5/1/1/2/12345 PR)

Compiled for:

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Prepared by

Banzai Environmental

20 September 2020

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

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SIGNATURE: 

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

Table 1 *- NEMA Table*

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vitae	Section 2 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section and 9	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 10	
(g) An identification of any areas to be avoided, including buffers		Section 1 and 11
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 11	
(k) Any mitigation measures for inclusion in the EMPr	Section 1 and 11	
(l) Any conditions for inclusion in the environmental authorisation		None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 11	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 11	
(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 11	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be	Section 3 compliance with SAHRA guidelines	

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

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Milnex CC to conduct the Palaeontological Field Assessment (PIA) assessing the proposed Prospecting Right Application on Portion 12, the remaining extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) of the farm Reads Drift 74, between Douglas and Prieska, Pixley ka Seme District Municipality, Northern Cape Province. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is necessary to determine if fossil material is present within the planned development. This PIA is therefore necessary to evaluate the effect of the construction on the palaeontological finds.

The Proposed Reads Drift 74 are mantled by Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup) and the Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup) as well as a very small portion of Vryburg Formation (Ghaap Group, Transvaal Supergroup). According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is High while that of the Tertiary to Quaternary calcretes is Low. The Dwyka Group and Vryburg Fm has a moderate Palaeontological Sensitivity and that of the Boomplaas Formation is Very High.

A one-day site specific field survey of the proposed Reads Drift 74 farm was conducted on foot and by motor vehicle on 19 September 2020. Poorly- to well-preserved, secondarily silicified stromatolite assemblages are recorded within the Boomplaas Formation. The stromatolites of the Boomplaas Formation represent some of the oldest stromatolite examples in South Africa. These stromatolites have not yet been comprehensively described and their geographical and stratigraphic distributions are poorly understood.

The project can be dividend in to two parts

- Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup); Vryburg Formation (Ghaap Group, Transvaal Supergroup)
- Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup)

The Impact significance for the Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group and Vryburg Formation will be a **Negative low Impact**. On the other hand, the Impact significance for the Boomplaas Formation will be a **Negative medium Impact**. The possibility of damaging the stromatolites by mining vehicles is likely and a precautionary approach must consequently be undertaken.

However, prospecting will only be conducted in the Late Cenozoic Superficial Sediments and Dwyka Group.

No visible evidence of fossiliferous outcrops was found in the remainder of the proposed footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the proposed development will be of a moderate significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.

In the event of the discovering of fossil remains during any phase of construction or operation, either on the surface or exposed by excavations, a **Chance Find Protocol** must be implemented by the ECO in charge of this development. These discoveries should be protected (if possible, *in situ*) and the ECO must report such discovery to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). Suitable mitigation (*e.g.* recording and collection) will consequently be undertaken by a palaeontologist.

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

These recommendations should be incorporated into the EMP for the Prospecting Right Application of the development.

Recommendations

- The ECO of the project must be informed that the Stromatolites of the Boomplaas Formation has a High Palaeontological Sensitivity and is widespread in the development footprint and special precaution must be undertaken not to damage any stromatolites.
- In the event that fossil remains are discovered in the Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group and Vryburg Formation during any phase of construction or operation, either on the surface or exposed by excavations, the **Chance Find Protocol** must be implemented by the ECO.

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1 INTRODUCTION

Milnex 189 CC was commissioned by Steinmann Groep (Pty) Ltd as the independent environmental consultant to conduct the Scoping and EIA process for a Prospecting Right Application on Portion 12 on the remaining extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) of the farm Reads Drift 74 between Prieska and Douglas, Pixley ka Seme District Municipality, Northern Cape Province. (Figure1-2).

The Northern Cape is the largest province in South Africa, with a surface area of 360 000 km^2. Diamond mining in the province forms a significant portion of the economy. Almond and Pether (2009) noted that mining threatens palaeontological heritage in the province (along ancient river systems; and on and off-shore along the coast).

1.1 Background

Information provided by Milnex CC

The Orange-Vaal River system is recognised as the primary secondary resource for alluvial diamond. The extensive diamondiferous gravels of the Lower Vaal, Harts, and Middle Orange River ("MOR") valleys are associated with remnants of outwash deposits formed during the retreat of the ancient Ghaap (Kaap) Valley glacial system and subsequent reworking and alluvial deposition by major rivers. Studies have shown that majority of the alluvial diamonds in gravel deposits along all the terraces along the Orange River are derived from two distinct gravel horizons. These comprise an upper deflation deposit (Rooikoppie) and an underlying (Primary fluvial-alluvial) gravel unit.

Primary fluvial-alluvial gravel deposits

The primary palaeo-fluvial succession comprises various proportions of gravel, sand and silt, typically with a basal gravel unit of up to 2m in thickness and an overlying finer-grained unit of up to 6m (the so-called “middlings” gravels). The poorly sorted gravels vary from pebble to cobble gravels, generally with a fair percentage of boulders (rarely +1m diameter). Interbedded sandy or granule beds and lenses occur frequently in more sandy, matrix supported gravel successions.

Deflation of ‘Rooikoppie’ deposits

These deposits represent derived gravel and consist mainly of well-rounded and polished siliceous pebbles and reddish coloured sand. The clastic material is believed to originate the fluvial alluvial gravel units and consists of its most resistant components, in particular chert, agate, jasper, quartzite and vein quartz. Due to the decomposition and winnowing of the less resistant clastic and matrix material there has been a substantial concentration of the more durable components in the original gravel, including diamonds.

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-six years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 16 years and have been conducting PIAs since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

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

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity which will change the character of a site—
    a. (exceeding 5 000 m^2 in extent; or
    b. involving three or more existing erven or subdivisions thereof; or
    c. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    d. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
    e. the re-zoning of a site exceeding 10 000m^2 in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

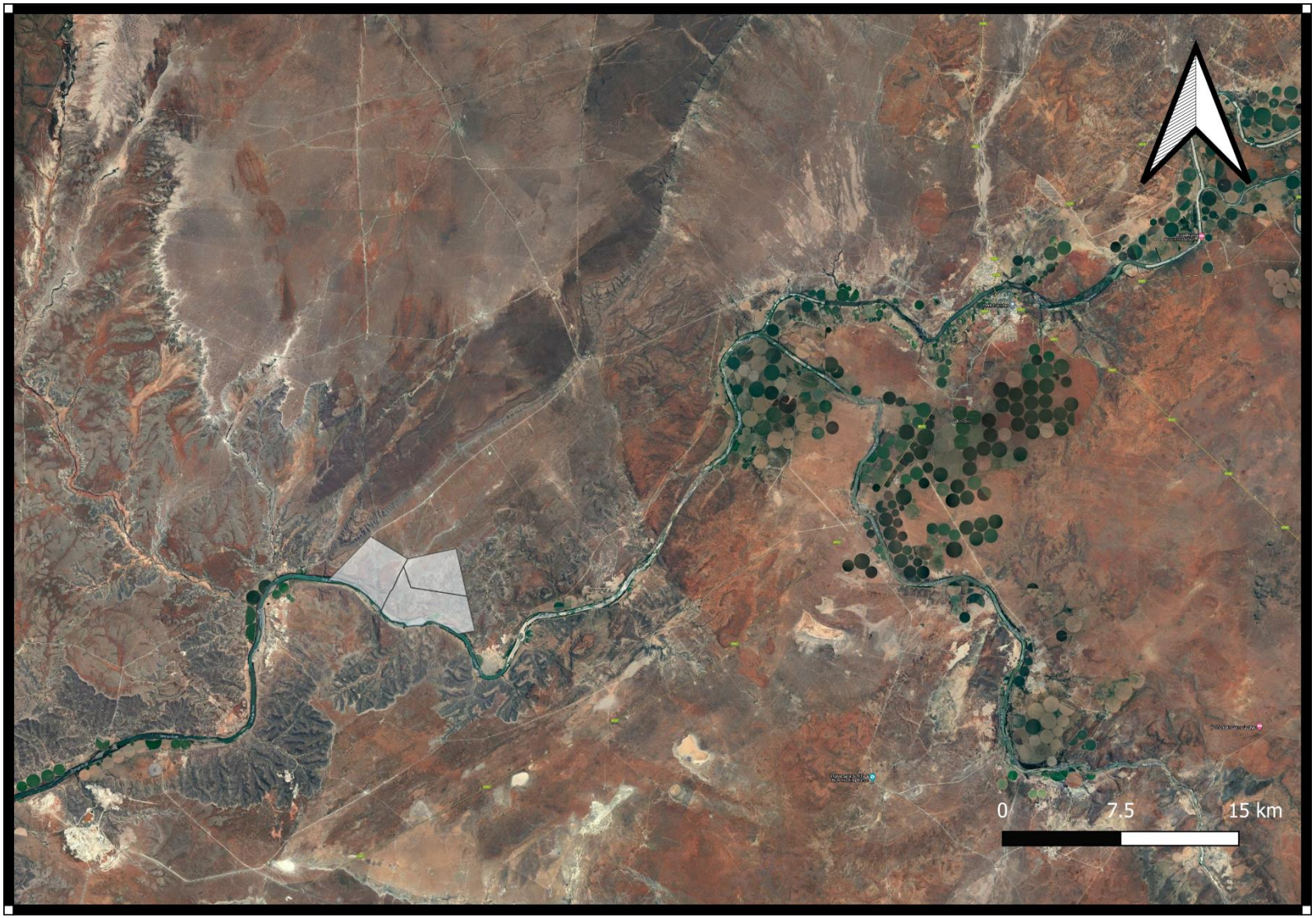


Figure 1: Google Earth Image (2020) indicating the general locality of the proposed development, between Douglas and Prieska, Northern Cape Province.

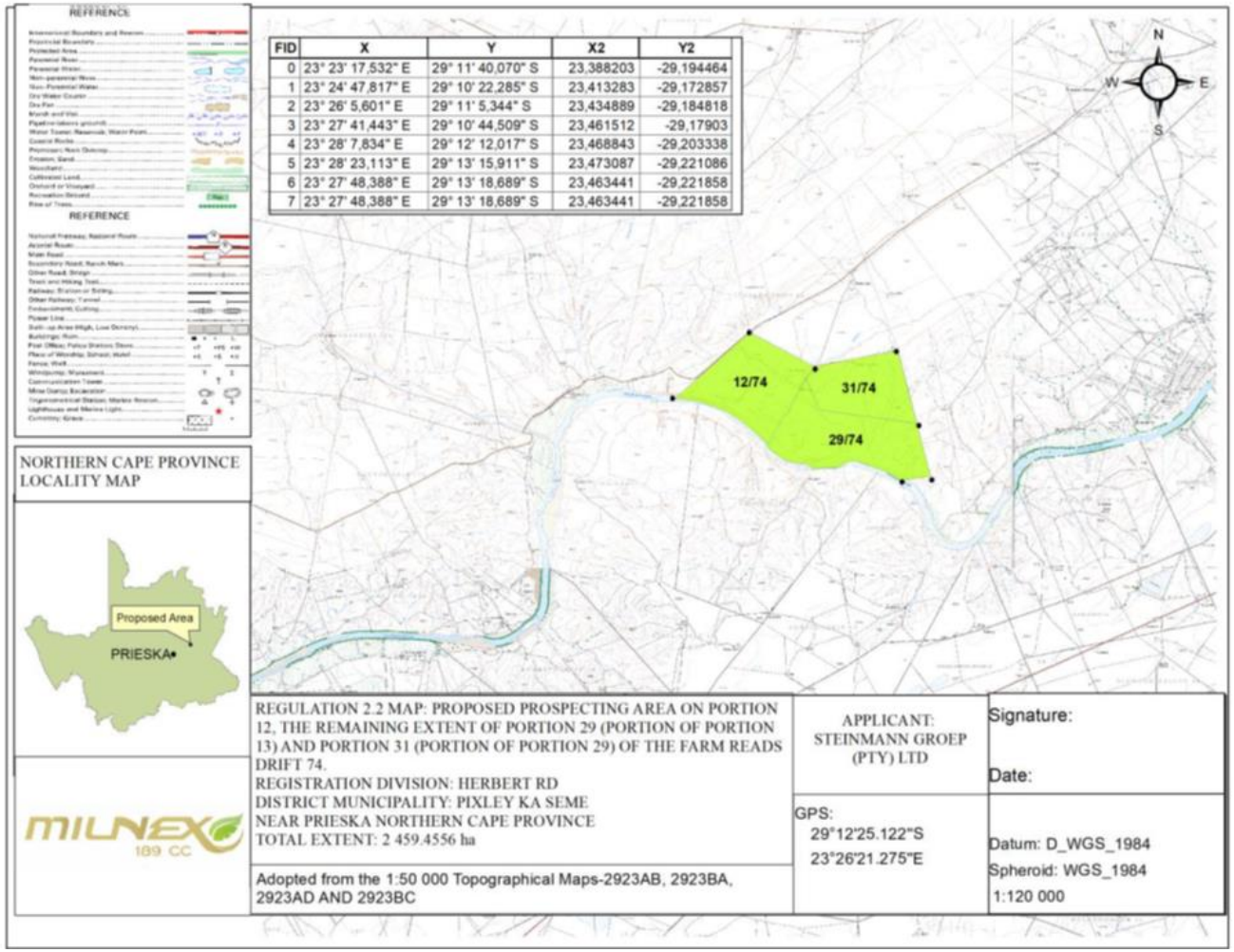


Figure 2: Locality of the proposed prospecting Right Application on Portion 12 on the remaining extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) of the farm Reads Drift 74 between Prieska and Douglas, Pixley ka Seme District Municipality, Northern Cape Province.

4 OBJECTIVE

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

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

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Description and location of the proposed development and provide geological and topographical maps;
- Provide Palaeontological and geological history of the affected area;
- Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed prospecting Right Application on Portion 12 on the remaining extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) of the farm Reads Drift 74 between Prieska and Douglas, Pixley ka Seme District Municipality, Northern Cape Province is depicted on the 1:250 000 2922 Prieska Geological Map (Council of Geoscience) (Figure 3).

The 2922 Prieska Geological Map indicates that the development footprint is largely covered by Late Cenozoic Superficial Sediments in the north (Figure 3). These sediments also include Late Tertiary to Quaternary calcretes (T-Qc). A small portion of Quaternary (Qs) sediments is present on Portion 12 of the development while the eastern margin (portion 29 and 31), of the development is underlain by the Dwyka Group (C-Pd; Mbizane Formation, Karoo Supergroup). The southern portion of the development is underlain by the Boomplaas Formation (Vb; Ghaap Group, Schmidsdrift Supergroup) with a small area in the east covered by the Vryburg Formation (Vv; Figure 3-4).

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments is High while that of the Late Tertiary to Quaternary calcrete are low, The Dwyka Group has a moderate Palaeontological Sensitivity and that of the Boomplaas Formation (Schmidsdrift Supergroup) is Very High.

The Superficial deposits in the Douglas area consists of alluvial gravels, aeolan sands, calcretes of the Quaternary Gordonia Formation that overlies the older sediments. The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in southern Africa. The sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge et al., 2006). The pan sediments of the area originated from the Gordonia Formation and contains white to brown fine-grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters. Quaternary alluvial gravels (DA; Figure 3) also known as high level gravels is mapped along both the Vaal and Orange River and is present south of the development footprint as well as in the northern part of the development. These gravels have been associated with diamond mining (De Wit *et al*., 2000). Windsorton is located northeast of Douglas and is known to have heavily calcretized “Older Gravels”. These gravels have been allocated to the **Windsorton Formation** and are supposed to be Miocene-Pliocene in age (Partridge & Brink 1967, De Wit *et a*l., 2000, Partridge *et al.* 2006). The ‘Younger gravels” of the Vaal River System comprise of the Rietputs Formation.

The Gordonia dune sands are dated as Late Pliocene/Early Pleistocene to Recent times by the Middle to Later Stone Age stone tools recovered from them (Dingle et al (1983). The boundary of

the Pliocene-Pleistocene has been extended back from 1.8 Ma to 2.588 Ma placing the Gordonia Formation almost entirely within the Pleistocene Epoch.

The fossil assemblages of the Kalahari are generally low in diversity and occur over a wide range but has a high Paleontologically Sensitivity. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. 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 skeletons have been uncovered where the depositional settings in the past were wetter.

The Dwyka Group is Late Carboniferous to Early Permian in age (300-290 Million years ago (Ma) and overlies glaciated Precambrian bedrock faces along the northern margin of the basin. In the south the Dwyka overlies the Cape Supergroup unconforrmably/paraconformably and in the east it unconformably overlies the Natal Group and Msikaba Formation. Underlying rocks, especially in the north, form in places well-developed striated glacial pavements. Visser (1986) identified several types of lithofacies which he perceived to be deposited in a marine basin.

The Dwyka Group is divided into northern and southern facies (Visser, 1981) due to the distinctive lithological variations over the basin. The Mbizane Formation consists mainly of the northern inlet facies which is characterised by thickness changes, extremely varying lithology and low massive diamictite (~20 %) and high mudrock (~40%) content. Visser et al. (1990) and Von Brunn and Visser (1999) found that the Dwyka rocks in the Douglas-Prieska area (close to the northern edge of the Main Karoo Basin) belong to the Mbizane Formation which can be up to 190 m thick. The Elandsvlei Formation is the southern platform and are depicted by a high massive diamictite (~70%) and low mudrock (~8%) content, gradual southernly increase in thickness (100 m to 800 m). Debris eroded, from the highlands was deposited by a ground ice sheet but in the west fluctuations in the ice front caused bedded diamictons and subaqueous and subglacial outwash sediments (Visser *et al* 1987). The key Reference Stratotype C section for the Mbizane Formation is situated a few km west of Douglas on the northern side of the Vaal River (Von Brunn & Visser, 1999)

The Dwyka sediments are of moderate palaeontological sensitivity. The Permo-Carboniferous Dwyka Group is known for its track ways also known as Ichnofacies that was formed by fish and arthropods. Fossilized faeces or coprolites have also been recovered. Body fossils consists of gastropods, invertebrates and marine fish, as well as fossil plants. A rich diversity of conifers, cordaitaleans, glossopterids, ginkgoaleans, pollens and spores have been described from this Group while ferns, horsetails and lycopods, are also found.

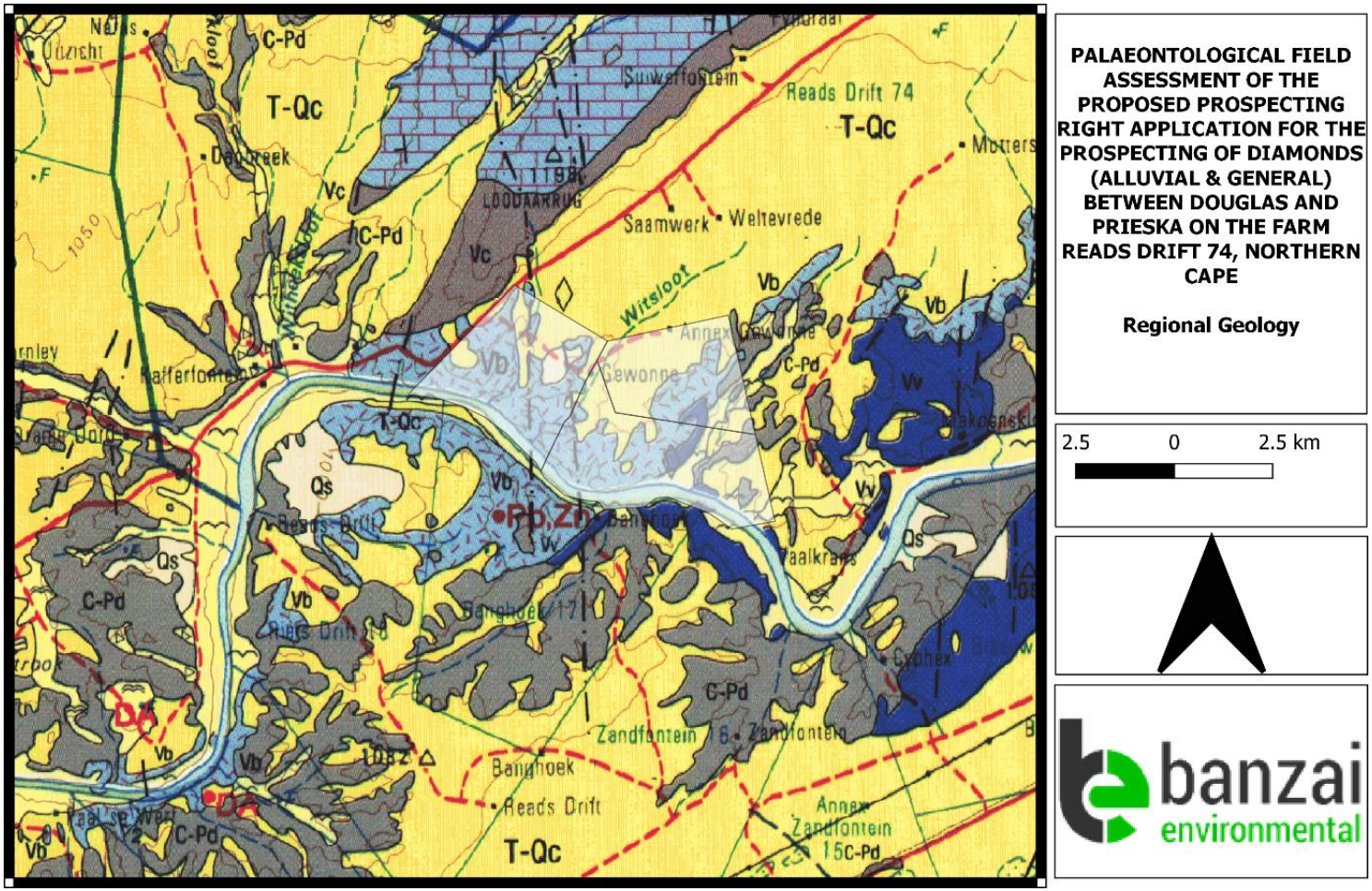
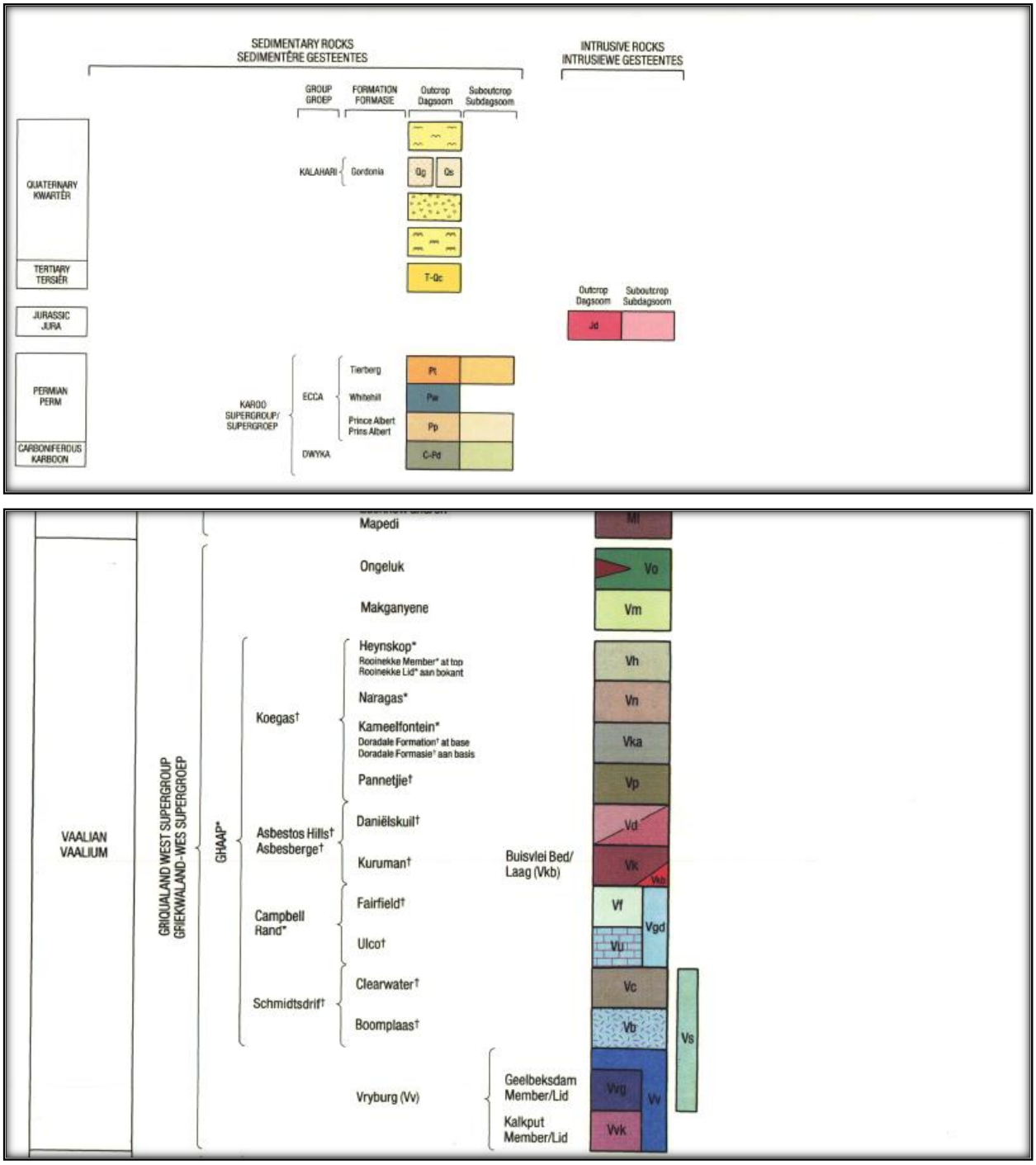


Figure 3: Extract of the 1:250 000 2922 Prieska Geological map (Council of Geoscience) indicating the proposed development in white. Surface geology indicates that the development footprint is underlain by the Late Cenozoic Superficial Sediments, the Late Tertiary to Quaternary calcrete, the Dwyka Group as well as the Boomplaas Formation (Vb; Ghaap Group, Schmidsdrift Supergroup) and Vryburg Formation (Vv). Map drawn by QGIS 2.18



Legend to Map and short explanation.

T-Qc-Calcrete

C-Pd – Dwyka Group, Karoo Supergroup

Vb Boomplaas Fm (Schmidsdrift Supergroup, Ghaap Group of the Transvaal Supergroup)- dolomite

Vv-Vryburg Formation, Ghaap Group of the Transvaal Supergroup

Mining activity –(DA) Diamonds

The southern margin of the study area is underlain by ancient sedimentary rocks of the Schmidtsdrif Subgroup. In the Prieska Sub-Basin, the Schmidtsdrif Subgroup is the basal subdivision of the Late Archaean to Early Proterozoic Ghaap Group (Transvaal Supergroup) (Figure 4). The Schmidtsdrif Subgroup can be divided into the geological older Boomplaas Formation and younger Clearwater Formation. The Ghaap Group represents 200 Ma of chemical sedimentation of which iron and manganese ores, cherts and carbonates with subordinate silicastic rocks are prominent. The Boomplaas Formation is known to contain well-preserved stromatolite assemblages (Figure 5; microbial dome). Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

The Boomplaas beds are characterized by grey dolomites which weathers reddish-brown with subordinate interbeds of limestone (weathering blue-grey), quartzite, flaggy sandstone and shale. Oolitic and stromatolitic dolomite alternating with intervals of carbonaceous possible lagoonal mudrocks containing interbeds of calcareous sandstone and mudclast breccias is present. The Boomplaas beds are overlain by the grey- to khaki-hued mudrocks and interbedded dolomites, flagstones, tuffites and BIF-like cherts of the Clearwater Formation (= Lokamonna Formation), the topmost unit of the Schmidtsdrif Subgroup. Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Keyser and Du Plessis, 1993; Truswell and Eriksson, 1973; Eriksson and Altermann, 1998).

Microbial stromatolites in the upper Vryburg Formation were described by Smith (1991). The stromatolitic carbonates are interpreted to be intertidal (Altermann and Wotherspoon, 1995). South African Archaean stromatolites have been discussed in detail (Altermann, 2001; Buick, 2001; and Schopf, 2006). Columnar stromatolites from the Schmidtsdrif Subgroup of the Northern Cape have been described by Bertrand-Sarfarti and Eriksson (1977).

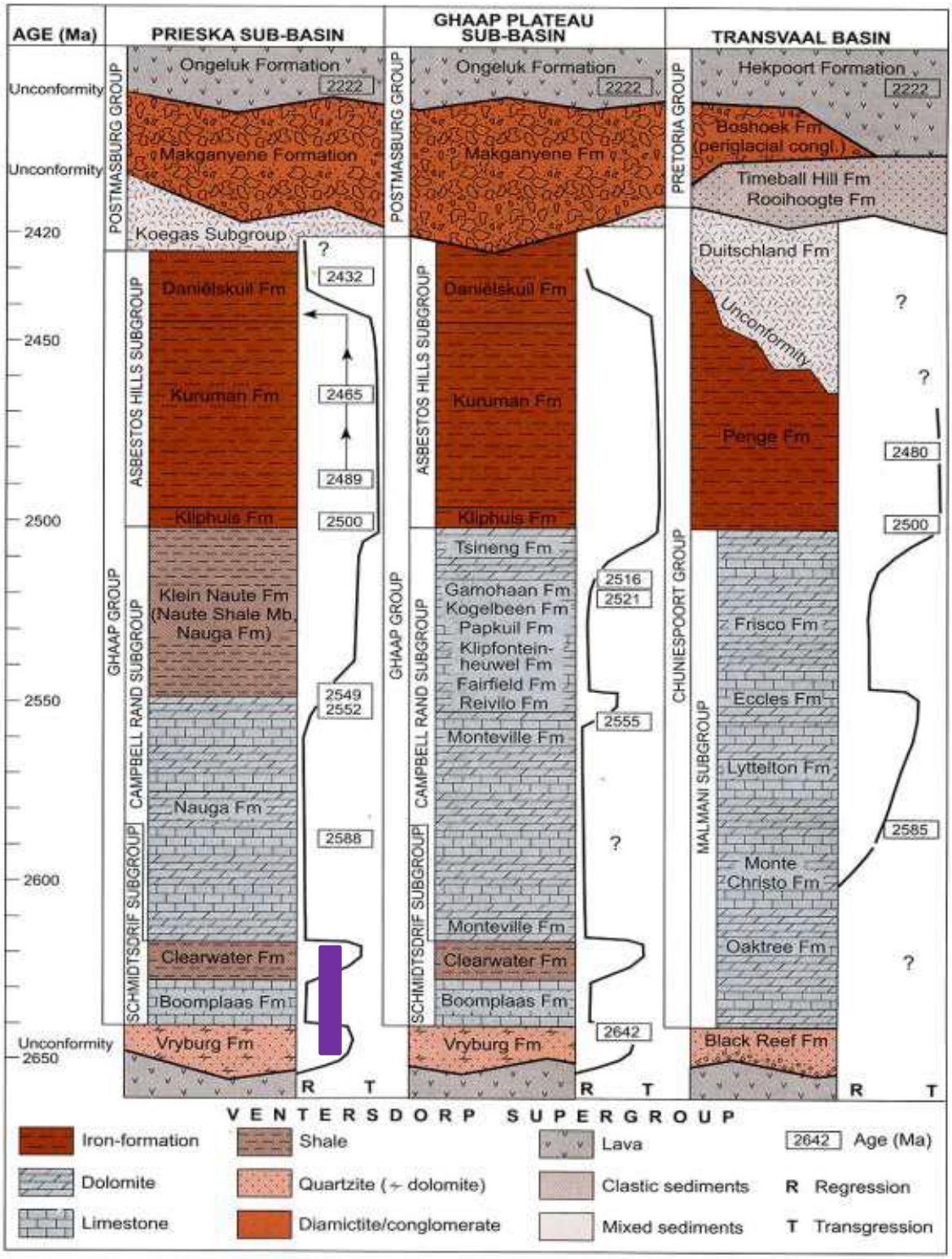


***Figure 4**: Stratigraphy of the Transvaal Supergroup of the Ghaap Plateau Basin. The left column shows the rock units represented in the proposed study area (purple line) (Eriksson, et al. 2006). The Vryburg Formation is incorporated within the base of the Schmidtsdrif Subgroup by some recent authors and is no longer correlated with the Black Reef Formation of the Transvaal Basin as shown here (e.g. Altermann and Wotherspoon, 1995, Sumner and Beukes, 2006).*

Figure 5: *Example of a well preserved stromatolite from the Archaean Era.*

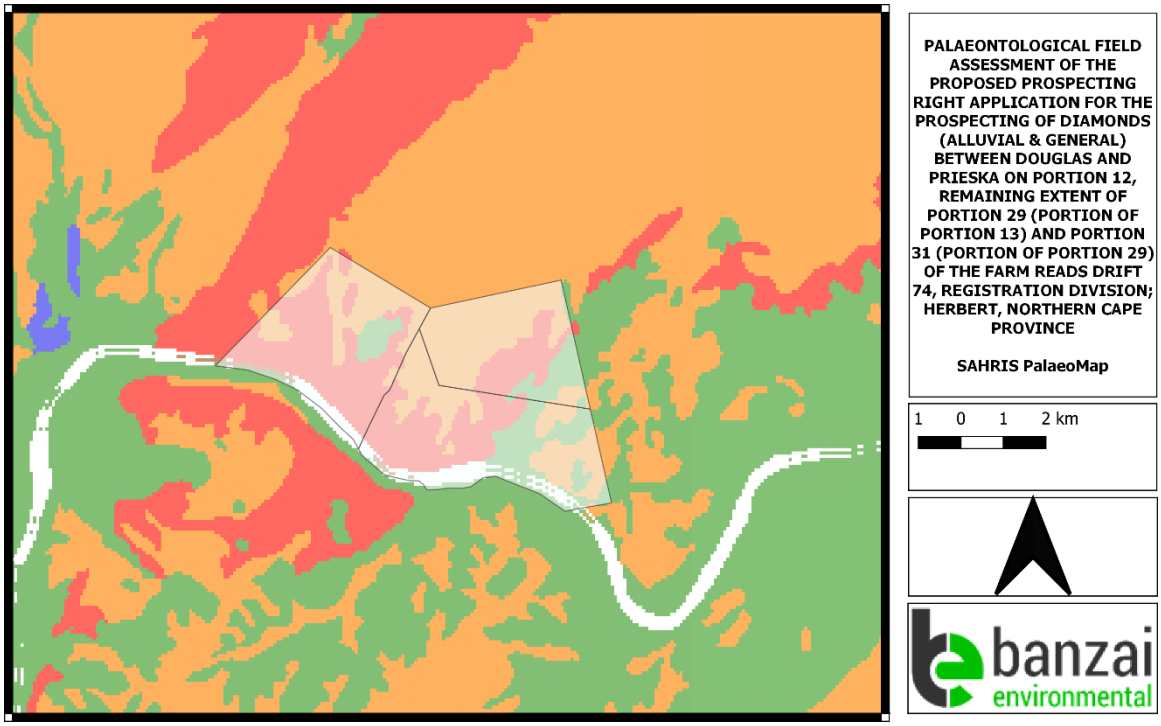


Figure 6: *Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the proposed development is indicated in red.*

Colour	Sensitivity	Required Action
RED	**VERY HIGH**	**field assessment and protocol for finds is required**
ORANGE/YELLOW	**HIGH**	**desktop study is required and based on the outcome of the desktop study; a field assessment is likely**
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS palaeosensitivity map (Figure 6) there is a high chance of finding fossils in this area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The farm Reads Drift 74 is situated approximately 80km Northeast of Prieska in the Northern Cape Province. The proposed development footprint is located along the Northern Bank of the Orange River between Douglas and Prieska in the Northern Cape. The site is approximately 100 km southwest of Douglas and 200 km from Kimberley.

7 METHODS

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

7.1 Assumptions and Limitations

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

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

8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984);
- 1: 250 000 2922 Prieska Geological map (Council of Geoscience);
- A Google Earth map with polygons of the proposed development was obtained from Milnex CC.;
- 1:50 000 Topographical Maps 2923 AB, 2923 BA; 2923AD and 2923BC
- Palaeontological Impact Assessments in the Douglas area include Almond 2010a, 2010b, 2010c, 2010d (see references)

9 SITE VIST

A one-day site specific field survey of the proposed Reads Drift 74 farm was conducted on foot and by motor vehicle on 19 September 2020. Poorly- to well-preserved, secondarily silicified stromatolite assemblages are recorded within the Boomplaas Formation. These stromatolites were found loose as well as in situ.

Figure 7: *Flat topography on the northern margin of the proposed development.*
GPS coordinates 29°18'47"S 23°44"E

Figure 8: *Loose stromatolite.* GPS coordinates 29°11'16"S 23°25' 04"E

Figure 9: *In situ stromatolites. GPS coordinates 29°12'23"S 23°26' 00"E*

Figure 10: *Small Stromatolites.* GPS coordinates 29°12'23"S 23°26' 60"E

Figure 11: *In situ stromatolites.* GPS coordinates 29°12'23"S 23°25' 60"E

Figure 12: *Overview of in situ stromatolites.* GPS coordinates 29°12'23"S 23°25' 59"E

Figure 13: *Unfossiliferous concretes.* GPS coordinates 29°10'42"S 23°25' 09"E

Figure 14: *Unfossiliferous riverbed.* GPS coordinates 29°10'50"S 23°24' 539"E

Figure 15: *Unfossiliferous concretes.* GPS coordinates 29°11'16"S 23°24' 59"E

Figure 16: *Low topography without a fossiliferous outcrop. Overview of in situ stromatolites.* GPS coordinates 29°20'05"S 23°21' 53"E

Figure 17:Localities of stromatolites found during *site visit*

10 IMPACT ASSESSMENT METHODOLOGY

10.1 Impact Rating System

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

• Construction

• Operation

• Decommissioning

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

Table 2: *The rating system of the Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup)*

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).

4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

Table 1 Continues

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

		ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

Table 1 Continues

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

Table 1 Continues

SIGNIFICANCE

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.** 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

10.1.1 Summary of Impacts for the Boomplaas (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup)

Only the site will be affected (1). It is probable that the impact will occur (3). The expected duration of the impact is assessed as potentially permanent to long term (4). The impact on fossil heritage will be irreversible and a complete loss of fossil heritage will take place (4). The cumulative effect of the impact will be high (4). The magnitude of the impact happening will be high (3)

The Impact significance will therefore be a negative medium Impact.

Table 3: *The rating system of the Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup); Vryburg Formation (Ghaap Group, Transvaal Supergroup)*

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

Table 1 Continues

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction

		period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

Table 1 Continues

REVERSIBILITY
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.

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

Table 1 Continues

SIGNIFICANCE
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.** 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

10.1.2 Summary of Impacts Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup); Vryburg Formation (Ghaap Group, Transvaal Supergroup)

Only the site will be affected (1). It is probable that the impact will occur (2). The expected duration of the impact is assessed as potentially permanent to long term (4). The impact on fossil heritage will be irreversible and a complete loss of fossil heritage will take place (4). The cumulative effect of the impact will be high (2). The magnitude of the impact happening will be medium (2)

The Impact significance will therefore be a negative low Impact.

11 FINDINGS AND RECOMMENDATIONS FOR THE

The Proposed Reads Drift 74 Prospecting Right Application are mantled by Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Karoo Supergroup) and the Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup) as well as a very small portion of Vryburg Formation (Ghaap Group, Transvaal Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the calcrete are low, The Dwyka Group has a moderate Palaeontological Sensitivity while that of the Boomplaas Formation (Schmidsdrift Supergroup) is Very High.

The Proposed Reads Drift 74 are mantled by Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup) and the Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup) as well as a very small portion of Vryburg Formation (Ghaap Group, Transvaal Supergroup). According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is High while that of the Tertiary to Quaternary calcretes is Low. The Dwyka Group and Vryburg Fm has a moderate Palaeontological Sensitivity and that of the Boomplaas Formation is Very High.

A one-day site specific field survey of the proposed Reads Drift 74 farm was conducted on foot and by motor vehicle on 19 September 2020. Poorly- to well-preserved, secondarily silicified stromatolite assemblages are recorded within the Boomplaas Formation. The stromatolites of the Boomplaas Formation represent some of the oldest stromatolite examples in South Africa. These stromatolites have not yet been comprehensively described and their geographical and stratigraphic distributions are poorly understood.

The project can be dividend in to two parts

- Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group (Mbizane Formation, Karoo Supergroup); Vryburg Formation (Ghaap Group, Transvaal Supergroup)
- Boomplaas Formation (Schmidsdrift Subgroup, Ghaap Group, Transvaal Supergroup)

The Impact significance for the Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group and Vryburg Formation will be a **Negative low Impact**. On the other hand, the Impact significance for the Boomplaas Formation will be a **Negative medium Impact**. The possibility of damaging the stromatolites by mining vehicles is likely and a precautionary approach must consequently be undertaken.

However, prospecting will only be conducted in the Late Cenozoic Superficial Sediments and Dwyka Group.

No visible evidence of fossiliferous outcrops was found in the remainder of the proposed footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the proposed development will be of a moderate significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.

In the event of the discovering of fossil remains during any phase of construction or operation, either on the surface or exposed by excavations, a **Chance Find Protocol** must be implemented by the

ECO in charge of this development. These discoveries should be protected (if possible, *in situ*) and the ECO must report such discovery to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). Suitable mitigation (*e.g.* recording and collection) will consequently be undertaken by a palaeontologist.

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

These recommendations should be incorporated into the EMP for the Prospecting Right Application of the development.

Recommendations

- The ECO of the project must be informed that the Stromatolites of the Boomplaas Formation has a High Palaeontological Sensitivity and is widespread in the development footprint and special precaution must be undertaken not to damage any stromatolites.
- In the event that fossil remains are discovered in the Late Caenozoic Superficial Sediments, Tertiary to Quaternary calcretes, the Dwyka Group and Vryburg Formation during any phase of construction or operation, either on the surface or exposed by excavations, the **Chance Find Protocol** must be implemented by the ECO.

12 REFERENCES

ALMOND, J.E. 2010a. Proposed photovoltaic power station adjacent to Herbert Substation near Douglas, Northern Cape Province: desktop study, 23 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2010b. Proposed photovoltaic power station adjacent to Herbert Substation near Douglas, Northern Cape Province: field scoping study, 23 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2010c. Proposed photovoltaic power station adjacent to Greefspan Substation near Douglas, Northern Cape Province: desktop study, 22 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2010d. Proposed photovoltaic power station adjacent to Ovaal Substation near Douglas, Northern Cape Province: recommended exemption from further palaeontological studies, 22 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences..

ANDERSON, A.M. 1974. Arthropod trackways and other trace fossils from the Early Permian lower Karoo Beds of South Africa. Unpublished PhD thesis, University of Witwatersrand, Johannesburg, 172 pp.

ANDERSON, A.M. 1975. Turbidites and arthropod trackways in the Dwyka glacial deposits (Early Permian) of southern Africa. Transactions of the Geological Society of South Africa 78: 265-273.

ANDERSON, A.M. 1976. Fish trails from the Early Permian of South Africa. Palaeontology 19: 397-409, pl. 54.

ANDERSON, A.M. 1981. The *Umfolozia* arthropod trackways in the Permian Dwyka and Ecca Groups of South Africa. Journal of Paleontology 55: 84-108, pls. 1-4.

ANDERSON, A.M. & MCLACHLAN, I.R. 1976. The plant record in the Dwyka and Ecca Series (Permian) of the south-western half of the Great Karoo Basin, South Africa. Palaeontologia africana 19: 31-42.

ANDERSON, J.M. 1977. The biostratigraphy of the Permian and the Triassic. Part 3: A review of Gondwana Permian palynology with particular reference to the northern Karoo Basin, South Africa. Memoirs of the Botanical Survey of South Africa 45, 14-36.

ANDERSON, J.M. & ANDERSON, H.M. 1985. Palaeoflora of southern Africa. Prodromus of South African megafloras, Devonian to Lower Cretaceous, 423 pp, 226 pls. Botanical Research Institute, Pretoria & Balkema, Rotterdam.

BAMFORD, M.K. 2000. Fossil woods of Karoo age deposits in South Africa and Namibia as an aid to biostratigraphical correlation. Journal of African Earth Sciences 31, 119-132.

BAMFORD, M.K. 2004. Diversity of woody vegetation of Gondwanan South Africa. Gondwana Research 7, 153-164.

BANGERT, B. & BAMFORD, M. 2001. Carboniferous pycnoxylic woods from the Dwyka Group of southern Namibia. Palaeontologia africana 37, 13-23.

BANGERT, B., STOLHOFEN, H., GEIGER, M. & LORENZ, V. 2000. Fossil record and high resolution tephrostratigraphy of Carboniferous glaciomarine mudstones, Dwyka Group, southern Namibia. Communications of the Geological Survey of Namibia 12, 235-245.
BUATOIS, L. & MANGANO, M.G. 1995. The paleoenvironmental and paleoecological significance of the lacustrine *Mermia* ichnofacies: an archetypal subaqueous nonmarine trace fossil assemblage. Ichnos 4: 151-161.
BUATOIS, L. & MANGANO, M.G. 2004. Animal-substrate interactions in freshwater environments: applications of ichnology in facies and sequence stratigraphic analysis of fluvio-lacustrine successions. In: McIlroy, D. (Ed.) The application of ichnology to palaeoenvironmental and stratigraphic analysis. Geological Society, London, Special Publications 228, pp 311-333.
BUTZER, K.W., HELGREN, D.M., FOCK, G. & STUCKENRATH, R. 1973. Alluvial terraces of the Lower Vaal River, South Africa: a re-appraisal and re-investigation. Journal of geololgy 81, 341-362.
CATUNEANU, O., WOPFNER, H., ERIKSSON, P.G., CAIRNCROSS, B., RUBIDGE, B.S., SMITH R.M.H., HANCOX, P.J. 2005. The Karoo basins of south-central Africa. Journal of African Earth Sciences 43: 211-253.
COOKE, H.B.S. 1949. Fossil mammals of the Vaal River deposits. Memoirs of the geological Survey of South Africa 35, 1-117.
COOPER, M.R. & OOSTHUIZEN, R. 1974. Archaeocyathid-bearing erratics from Dwyka Subgroup (Permo-Carboniferous) of South Africa, and their importance to continental drift. Nature 247, 396-398.
DE WIT, M.C.J. 2008. Canteen Koppie at Barkly West: South Africa‟s first diamond mine. South African Journal of Geology 111, 53-66.
DE WIT, M.C.J.1999. Post-Gondwana drainage and the development of diamond placers in western South Africa. Economic Geology. 94:721–740.
DE WIT, M.C.J., MARSHALL, T.R. & PARTRIDGE, T.C. 2000. Fluvial deposits and drainage evolution. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.55-72. Oxford University Press, Oxford.
DICKENS, J.M. 1961. *Eurydesma* and *Peruvispira* from the Dwyka Beds of South Africa. Palaeontology 4: 138-148, pl. 18.
DICKENS, J.M. 1984. Late Palaeozoic glaciation. BMR Journal of Australian Geology and Geophysics 9: 163-169.
DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.
DU TOIT, A. 1954. The geology of South Africa. xii + 611pp, 41 pls. Oliver & Boyd, Edinburgh.
ERIKSSON, P.G., ALTERMANN, W. & HARTZER, F.J. 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 237-260. Geological Society of South Africa, Marshalltown.
EVANS, F.J.E. 2005. Taxonomy, palaeoecology and palaeobiogeography of some Palaeozoic fish of southern Gondwana. Unpublished PhD thesis, University of Stellenbosch, 628 pp.

GRESSE, P. G.,2003. Journal of The South African Institute of Mining and Metallurgy:535-538
GRILL, H. 1997. The Permo-Carboniferous glacial to marine Karoo record in southern Namibia: sedimentary facies and sequence stratigraphy. Beringeria 19: 3-98, 1 pl.
HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.
HELGREN, D.M. 1977. Geological context of the Vaal River faunas. South African Journal of Science 73, 303-307.
HERBERT, C.T. & COMPTON, J.S. 2007. Depositional environments of the lower Permian Dwyka diamictite and Prince Albert shale inferred from the geochemistry of early diagenetic concretions, southwest Karoo Basin, South Africa. Sedimentary Geology 194: 263-277.
JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., De V. WICKENS, H., CHRISTIE, A.D.M., ROBERTS, D.L. & BRANDL, G. 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.
JOHNSON, M.R., Visser, J.N.J., et al.2006. Sedimentary rocks of the Karoo Supergroup In JOHNSON, M.R., ANHAEUSSER, C.R. & THOMAS, R.J.. (eds). The geology of South Africa. 691 pp. Geological Society of South Africa, Johannesburg and Council for Geoscience, Pretoria.
KENT, L.E. 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei and Venda. SACS, Council for Geosciences, pp. 535-574.
KLEIN, R.G. 1984. The large mammals of southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 107-146. Balkema, Rotterdam.
MACRAE , C. 1999. Life etched in stone. Fossils of South Africa. 305 pp. The Geological Society of South Africa, Johannesburg.
MCCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town
MCLACHLAN, I.R. & ANDERSON, A. 1973. A review of the evidence for marine conditions in southern Africa during Dwyka times. Palaeontologia africana 15: 37-64.
MILLER, R.M. 2008. Karoo Supergroup, pp. 16-1 to 16-115 *in* Miller, R.G. The geology of Namibia. Volume 3. Upper Palaeozoic to Cenozoic. Geological Survey, Namibia.
MOORE, A.E. and BLENKINSOP, T. The role of mantle plumes in the development of continental-scale drainage patterns: The southern African example revisited. South African Journal of Geology, vol. 105, 2002. pp. 353–360
MOORE, A.E. and LARKIN, P.A. Drainage evolution in south-central Africa since the breakup of Gondwana. South African Journal of Geology, vol. 104, 2001. pp. 47–68.
OELOFSEN, B.W. 1986. A fossil shark neurocranium from the Permo-Carboniferous (lowermost Ecca Formation) of South Africa. In: Uyeno, T, Arai, R., Taniuchi, T & Matsuura, K. (Eds.) Indo-Pacific fish biology. Proceedings of the Second International Conference on Indo-Pacific Fishes. Ichthyological Society of Japan, Tokyo, pp 107-124.

PARTRIDGE, T.C. & BRINK, A.B.A. 1967. Gravels and terraces of the lower Vaal River basin. South African Geographical Journal 49, 21-38.
PARTRIDGE, T.C. & SCOTT, L. 2000. Lakes and pans.. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.145 - 161. Oxford University Press, Oxford.
PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.
PLUMSTEAD, E.P. 1969. Three thousand million years of plant life in Africa. Alex Du Toit Memorial Lectures No. 11. Transactions of the Geological Society of South Africa, Annexure to Volume 72, 72pp. 25 pls.
PRINSLOO, M.C. 1989. Die geologie van die gebied Britstown. Explanation to 1: 250000 geology Sheet 3022 Britstown, 40 pp. Council for Geoscience, Pretoria.
SAVAGE, N.M. 1970. A preliminary note on arthropod trace fossils from the Dwyka Series in Natal. IUGS Second Gondwana Symposium, South Africa, 1970, Proceedings and Papers, pp 627-635, pls. 1-5.
SAVAGE, N.M. 1971. A varvite ichnocoenosis from the Dwyka Series of Natal. Lethaia 4: 217-233.
SEILACHER, A. 2007. Trace fossil analysis, xiii + 226pp. Springer Verlag, Berlin.
SG 2.2 SAHRA APMHOB Guidelines, 2012. Minimum standards for palaeontological components of Heritage Impact Assessment Reports, Pp 1-15.
STAPLETON, R.P. Carboniferous unconformity in southern Africa. Nature 268, 222-223.
STEPHENSON, M.H. 2008. A review of the palynostratigraphy of Gondwanan Late Carboniferous to Early Permian glacigene successions. In: Fielding, C.R., Frank, T.D. & Isbell, J.L. (eds). Resolving the Late Paleozoic Ice Age in time and space. Geological Society of America Special Paper 441, 317-330.
STOLLHOFEN, H., STANISTREET, I.G., BANGERT, B. & GRILL, H. 2000. Tuffs, tectonism and glacially-related sea-level changes, Carboniferous-Permian, southern Namibia. Palaeogeography, Palaeoclimatology, Palaeoecology 161: 127-150.
STONE, P. & THOMSON, M.R.A. 2005. Archaeocyathan limestone blocks of likely Antarctic origin in Gondwanan tillite from the Falkland Islands. Geological Society, London, Special Publications 246, 347-357.
THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.
THOMAS, R.J., THOMAS, M.A. & MALHERBE, S.J. 1988. The geology of the Nossob and Twee Rivieren areas. Explanation for 1: 250 000 geology sheets 2520-2620. 17pp. Council for Geoscience, Pretoria.
VAN DER WESTHUIZEN, W.A., DE BRUIYN, H. & MEINTJES, P.G. 2006. The Ventersdorp Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 187-208. Geological Society of South Africa, Marshalltown.
VEEVERS, J.J., COLE, D.I. & COWAN, E.J. 1994. Southern Africa: Karoo Basin and Cape Fold Belt. Geological Society of America, Memoir 184: 223-279.

VISSER, J.N.J. 1982. Upper Carboniferous glacial sedimentation in the Karoo Basin near Prieska, South Africa. Palaeogeography, Palaeoclimatology, Palaeoecology 38, 63-92.
VISSER, D.J.L. (ed) 1984. Geological Map of South Africa 1:100 000. South African Committee for Stratigraphy, Council for Geoscience, Pretoria.
VISSER, J.N.J. 1985. The Dwyka Formation along the north-western margin of the Karoo Basin in the Cape Province, South Africa. Transactions of the Geological Society of South Africa 88, 37-48.
Visser, D.J.L., LOOCK, J.C., and COLLISTON., W.P. 1987. Subaqueous outwash fan and esker sandstones in the Permo-Carboniferious Dwyka Formation of South Africa. J.Sed.Petrol., 57:467-478
VISSER, D.J.L. (ed) 1989. *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland*. South African Committee for Stratigraphy. Council for Geoscience, Pretoria, Pp 494.

VISSER, J.N.J. 1989. The Permo-Carboniferous Dwyka Formation of southern Africa: deposition by a predominantly subpolar marine ice sheet. Palaeogeography, Palaeoclimatology, Palaeoecology 70, 377-391.
VISSER, J.N.J. 1992. Deposition of the Early to Late Permian Whitehill Formation during a sea-level highstand in a juvenile foreland basin. South African Journal of Geology 95: 181-193.
VISSER, J.N.J. 1997. Deglaciation sequences in the Permo-Carboniferous Karoo and Kalahari Basins of southern Africa: a tool in the analysis of cyclic glaciomarine basin fills. Sedimentology 44: 507-521.
VISSER, J.N.J. 2003. Lithostratigraphy of the Elandsvlei Formation (Dwyka Group). South African Committee for Stratigraphy, Lithostratigraphic Series No. 39, 11 pp. Council for Geoscience, Pretoria.
VISSER, J.N.J., LOOCK, J.C., VAN DER MERWE, J., JOUBERT, C.W., POTGIETER, C.D., MCLAREN, C.H., POTGIETER, G.J.A., VAN DER WESTHUIZEN, W.A., NEL, L. & LEMER, W.M. 1977-78. The Dwyka Formation and Ecca Group, Karoo Sequence, in the northern Karoo Basin, Kimberley-Britstown area. Annals of the Geological Survey of South Africa 12, 143-176.
VISSER, J.N.J., VAN NIEKERK, B.N. & VAN DER MERWE, S.W. 1997. Sediment transport of the Late Palaeozoic glacial Dwyka Group in the southwestern Karoo Basin. South African Journal of Geology 100: 223-236.
VISSER, J.N.J., VON BRUNN, V. & JOHNSON, M.R. 1990. Dwyka Group. Catalogue of South African Lithostratigraphic Units 2, 15-17. Council for Geoscience, Pretoria.
VISSER, J.NJ., 1989. The Permo-Carboniferous Dwyka Formation of southern Africa: deposition by predominantly subpolar marine ice sheet. Palaeogreogr., Palaeoclimatol, Palaeoecol., 70:377-391.
VON BRUNN, V. & VISSER, J.N.J. 1999. Lithostratigraphy of the Mbizane Formation (Dwyka group). South African Committee for Stratigraphy, Lithostratigraphic Series No. 32, 10 pp. Council for Geoscience, Pretoria.
WELLS, L.H. 1964. The Vaal River „Younger Gravels" faunal assemblage: a revised list. South African Journal of Science 60, 92-94.
ZAWADA, P.K. 1992. The geology of the Koffiefontein area. Explanation of 1: 250 000 geology sheet 2924 Koffiefontein, 30 pp. Council for Geoscience, Pretoria.

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 D*aptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part-time Laboratory assistant — Department of Zoology & Entomology University of the Free State Zoology 1989-1992

Part-time laboratory assistant — Department of Virology University of the Free State Zoology 1992

Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

TECHNICAL REPORTS

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

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.

Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.

Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 mw Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modderfontein Filling Station on Erf 28 Portion 30, Founders Hill, City Of Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modikwa Filling Station on a Portion of Portion 2 of Mooihoek 255 Kt, Greater Tubatse Local Municipality, Limpopo Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Heidedal filling station on Erf 16603, Heidedal Extension 24, Mangaung Local Municipality, Bloemfontein, Free State Province. Bloemfontein.

Butler, E. 2016. Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single Or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Savannaha South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the

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

Butler, E. 2016. Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from the 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. Savannaha South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces. PGS Heritage. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed development of two burrow pits (DR02625 and DR02614) in the Enoch Mgijima Municipality, Chris Hani District, Eastern Cape.

Butler, E. 2016. Ezibeleni waste Buy-Back Centre (near Queenstown), Enoch Mgijima Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed development of four Leeuwberg Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed Aggeneys south prospecting right project, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment of the proposed Motuoane Ladysmith Exploration right application, Kwazulu Natal. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed construction of two 5 MW solar photovoltaic power plants on farm Wildebeestkuil 59 and farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016: Palaeontological desktop assessment of the establishment of the proposed residential and mixed use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 Ir, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamagara local municipality and John Taolo Gaetsewe district municipality, Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment Of The Proposed Development Of The New Open Cast Mining Operations On The Remaining Portions Of 6, 7, 8 And 10 Of The Farm Kwaggafontein 8 In The Carolina Magisterial District, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Scoping Report for the Proposed Construction of a Warehouse and Associated Infrastructure at Perseverance in Port Elizabeth, Eastern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Establishment of a Diesel Farm and a Haul Road for the Tshipi Borwa mine Near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Changes to Operations at the UMK Mine near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Ventersburg Project-An Underground Mining Operation near Ventersburg and Henneman, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological desktop assessment of the proposed development of a 3000 MW combined cycle gas turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Revalidation of the lapsed General Plans for Elliotdale, Mbhashe Local Municipality. Bloemfontein.

Butler, E. 2017. Palaeontological assessment of the proposed development of a 3000 MW Combined Cycle Gas Turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the new open cast mining operations on the remaining portions of 6, 7, 8 and 10 of the farm Kwaggafontein 8 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed mining of the farm Zandvoort 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of open pit mining at Pit 36W (New Pit) and 62E (Dishaba) Amandelbult Mine Complex, Thabazimbi, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed development of the sport precinct and associated infrastructure at Merrifield Preparatory school and college, Amathole Municipality, East London. PGS Heritage. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed construction of the Lehae training and fire station, Lenasia, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new open cast mining operations of the Impunzi mine in the Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the Lephalale coal and power project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelburg, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

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.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

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.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed of the Lephalale Coal and Power Project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

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

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.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

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

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 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 decommisioning 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.

Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

Butler, E. 2018 Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

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.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delportshoop in the Northern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption letter for the proposed reclamation and reprocessing of the City Deep Dumps and Rooikraal Tailings Facility in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Mookodi – Mahikeng 400kV Line, North West Province. Bloemfontein.

Butler, E. 2018. Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein And Sutherland In The Northern Cape Province.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of the Tooverberg Wind Energy Facility, and associated grid connection near Touws River in the Western Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological impact assessment of the proposed Kalabasfontein Mining Right Application, near Bethal, Mpumalanga.

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.

E. Butler. 2019. Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

E. Butler. 2019. Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

E. Butler. 2019. Palaeontological Field Assessement for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.

E. Butler. 2019. Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.

E. Butler. 2019. Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

E. Butler. 2019. Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

E. Butler. 2019. Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo

E. **Butler. 2019.** Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province

E. Butler. 2019. Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.

E. Butler. 2019. Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.

E. Butler. 2019. Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

E. Butler. 2019. Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

E. Butler. 2019. Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province.

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.

E. Butler. 2019. Palaeontological Desktop Assessment for The Proposed 920 Kwp Groenheuwel Solar Plant Near Augrabies, Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment for the establishment of a Super Fines Storage Facility at Amandelbult Mine, Near Thabazimbi, Limpopo Province

E. Butler. 2019. Palaeontological Impact Assessment for the proposed Sace Lifex Project, Near Emalahleni, Mpumalanga Province

E. Butler. 2019. Palaeontological Desktop Assessment for the proposed Rehau Fort Jackson Warehouse Extension, East London

E. Butler. 2019. Palaeontological Desktop Assessment for the proposed Environmental Authorisation Amendment for moving 3 Km Of the Merensky-Kameni 132KV Powerline

E. Butler. 2019. Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape

E. Butler. 2019. Palaeontological Desktop Assessment for six proposed Black Mountain Mining Prospecting Right Applications, without Bulk Sampling, in the Northern Cape.

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

E. Butler. 2019. Palaeontological Desktop Assessment Of The Proposed Upgrade Of The Vaal Gamagara Regional Water Supply Scheme: Phase 2 And Groundwater Abstraction

E. Butler. 2019. Palaeontological Desktop Assessment Of The Expansion Of The Jan Kempdorp Cemetry On Portion 43 Of Farm Guldenskat 36-Hn, Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment of the Proposed Residential Development On Portion 42 Of Farm Geldunskat No 36 In Jan Kempdorp, Phokwane Local Municipality, Northern Cape Province

E. Butler. 2019. Palaeontological Impact Assessment of the proposed new Township Development, Lethabo Park, on Remainder of Farm Roodepan No 70, Erf 17725 And Erf 15089, Roodepan Kimberley, Sol Plaatjies Local Municipality, Frances Baard District Municipality, Northern Cape

E. Butler. 2019. Palaeontological Protocol for Finds for the proposed 16m WH Battery Storage System in Steinkopf, Northern Cape Province

E. Butler. 2019. Palaeontological Exemption Letter of the proposed 4.5WH Battery Storage System near Midway-Pofadder, Northern Cape Province

E. Butler. 2019. Palaeontological Exemption Letter of the proposed 2.5ml Process Water Reservoir at Gloria Mine, Black Rock, Hotazel, Northern Cape

E. Butler. 2019. Palaeontological Desktop Assessment for the Establishment of a Super Fines Storage Facility at Gloria Mine, Black Rock Mine Operations, Hotazel, Northern Cape:

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed New Railway Bridge, and Rail Line Between Hotazel And The Gloria Mine, Northern Cape Province

E. Butler. 2019. Palaeontological Exemption Letter Of The Proposed Mixed Use Commercial Development On Portion 17 Of Farm Boegoeberg Settlement Number 48, !Kheis Local Municipality In The Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment of the Proposed Diamond Mining Permit Application Near Kimberley, Sol Plaatjies Municipality, Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment of the Proposed Diamonds (Alluvial, General & In Kimberlite) Prospecting Right Application near Postmasburg, Registration Division; Hay, Northern Cape Province

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed diamonds (alluvial, general & in kimberlite) prospecting right application near Kimberley, Northern Cape Province.

E. Butler. 2019. Palaeontological Phase 1 Impact Assessment of the proposed upgrade of the Vaal Gamagara regional water supply scheme: Phase 2 and groundwater abstraction

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed seepage interception drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province

E. Butler. 2019. Palaeontological Desktop Assessment letter for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng.

E. Butler. 2019. Palaeontological Phase 1 Assessment letter for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng.

E. Butler. 2019. Palaeontological field Assessment for the Proposed Upgrade of the Kolomela Mining Operations, Tsantsabane Local Municipality, Siyanda District Municipalitty, Northern Cape Province, Northern Cape

E. Butler. 2019. Palaeontological Desktop Assessment of the proposed feldspar prospecting rights and mining application on portion 4 and 5 of the farm Rozynen 104, Kakamas South, Kai! Garib Municipality, Zf Mgcawu District Municipality, Northern Cape

E. Butler. 2019. Palaeontological Phase 1 Field Assessment of the proposed Summerpride Residential Development and Associated Infrastructure on Erf 107, Buffalo City Municipality, East London.

E. Butler. 2019. Palaeontological Desktop Impact Assessment for the proposed re-commission of the Old Balgray Colliery near Dundee, Kwazulu Natal.

E. Butler. 2019. Palaeontological Phase 1 Impact Assessment for the Proposed Re-Commission of the Old Balgray Colliery near Dundee, Kwazulu Nata.l

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery.

E. Butler. 2019. Palaeontological Impact Assessment and Protocol for Finds of a Proposed New Quarry on Portion 9 (of 6) of the farm Mimosa Glen 885, Bloemfontein, Free State Province

E. Butler. 2019. Palaeontological Impact Assessment and Protocol for Finds of a proposed development on Portion 9 and 10 of the Farm Mimosa Glen 885, Bloemfontein, Free State Province

E. Butler. 2019. Palaeontological Exemption Letter for the proposed residential development on the Remainder of Portion 1 of the Farm Strathearn 2154 in the Magisterial District of Bloemfontein, Free State

E. Butler. 2019. Palaeontological Field Assessment for the Proposed Nigel Gas Transmission Pipeline Project in the Nigel Area of the Ekurhuleni Metropolitan Municipality, Gauteng Province

E. Butler. 2019. Palaeontological Desktop Assessment for five Proposed Black Mountain Mining Prospecting Right Applications, Without Bulk Sampling, in the Northern Cape.

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and an Integrated Water Use Licence Application for the Reclamation of the Marievale Tailings Storage Facilities, Ekurhuleni Metropolitan Municipality - Gauteng Province.

E. Butler. 2019. Palaeontological Impact Assessment for the Proposed Sace Lifex Project, near Emalahleni, Mpumalanga Province.

E. Butler. 2019. Palaeontological Desktop Assessment for the proposed Golfview Colliery near Ermelo, Msukaligwa Local Municipality, Mpumalanga Province

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed Kangra Maquasa Block C Mining development near Piet Retief, in the Mkhondo Local Municipality within the Gert Sibande District Municipality

E. Butler. 2019. Palaeontological Desktop Assessment for the Proposed Amendment of the Kusipongo Underground and Opencast Coal Mine in Support of an Environmental Authorization and Waste Management License Application.

E. Butler. 2019. Palaeontological Exemption Letter of the Proposed Mamatwan Mine Section 24g Rectification Application, near Hotazel, Northern Cape Province

E. Butler. 2020. Palaeontological Field Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery

E. Butler. 2020. Palaeontological Desktop Assessment for the Proposed Extension of the South African Nuclear Energy Corporation (Necsa) Pipe Storage Facility, Madibeng Local Municipality, North West Province

E. Butler. 2020. Palaeontological Field Assessment for the Proposed Piggery on Portion 46 of the Farm Brakkefontien 416, Within the Nelson Mandela Bay Municipality, Eastern Cape

E. Butler. 2020. Palaeontological field Assessment for the proposed Rietfontein Housing Project as part of the Rapid Land Release Programme, Gauteng Province Department of Human Settlements, City of Johannesburg Metropolitan Municipality

E. Butler. 2020. Palaeontological Desktop Assessment for the Proposed Choje Wind Farm between Grahamstown and Somerset East, Eastern Cape

E. Butler. 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application for the Prospecting of Diamonds (Alluvial, General & In Kimberlite), Combined with A Waste License Application, Registration Division: Gordonia And Kenhardt, Northern Cape Province

E. Butler. 2020. Palaeontological Impact Assessment for the Proposed Clayville Truck Yard, Ablution Blocks and Wash Bay to be Situated on Portion 55 And 56 Of Erf 1015, Clayville X11, Ekurhuleni Metropolitan Municipality, Gauteng Province

E. Butler. 2020. Palaeontological Desktop Assessment for the Proposed Hartebeesthoek Residential Development

E. Butler. 2020. Palaeontological Desktop Assessment for the Proposed Mooiplaats Educational Facility, Gauteng Province

E. Butler. 2020. Palaeontological Impact Assessment for the Proposed Monument Park Student Housing Establishment

E. Butler. 2020. Palaeontological Field Assessment for the Proposed Standerton X10 Residential and Mixed-Use Developments, Lekwa Local Municipality Standerton, Mpumalanga Province

E. Butler. 2020. Palaeontological Field Assessment for the Rezoning and Subdivision of Portion 6 Of Farm 743, East London

E. Butler. 2020. Palaeontological Field Assessment for the Proposed Matla Power Station Reverse Osmosis Plant, Mpumalanga Province

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.18 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.

Butler, E., and J. Botha-Brink. Postcranial skeleton of *Galesaurus planiceps*, implications for biology and lifestyle.14th Conference of the PSSA, Matjesfontein, South Africa. September 2008:

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