

**PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED TOWNSHIP
DEVELOPMENT ON PORTION OF THE FARM KLIPFONTEIN 716 AND FARM CERES 626,
BLOEMFONTEIN, MANGAUNG METROPOLITAN MUNICIPALITY, FREE STATE**

CaseID: 15154

Compiled for:

Inaluk Consulting Services

Boardwalk Office Park
Block 9 unit 2
6 Eros Road
Fearie Glen

Prepared by

Banzai Environmental

18 July 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;

PALAEONTOLOGICAL CONSULTANT:

Banzai Environmental (Pty) Ltd

CONTACT PERSON:

Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com



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 8 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 vita	Appendix A	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page 1 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 1 and 11	
(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 11	
(g) An identification of any areas to be avoided, including buffers		No buffers or areas of sensitivity identified
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 11	
(k) Any mitigation measures for inclusion in the EMPr	Section 12	
(l) Any conditions for inclusion in the environmental authorisation	Section 12	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A	
(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		Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised.
(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 applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Inaluk Consulting Services to conduct the Palaeontological Impact Assessment (PIA) to assess the proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a PIA is necessary to identify the presence of fossil material within the planned development footprint. This PIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State is underlain by the Adelaide Subgroup, Balfour Formation of the Karoo Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Adelaide Subgroup is Very High (Almond *et al*, 2013; SAHRIS website; Figure 6).

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 18 July 2020. No visible evidence of fossiliferous outcrops was found. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the proposed new Township development in Bloemfontein will be of a low significance in palaeontological terms. Thus, the construction and development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist.

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TABLE OF CONTENT

1	INTRODUCTION	8
2	QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	8
3	LEGISLATION	12
3.1	National Heritage Resources Act (25 of 1999)	12
4	OBJECTIVE	12
5	GEOLOGICAL AND PALAEOLOGICAL HISTORY	14
6	GEOGRAPHICAL LOCATION OF THE SITE	19
7	METHODS.....	19
7.1	Assumptions and Limitations	19
8	ADDITIONAL INFORMATION CONSULTED	20
9	SITE VISIT.....	20
10	IMPACT ASSESSMENT METHODOLOGY AND HIERARCHY.....	25
10.1	Impact Rating System	25
10.2	Summary of Impacts	29
11	FINDINGS AND RECOMMENDATIONS.....	29
12	CHANCE FINDS PROTOCOL.....	30
12.1	Legislation	30
12.2	Background	30
12.3	Introduction	30
12.4	Chance Find Procedure	31
13	REFERENCES	32

List of Figures

Figure 1 –Google Earth Image (2020) indicating the Regional setting of the proposed new township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State.....	9
Figure 2 – Close up Google Earth Image (2020) Google Earth Image (2020) indicating the Regional setting of the proposed new township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State.....	10
Figure 3 – Local setting.....	11
Figure 4: Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions of the Beaufort Group with rock units and fossil assemblage zones relevant to the present study marked in blue (Modified from Rubidge 1995). The subdivisions of the Beaufort Group include the Adelaide and Tarkastad Subgroups and range in age from Late Permian to Middle Triassic. Abbreviations: F. = Formation, M. = Member.....	16
Figure 5 - Extract of the 1: 250 000 2926 Bloemfontein Geological Map (Council of Geosciences, Pretoria). The study area is underlain by the Adelaide Subgroup, Balfour Formation of the Karoo Supergroup.	17
Figure 6 - Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the locality of the proposed development.	18
Figure 7 – View from the southern corner overlooking the proposed new township development.	21
Figure 8 – Centre of the proposed development.	22
Figure 9 – South-eastern border of the proposed development.	23
Figure 10 – Northern corner of the proposed development.....	24
Figure 11 – View from the north-western border overlooking the proposed development.	25

List of Tables

Table 1 - NEMA Table.....	3
Table 2: Stratigraphy of the Adelaide Subgroup.....	14
Table 3: The rating system.....	26

Appendix A: CV

1 INTRODUCTION

Mangaung Metropolitan Municipality proposes the development of a new township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State (Figure 1-3). Ngoti Development appointed Inaluk Consulting Service to conduct the EIA for the authorisation of the proposed development.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 14 years. She has been conducting Palaeontological Impact Assessments (PIA) since 2014.

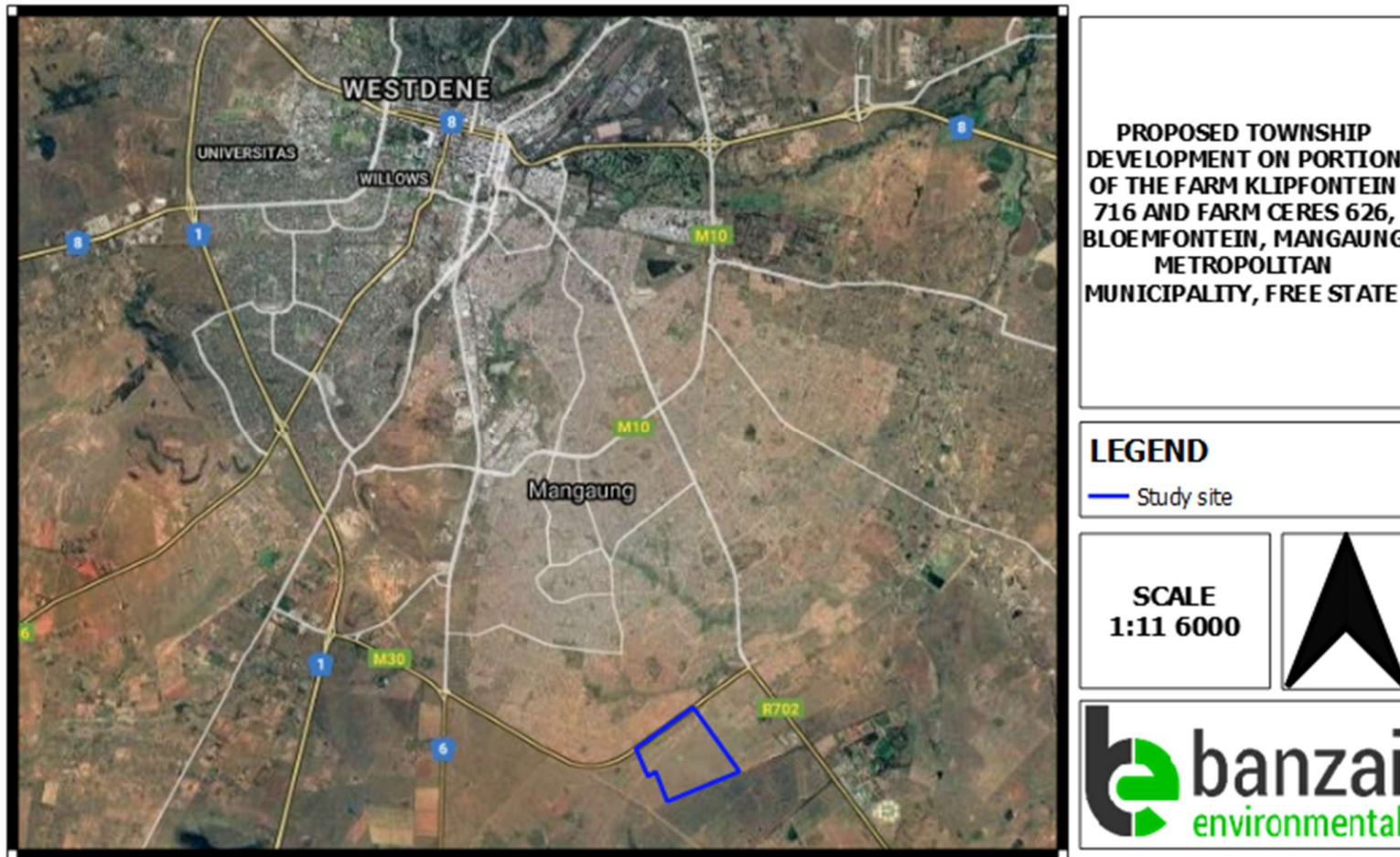


Figure 1 –Google Earth Image (2020) indicating the Regional setting of the proposed new township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State.

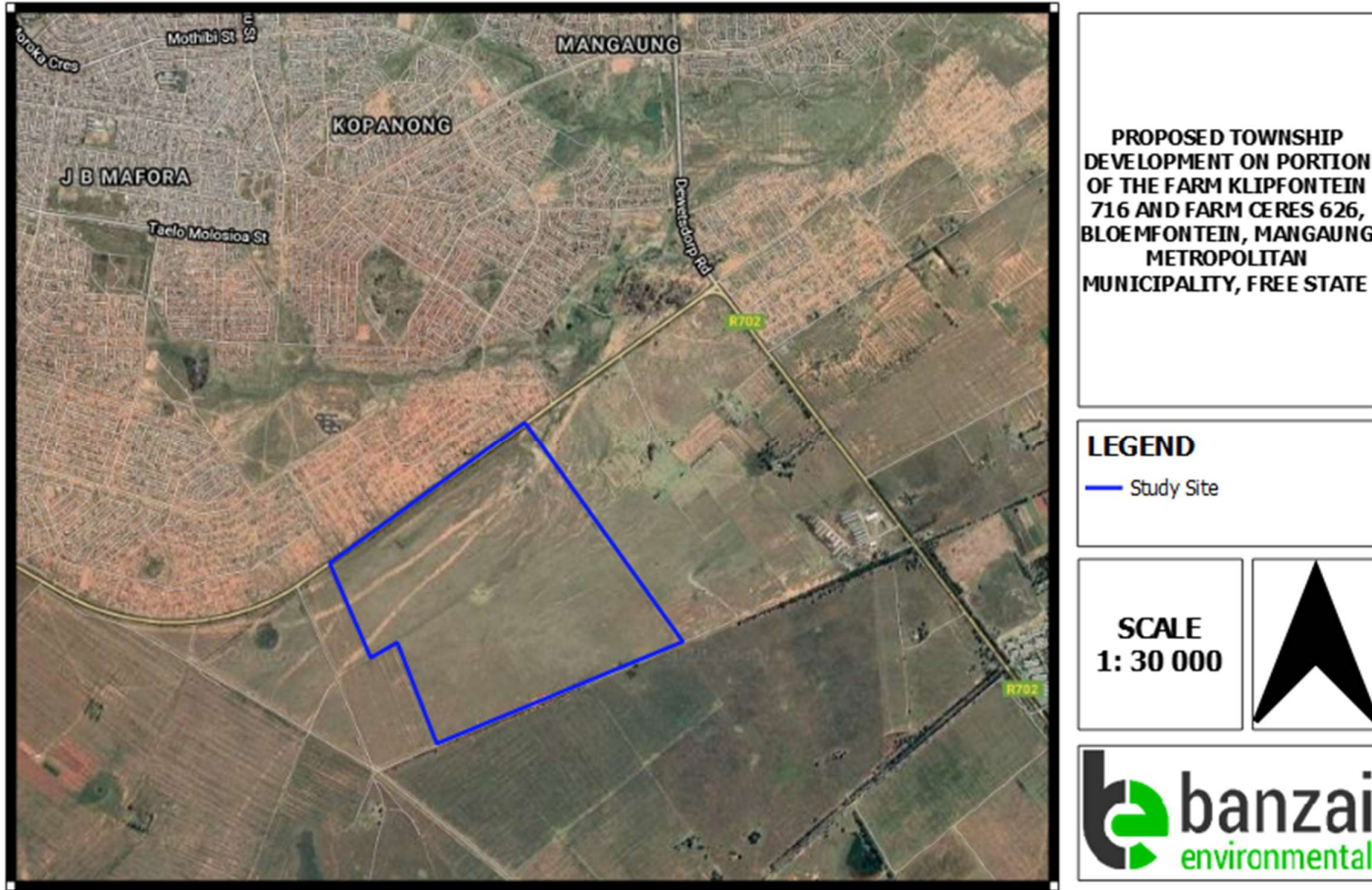


Figure 2 – Close up Google Earth Image (2020) Google Earth Image (2020) indicating the Regional setting of the proposed new township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State.

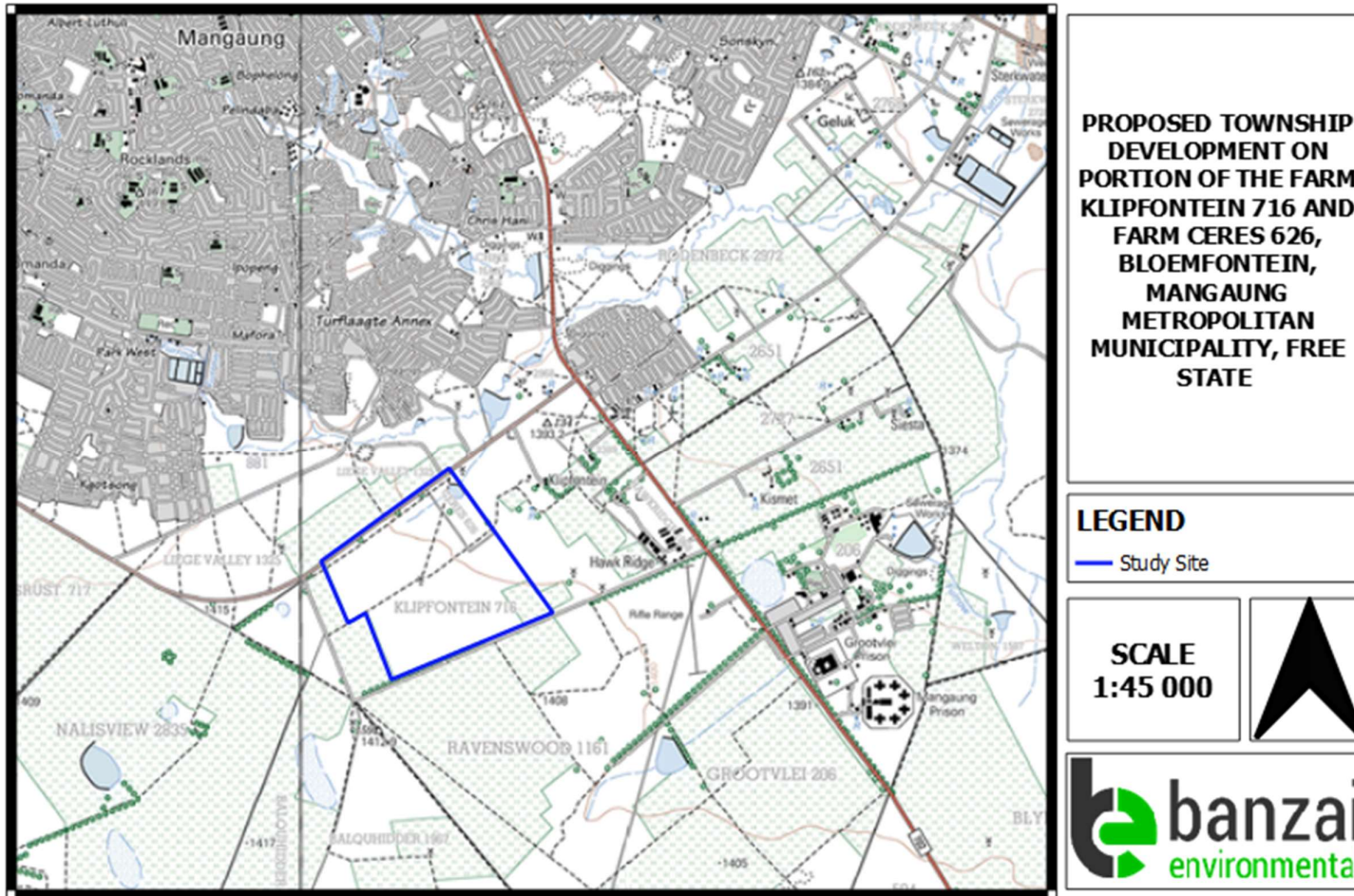


Figure 3 – Local setting.

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

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

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

4 OBJECTIVE

The aim of a PIA is to decrease the effect of the development on potential fossils at the development site.

According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the purpose of the Paleontological

Impact Assessment (PIA) are: 1) to **identify** the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to determine the **impact** on fossil heritage; and 4) to **recommend** how the property developer should guard against and lessen 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/kml's) in the proposed development.
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
 - a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
 - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
 - c. **Cumulative impacts** result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and Implications of specialist findings for the proposed development (such as permits, licenses etc).

5 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State is depicted on the 1:250 000 2926 Bloemfontein Geological Map (Council of Geosciences). The proposed new township development is underlain by Adelaide Subgroup, Balfour Formation of the Karoo Supergroup (Table 2, Figure 4-5). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Adelaide Subgroup is Very High (Almond *et al*, 2013; SAHRIS website; Figure 6). The Balfour Formation forms the upper part of the Adelaide Subgroup and part of what was called lower to middle Beaufort. The proposed development falls in the *Daptocephalus* Assemblage Zone (Figure 4).

Table 2: Stratigraphy of the Adelaide Subgroup

Period	Supergroup	Group	Subgroup	Formation West of 24° E	Formation East of 24° E
Middle Permian - Middle Triassic	Karoo Supergroup	Beaufort Group	Adelaide Subgroup		Balfour Formation
				Teekloof Formation	Middleton Formation
				Abrahamskraal Formation	Koonop Formation

The proposed township development in Bloemfontein is underlain by a series of Karoo sandstones, mudstones and shales, deposited under fluvial environments of the Adelaide Subgroup that forms part of the Beaufort Group. The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup. The Beaufort group overlays the Ecca Group and consists essentially of sandstones and shales, deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods and was deposited on land through alluvial processes. The Beaufort Group covers a total land surface area of approximately 200 000 km² in South Africa and is the first fully continental sequence in the Karoo Supergroup. This Group is divided into the Adelaide subgroup and the overlying Tarkastad subgroup. The Adelaide subgroup rocks are deposited under a humid climate that allowed for the establishment of wet floodplains with high water tables and are interpreted to be fluvio-lacustrine sediments.

Stratigraphy

In the south eastern portion of the Karoo Basin the Adelaide Subgroup consists of the Koonop, Middleton and Balfour Formations. West of 24° the Adelaide Subgroup is represented by the Abrahamskraal and Teekloof Formations and in the north the Group is represented by the Normandien Formation. The Adelaide Subgroup is approximately 5 000 m thick in the southeast but decreases to about 800 m in the centre of the basin which thinness out to about 100 to 200m in the north. The Koonop

Formation is about 1 300 m, Middleton 1 600 m and the Balfour Formation approximately 200 m thick. The Abrahamskraal Formation is about 2 500 m thick and the Teekloof Formation 1 000 m. The Normandien Formation is only about 320 m thick.

The Adelaide Subgroup contains alternating greyish-red, bluish-grey, or greenish-grey mudrocks in the southern and central parts of the Karoo Basin with very fine to medium grained, grey lithofeldspathic sandstones. Singular sandstone units could vary from 6 meters to 60 meters in the south thinning northwards. Thicker sandstones of the Adelaide are usually multi-storey and usually have cut-and fill features. The sandstones are characterized internally by horizontal lamination together with parting lineation and less frequent trough crossbedding as well as current ripple lamination. The bases of the sandstone units are massive beds, while ripple lamination is usually confined to thin sandstones towards the top of the thicker units.

The *Daptocephalus* Assemblage Zone of the Beaufort Group shows the greatest vertebrate diversity and includes numerous well-preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida as well as captorhinid Reptilia and less well represented eosuchian Reptilia, Amphibia and Pisces. Trace fossils of vertebrates and invertebrates as well as Glossopteris flora plants have also been described (Abdala *et al*, 2006; Botha *et al*, 2007; Damiani *et al*, 2003, Modesto *et al*, 2010, Smith *et al*, 2005).

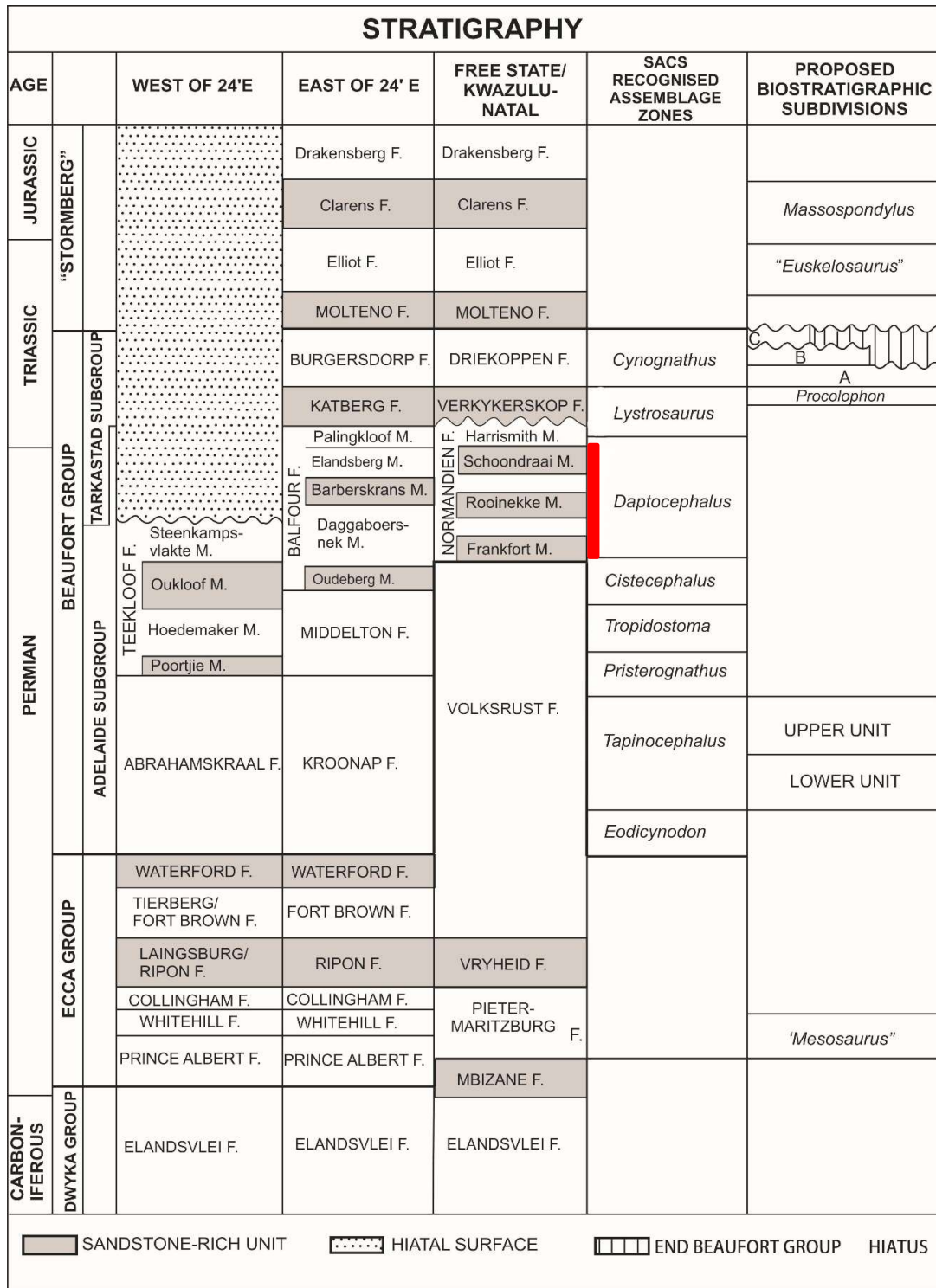


Figure 4: Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions of the Beaufort Group with rock units and fossil assemblage zones relevant to the present study marked in blue (Modified from Rubidge 1995). The subdivisions of the Beaufort Group include the Adelaide and Tarkastad Subgroups and range in age from Late Permian to Middle Triassic. Abbreviations: F. = Formation, M. = Member.

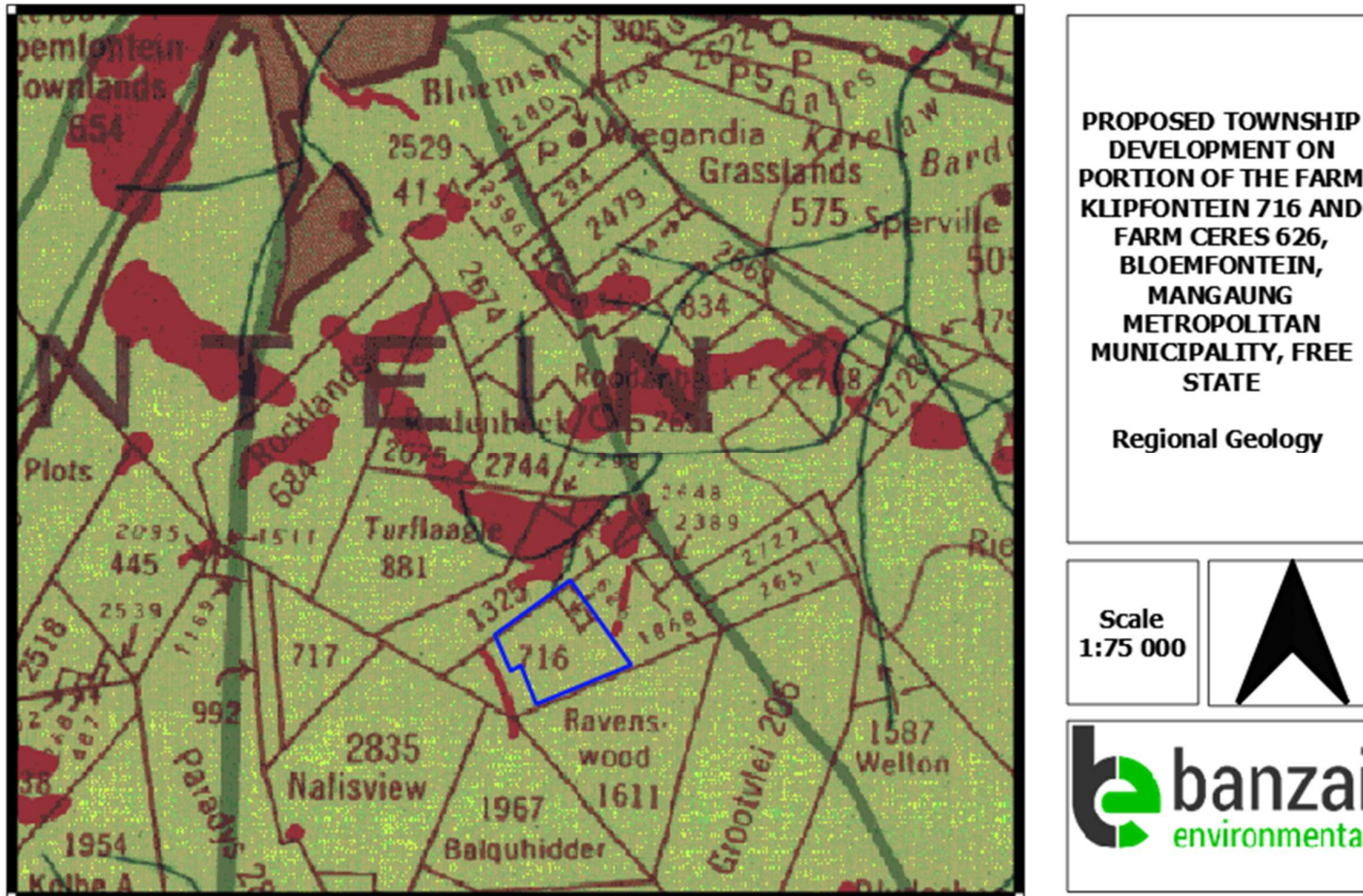


Figure 5 - Extract of the 1: 250 000 2926 Bloemfontein Geological Map (Council of Geosciences, Pretoria). The study area is underlain by the Adelaide Subgroup, Balfour Formation of the Karoo Supergroup.

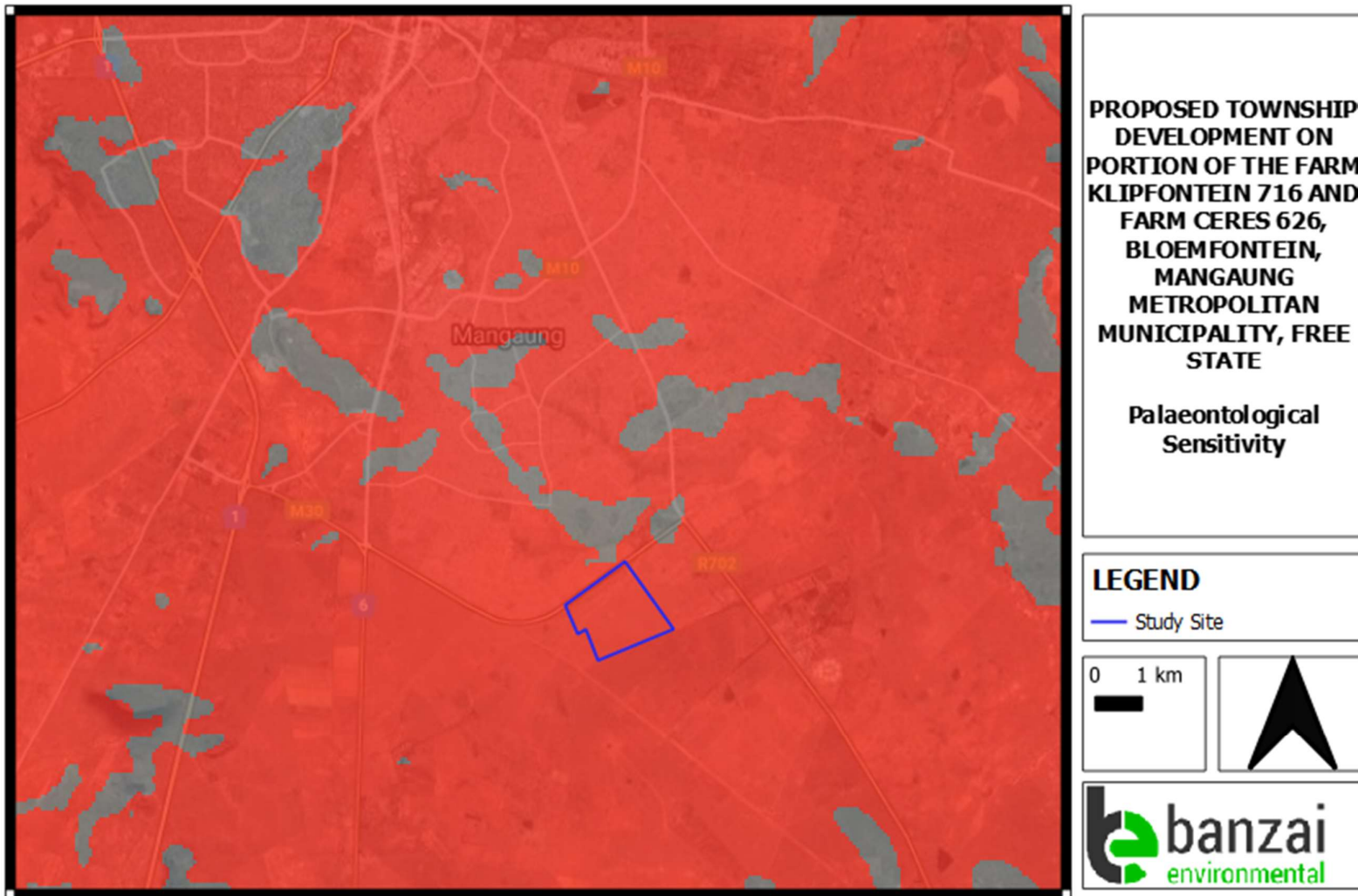


Figure 6 - Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the locality of the proposed development.

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 66) there is a Very High chance of finding fossils in this area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State and is situated across the road from an already established township area (near Kopanong) which is almost 214,1 ha in extent. The site is next to the Dewetsdorp Road (Figure 1-3). The proposed development is about 17 km from Bloemfontein central.

7 METHODS

The aim of a PIA 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: PIA reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

When conducting a PIA several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have not been reviewed by

palaeontologists and data is generally based on aerial photographs. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is used to provide information on the existence of fossils in an area which was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment is thus necessary to 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 2926 Bloemfontein Geological Map (Council of Geosciences, Pretoria).
- A Google Earth map with polygons of the proposed development was obtained from Inaluk Consulting Service

9 SITE VISIT

A one-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 18 July 2020. The following photographs were taken during the site visit to the proposed development. No fossiliferous outcrop was identified during the site visit. Well-preserved fossils may be found during excavations and due care must be taken to preserve them- see protocol for finds.



Figure 7 – *View from the southern corner overlooking the proposed new township development.*



Figure 8 – Centre of the proposed development.



Figure 9 – South-eastern border of the proposed development.



Figure 10 – Northern corner of the proposed development.



Figure 11 – View from the north-western border overlooking the proposed development.

10 IMPACT ASSESSMENT METHODOLOGY AND HIERARCHY

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 3: *The rating system*

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

Table 1 Continues

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be

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

Table 1 Continues

REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

Table 1 Continues

SIGNIFICANCE		
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

10.2 Summary of Impacts

The impact on Fossil Heritage is DIRECT NEGATIVE. Only the study site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent. The impact is highly destructive but will only occur during the construction phase. The significance of the impact occurring will be **low**. As fossil heritage will be destroyed the impact is **irreversible** but the degree to which the impact can cause irreplaceable loss of resources is Low if proper mitigation is to undertaken.

11 FINDINGS AND RECOMMENDATIONS

The proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State is underlain by the Adelaide Subgroup, Balfour Formation of the Karoo Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Adelaide Subgroup is Very High (Almond *et al*, 2013; SAHRIS website; Figure 6).

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 18 July 2020. No visible evidence of fossiliferous outcrops was found. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the proposed new Township development in Bloemfontein will be of a low significance in palaeontological terms. Thus, the construction and development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist.

12 CHANCE FINDS PROTOCOL

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

12.1 Legislation

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

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

12.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

12.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

12.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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Appendix A – 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

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

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

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

Research Assistant National Museum, Bloemfontein 1993 – 1997

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

TECHNICAL REPORTS

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