

**PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED ESTABLISHMENT
OF AN EMULSION PLANT ON ERF 1559, HARDUSTRIA, HARRISMITH, FREE STATE.**

**Prepared by:
BANZAI ENVIRONMENTAL (PTY) LTD
12 January 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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CONTACT PERSON:

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Email: elizebutler002@gmail.com

SIGNATURE:

A handwritten signature in black ink, appearing to read 'Elize Butler', written in a cursive style.

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

NEMA Regs (2014) - Appendix 6	Relevant section in report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii and iii of Report – Contact details and company and Appendix B
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4 – Objective
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 – Geological and Palaeontological history
(B) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10
d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1 and 9
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modeling used;	Section 7 Approach and Methodology
f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 5
g) an identification of any areas to be avoided, including buffers;	Not identified, Section 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

NEMA Regs (2014) - Appendix 6	Relevant section in report
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 11
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorization;	Section 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorization;	N/A
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorized; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable.
q) any other information requested by the competent authority.	Not applicable.
2) Where a government notice <i>gazetted</i> by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Turn 180 Environmental Consultants to conduct the **Palaeontological Field Assessment** to assess the proposed Emulsion Plant on erf 1559, Hardustria, Harrismith, Free State. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA) declares that a Palaeontological Impact Assessment (PIA) is key to verify the presence of fossil material within the planned development. This Assessment is thus necessary to evaluate the effect of the construction on palaeontological resources.

The proposed Harrismith emulsion development is situated within the Late Permian sedimentary rocks of the Normandien Formation, Adelaide Subgroup, (Beaufort Group of the Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Normandien Formation is Very High (Almond and Pether 2008, SAHRIS website).

A day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 30 December 2019. No fossiliferous outcrop was found in the proposed development area. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The apparent rarity of fossil heritage at the proposed development footprint suggests that the impact of the emulsion plant establishment in Harrismith will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted 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 ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO/site manager 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 mitigation (recording and collection) can be carry out by a paleontologist.

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1 INTRODUCTION

Turn 180 Environmental Consultants was employed by the South African Road Binders (Pty) Ltd. as Environmental Assessment Practitioner to manage the required authorisation processes for the proposed Emulsion Plant on erf 1559, Hardustria, Harrismith, Free State. Banzai Environmental was in turn appointed by Turn 180 Environmental Consultants to conduct the **Palaeontological Field Assessment** (PIA) to assess the Palaeontological Heritage on the proposed development footprint.

The South African Road Binders (Pty) Ltd proposes the development of a Macadam preparation Emulsion Plant for which about 0.74 ha vegetation will be cleared (Figure 1-3). The Bitumen emulsion will be sold commercially for the construction and repair of roads. The operation of the Emulsion Plant includes mixing emulsifiers, chemicals additives and water with the heated raw bitumen in a colloid mill. The product will be stored in cold storage tanks from where it will be sold. The Plant will have the capacity to store approximately 1 102 000 L of hazardous chemicals including 9 000 L Diesel, 23 000 L Paraffin as well as 816 000 L Raw Bitumen and 254 000 L Bitumen Emulsion. Five tons of Caustic Soda and 5 000 L of Hydrochloric Acid will also be stored on site.

Proposed Site Description:

- The Site will be approximate 0.74 ha in extent.
- The Site is presently zoned as "General Industrial" but may be rezoned to allow an Emulsion Plant (Noxious Industrial).

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 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 and has been conducting PIAs since 2014.



Figure 1: Google Earth Image (2019) of the general location of the proposed Emulsion Plant on Farm 1559 in Harrismith, Free State is indicated in white.



Figure 2: Close-up Google Earth Image (2019) of the location of the proposed *Emulsion Plant on Farm 1559 in Harrismith, Free State* is indicated in white.

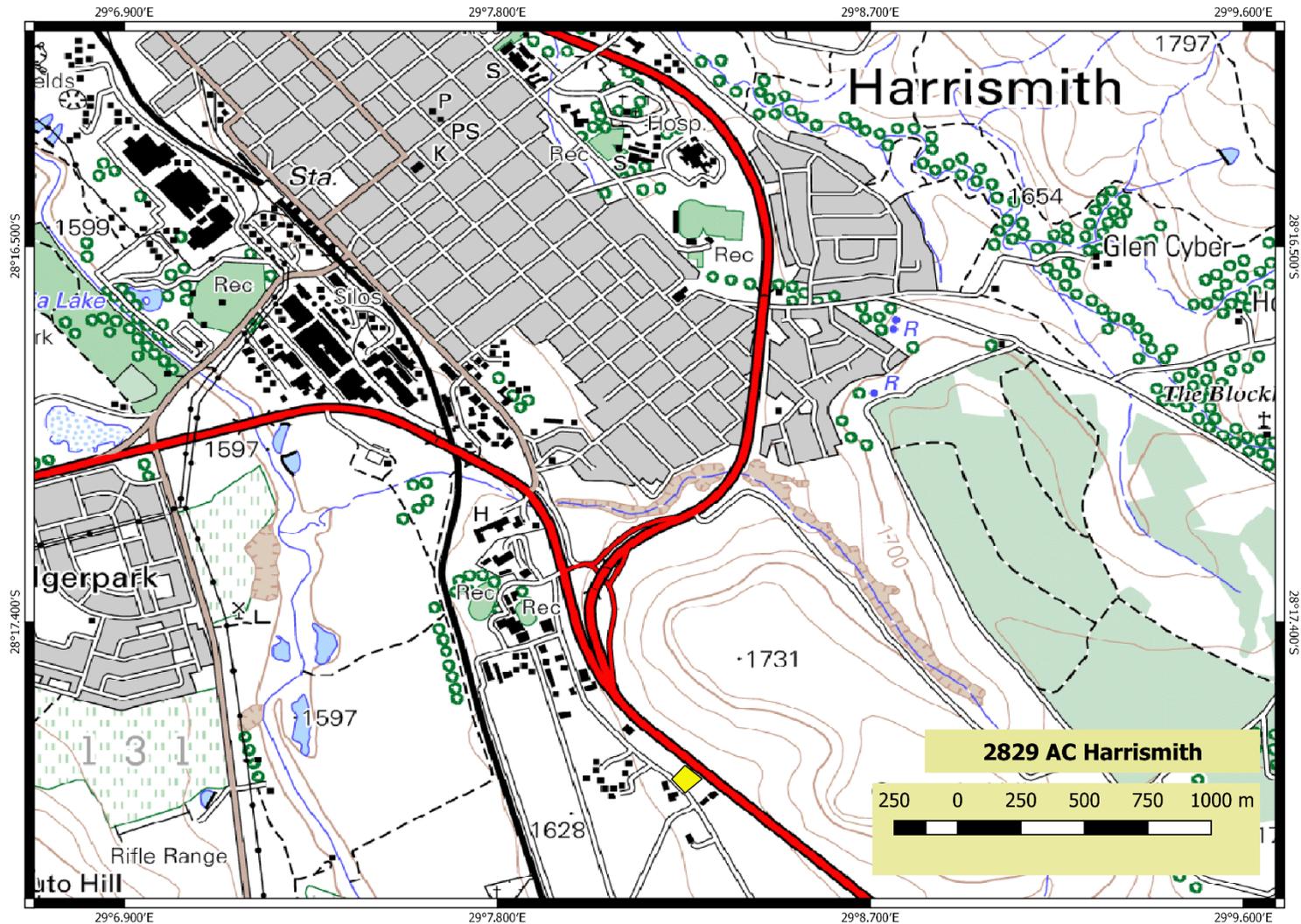


Figure 3: Extract of the 1: 50000, 2829 AC Harrismith topographical map indicating the location of the proposed Harrismith emulsion plant in yellow. Map drawn by QGIS 2.18.28.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

National Heritage Resources Act (25 of 1999)

Cultural Heritage includes all heritage resources and is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act comprise **“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 Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 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 Palaeontological Impact Assessment (PIA) is to decrease the effect of the development on potential fossils at the development site.

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

The geology of the Harrismith area is charted on the 1: 250 000 2828 Harrismith Geological Map (Council for Geoscience, Pretoria) with the explanation by Johnson and Verster (1994). The proposed Harrismith emulsion development is underlain by the Late Permian sedimentary rocks of the Normandien Formation, Adelaide Subgroup (Beaufort Group of the Karoo Supergroup) (Fig. 4-5). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Normandien Formation is Very High (Almond and Pether 2008, SAHRIS website).

The planned development is underlain by a series of Karoo mudstones, sandstones and shales, which were deposited under fluvial environments of the Adelaide Subgroup. The Adelaide Subgroup forms part of the Beaufort Group. The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup. This group overlays the Ecca (Figure 5) 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. The Beaufort Group was deposited on land through alluvial processes. This 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. The Beaufort Group is divided into the Adelaide 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 (Johnson *et al* 2006).

In the south eastern portion of the Karoo Basin the Adelaide Subgroup consists of the Koonap, 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 (Table 1). The Adelaide Subgroup is approximately 5 000 m thick in the southeast, but this decreases to about 800m in the centre of the basin which thins out to about 100 to 200m in the north. The Balfour Formation is 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 Beaufort Group is subdivided into a series of biostratigraphic units on the basis of its faunal content (Figure 5) (Kitching 1977, 1978; Keyser *et al*, 1977, Rubidge 1995). The formation present in the proposed development is the *Daptocephalus* Assemblage Zone (DAZ) (Rubidge 1995, Smith 2012; Viglietti *et al* 2015).

Table 1: Adelaide Subgroup (modified Johnson 2006)

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

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. In the northern Normandien formation the basin consists of coarse to very coarse sandstones and granulostones. Coarsening-upward cycles are present in the lower part of the Normandien Formation while the mudrocks and sandstone units usually form fining-upward cycles. These cycles are positioned on erosion surfaces which is overlain by thin intraformational mud-pellet conglomerate and vary in thickness from a few meters to tens of meters. Singular sandstone units could vary from 6 meters to 60 meters in the south thinning northwards but thick sandstone units are also present in the northern Normandien Formation (Groenewald 1989, 1990).

The 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 mudrocks of the Adelaide Subgroup usually has massive and blocky weathering apart from in the Normandien and Daggaboersnek Member (Groenewald 1989, 1990). Sometimes desiccation cracks and impressions of raindrops are present. In the mudstones of the Beaufort Group calcareous nodules and concretions occur throughout.

The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the worlds' most complete transition from early "reptiles" to mammals. Biotas of the diverse *Daptocephalus* Assemblage Zone are of special interest because they provide some of the best available information on terrestrial ecosystems immediately preceding the catastrophic end-Permian mass extinction (Gastaldo *et al.* 2005, Rubidge 2005; Smith *et al.* 1993, 2001, 2012). Vertebrate fossils are abundantly found in the sediments of the Beaufort Group. Authors describing the *Daptocephalus* fauna in detail include Kitching (in Rubidge 1995), and Smith *et al.* (2012). The *Daptocephalus* Assemblage Zone is characterized by the occurrence of the two therapsids namely *Dicynodon* and *Theriongnathus* (Figure 6) and may also include the following specimens: Articulated (as well as isolated bones and

bone fragments) of reptiles like the small millerettids and large pareiasaurs. Examples of dicynodonts include *Aulacephalodon*, *Diictodon*, *Dicynodon* and *Oudenodon*. A few Gorgonopsians and Therocephalians (*Theriongnathus*) have also been uncovered as well as primitive cynodonts like *Procynosuchus*, and biarmosuchians. Even aquatic vertebrates are represented by temnospondyl amphibians (usually disarticulated *Rhinesuchus*). Palaeoniscoid bony fish (*Atherstonia*, *Namaichthys*) have been uncovered as well as freshwater bivalves. Various trace fossils include coprolites, tetrapod burrows and trackways. Vascular plants are rare compared to the vertebrates but include leaves, roots and petrified woods (“*Dadoxylon*”) of the *Glossopteris* Flora (Bamford 2000, 2004).

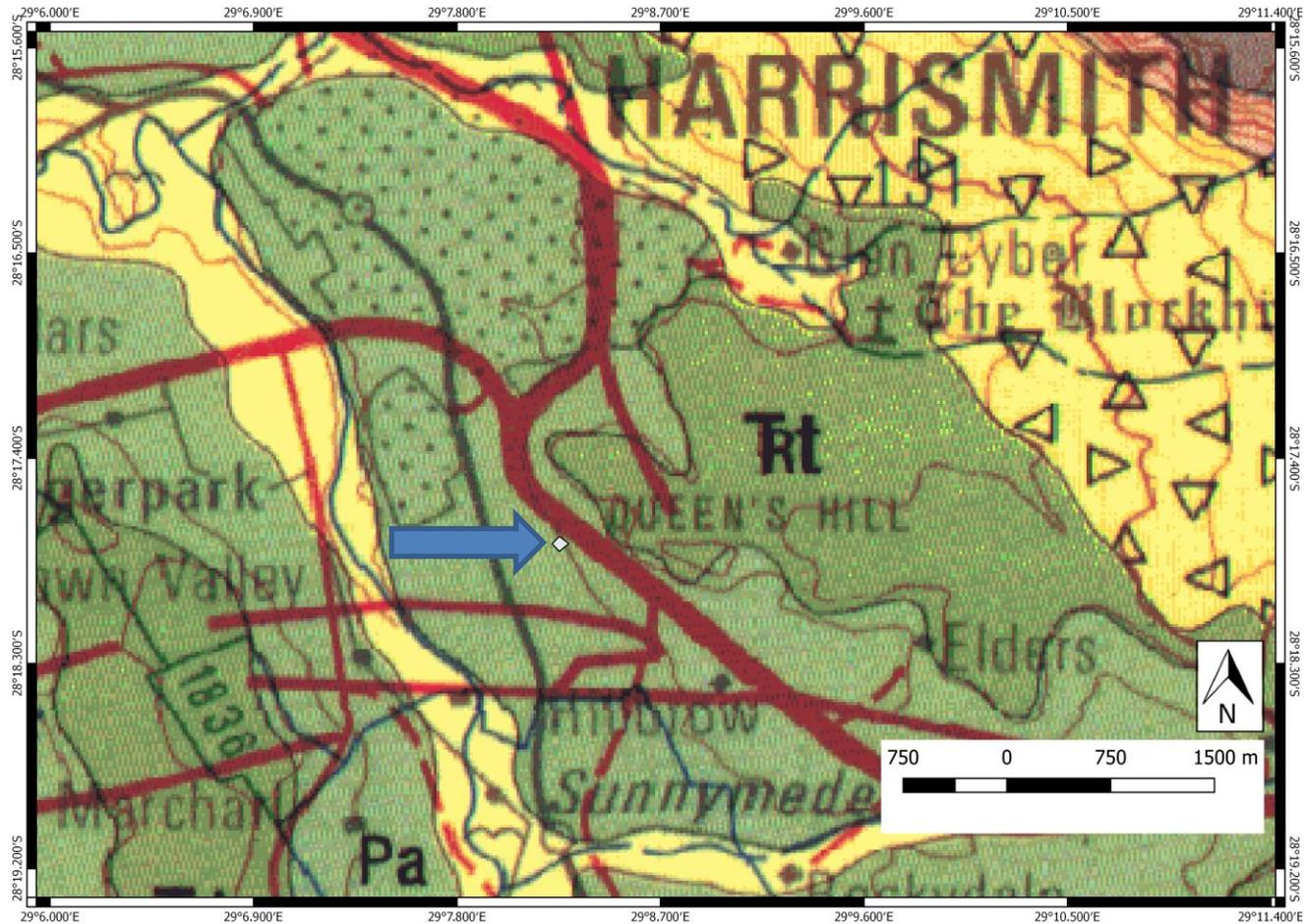
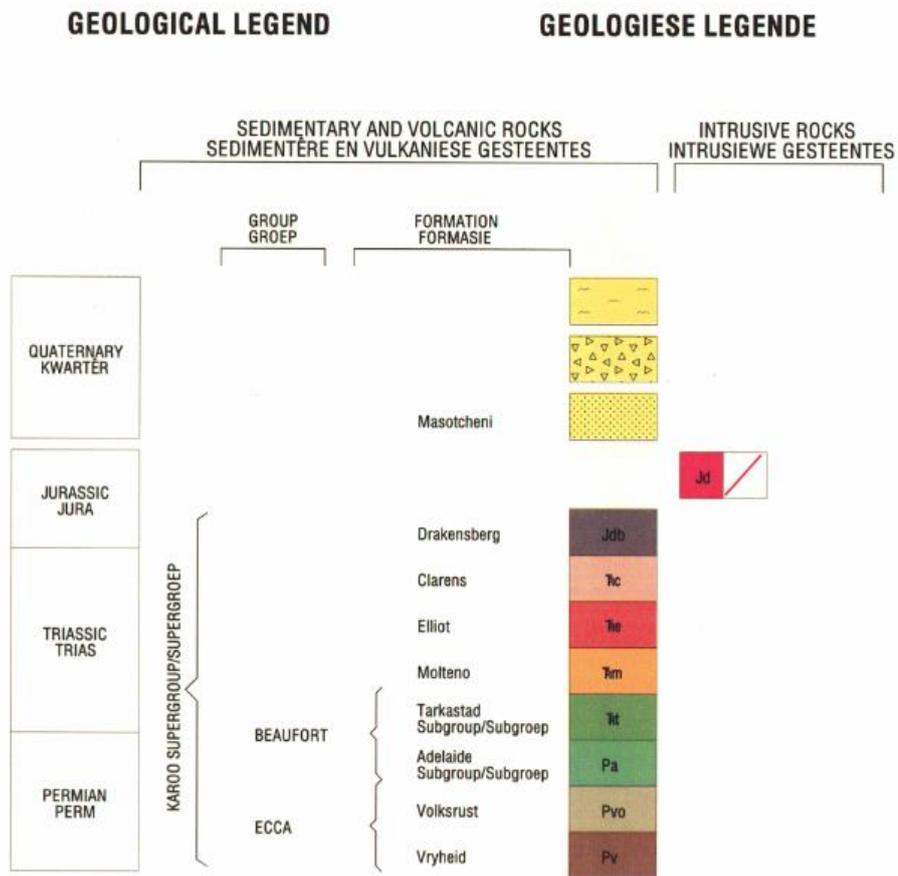


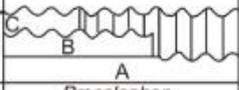
Figure 4: Extract of the 1:250 000 2828 Harrismith Geological map (Council of Geoscience) of the proposed Harrismith emulsion plant establishment, Free State. The proposed development is coloured in white and indicated by the blue arrow. The proposed development is located within the Late Permian sedimentary rocks of the Normandien Formation, Adelaide Subgroup (Beaufort Group of the Karoo Supergroup). Map drawn by QGIS 2.18.28.

LEGEND



Beaufort Group:

Normandien Formation (**Pa**, pale green) – Adelaide Subgroup (Lower Beaufort Group)
 Katberg Formation (**TRt**, dark green) – Tarkastad Subgroup (Upper Beaufort Group)

STRATIGRAPHY							
AGE		WEST OF 24°E	EAST OF 24° E	FREE STATE/ KWAZULU- NATAL	SACS RECOGNISED ASSEMBLAGE ZONES	PROPOSED BIOSTRATIGRAPHIC SUBDIVISIONS	
JURASSIC	"STORMBERG"		Drakensberg F.	Drakensberg F.			
			Clarens F.	Clarens F.		<i>Massospondylus</i>	
TRIASSIC	TARKASTAD SUBGROUP		Elliot F.	Elliot F.		" <i>Euskelosaurus</i> "	
			MOLTENO F.	MOLTENO F.			
PERMIAN	BEAUFORT GROUP	TEEKLOOF F.	BURGERSDORP F.	DRIEKOPPEN F.	<i>Cynognathus</i>		
			KATBERG F.	VERKYKERSKOP F.	<i>Lystrosaurus</i>	<i>Procolophon</i>	
			Palingkloof M.	Harrismith M.	<i>Daptocephalus</i>		
			Elandsberg M.	Schoondraai M.			
			Barberskrans M.	Rooinekke M.			
			Daggaboers- nek M.	Frankfort M.			
	ABRAHAMSKRAAL F.	KROONAP F.	VOLKSRUST F.	<i>Cistecephalus</i>	UPPER UNIT		
	ADELAIDE SUBGROUP			<i>Tropidostoma</i>	LOWER UNIT		
	ECCA GROUP	ADELAIDE SUBGROUP	WATERFORD F.	WATERFORD F.			
			TIERBERG/ FORT BROWN F.	FORT BROWN F.			
			LAINGSBURG/ RIPON F.	RIPON F.	VRYHEID F.		
			COLLINGHAM F.	COLLINGHAM F.	PIETER- MARITZBURG F.		
WHITEHILL F.			WHITEHILL F.				
PRINCE ALBERT F.			PRINCE ALBERT F.		<i>Mesosaurus</i> "		
CARBON- IFEROUS	DWYKA GROUP						
		ELANDSVLEI F.	ELANDSVLEI F.	ELANDSVLEI F.			

 SANDSTONE-RICH UNIT

 HIATAL SURFACE

 END BEAUFORT GROUP

 HIATUS

Figure 5: 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 red (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.

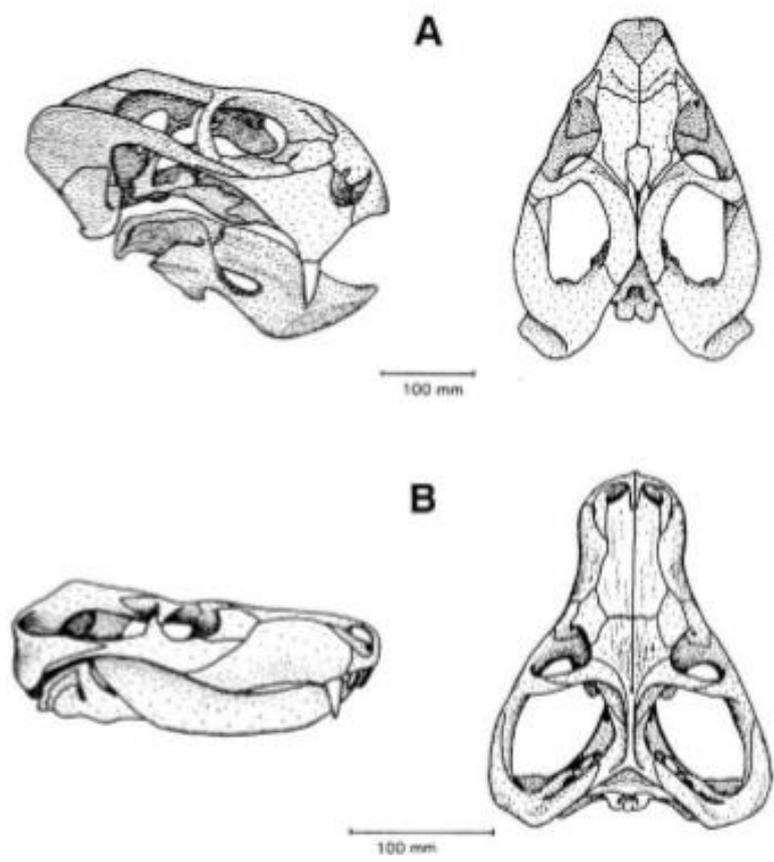


Figure 6: Dicynodon (A) and Theriognathus (B) skulls from the *Daptocephalus* Assemblage Zone. (Image taken from Kitching in Rubidge 1995).

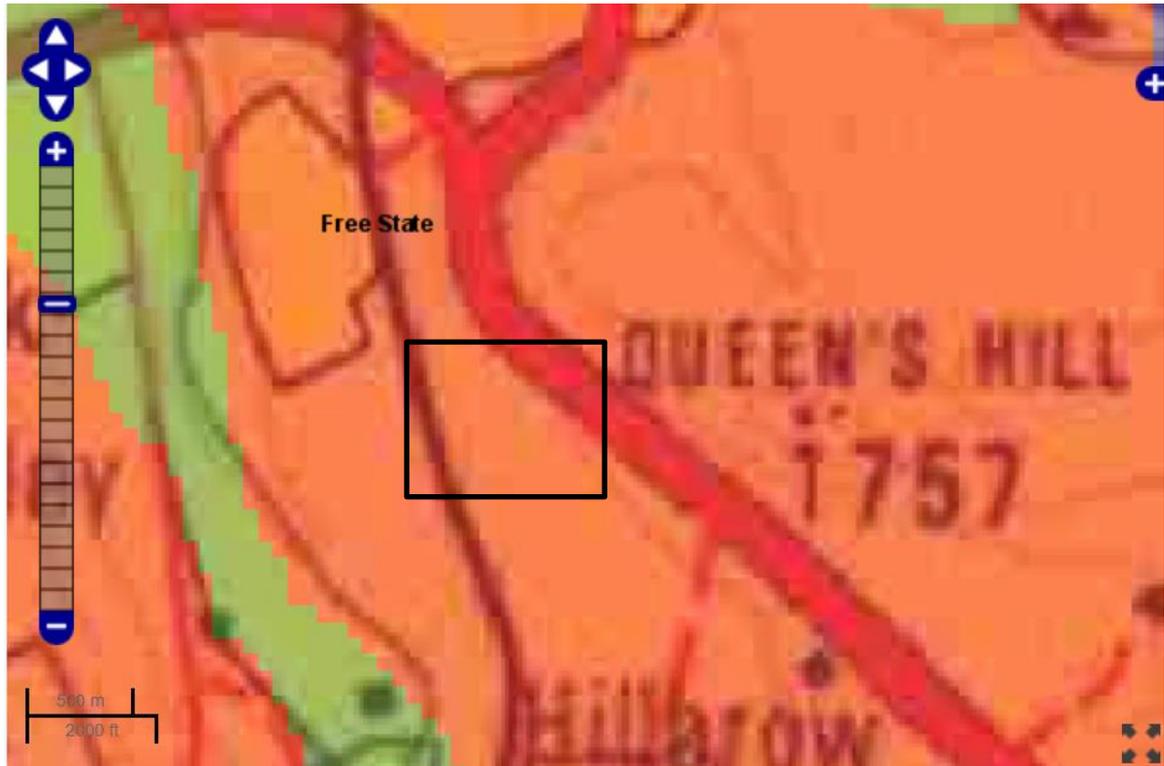


Figure 7: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences).
Approximate location of the proposed development is indicated in black.

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 7) there is a very high chance of finding fossils in this area.

6 GEOGRAPHICAL LOCATION OF THE SITE

The development will involve erf 1559, Hardustria, Harrismith, Free State. The proposed development is situated at the following coordinates:

28°17'46.80"S and 29° 8'15.25"E

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

When conducting a DIA 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 2828 Harrismith Geological map (Council of Geoscience)
- A Google Earth map with polygons of the proposed development was obtained from Turn 180 Environmental Consultants.
- 1:50 000 Topographical Map 2828 AC.
- National Museums Palaeontological Database
- PIAs near the development site consulted include: Almond 2015; Almond 2017; Rubidge 2008; Groenewald 2011a; Groenewald 2011b; Groenewald *et al*, 2010 (See references).

9 SITE VISIT

A one-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 30 December 2019. No fossiliferous outcrops were identified during the site visit in the development footprint. However, it is important to note that although no surface outcrops

were identified in the development area fossil heritage could be embedded within rocks beneath the surface or covered by surface deposits and vegetation cover. It is thus possible that fossil heritage could be present in the development footprint. The following photographs were taken during the site visit to the proposed development. No fossiliferous outcrop was found on the proposed development.



Figure 8: View towards the south- overlooking the proposed Emulsion Plant development area
(GPS 28° 17" 45' S 29° 08" 15'E)



Figure 9: Flat topography with grass covering of the proposed Emulsion footprint

10 IMPACT ASSESSMENT METHODOLOGY

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

- Construction
- Operation
- 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

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

3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		

This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. 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 Summary of Impact Tables

The proposed Harrismith emulsion development is situated within the Late Permian sedimentary rocks of the Normandien Formation, Adelaide Subgroup, (Beaufort Group of the Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Normandien Formation is Very High (Almond and Pether 2008, SAHRIS website).

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent and irreversible. Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as having a low possibility. The significance of the impact occurring pre-mitigation will be low.

11 FINDINGS AND RECOMMENDATIONS

The proposed Harrismith emulsion development is situated within the Late Permian sedimentary rocks of the Normandien Formation, Adelaide Subgroup, (Beaufort Group of the Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Normandien Formation is Very High (Almond and Pether 2008, SAHRIS website).

A day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 30 December 2019. No fossiliferous outcrop was found in the proposed development area. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The apparent rarity of fossil heritage at the proposed development footprint suggests that the impact of the emulsion plant establishment in Harrismith will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to damaging impacts on the palaeontological resources of the area. Thus, the construction of the development may be permitted 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 ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO/site manager 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 suitable 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 Officer (EO) 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 EO, 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 EO or site manager. The EO 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 EO (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 ECO (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

Registered as a PhD fellow at the Zoology Department of the UFS

2013 to current

Dissertation title: A new gorgonopsian from the uppermost *Daptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

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

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

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

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