



PGS

HERITAGE

**Palaeontological Desktop Assessment for the Proposed
Electricity Expansion Project and Sekgame Switching Station at
the Sishen Mine, Northern Cape Province**

Issue Date: 7 March 2018
Revision No.: v1.0
Client: Environmental Impact Management Services
PGS Project No: 301PIA

DECLARATION

This report has been compiled for PGS Heritage (Pty) Ltd by Banzai Environmental, an independent palaeontological service provider. The views stipulated in this report are purely objective and no other interests are displayed during the decision-making processes discussed in this report.

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A handwritten signature in black ink, appearing to be 'Wouter Fourie', is written over a horizontal line. The signature is stylized and somewhat cursive.

ACKNOWLEDGEMENT OF RECEIPT

CLIENT: Environmental Impact Management Services

CONTACT PERSON: Liam Whitlow

SIGNATURE:

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 favourable 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 favourable 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 realise that a false declaration is an offence 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:

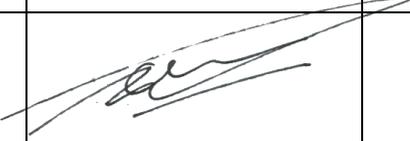
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Report Title	Palaeontological Desktop Assessment for the Proposed Electricity Expansion Project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province		
Control	Name	Signature	Designation
Author	Elize Butler		Palaeontologist
Reviewed	Wouter Fourie		Principal Heritage Specialist
Client			

ABBREVIATIONS USED IN THIS DOCUMENT

ABBREVIATIONS	DESCRIPTION
EIA	Environmental Impact Assessment
EMPR	Environmental Management Programme Report
HIA	Heritage Impact Assessment
NHRA	National Heritage Resources Act
PGS	PGS Heritage

Terminology

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects (The Burra Charter, 2013).

Fossil

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

Cultural heritage

- (i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values;
- (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and
- (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles (International Finance Corporation, 2012).

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Desktop Assessment Report for the proposed electricity expansion project and Sekgame switching station at the Sishen mine, Northern Cape Province. According to the National Heritage Resources Act (No 25 of 1999, section 38), a palaeontological impact assessment is key to detect the presence of fossil material within the proposed development footprint and it is thus necessary to evaluate the impact of the construction on the palaeontological resources.

The proposed development footprint (preferred alternative as well as two alternative routes) is primarily underlain by the red Kalahari sands of the Gordonia Formation. According to the SAHRIS PalaeoMap the Palaeontological Sensitivity of the Kalahari Group is low and thus none of the alternative sites are preferred above the other.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is thus considered that the development of 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 that fossil remains are discovered during any phase of construction, either on the surface or unearthed by fresh excavations, the ECO in charge of these developments ought to be alerted immediately. These discoveries should to be protected, preferably *in situ*, and the ECO must report to SAHRA so that proper mitigation (recording, collection) can be carry out by a professional paleontologist.

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

CONTENTS	PAGE
1 INTRODUCTION.....	1
1.1 Project Description	1
2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	6
3 LEGISLATION	6
3.1 National Heritage Resources Act (25 of 1999).....	6
4 OBJECTIVE	7
5 GEOLOGICAL AND PALAEOLOGICAL HISTORY	8
5.1 Geology	8
5.2 Palaeontology	8
6 GEOGRAPHICAL LOCATION OF THE SITE	10
6.1 Assumptions and Limitations.....	10
7 FINDINGS AND RECOMMENDATIONS	10
8 IMPACT TABLE.....	11
8.1 Method of Assessing Impacts:	11
9 REFERENCES	16

List of Figures

<i>Figure 1. Google Earth Image of the location of the proposed electrical development near Kathu, Northern Cape (indicated in green). Scale bar represents 8.67 km.</i>	<i>2</i>
<i>Figure 2. Layout / Route Plan: Preferred. Map provided by EXIGO.</i>	<i>3</i>
<i>Figure 3. Locality Map showing Alternatives. Map provided by EXIGO.</i>	<i>4</i>
<i>Figure 4. Layout / Route Plan for Alternatives. Map provided by EXIGO.</i>	<i>5</i>
<i>Figure 5. The approximate location of the proposed development site is indicated as a black line (next to the N14 road) on the extract of the 1:250 000 Geological map of 2722 Kuruman (Council of Geosciences, Pretoria).</i>	<i>9</i>

List of Tables

Table 1: Criteria for determination of impact consequence..... 13
Table 2: Probability scoring. 14
Table 3: Sensitivity ratings and weighting..... 15

1 INTRODUCTION

The development of the proposed electricity expansion project and Sekgame switching station at the Sishen mine, Northern Cape Province is proposed (**Figure 1**).

1.1 Project Description

The project description has been extracted from the Basic Assessment for the Proposed Electricity Expansion Project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province as prepared by Exigo³.

The preferred alternative (**Figure 2**) comprises the development of electricity distribution lines from the existing Ferrum Substation in the North of the study area, southwards between the existing Shooting Range servitude and the N14 highway, up to the planned Sekgame Switching Station which will consist of a footprint area of about 250 meters long by 100 meters wide. The Sekgame Switching Station is approximately 110 meters west from the N14.

The alternative sites are indicated in **Figure 3** and **Figure 4**. The first alternative considers the location of the Sekgame Switching Station on the existing Shooting Range servitude. This Alternative will result in similar impacts as the preferred alternative, but implementation of this alternative is not feasible due to the potential interference with the Shooting Range servitude.

The second alternative considered extends the proposed electricity distribution infrastructure to the South. The impacts associated with this alternative would be the same as for the preferred alternative, and possibly more significant (the ecology and archaeology investigations did not include this extended footprint and thus the precautionary principle would dictate that insufficient information is available to adequately assess the impacts on the extended footprint area and that the impacts must therefore be considered significant).



Figure 1. Google Earth Image of the location of the proposed electrical development near Kathu, Northern Cape (indicated in green). Scale bar represents 8.67 km.

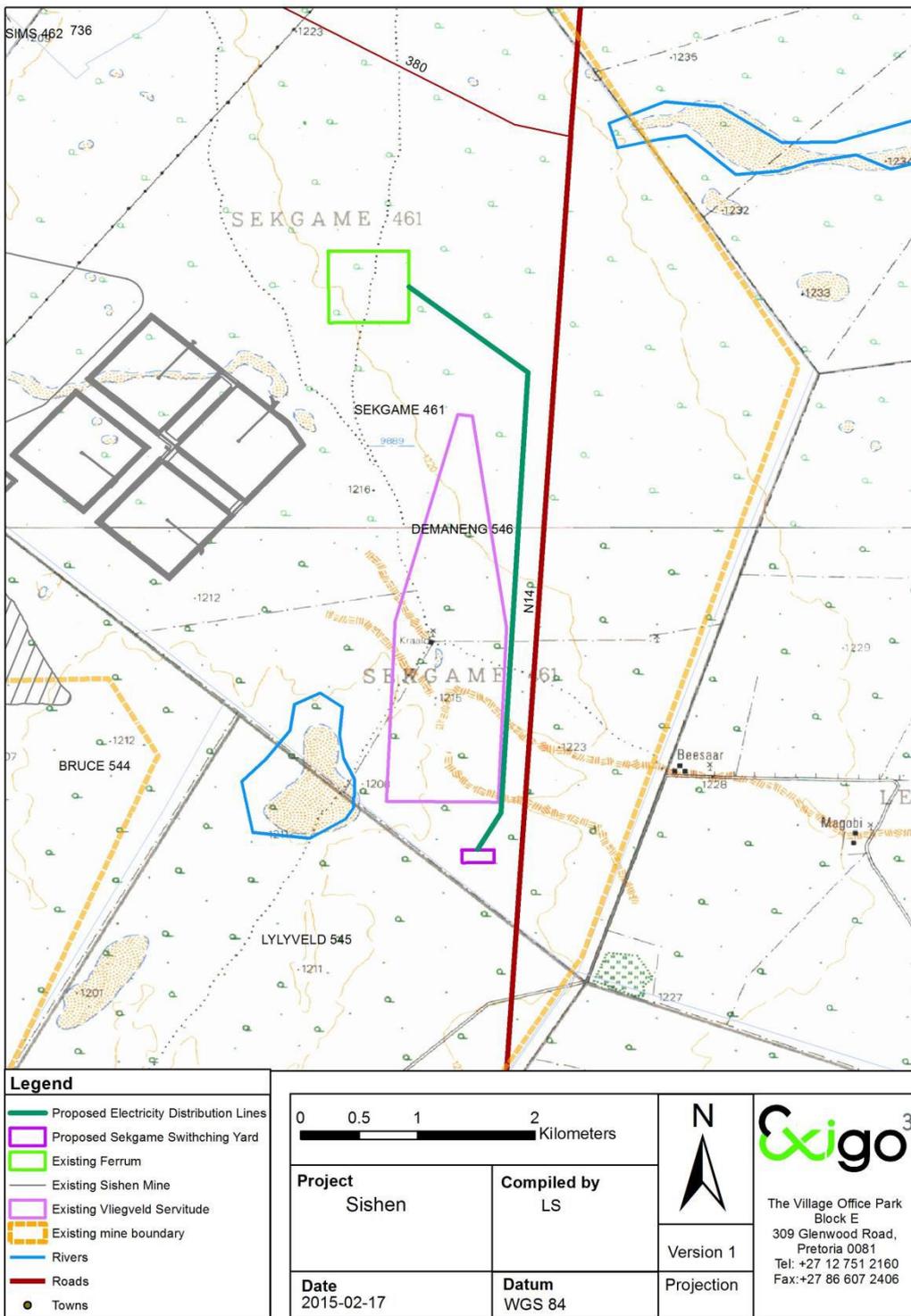


Figure 2. Layout / Route Plan: Preferred. Map provided by EXIGO.

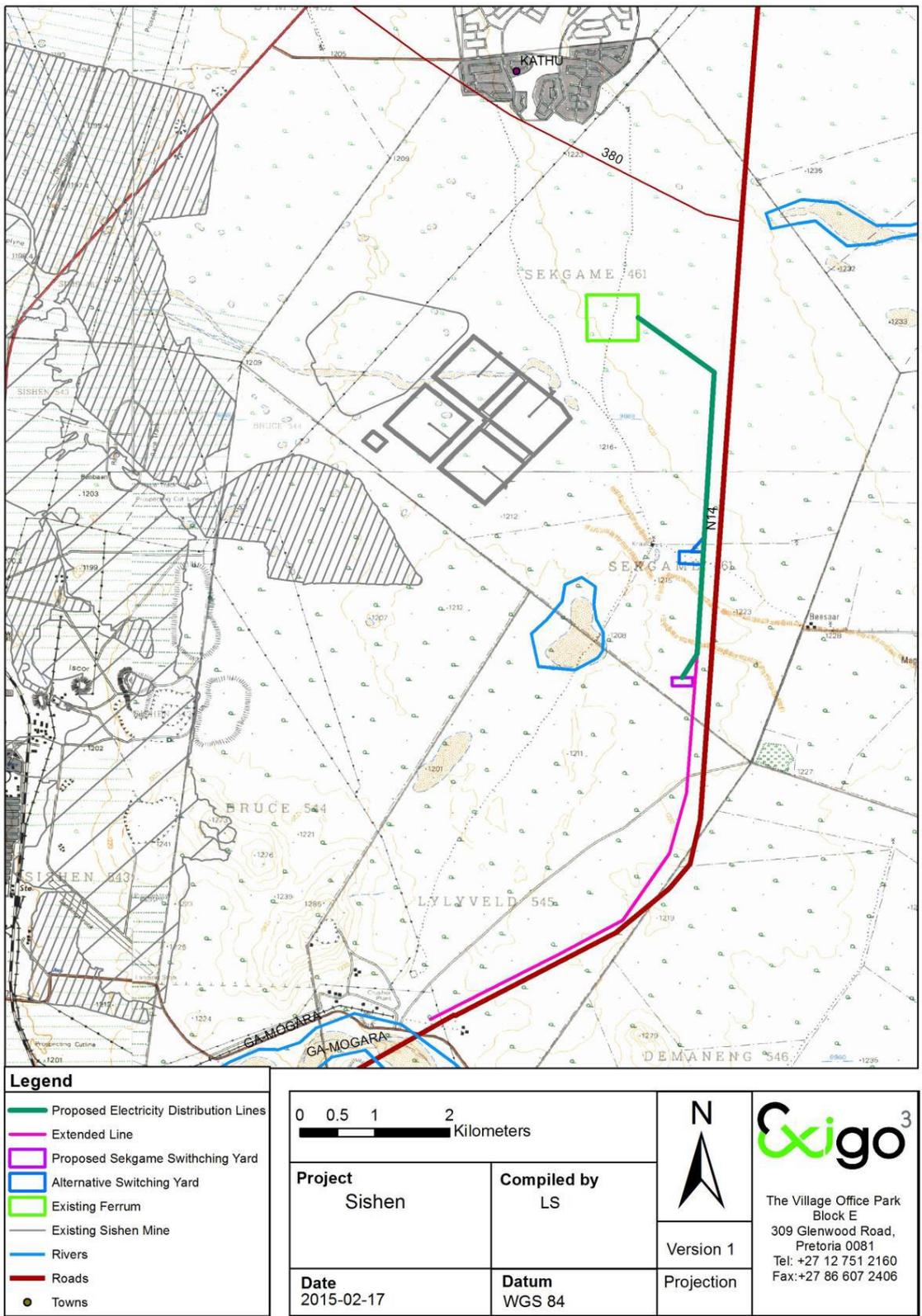


Figure 3. Locality Map showing Alternatives. Map provided by EXIGO.

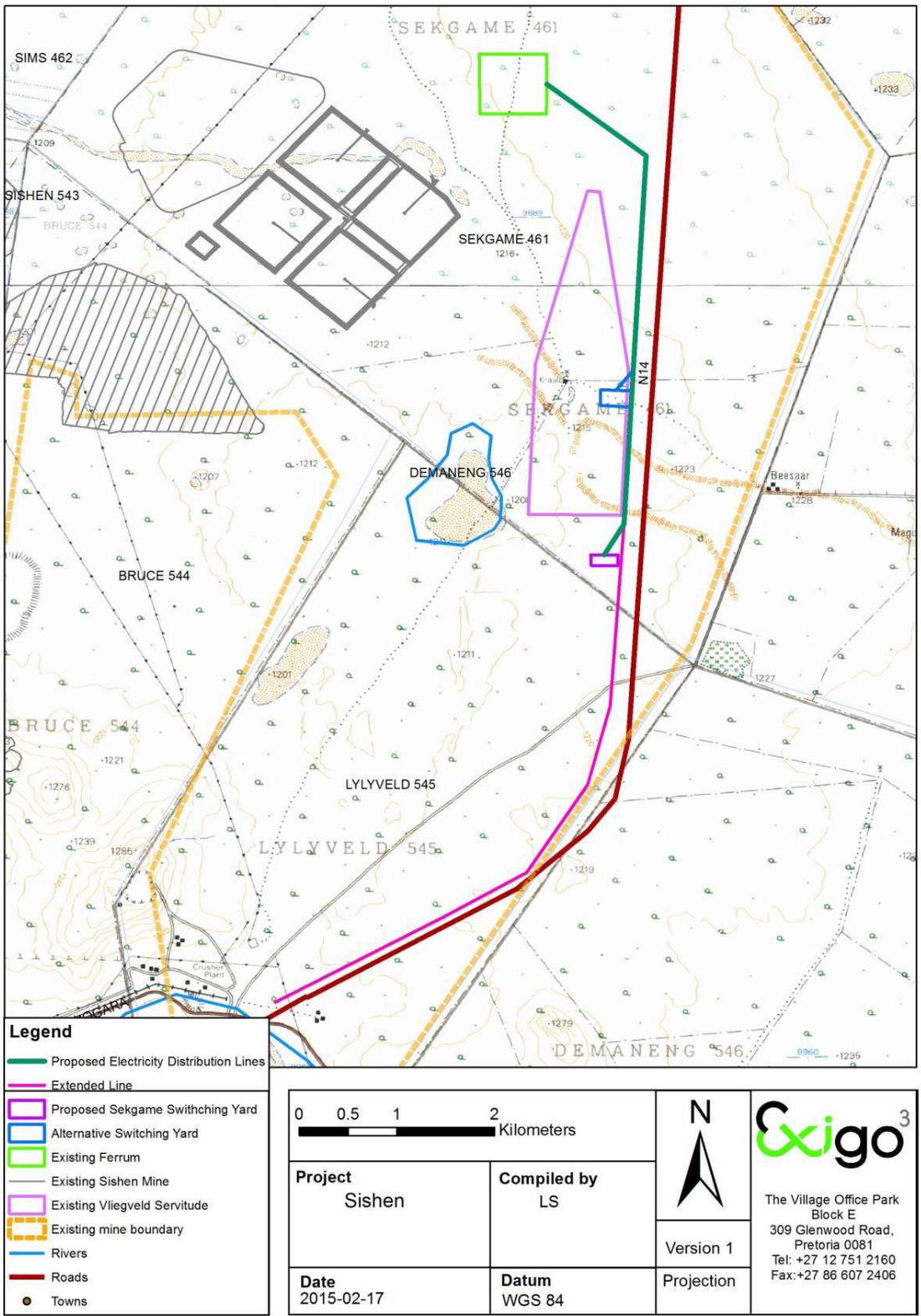


Figure 4. Layout / Route Plan for Alternatives. Map provided by EXIGO.

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 10 years. She has been conducting Palaeontological Impact Assessments 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, moved, broken 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 Desktop 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 objective of a Palaeontological Desktop Assessment 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 palaeontological impact assessment are: 1) to identify the palaeontological importance of the exposed and subsurface rock formations in the development footprint 2) to evaluate the palaeontological importance of the formations 3) to determine the impact of the development on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage”.

When a palaeontological desktop study is compiled, the potentially fossiliferous rocks (i.e. groups, formations, etc.) present within the study area are established from 1:250 000 geological maps. The topography of the development area is identified using 1:50 000 topography maps as well as Google Earth Images of the development area. Fossil heritage within each rock section is obtained from previous palaeontological impact studies in the same region, the PalaeoMap from SAHRIS; and databases of various institutions (identifying fossils found in locations specifically in areas close to the development area). The palaeontological importance of each rock unit of the development area is then calculated. The possible impact of the proposed development footprint on local fossil heritage is established on the following criteria: 1) the palaeontological importance of the rocks and 2) the type and scale of the development footprint and 3) quantity of bedrock excavated.

In the event that rocks of moderate to high palaeontological sensitivity are present within the study area, a field-based assessment by a professional palaeontologist is required. Based on both the desktop data and field examination of the rock exposures, the impact significance of the planned development is measured with recommendations for any further studies or mitigation. In general, destructive impacts on palaeontological heritage only occur during construction. The excavations will transform the current topography and may destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

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

5 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The geology of the proposed development (**Figure 5**) is shown on the 1: 250 000 geological map of 2722 Kuruman (Council of Geoscience, Pretoria). The proposed development footprint (preferred route as well as two alternative routes) is entirely underlain by the Late Cenozoic Gordonia Formation of the Kalahari Group.

5.1 Geology

The Tertiary to Quaternary Cenozoic superficial deposits consist of aeolian sand, alluvium (clay, silt and sand deposited by flowing floodwater in a river valley/ delta producing fertile soil), colluvium (material collecting at the foot of a steep slope), spring tufa/tuff (a porous rock composed of calcium carbonate and formed by precipitation from water, around mineral springs and lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravels.

5.2 Palaeontology

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. In the past palaeontologists did not focus on Cenozoic superficial deposits although they sometimes comprise of significant fossil biotas. Fossil assemblages may comprise of bones, horn cores, mammalian teeth, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells and freshwater stromatolites are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

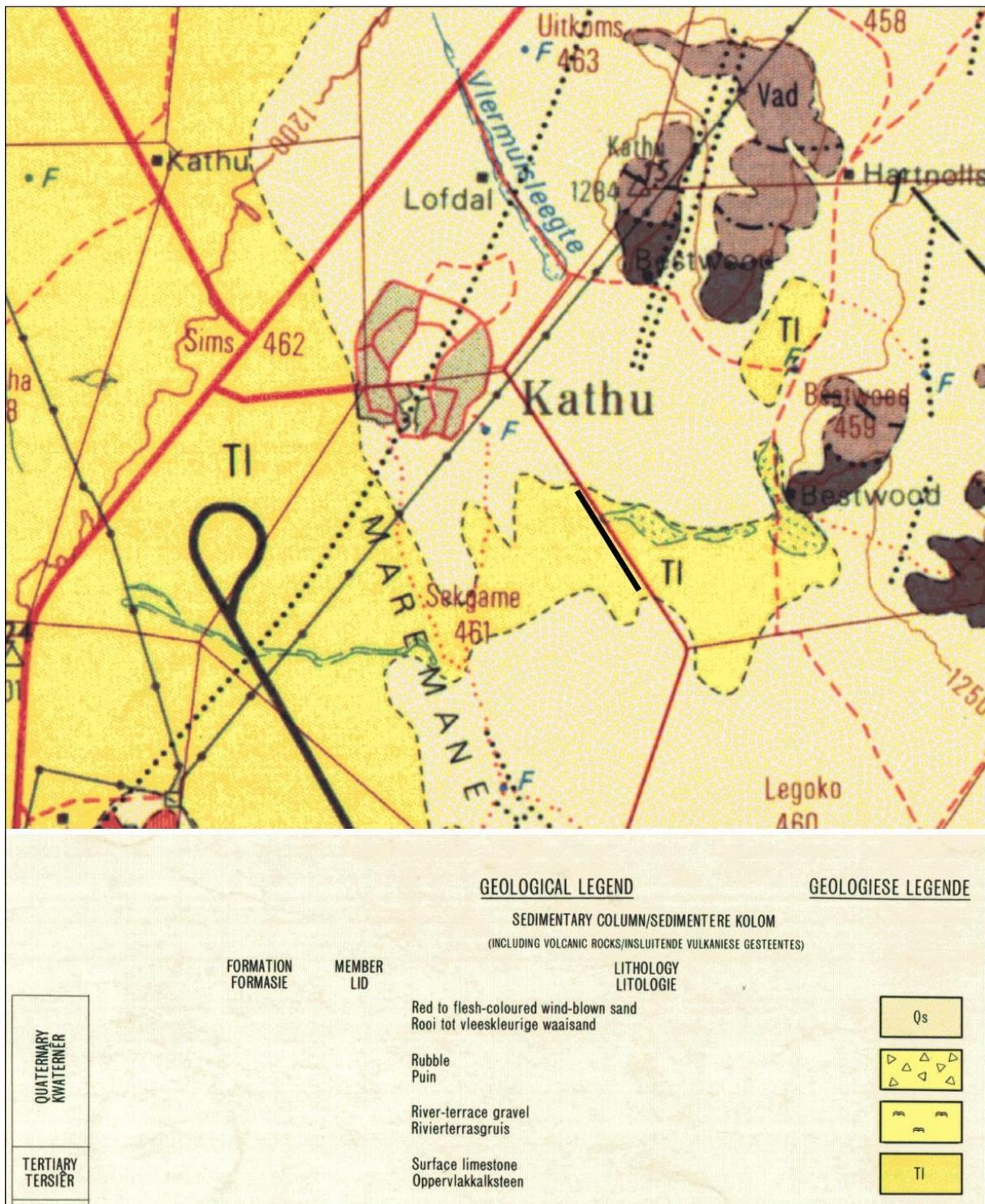


Figure 5. The approximate location of the proposed development site is indicated as a black line (next to the N14 road) on the extract of the 1:250 000 Geological map of 2722 Kuruman (Council of Geosciences, Pretoria).

6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed development site is located along the N14 near Kathu in the Northern Cape Province.

6.1 Assumptions and Limitations

The accurateness of Palaeontological Desktop Impact Assessments is reduced by old fossil databases that do not always include relevant locality or geological formations. The geology in various remote areas of South Africa may be less accurate because it is based entirely on aerial photographs. The accuracy of the sheet explanations for geological maps is inadequate as the focus was never intended to be on palaeontological material.

The entire South Africa has not been studied palaeontologically. Similar Assemblage Zones but in different areas, might provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations generally assume that unexposed fossil heritage is present within the development area. Thus, the accuracy of the Palaeontological Impact Assessment is improved by a field-survey.

7 FINDINGS AND RECOMMENDATIONS

The proposed development footprint (preferred alternative as well as two alternative routes) is entirely underlain by the red Kalahari sands of the Gordonia Formation. According to the SAHRIS PalaeoMap the Palaeontological Sensitivity of the Kalahari Group is low and thus none of the alternative sites are preferred.

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. In the past palaeontologists did not focus on Caenozoic superficial deposits although they sometimes comprise of significant fossil biotas. Fossils assemblages may comprise of bones, horn cores, mammalian teeth, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells and freshwater stromatolites are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is thus considered that the development of 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 that fossil remains are discovered during any phase of construction, either on the surface or unearthed by fresh excavations, the ECO in charge of these developments ought to be alerted immediately. These discoveries should to be protected, preferably *in situ*, and the ECO must report to SAHRA so that appropriate mitigation (recording, collection) can be carry out by a professional paleontologist.

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

8 IMPACT TABLE

The project phases are Planning, Construction, and Operational as well Decommissioning.

During the Planning phase there will be no impact on the palaeontological heritage in the development footprint thus no impacts will be discussed. There will only be Palaeontological Impacts in the Construction and Operational phases. These impacts will be similar for both phases and will be handled as the same.

8.1 Method of Assessing Impacts:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk: The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\begin{aligned}C &= (E + D + M + R)/4 \times N \\&= (2+5+2+5)/4 \times 1 \\&= 14/4 \times 1 \\&= 3.50\end{aligned}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Table 1**.

Table 1: Criteria for determination of impact consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per **Table 2**.

Table 2: Probability scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P = 3.50 \times -1 = -3.50$$

Table 3: Sensitivity ratings and weighting

Sensitivity Rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1	
Low/Poor	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	0	
High	The proposed development will negatively influence the current status of the feature.	+1	
Very High	The proposed development will negatively significantly influence the current status of the feature.	+2	

Notes:

Must provide scored shapefile for entire study area (i.e. every section of the study area must have a score).

Must include a written descriptor in the layer regarding the reasons for the equivalent ranking- i.e. must include description of identified spatial point source sensitivities.

Impact Name	Loss of fossil heritage				
Alternative	All Alternatives				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	2	1
Extent	2	2	Reversibility	5	5
Duration	5	5	Probability	1	1
Environmental Risk (Pre-mitigation)					-3.50
Mitigation Measures					
<p>The proposed development will only have an impact on the construction phase of the development</p> <p>In the event that fossil remains are discovered during any phase of construction, either on the surface or unearthed by fresh excavations, the ECO in charge of these developments ought to be alerted immediately. These discoveries should to be protected, preferably <i>in situ</i>, and the ECO must report to SAHRA so that appropriate mitigation (recording, collection) can be carry out by a professional paleontologist.</p> <p>Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies created by SAHRA</p>					
Environmental Risk (Post-mitigation)					-3.25
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
Low: Where the impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
Final Significance					-3.25

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