

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED
LANDFILL SITE IN LUCKHOFF, LETSEMENG LOCAL MUNICIPALITY, XHARIEP DISTRICT, FREE STATE**

Prepared for:

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DATE: 24 June 2018

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EXECUTIVE SUMMARY

The rehabilitation of the existing Luckhoff solid waste site and construction of a waste facility in Luckhoff, Letsemeng Local Municipality, Xhariep District in the Free State Province is proposed. According to the National Heritage Resources Act (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 of the planned new waste site near Luckhoff is entirely underlain by Permian sedimentary rocks of the Karoo Supergroup, Ecca Group, Tierberg Formation as well as Quaternary sediments. According to the SHRIS Palaeomap the Tierberg formation has a moderate palaeontological sensitivity. This Formation contains trace fossils (burrows and track ways of arthropods) and a few ichnogenera have also been described. The plant impressions, mud and vertebrate fragments found suggest a shallow water environment. Body fossils are not common but include micro vertebrates, fish teeth and scales. Reworked petrified wood have been uncovered from this Formation but is exceptionally rare. Quaternary fossil assemblages may comprise of mammalian teeth, bones and horn cores, 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). During a field survey of the development footprint, no fossiliferous outcrops were found. For this reason, a **low palaeontological sensitivity** is allocated to the development footprint. Irrespective of the uncommon occurrence of fossils a solitary fossil may be of scientific value as many fossil taxa are known from a single fossil. The recording of fossils will expand our knowledge of the Palaeontological Heritage of the development area.

The scarcity of fossil heritage at the proposed development footprint indicates that the **impact of the development 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 detrimental impacts on the palaeontological resources of the area.

In the event that fossil remains are uncovered during any phase of construction, either on the surface or unearthed by new excavations and vegetation clearance, the ECO in charge of these developments ought to be alerted immediately. These discoveries ought to be protected (if possible *in situ*) and the

ECO must report to SAHRA so that appropriate mitigation (*e.g.* recording, collection) can be carried out by a professional palaeontologist.

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 accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies as required by SAHRA

Table of Contents

1	INTRODUCTION	5
2	LEGISLATION	6
3	OBJECTIVE	9
4	GEOLOGICAL AND PALAEOLOGICAL HISTORY	10
4.1	Geological History	10
4.2	Palaeontological History	11
5	GEOGRAPHICAL LOCATION OF THE SITE	14
5.1	Assumptions and Limitations	14
6	FIELD SURVEY	14
7	IMPACT RATING	17
8	FINDINGS AND RECOMMENDATIONS	20
9	REFERENCES	21
10	QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	22

1 INTRODUCTION

The rehabilitation of the existing Luckhoff solid waste site and construction of a new waste facility in Luckhoff, Letsemeng Local Municipality, Xhariep District in the Free State Province is planned (Fig. 1). The Letsemeng Local Municipality in the Free State is approximately 9829 km² in extent. The Census of 2011 recorded a population of 38 628 people from 11 242 households. The refuse removal of these households occurs on a weekly basis. The town of Luckhoff/Relebohile is a part of Ward 1 within the Local Municipality and has a population of 3699.

It is very important that Municipalities have functional solid waste disposal sites. Dysfunctional waste disposal sites could lead to unsanitary conditions and pollution with the outbreak of vector borne diseases. The main objective of a land fill site in a municipality is to enhance waste disposal and to reduce the environmental impacts.

NSVT Consultants has been appointed to assist in the EIA process in compiling the Integrated Waste Management Plan for the Letsemeng Local Municipality.

The project will consist of the following:

- constructing of the landfill site,
- fencing the site with 1.8 m high fence,
- the installation of a access gate with a shelter,
- construction of restrooms and ablution facilities
- Construction of an access road to the landfill site.

PROPOSED SOLID WASTE SITE IN LUCKHOFF, FREE STATE PROVINCE

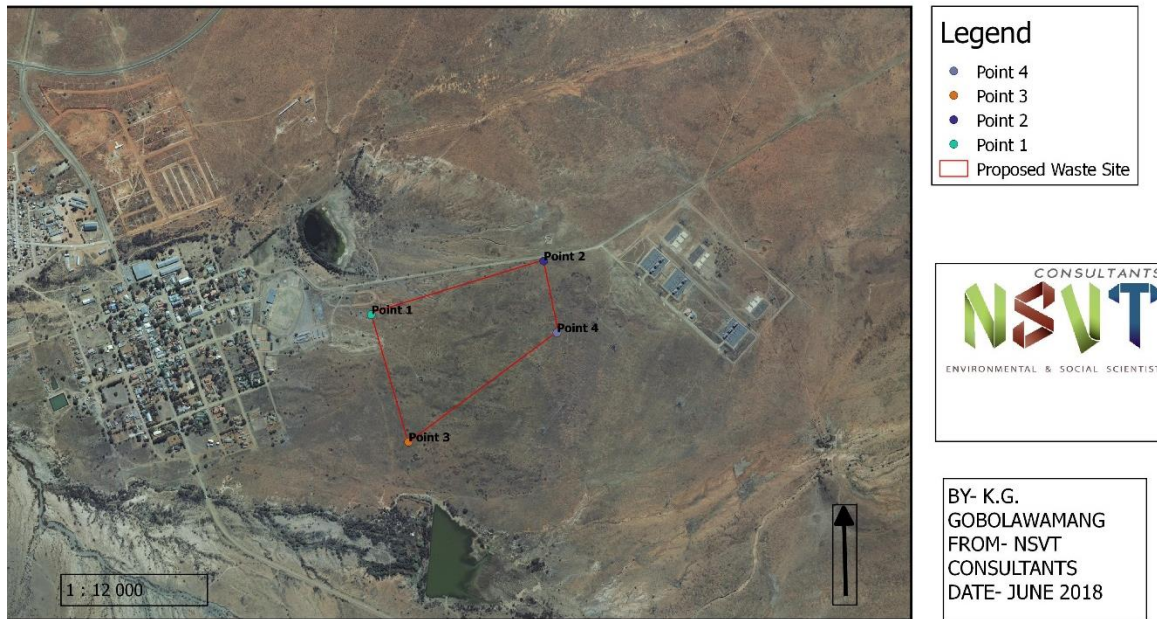


Figure 1. Location of the proposed construction of the new waste facility in Luckhoff, Letsemeng Local Municipality, Xhariep District in the Free State Province. Map provided by NSVT Environmental Consultants.

2 LEGISLATION

NATIONAL HERITAGE RESOURCES ACT (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). 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 above mentioned Act. 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.

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

ACCORDING TO SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 1999, DEALING WITH ARCHAEOLOGY, PALAEOLOGY AND METEORITES:

35. (1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

(a) Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) Serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) Carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

(6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or a meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

(7) (a) Within a period of two years from the commencement of this Act, any person in possession of any archaeological or palaeontological material or object or any meteorite which was acquired other than in terms of a permit issued in terms of this Act, equivalent provincial legislation or the National Monuments Act, 1969 (Act No. 28 of 1969), must lodge with the responsible heritage resources authority lists of such objects and other information prescribed by that authority. Any such object which is not listed within the prescribed period shall be deemed to have been recovered after the date on which this Act came into effect. (b) Paragraph (a) does not apply to any public museum or university. (c) The responsible authority may at its discretion, by notice in the *Gazette* or the *Provincial Gazette*, as the case may be, exempt any institution from the requirements of paragraph (a) subject to such conditions as may be specified in the notice, and may by similar notice withdraw or amend such exemption.

(8) An object or collection listed under subsection (7) — (a) Remains in the ownership of the possessor for the duration of his or her lifetime, and SAHRA must be notified who the successor is; and (b) must be regularly monitored in accordance with regulations by the responsible heritage authority.

HERITAGE RESOURCES MANAGEMENT

38. (1) Subject on the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will

change the character of a site—(i) exceeding 5 000 m² in extent; or (ii) involving three or more existing erven or subdivisions thereof; or (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority (d) the re-zoning of a site exceeding 10 000 m² in extent; (e) or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

3 OBJECTIVE

The **objective of a Palaeontological Impact 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.

4 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The proposed development footprint of the planned new waste site near Luckhoff is entirely underlain by Early to Middle Permian sedimentary rocks of the Karoo Supergroup, Ecca Group, Tierberg Formation (Fig. 3-4). Recent Quaternary Alluvium deposits are also present in the study area. The Geology of the study area is represented on the 1:250 000 geological sheet of the 2924 Koffiefontein map (Council for Geosciences, Pretoria).

4.1 Geological History

The Permian Ecca Group is divided into 16 formations of which only the Prins Albert and Whitehill formations is fairly extensive. The other formation can be divided into three geographic areas namely the southern, western, and north-western north-eastern groups. The Tierberg Formation falls in the north-western to north-eastern group.

The Tierberg Formation is mainly an argillaceous succession with a maximum thickness of about 700 m in the west thinning to about 350 m in the northeast. The Tierberg Formation consist of laminated dark shales. This Formation has been described as offshore non-marine mudrocks. Distal turbidite beds and prodeltaic sediments are also present in the Tierberg Formation and is characterised by greenish weathering shale with subordinated siltstone and sandstone (Johnson *et al*, 2006). The Ecca mudrocks in the Luckhoff of the Karoo are often weathered and calcretised near-the surface and well-preserved exposures are very rare. This formation has a moderate palaeontological sensitivity.

Late Cenozoic superficial sediments consist of alluvial deposits, deposited by rivers in the valley floors. 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, for example, around mineral springs.) and lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravels.

4.2 Palaeontological History

Tierberg Formation

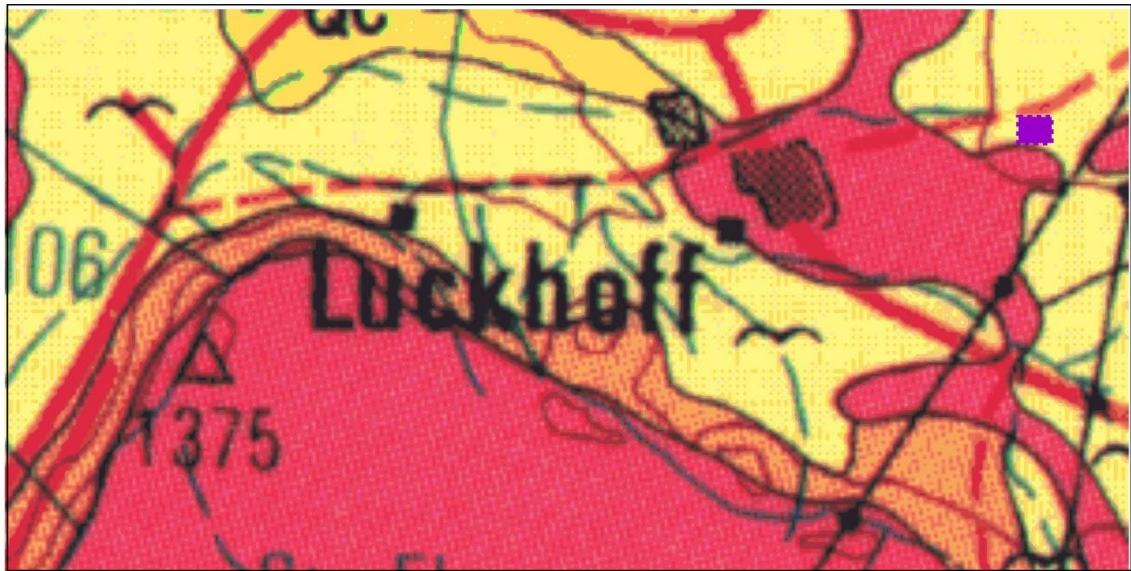
The Tierberg Formation contains trace fossils (burrows and track ways of arthropods) and a few ichnogenera have been described from this formation. The upper sandstone layers contain plant impressions, mud and vertebrate fragments and suggest a shallow water environment. The fossils of the Tierberg Formation have a low diversity but are plentiful when found (Almond & Pether, 2008). Body fossils are not commonly found but include micro vertebrates which include fish teeth and scales. Reworked petrified wood have been uncovered from this Formation but is exceptionally rare

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits cut by dongas. The Cenozoic superficial deposits have not been studied comprehensively in the past although they sometimes comprise of significant fossil biotas. Fossils assemblages may comprise of mammalian teeth, bones and horn cores, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells and freshwater stromatolites have been recovered 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).

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	ADELAIDE SUBGROUP	BURGERSDORP F.	DRIEKOPPEN F.	<i>Cynognathus</i>		
			KATBERG F.	VERKYKERSKOP F.	<i>Lystrosaurus</i>	A	
			Palingkloof M.	Harrismith M.	<i>Daptocephalus</i>		
			Elandsberg M.	Schoondraai M.			
			Barberskrans M.	Rooinekke M.			
			Steenkamps- vakte M.	Daggaboers- nek M.	VOLKSRUST F.		
	Oukloof M.	Oudeberg M.	<i>Cistecephalus</i>				
	Hoedemaker M.	MIDDELTON F.	<i>Tropidostoma</i>				
	Poortjie M.		<i>Pristerognathus</i>				
	ABRAHAMSKRAAL F.	KROONAP F.	<i>Tapinocephalus</i>	UPPER UNIT			
				LOWER UNIT			
	ECCA GROUP	ADELAIDE SUBGROUP		WATERFORD F.	WATERFORD F.	<i>Eodicynodon</i>	
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.	MBIZANE F.		
CARBON- IFEROUS	DWYKA GROUP		ELANDSVLEI F.	ELANDSVLEI F.			

SANDSTONE-RICH UNIT HIATAL SURFACE END BEAUFORT GROUP HIATUS

Figure 2. Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subunits of the Beaufort Group with rock units and fossil assemblage zones significant to the current study marked in red (Modified from Rubidge 1995). The subdivisions of the Beaufort Group consist of the Adelaide and Tarkastad Subgroups and range in age from Late Permian to Middle Triassic. Abbreviations: F. = Formation, M. = Member.



GEOLOGIESE LEGENDE

GEOLOGICAL LEGEND

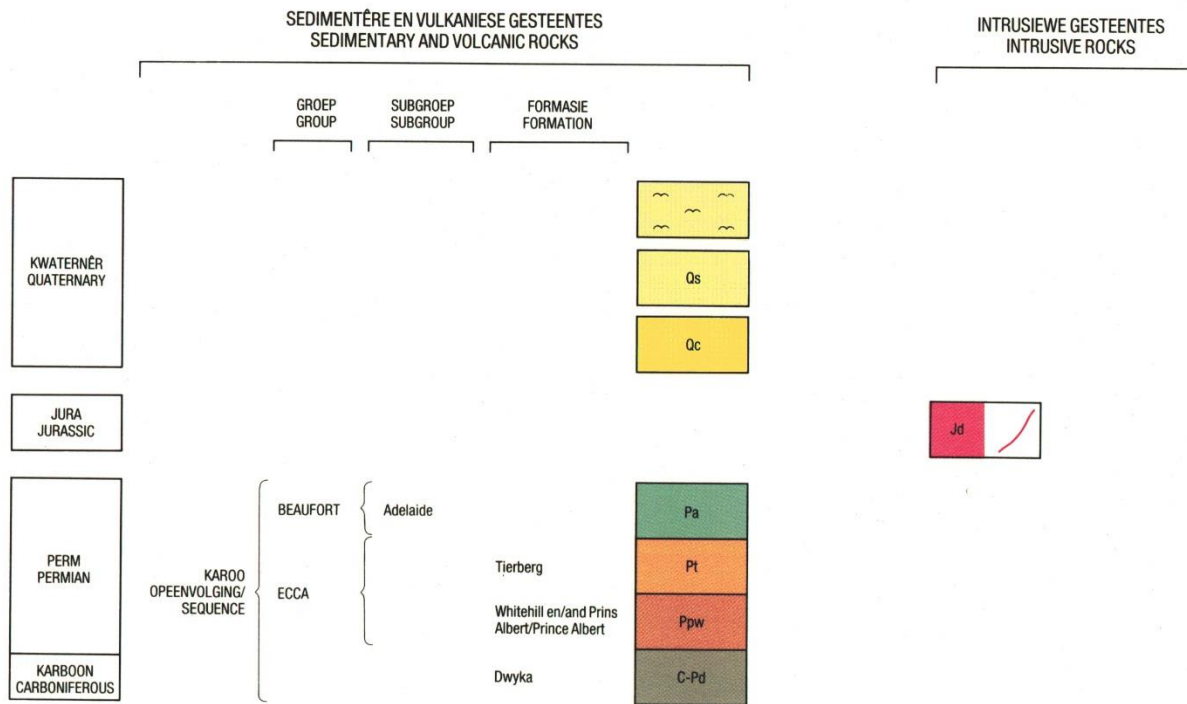


Figure 3. Extract of the local Geology of the Luckhoff, Letsemeng Local Municipality, Xhariep District in the Free State Province. The approximate study area is indicated in purple and is represented on the 1:250 000 geological sheet of the 2924 Koffiefontein map (Council for Geosciences, Pretoria). The proposed waste site is primarily underlain by Early to Middle Permian sedimentary rocks of the Karoo Supergroup, Ecca Group, Tierberg Formation as well as Quaternary superficial deposits.

5 GEOGRAPHICAL LOCATION OF THE SITE

The proposed development footprint of the proposed new waste site near Luckhoff is located on the eastern borders of the town, adjacent to a large water body and an Eskom substation (Fig. 1).

5.1 Assumptions and Limitations

The accurateness of Palaeontological Desktop Impact Assessments is reduced by old fossil databases that does 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 have 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.

6 FIELD SURVEY

The following photographs were taken on a site visit to the proposed development footprint in Luckhoff, Letsemeng Local Municipality, Xhariep District in the Free State Province in June 2018.



Figure 4. Flat topography of the proposed development site. During the field survey no fossiliferous outcrops were found and dense vegetation was present on the proposed development footprint.



Figure 5: Flat topography of the proposed development site. During the field survey no fossiliferous outcrops were found and dense vegetation was present on the proposed development footprint.

7 IMPACT RATING

Impact Rating Matrix

<p>NATURE:</p> <p>The character of the impact</p> <p>Although insignificant, the excavations, ground disturbance and clearing of vegetation during the construction phase will involve excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will change the existing topography and may disturb, and destroy or permanently seal-in fossils at or below the ground surface that are then no longer accessible for research. This impact is likely to occur only within the construction phase. No impacts are expected to occur during the operation phase</p>			
EXTENT	DURATION	PROBABILITY	MAGNITUDE
Area	Time Frame	Likelihood	Intensity of impact to destroy or alter the environment.
<p>SIGNIFICANCE:</p> <p>Implication of the impact both with or without mitigation</p> <p>Possible impact management, minimization and mitigation of the identified impacts.</p> <p>Mitigation is the protection of identified fossils uncovered during the construction phase. If fossil material occur within the development footprint any negative impact could be mitigated by plotting, and recording, and sampling of well-preserved fossils by a professional palaeontologist. This action should take place after initial vegetation clearance.</p>			
<p>TYPE:</p> <p>Description as to whether the impact is negative or positive or neutral.</p> <p>The development of the proposed development footprint and associated infrastructure is beneficial on not only a local level, but regional and national levels as well. The facility will provide a long term benefit to the community in terms of creating jobs and would thus provide an economical boost to the area.</p> <p>A potential secondary advantage of the construction of the project would be that the excavations may recover fossils and would have stayed unknown to scientific research.</p>			
<p>MITIGATION:</p> <p>Possible impact management, minimization and mitigation of the identified impacts.</p> <p>The lack of appropriate exposure at the proposed development footprint (including all alternative sites) indicates that the impact of the development is of low significance in palaeontological terms.</p>			

NO GO OPTION:

Evaluation of the no-go-option
 No-Go areas were not identified

1.1.1 Nature of Impact

Nature of impact describes the character of the impact in terms of the effect on the relevant environmental aspect.

1.1.2 Spatial Extent of Impact

Measures the area extent, physical and spatial scale over which the impact will occur. This implies the scale limited to the Project Site (footprint) - including adjacent areas (localized), or the Local Municipality area (regional) or the entire Province (Provincial), or the entire country (National) or beyond the borders of South Africa.

Criteria	Footprint	Site/Local	Regional	National	International
	(F)	(S-L)	(R)	(N)	(I)
Rating	1	2	3	4	5

1.1.3 Duration of Impact

Duration measures the timeframe of the impact in relation to the lifetime of the Project activities under application. It gives an assessment of whether the impact will disappear with mitigation immediately (0-1) after a short time (1-5 years), medium term (5-10 years), long term (11- 30 years of the Project activities), or permanent (persists beyond life) due to the Project activities.

Criteria	Temporary	Short Term	Medium Term	Long Term	Permanent
	(T)	(ST)	(MT)	(LT)	(P)
Rating	1	2	3	4	5

1.1.4 Probability of Impact

Probability measures the probability or likelihood of the impact actually occurring, as either probable, possible, likely, highly likely or definite (impact will occur regardless of preventative measures).

Criteria	Probable (PR) (0-10%)	Possible (PO) (10-25%)	Likely (L) (25-50%)	Highly Likely (HL) (50-75%)	Definite (D) (100%)
Rating	1	2	3	4	5

1.1.5 Magnitude/Intensity of Impact

Magnitude or intensity of the impact measures whether the impact is destructive or benign, whether it destroys, alters the functioning of the environment, or alters the environment itself. It is rated as insignificant, low, medium, high or very high.

Criteria	Insignificant (I)	Low (L)	Medium (M)	High (H)	Very High (VH)
Rating	2	4	6	8	10

1.1.6 Significance of Impact

Significance measures the foreseeable significance of the impacts of the Project both with and without mitigation measures. The significance on the aspects of the environment is classified as:

Significance Rating (SR) =	(Extent + Intensity + Duration) x Probability
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Extent		Duration		Intensity		Probability		Significance Rating	
Footprint	1	Temporary	1	Insignifi- cant	2	Probable	1	Insignificant	0-19
Site	2	Short	2	Low	4	Possible	2	Low	20-39
Regional	3	Medium	3	Medium	6	Likely	3	Medium	40-59
National	4	Long	4	High	8	Highly Likely	4	High	60-89

Inter-national	5	Permanent	5	Very High	10	Definite	5	Very High	90 <
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The following is a guide to interpreting the final scores of impact:

INSIGNIFICANT: the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts.

LOW: the impact will be noticeable but should be localised or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in the environmental management plan (EMP) and managed appropriately.

MEDIUM: the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact.

HIGH: the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed.

VERY HIGH the impact will result in large, permanent and severe impacts, such as local species extinction, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives which are substantially different should be looked at, otherwise the project should not be approved.

1.1.7 Status of Impact

Status of impact describes whether the impact is positive (beneficial) on the affected environment (social) or negative (detrimental) or neutral.

8 FINDINGS AND RECOMMENDATIONS

The proposed development footprint of the planned new waste site near Luckhoff is entirely underlain by Permian sedimentary rocks of the Karoo Supergroup, Ecca Group and Tierberg Formation as well as Quaternary Superficial deposits. The Tierberg formation has a moderate palaeontological

sensitivity. The Tierberg Formation contains trace fossils (burrows and track ways of arthropods) and a few ichnogenera have been described. The plant impressions, mud and vertebrate fragments found suggest a shallow water environment. The fossils of the Tierberg Formation have a low diversity but are plentiful when found. Body fossils are not common but include micro vertebrates which include fish teeth and scales. Reworked petrified wood have been uncovered from this Formation but is exceptionally rare. Quaternary fossil assemblages may comprise of mammalian teeth, bones and horn cores, 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). During a site visit to the area no fossils were recovered and thus a low-low palaeontological sensitivity was allocated to the development sites

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 ought to be protected (preferably *in situ*) and the ECO must report to SAHRA so that appropriate mitigation (*e.g.* recording, collection) can be carry out by a professional paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for 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.

9 REFERENCES

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10 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

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

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SIGNATURE:

A handwritten signature in black ink that reads "Elize Butler." The signature is written in a cursive style with a period at the end.