



The Proposed Development of Roypoint Housing Units within the Newcastle Local Municipality, Amajuba District, Kwa-Zulu Natal Province

**Newcastle Local Municipality, Amajuba District Municipality, Kwa-Zulu Natal
Province Farm: Roy Point 2959-HS, Ref: KZN/EIA0001310/2020**

Paleontological Impact Assessment: Phase 1: Field Study

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August 2020

Irrigasie Formation plant fossil



B. Executive summary

Outline of the development project: Tsimba Archaeological Footprints has been appointed to undertake a Palaeontological Impact Assessment (PIA), Phase 1: Field Study of the suitability of The Proposed Development of Roypoint Housing Units within the Newcastle Local Municipality, Amajuba District, Kwa-Zulu Natal Province on the Farm Portion Roy Point 2959-HS, Newcastle Local Municipality, Amajuba District Municipality within the Kwa-Zulu Natal, Province.

The applicant, Newcastle Local Municipality intends to formalize 780 low income housing units for the Roypoint informal settlement. The formalization will include the development of single-story residential dwellings (Low-cost housing), road infrastructure and the installation of bulk services such as water, sewage, electricity and storm water systems.

The Project includes three Alternatives (see Figure 2):

Alternative A This alternative proposes that +/-200 housing units to be developed on the wider farm portion, to the north-east of the farm. The remaining 580 housing units will be constructed on the vacant stands that have been identified in the area, as per the initial plan. This alternative will result in the settlement being extended towards the north-easterly portion of the Roypoint farm, which is currently undeveloped.

Alternative B: This alternative proposes the relocation of the affected households to a more favourable location.

Alternative C: (**Most Preferred.**) This alternative proposes the formalization of the existing erven and houses, so as to ensure the possibility of retaining most of the \pm 780 houses that have been built on the allocated stands in the settlement.

The size of the site is approximately 38 hectares.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

—palaeontological means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or traces.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):

(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).

Subject to 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 (see Section 38); (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 PHRA authority.

This report aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary **(1c)**.

Outline of the geology and the palaeontology:

The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 2728 Frankfort, 1:250 000 geological map (Muntingh 1987).

Figure 3: The geology of the development area.



Legend to Map and short explanation.

M – Alluvium (yellow). Quaternary.

Jd – Dolerite (pink). Karoo Supergroup. Jurassic.

Pvo – Bluish-grey or dark-grey mudstone and shale, subordinate siltstone (amber). Volksrust Formation, Eccca Group, Karoo Supergroup. Permian.

Pv – Sandstone, dark-grey mudstone and shale, coal beds in places (grey). Vryheid Formation, Eccca Group, Karoo Supergroup. Permian.

..... – (black) Lineament (Possible dyke).

--f-- Fault.

⊥10° - Strike and dip.

□ – Approximate position of Roypoint.

Over areas totalling fully 40% of Southern Africa the ‘hard rocks’, from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-too-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Eccca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Palaeontology – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally **VERY HIGH** for the Vryheid Formation and **LOW** for the Quaternary sediments (SG 2.2 SAHRA APMHOB, 2012).

The Quaternary sediments may contain fossils. A very wide range of possible fossil remains, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. Stromatolite structures range from a centimetre to several tens of metres in size. Large areas of the coastal plain of Kwazulu-Natal are covered in a blanket of alluvial sand and no significant fossils have been described from these sediments (Groenewald 2012).

The rocks of the Karoo Supergroup are internationally acclaimed for their richness and diversity of fossils. The Eccca Group, Vryheid Formation may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Summary of findings (1d): The Phase 1: Field Study was undertaken in August 2020 in the winter in dry and mild conditions during the official covid-19 Level 2 lockdown period. The following is reported:

Field Observation – The area is not too large. Informal housing and gravel roads are present. The walk through located the Vryheid Formation, but no fossils. The topography is undulating with the iNgaga river nearby.

Recommendation:

The potential impact of the development on fossil heritage is **VERY HIGH** therefore a field survey was necessary for this development (according to SAHRA protocol). A Phase 2: Palaeontological Impact Assessment Mitigation is only recommended if fossils are found during clearing, excavating, drilling and blasting or if the Phase 1: Field Study finds fossils.

The Project includes two Alternatives (see Figure 2) present on the Vryheid Formation with a **VERY HIGH** sensitivity and Quaternary sediments with a **LOW** sensitivity:

Alternative A This alternative proposes that +/-200 housing units to be developed on the wider farm portion, to the north-east of the farm. The remaining 580 housing units will be constructed on the vacant stands that have been identified in the area, as per the initial plan. This alternative will result in the settlement being extended towards the north-easterly portion of the Roypoint farm, which is currently undeveloped.

Alternative B: This alternative proposes the relocation of the affected households to a more favourable location.

Alternative C: **Preferred.** This alternative proposes the formalization of the existing erven and houses, so as to ensure the possibility of retaining most of the ± 780 houses that have been built on the allocated –stands in the settlement.

The size of the site is approximately 38 hectares.

Concerns/threats (**1g,1ni,1nii,1o,1p**) to be added to EMPr:

1. Threats are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers.

The recommendations are (**1c,1g,1n**):

1. Mitigation will still be needed if fossils are found during the construction.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.
3. The development may go ahead with caution.
4. The ECO must visit site after clearing, blasting, excavating and drilling and survey for fossils.
5. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.
6. That the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO or during the digging and excavation phase of the development or a site visit as determined.

Stakeholders: Developer – Newcastle Local Municipality, 37 Murchison Street, Newcastle, 2.

Environmental – Envolo Quality and Environmental consultant (PTY) Ltd, Promenade Building, 1st Floor, Unit D2, 24 Lira Link CBD,

Richards Bay, 3900. P.O. Box 101672, Meerensee, 3901

Landowner – Newcastle Local Municipality.

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D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 2). It also is in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pg 1-15 (2).

Outline of development (1f)

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-construction phase, it may be necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA / PHRA).

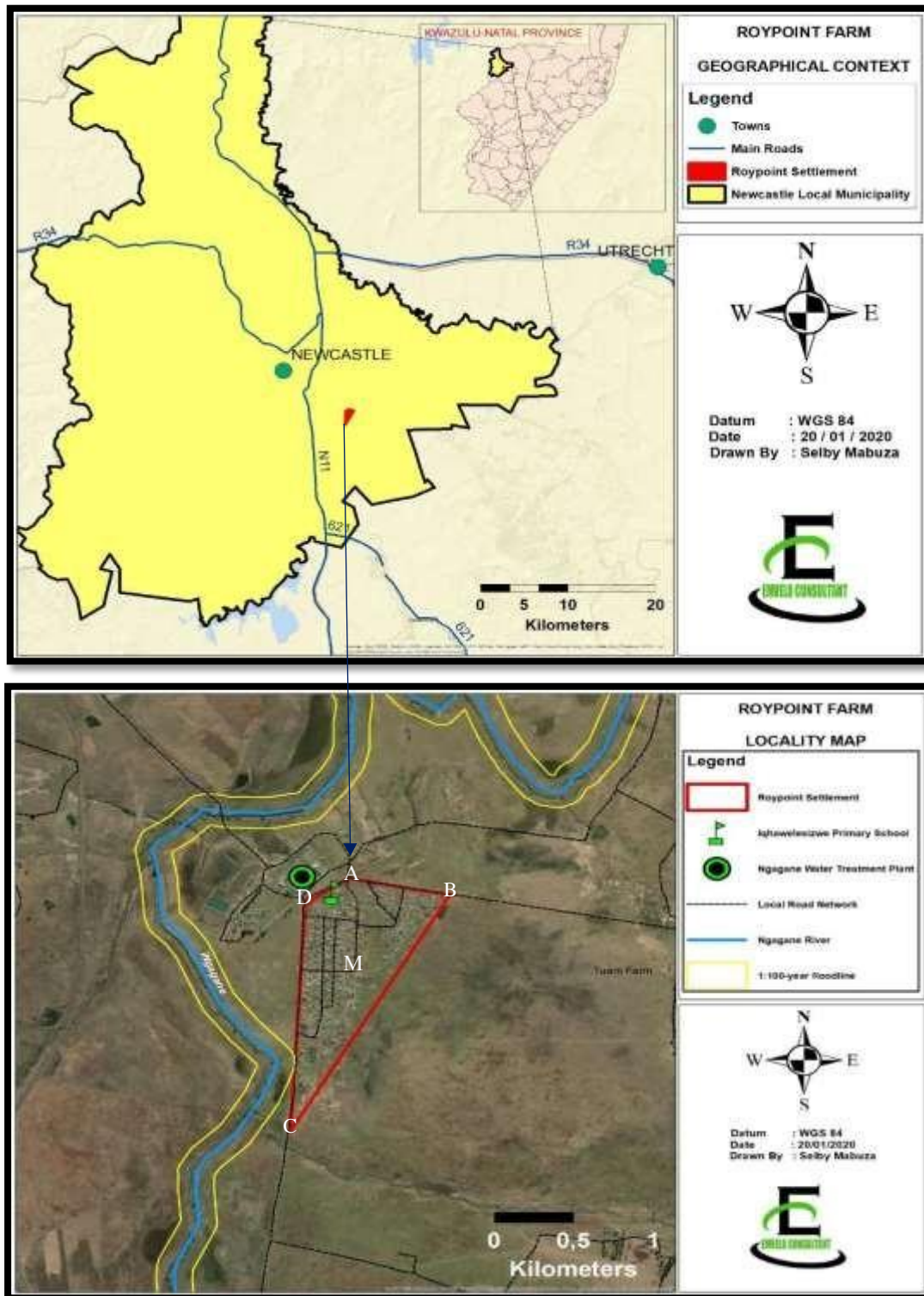
The applicant, Newcastle Local Municipality intends to formalize 780 low income housing units for the Roypoint informal settlement. The formalization will include the development of single-story residential dwellings (Low-cost housing), road infrastructure and the installation of bulk services such as water, sewage, electricity and storm water systems. The property in which the proposed development is to be undertaken is owned by the Newcastle Local Municipality. The proposed site is situated, approximately 7 km southeast of the Newcastle town. The current zoning of the property is Residential.

This alternative proposes the formalization of the existing erven and houses, so to ensure the possibility of retaining most of the +/- 780 houses that have been built on the allocated stands in the settlement. Houses shall be constructed for those who cannot afford to build their own houses on the vacant stands identified in the area. The alternative also includes the installation of bulk services such as water, electricity sewage and storm water systems for all the houses, old and new, and the upgrading of local roads.

From an environmental perspective, alternative C is the most preferable alternative. This is due to the minimal environmental degradation that might be expected during the course of the project, as there will be a minimum clearance of vegetation. Furthermore, this alternative will ensure that the environmental risks associated with

alternative A and B will not be incurred. Also, upgrading the already existing houses will maximize the provision of basic services through the installation of adequate sanitation infrastructure and the upgrading of the local roads within the community. This will improve the overall standard of living for the local people of the Roypoint settlement.

Figure 1: Proposed location of development (Emvelo Quality and Environmental consultant (Pty) Ltd).



Related Infrastructure:

1. Roads,
2. Buildings,
3. Sewage pipelines.

The Vezobuhle settlement is an informal settlement which consists of families who are settled on a farm called Roypoint. Within the municipality, especially in low income and poor communities, the population growth rate is in an upward trajectory, with glaringly disturbing inequalities characterized by a large number of informal housing facilities and lack or poor provision of basic services.

As a result, the KwaZulu Natal Department of Human Settlements and the Newcastle Municipality have prioritized the formalization of this settlement as part of the Integrated Residential Development Programme. This project will, therefore, provide access to more formal housing in a municipality that is experiencing population growth and hence higher human settlements demands.

The project seeks to facilitate the provision of housing in line with the national and provincial norms and standards and hence reduce housing back-logs to meet the provincial and national targets. The project will also create more opportunities for the local people, including the creation of jobs and the provision of basic services, as formal roads and sanitation facilities

The Project includes two Alternatives (see Figure 2):

Alternative A This alternative proposes that +/-200 housing units to be developed on the wider farm portion, to the north-east of the farm. The remaining 580 housing units will be constructed on the vacant stands that have been identified in the area, as per the initial plan. This alternative will result in the settlement being extended towards the north-easterly portion of the Roypoint farm, which is currently undeveloped.

Alternative B: This alternative proposes the relocation of the affected households to a more favourable location.

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The size of the site is approximately 38 hectares.

Rezoning/ and or subdivision of land: No.

Name of Developer and Consultant: Newcastle Local Municipality and Tsimba Archaeological Footprints.

Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.

Short Curriculum vitae (1ai,1aii): Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is curator of a large fossil invertebrate collection, Therapsids, dinosaurs, amphibia, fish, reptiles, and plants at Ditsong: National Museum of Natural History. For the past 14 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, Limpopo, Mpumalanga, Gauteng and Free State Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 26 years.

Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

E. Description of property or affected environment

Location and depth:

The suitability of The Proposed Development of Roypoint Housing Units within the Newcastle Local Municipality, Amajuba District, Kwa-Zulu Natal will be situated on the Farm Portion Roy Point 2959-HS, Newcastle Local Municipality, Amajuba District Municipality within Kwa-Zulu Natal Province.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores.

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The size of the site is approximately 38 hectares.

Figure 2: Google.earth image showing location of the development (Emvelo Quality and Environmental consultant (Pty) Ltd).



F. Description of the Geological Setting

Description of the rock units:

Over areas totalling fully 40% of Southern Africa the 'hard rocks', from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-too-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996).

Large areas of the southern African continent are covered by the Karoo Supergroup (Figure 3). It covers older geological formations with an almost horizontal blanket. Several basins are present with the main basin in the central part of south Africa and several smaller basins towards Lebombo, Springbok Flats and Soutpansberg. An estimated age is 150 – 180 Ma. And a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. The Elliot Formation is also known as the Red Beds and the old Cave Sandstone is known as the Clarens Formation. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, etc. (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which lies on the Dwyka Group.

Figure 3: Geology of the development area (1h).



Legend to Map and short explanation.

M – Alluvium (yellow). Quaternary.

Jd – Dolerite (pink). Karoo Supergroup. Jurassic.

Pvo – Bluish-grey or dark-grey mudstone and shale, subordinate siltstone (amber). Volksrust Formation, Ecca Group, Karoo Supergroup. Permian.

Pv – Sandstone, dark-grey mudstone and shale, coal beds in places (grey). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

..... – (black) Lineament (Possible dyke).

--f-- Fault.

⊥10° - Strike and dip.

□ – Approximate position of Roypoint.

Mining Activities on Figure:

C – Coal.

Mining past and present.

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

Kent (1980) described the Volksrust Formation as the 150-270 m of shale which overlies the Vryheid Formation. The deposition of this formation coincides with that of the Fort Brown and Waterford Formations in the south (Snyman 1996). It occurs from the south of Kwazulu-Natal into the Free State and is concordant (Visser 1989). Very little is written on the Volksrust Formation. It rests conformably on the Vryheid Formation. Fossils consist of fish scales and wood. This formation reaches thicknesses of 170-270 m (Visser 1989). A monotonous sequence of grey shale is present and fossils are significant, but very rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant remains, petrified wood, and low-diversity marine to non-marine trace fossil assemblages (Groenewald and Groenewald 2014).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

The Project includes two Alternatives (see Figure 2) present on the Quaternary and Vryheid Formation:

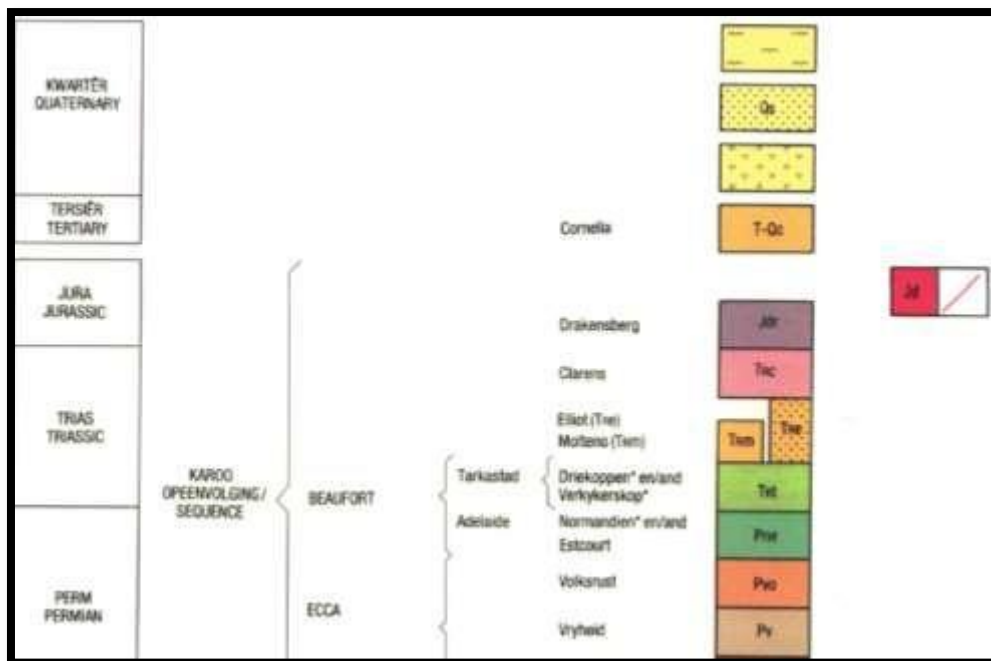
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The size of the site is approximately 38 hectares.

Figure 4: Lithostratigraphic column of the development area (Muntingh 1987).



Dolerite dykes (Jd) occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport.

Field Observation – The area is not too large. Informal housing and gravel roads are present. The walk through located the Vryheid Formation, but no fossils. The topography is undulating with the iNgaga river nearby.

Figure 5: View of north-eastern corner of site showing gravel road.



Figure 6: View of northern middle section of site.



Figure 7: View of north-western corner with pylons visible.



Figure 8: View of south-eastern corner of site.



Figure 9: View of western border of site.



Figure 10: Present sewerage manhole.



Figure 11: View of where Alternative A will be situated.



Figure 12: Channel showing depth of overburden.



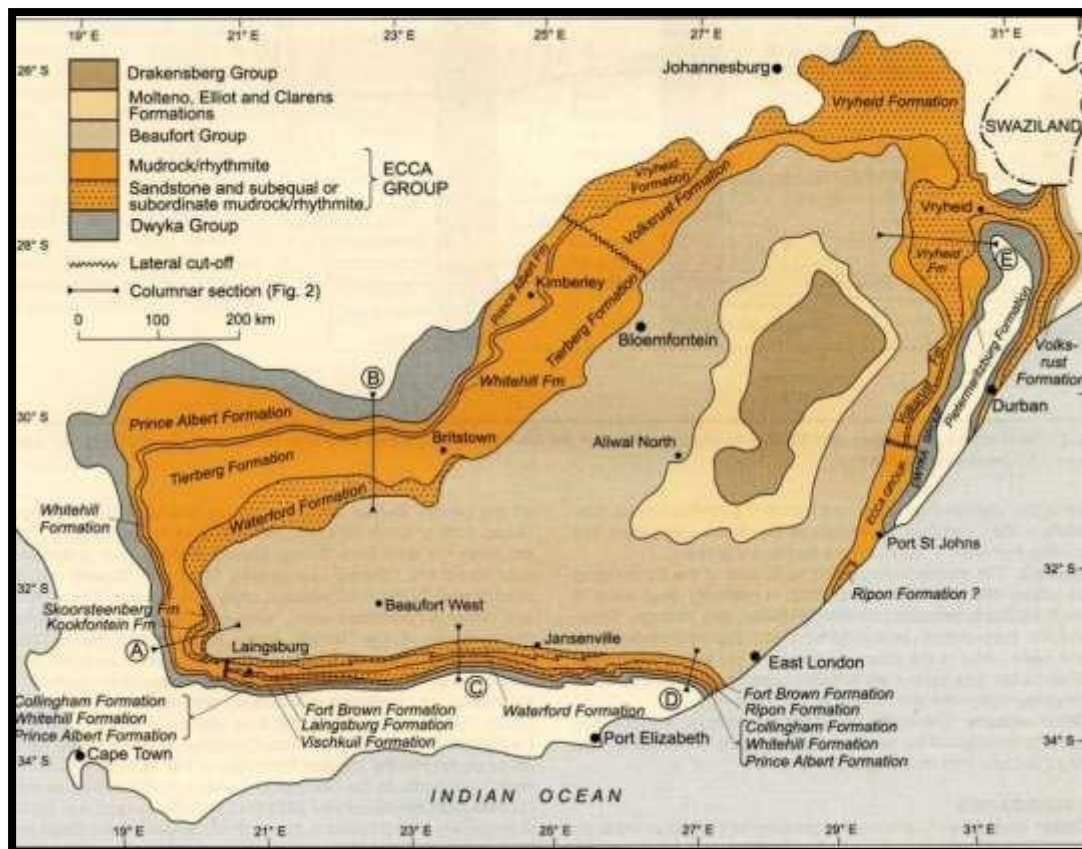
It is recommended to wait for the response from SAHRA on the Phase 1: Field Study (this report). SAHRA protocol must be followed.

G. Background to Palaeontology of the area (1j)

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

The Quaternary sediments may contain fossils. A very wide range of possible fossil remains, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. Stromatolite structures range from a centimetre to several tens of metres in size. Large areas of the coastal plain of Kwazulu-Natal are covered in a blanket of alluvial sand and no significant fossils have been described from these sediments (Groenewald 2012).

Figure 13: Extent of the Karoo Supergroup (Johnson 2009).



The rocks of the Karoo Supergroup are internationally acclaimed for their richness and diversity of fossils. The rocks of the Beaufort Group of South Africa cover approximately one-third of the land surface and have yielded an abundance of well-preserved therapsids and other tetrapods which have been used to subdivide this Group into eight faunal Assemblage Zones.

The Volksrust Formation consists of a monotonous sequence of grey shale and fossils are significant, but very rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant

remains, fish scales, petrified wood, and low-diversity marine to non-marine trace fossil assemblages (Groenewald and Groenewald 2014).

The Ecca Group, Vryheid Formation may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The *Glossopteris* flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**, but here locally **VERY HIGH** for the Vryheid Formation and **LOW** for the Quaternary sediments.

Table 1: Taken from Palaeotechnical Report (Groenewald and Groenewald 2014) (**1cA**).
Quaternary.

Wide range of fossils possible, including mammalian bones and teeth, tortoise remains, ostrich egg etc	Alluvial deposits associated with recent water courses of main rivers and streams. These sediments are presently not well studied and records of fossil occurrences are mainly associated with archaeological reports
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Vryheid Formation.

Rich fossil plant assemblages of the Permian <i>Glossopteris</i> Flora (lycopsids, rare ferns and horsetails, abundant glossopterids, cordaitaleans, conifers, ginkgoaleans), rare fossil wood, diverse palynomorphs. Abundant low diversity trace fossils, rare insects, possible conchostracans, non-marine bivalves, fish scales.	Globally important fossil floras from Middle Permian Gondwana. Seriously under-collected in recent years, despite ongoing mining for coal
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Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA) (**1cB**):

Rock Unit	Significance/vulnerability	Recommended Action
Quaternary	Low	Desktop survey, surrounded by rocks of a Very High sensitivity
Vryheid Formation	Very High	Field assessment and protocol for finds is required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).

Impact: **VERY HIGH** for the Vryheid Formation, **LOW** for the Quaternary sediments. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

H. Description of the Methodology (1e)

The palaeontological impact assessment study was undertaken in August 2020. A Phase 1: Field Survey of the affected portion will include photographs (in 7.1 mega pixels) taken of the site with a digital camera (Canon PowerShot A470). Additionally, Google.maps will be accessed on a cellular phone for navigation. A Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 (SAHRA 2012) requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

Assumptions and Limitations (1e):-

The accuracy and reliability of the report may be limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes.

Act No. 25 of 1999. National Heritage Resources Act, 1999.

National Estate: 3 (2) (f) archaeological and palaeontological sites,

(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,

Heritage assessment criteria and grading: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;

(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.

SAHRA is responsible for the identification and management of Grade 1 heritage resources.

Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.

Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.

Archaeology, palaeontology and meteorites: Section 35.

(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.

(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.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (e. g. during bedrock excavations), this must be safeguarded, where feasible *in situ*, and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (e. g. Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

I. Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Vryheid Formation.

The Quaternary sediments may contain fossils. A very wide range of possible fossil remains, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. Stromatolite structures range from a centimetre to several tens of metres in size. Large areas of the coastal plain of Kwazulu-Natal are covered in a blanket of alluvial sand and no significant fossils have been described from these sediments (Groenewald 2012). Large areas of the coastal plain of Kwazulu-Natal is covered in a blanket of alluvial sand and no significant fossils have been described from these sediments (Groenewald 2012).

Fossils likely to be found are mostly plants (Appendix 1) such as '*Glossopteris flora*' of the Vryheid Formation. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present. During storms a great variety of leaves, fructifications and twigs accumulated and because they were sandwiched between thin films of mud, they were preserved to bear record of the wealth and the density of the vegetation around the pools. They make it possible to reconstruct the plant life in these areas and wherever they are found, they constitute most valuable palaeobotanical records (Plumstead 1963) and can be used in palaeoenvironmental reconstructions.

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:- earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above – not applicable to this development.

J. Recommendation (1o,1p,1q)

- a. There is no objection (see Recommendation B) to the development, it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity of the Vryheid Formation is **VERY HIGH**. A Phase 2 Palaeontological Mitigation is only required if fossils are found during construction or if the Phase 1: Field Study finds fossils. Protocol is attached (Appendix 2).
- b. This project may benefit the economy, the life expectancy of the community, the growth of the community and social development in general.
- c. Preferred choice: Preferred Alternative. All Alternatives have the same impact.
- d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures.
- e. This report must be submitted to SAHRA with the Heritage Impact Assessment.

Sampling and collecting (1k,1l,1m):

Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

- a. Objections: Cautious. See heritage value and recommendation.
- b. Conditions of development: See Recommendation.
- c. Areas that may need a permit: Yes.

- d. Permits for mitigation: **Needed from SAHRA/PHRA prior to Mitigation.**

K. Conclusions

- a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
- b. All information needed for the Desktop Study was provided by the Consultant. All technical information was provided by Tsimba Archaeological Footprints.
- c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
- d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures. Especially shallow caves.
- e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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Declaration (1b)

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

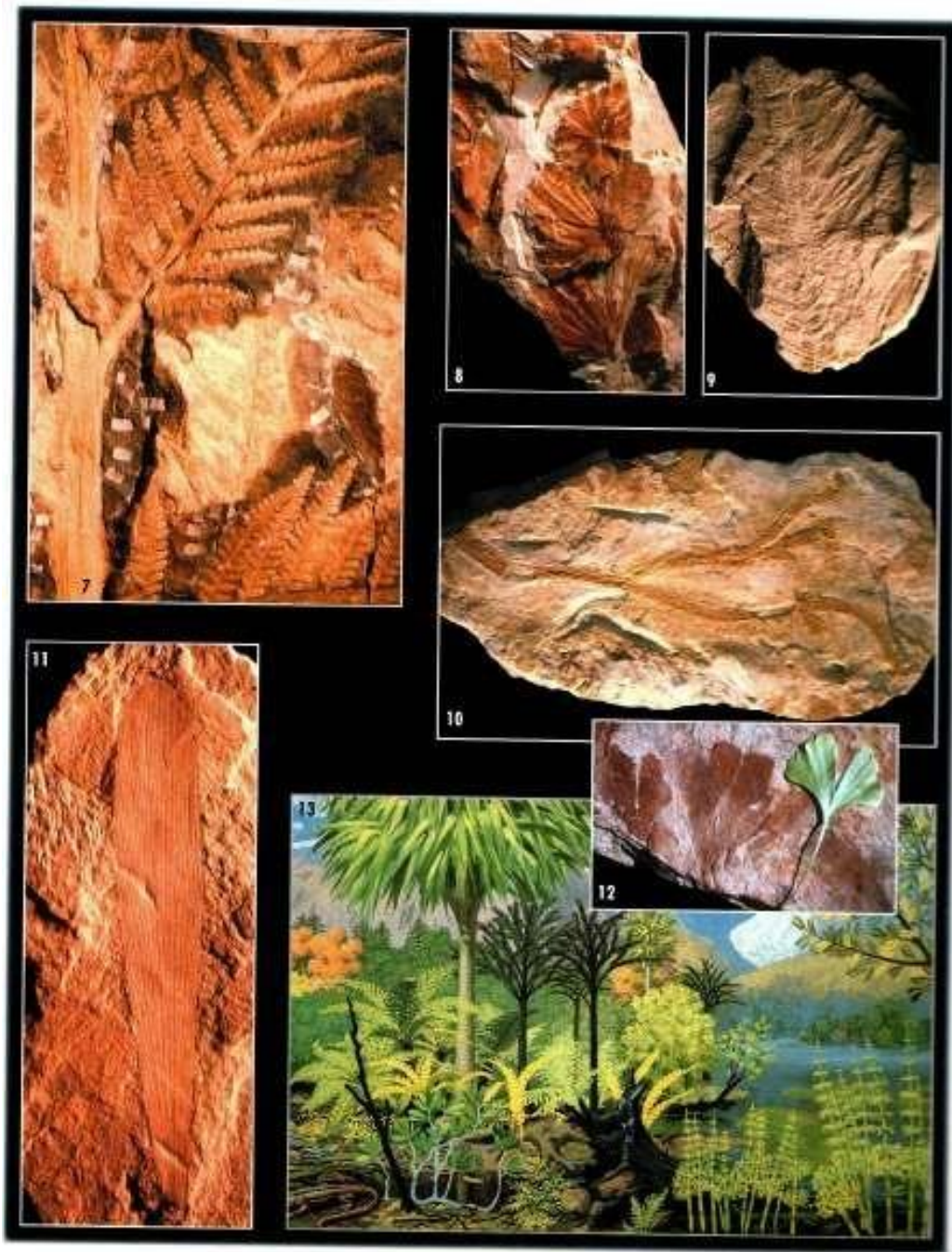
It may be possible that the Palaeontological Impact Assessment may have missed palaeontological resources in the project area as outcrops are not always present or visible while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.

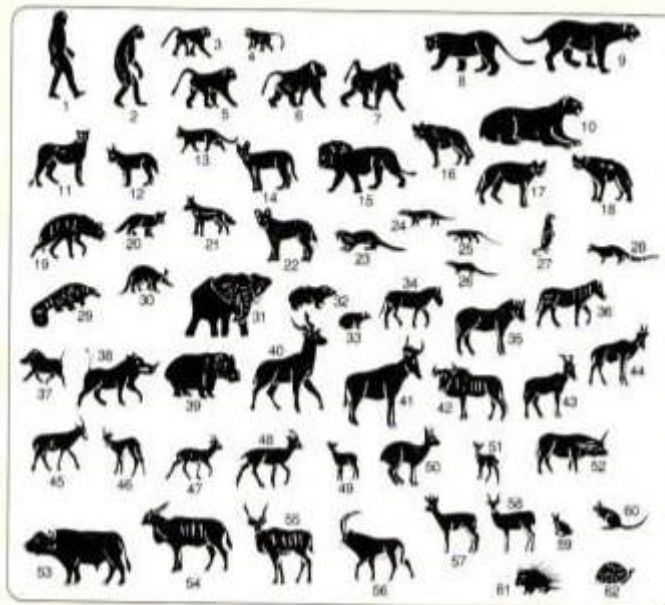


Heidi Fourie
2020/08/21

Appendix 1: Examples of Vryheid Formation fossils (MacRae 1999).



Examples of Quaternary fossils (MacRae 1999).



Silhouette representation of the larger vertebrates whose remains are represented in Members 1-3 of the Swartkrans site on the outskirts of the town of Krugersdorp. Numbers after each taxon comprise minimum numbers of individuals represented in the remains of the lower bank (Member 1), hanging remnant (Member 2), Member 2 and Member 3 respectively.

Courtesy of Dr C.K. Brain,
Museum of Natural History, Pretoria

FAUNA FROM MEMBERS 1-3, SWARTKRANS (Makapanian Mammal Age) Courtesy Dr B. Brain, - Museum of Natural History, Pretoria

1: *Homo erectus* (man) 1,3,2,0. 2: *Australopithecus robustus* (robust apeman) 13,87,17,9. 3: *Parapapio jonesi* 0,8,0,0. 4: *Carcapithecoides* sp. 1,0,0,0. 5: *Papio hamadryas robinsoni* 6,38,8,11. 6: *Theropithecus oswaldi danelli* 1,17,1,14. 7: *Dinopithecus ingens* 1,26,0,0. 8: *Panthera pardus* (leopard) 4,12,2,5. 9: *Dinofelis* sp. (false sabre-toothed cat) 0,1,0,0. 10: *Megantheron* sp. (dikik-toothed cat) 0,1,0,1. 11: *Achanyx jubatus* (cheetah) 0,1,0,1. 12: *Felis caracal* (caracal) 1,0,0,0. 13: *Felis lybica* (African wild cat) 0,0,0,1. 14: *Felis serval* (serval) 1,0,0,0. 15: *Panthera leo* (lion) 1,1,0,0. 16: *Hyena brunnea* (brown hyena) 1,4,2,3. 17: *Chasmaportetus nitidula* (hunting hyena) 2,8,1,2. 18: *Crocuta crocuta* (spotted hyena) 0,2,1,1. 19: *Proteles* sp. (large fossil aardwolf) 1,1,0,1. 20: *Vulpes* sp. (fox) 0,2,0,3. 21: *Canis mesomelas* (black-backed jackal) 3,4,4,5. 22: Large canid gen. and sp. indet. 0,0,1,1. 23: *Aonyx capensis* (Cape clawless otter) 2,0,1,2. 24: *Atilax* sp. (water mongoose) 0,0,1,1. 25: *Cynictis penicillata* (yellow mongoose) 0,0,1,1. 26: *Harpagaster ichneumon* (large grey mongoose) 1,0,0,0. 27: *Suricata suricatta* (suricate) 0,0,2,1. 28: *Genetta hyalina* (large-spotted genet) 0,0,0,1. 29: *Manis* sp. (pangolin) 0,0,0,1. 30: *Orycteropus afer* (antbear) 1,0,1,1. 31: cf. *Elphas* sp. 2,0,0,1. 32: *Procavia transvaalensis* (large fossil dassie) 3,8,3,5. 33: *Procavia antiqua* (fossil dassie) 17,16,10,11. 34: *Hippotaphus lybicum strepteni* (three-toed horse) 1,1,1,1. 35: *Equus capensis* (giant Cape horse) 2,6,3,5. 36: *Equus burchelli* (Burchell's zebra) 0,0,0,1. 37: *Phacocherus* sp. (warthog) 1,0,3,1. 38: cf. *Tapinchoerus meadowsi* (large fossil pig) 1,7,1,1. 39: *Hippopotamus* sp. (hippopotamus) 1,0,0,1. 40: *Guaffid* 0,1,1,1. 41: *Megalotragus* sp. (giant hartebeest) 0,3,1,3. 42: *Connacheites* sp. (wildbeest) 7,19,7,7. 43: Medium otelaphine: *Akelaphus* sp. or *Beatragus* sp. (hartebeest) 3,22,3,6. 44: *Bobatiscus paracomus* 0,2,0,0. 45: *Damaiscus* sp. (blesbok) 2,4,6,6. 46: *Antidorcas marsupialis australis* (springbok) 11,0,10,18. 47: *Antidorcas recki* 0,6,2,1. 48: cf. *Gazella* sp. (gazelle) 5,6,5,14. 49: *Oreotragus oreotragus* (klipspringer) 1,0,0,1. 50: *Oreotragus major* (fossil klipspringer) 0,1,0,0. 51: *Raphicerus campestris* (steenbok) 1,0,1,3. 52: *Makapania* sp. (musk ox) 0,3,0,0. 53: *Syncerus* sp. (buffalo) 2,3,2,3. 54: *Loxotragus oryx* (eland) 0,0,1,1. 55: *Tragelaphus strepsiceros* (kudu) 0,4,0,1. 56: *Hippotragus* cf. *niger* (sable) 0,0,1,3. 57: *Pelea* sp. (rhinoceros) 0,2,0,2. 58: *Redunca arundinum* (reedbuck) 0,1,0,0. 59: *Lagomorph* gen. and sp. indet. (hare) 9,0,4,7. 60: *Padetes* sp. (springhare) 1,0,1,1. 61: *Hystrix africaeastensis* (porcupine) 2,2,1,2. 62: *Chelonaria* indet. (tortoise) 1,0,2,2.



Left: Teeth of the white rhino *Ceratotherium simum* from Makopansgat. Right: View from above shows the sharp cutting edges of the tooth row of this predominant grazer. Specimen 170 mm long.
In the collection of the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand, Johannesburg.
Photograph C.S. MacRae

Appendix 2: Protocol for Chance Finds and Management Plan (1k,1l,1m)

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr).

- The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.
- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. Construction workers must be informed that this is a no-go area.
- It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO or during the digging and excavation phase of the development or a site visit as determined.
- The ECO must visit the site after drilling, excavating or blasting and keep a photographic record.
- The developer may be asked to survey the areas affected by the development and indicate on plan where the construction / development / mining will take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden (already done for this project).

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (e. g. during bedrock excavations), this must be safeguarded, where feasible *in situ*, and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (e. g. Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer may be required to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire development as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.
2. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Using Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils are visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

This document forms part of the Environmental Monitoring Programme. For practical reasons a palaeontologist/palaeobotanist may be required to be on site as recommended. If any fossil material is discovered then a Phase 2 rescue operation may be necessary, and a permit will be required.

The South African Heritage Resources Agency has the following documents in place:

Guidelines to Palaeontological Permitting policy.

Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.

Guidelines for Field Reports.

Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, Kwazulu Natal, and Limpopo)

Appendix 3:

Table 2: Listing points in Appendix 6 of the Act and position in Report (bold in text).

Section in Report	Point in Act	Requirement
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
B	1(ni)(niA)	Authorisation
B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr

D	2	Protocol or minimum standard
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