

**PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED DEVELOPMENT
OF THE RICHARDS BAY COMBINED CYCLE POWER PLANT (CCPP) AND
ASSOCIATED INFRASTRUCTURE ON A SITE NEAR RICHARDS BAY, KWAZULU-
NATAL PROVINCE**

Prepared for:
Savannah Environmental (Pty) Ltd
PO Box 148
Sunninghill
Johannesburg
2157

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Prepared by

BANZAI ENVIRONMENTAL (PTY) LTD
P.O. BOX 11023
UNIVERSITAS
BLOEMFONTEIN
9323

EXECUTIVE SUMMARY

Eskom proposes the development and construction of a 3000MW Combined Cycle Power Plant (CCPP) and associated infrastructure in Richards Bay, KwaZulu-Natal. According to the National Heritage Resources Act (Act No 25 of 1999, section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to assess the impact of the construction and operation of the project on the palaeontological resources.

The proposed project site for the Combined Cycle Power Plant (CCPP) will be located on Erf 2/11376 (approx. 65 ha) and Erf 4/11376 (approx. 6 ha) in Richards Bay. The project site is completely underlain by the Tertiary and Cretaceous successions of the coastal plains of KwaZulu-Natal Maputoland Group (Late Caenozoic Era) which is approximately 18 000 year old. The largest portion of the Uloa Formation is known for the wealth of the bivalve *Aeqipectenuloa*. Gastropods, brachiopods, coralline algae, corals, polyzoa, foraminifera and echinoids are present, as well as isolated teeth of the extinct giant shark, *Carcharodon megalodon*. The Port Durnford Formation, which is also present, includes fossils of terrestrial vertebrates such as antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils and fragments of turtles and crocodiles. Formations in this group have a moderate palaeontological sensitivity.

During a field survey of the proposed development footprint, no fossiliferous outcrops were found. For this reason, a **low palaeontological sensitivity** is allocated to the development footprint. Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

The scarcity of fossil heritage at the proposed development footprint indicate that the impact of the Richards Bay Combined Cycle Power Plant (CCPP) will be of a low significance in palaeontological terms. **It is therefore considered that the construction and operation of the development footprint and associated infrastructure is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.** Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources. No further study is required.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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1 INTRODUCTION

Savannah Environmental (Pty) Ltd has been appointed as the independent Environmental Consultant by Eskom for the undertaking of the Environmental Impact Assessment (EIA) process for the proposed development of the Richards Bay Combined Cycle Power Plant (CCPP) and associated infrastructure on a site near Richards Bay.

Eskom currently generates up to 92% of its electricity from coal sources. The large contribution of coal in the generation mix resulted in Eskom having a large carbon footprint. Climate change, the pursuit for sustainable development and health concerns provided opportunities for Eskom to implement efficient usage of energy, energy generation and effective usage of other scarce input resources such as water. Due to the deterioration in performance of ageing coal infrastructure Eskom has taken the initiative to investigate, develop and construct a 3000MW Combined Cycle Power Plant (CCPP) in Richards Bay. Through the development of the CCPP Eskom supports the Government's National Development Plan and other development policies.

The project site is approximately 71 ha in extent and is located in close proximity to the National Port Authority. The concept design of the CCPP includes a 2:2:1, Gas Turbine: HRSG: Steam turbine configuration with a total of 8 gas turbines and 4 steam turbines that will produce 3000MW of electricity. The CCPP will consist of the gas turbines, HRSGs, steam turbines, diesel storage, Balance of Plant, and buildings and auxiliaries (including gas and water pipelines) to support power generation. Operations of this plant may be mid-merit or baseload which will be decided at a later stage. The plant can be operated on both gas and diesel, which will be transported in various alternatives.

The plant will use gas, Liquefied Natural Gas (LNG) shipped to Richards Bay through the port or pipe or natural gas from Mozambique. Diesel will be mainly used for backup and will be trucked from the source.

Need for the Project (Information provided by SavannahEnvironmental)

Eskom Holdings SOC Ltd is the South African utility that generates, transmits and distributes electricity. Eskom supplies about 95% of the country's electricity and has long recognised the need for sustainable options for generating clean (low carbon) electricity. Gas generation is considered as one such clean option. While electricity distribution is channelled through the National Grid, this plant is required:

- To provide new electricity capacity for South Africa.
- To avoid transmission investment and reduce transmission losses by having a generation centre in KwaZulu-Natal.
- To reduce Eskom's carbon footprint, as power plants using natural gas emit approximately half the carbon of coal-fired power plants while using considerably less water, thus supporting Government's commitment to reduce carbon emissions.
- To support government's energy objective of diversifying South Africa's energy mix.
- To enable a new feed stock for the stimulation of new industry

- To take advantage of gas discoveries in the Rovuma basin of Mozambique thereby gaining access to reasonably priced gas and utilising a regional resource for the benefit of the region.



Figure 1: Google Earth image of the location of the proposed project site on Erf 2/11376 and Erf 4/11376 (orange polygon) of the 3000MW Combined Cycle Power Plant (CCPP) near Richards bay, KwaZulu-Natal (Map modified from Google Earth 2016). Scale bar represent 1000 m.

1.1 LEGISLATION

Cultural Heritage in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Environmental scoping assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the site.

SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- 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.
- No person may, without a permit issued by the responsible heritage resources authority—
 - Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - 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
 - 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.
- 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—
 - 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; and/or
 - 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.

2 OBJECTIVE

According to the South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites (APM) Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports, the aims of the palaeontological impact assessment are:

- To identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- To assess the level of palaeontological significance of these formations;
- To comment on the impact of the development on these exposed and/or potential fossil resources; and
- To make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is therefore to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA) and the EIA Report, to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; fossil sensitivity maps; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area on a desktop level. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of the palaeontological sensitivity of the rocks and the nature and scale of the development itself (extent of new bedrock to be excavated).

If rocks of moderate to high palaeontological sensitivity are present within the study area, a Phase 1 field-based assessment by a professional palaeontologist is necessary. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.

When specialist palaeontological mitigation is suggested, it may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is still exposed and available for study. Mitigation usually involves the careful sampling, collection and recording of fossils, as well as relevant data concerning the surrounding sedimentary matrix. Excavation of the fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. With appropriate mitigation, many developments involving

bedrock excavation will have a *positive* impact on our understanding of local palaeontological heritage.

3 GEOLOGICAL AND PALAEOLOGICAL HISTORY

Cenozoic deposits of aeolian, estuarine, fluvial, lacustrine and marine origin are extensively developed along the coastal plains of the southern African subcontinent. These deposits are overall thin due to buoyancy and erosion, although thick Cenozoic deposits have accumulated offshore in extensional rift basins as sediment funnels at river mouths. The onshore Cenozoic deposits overlie a broad coastal plain in southern Mozambique and northern KwaZulu-Natal with a maximum width of approximately 60km which narrows progressively southwards.

The Cenozoic deposits consist of five coastal Groups namely the Maputuland, Algoa, Bredasdorp, Sandveld and West Coast Groups (Fig. 2).

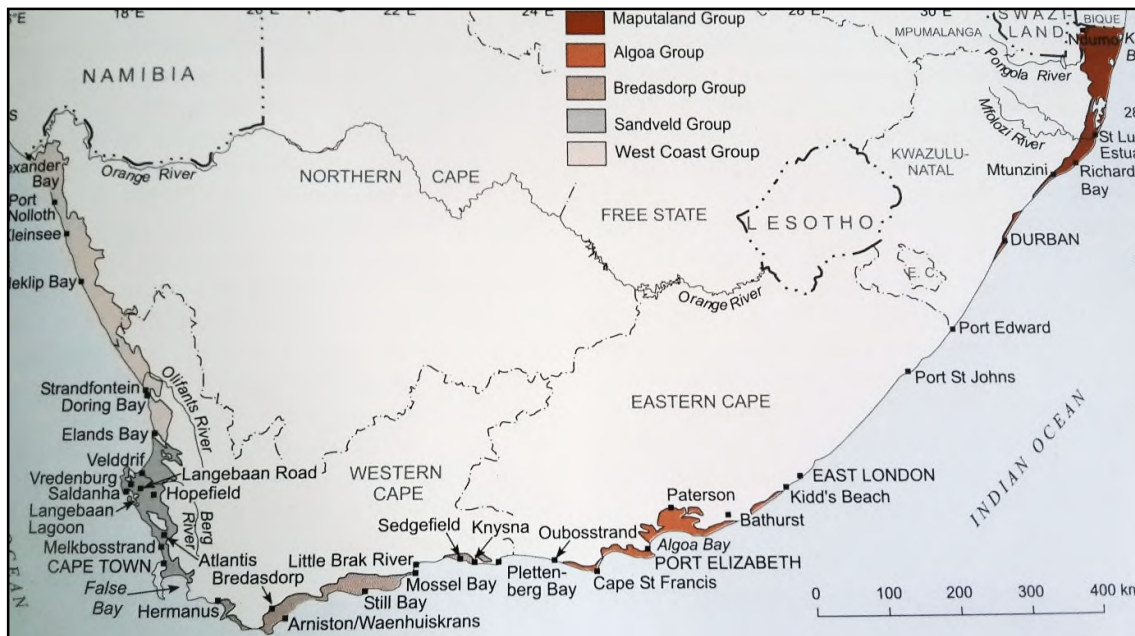


Figure 2: Distribution of coastal Cenozoic sediments in South Africa (Roberts et al, 2006).

The geology of the study area is situated on the 1:250 000 geology map (27.5 32) of St Lucia (Council for Geoscience). The proposed project site of the Combined Cycle Power Plant (CCPP) near Richards Bay is completely underlain by Tertiary and Cretaceous successions of the Maputuland Group (Late Cenozoic Era) (Fig. 3). The geology and soils of the Maputuland Group consists of ~18 000 year old quaternary sediments.

The geology of this sediment will be discussed as in the explanation sheet of the 1:250 000 geology map (27.5 32) of St Lucia (Wolmarans and Du Preez, 1986). This is a less detailed subdivision as that of Johnson et al (2006).

The Maputuland Group forms a thin blanket of Tertiary and Cretaceous sequences that are distributed from Mozambique southwards to Durban.

The largest portion of the Uloa Formation consists of approximately 5 metres of unbedded calcirudite, known as the "Pecten Bed", due to the wealth of the bivalve *Aeqipectenuloa*. Gastropods, brachiopods, coralline algae, corals, polyzoa, foraminifera and echinoids are present, as well as isolated teeth of the extinct giant shark *Carcharodon megalodon* (Johnson et al, 2006).

No fossils have been recorded from the Muzi Formation. The Bluff Formation has local fossiliferous zones whereas the Berea Formation, as well as the Masotcheni Formation and recent alluvial and sand deposits, and do not contain significant fossil remains.

The Port Durnford Formation contains a sequence of carbonaceous muds and sand, comprising fossils of terrestrial vertebrates for example antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils including crustaceans and fish, foraminifera, marine molluscs and fragments of turtles and crocodiles.

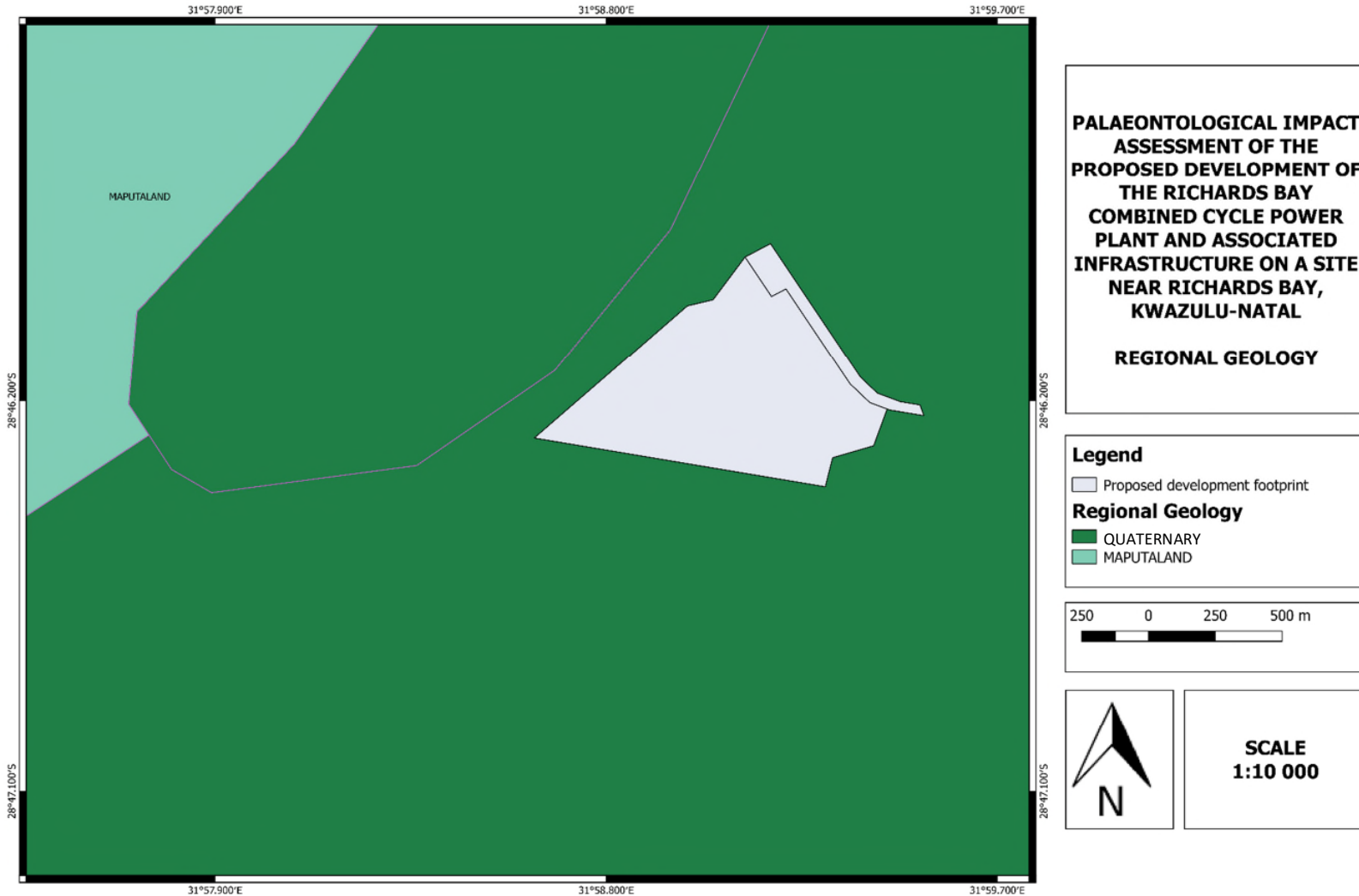


Figure 3: The surface geology of the proposed project site of the Combined Cycle Power Plant (CCPP) on Erf 2/11376 and Erf 4/11376 near Richards Bay, KwaZulu-Natal. The project site is completely underlain by the Tertiary and Cretaceous sequences of the Maputaland Group (Late Cenozoic Era).

4 GEOGRAPHICAL LOCATION OF THE SITE

The proposed project site is located near the Richards Bay area (Fig.1). The entire development footprint is underlain by Tertiary and Cretaceous sequences sediments of the Maputuland Group (Late Caenozoic Era).

5 METHODS

As part of the Palaeontological Impact Assessment, a field-survey of the site proposed for the proposed development was conducted on 11 April 2017, to assess the potential risk to palaeontological material in the proposed footprint of the development. A physical field-survey was conducted on foot within the proposed site. The results of the field-survey, the author's experience, aerial photos (using Google Earth, 2016) topographical and geological maps and other reports from the same area were used to assess the proposed site. No consultations were undertaken for this Impact Assessment.

5.1 ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist.
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g.* of commercial mining companies) is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

In order to ensure that an accurate description of the area proposed for the development is considered a field survey was undertaken to ground truth any potential impacts that

the facility may have on the palaeontological resources of the site. The field-survey was undertaken on 11 April 2017, as indicated in Section 5 above.

6 FIELD OBSERVATIONS



Figure 4. Lush vegetation at the proposed development site.



Figure 5. Lush vegetation with exposed surface at the proposed development site.



Figure 6. Exposed surface at the proposed development site.



Figure7. Exposed surface at the proposed development site.

7 FINDINGS AND RECOMMENDATIONS

The proposed project site for the Combined Cycle Power Plant (CCPP) near Richards Bay, KwaZulu-Natal is completely underlain by the Tertiary and Cretaceous successions of the Maputoland Group (Late Cenozoic Era) which is approximately 18 000 year old. The largest portion of the Uloa Formation is known for the wealth of the bivalve *Aeqipectenuloa*. Gastropods, brachiopods, coralline algae, corals, polyzoa, foraminifera and echinoids are present, as well as isolated teeth of the extinct giant shark *Carcharodon megalodon*. The Port Durnford Formation includes fossils of terrestrial vertebrates such as antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils and fragments of turtles and crocodiles. Formations in this group have a moderate palaeontological sensitivity.

During a field survey of the proposed development footprint, no fossiliferous outcrops were found. For this reason, a **low palaeontological sensitivity** is allocated to the development footprint. Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

The scarcity of fossil heritage at the proposed development footprint indicate that the impact of the Richards Bay Combined Cycle Power Plant (CCPP) will be of a low significance in palaeontological terms. **It is therefore considered that the construction and operation of the development footprint and associated infrastructure is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.** Thus, the

construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources. No further study is required.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

Impacts

There is a possibility that Gastropods, brachiopods, coralline algae, corals, polyzoa, foraminifera and echinoids are present, as well as isolated teeth of the extinct giant shark *Carcharodon megalodon*. Terrestrial vertebrates include antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils including crustaceans and fish and fragments of turtles and crocodiles.

The impact on fossil materials and thus palaeontological heritage will be limited to the construction phase when new excavations into fresh potentially fossiliferous bedrock take place and the possible destruction of the heritage resources will take place. The extent of the area affected by this potential impact is restricted to the development footprint.

Desktop Sensitivity Analysis of the Site

The proposed project site is completely underlain by the Tertiary and Cretaceous sequences sediments of the Maputuland Group (Late Caenozoic Era). The geology and soils of the Maputuland Group consists of ~ 18 000 year old quaternary sediments.

Six Formations can be distinguished:

The largest portion of the Uloa Formation consists a wealth of the bivalve *Aeqipectenuloa*. Gastropods, brachiopods, coralline algae, corals, polyzoa, foraminifera and echinoids are present, as well as isolated teeth of the extinct giant shark *Carcharodon megalodon* (Johnson et al, 2006). No fossils have been recorded from the Muzi Formation. The Bluff Formation has local fossiliferous zones whereas the Berea Formation, as well as the Masotcheni Formation consists of recent alluvial and sand deposits, and does not contain significant fossil remains. The Port Durnford Formation includes fossils of terrestrial vertebrates such as antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils including crustaceans and fish, foraminifera, marine molluscs and fragments of turtles and crocodiles.

Issue	Nature of the Impact	Extent of the Impact	No-Go Areas
Loss of Palaeontological Heritage:	Construction of the Combined Cycle Power Plant (CCPP) will permanently modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface which are then no longer available for scientific research or as cultural heritage. Any fossils occurring in the project area are potentially scientifically and culturally significant and any negative impact on them would be of high significance. The destruction or inadvertent relocation of any affected fossils will be permanent and irreversible.	Local	No no-go areas have not been identified
<p>Gaps in knowledge and recommendations for further study</p> <p>Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have major scientific importance as many vertebrate fossil taxa are known from a single fossil. During a field survey of the development footprint no fossil heritage was detected. It is therefore considered that the construction and operation of the Richards Bay development and associated infrastructure is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. No further study is required.</p>			

8 REFERENCES

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9 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 three years. She has been conducting Palaeontological Impact Assessments since 2014.

10 DECLARATION OF INDEPENDENCE

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT:

Banzai Environmental (Pty) Ltd

CONTACT PERSON:

Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: