PALAEONTOLOGICAL IMPACT ASSESSMENT AND "PROTOCOL FOR CHANCE FIND OF FOSSILS" FOR THE FOR THE CONSTRUCTION OF THE ACWA POWER KHANYISA IPP PROEJCT, ASH DISPOSAL SITE AND BULK WATER SUPPLY PIPELINE SOUTH OF EMALAHLENI, EMALAHLENI LOCAL MUNICIPALITY, NKANGALA DISTRICT MUNICIPALITY, MPUMALANGA PROVINCE

FOR

HIA CONSULTANTS

AURECON SOUTH AFRCIA (Pty) Ltd

DATE: 01 March 2017

By

Gideon Groenewald
Cell: +27 78 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Aurecon South Africa (Pty) Ltd to undertake a Phase 1 Palaeontological Impact Assessment to confirm the potential Palaeontological Impact for the construction of the ACWA Power Khanyisa IPP Project and associated Infrastructure, which includes a Power Plant Site, Ash Disposal Site and Bulk Water Supply Pipeline near eMalahleni, Mpumalanga Province. The study refers to proposed development areas where the Palaeontology might be impacted on by the construction activities.

Legal Requirements

This "Chance Find Protocol" (CFP) report forms part of the Phase 1 Palaeontological Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development and the SAHRA need to know the basic procedures to be followed during the initial excavations for this project. The recommendations contained in this "Chance Find Protocol" document must form part of the EMPr for the project and timed to coincide with the initial excavations for the foundations that will exceed 1.5m into any geological formation on the development site.

The proposed ACWA Power Khanyisa IPP Project and associated Infrastructure, falls on shale and coal seams of very high significance, as well as thick layers of sandstone and gravel beds that might contain very significant fossils.

Fossils were recorded from previous studies in these rock formations. The potential of finding significant micro-fossils in any excavation into sediments of the Vryheid Formation, is always high and the cooperation of the entire team at the ACWA Power Khanyisa Thermal Power Station is of critical importance. The interest and cooperation of the management team will be highly appreciated. It is essential that the excavation be monitored during the first week of excavation and that this "Chance Find Protocol" be updated on a weekly bases during the first three months of construction and then on a quarterly basis for the life-time of the excavation period for the project.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity was allocated to the entire development. The discovery of “suspicious plant-like material” and other material during the field surveys indicates that significant fossil finds are expected at the start of excavations for foundations.
- The entire team at the construction site must be introduced to Palaeontological material that is likely to be found on site. It is best to pre-arrange a once-off information session with the Palaeontological specialist, to present a simple and understandable (preferably audio-visual presentation in an “interpreted voice”) of the majority of the contractual workers on site during the initial site visit that must form part of the EMPr for the project.
- This “Chance Find Protocol” must be included in the EMPr of the project and a reasonable budget need to be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The SAHRA must be informed of the content of this “Chance Find Protocol” and EMPr arrangements.

TABLE OF CONTENT

INTRODUCTION

Gideon Groenewald was appointed by Aurecon South Africa (Pty) Ltd to undertake a Phase 1 Palaeontological Impact Assessment, to confirm the potential Palaeontological Impact of the construction of the ACWA Power Khanyisa Thermal Power Station and associated Infrastructure, which includes a Power Plant Site, Ash Disposal Site and Bulk Water Supply Pipeline near eMalahleni, Mpumalanga Province. The study refers to proposed development areas where the Palaeontology might be impacted through construction activities.

Legal Requirements

This "Chance Find Protocol" (CFP) report forms part of the Phase 1 Palaeontological Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development and the SAHRA need to know the basic procedures that must be followed during the initial excavations for this project. The recommendations contained in this "Chance Find Protocol" document must form part of the EMPr for the project and timed to coincide with the initial excavations for foundations that will exceed 1.5m into any geological formation on the development site.

The purpose of this communication, as an addendum to the Desktop and Phase 1 Palaeontological Impact Assessments, is to discuss a procedure for the recording of any significant fossils in this development site. The proposal for development includes the extension of the present activities of the proposed construction of the ACWA Power Khanyisa IPP Project and associated Infrastructure. The development falls on Very Highly significant shale and economic minable coal seams, associated with significant plant fossil remains.

Fossils were recorded from previous studies in these rock formations. The potential for finding significant micro-fossils mostly marine and other fossils that might be associated with river delta environments, in any excavation into sediments of the Vryheid Formation, is always high and the cooperation of the entire team at ACWA Power Khanyisa Thermal Power Station Facility is of critical importance. The interest and cooperation of the management team will be highly appreciated. It is essential for the excavation to be monitored during the first week of excavation. This "Chance Find Protocol" must be updated on a weekly basis for the first three months of the project, and then at least every three months, during the lifetime of the excavation period for the project. Significant fossils will be associated with all the clay-rich sediments and gravel beds on site. The quarterly

"Chance Find Protocol" (CFP) reports must be in the public domain and must comply with the basic requirements of the SAHRA legislation in South Africa, whilst being included in the long term EMPr for the entire lifetime of this project. Significant fossil finds has to be recorded and curated according to prescriptions by the South African Heritage Resources Agency (SAHRA). It is specifically stated in this, "Chance Find Protocol" document, that the plant fossils referred to in this context have "no economic value", and are associated with shale beds, that are considered to be "uitskot", and will be dumped during the lifetime of the project.

PHASE 1 FIELD INVESTIGATION

Excavations for the new development will by definition of mining for coal seams, expose mostly sandstone, siltstone and carbonaceous shale of the Vryheid Formation of the Ecca Group, Karoo Supergroup. There is a Very High Chance Find of significant plant, terrestrial and marine fossils in the mudstones of the Vryheid Formation.

Fossil finds will contribute significantly to our understanding of the paleao-environments that prevailed in the area during the Permian ages in Southern Africa, with special reference to the development of thick layers of plant fossils that in some cases resulted in economic quantities of coal deposits.

The Chance find Protocol includes procedures that needs to be followed with the training of the ECO by a suitably qualified Palaeontologist, and recording of significant fossils. The training of the ECO and recording of fossils does not replace the normal communication between the Palaeontologist and the Site Management Team or ACWA Power Management during the life-time of the excavation for this development.

The initial budget for the Palaeontological Heritage component must include the full-time involvement of a suitably qualified palaeontologist (budget must be discussed before the onset of excavations). The reality is that the sediments might be less fossiliferous and the expected time for the Palaeontologist to be on site might be significantly reduced with proper training of, and communication with the ECO and EAP for this project.

PALAEONTOLOGICAL IMPACT AND MITIGATION PROTOCOL

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the Desktop and Phase 1 investigation. The Desktop investigation confirmed that sedimentary rocks of the Vryheid Formation, Ecca Group of the Karoo Supergroup

underlies the study area. The entire study area has been reworked by human intervention and is entirely covered in either naturally deep soils or material used for rehabilitation of old mining areas. The exposure of rock in these environments provide a very unique opportunity for scientists to find new fossils that have never been recorded before. The fact that the fossils are mostly associated with "worthless" waste from mining activities is very important in terms of the South African legislation where rocks with an "economic value" is normally excluded from the list of National Natural Heritage Items. The Very Highly significant fossils in this study area will be associated with "worthless" shale deposits.

During the field survey, highly significant plant remains were observed in association with coal beds and the discovery of significant plant fossils are expected during excavation for foundations, infrastructure and mining of coal. Exposure of bedrock (highly clay-rich sediments) during excavation, might even result in the exposure of well-defined marine invertebrate fossils, and even Permian aged vertebrate fossils from the gravel beds. As indicated in the Phase 1 study, areas underlain by the Vryheid Formation might have a significant impact on palaeontological heritage, and fossils will be restricted to excavations into Permian aged sediments, mapped as such on the published 1:2500 000 geological maps of South Africa.

CHANCE FIND PROTOCOL FOR PALAEONTOLOGICAL HERITAGE

Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Project Manager of the Excavation works, and the ACWA Power Khanyisa IPP Project Team, develop a short-term strategy for the recovery of significant fossils during the excavation operation. As part of such a strategy, the palaeontologist will have to:

- Initially, and at least for the first week of excavation, visit the site at least once to ensure recording of all potentially significant fossil strata.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy can simply be an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO by the appointed palaeontologist to know what to look out for in terms of fossil heritage on site.
- In the case of any unusual structures, the Palaeontologist must be notified by the ECO, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the ECO or the Site Manager becoming aware of suspicious looking material that might be a "Significant

Find", the construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.

Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when "trial excavation" takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.

2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University (or any other registered Institute proposed by SAHRA, which is the closest Institute to the site.

3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the ACWA Power Khanyisa IPP Project

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. In the case of this project it is foreseen that only one representative sample of $1m^3$ of rock with micro-fossils will be sampled. (*If trace fossils of Permian age are exposed, it will be Very Highly significant and the Palaeontologist will obviously be in close communication with the ECO to act as required by SAHRA without causing undue standing time for the contractors).*
3. "Facilitate" systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying

of positions where significant fossils are found. *(In the case of this specific development, the likelihood of such finds is Very High).*

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.

5. Provide covered, dry storage for samples and provide facilities that must be defined as a work area for sorting, labelling and boxing/bagging of samples.

6. Costs of basic curation and storage in the sample archive at the ESI, WITS University or an Alternative Institute proposed by SAHRA (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

Documentary record of palaeontological occurrences

1. The contractor will in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the information below must be indicated on the plan. This must be done in conjunction with the appointed specialist and form part of the on-going revision of the EMPr during the excavation stage of the project:

1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period

1.2 Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation.

Functional responsibilities of the appointed Palaeontologist

1. Establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University, or the alternative recognised Institution.

2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A one-day training session of the ECO must be included in this first site visit to this project.

3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the contractor management team, more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for “major finds”, which might include well-defined marine invertebrate remains.

4. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the ECO and environmental staff by the appointed specialist.

5. Respond to significant finds and undertake appropriate mitigation.

6. Initially, for the first three months of operation, at least two weekly visits to "touch base" with the monitoring progress, process and document interim "normal" finds and to undertake an inspection and documentation of new excavation faces. A strategy for further visits during the life of the excavation must then be determined.
7. Transport of material from the site to the ESI, WITS University or other appropriate Institute.
8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI and the South African Heritage Resources Authority (SAHRA). It must fulfil the reporting standards and data requirements of these bodies.
9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

Exposure of palaeontological material

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:

1.1 The appointed specialist or alternates (SAHRA; ESI WITS University and/or other Institute as applicable) must be notified by the responsible officer (e.g. the ECO or contractor manager), of major or unusual discoveries during excavation, found by the Contractor Staff.

1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the appropriate Institute and Authority (eg ESI at WITS University), or its designated representatives, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.

CONCLUSION

The proposed ACWA Power Khanyisa IPP Project and associated Infrastructure, falls on Very Highly significant shale and coal seams with thick layers of sandstone and gravel beds that might contain very significant fossils.

Fossils were recorded from previous studies in these rock formations. The potential for finding significant micro-fossils in any excavation into sediments of the Vryheid Formation, is always high and the cooperation of the entire team at the ACWA Power Khanyisa IPP Project is of critical importance. The interest and cooperation of the management team will be highly appreciated. It is essential that the excavation be monitored during the first week of excavation and that this "Chance Find Protocol" be updated on a weekly basis during the first three months

of construction and then on a quarterly basis for the life-time of the excavation period for the project.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity was allocated to the entire development. The discovery of "suspicious plant-like material" and other material during the field surveys indicates that significant fossil finds are expected at the start of excavations for foundations.
- The entire team at the construction site must be introduced to Palaeontological material that is likely to be found on site. It is best to pre-arrange a once-off information session with the Palaeontological specialist, to present a simple and understandable (preferably audio-visual presentation in an "interpreted voice") of the majority of the contractual workers on site during the initial site visit that must form part of the EMPr for the project.
- This "Chance Find Protocol" must be included in the EMPr of the project and a reasonable budget need to be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The SAHRA must be informed of the content of this "Chance Find Protocol" and EMPr arrangements.

REFERENCES

Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014. *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces*. Internal Palaeotechnical Reports, SAHRA.

QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo

Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist