SAHRA Case ID: 13104

GEMSBOK HORN SALT PROSPECT

BASIC PALAEONTOLOGICAL ASSESSMENT

Letter of Recommendation for Exemption from further Palaeontological Studies

Gemsbok Horn 242, Dawid Kruiper Municipality, Gordonia District, Northern Cape

By

John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)

Geological and Palaeontological Consultant
P. O. Box 48318, Kommetjie, 7976
Tel./Fax (021) 7833023
Cellphone 083 744 6295
jpether@iafrica.com

Prepared at the Request of

SITE PLAN CONSULTING
021 854 4260
084 511 1520

CLIENT

Transalt (Pty) Ltd

10 JUNE 2019

SUMMARY

The Applicant, Transalt (Pty) Ltd., proposes to sample the saline groundwater (brine) beneath the Bettestat and Tsongna pans on the farm Gemsbok Horn 242 in the southwestern Kalahari (Figures 1, 2), to prospect the potential for salt extraction. A mobile auger drill will drill 5 centrally-located holes of ~20 cm diameter to a depth of about 10 metres, to acquire brine water samples.

The pans are underlain by bedrock of Karoo Supergroup sedimentary rocks of the Dwyka and lowermost Ecca groups (Figure 3). The fossils in these Karoo formations include trace fossils, plant material, a low diversity of invertebrates (molluscs, brachiopods) and fish remains

The pan deposits (Goeboe Goeboe Fm.) are mapped as of uncertain palaeontological sensitivity (Figure 2). The pans are quite ancient features and have been fresher water bodies in the past, as is evident by pan carbonates, diatomaceous layers and aquatic molluscs. Excavations in pans have also uncovered fossil bones and Stone Age artefacts.

The 5 drill holes will penetrate a small volume of pan deposits and the underlying Karoo bedrock. The “point” nature of the drill holes renders the likelihood of intersecting fossil bones in the pan deposits improbable. The Karoo bedrock beneath the pans is expected to be weathered and friable and is unlikely to yield well-preserved fossils.

In view of the very small footprint of the proposed 5 auger drill holes the anticipated palaeontological impact of the brine sampling is considered to be LOW to MARGINAL and no additional palaeontological interventions are required.

Notwithstanding, although improbable, a chance occurrence of fossil material cannot be entirely dismissed. It is recommended that the drill holes be regarded as an exploration opportunity for the nature of the pan deposits and be observed for the possible occurrence of Stone Age artefacts and bone and teeth fragments. Should such material be encountered in the drill spoil then SAHRA and/or the McGregor Museum must be informed and supplied with contextual information, such as images of the find and its context in the bore hole log, for assessment and decision on a suitable response.

CONTENTS

1 BACKGROUND

The Applicant, Transalt (Pty) Ltd., proposes to sample the saline groundwater (brine) beneath the pans on farm Gemsbok Horn 242 in the southwestern Kalahari (Figure 1), to prospect the potential for salt extraction. Site Plan Consulting has been appointed to conduct the Basic Assessment Report (BAR) process for the required environmental authorizations for the Prospecting Right.

The draft BAR was submitted to the South African Heritage Resources Agency (SAHRA) for comment. SAHRA indicated that a Heritage Impact Assessment (HIA) is required, due to the potential moderate to high palaeontological sensitivities indicated by the sensitivity guide map (Figure 2).

This brief report is part of the HIA and its intention is to provide a summary of the main aspects of the geology and the palaeontological sensitivity of the affected formations.

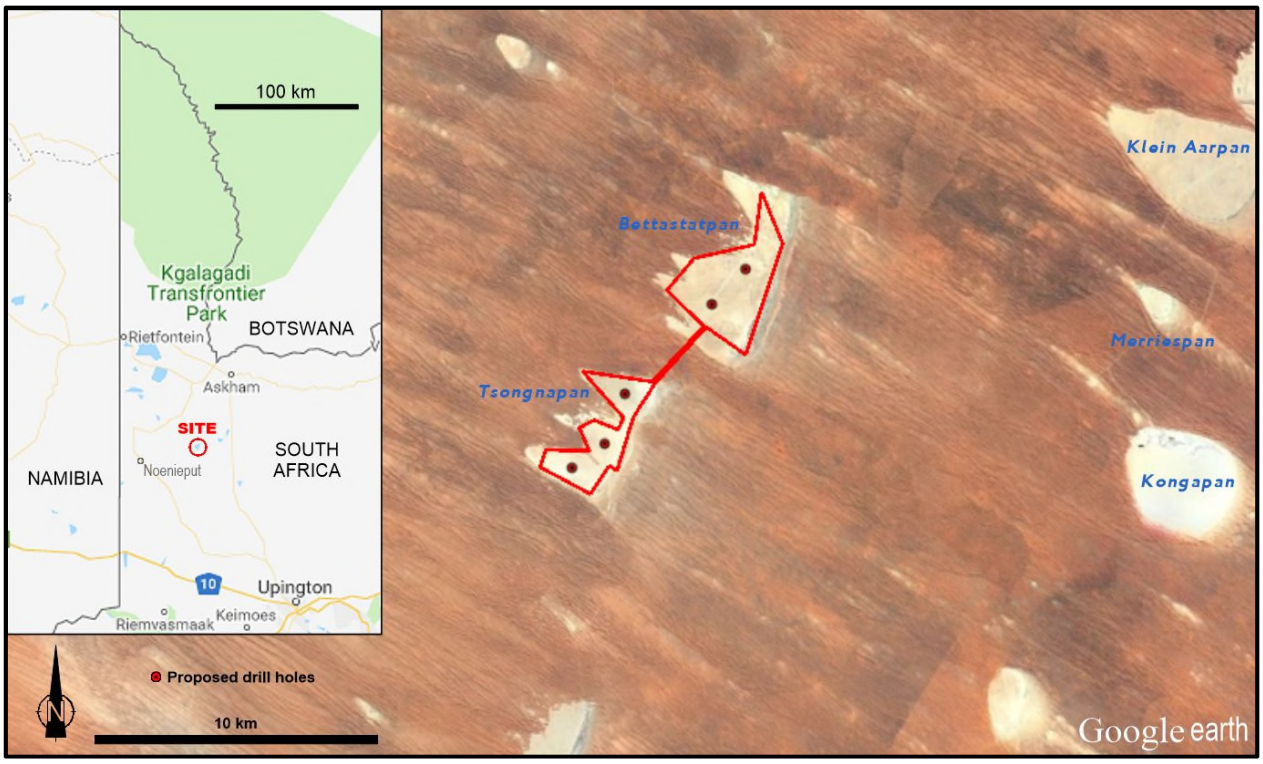


Figure 1. Location of the Prospecting Right Application Area and proposed drill holes for brine sampling.

2 LOCATION

The property Gemsbok Horn 242 is located ~130 km NNW of Upington and ~40 km E of the village of Noenieput (Figure 1), in the Dawid Kruiper Municipality, Gordonia Magisterial District, in the Northern Cape.

1:50 000 Topo-cadastral Sheets 2720AD KOOPAN-SUID and 2720BC AARPAN. CD NGI.

1:250 000 Topo-cadastral Sheet 2720 NOENIEPUT. CD NGI.

1:250 000 Geological Sheet 2720 NOENIEPUT. Council for Geoscience.

Centre co-ordinate between pans: -27.456288 °S / 20.529804 °E.

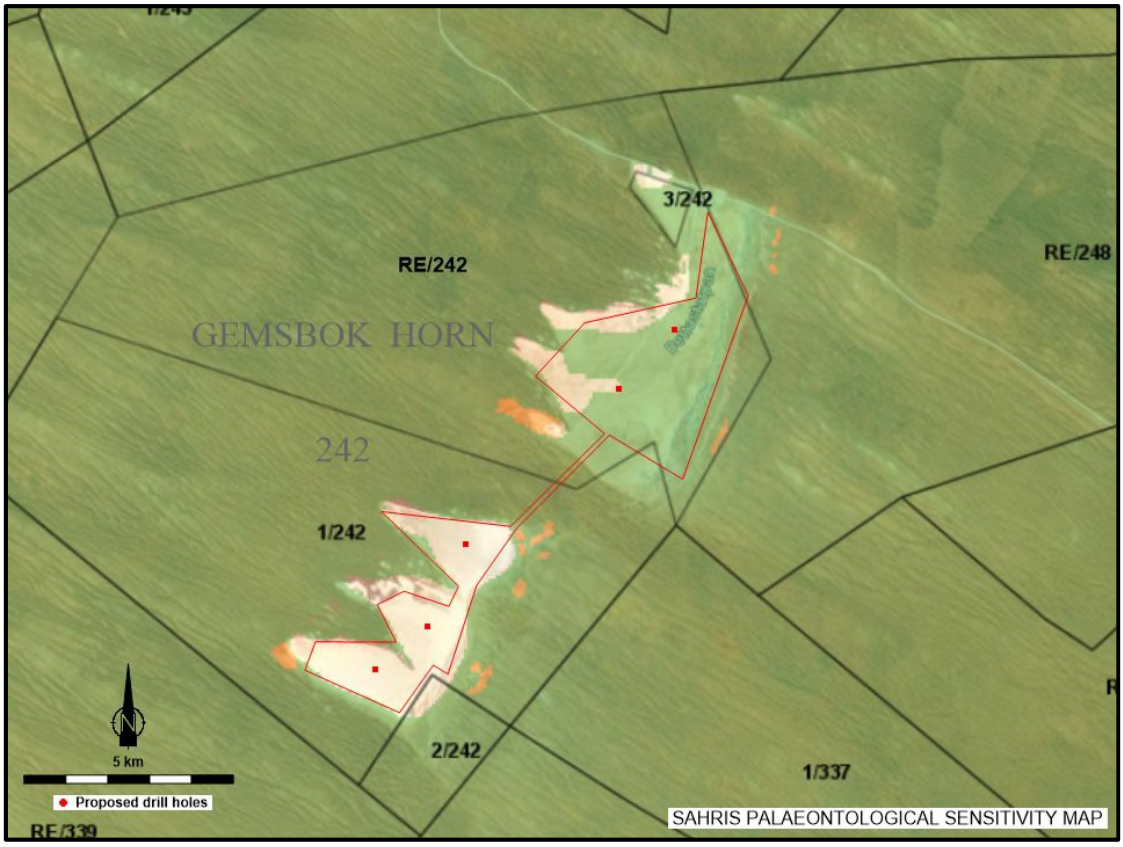


Figure 2. Palaeontological sensitivities of the Prospecting Right Area. Green = moderate; orange = high; clear/white = unknown.

3 LOCALITY PLAN

The Prospecting Right Application Area includes parts of Gemsbok Horn 1/242 and RE/242 and encompasses most of the area of the two pans Tsongna Pan and Bettestat Pan (Figures 1 & 2). Five prospecting drill holes located centrally in the pans are proposed for sampling the subsurface brines.

4 DESCRIPTION OF THE PROPOSED ACTIVITY

A mobile auger drill will be contracted and deployed to drill 5 holes of ~20 cm diameter to a depth of about 10 metres. Each hole will entail the extraction of ~0.315 m^3 of material, amounting to a total of ~1.6 m^3 of disturbed material for the 5 holes. The Applicant's representative will measure the depth of the water table in the completed holes and acquire water samples. The drill holes will then be backfilled.

5 HERITAGE RESOURCES IDENTIFIED

The bedrock of the area comprises sedimentary rocks of the lowermost formations of the Karoo Supergroup, *viz*. the basal **Dwyka Group** glacial tillites (Figure 3, C-Pd) and the overlying shales and sandstones of the lower **Ecca Group** (Figure 3, Pp). Southern Africa, then part of the Gondwana supercontinent, was in the vicinity of the South Pole about 300 Ma (Ma = million years ago) and covered with glaciers and ice sheets. The Dwyka sediments represent the melt-out content from the ice, when ice sheets melted back to the highlands, depositing massive tillites in the ice-scoured valleys which were then succeeded by marine muds, with melt-out dropstones from floating icebergs (the "boulder shales"). These valley and inlet deposits, named the **Mbizane Formation** (Visser *et al*., 1990), are therefore very

variable, comprising tillites, conglomerates, sandstones and mudrocks which were left behind on the ice-scoured landscape by the retreating glaciers. These beds were then submerged in meltwater lakes and the succeeding Ecca deposits of the **Prince Albert Formation** (Pp) are dark, carbonaceous, lacustrine shales and lake-edge deltaic sandstones (Schulz *et al*., 2016).

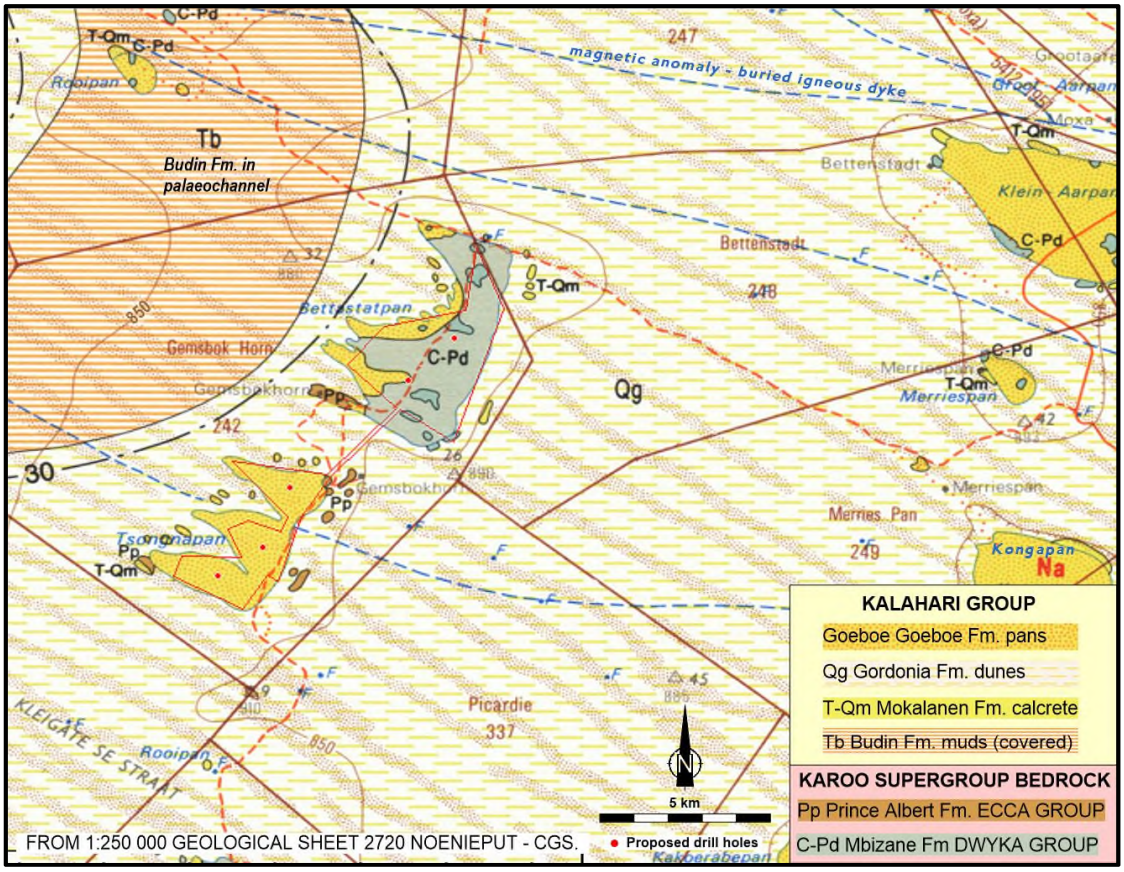


Figure 3. Geology of the Prospecting Right Application Area.

Much later, subsequent to the breakup of Gondwana 140-130 Ma, most of the Karoo Supergroup was eroded away and by the late Cretaceous (80-70 Ma) a wide, shallow basin had formed in the interior of the subcontinent by crustal warping. This Kalahari Basin accommodates the **Kalahari Group** sedimentary basin infill deposited mainly during the Cenozoic Era (Partridge *et al*, 2006). The Kalahari Basin has a buried topography of palaeovalleys in which the thickest deposits occur. Basal fluvial gravels of the Wessels Formation are succeeded by red and brown calcareous muds of the Budin Formation, the latter being mainly lake sediments extensively deposited in the palaeovalleys (Figure 3, Tb). The lacustrine muds pass upwards into alluvial sandstones and gravels of the Eden Formation which, not being mapped, lacks outcrops in this area. The sequence is capped by a regional calcrete named the **Mokalanen Formation** (Figure 3, T-Qm), considered to reflect aridification since the late Pliocene. The typical reddened aeolian sands of the Kalahari linear dune ridges, the Gordonia Formation, overlie the calcrete and dominate the landscape. Pans are numerous and are related to local groundwater surfacing in the flat, poorly drained landscape, concomitant salt accumulation and wind erosion. The pan deposits of mud, fine-grained sand and evaporitic salt layers have been named the **Goeboe Goeboe Formation** (Malherbe, 1984) (Figure 3).

6 ANTICIPATED IMPACTS ON PALAEONTOLOGICAL HERITAGE RESOURCES

Beneath thin pan sediments Bettestat Pan is underlain by the bedrock of the Mbizane Formation (Figure 3). The overall palaeontological sensitivity of this Dwyka formation is rated "moderate" (Figure 2). Tsongna Pan is surrounded by outcrops of the Prince Albert Formation (Figure 3), suggesting that the pan is underlain by this bedrock formation. The overall palaeontological sensitivity of the Prince Albert Fm. is rated "high" (Figure 2). The fossils in these Karoo formations include trace fossils, plant material (typically the *Glossopteris* Flora), a low diversity of invertebrates (molluscs, brachiopods) and fish remains (Almond & Pether, 2009).

Both pans are rimmed by the Mokalanen Fm. calcrete, as indicated by the surrounding outcrops (Figure 3, T-Qm). The overall palaeontological sensitivity of the Mokalanen Fm. is indicated as "high" (Figure 2). The calcrete is likely to have been superimposed on the surficial regolith and possibly alluvium broadly equivalent to the Eden Fm., and may also involve the Karoo bedrock. The calcrete generally includes fossil roots and trace fossils such as termitaria. The thick calcretes conceal amalgamated palaeosurfaces on which fossil bones and land snails occur and may also include lithified, "fossil" pan deposits. The current pan deposits (Goeboe Goeboe Fm.) are mapped as of uncertain palaeontological sensitivity (Figure 2, clear). However, the pans are quite ancient features and have been fresher water bodies in the past, as is evident by pan carbonates, diatomaceous layers and aquatic molluscs. Unsurprisingly, excavations in pans have also uncovered fossil bones and Stone Age artefacts (*e.g*. Kiberd, 2001).

The 5 drill holes will penetrate a small volume of pan deposits and the underlying Karoo bedrock. The "point" nature of the drill holes renders the likelihood of intersecting fossil bones in the pan deposits improbable. The Karoo bedrock beneath the pans is expected to be weathered and friable and is unlikely to yield well-preserved fossils.

7 RECOMMENDATIONS

In view of the very small footprint of the proposed 5 auger drill holes the anticipated palaeontological impact of the brine sampling is considered to be LOW to MARGINAL and no additional palaeontological interventions are required.

Notwithstanding, although improbable, a chance occurrence of fossil material cannot be entirely dismissed. It is recommended that the drill holes be regarded as an exploration opportunity for the nature of the pan deposits and be observed for the possible occurrence of Stone Age artefacts and bone and teeth fragments. Should such material be encountered in the drill spoil then SAHRA and/or the McGregor Museum must be informed and supplied with contextual information, such as images of the find and its context in the bore hole log, for assessment and decision on a suitable response.

8 REFERENCES

Almond, J.E. & Pether, J. 2009. Palaeontological Heritage of the Northern Cape. SAHRA Palaeotechnical Report, Natura Viva cc., Cape Town.

Kiberd, P. 2001. Bundu Farm. A Middle and Later Stone Age Pan Site, Northern Cape, South Africa. Preliminary results of fieldwork 1998-2000. Nyame Akuma 55: 51-55.

Malherbe, S.J. 1984. The Geology of the Kalahari Gemsbok National Park. Supplement to Koedoe: 33-34.

Partridge, T.C., Botha, G.A. & Haddon, I.G. 2006. Cenozoic deposits of the Interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The Geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

Schulz, H.-M., Chere, N., Geel, C., Booth, P. & de Wit, M.J. 2016. Is the Postglacial History of the Baltic Sea an Appropriate Analogue for the Formation of Black Shales in the Lower Ecca Group (Early Permian) of the Karoo Basin, South Africa? In: B. Linol and M.J. de Wit (eds.), Origin and Evolution of the Cape Mountains and Karoo Basin. Regional Geology Reviews: 111-117. Springer International Publishing, Switzerland.

Visser, J.N.J., Von Brunn, V. & Johnson, M.R. 1990. Dwyka Group. Catalogue of South African Lithostratigraphic Units 2: 15-17. Council for Geoscience, Pretoria.

9 APPENDIX 1. PALAEONTOLOGICAL SENSITIVITY RATING

Palaeontological Sensitivity refers to the likelihood of finding significant fossils within a geologic unit.

VERY HIGH: Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironments and which are of international significance.

HIGH: Assigned to geological formations known to contain palaeontological resources that include rare, well-preserved fossil materials important to on-going palaeoclimatic, palaeobiological and/or evolutionary studies. Fossils of land-dwelling vertebrates are typically considered significant. Such formations have the potential to produce, or have produced, vertebrate remains that are the particular research focus of palaeontologists and can represent important educational resources as well.

MODERATE: Formations known to contain palaeontological localities and that have yielded fossils that are common elsewhere, and/or that are stratigraphically long-ranging, would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven, but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.

LOW: Formations that are relatively recent or that represent a high-energy subaerial depositional environment where fossils are unlikely to be preserved, or are judged unlikely to produce unique fossil remains. A low abundance of invertebrate fossil remains can occur, but the palaeontological sensitivity would remain low due to their being relatively common and their lack of potential to serve as significant scientific resources. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area. Other examples include decalcified marine deposits that preserve casts of shells and marine trace fossils, and fossil soils with terrestrial trace fossils and plant remains (burrows and root fossils)

MARGINAL: Formations that are composed either of volcaniclastic or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain contexts at localized outcrops. Volcaniclastic rock can contain organisms that were fossilized by being covered by ash, dust, mud, or other debris from volcanoes. Sedimentary rocks that have been metamorphosed by the heat and pressure of deep burial are called metasedimentary. If the meta sedimentary rocks had fossils within them, they may have survived the metamorphism and still be identifiable. However, since the probability of this occurring is limited, these formations are considered marginally sensitive.

NO POTENTIAL: Assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no palaeontological resource potential.

Adapted from Society of Vertebrate Paleontology. 1995. Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources - Standard Guidelines. News Bulletin, Vol. 163, p. 22-27.

10 APPENDIX 2. DECLARATION OF INDEPENDENCE

GEMSBOK HORN SALT PROSPECT

BASIC PALAEONTOLOGICAL ASSESSMENT

Letter of Recommendation for Exemption from further Palaeontological Studies.

Gemsbok Horn 242, Dawid Kruiper Municipality, Gordonia District, Northern Cape.

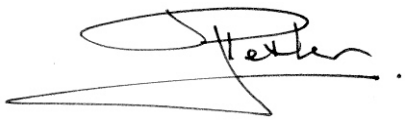
Terms of Reference

This assessment forms part of the Heritage Assessment and it assesses the overall palaeontological (fossil) sensitivities of formations underlying the Project Area.

Declaration

I …**John Pether**……, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in the compilation of the above report;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed to the EAP any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management act;
- have provided the EAP with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.



Signature of the specialist

Date: 10 JUNE 2019

11 APPENDIX 3. CURRICULUM VITAE

John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)

Independent Consultant/Researcher recognized as an authority with 38 years' experience in the field of coastal-plain and continental-shelf palaeoenvironments, fossils and stratigraphy, mainly involving the West Coast/Shelf of southern Africa. Has been previously employed in academia (South African Museum) and industry (Trans Hex, De Beers Marine). At present an important involvement is in Palaeontological Impact Assessments (PIAs) and mitigation projects in terms of the National Heritage Resources Act 25 (1999) (~300 PIA reports to date) and is an accredited member of the Association of Professional Heritage Practitioners (APHP). Continues to be involved as consultant to offshore and onshore marine diamond exploration ventures. Expertise includes:

- Coastal plain and shelf stratigraphy (interpretation of open-pit exposures, on/offshore cores and exploration drilling).
- Sedimentology and palaeoenvironmental interpretation of shallow marine, aeolian and other terrestrial surficial deposits.
- Marine macrofossil taxonomy (molluscs, barnacles, brachiopods) and biostratigraphy.
- Marine macrofossil taphonomy.
- Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones).

Membership of Professional Bodies

- South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.
- Geological Society of South Africa.
- Palaeontological Society of Southern Africa.
- Southern African Society for Quaternary Research.
- Association of Professional Heritage Practitioners (APHP), Western Cape. Accredited Member No. 48.

Past Clients Palaeontological Assessments

AECOM SA (Pty) Ltd.	Guillaume Nel Environmental Management Consultants.
Agency for Cultural Resource Management (ACRM).	Klomp Group.
AMATHEMBA Environmental.	Megan Anderson, Landscape Architect.
Anél Blignaut Environmental Consultants.	Ninham Shand (Pty) Ltd.
Arcus Gibb (Pty) Ltd.	PD Naidoo & Associates (Pty) Ltd.
ASHA Consulting (Pty) Ltd.	Perception Environmental Planning.
Aurecon SA (Pty) Ltd.	PHS Consulting.
BKS (Pty) Ltd. Engineering and Management.	Resource Management Services.
Bridgette O'Donoghue Heritage Consultant.	Robin Ellis, Heritage Impact Assessor.
Cape Archaeology, Dr Mary Patrick.	Savannah Environmental (Pty) Ltd.
Cape EAPrac (Cape Environmental Assessment Practitioners).	Sharples Environmental Services cc
CCA Environmental (Pty) Ltd.	Site Plan Consulting (Pty) Ltd.
Centre for Heritage & Archaeological Resource Management (CHARM).	SRK Consulting (South Africa) (Pty) Ltd.
Chand Environmental Consultants.	Strategic Environmental Focus (Pty) Ltd.
CK Rumboll & Partners.	UCT Archaeology Contracts Office (ACO).
CNdV Africa	UCT Environmental Evaluation Unit
CSIR - Environmental Management Services.	Urban Dynamics.
Digby Wells & Associates (Pty) Ltd.	Van Zyl Environmental Consultants
Enviro Logic	Western Cape Environmental Consultants (Pty) Ltd, t/a ENVIRO DINAMIK.
Environmental Resources Management SA (ERM).	Wethu Investment Group Ltd.
Greenmined Environmental	Withers Environmental Consultants.

Stratigraphic consulting including palaeontology

Afri-Can Marine Minerals Corp	Council for Geoscience
De Beers Marine (SA) Pty Ltd.	De Beers Namaqualand Mines.
Geological Survey Namibia	IZIKO South African Museum.
Namakwa Sands (Pty) Ltd	NAMDEB