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DRAFT HERITAGE SPECIALIST IMPACT ASSESSMENT

PALAEONTOLOGICAL INVESTIGATION AND MITIGATORY ACTIONS FOR PROPOSED RESIDUE DAM, NAMAKWA SANDS SMELTER, SALDANHA BAY MUNICIPAL AREA

PREPARED FOR RESOURCE MANAGEMENT SERVICES

By John Pether

PROJECT DESCRIPTION

This document is prepared for **Resource Management Services (RMS)**, the environmental management consultants conducting the Screening and Scoping phases of the Environmental Impact Assessment (EIA) process for **Namakwa Sands** (Pty) Ltd., the latter applicant intending the construction of a residue dam adjacent to the smelter plant in the SALCOR railyard industrial area. The affected area is 3-4 ha in extent, about 280 by 140 m.

In terms of the National Heritage Resources Act No. 25 of 1999, Sections 35 & 38, palaeontological materials (fossils) are regarded as a heritage resource and appropriate actions are required to mitigate impacts from construction and development on palaeontological heritage.

The main purposes of this assessment are to:

- Outline the nature of palaeontological heritage resources in the vicinity of the site.
- Suggest the mitigatory actions to be taken during the construction of the waste disposal site with respect to the occurrence of fossils.

This document also serves as the basis for the Agreed Terms of Reference for the heritage impact management part of the project.

As yet there are no dates scheduled for the work or provision of details of the excavations wrt. precise positions and excavation depths.

The site is shown here by the attached image provided by RMS (page 7 hereof).

THE PALAEONTOLOGICAL ASSESSMENT AND MITIGATION PROCESSES

Introduction

Although fossiliferous strata may be exposed at some sites in the vicinity, most of the fossils will be exposed in the excavations made for the installation. Palaeontological interventions mainly happen once fossil material is exposed at depth, i.e. once the EIA process is done and construction commences.

The action plans and protocols for palaeontological mitigation must therefore be *included in the EMP* and embodied in the Agreed Terms of Reference for the appointed heritage assessment/mitigation practitioner.

Therefore, although this submission occurs at the screening/scoping phase, it may be regarded as the draft input for the EIA phase.

Screening Phase

Desktop Study. Existing scientific literature and collection holdings of relevance to the palaeontological/geological record of the site area will be reviewed, assessed and summarized. On this basis the general expectations wrt. potential fossil occurrences will be outlined.

Specific site features. Identification and basic description of significant features wrt. palaeontological heritage *currently exposed* in the site area. Some of these features may be affected by the proposed constructions; either directly by potential destruction, or less directly by potential degradation as a result of increased traffic, access, visibility , etc.

The object here is the advance earmarking of fossil sites of such importance that they may constitute a permanent No-Go site, necessitating revision of the siting of the envisaged installation. Alternatively, that the outcrop/exposure is sufficiently important that mitigation measures should be carried out *before* the commencement of construction activities on the site.

Outcome: Initial HIA Palaeontological Report for the site (this report).

Scoping Phase

It is not foreseen that further palaeontological input is required at this stage. However, the Draft HIA Palaeontology could be further discussed and elaborated if required, for input to the Scoping Report.

EIA Phase

At this stage, any additional information arising and issues from discussions with interested parties wrt. recommendations for mitigatory actions for the selected site will be elaborated for inclusion in the finalized EIA Report, for the input to the EMP.

Also, at this stage the examination of any available drill cores/samples of sediments obtained in the course of geotechnical and geohydrological investigations would facilitate an improved assessment of the fossils likely present. It might also “add value” to such investigations.

Site visits may not be necessary, unless to examine additional material such as cores.

EMP Phase

Mitigatory recommendations to be carried out during a fieldwork phase at the selected site. See below.

Outcome: Final Report. Rescued fossil material deposited in the appropriate scientific institution.

Desktop input: Expected Palaeontology/Geology

The scientific literature and museum collection holdings pertaining to the fossils from the area are voluminous and the compiled lists are not included at this stage of reporting. This section outlines some of the salient points.

The site is situated on the northern flank of the broad, flat plain of the Saldanha Embayment at about 25-30 m asl. Beneath a thin cover of sand, the area is underlain by aeolianites and calcretes of the Langebaan Formation (Visser & Schoch, 1973, map). Sediment thickness in the area is estimated to be about 10 m (Rogers, 1980, Fig. 3.20), but this is a very broad estimate based on widely-spaced data.

The excavation for the dam will expose Langebaan Formation aeolianites (old dune sands), variously cemented by pedogenic calcretes, with soil horizons. Although usually not very fossiliferous, aeolianites do have a fossil content. Buried Early and Middle Stone Age archaeological sites may occur within the aeolianite, particularly in its upper part. Most of the fossils are associated with old, buried surfaces in the aeolianites (palaeosurfaces), usually formed during wetter periods with reduced rates of sand accumulation, with soil formation showing the surface stability.

The common fossils include shells of extinct landsnails, fossil tortoises, ostrich incl. egg fragments, sparsely scattered bones etc. Concentrations of bones of antelopes and carnivores may occur in the liars of hyaenas. Since overhangs and crevices were used as liars, these bone concentrations are usually “superimposed” into an older, cementing aeolianite. “Blowout” erosional palaeosurfaces may carry fossils concentrated by the removal of sand by the wind. Hollows between dunes (interdune areas) are the sites of ponding of water seeping from the dunes, leading to the deposits of springs, marshes and vleis. These are usually muddy, with plant fossils, but being waterholes, are usually richly fossiliferous. At this stage the Langebaan Fm. includes various aeolianites of different ages and is an “amalgam” of the dune plumes that formed on the coastal plain, at differing places and times, during the last ~2.5 Ma (Ma: Mega-annum or million years before present).

If the excavation for the dam is deep enough, beneath the aeolianites are expected marine shelly sands of the Uyekraal Shelly Sand Formation (Rogers, 1983). The site is in fact in the “type area” of the Uyekraal Formation. However, there is no type section available and the Uyekraal Fm. is known only from boreholes. Thus no detailed descriptions of exposures exist, nor has the fossil content and age been adequately established. It has a capping hardpan calcrete, beneath which is green-hued shelly, gravelly sand with phosphatic casts (steinkerns) of molluscs and shark teeth. (Rogers, 1982, 1983).

On the basis of borehole and geomorphological observations, the Uyekraal Fm. is younger than the famously fossiliferous ~5 Ma Varswater Fm., exposed in the old phosphate mine just a few km to the east (now the West Coast Fossil Park). The Uyekraal Fm. is probably the equivalent of the marine 30 m Package or “Hondeklip Fm.”, which, on indirect grounds, is thought have been deposited 3.0-3.4 Ma (Pether *et al.*, 2000).

The underlying marine/estuarine Varswater Formation, with its beds rich in vertebrate fossils (bones), is thought to be eroded away in the general area of the site. However, it is quite likely that eroded patches of the Varswater Formation are preserved very locally and could be encountered. These may or may not be of the same, extremely fossiliferous, palaeoenvironments found at the Varswater “E Quarry” (Fossil Park).

References

Pether, J, Roberts, D.L. and Ward, J.D. 2000. Deposits of the West Coast (Chapter 3). In: Partridge, T.C. and Maud, R.R. eds. *The Cenozoic of Southern Africa*. Oxford Monographs on Geology and Geophysics No. 40. Oxford University Press.

Rogers, J. 1980. First report on the Cenozoic sediments between Cape Town and Elands, Bay. *Geological Survey of South Africa Open File* **136**.

Rogers, J. 1982. Lithostratigraphy of Cenozoic sediments between Cape Town and Eland's Bay. *Palaeoecology of Africa* **15**: 121-137.

Rogers, J. 1983. Lithostratigraphy of Cenozoic sediments on the coastal plain between Cape Town and Saldanha Bay. *Technical Report of the Joint Geological Survey/University of Cape Town Marine Geoscience Unit* **14**: 87-103.

Visser, H.N. and Schoch, A.E. 1973. The geology and mineral resources of the Saldanha Bay area. *Memoir Geological Society of South Africa* **63**.

Site-specific features

Given the relatively flat, sand-covered topography of the site, natural surface fossil occurrences are unlikely and thus a preliminary site-surface survey was not considered a requirement for palaeontological assessment purposes. Often surface/near-surface fossils are in an archaeological context in any event.

Scientific surveys of the surface of the affected site are carried out by archaeological and botanical heritage assessment practitioners. Surface occurrences of fossils (shells, bones) would be noticed by them and be reported.

No fossils were noticed on the surface of the *specific* site during the initial archaeological inspection by Jonathan Kaplan, ACRM. However, visibility of the surface is low due to vegetation cover.

However, adjacent to the proposed new dam is an existing dam and “borrow-pit” excavation, the latter evidently having supplied material for the construction of the existing dam. Mr Kaplan observed bone and teeth fossils in this excavation during his site visit. These occurrences are typical of those in the Langebaan Limestone, as outlined above.

Provided most these occurrences are under not under immediate threat, it is proposed that they be temporarily be left “as is”. They can then serve as examples for educational/interest-invoking purposes for personnel involved in the new excavation (see Mitigation/Monitoring below), and be retrieved at the completion of the mitigation project.

If this existing pit is to be enlarged for further supply of material during construction of the new dam, then these fossils and any additional fossils exposed must also be timeously retrieved.

Mr Eichstadt, RMS, has subsequently communicated the request from Namakwa Sands that the currently exposed fossils in the existing quarry be collected prior to the commencement of construction activites.

Significance of the Heritage Resource

The significance of fossils and palaeontological objects as natural heritage is primarily their scientific value. They contribute to the understanding of South Africa’s geohistory, the progression through “deep time” of changing climates, oceanography and of the biota, both plant and animal, that lived on the land and in the sea, and which ultimately resulted in the landscapes and coasts and the resources that sustain us today. Generally-speaking they are scarce, non-renewable and irreplaceable when destroyed. Their value is also severely compromised when they are collected without proper recording of

their geological context. Geological (sedimentological/palaeoecological) observations are indispensable for the interpretation of fossil finds.

The value of fossils extends far beyond the curiosity of palaeontological study in museums, for they provide the basis for biostratigraphy, the division of the sedimentary record into units of distinct ages that can be correlated both regionally and globally. The fossil content of strata is thus very important for understanding the genesis of exploitable mineral resources and for the "geological models" that furnish the basis for ongoing mineral and fossil-fuel exploration.

Another very current application is that the exposures provided by excavations may contain evidence of past earthquake activity, whilst the fossils provide age constraints for when such events occurred. This is an important consideration for the siting of sensitive structures such as nuclear power stations, oil/gas pipelines and, of course, waste disposal sites.

In spite of the scientific attention the area has received, most observations and recovered fossils pertain to the West Coast Fossil Park exposures at the old phosphate mine and to strata exposed along the present coast. Little is known of the wider Saldanha-area coastal plain due to the lack of natural exposures. Some basic information came from Water Affairs boreholes. Practically every excavation made in the past has yielded fossils, but palaeontological mitigation requirements were not in place and, other than some *ad hoc* recoveries, the "windows of opportunity" were lost. Thus effective palaeontological mitigation at the Namakwa Sands site stands to have substantial heritage/scientific benefits.

Nature of the Impact

Extent

The physical extent of impacts on potential palaeontological resources in this case relates directly to the extents of subsurface disturbance. This will mainly be in the areas of pit construction and deeper infrastructure installation.

It is worth noting that palaeontological and archaeological fossils from the Saldanha area have national and international scientific importance.

Duration

The duration of the impact is mainly short term and primarily related to the period over which excavations are made. However, in the case of "borrow-pit", quarry-type excavations that are left open, natural erosion of the quarry faces continues to expose fossils in the longer term.

Intensity

The impact of construction on fossil resources is potentially high. This is because fossils are rare objects, often preserved due to unusual circumstances. This is particularly applicable to vertebrate fossils (bones), which tend to be sporadically preserved and have high value wrt. palaeoecological and biostratigraphic (dating) information. Such fossils are non-renewable resources and loss of the opportunity to recover them at a particular site is usually irreversible.

Probability of occurrence

The likelihood of impact is highly probable to definite. The area is known to have considerable fossil potential, being in the region of significant fossil occurrences. Specifically, the existing excavation shows that fossils are readily evident.

Significance (unmanaged)

There is a high probability of fossils being lost in the absence of management actions to mitigate such loss.

Significance (managed)

There remains a medium to high risk of valuable fossils being lost *in spite of* management actions to mitigate such loss. Machinery involved in excavation may damage or destroy fossils, or they may be hidden in "spoil" of excavated material.

Status of the impact

The status of the potential impact for palaeontology is not neutral. From the point of view that the "windows" into the coastal plain depository, that provide access to fossils, would not exist without excavations being made, the impact is positive for palaeontology. However, some fossils may be destroyed, in spite of efforts at mitigation.

MITIGATION APPROACH

First, any exposed fossil occurrences threatened by construction will be mitigated by description and sampling.

It is suggested that an acceptable degree of monitoring be carried out during the making of excavations.

The primary mitigation task of the specialist entails the inspection of larger, deeper excavations made for the infrastructure installations. This activity should co-incide with the time of maximum exposure of the faces of the excavations, for best cost-effectiveness.

Monitoring

In general, fossil bones are sparsely scattered in coastal deposits and much depends on spotting them as they are uncovered during digging. In contrast, shelly layers are usually fairly extensive and normally are exposed in the sides of the finished excavation, when they can be documented and sampled easily.

Since it is impractical to have excavations constantly monitored by a professional during the construction phase, it is very desirable to have the co-operation of the people on the ground. By these I mean personnel in supervisory/inspection roles, such as engineers, surveyors, site foremen, etc., who are willing and interested to look out for occurrences of fossils. This particularly applies to finds of fossil bones "turned up" during excavation.

Successful and cost-effective monitoring depends a lot on this goodwill and co-operation of managers and on-site people. To aid this process, a general background information document is useful.

There should also be some guidelines for potential finds and a reporting/action protocol in place when finds are uncovered.

Primary Mitigation

When the excavations are near or at completion:

The excavation faces will be inspected for fossil content.

Key vertical sections representative of the exposures will be identified.

These will be described in detail sedimentologically (logged), photographed and sampled.

Representative samples of fossils will be collected. In the case of shelly beds, bulk samples will be taken. If material is delicate/poorly-preserved, it will be removed within blocks of the enclosing sediment, reinforced if required by encasement. The strategy is to "rescue" the material as quickly as possible.

If major bone beds are encountered, the strategy would be to remove as much as is feasible in encased blocks and also to remove a large, disturbed sample by excavator and truck from the site. This material could then be stored/stockpiled locally, for sieving and further

preparation. A temporary pause in activity at a limited locale will be required. *(Note that the submitted work duration/budget does not provide for a major fossil bone-bed occurrence)*

For the purposes of planning and costs containment, I must be informed on the scheduled excavation planning and the progress being made. To this purpose I would need to establish liaison protocols with suitably-placed persons.

A prescribed data requirement is adequate 3D spatial referencing. For this I would require the assistance of the surveyor wrt. co-ordinates and base maps, to plot the locations of finds during monitoring, the measured sections, samples and other observations.

THE REPORT

At the end of the task a detailed report will be submitted.

This report is in the public domain and copies of the report must be deposited at the IZIKO S.A. Museum and Heritage Resources Western Cape. It must fulfil the reporting standards and data requirements of these bodies.

The report will be in standard scientific format, basically:

A summary/abstract.
Introduction.
Previous work/context.
Observations (incl. graphic sections, images).
Palaeontology.
Interpretation.
Concluding summary.
References.
Appendices

The draft report may be reviewed by the client, or externally, before submission of the Final Report.

APPLICATION FOR PALAEONTOLOGICAL PERMIT FROM HERITAGE WESTERN CAPE

I am required to obtain a palaeontological permit from the Provincial Heritage Resources Authority of the Western Cape in order to carry out the work. For this I will need details of the registered owners of the sites, their permission and a site-plan map. A permit fee of R150 is now operative.

All samples of fossils and sediments must be deposited at the IZIKO S.A. Museum.

The client might desire a small display/exhibition of findings and features: out of a combination of interest, public-mindedness and to demonstrate diligence wrt. heritage/science resources. This would have to be at a location and under conditions approved under the auspices of the IZIKO S.A. Museum and the Heritage Resources Authority Western Cape. *(Costing of such was not included in the submitted budget)*

FORTHCOMING REQUIREMENTS/ACTIONS

Drafting of the Agreed Terms of Reference of the contract. In addition to the required mitigatory actions, this to include designation of contact persons for:

Progress of the EIA process and further liaison wrt. palaeontological heritage inputs (prov. Mr Eichstadt)

Provision of information for the HWC permit application (submitted by myself).

Arrangements and protocols for access to the site.

Liaison protocol with appropriate managers regarding:

- scheduled excavation planning and progress
- provision of detailed spatial data, site maps

Responsible persons and reporting/action protocol when finds/features are uncovered during *ad hoc* monitoring during excavation

Provision by myself, prior to commencement of construction, of a general-interest information document for circulation, with guidelines for potential finds uncovered during digging the excavations.

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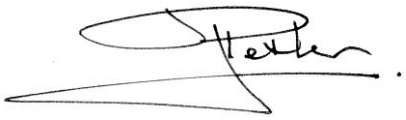

John Pether

Site of proposed disposal dam, Namakwa Sands Smelter, Saldanha.