

**HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED
EXTENSION OF A CAR PARK AT THE KOEBERG NUCLEAR
POWER STATION, CAPE FARM DUYNEFONTYN 1552, CAPE
TOWN MAGISTERIAL DISTRICT, WESTERN CAPE**

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

HWC Case No.: 16052406AS0711E

Report for:

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On behalf of:

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Initial HIA: 31 August 2016

Revised after test excavations: 28 September 2016

EXECUTIVE SUMMARY

1. Site Name

Koeberg Nuclear Power Station

2. Location

Off R27 (West Coast Road), north of Melkbosstrand, Cape Town Magisterial District
Farm 1552 with site located at 33° 40' 29" S 18° 26' 13" E

3. Locality Plan



Aerial view of Koeberg Power Station showing the position of the proposed car park extension (red polygon).

4. Description of Proposed Development

It is proposed to extend the existing car park by approximately 1.35 ha. Construction will entail typical layerworks as used in road construction with a depth of between 380 mm and 500 mm. The deepest excavations, up to 1 m deep, will be required in areas where drainage will be installed but depths can vary slightly depending on the slope and the subsurface conditions.

5. Heritage Resources Identified

The entire study area was found to be covered in material excavated from the power station reactor area in the 1970s. As such, there was nowhere on site where the original surface was visible and it

was not possible to directly assess any archaeological and/or palaeontological resources that might be present with the exception of fossil bones contained within the dumped material, which, despite their secondary context, are of some significance. A program of test excavations has shown that the dumped material is thick enough to protect the subsurface deposits from disturbance over the bulk of the site. There was no sign of the sensitive Langebaan Formation sediments which must lie still deeper down. Only very rare isolated bones and a single stone artefact were noted and because of their very low density, these materials are considered to be of low cultural significance (Grade III C or less).

6. **Anticipated Impacts on Heritage Resources**

No significant impacts to heritage resources is likely to occur and there are no fatal flaws in terms of heritage.

7. **Recommendations**

The thick layer of *ex situ* material across the bulk of the site renders it of low sensitivity. It is thus recommended that the proposed car park construction proceed but subject to the following points being incorporated into the conditions of authorisation:

- A briefing session for the ECO and relevant project staff must be carried out prior to commencement of earthworks so that any isolated fossils seen during construction can be collected and retained. Such material would need to be given to a palaeontologist for description and accessioning in an approved repository; and
- If any substantial archaeological or palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

8. **Author/s and Date**

Heritage Impact Assessment: Dr Jayson Orton & Dr Graham Avery, 28 September 2016

- Archaeological aspects: Dr Jayson Orton, ASHA Consulting (Pty) Ltd
- Palaeontological aspects: Dr Graham Avery, Sole Proprietor

Test excavation report: Dr Jayson Orton, ASHA Consulting, (Pty) Ltd, 28 September 2016

Glossary

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Hand-axe: A bifacially flaked, sharp-edged and pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last 10-12 000 years.

Hominin: a group consisting of modern humans, extinct species of humans and all their immediate ancestors.

Kraal: a livestock enclosure.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BAR: Basic Assessment Report

CRM: Cultural Resources Management

ECO: Environmental Control Officer

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

HWC: Heritage Western Cape

LSA: Later Stone Age

MSA: Middle Stone Age

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

NID: Notification of Intent to Develop

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

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1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Advisian to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed extension of a car park at the Koeberg Nuclear Power Station, north of Melkbosstrand, in the Cape Town Magisterial District (Figure 1). An approximate mid-point for the site is at 33° 40' 29" S 18° 26' 13" E and it lies on Farm 1552. The property is 1286.7105 ha in extent.

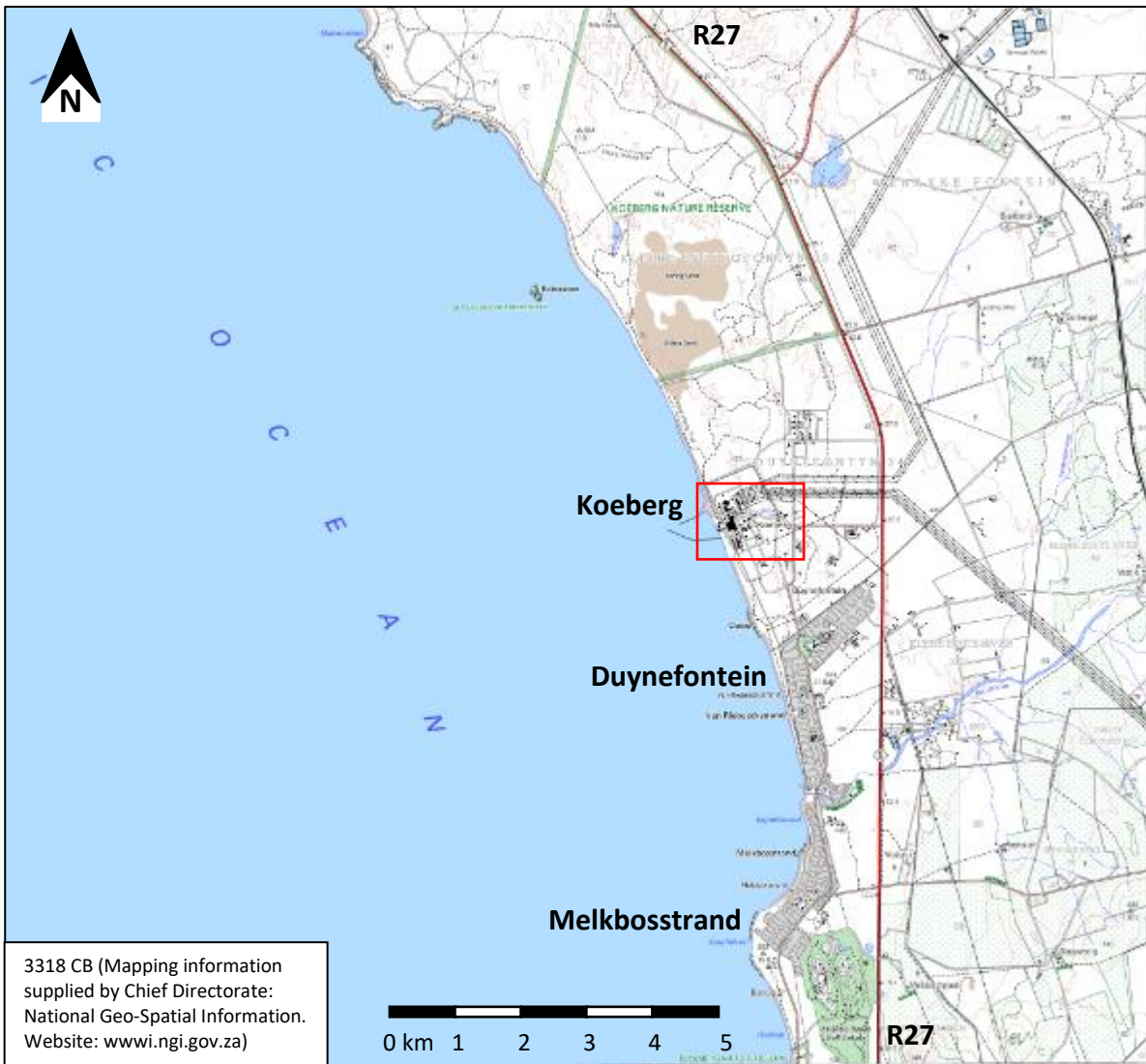


Figure 1: Map showing the location of the site relative to nearby suburbs. The area enclosed by the red box is enlarged in Figure 2.

1.1. Project description

Because of the number of staff working at Koeberg Nuclear Power Station, the existing car park has become too small and overflow parking has been occurring alongside the formal car park. As a result a new approximately 1.35 ha extension to the existing car park has been proposed. The construction work will entail typical layerworks as used in road construction with a depth of between 380 mm

and 500 mm. The deepest excavations, up to 1 m deep, will be required in areas where drainage will be installed but depths can vary slightly depending on the slope and the subsurface conditions.

1.1.1. Aspects of the project relevant to the heritage study

Excavations for foundations and/or services may impact on archaeological and/or palaeontological remains. Because the development will be constructed at ground level and will be consistent with the land use alongside the site, the above-ground aspects are of no concern.



Figure 2: Aerial view showing the location of the study area for the proposed new car park (red polygon). Source: <http://emap.capetown.gov.za/egisviewer/>

1.2. Terms of reference

ASHA Consulting (Pty) Ltd was requested to complete a Notification of Intent to Develop (NID) and then produce any follow-up Heritage Impact Assessment (HIA) that may be required by Heritage Western Cape (HWC). The process followed to date is as follows:

- 11 July 2016: the NID was submitted to HWC.
- 25 July 2016: HWC issued a response that requested an HIA that specifically addressed the potential impacts to archaeological and palaeontological resources.
- 31 August 2016: HIA submitted to HWC along with a workplan for proposed test excavations.
- 15 September 2016: HWC (APM committee) approved the workplan application.
- 20 September 2016: HWC (IACom committee) issued an interim comment supporting the recommendation of test excavations.

It should also be noted that, following S.38(3) of the National Heritage Resources Act (No. 25 of 1999; NHRA), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.3. Scope and purpose of the report

An HIA is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued by them for consideration by the National Department of Environmental Affairs (DEA) who will review the Basic Assessment Report (BAR) and grant or refuse authorisation. The HIA report will outline any mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. The authors

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in the Western Cape and Northern Cape provinces of South Africa since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

Dr Graham Avery has an MA (UCT, 1976) and PhD (UCT, 1990), both in archaeology but has worked extensively in the palaeontological field, focusing on the south-western coast of South Africa and in both research and commercial contexts (please see curriculum vitae included as Appendix 1). He has conducted research on a variety of Early, Middle and Later Stone Age and palaeontological sites and published the findings. He is a member of the Palaeontological Society of South Africa. He holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #008) as follows:

- Principal Investigator: Stone Age, Shell Middens, Middle Pleistocene Studies & Archaeozoology.

1.5. Declaration of independence

ASHA Consulting (Pty) Ltd and its consultants have no financial or other interest in the proposed development and will derive no benefits other than fair remuneration for consulting services provided.

2. HERITAGE LEGISLATION

The NHRA (No. 25 of 1999) protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;
- Palaeontological material: “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation”; and d) “features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found”;
- Grave: “means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place”; and
- Public monuments and memorials: “all monuments and memorials a) “erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government”; or b) “which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.”

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list “historical settlements and townscapes” and “landscapes and natural features of cultural significance” as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BAR. HWC is required to provide comment on the proposed project in order to facilitate final decision making by the National Department of Environmental Affairs (DEA).

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:50 000 map and historical aerial images were/was sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field survey

The site was subjected to an initial foot survey by Dr Orton on 7 June 2016. This was in mid-winter, but the disturbed nature of the site meant that vegetation cover did not hamper visibility in any way during the survey. During the survey walk-paths were recorded on a hand-held GPS receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.



Figure 3: Aerial view of the study area showing the walk-paths (yellow lines) recorded during the survey.

3.3. Specialist studies

This report includes specialist assessments of both archaeology (by Dr Jayson Orton) and palaeontology (by Dr Graham Avery). Both assessments are included within the body of this report. The supplementary test excavation report by Dr Orton is included as Appendix 2.

3.4. Impact assessment

For consistency, the impact assessment was conducted through application of a scale supplied by Advisian.

3.5. Grading

S.7(1) of the NHRA provides for the grading of heritage resources into those of National (Grade I), Provincial (Grade II) and Local (Grade III) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade I and II resources are intended to be managed by the national and provincial heritage resources authorities respectively, while Grade III resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. Heritage Western Cape (2016), however, uses a system in which resources of local significance are divided into Grade IIIA, IIIB and IIIC. These approximately equate to high, medium and low local significance, while sites of very low or no significance (and generally not requiring mitigation or other interventions) are referred to as Not Conservation Worthy (NCW).

3.6. Assumptions and limitations

The initial field study was carried out at the surface only and hence any completely buried archaeological or palaeontological sites would not be readily located. Similarly, it is not always possible to determine the actual depth of such material even when visible at the surface. In the present case a major limitation was posed by the fact that the entire site had been covered in material excavated from the nuclear plant site when it was constructed. This meant that, although the dumped material is also fossiliferous, the original land surface could not be seen at all in order to assess the presence of any *in situ* material on the site. Limitations to the supplementary test excavations are presented in Appendix 2.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site lies within the Koeberg Nuclear Power Station complex and is immediately alongside an existing car park and access road. There are many buildings to the west and a number of power lines cross the landscape feeding into the power station.

4.2. Site description

The site is on level ground with only very light vegetation cover (Figures 4 to 7). Part of the site immediately south of the existing car park was lightly gravelled (Figure 7).



Figure 4: View towards the south with the existing car park visible towards the right.



Figure 5: View towards the north with power lines entering Koeberg just to the north of the site.



Figure 6: View towards the southwest across the southern part of the site.



Figure 7: View towards the north of the area adjoining the existing car park.

5. HERITAGE CONTEXT

This section of the report contains the desktop study and establishes what is already known about archaeological and palaeontological heritage resources in the vicinity of the study area. What was found during the field survey may then be compared with what is already known in order to gain an improved understanding of the significance of any newly reported resources.

5.1. Archaeological aspects

The well-known site of Duinefontein 2 (DFT2) is located some 1.3 km northwest of the proposed car park. It has been extensively researched by Richard Klein and colleagues since the 1970s (Cruz-Uribe *et al.* 2003; Deacon 1976; Feathers 2002; Klein 1976; Klein *et al.* 1999; Sampson 2003). DFT2 comprises a series of three bone horizons (with scattered stone artefacts). The upper horizon (H1) was deflated; beneath this the main horizon (H2) was thought to have been deposited around a wetland and is dated at some 270 000 years ago (Cruz-Uribe *et al.* 2003). Although initially thought

to be associated with Middle Stone Age (MSA) archaeology, the presence of one whole and two broken hand-axes has shown that Early Stone Age (ESA) hominins were present there (Cruz-Uribe *et al.* 2003). It is highly likely, however, that many of the bones were deposited in the absence of hominins and would therefore be palaeontological. Just north of this site a similar exposure also revealed ESA artefacts and animal bones (Avery & Klein 2011).

Stoch recorded Later Stone Age (LSA) material in the general vicinity of Koeberg during the course of the development of the power station (G. Avery pers. comm. 2016), while recent work immediately alongside its northern edge revealed the presence of LSA artefacts there (Kaplan 2015). The latter seem to have been found in secondary context, however. LSA sites are in general very common along the Cape west coast, but are far more prolific in areas close to rocky shorelines, like Melkbosstrand (Gray 2000; Halkett 2008; Kaplan 1997, 1998, 2000; Orton 2010a, 2010b, 2013b; Sealy *et al.* 2004). Further inland, other LSA sites have been recorded but these are generally more ephemeral scatters (Hart 2005; Orton 2007, 2013a).

Stone Age burials are frequently encountered behind the rocky shores of Melkbosstrand (e.g. Friedling 2014; Hutten 2014a, 2014b; Kaplan 2013; Morris 1992; Yates 2001) but are also far less common behind sandy shores.

In a survey to the south of the proposed parking area Hart (2008) found no archaeological remains and suggested that, due to the extensive disturbance of the landscape around the nuclear power station during its 1970s construction period, there is very little chance of finding any *in situ* shell midden material. Archaeological material was found to the north of the power station however (Avery pers. comm. 2016; Kaplan (2015)).

5.2. Palaeontological aspects

The study area lies within a palaeontologically sensitive area of the west coast foreland extending from the Saldanha area in the north right down to Woodstock Beach in the south, although the density and nature of fossil material varies greatly through the area. Most fossil material from this region is, however, regarded as significant (Almond & Pether 2008).

The Koeberg area specifically is well known for the fossil material that has been recovered both from DFT2 (some of which is in an archaeological context as described above) and the nearby DFT1 which was a Middle/Late Pleistocene brown hyaena den accumulation associated with calcrete (R. Klein pers. comm. 2005). Hendey (1968, 1969) also described fossil bone from the Koeberg area which he thought might be associated with MSA artefacts. This was from the extensive deflated surface that extended from Melkbosstrand to Duinefontein. Material from these disturbed areas had been collected since the 1950s (Inskeep 1976).

Most importantly for the present project, fossils were recovered from the excavations for the nuclear power station. The following geological/palaeontological sequence was recorded (Figure 8 shows the stratigraphy through the Varswater and Springfontuyn Formations):

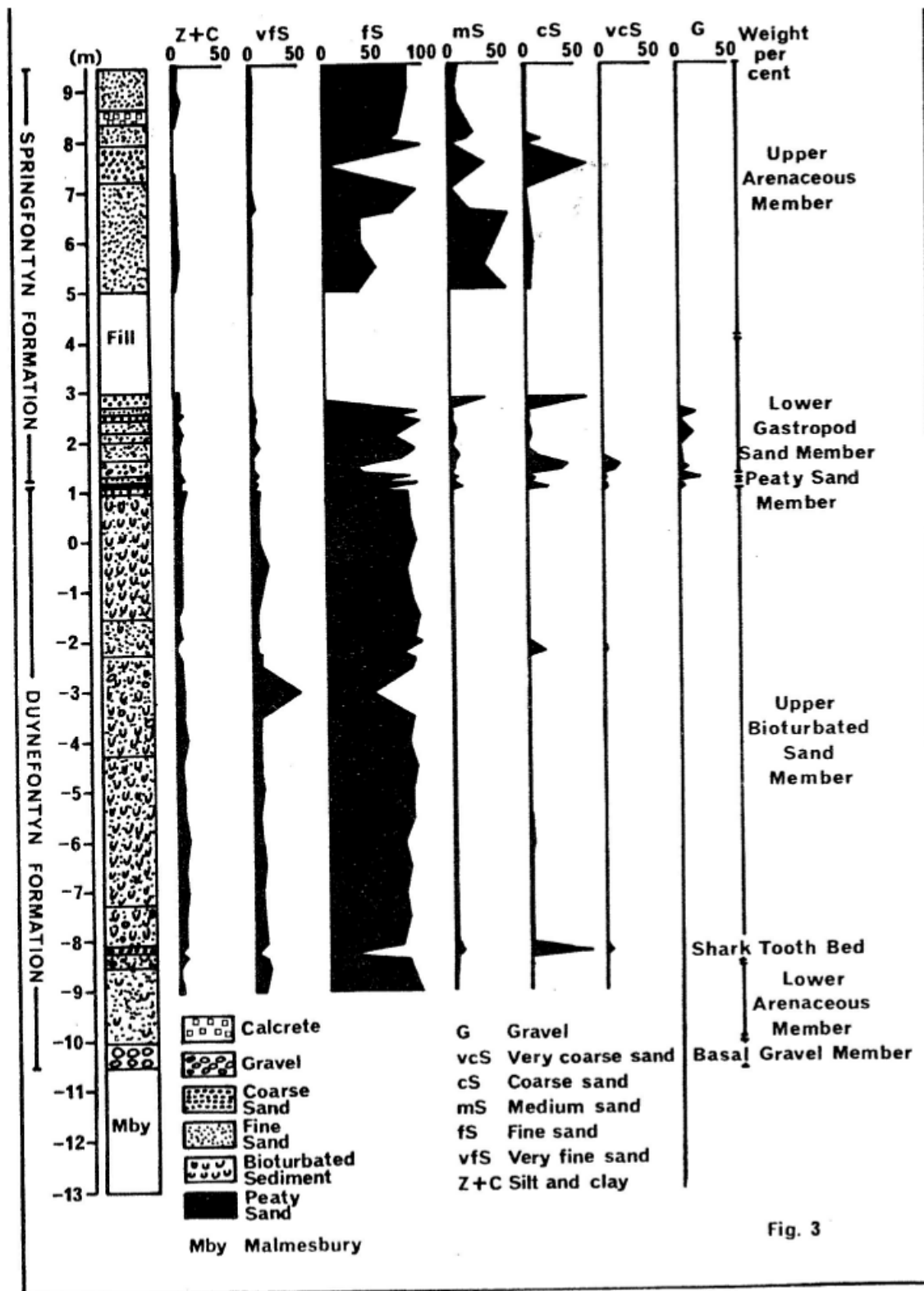


Figure 8: Stratigraphy revealed during excavation for the Koeberg nuclear power station reactor foundations, Profile of line 2 Koeberg Main Excavation (Source: Rogers 1979). Note that the name 'Duynfontyn Formation' in this image is now a part of the uppermost member of the Varswater Formation and is no longer in use.

- The excavations reached Malmesbury Group bedrock at about 10 m below sea level (Rogers 1982, 2006).

- The overlying five million year old Early Pliocene Varswater Formation sediments extend from about 8.1 m below sea level to about 1 m above sea level (Rogers 2006) and yielded marine mammals (largely whales) and a range of marine fish, seabirds and possibly an unknown species of fur seal (Simpson 1975; Olson 1985; Avery and Klein 2011).
- The lower part of the overlying Springfontyn Formation is a mottled sandy bed, 0.3 m thick, rich in the internal casts of high-spired gastropods similar to *Bullia*, and containing quartz pebbles and shark's teeth. This is overlain by a pale yellowish-brown to pale orange quartzose sand bed capped by calcrete at c. 8.5 m above sea level. A 0.1 to 0.15 m thick peaty sand bed containing gastropod casts and terrestrial pollens was also found within this quartzose bed (Rogers 2006).
- The shelly Velddrif Member of the Langebaan Formation was also exposed. Its basal bed, 0.4m thick, contained cobbles and boulders of calcrete and Tygerberg Formation siltstones. This was overlain by a 0.7 m thick cross-bedded gravelly (shelly) calcareous sand containing bivalves. Above this was 0.6 m of horizontally laminated shelly sand and a further 1.7 m of homogenous shelly sand.
- The calcareous dunes of the Witzand Formation cap the sequence (Rogers 2006).

Although Hart (2008) did not locate any palaeontological material just south of the present power station site, he did note the high likelihood of paleontological material being present beneath the surface.

Figure 9 presents the surface geology of the area, while Figure 10 shows the corresponding paleontological sensitivity as recorded on the SAHRIS database.

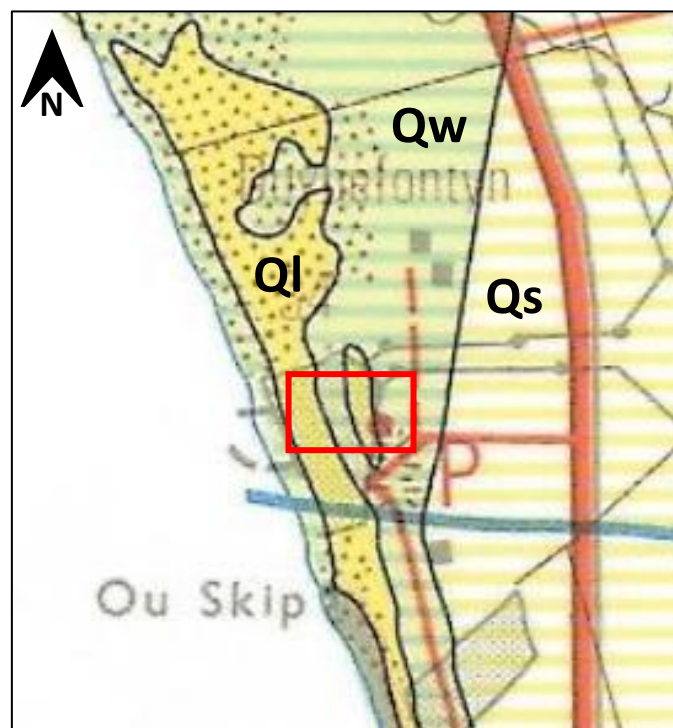


Figure 9: Surface geology of the study area from Geological Series 3318 Cape Town. The relevant formations of the Quaternary Sandveld Group are the Witzand Formation (Qw; loose, aeolian white dune sands), the Pleistocene- to Holocene-aged Springfontein Formation (Qs; light grey to pale red sandy soil with inter-bedded palaeosols) and the Langebaan Formation (Ql: limestone and calcrete aeolianites).

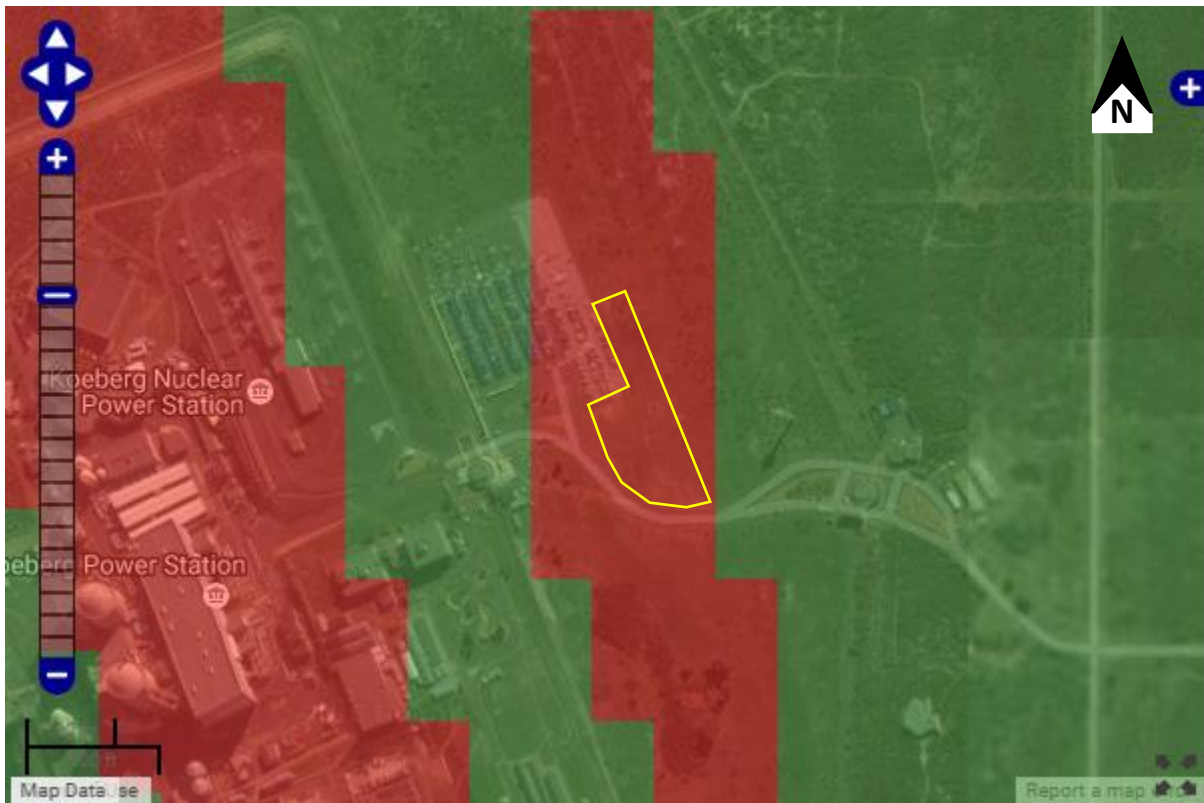


Figure 10: Extract from the SAHRIS Palaeosensitivity map showing areas of high (red) and moderate (green) sensitivity. The study area (yellow polygon) is thus of high palaeontological sensitivity because of the underlying, but now buried, Langebaan Formation.

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project.

6.1. Test excavations

A full description of the test excavations is available in Appendix 2. However, it is noted here that 31 test holes were excavated across the site and the majority revealed disturbed or dumped material throughout most or all of their depth. In 12 holes there was a compacted orange gravel surface present some 10-40 cm beneath the present surface, while in one hole (Hole 11) a concrete slab was reached at 90 cm depth. Just four holes appeared to contain relatively undisturbed profiles through all or most of their depth (Holes 5, 6, 22 & 31). Figure 11 shows the spatial layout of the holes mentioned above. Although archaeological and palaeontological material was found in a few places, the majority was associated with disturbed deposits and its distribution thus carries no meaning.

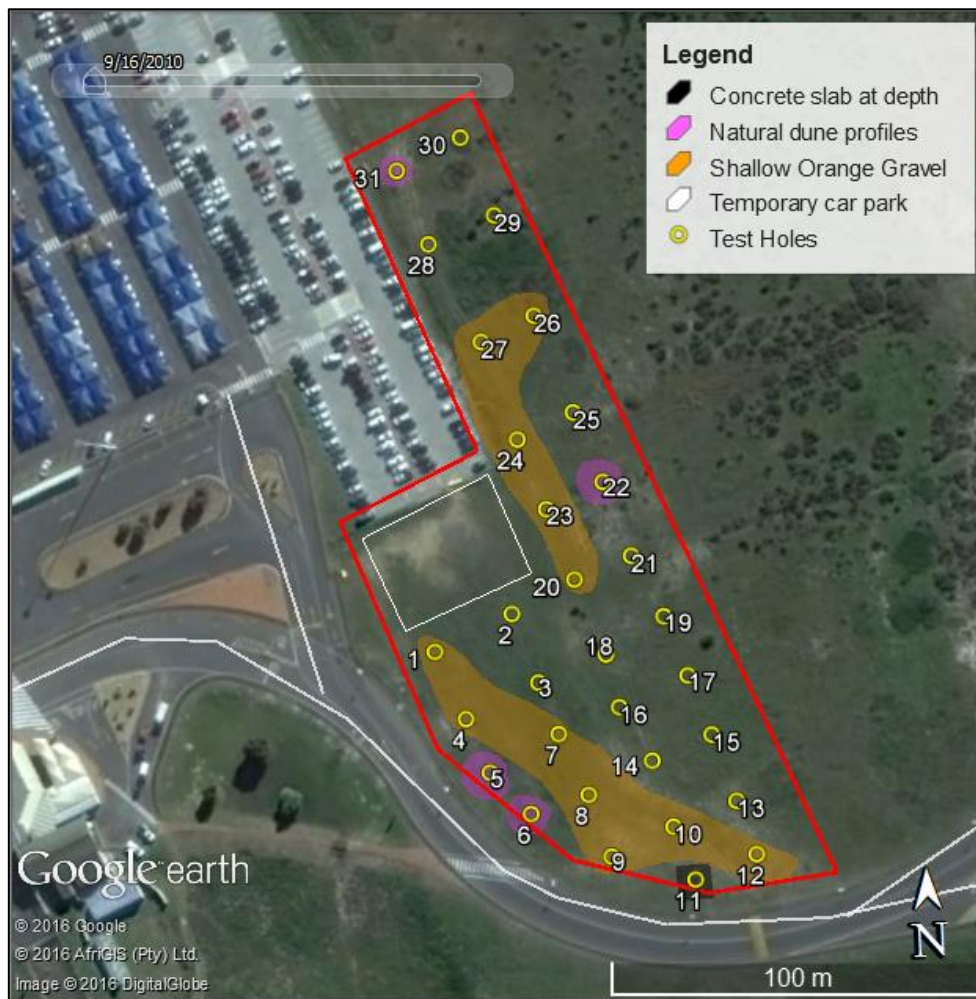


Figure 11: Aerial view of the study area (red polygon) showing the characteristics of various test holes.

6.2. Archaeological assessment

No archaeological remains were seen during the initial site inspection. This was not surprising given that the surface was obscured by older sediments excavated from the power station site. Nothing could be said of the original surface and any archaeology that might be present in the area because the original surface lies at an unknown depth beneath the dumped material. The potential for archaeology and/or unmarked graves could not be meaningfully assessed at that stage.

The test excavations resulted in the recovery of a single stone artefact from 95 cm depth in Hole 6. This was one of the holes with a natural dune profile preserved. The artefact is red in colour and may be silcrete. It is heavily weathered and no doubt dates back well into the MSA, if not the ESA.

6.3. Palaeontological assessment

The field inspection revealed three large fragments of bone and many small pieces of water worn marine shell (Figures 12 to 14). Their mixed context shows that they are out of place and derive from the dumped material from the power station site. Nothing could be said of the original surface or any palaeontology that might have been revealed in mole hills in this area because the original surface lies at an unknown depth beneath the dumped material.



Figure 12: Selection of objects found on the surface of the site. They include pebbles from the Malmesbury Formation, calcrete nodules, white mussel, barnacle and whelk shell fragments and some fossil bones. Scale in cm.



Figure 13: Fossil bone fragment found on the surface of the study area. Scale in cm.

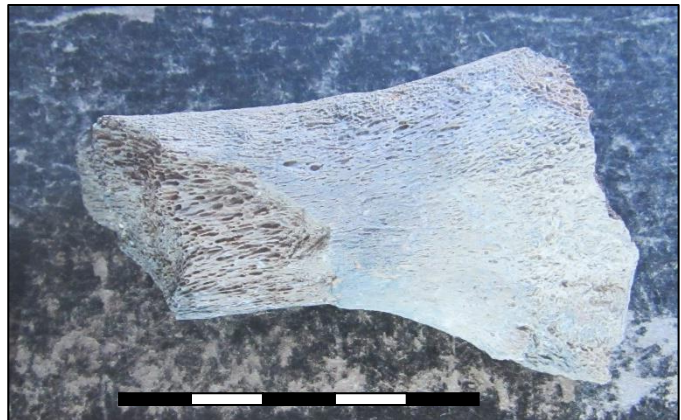


Figure 14: Fossil bone fragment found on the surface of the study area. Scale in cm.

During the test excavations a further

6.4. The landscape

A brief historical map and aerial photograph survey of the site aids in understanding the area and serves to identify any other heritage resources that might have been present. The earliest available survey diagram shows the farm as it was in 1834 (Figure 14). A *kraal* is marked. Overlaying this diagram on Google Earth shows the *kraal* to have been just beyond the north-eastern corner of the power station complex. The *kraal* is also indicated on the late 19th century Southern Districts map. There is no sign of this *kraal* on modern aerial photography (Figure 14).

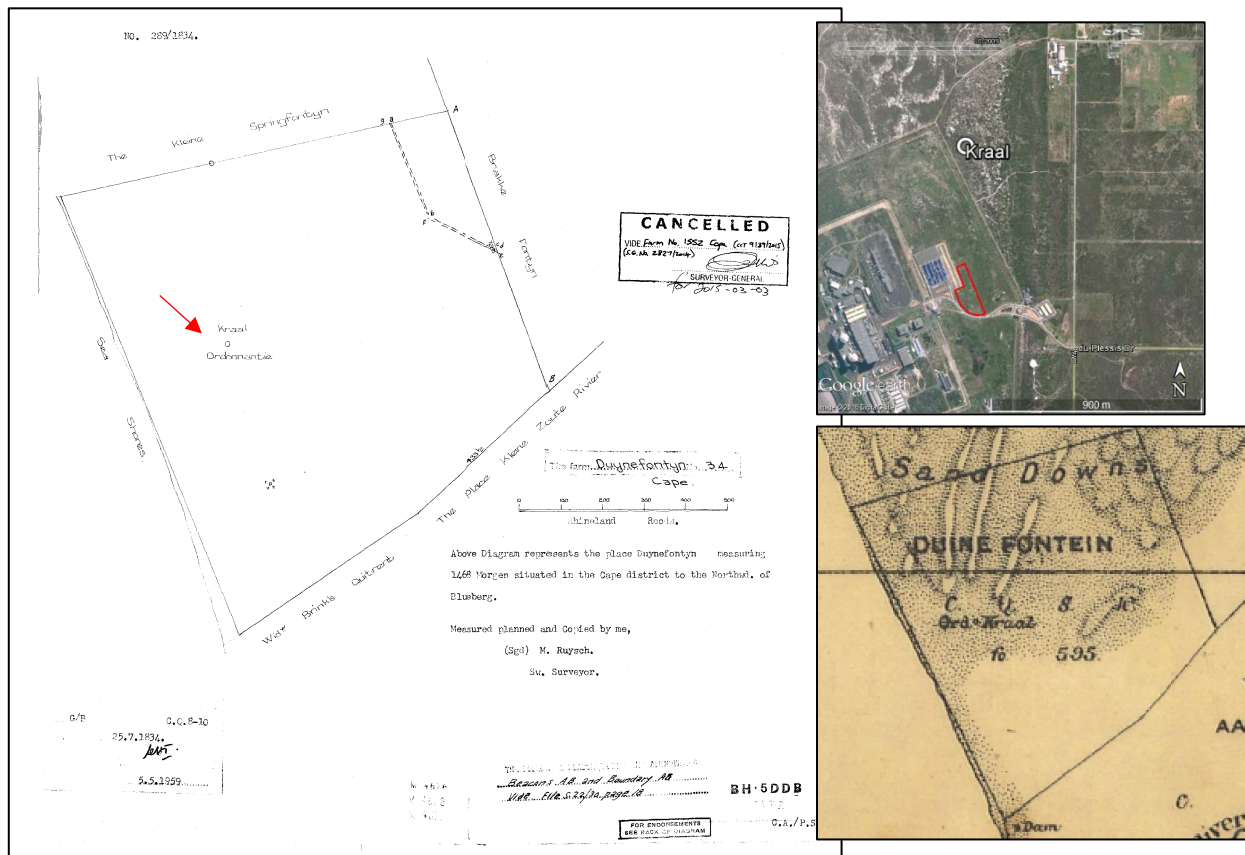


Figure 14: 1834 survey diagram of the farm Duynefontyn 34 showing the position of a kraal in the central western part of the farm (arrowed). The small mark to the south of this is a 1988 servitude, while a 1984 pipeline servitude crosses the north-eastern part of the farm. The insets show the position of the kraal on today's landscape and on the late 19th century Southern Districts map.

The earliest 1:50 000 topographic map series dates to 1941 (Figure 15). It shows the farm as being largely undeveloped with only a few tracks crossing it and a farmstead, labelled 'Duynefontein (Rietdam)', located in the eastern part of the farm. Overlaying this map on Google Earth shows this site to have been on the bend of the R27 some 1.5 km north of the present main entrance to Koeberg. There is no trace of this farmstead on modern aerial photography. There were also various small patches of agricultural land but only a farm track was present in the vicinity of the present study area.

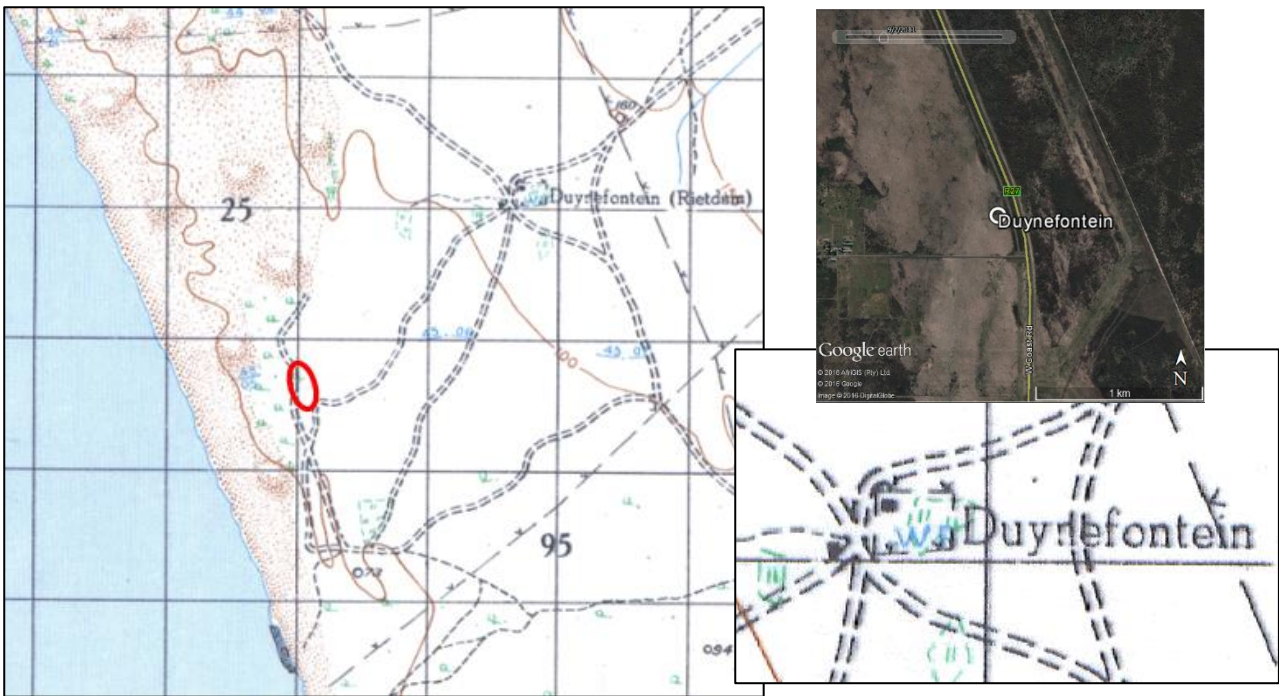


Figure 15: Mapsheet 3318CB from 1941 showing the Duynfontein (Rietdam) farm complex in the eastern part of the farm. The red oval shows the approximate location of the study area. The insets show a close up of the farm complex and the location of this spot on the modern landscape.

Given the layout of agricultural fields, this map series was no doubt based on the February/March 1938 aerial photographic survey, an extract of which is reproduced in Figure 16 alongside the same portion of the 1941 map. It clearly shows the farm complex but there is no evidence of permanent structures which perhaps shows why there is little or no surface trace of this complex today.

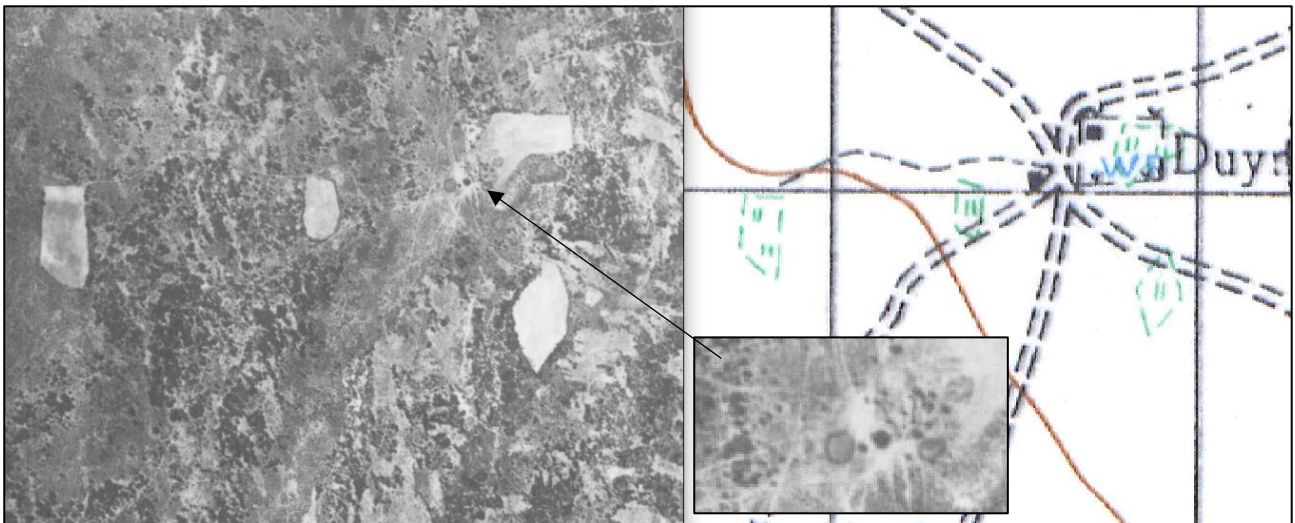


Figure 16: Excerpt of the 1938 aerial photograph (Job 126, strip 067, photograph 10806) and the corresponding portion of the 1941 topographic map. The inset shows a close up of the farm complex.

The second topographic map series, dating to 1965, does not show this farm complex at all (Figure 17). Many of the tracks from 1941 are also no longer illustrated. The subdivisions of the land are also shown differently with the dune areas now being incorporated into a single property. This does

not appear to be reflected in survey diagrams, however. The 1965 map shows a structure, labelled 'Rietdam', and wind pump in the southern part of the property but with a track still running to the place where the earlier farm complex had been situated.

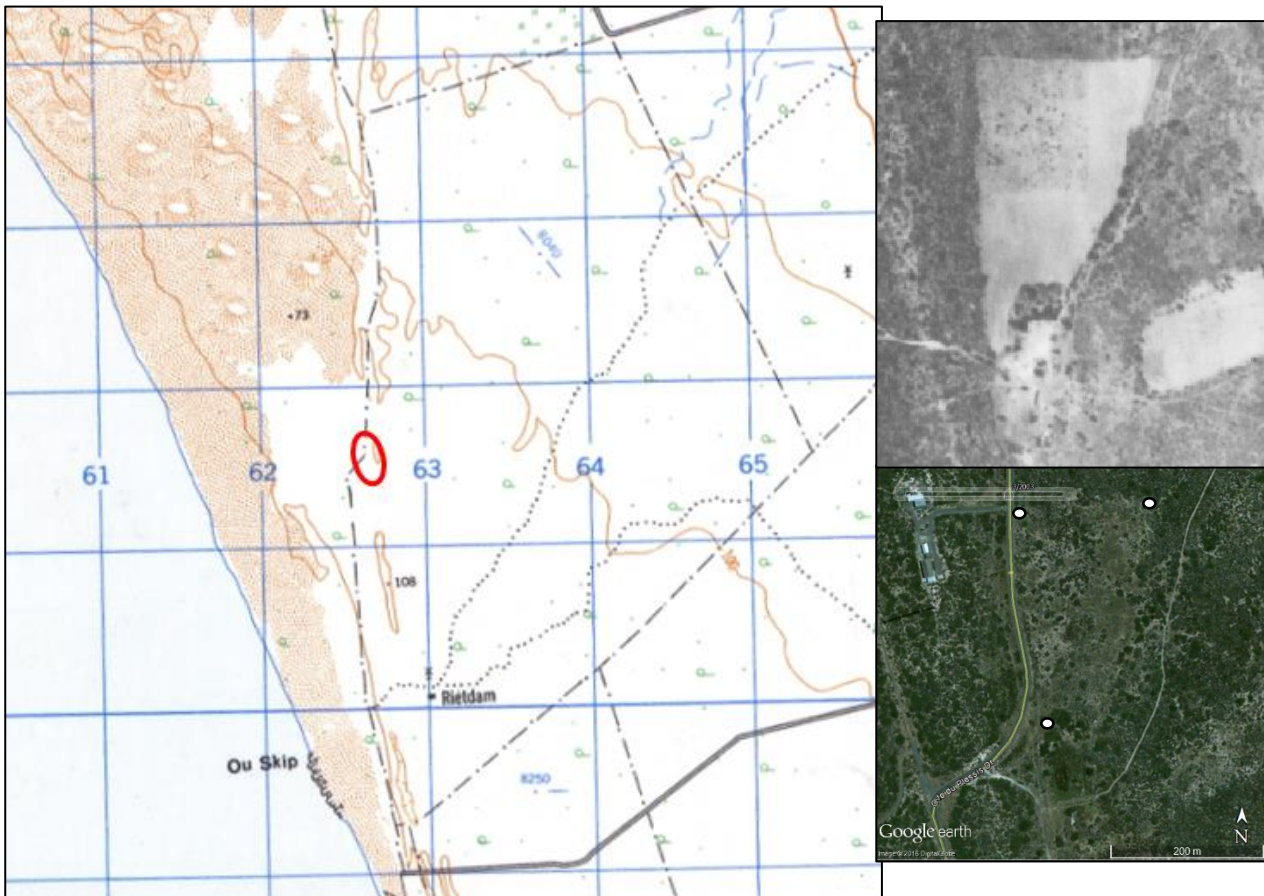


Figure 17: Mapsheet 3318CB from 3318CB from 1965 showing 'Rietdam' in the southern part of the property. The red oval shows the approximate location of the study area. The insets show the vicinity of 'Rietdam' as marked on the map in 1938 (above) and in 2003 (below). The white dots on the 2003 image show the outline of the field still visible by the lower density vegetation.

Figure 18 shows an aerial photograph from 1977 when the excavations for the reactor site were still underway. It is clear that the area where the car park is proposed was disturbed in the process. Figure 19 shows the 1989 aerial view. The larger complex has now been enclosed and once more disturbance is evident by the much lighter colouring of the surface – it seems that the vegetation was likely cleared and quite possibly all the dunes levelled within this perimeter fence.

This review shows that there was never a strongly developed cultural landscape on the farm with only low density agricultural practices having taken place at times in the past. Limited evidence of these activities survives only in the lower density of vegetation in the old lands. The site of the present car park application does not appear to have featured in these agricultural activities since it was too close to the mobile Witzand sand dunes which offer very poor quality soils. Recent aerial photography confirms that the car park site was disturbed during the construction of the power station.

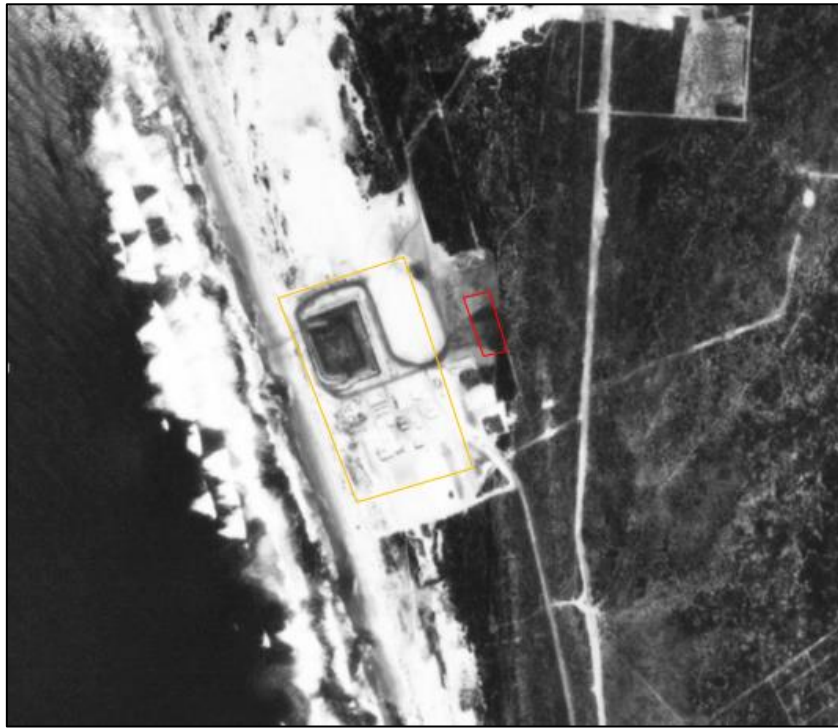


Figure 18: 1977 aerial photograph (Job 786, Strip 007, photo 00456) showing the early development of Koeberg Nuclear Power Station with excavations well underway. The orange box shows the location of the main plant site, while the red box shows the location in which the car park lies. It is clear that the surface is disturbed.



Figure 19: 1989 aerial photograph (Job 929, Strip 003, photo 02216) showing Koeberg Nuclear Power Station. The orange box shows the location of the main plant site, while the red box shows the location in which the car park lies. It is clear that the surface has not yet recovered to look like virgin veld.

Although the R27 is considered a scenic route and given Grade III significance (in parts) by Winter and Oberholzer (2013), the nature of the development and its existing surroundings mean that no impacts will be felt.

6.5. Statement of significance

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), “cultural significance” means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Despite the test excavations and with the exception of a single flake, it was still not possible to determine whether there was any archaeology or palaeontology present beneath the dumped material. However, it was possible to determine that no significant archaeological or palaeontological resources are likely to be impacted by the development because of the depth of the dumped material over the majority of the site. Any isolated items that might be present are likely to have low cultural significance for their scientific value.

Both Professor Richard Klein (who led the DFT2 excavations) and Pippa Haarhof (from the West Coast Fossil Park) suggested during consultation on the original HIA that any fossil material from the site, whether in good or bad context, is likely to have at least some scientific significance and that such material should be collected. Despite its limited value, this was done and reported on here. Because so few items were found, the material is considered to have low cultural significance for its scientific value.

6.6. Summary of heritage indicators and provisional grading

No significant heritage resources are likely to occur within the proposed disturbance zone (within 1 m of the present land surface) for the car park. Any isolated items, such as those recovered during the test excavations, are likely to be of Grade IIIC value or less.

7. ASSESSMENT OF IMPACTS

7.1. Impacts to archaeological and palaeontological resources

No significant archaeological resources are likely to occur on the site. The density of the test excavations lends a high degree of certainty to this conclusion. Impact assessment ratings are provided in Table 1. Should any impacts occur, they would be direct negative impacts that would occur during the construction phase only. Because these impacts would be to isolated items, the severity of the impacts is considered to be very low and the significance **low**. Although isolated fossils from the dumped material would be of some limited academic value, the test excavations have shown that their density is likely to be low.

Table 1: Assessment of potential archaeological and palaeontological impacts.

	Before mitigation	After mitigation
Status	Negative	Positive
Spatial Scale	Very low (1)	Very low (1)

Temporal scale	Very high (5)	Very high (5)
Probability	Highly improbable (1)	Highly Improbable (1)
Severity	Very low (1)	Very low (1)
Significance	Low	Low
Reversible	No	
Replaceable	No	
Cumulative impacts	No significant cumulative impacts are expected because of the lack of significant archaeological material on the site.	

7.2. Mitigation

No mitigation measures are suggested. However, should substantial fossil material still be found during development then some rescue excavation may still be required.

7.3. Management

Although it was originally suggested that archaeological/palaeontological monitoring of earthworks would be required, the very low density of fossils in the dumped fill and the complete lack of Langebaan Formation calcrete within the upper 1 m of deposit suggests that this recommendation can now be withdrawn. However, the Environmental Control Officer (ECO) and other relevant project staff should be briefed on the possible material that might be found and asked to collect all fossils uncovered during the earthworks for the project.

8. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development. The only social benefit that will be realised by the proposed project is that staff of Koeberg will not have to park their vehicles in sandy area around the car park. The heritage resources are deemed to take precedence

9. CONSULTATION WITH HERITAGE CONSERVATION BODIES

There are no conservation bodies on the HWC database that have registered an interest in this area. Nevertheless, consultation with the City of Cape Town Environmental Resource Management Department, Professor Richard Klein who has conducted research at Koeberg, and Pippa Haarhof who manages the WCFP was carried out in order to inform the present study.

9.1. Consultation on initial HIA

A draft report was sent to the above parties for comment. The responses are reproduced in Appendix 3 and briefly summarised here:

- Richard Klein’s comment implied support for the assessment and proposed test excavations. He recommended that all material from the dump deposits should be retained because individual specimens, even from poor contexts, will have scientific value. He also noted that another hyaena lair site, DFT4, was located close to, or in the vicinity of, the study area.
- Pippa Haarhof emphasised the academic value of *any* bones from the Koeberg area, even those out of context, and that monitoring of all works is important. She also offered support for the proposed test excavations.
- The City of Cape Town provided a comment that supports the recommendations made in the draft HIA. They agree that material in the range of Grade II to Grade IIIC could be present.

All three responses offer support for the proposed way forward in terms of test excavations and subsequent compulsory monitoring to rescue isolated fossils which are likely to occur quite frequently.

9.2. Consultation on revised HIA

Update after further consultation.

10. DISCUSSION & CONCLUSIONS

Because the natural ground surface was completely obscured by dumped material and the potentially highly significant Langebaan Formation underlies the site at unknown depth, a program of test excavations was carried out. Due to the great depth of the dumped material spread across the study area it has been determined that no significant impacts to heritage resources will occur. A key observation is that in none of the test holes was the highly sensitive Langebaan Formation reached. Also, the apparent very low density of fossil material within the dumped sand substantially reduces the perceived academic value of this material. Although monitoring and recovery of any isolated bones would be desirable in spite of the fact that they are no longer in primary context, this can be done by project staff and the ECO. It is likely that very few bones would be seen in these deposits when bulk earthworks are underway, no matter how experienced the eye.

There are no other heritage issues of concern for this development and there are no fatal flaws.

11. RECOMMENDATIONS

The thick layer of *ex situ* material across the bulk of the site renders it of low sensitivity. It is thus recommended that the proposed car park construction proceed but subject to the following points being incorporated into the conditions of authorisation:

- A briefing session for the ECO and relevant project staff must be carried out prior to commencement of earthworks so that any isolated fossils seen during construction can be

collected and retained. Such material would need to be given to a palaeontologist for description and accessioning in an approved repository; and

- If any substantial archaeological or palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae



Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

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Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Memberships and affiliations:

South African Archaeological Society Council member	2004 –
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
ASAPA Cultural Resources Management Section member	2007 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233

CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
 - Stone Age archaeology (awarded 2007)
 - Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
 - Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP)

- Accredited Professional Heritage Practitioner

Fieldwork and project experience:

Extensive fieldwork as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Phase 1 surveys and impact assessments:

- Project types
 - Notification of Intent to Develop applications (for Heritage Western Cape)
 - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
 - Archaeological specialist studies
 - Phase 1 test excavations in historical and prehistoric sites
 - Archaeological research projects
- Development types
 - Mining and borrow pits
 - Roads (new and upgrades)
 - Residential, commercial and industrial development
 - Dams and pipe lines
 - Power lines and substations
 - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
 - Duinefontein, Gouda
- MSA rock shelters
 - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
 - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
 - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
 - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
 - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
 - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
 - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
 - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

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Professional Qualifications

- ☐ PhD (archaeology) 1990 “*Archaeological and palaeoenvironmental interpretation of avian remains from archaeological sites*”. University of Cape Town.
- ☐ MA (archaeology) 1976 “*Systematic Investigation of Coastal Shell Middens in the South Western Cape*”. University of Cape Town.
- ☐ BA (Archaeology, Social Anthropology, African History, History and Geography) 1969 University of Cape Town.

Current Position

Retired 31 January 2012.

Associate Natural History Collections Department, Cenozoic Studies, Iziko South African Museum (April 2012–).

Research Associate, Archaeology Department, University of Cape Town (July 2012–).

Positions Held

- ☐ Archaeozoologist, Curator of Quaternary Collections, Cenozoic Studies Section, Natural History Department, Iziko South African Museum (2002–January 2012). [moved to Natural History Collections Department when Iziko came into being]
- ☐ Head of Human Sciences Division, South African Museum (1993–2002).
- ☐ Head of Archaeology Department, South African Museum (1990–1993).
- ☐ Acting Head of Archaeology Department, South African Museum (1985–1990).
- ☐ Researcher, Archaeology Department, South African Museum (1980–2002).
- ☐ Manager: Archaeological Data Recording Centre, South African Museum (1974–1979).
- ☐ Environmental Archaeologist, South African Museum (1970–1973).
- ☐ Manager (temporary): Archaeological Data Recording Centre, South African Museum (1969).

Research

Research Interests

The Late Quaternary palaeoecology of south-western Africa covering material from the Pliocene to the Holocene:

- ☐ Archaeozoological studies—mammals, birds and molluscs in the palaeo-ecological and human history of South Africa;
- ☐ Experimental and comparative actualistic studies – taphonomy of human and non-human bone accumulations resulting from carnivores, scavengers and raptors, such as hyaenas, jackals, leopards, eagles and the larger owls. These include a 29-year long-term project monitoring beached birds and mammals;
- ☐ Past climates and environments using evidence from birds and mammals (including pollens from hyaena coprolites); and
- ☐ The application of archaeozoological and palaeontological research to modern issues of global change, conservation, heritage resource management and education.

Research Projects

- ☐ Taphonomy of Verreaux’s Eagle prey (with Aaron Armstrong, University of Minnesota).
- ☐ Prey of Verreaux’s Eagles in the Cedarberg and Sandveld (with Megan Murgatroyd, UCT) – ongoing.
- ☐ Prey of African Crowned Eagle in Urban areas of Kwazulu Natal (with Malan, et al.). 2008 – 2014. Paper submitted to Ostrich.
- ☐ Taphonomy and pathology of seal remains from the Langebaanweg Early Pliocene fossil site (with R. Govender, Iziko Museums of South Africa).
- ☐ Interpreting the environment of human development in eastern Africa (with D.M. Avery, Iziko SA Museum and F.K. Manthi and S. Mucila, National Museums of Kenya. Funding from PAST 2009 – ongoing.
- ☐ Spreeuwalle Late Pleistocene Wetland on The Western Cape Coast, South Africa, And its Implications for the Pleistocene History of the Fynbos (with R.G. Klein, Stanford University, USA, C. Cordova, Oklahoma State University, USA, E. Bergh, Iziko South African Museum, Warren Sharp, UC Berkeley, USA and Julie Luyt, University of Cape Town). Funding From Leakey Foundation and PAST. 2003 – Ongoing.
- ☐ Uniab brown hyaena den: Taphonomy of a modern hyaena den on the Uniab delta fan, Skeleton Coast Park, Namibia (with P. Fosse, CNRS, Université de Toulouse Mirail, France, J-B. Fourvel, Université de Toulouse Mirail, France, J-F. Tournepiche, Angolême Museum, D.M. Avery, Iziko Museums of South Africa, R. Loutit and S. Braine).

- ❑ Pathologies on Gemsbok at the Uniab brown hyaena den (with R. Govender, Iziko Museums of South Africa).
- ❑ Human behavior, taphonomy, biodiversity and palaeoecology from osteological remains of birds from archaeological and palaeontological sites in the western and Eastern Cape Provinces: Includes a range of Middle and Late Pleistocene occurrences.
- ❑ CNRS/NRF International Co-operation Project on taphonomy of spotted hyaena bone accumulating habits. (with P. Fosse, CNRS, Université de Toulouse Mirail, France, J-F. Tournepiche, Angoulême Museum and J-B Fourvel, Université de Toulouse Mirail, France). 2002 – ongoing.
- ❑ Late Pleistocene Middle Stone Age shell midden at Ysterfontein (with R.G. Klein, Stanford University, T.E. Steele, UC Davis, D. Halkett, University of Cape Town): excavation and study of the bird remains. 2002–2007.
- ❑ Records of Middle and Upper Pleistocene birds in fossil and archaeological sites. – ongoing.
- ❑ Palaeo-ecology of the Western Cape Coast. (with Klein, R.G., Stanford University, L. Scott, University of the Free State). Funded initially by NRF grant to A. Chinsamy-Turan, Iziko Museums of Cape Town). 2002 – ongoing.
- ❑ Prey of black sparrow hawks in the western Cape (with R. Simmons, Percy FitzPatrick Institute for African Ornithology, University of Cape Town, and O. Curtis, Cape Technikon Nature Conservation MA student). 2002 – ongoing.
- ❑ Cercopithecoid and other remains in crowned and black eagle prey assemblages. (with J. P. Kerbis, Field Museum, Chicago, USA; G. Malan, Tshwane University of Technology; A. Armstrong, University of Minnesota, USA). 2001 – ongoing.
- ❑ Co-Director of Duinefontein Project (with R.G. Klein, Stanford University and K. Cruz-Urbe, Northern Arizona University): excavation and overall interpretation; avian remains; palaeo-environment (carbon and oxygen isotopes with J. Lee-Thorp, University of Cape Town); pollens in hyaena coprolites (with L. Scott). NSF and Leakey Foundation funding allocated to RGK. 1997–2002.
- ❑ Co-Director of Die Kelders Cave Project (with R.G. Klein Stanford University, F.E. Grine and C. Marean, State University of New York at Stony Brook). NSF funding allocated to RGK. 1992–1995.
- ❑ Prey of black, martial and crowned eagles in the Cape Province (with A. Boshoff and G.N. Palmer, Cape Nature Conservation). 1988–1994.
- ❑ Late Quaternary palaeoecology of south-western Africa – avian fauna project, taphonomy of modern and archaeological/fossil bone accumulations and an investigation of the Middle Pleistocene hominid and other occurrences at the Elandsfontein fossil site, south-western Cape. Funding through colleagues involved in the project. Now part of “Palaeo-ecology of the Western Cape Coast Project” 1980 – ongoing.
- ❑ Avian fauna, palaeoenvironments and palaeoecology in the Pleistocene/Holocene of the southern and western Cape (PhD). Funding through colleagues involved in excavation projects. 1978–1990.
- ❑ Monthly survey of dead seabirds and marine mammals on South African beaches. 1977–2006.
- ❑ Archaeological salvage of historical material from the Cape Town Station Concourse and Golden Acre Sites. Excavation and preservation of Wagenaar's Reservoir. 1974–1979.
- ❑ Systematic investigation of open-station shell midden sites along the south-western Cape coast (MA). CSIR, HSRC, Museum funding to GA. 1970–76.

Fieldwork Experience

- ❑ Extensive fieldwork (survey and excavation) at a range of archaeological and palaeontological sites dating from the Miocene to the Holocene (see Appendices 1 & 2).
- ❑ Surveys and collections of modern prey of mammals and raptors for taphonomic and palaeo-environmental studies.
- ❑ Monthly surveys for beached seabirds birds and marine mammals over 29 years.
- ❑ Initial development of the avian comparative osteology collection and contributions to its subsequent expansion and to that of the mammal comparative osteology collection. Assisted in the collection of barn owl pellets and in bird atlassing. This and other study material (above) led to the establishment of the Iziko Taphonomic Collection in Cenozoic Studies.

Curatorial and Museology

Collections Management

Planning, management, curation and co-ordination of the archaeological, physical anthropology and Quaternary collections of Iziko SA Museum, as well as the Archaeological Data Recording Centre. Using databases of different types. Writing contracts for collections, external loans and impact assessments. Overseeing the input of the archaeological, physical anthropology and Quaternary mollusc collections on Excel spreadsheets to make them more accessible and contributing to the improvement and upgrading of the LogosFlow Humanities Database, used by the African Studies section. Assisting in the development of a LogosFlow Archaeology/Quaternary Database to capture data for individual cultural items, fossils and assemblages with a view to simplifying transfer of data already on spreadsheets to an Access relational database.

Collections Policy Development

Assisting in the development of Archaeology, Human Remains and Palaeontology collection policies.

Sensitive Collections

Best practices for sensitive collections (human remains). Organized a workshop on sensitive collections, the results of which led to greater understanding of museum and social issues, which have significantly changed the way in which many museums in South Africa treat human remains in particular. Contributed to public forums on the issues of museums and human remains and a member of the Iziko Reference Group on Human Remains, which developed Iziko's current Policy on Human Remains.

Collection Development and Access

Development of the archaeology, Quaternary, Comparative Osteology and Taphonomy collections.

Encouraged researchers to use the museum as an institutional base and to deposit their material in Iziko's collections leading to significant additions to Iziko holdings at virtually no cost to the museum. As visitors, they have helped to create critical mass in

cultural archaeology, archaeozoology, and Quaternary palaeontology, added scientific value to the collections and enhanced public and academic perceptions (local and international) of the museum.

Marketing Iziko's archaeological and Quaternary collections, which have been increasingly studied by local and international researchers and postgraduate students.

Cultural Resource Management

Extensive experience in this field.

Contributions to Development and Training

Lectures to university and technikon students and courses on the curation and conservation of collections and collection management. Provided in-service training and mentoring for museum staff, university students, postdocs and interns. Participated in training programmes for tour guides and museum volunteers.

Membership of Professionally-Related Societies

- Royal Society of South Africa.
- Association of Southern African Professional Archaeologists (ASAPA). Professional Member #008 with Cultural Resource Management (CRM) accreditation.
- South African Society for Quaternary Research (SASQUA).
- International Council for Archaeozoology (ICAZ).
- South African Archaeological Society.
- Southern African Museums Association (SAMA) (Life Member).

Other primary interests

Conservation, particularly participation in processes aimed at engendering and promoting civil and State understanding and the implementation of sound practices in environment and resource use. To this end, I have been active in promoting the principles, policies and actions of WESSA of which I have been a Regional Chairman, National Councilor, Board member and, as national President, Chairman of the Council and Board of Directors. I am a strong supporter of the Society's initiatives in environmental education and conservation, empowerment of communities and networking with other environmental NGOs.

Honorary Positions

Honorary Research Associate, Iziko South African Museum (2012–).

Research Associate, Archaeology Department, University of Cape Town (2012–).

Editor *RSSAfNews* (2012–).

Editor *Piscator* (2012–).

Council Member Royal Society of South Africa (RSSAf) (2010–).

Member Cape Town Science Centre Scientific Advisory Board (2008–).

Member of Cape Nature Klipgat Development Group (2004–2007).

Past President and Honorary Life Member Wildlife and Environment Society of South Africa (WESSA) (2004–).

Member: Permit Review Committee, Amafa aKwaZulu-Natali (Heritage KwaZulu-Natal) (2001–ongoing).

Chairperson, Southern African Association of Archaeologists (now ASAPA) (2000–2004).

Specialist Advisor: Archaeology, Palaeontology & Meteorite Permit Committee, South African Heritage Resources Agency (SAHRA) (2000–2003).

Research Associate, University of Cape Town (UCT/Iziko MOU) (1999–2011).

Member of the Percy FitzPatrick Institute for African Ornithology Advisory Board (Representing WESSA) (1999–).

Trustee, World Wildlife Fund South Africa (WWF SA) (1999–).

Trustee, Klipgat Trust for coastline and heritage between Die Kelders Cave (Klipgat) and Gansbaai (1998–).

APPENDIX 2 – Test excavation report

Proposed car park at Koeberg Nuclear Power Station: test excavation workplan report.

Conducted under a workplan approved by Heritage Western Cape.

Dr Jayson Orton

INTRODUCTION

This program of test excavations was conducted in response to a Heritage Impact Assessment (HIA) for a new car park at the Koeberg Nuclear Power Station. Please see the HIA report for full details of the proposed development. Although it was proposed to excavate approximately 22 test holes, a total of 31 holes were excavated.

SCOPE OF THIS REPORT

This brief report serves to describe the test excavations carried out and present the observed stratigraphy at each. Any archaeological or palaeontological material discovered during the process is also described here.

METHODOLOGY

The test excavations were conducted on 26 September 2016 by Jayson Orton with the assistance of Ryan Jonas of Advisian (the appointed environmental assessment practitioner). The layout of the excavations is shown in Figure A2.1. The excavations were located in a grid in order to try and be as systematic as possible. The aim was to excavate each hole to approximately 1 m deep as that was the maximum depth to which any work would be carried out for the proposed development. All excavations were carried out by hand using a spade. Although it was intended to sieve the sand from time to time to check for small finds, this was found to be virtually impossible due to the dampness of the sand and, at times, a high clay content. Sieving was thus not attempted at all. A representative sample of the holes was recorded photographically.

All artefacts and fossil bones were required to be retained. During the excavations the surface around each test hole was examined for any bones present and, where found, these were collected.

LIMITATIONS

A small section of the study area had been fenced off and was in use as overflow parking (Figure A2.1 & A2.2). This section was not tested. As already noted, the damp sand precluded the possibility of sieving and locating very small finds. We were not allowed to bring a camera onto site and were required to make use of a camera belonging to Eskom in the presence of a security official during a short period before the end of the day. This meant that no photography could be taken during excavation and that it was not feasible to leave every hole open for recording at the end. The security official had to leave prior to completion of the last test hole.



Figure A2.1: Aerial view of the study area showing the spatial distribution of the test excavations carried out across the site.

FINDINGS

The observed stratigraphy in each hole is described below. Archaeological/palaeontological finds are highlighted in bold text. It should be noted that small water worn shell fragments were ubiquitous on the surface and seemed to be common in the test excavations. No effort was made to record these, although it was evident that when seemingly natural white dune sand was present these shell fragments were not noticed.



Figure A2.2: View towards the south showing the existing car park and overflow extension are (beyond the mini-bus).

Test Hole 1

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10 cm: compacted orange gravel surface.

Test Hole 2

- 0-67 cm: brown sand with occasional calcrete nodules and other small stones.
- 67-107 cm: white sterile dune sand.



View into Test Hole 2. Scale bar = 0.5 m.

Test Hole 3

- 0-40 cm: yellow/brown sand with occasional calcrete nodules and other small stones.
- 40-62 cm: pale brown/beige sand.
- 62-82 cm: pale beige dune sand.
- 82-120 cm: grey/brown and beige mixed sand.



View into Test Hole 3. Scale bar = 0.5 m.

Test Hole 4

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10 cm: compacted orange gravel surface.

Test Hole 5

- 0-5 cm: soft white sand with occasional calcrete nodules and other small stones.
- 5-14 cm: sterile white dune sand.
- 42-62 cm: mottled white/brown sand (looks like a Holocene palaeo-dune surface with staining from vegetation).
- 62-115 cm: sterile pale beige dune sand.

NB: From 5 cm downwards this looks like a natural dune profile.



View into Test Hole 5. Scale bar = 0.5 m.

Test Hole 6

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10-14 cm: uncompacted layer of gravel.
- 14-33 cm: beige/pale brown mottled sand.
- 33-49 cm: white sterile dune sand.
- 49-125 cm: beige dune sand with a **very weathered possibly silcrete flake found at 95 cm depth.**

NB: From 33 cm (and possibly even from 14 cm) downwards this looks like a natural dune profile.



The ventral (left) and dorsal (right) surfaces of the flake found in Test Hole 6. Scale in cm and mm.

Test Hole 7

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10 cm: compacted orange gravel surface.

Test Hole 8

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10 cm: compacted orange gravel surface.

Test Hole 9

- 0-17 cm: soft white sand with occasional calcrete nodules and other small stones.
- 17 cm: compacted orange gravel surface.

Test Hole 10

- 0-15 cm: soft white sand with occasional calcrete nodules and other small stones.
- 15 cm: compacted orange gravel surface.

Test Hole 11

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10-90 cm: hard mottled sand with much clay.
- 90 cm: concrete slab present over most of the base of the hole.
- 90-95 cm: the hard mottled sand with much clay continues alongside the slab.

Test Hole 12

- 0-8 cm: soft white sand with occasional calcrete nodules and other small stones.
- 8-30 cm: hard gravel.
- 30 cm: compacted orange gravel surface.

Test Hole 13

- 0-15 cm: soft white sand with occasional calcrete nodules and other small stones.
- 15-65 cm: hard, mottled beige/brown sand with calcrete gravel.
- 65-99 cm: hard brown sand.
- 99-120 cm: dark grey sand, possible natural dune sand.



View into Test Hole 13. Scale bar = 0.5 m.

Test Hole 14

- 0-10 cm: soft white sand with occasional calcrete nodules and other small stones.
- 10-106 cm; hard, dark yellow/brown sand with a diagonal stripe of mottled black/white/yellow sand starting at 72 cm and angling down steeply towards the west.



View into Test Hole 14 with the diagonal layers evident. Scale bar = 0.5 m.

Test Hole 15

- 0-16 cm: soft white sand with occasional calcrete nodules and other small stones.
- 16-48 cm: light brown sand.
- 48-85 cm: slightly darker, very compact sand with much clay. Contained a ***Cymbula granatina* apex fragment with white/beige sand inside it at 72 cm depth**. From the condition and colour, the shell is likely Later Stone Age and thus should not have been at such depth.



View into Test Hole 15. Scale bar = 0.5 m.

Test Hole 16

- 0-15 cm: soft white sand with occasional calcrete nodules and other small stones.
- 15-105 cm; dark yellow/brown sand with a diagonal stripe of white and black mottled sand at 42 cm and sloping down towards the west.

Test Hole 17

- 0-20 cm: soft white sand with occasional calcrete nodules and other small stones.
- 20-107 cm: hard, dark yellow/brown sand with a white/brown mottled stripe at 54 cm. **Two fossil bones were found at 92 cm depth**. The larger bone was damaged by the spade during excavation and refitted for the photograph.



The fossil bone found on the surface at Test Hole 17. Scale in cm and mm.



The fossil bone found at 92 cm depth in Test Hole 17. Scale in cm and mm.

Test Hole 18

- 0-12 cm: soft white sand with occasional calcrete nodules and other small stones.
- 12-20 cm: yellow sand.
- 20-37 cm: hard beach sand with many very tiny shell fragments (looks Pleistocene).
- 37-95 cm: hard brown sand.



The fossil bones found on the surface at Test Hole 18. Scale in cm and mm.



View into Test Hole 18. Scale bar = 0.5 m.



Close up of the white beach sand layer.

Test Hole 19

- 0-20 cm: soft white sand with occasional calcrete nodules and other small stones.
- 12-107 cm: hard, brown stripy sand that seemed very mixed.



View into Test Hole 19. Scale bar = 0.5 m.

Test Hole 20

- 0-15 cm: soft white sand with occasional calcrete nodules and other small stones.
- 15-35 cm: yellowish sand with many lumps of calcrete in it.
- 35 cm: compacted orange gravel surface.

Test Hole 21

- 0-13 cm: soft white sand with occasional calcrete nodules and other small stones.
- 13-86 cm; hard, yellow/brown sand.
- 86-122 cm: sterile white dune sand.



*The fossil bone found on the surface at Test Hole 21.
Scale in cm and mm.*



*View into Test Hole 21. Scale bar =
0.5 m.*

Test Hole 22

- 0-96 cm: white dune sand with fine striations typical of natural aeolian deposition.
 - 96-114 cm; dark brown, very hard sand.
- NB: This looks like a natural dune profile.



View into Test Hole 22. Scale bar = 10 cm intervals.

Test Hole 23

- 0-11 cm: soft white sand with occasional calcrete nodules and other small stones.
- 11-40 cm: hard beige sand with calcrete rubble in it.
- 40 cm: compacted orange gravel surface.



View into Test Hole 23. Scale bar = 0.5 m.

Test Hole 24

- 0-21 cm: soft white dune sand.
- 21-42 cm: hard, pale brown/beige sand.
- 42 cm: compacted orange gravel surface.

Test Hole 25

- 0-15 cm: soft white sand with occasional calcrete nodules and other small stones.
- 15-83 cm; harder brown/beige sand with many lumps of calcrete in it. A calcrete boulder was encountered at 45 cm depth in the northern side of the hole. The hole was expanded to the south to enable further excavation.
- 83-118 cm: darker brown sand with calcrete and ferricrete nodules. A piece of rusted wire was located near the base of the excavation.



View into Test Hole 25 showing above and below the calcrete boulder. Scale bar = 0.5 m.

Test Hole 26

- 0-32 cm: soft white sand with occasional calcrete nodules and other small stones.
- 32 cm: compacted orange gravel surface.



View into Test Hole 26. Scale bar = 0.5 m.

Test Hole 27

- 0-25 cm: soft white sand with occasional calcrete nodules and other small stones. A piece of plastic was found at 20 cm depth.
- 25 cm: compacted orange gravel surface.

Test Hole 28

- 0-31 cm: soft white sand with occasional calcrete nodules and other small stones.
- 31-90 cm: mottled beige/brown/white sand.
- 90-104 cm: white dune sand.



View into Test Hole 28. Scale bar = 0.5 m.

Test Hole 29

- 0-100 cm: pale beige sand with calcrete nodules in it. A piece of plastic was found at 95 cm.

Test Hole 30

- 0-75 cm: mottled white/brown/yellow sand.
- 75-88 cm: white sand.

Test Hole 31

- 0-27 cm: light brown sand.
- 27-46 cm: white dune sand.
- 46-52 cm: thin layer of what appeared to be an *in situ* lens of calcrete.
- 82-105 cm: sterile white dune sand.

DISCUSSION

The 31 test holes have shown that there is tremendous variability within the substrate of the study area. The vast majority is introduced fill relating to the excavation of the nuclear power plant site in the late 1970s, but a few locations showed largely natural dune profiles. In some holes there were diagonal stripes in the sediments indicating tipping of material from trucks. A number of holes revealed compacted orange gravel suggestive of a construction yard or similar having been made in this area in the past. The concrete slab is indicative of some sort of infrastructure having been in place at one time.

The fill material appears to be quite sparse in terms of fossil content throughout the study area and is this of very little concern. There certainly appear to be far too few fossils visible to merit any professional monitoring of excavations. Furthermore, the excavations have shown that there is no chance of intersecting *in situ* Langebaan Formation calcrete during the course of the proposed car park development.

CONCLUSION

It is concluded from this work that no significant impacts to subsurface heritage resources are likely to occur and that the site is of low sensitivity in terms of both archaeology and palaeontology.

APPENDIX 3 – Consultation emails

Original email to consulted parties

(Note that original email files (.eml) were submitted electronically with this application)

From: "Jayson Orton" <jayson@asha-consulting.co.za>
To: "Pippa Haarhof" <pjh@fossilpark.org.za>; "Richard G. Klein" <rklein@stanford.edu>; "Sonja Warnich Stemmet" <Sonja.WarnichStemmet@capetown.gov.za>; "Harriet Clift" <Harriet.Clift@capetown.gov.za>
Cc: "Jonas, Ryan (Advisian)" <Ryan.Jonas@Advisian.com>; "Herbert, Michelle (Advisian)" <MICHELLE.HERBERT@advisian.com>; "Graham Avery" <gavery@iziko.org.za>
Sent: 2016-08-24 09:46:47 PM
Subject: HIA draft report for comment

Dear Pippa, Richard, Sonja and Harriet

I have been requested to prepare a Heritage Impact Assessment for a proposed carpark development at Koeberg Power Station. Dr Graham Avery serves as co-author with the palaeontological responsibility. Although there are no registered conservation bodies for this area, I have felt it prudent to request comment from each of you.

I have attached the draft report for your consideration and would appreciate any input you may have. Any comments received will be presented in the report along our author responses.

Many thanks for your time in this matter.

with all best wishes
Jayson

Responses received

From: "Richard G. Klein" <rklein@stanford.edu>
To: "Jayson Orton" <jayson@asha-consulting.co.za>
Cc: "Pippa Haarhof" <pjh@fossilpark.org.za>; "Sonja Warnich Stemmet" <Sonja.WarnichStemmet@capetown.gov.za>; "Harriet Clift" <Harriet.Clift@capetown.gov.za>; "Jonas, Ryan (Advisian)" <Ryan.Jonas@Advisian.com>; "Herbert, Michelle (Advisian)" <MICHELLE.HERBERT@advisian.com>; "Graham Avery" <gavery@iziko.org.za>
Sent: 2016-08-26 05:47:04 PM
Subject: Re: HIA draft report for comment

Dear Jayson,

[personal greeting extracted]

I think your approach is on the mark. DFT 4 was very near the proposed extension. It was probably a brown hyena lair with some of the best preserved bone from Koeberg, including a rhino skull. It was bulldozed away before we could collect more than a small sample, and there could be no more than a trace left now. There were also LSA middens, all with potsherds.

It's hard to be certain, but I think the most interesting stuff you're likely to encounter will have originated from the Miocene clays deep in the power plant excavation. Besides giant white shark's teeth, there could be bird and marine mammal bones. Even if the context is a bit of a mess now, the specimens will be valuable in their own right, and it will take or be good to retain them all.

I look forward to your results.

As ever,
Richard

----- Forwarded Message -----

From: "Pippa Fossilpark mailbox" <pjh@fossilpark.org.za>

To: "Jayson Orton" <jayson@asha-consulting.co.za>

Sent: 2016-08-30 11:23:57 PM

Subject: RE: HIA draft report for comment

Dear Jayson

I think what you are proposing is thorough and sensible – it would be advantageous to do test excavations as you recommend.

I re-iterate what I said before regarding the high possibility of finding Mio/Pliocene material in the overlying dump. It would still have academic value in spite of not being *in situ*.

I also agree with the level of monitoring that you are proposing. This is really important to emphasise as it seems that this is not always carried out and could lead to the loss of valuable material.

Please let me know if you need further input.

Am interested in your findings.

Best wishes, Pippa

Pippa Haarhoff

Manager, West Coast Fossil Park



COMMENT TO HWC ON DEVELOPMENT ACTIVITY WHICH MAY IMPACT ON A HERITAGE RESOURCE

REF #:2016-08 -29 /-
YYYY -MM -DD /APPLICANT INITIALS

PART A: (APPLICANT TO COMPLETE) PROPERTY INFORMATION AND APPLICATION DETAILS

A i: SITE AND PROPOSAL PARTICULARS:				Site name (if relevant)	Koeberg Nuclear Power Station	
Site Address	Off R27, north of Melkbosstrand.		Erf Nos	Farm 1552		
Owner	Eskom Holdings Ltd		Has formal application been made to the City?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	If Yes, Application & Receipt Number	&
Applicant	Asha Consulting (Pty)Ltd – Dr Jayson Orton		Applicant contact No	0832723225 / jayson@asha-consulting.co.za		
Architect/Designer	n/a		Architect/Designer contact No			
Drawing Nos		Date	Rev 0	Has the work already started without consent	No	Comment

Comment to HWC on Applications made in terms of Sections 27, 29, 34 and 38 of the National Heritage Resources Act 25 of 1999.

A ii: NHRA TRIGGERS AND TYPES OF ACTIVITIES COVERED BY THE APPLICATION								
S27	<input type="checkbox"/>	S31	<input type="checkbox"/>	New Building	<input type="checkbox"/>	Is Section 38 triggered?	Y <input checked="" type="checkbox"/>	
S28	<input type="checkbox"/>	S34	<input type="checkbox"/>	External alterations	<input type="checkbox"/>	IF YES, tick the appropriate triggers below:	N <input type="checkbox"/>	
S29	<input type="checkbox"/>	S35	<input type="checkbox"/>	Internal alterations	<input type="checkbox"/>	<ul style="list-style-type: none"> Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length 	<input type="checkbox"/>	
S30	<input type="checkbox"/>	S36	<input type="checkbox"/>	External additions	<input type="checkbox"/>		<ul style="list-style-type: none"> Construction of a bridge or similar structure over 50 m Re-zoning of a site exceeding 10 000m² in extent 	<input type="checkbox"/>
Other activities: Expand				Full demolition	<input type="checkbox"/>	A development or activity which will change the character of a site -		
Click here to enter text.				Partial demolition	<input type="checkbox"/>		<ul style="list-style-type: none"> Exceeding 5000m² in extent 	<input type="checkbox"/>
				Excavation	<input type="checkbox"/>		<ul style="list-style-type: none"> Involving 3 or more existing erven or 	<input type="checkbox"/>
				Underground services	<input type="checkbox"/>		<ul style="list-style-type: none"> A subdivision involving 3 or more erven or divisions thereof which have been consolidated within the past 5 years 	<input type="checkbox"/>
				Landscaping	<input type="checkbox"/>			
				Consolidation	<input type="checkbox"/>			
				Subdivision	<input type="checkbox"/>			
				Change of planning status	<input type="checkbox"/>			
Is S38 (8) triggered?		<input type="checkbox"/>	If YES, name of approval authority and other legislation:		To HWC for COMMENT ONLY		<input type="checkbox"/>	
				Click here to enter text.				
Description of the development proposal: (Scale drawings & minimum 5 photos required from applicant)								
A proposed extension to the existing carpark, approximate 1.35ha extension. Detailed description provided by the applicant: "The construction work will entail typical layerworks as used in road construction with a dept of between 380mm and 500mm."								

PART B: (E&HM OFFICIAL/BRANCH USE ONLY)

HERITAGE SIGNIFICANCE AND COMMENT (To HWC, PBDM, Permit, HIA or EIA Process)

B i: PREVIOUS APPLICATIONS, ADVICE AND PRE-SUBMISSION CONSULTATION (E&HM OFFICIAL/BRANCH USE ONLY)	
Are there any other current or previous applications involving this site? Click here to enter text.	Y <input checked="" type="checkbox"/>
If YES, please expand below and include the planning application reference number(s) and/or year of application:	N <input type="checkbox"/>
Rezoning application reference number B21/1/2/2/13 Master Landscape Plan approval, 31 December 2015. Environmental Impact Assessment of the Used Fuel Transien Itnerim Storage facility at Koeberg Nuclear Power Station, Scoping report July 2016, by SRK Consulting (South Africa)(Pty)Ltd	

Was City Heritage (E&HM) advice sought by the applicant about this erf or proposal: If YES, please expand below:		Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
If YES, what is the previous Heritage Resources Advice, number or date?		REF #:	- - - Date
Has the City Heritage advice given on the HRA from been implemented in the current proposal? Please expand below:		Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
Click here to enter text.			
B ii: HERITAGE SIGNIFICANCE – SITE STATUS (E&HM OFFICIAL USE)		DATE RECEIVED FOR COMMENT: 5/27/2016	
2013 – 2018 Heritage database* (as displayed on CityMap viewer):			
Grading category:		Management Level ranking/classification in terms of CCT Heritage Strategy	
National Formal Protection	<input type="checkbox"/> NHS	Provincial Formal Protection	<input type="checkbox"/> PHS
		Local Formal Protection	HPO EXEMPTIONS
		<input type="checkbox"/> HPO Overlay Ref:	<input type="checkbox"/> None
		<input type="checkbox"/> S31 Heritage Area	<input type="checkbox"/> 1: Gardening/landscaping <input type="checkbox"/> 3: Internal AIs
		<input type="checkbox"/> S30 Register	<input type="checkbox"/> 2: Routine maintenance <input type="checkbox"/> 4: Heritage Management Plan
Heritage resources with qualities so exceptional that they are of special national significance.	Heritage resources which have special qualities which make them significant within the context of W. Cape province or a region	Other heritage resources worthy of conservation and/or of Local significance in terms of the requirements of the NHRA	
<input type="checkbox"/> SAHRA Grade I	<input type="checkbox"/> HWC Grade II	<input checked="" type="checkbox"/> Grade III	IIIA: Buildings and sites of outstanding local architectural, aesthetic and historical value. Structures and sites of outstanding intrinsic value for social, historical, scenic or aesthetic reasons, individually or as a group; on a metropolitan scale. <input checked="" type="checkbox"/>
<input type="checkbox"/> CCT recommended Grade I	<input type="checkbox"/> CCT recommended Grade II		IIIB: Buildings and sites of considerable architectural, aesthetic, social and historical value. Structures and sites of considerable intrinsic value for social, historical, scenic and/or aesthetic reasons either individually or as a whole; on a neighbourhood scale. <input checked="" type="checkbox"/>
			IIIC: Buildings, sites and areas of considerable local contextual value for social, historical, scenic or aesthetic reasons either individually or as a whole; on a localised, streetscape scale. <input checked="" type="checkbox"/>
			Potential IIIC: Local heritage resources that are older than 60 years, but which has undergone some retrievable loss or been altered to such an extent that their heritage value has been greatly diminished. The detractors could be reversed and the contribution to the heritage environment or narrative of the place improved. <input type="checkbox"/>
		Not conservation worthy (Ungradable)	<input type="checkbox"/>
		Requires investigation	Suspect significant early fabric/archaeology present <input type="checkbox"/>
If the information is not displayed on the CityMap viewer – please contact the Metro office for information update.			
SUMMARY STATEMENT OF SIGNIFICANCE:			
The Koeberg Nuclear Power Station is located in an area with known high archaeological and palaeontological research potential (high scientific significance). It is agreed that the heritage significance of the artefacts and deposits in this locality range from IIIC to II.			
Flagged significance criteria:		Intrinsic <input type="checkbox"/>	Comparative <input type="checkbox"/>
Aesthetic <input type="checkbox"/>	Architectural <input type="checkbox"/>	Contextual/ In group <input type="checkbox"/>	Historical <input type="checkbox"/>
Social <input type="checkbox"/>	Spiritual <input type="checkbox"/>	Community significance <input type="checkbox"/>	History of slavery <input type="checkbox"/>
Creative <input type="checkbox"/>	Natural features <input type="checkbox"/>	Tree(s)/Avenue <input type="checkbox"/>	Struggle history <input type="checkbox"/>
Archaeological <input type="checkbox"/>	Paleontological <input type="checkbox"/>	Technological <input type="checkbox"/>	Oral traditions <input type="checkbox"/>
		Potential for information <input type="checkbox"/>	Linguistic <input type="checkbox"/>
		Scientific <input checked="" type="checkbox"/>	Burial grounds <input type="checkbox"/>
B iii: COMMENT FROM HERITAGE RESOURCES SECTION TO HWC (E&HM OFFICIAL USE ONLY) (This comment to HWC does not in any way constitute an approval by the City of Cape Town or by HRS)			
City Comment on Proposal	The E&HM did not provide comment on the NID form that was submitted to HWC previously. The recommendations by the heritage specialist are deemed appropriate and therefore supported. The site is located in an area of known high archaeological and palaeontological sensitivity. In this regard any of the range of gradings could be applicable.		
Suggested Additional Consultation			
Suggested Conditions:	1. The recommendations on page iii of the HIA		
Approved drawings must be publically displayed on site during construction. All materials, dimensions and details must be strictly implemented in accordance	2. Click here to enter text.		
	3. Click here to enter text.		

with the approved application.		4. Click here to enter text.		
HRS Support <input checked="" type="checkbox"/>	HRS not supported <input type="checkbox"/>	Officials Name: S Warnich-Stemmet	Signature: <i>S Warnich-Stemmet</i>	Date: 8/29/2016

ANNEXURES to comment form; Specify:

City of Cape Town
Environmental Resource Management Dept.
Environmental and Heritage Management

29 AUG 2016

S Warnich-Stemmet
Name

S Warnich-Stemmet
Signature