Report on Sub-surface Investigation of Palaeontological and Archaeological Potential, Weskusfleur Substation Alternative 4 (1:50 000 3318CB Melkbosstrand)

Prepared by

Graham Avery[1] and Jonathan Kaplan[2]

(Sole Proprietor)

1. Archaeozoology, Stone Age Archaeology and Quaternary Palaeontology
2. Agency for Cultural Resource Management (ACRM)

March, 2016

Contents

Executive Summary

Graham Avery was commissioned by Jonathan Kaplan Agency for Cultural Resource Management (ACRM), through Lidwala Consulting Engineers (SA) (Pty) Ltd) on behalf of client Eskom Holdings (SOC) Limited (Eskom), to assist with the digging of a series of test pits on alternative construction area 4 on Brakkefontein. This was to establish the sub-surface palaeontological and archaeological potential.

Applicant:	Eskom Holdings (SOC) Limited (Eskom)
Proposed activity:	Construction of Sub-station
Location:	Approx. 33° 40.646'S; 18° 27.680'E (central point on area 4)

Heritage Western Cape preferred Alternative 4, in view of the fact that Alternative 1 was known to include palaeontological remains in the Springfontyn and earlier Varswater Formations. Since the sub-surface sediments, palaeontological and archaeological potential on Alternative 4 are unknown, the objective was to excavate a series of test pits to the proposed sub-station foundation depth (~3.5 m) in order to establish a clearer picture.

Nine test pits were excavated. No palaeontological remains were found; three stone artefacts were recovered from apparently-disturbed contexts in test pits KO1 and KO8. The results suggest that they may be Late Acheulian with possible similarities to DFT 2. However, the sparsity of finds makes the sample too small to confirm this. No earlier deposits, such as the Varswater Formation, were encountered in the test pits; the test pits appear to have confirmed that the fossiliferous deposits that are found on the coast do not appear to extend inland to Alternative 4, although sparse remnants of Middle Pleistocene material (viz, the stone artefacts) are of potential interest.

The 9 test pits were spatially remarkably similar and we believe that coverage was adequate to acquire a good idea of what could be expected. However, the larger the site, the greater becomes the potential to encounter heritage material. But, if palaeontological and/or archaeological material exists elsewhere on Area 4, the test pits indicate that it is likely to be very sparse. As such, we do not see excavation on this site producing any finds that could not be adequately managed by monitoring during excavations.

Introduction

Eskom Holdings (SOC) Limited (Eskom) seeks to construct a new sub-station on one of two alternative sites (1 & 4) adjacent to the Koeberg Nuclear Power Station). The alternative sites are on 1:50 000 topographical map 3318CB Melkbosstrand (Figures 1 & 2).

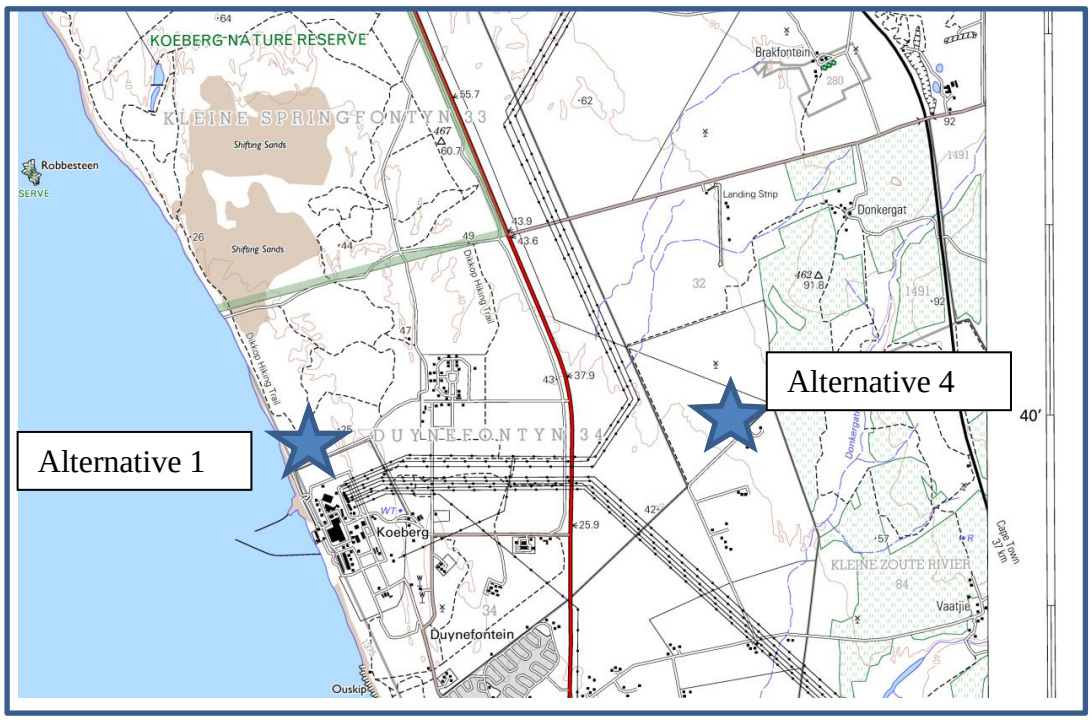

Figure 1. Portion of 1:50 000 map 3318CB Melkbosstrand showing general area with alternatives starred.

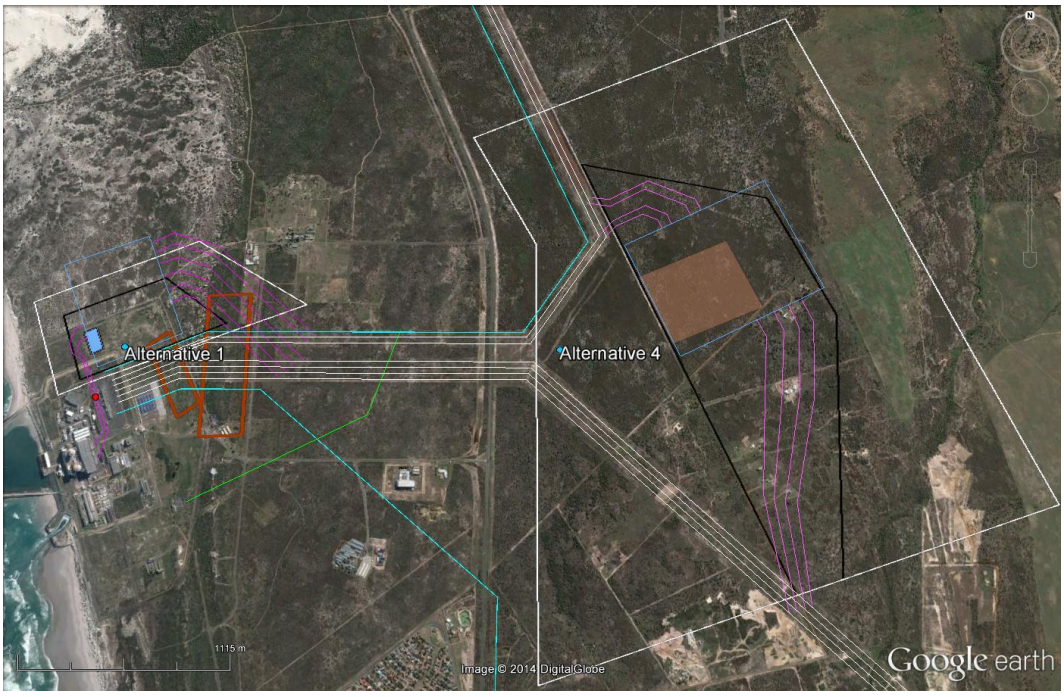

Figure 2. Google Earth view showing the location of alternative sites 1 and 4.

Heritage Western Cape preferred Alternative 4, in view of the fact that Alternative 1 was in an area known to include palaeontological remains in the Springfontyn and earlier Varswater Formations (Rogers, 2006, Cruz-Uribe, et al., 2003).

The Western Cape is yielding significant fossil remains, dating back several million years, relating to South Africa's palaeontological, palaeoenvironmental and past animal and human heritage. (Hendey, 1983, Roberts, et al., 2013) provide general background. Most known observations of the more ancient occurrences are within a kilometer of the coast and associated with dune plumes that have ancient origins; large areas further inland are vegetated or under agriculture and subaerial sediments have not been exposed; so the overall extent of potentially fossiliferous deposits, while likely to extend well into the Duinefontyn Dune Plume (Roberts, et al., 2009), which continues inland 'northeast' of Koeberg, remains to be confirmed. This project is expected to throw light on this.

Although Witzand Formation aeolian sands and Springfontyn Formation sediments occur on part of Brakkekloof (Figure 3), the extent of the fossiliferous coastal deposits is unknown. Since sub-surface observations have never been made in the Alternative 4 area and the palaeontological and archaeological potential is unknown, Heritage Western Cape requested that test pits be dug to establish whether palaeontological and/or archaeological remains occur there.

During excavations for the Koeberg Nuclear Power Station it was found that the Witzand Formation dunes (<10 ka) and Middle Pleistocene Springfontyn Formation (<~2 Ma) sediments were underlain by Late Miocene-Early Pliocene Varswater Formation marine palaeontological material (5 Ma) over Malmesbury Group bedrock (Rogers, 2006). Middle Pleistocene Springfontyn sediments, which are of particular relevance to this study, include palaeontological and archaeological (Early Stone Age) material dated to 330 ka (Cruz-Uribe, et al., 2003, Hendey, 1969, Klein, et al., 1999). At DFT 2 calcretes dated to ~160 ka overlie the fossiliferous levels (Cruz-Uribe, et al., 2003). The fossiliferous levels were associated with wetlands that were an attraction to game and Late Early Stone Age people (Cruz-Uribe, et al., 2003, Sampson, 2003). Late Pleistocene Middle Stone Age artefacts have been recovered elsewhere on Duinefontein. Historically important records have been found in recent cover dunes, e.g. black rhinoceros remains in the Witzand Formation dunes near Atlantis (G Avery, pers. obs.).

The area is relatively flat and slopes seaward (west); it is infested with Port Jackson Willow, which makes surface visibility difficult. It is to be noted, that the superficial cover sands are recent.

Objectives of the Report

Since the sub-surface sediments, palaeontological and archaeological potential on Alternative 4 are unknown, the objective was to excavate a series of test pits to the proposed sub-station foundation depth (3.5 m) in order to establish a clearer picture.

Method

The work was based on the Work Plan (Appendix A) agreed by Heritage Western Cape. On site it was decided to start with a series of test pits (to be dug to a depth of 3.5 m with a Yanmar ViC 8 excavator fitted with a bucket and scraper) along three sides of Alternative 4. Further pits would be considered if findings proved this to be necessary.

Excavations were supervised by Jonathan Kaplan (archaeologist) and Graham Avery (archaeozoologist), assisted by Danie Brummer (Lidwala)). This report should be read in

conjunction with previous reports on the Weskusfleur project (Avery, 2014, Kaplan, 2014). Excavated material was spread by the machine and then further spread with a spade to maximize the potential visibility of any palaeontological or archaeological material. All holes were re-filled and surfaces graded after examination and photography.

Geology

The general surface geology of the area is shown on a portion of 1:250 000 Geological Series 3318 Cape Town (Figure 3). The lithography of the Sandveld Group (Rogers, 2006, Pether, et al., 2000, Roberts, et al., 2006) is summarized in Figure 4.

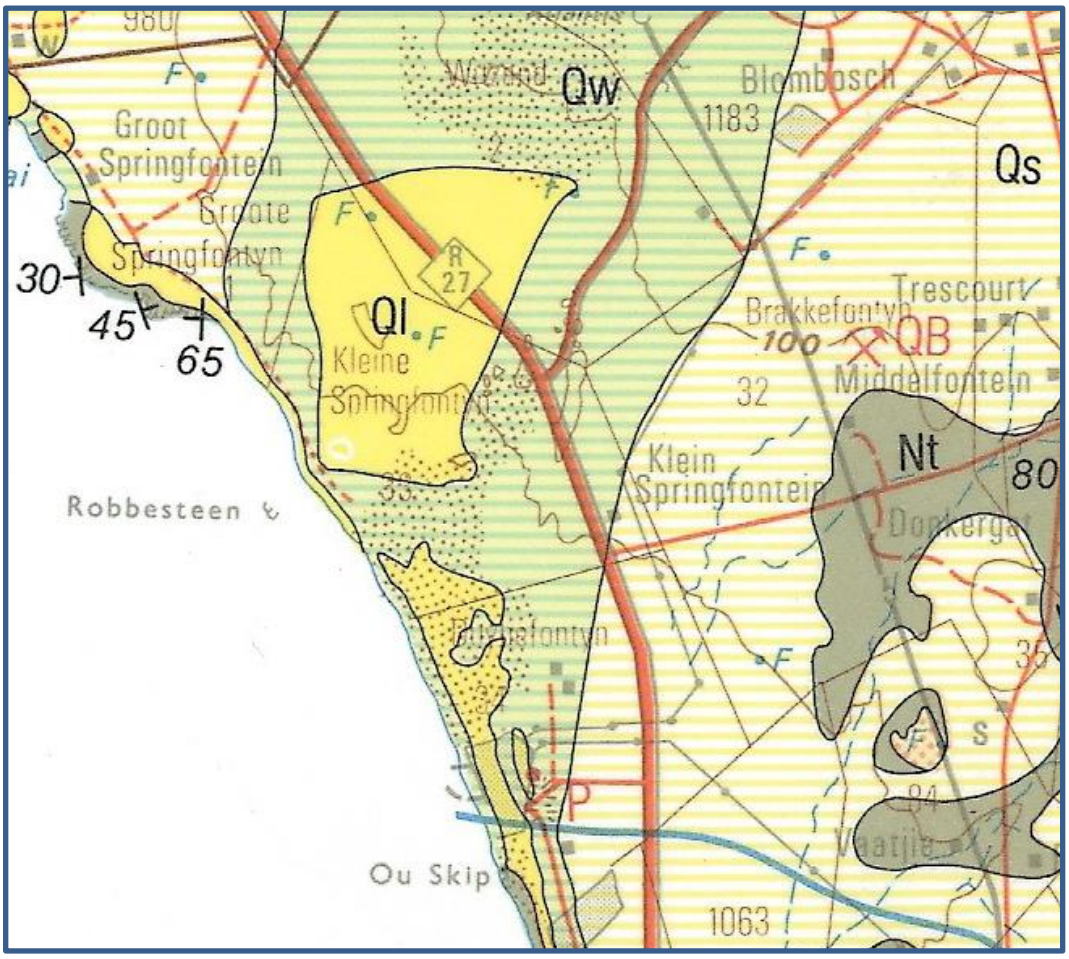

Figure 3. General surface geology of the area (from 1:250 000 Geological Series 3318 Cape Town): Elements of the Quaternary Sandveld Group include Recent (Holocene) surface Witzand Formation sand (Qw: loose white dune sand), which overlies [or is mixed with] Pleistocene to Holocene Springfontyn (Qs: Light grey to pale red sandy soil with inter-bedded palaeosols) and Pliocene to Late Pleistocene Langebaan Formation (Ql: limestone and calcrete aeolianites) sands. Basal rock is Malmesbury Group (Nt: greywacke, phyllite and quartzitic sandstone), which outcrops along the coast and inland.

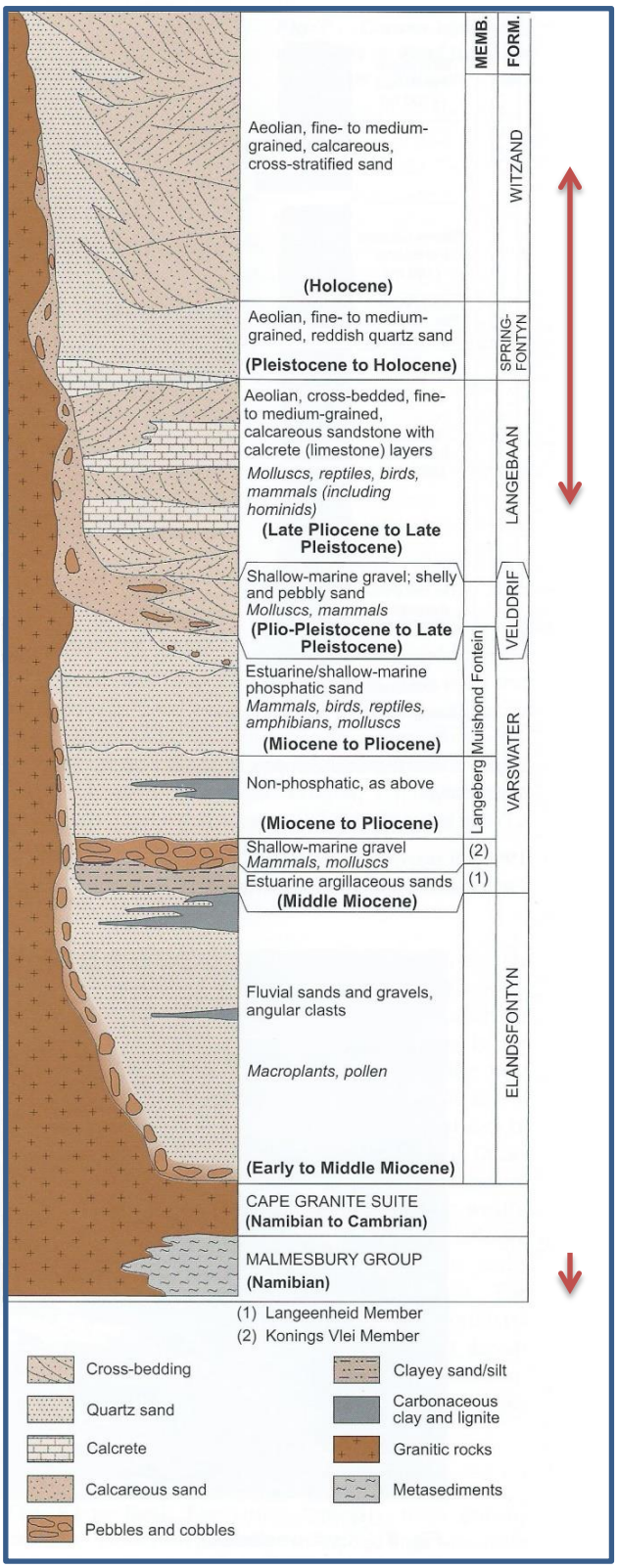

Figure 4. Generalized section through the Sandveld Group (Roberts, et al., 2006), figure 10: 616. Arrows indicate formations most likely to be expected in the test pits.

Findings in the Test Pits (Figures 5 to 20).

A total of 9 test pits (KO1-KO9) were dug along three sides of the Brakkefontein area in which Alternative 4 would be located (Figure 5). The occurrence of hard ferrugenous nodules may be related to ground water on iron-rich Malmesbury Group bed rock. It is likely

that the cover sands have been re-worked in the dune plume (Roberts, et al., 2009). Three stone artefacts, but no bones, were recovered (Two in KO1, one in KO8) (Figure 20). The apparent polish on the artefacts suggests that they were previously exposed to wind or water. If, as it seems, they are of Late Acheulian age, there may be similarities in age with DFT 2 where Middle Pleistocene artefacts and bones have been dated to 330 ka (Cruz-Uribe, et al., 2003, Klein, et al., 1999).

Given the broad sedimentary agreement and lack of palaeontological material in any of the pits, it was decided that additional pits were not warranted. Sedimentary details from the test pits are summarized in Table 1.

Figure 5. Location of numbered test pits dug along perimeter of Alternative 4.

Figure 6. KO1. JK using spade to spread sediment being excavated.

Figure 7. KO1. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock. Two stone artefacts were recovered at the sand/ferrugenous nodule level (between 0.8 and 1.0 m). The shine may be polish, which suggests that they may have been exposed to wind previously or to water.

Figure 8. KO1. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock.

Figure 9. KO2. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock.

Figure 10. KO2. Re-filling test pit and levelling to surrounding surface.

Figure 11. KO3. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock.

Figure 12. KO4. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock.

Figure 13. KO4. Example showing the test pit surface after re-filling and grading.

Figure 14. KO5. Pale sand overlying ferrugenous nodules on weathered Malmesbury Group bed rock.

Figure 15. KO6. Pale sand over ferrugenous nodules overlying weathered Malmesbury Group bedrock.

Figure 16. KO7. Pale sand with ferrugenous nodules overlying weathered Malmesbury Group bedrock.

Figure 17. KO8. Pale sand on dark band with ferrugenous nodules on weathered Malmesbury Group bed rock. 1 Silcrete core @ ± 1.2m in sand and ferrugenous nodules. The shine may be polish, which suggests that it may have been exposed to the wind previously or under water.

Figure 18. KO8. Graded surface after re-filling.

Figure 19. KO9. Pale grey sand over ferrugenous nodules and apparently-mixed calcrete lenses and weathered Malmesbury Group rock on weathered Malmesbury Group bed rock.

Figure 20. Stone artefacts from KO1 and KO8.

Table 1. Summary of Archaeological Test Excavations, Weskusfleur Substation Site 4 (Farm Brakkefontein No. 32)

Test Pit	GPS co-ordinates	Surface observations	Sub-surface observations	Cultural & Palaeontological remains	Grading
KO1	33°39'56.40"S 18°28'37.76"E	Wind-blown sand in clearing	0.0-0.8m – Grey sand 0.8-1.0m – ferrugenous nodules 1.0-3.5m yellow clay/hard weathered shale = bedrock	1 Silcrete flake and 1 silcrete chunk	3C
KO2	33°39'47.08"S 18°28'38.29"E	Wind-blown sand alongside fence	0.0-0.90m – sand 0.90-1.20m – ferrugenous nodules 1.20-2.0m – yellow clay/hard weathered shale = bedrock	None/Sterile	3C
KO3	33°39'23.70"S 18°28'35.43"E	Wind-blown sand alongside fence	0.0-1.40m – sand 1.40-1.70m – ferrugenous nodules 1.70-2.60m – Yellow clay/hard weathered shale = bedrock	None/Sterile	3C
KO4	33°39'30.74"S 18°28'13.22"E	Wind-blown sand near fence, lots of bush and trees	0.0-3.20m – sand, with some patchy lighter pink deposit at depth, but no discernible stratigraphy. 3.20-3.4m – yellow clay/hard weathered shale = bedrock. No ferrugenous nodules	None/Sterile	3C
KO5	33°39'36.78"S 18°28'0.26"E	Wind-blown sand near fence	0.0-1.90m – sand 1.90-2.30m – Ferruginous sands, with some calcrete 2.30-3.20m – light yellow sand	None/Sterile	3C
KO6	33°39'36.03"S 18°27'53.15"E	Wind-blown sand alongside fence	0.0-0.80m – sand 0.80-1.10m – light coloured yellow sands 1.10-2.0m – Ferruginous sands (waterlogged, collapsing)	None/sterile	3C
KO7	33°40'4.20"S 18°28'27.12"E	Wind-blown sand near fence	0.0-3.3m - sand	None/Sterile	3C
KO8	33°40'13.79"S 18°28'15.65"E	Wind-blown sand alongside fence	0.0-1.20m – sand 1.20-1.90m- Ferruginous sand and nodules 1.90-2.6m- clay and some ferruginous nodules	1 Silcrete core @ ± 1.2m Sterile	3C
KO9	33°40'20.77"S 18°28'7.47"E	Grass and wind-blown sand	0.0-0.20m – grass & roots 0.20-0.60m – sand 0.60-1.0m – patches/bands of calcrete (1.10m) & orange-coloured sand 1.10-1.80m – yellow clay 1.80-3.20 – Black ferruginous material below calcrete.	None/Sterile	3C

Palaeontological and Archaeological Potential

Although palaeontological material was not found on Alternative 4, the possibility that fossils may occur there cannot be excluded; small pockets of bone can occur, for instance, where bone accumulators like hyaenas, Jackals or porcupines used holes/burrows dug by aardvarks; older and younger younger sediments, too, may contain ancient wetland deposits and/or more-recent fossils. In addition to fossil bones there is the possibility that more Early Stone Age artefacts, and pre-colonial burials, may be encountered.

Human Burials

No signs of human burials were seen. However, Later Stone Age people inhabited the region as evidenced by archaeological surface scatters in Witzand Formation dunes; San and/or Khoekhoe burials may be encountered commonly on the coast, but also further inland e.g. Pfeiffer, et al. (1999) and Pfeiffer and Van der Merwe (2004).

Conclusions

Results of the test pits indicated relatively similar sediments and the probability that earlier erosional episodes have mixed/removed sediments.

No direct fossil or sub-surface palaeontological evidence was found in the test pits; however, two stone artefacts, of probable Early Stone Age origin, were found in KO1 and one in KO8 (Table 1). This does not mean that potential is lacking, but is clearly indicative of the fact that finds, if any, will be sparse. Appropriate monitoring during construction would reduce any impact, even if a more-concentrated patch of bones and/or artefacts was encountered.

It should be noted that only one Pleistocene fossil and stone artefact occurrence was observed during the excavation for Koeberg reactors 1 & 2 on Duinefontein. The implication is that such occurrences are patchy and not as common as in coastal areas further north (DFT 2, etc.). Indeed, geotech tests for the previously-proposed Pebble Bed Reactor (PBR) adjacent to the southern end of the Koeberg reactors, revealed no palaeontological or archaeological remains to a depth of about 2 m, which was the limit of the test holes.

Current information indicates that locating the sub-station on the Alternative 4 area would not impact significantly on palaeontological or archaeological remains. Nevertheless, should this go ahead, monitoring of excavations and collection of any finds must be included in the conditions of a heritage permit.

References

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Appendix A

HERITAGE WESTERN CAPE WORK PLAN APPLICATION FOR MITIGATION OF ARCHAEOLOGICAL AND PALAEONTOLOGICAL SITES

Note: The proposed work plan cannot be approved if it is incomplete.

PROJECT DETAILS		
Author and title of impact assessment report to which this application refers[1]:	Kaplan, J. 2015. Heritage Impact Assessment, the proposed Weskusfleur substation near Cape Town	
HWC Case Number[2]:	14072909GT0826E	
	Farm name(s), number(s) and portion(s) or erf number(s):	
	Nearest town:	Cape Town
	Municipality:	Cape Town
	Magisterial district:	City of Cape Town
Registered landowner[3]:		
Briefly describe the nature of the proposed development:	The proposed construction of the Weskusfleur 400/132 kV substation north of Cape Town in the Western Cape, including powerline requirements	
List all sites to be mitigated:	HWC require that test excavations be done in Alternative 4 in order to establish the extent, depth and context of heritage resources that may be impacted	

SITE DETAILS (please copy the rows below, place cursor in space beneath and paste as required for every site covered by this work plan)		
Name and co-ordinates (WGS84) of site proposed for mitigation:	Name:	Weskusfleur Substation, Alternative Site 4
	Co-ordinates:	S33 39.896 E18 28.552
Information to allow HWC to manage conditions and requirements:	Extent of site (if known):	Unknown <40 h
	Depth of site (if known):	Unknown
	Extent of planned excavations[4]:	It is proposed that a back excavator be used to excavate 2 m x 2 m (possibly 2x3 if sediment is very dry) test pits to a maximum depth of ± 3.5m. Number will depend on the actual footprint of the proposed

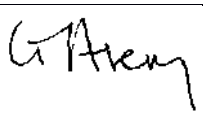
[1] If this work plan is not submitted with an impact assessment report, please supply a digital copy of the impact assessment with this application.
[2] If the impact assessment was submitted earlier, please supply a copy of the HWC comment with this application. Please note that the conditions of the HWC comment still apply.
[3] Please supply a copy of the registered land owner's permission to access the site(s).
[4] Please note the approximate number and size of test excavations, or the area proposed for full excavation if conducting mitigation.

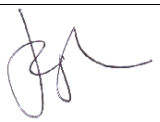
		construction and what is revealed in the preliminary pits, starting ideally with 4 corners and a centre point, alternatively points on access track if corners are inaccessible = 2-5 pits minimum
Describe the nature of the site for which mitigation is proposed, including all visible surface material, and provide an estimation of age and of possible significance.	The footprint area is infested with alien vegetation, resulting in very low surface visibility. In addition, access to the site is also severely constrained, with only one sandy track that provides access. No sub-surface archaeological or palaeontological investigations have been conducted on the site. Locally it is known that, depending on depth, Holocene Witzand Formation dunes may be underlain by Middle Pleistocene Springfontyn Formation sediments which could include archaeological and/or palaeontological remains.	

MITIGATION DETAILS	
Indicate the reason for the proposed work (check all boxes that apply):	✓ Test excavation to establish whether archaeological and/or palaeontological material is present. ✓ Test excavation to establish significance (part of impact assessment process) ✓ Test excavation to establish depth and extent of deposits (to enable planning of further mitigation) ☐ Full mitigation in advance of development (to rescue significant information and material)
Motivation for the proposed action, with reference to conservation policy and/or principles, where appropriate:	To fulfil the requirements of Section 38 (3) of the National Heritage Resources Act (No. 25 of 1999) – refer to attached HWC interim comment
Motivation for the use of mechanical equipment or a metal detector, if required:	The maximum depth of the excavations for the proposed Weskusfleur Substation is 3.5 m. In order to establish significance of sub-surface deposits at this depth and across a large area, it is practical to make use of a mechanical excavator
Describe plans for conservation of the site(s) after the proposed actions, where appropriate.	Test excavations will be photographed, re-filled and capped with topsoil
Proposed excavation / sampling / collection methodology (a plan of the proposed excavations can be inserted in the space at the end of this document):	It is proposed to mechanically excavate a series of test pits across the site in a north-south, east-west direction. A minimum of 2 - 9 test pits are envisaged, depending on what is revealed
Repository[5]:	Attached
Please supply any further details that might be relevant to this application (e.g. plans for dating	n/a

[5] Please supply a copy of the signed repository agreement with this application.

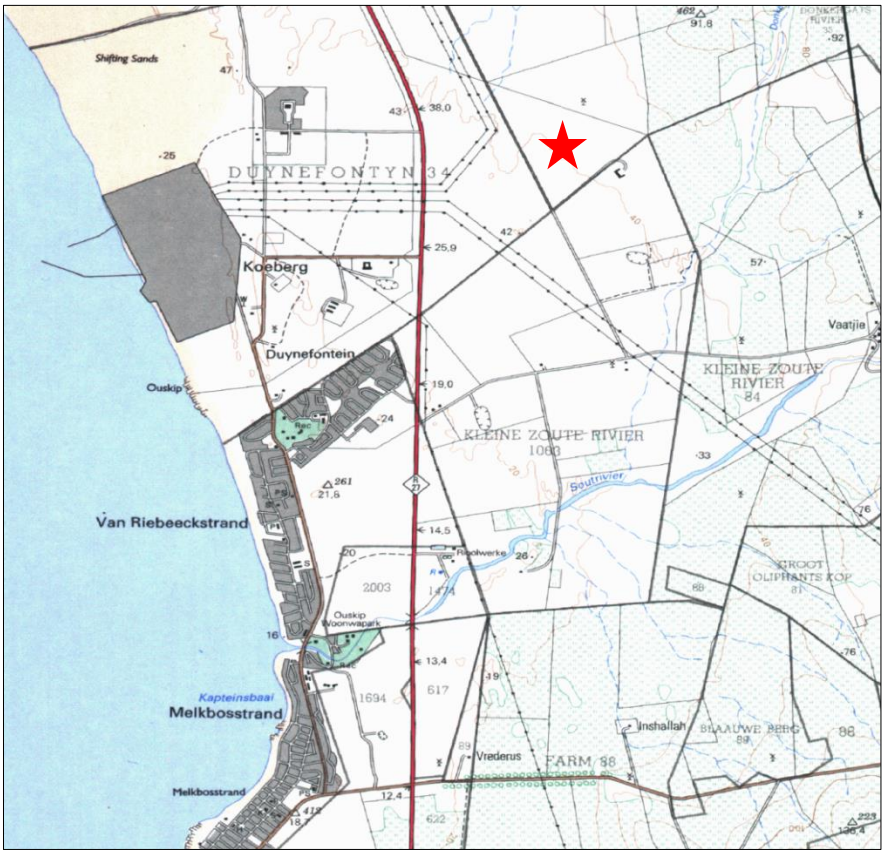
of the site(s)):	
• Note that the work plan approval will automatically allow for excavation, collection and destruction (as may be required for dating and other analyses).	

APPLICANT DETAILS (PRINCIPAL INVESTIGATOR)		
Name and title:	Dr Graham Avery	
Postal address:	25 San Bernardo, 18 de Lorentz St, Gardens, 8001	
Contact numbers:	W: *021 424 1285*	C: *0834410028*
E-mail address:	*gavery@iziko.org.za*	
Qualifications:	MA, PhD	
Relevant experience:	Over forty years of archaeological and Quaternary palaeontological experience	
Current academic status:	Retired; Research Associate; Natural History Collections Department, Iziko Museums of South Africa; Honorary Researcher, Archaeology Department, UCT	
Details of accreditation with Professional Association (including membership number):	ASAPA Professional Member, CRM Accredited 008	
Identity / Passport number:	4701195153084	
Signature of applicant:		
Date:	21 11 2015	

ASSISTANT DETAILS[6]		
Name and title:	Jonathan Kaplan	
Postal address:	5 Stuart Road, Rondebosch, 7700	
Contact numbers:	W: 021 685 7589	C: 0823210172
E-mail address:	acrm@wcaccess.co.za	
Qualifications:	MA (1989) Archaeology, University of Cape Town	
Relevant experience:	Has undertaken numerous test excavations in order to determine significance of archaeological deposits	
Current academic status and affiliation(s):	Independent consultant: Agency for Cultural Resource Management	
Details of accreditation with Professional Association (including membership number):	Association of Southern African Professional Archaeologists (ASAPA). Membership No. 253	
Identity / Passport number:	6109235177089	
Signature of assistant:		
Date:	17 November, 2015	

1. Please insert an excerpt of the relevant 1:50 000 map to show the general location(s) of the archaeological/ palaeontological site(s) for which this work plan application is made:

[6] This section is only required if the PI will not be on site full-time. It indicates the person to whom responsibility will be delegated.



Red star indicates the location of Alternative Site 4

2. Please insert an aerial photograph of the project and/or a larger scale map to show the locations of the archaeological/ palaeontological sites relative to surrounding landscape features:

Google aerial photograph indicating the location of alternative 4 for the proposed Weskusfleur Sub-substation.

3. Please insert any images that will assist the committee in evaluating this work plan and provide explanatory captions:

The site is infested with alien vegetation. Access to many parts is a severe constraint. Open areas will be tested where possible.

A single access sandy track runs through the site provides likely points for testing, at least along its route

The site is infested with alien vegetation. Access is severely constrained

The site is infested with alien vegetation. Access is severely constrained

Attachment checklist:

☐ Original impact assessment report (digital only unless work plan is submitted with impact assessment)
☐ HWC comment (if already issued)
☐ Land owner permission letter
☐ Signed repository agreement

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