

**ENVIRONMENTAL IMPACT ASSESSMENT:
IDENTIFICATION OF REGIONAL LANDFILL SITE AND PERMIT
APPLICATION FOR THE NORTHERN WEST COAST DISTRICT
MUNICIPALITY.**

HERITAGE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act (No. 25 of 1999) as part of an EIA)

Prepared for

Anél Blignaut Environmental Consultants

P.O. Box 12268, Die Boord,
Stellenbosch, 7613

1st draft; 15 October 2010
Revised: 23 November 2010
Final report: 08 July 2011



Prepared by

Jayson Orton

Archaeology Contracts Office

Department of Archaeology
University of Cape Town
Private Bag
Rondebosch
7701

Phone (021) 650 2357
Fax (021) 650 2352
Email Jayson.Orton@uct.ac.za

EXECUTIVE SUMMARY

The UCT Archaeology Contracts Office was requested by Anél Blignaut Environmental Consultants to assess the potential impacts to heritage resources that might occur as a result of construction of a new regional waste disposal site. The site is intended to serve the Matzikamma and Cederberg Municipalities for a period of 50 years.

Three alternatives are assessed, all within the Matzikamma Municipality. They are located east of Vanrhynsdorp (Site B, a part of Droogerivier 243), between Vanrhynsdorp and Vredendal (Site C, a part of Vaderlandsche Rietkuil 308) and just north of Vredendal (Site D, a part of Vredendal 292) respectively. These sites are currently zoned agriculture. Negotiations are still underway with regards to land access but it is likely that subdivision and rezoning will need to take place.

The proposed waste disposal site will be 43 ha in area and will also include a recycling facility, a composting area and an area for the processing of builders' waste. Other proposed infrastructure includes an access road, internal roads, stormwater pipelines, offices, a 1.8 metre high fence, a weighbridge and security infrastructure and waste disposal cells, which will reach a maximum height of 6 metres above natural ground level.

Sites B and D are essentially pristine natural environments, while part of Site C has been disturbed by past gypsum mining. Generally, the sites are covered in low vegetation but with considerable space between bushes. Archaeological visibility is good. Site B is located close to an important scenic route, while Site D lies at the southern end of the unspoilt expanse of the Knersvlakte and 1 km from the outskirts of Vredendal.

Archaeological resources were found in very low densities on Sites B and D, while Site C contains higher densities. All areas seem likely to reflect background scatter. None is of high significance and those areas on Sites C and D that require it can be easily mitigated. Impacts to cultural landscapes will not occur as a result of the lack of such landscapes at each site. Three small, modern structures linked to the gypsum mine are present on Site C with no other structures or ruins on the remaining sites. Visual impacts are more of a concern. To this end it is suggested that Site B cannot be selected for the landfill due to its proximity to an important scenic route and the lack of any topography to assist with mitigation. It is thus fatally flawed. Site D is still sensitive, but its topography is better suited to absorbing the visual impacts of the proposed landfill. Overall, visual impacts are the only impacts deemed to be of high significance (Sites B and D), but they are rated low for Site C.

In terms of alternatives, Site C is preferred, followed by Site D. Site B should not be considered further. The landscape at and around Site C is most capable of absorbing the visual impacts, while Site B is entirely incapable of doing the same.

Recommendations differ for each site. Overall, it is recommended that Site C be chosen as it presents the least impacts to heritage resources. Site B should not be considered at all.

If Site C is chosen then the following recommendations apply:

- The landfill should be located as close to the northeast corner of the site as possible, preferably maximising use of the already disturbed areas;
- If the archaeological material at Points 29 (A&B), 59, 60 and/or 61 are to be impacted then mitigation should be carried out as required; and
- Should archaeological material other than at the Points mentioned above be impacted, then an archaeological destruction permit may be required by HWC.

If Site D is chosen then the following recommendations apply:

- The landfill should be located as close to the northwest corner of the site as possible maximising use of the lowest-lying ground;

- A VIA should be carried out to inform the mitigation process and determine precisely the best location for the landfill; and
- If the archaeological material at Points 103 and/or 107 are to be impacted then mitigation should be carried out as required.

It should also be noted that a very small chance of intersecting unmarked human burials does exist, particularly in sandy areas. Should human remains be encountered at any stage of development work in the immediate vicinity should stop, the bones should be protected and the find reported to HWC (021 483 9685). An archaeologist will need to be contracted to remove the remains.

The final decision-making on heritage matters rests with HWC and the above recommendations are subject to their approval.

08 July 2011

Declaration of independence:

I, Jayson Orton, am an independent specialist consultant who is in no way connected with the proponent, other than in terms of the delivery of consulting services.

I hold a Masters degree in archaeology and have been consulting since 2004 in the Northern, Eastern and Western Cape Provinces. I am an accredited Principal Investigator with the Association of Southern African Professional Archaeologists (ASAPA, member #233).



GLOSSARY OF TERMS

Adze: a small wood-working tool commonly made during the Holocene.

Background scatter: artefacts occurring in the environment in such a manner that suggests long terms exposure to the elements and a distribution more strongly conditioned by nature than by human influence.

Early Stone Age: the period of pre-colonial archaeology occurring before 200 000 years ago.

Hand-axe: a type of stone artefact commonly made during the Early Stone Age.

Heuweltijies: low, partially calcretized earth mounds created by termites (see Moore & Picker 1991). They are usually slightly more resistant to erosion and manifest as raised mounds that host a different set of plants to their neighbouring areas.

Holocene: the last 10 000 years.

Later Stone Age: the most recent period of pre-colonial archaeology covering the last 20 000 years.

Middle Stone Age: the period of pre-colonial archaeology falling between approximately 200 000 and 20 000 years ago.

Retouch: delicate flaking deliberately applied to an artefact to shape and/or strengthen its edge.

LIST OF ABBREVIATIONS

CCS: Cryptocrystalline silica

ESA: Early Stone Age

HWC: Heritage Western Cape

LSA: Later Stone Age

MSA: Middle Stone Age

OES: ostrich eggshell

VIA: Visual Impact Assessment

Table of Contents

GLOSSARY OF TERMS	4
LIST OF ABBREVIATIONS	4
1. INTRODUCTION	6
2. TERMS OF REFERENCE	6
3. HERITAGE LEGISLATION	8
4. STUDY APPROACH	8
4.1. Information base.....	8
4.2. Assumptions.....	8
4.3. Limitations	8
4.4. Methodology.....	8
4.4.1. Literature survey.....	8
4.4.2. Ground truthing.....	8
5. DESCRIPTION OF THE AFFECTED ENVIRONMENT	9
6. HERITAGE CONTEXT	12
7. FINDINGS.....	13
7.1. Palaeontology.....	13
7.2. Archaeology	14
7.2.1. Site B	14
7.2.2. Site C	16
7.2.3. Site D	22
7.3. Built environment.....	25
7.4. Cultural landscapes.....	25
7.4.1. Colonial.....	25
7.4.2. Griqua	25
7.5. Visual impacts and scenic routes.....	25
7.5.1. Site B	25
7.5.2. Site C	27
7.5.3. Site D	27
8. IMPACT ASSESSMENT	29
8.1. Archaeology	30
8.2. Visual impacts and scenic routes.....	31
8.3. Cumulative impacts	32
9. GENERIC MITIGATION	32
10. ALTERNATIVES	32
11. CONCLUSIONS	33
12. RECOMMENDATIONS	33
13. REFERENCES	34

1. INTRODUCTION

The UCT Archaeology Contracts Office was requested by Anél Blignaut Environmental Consultants, on behalf of Jan Palm Consulting Engineers cc, to assess the potential impacts to heritage resources that might occur as a result of construction of a new regional waste disposal site. The site is intended to serve the Matzikamma and Cederberg Municipalities for a period of 50 years. There are currently ten land fill sites located in these two municipalities but, due to poor location and/or limited capacity, all are required to close in the immediate future.

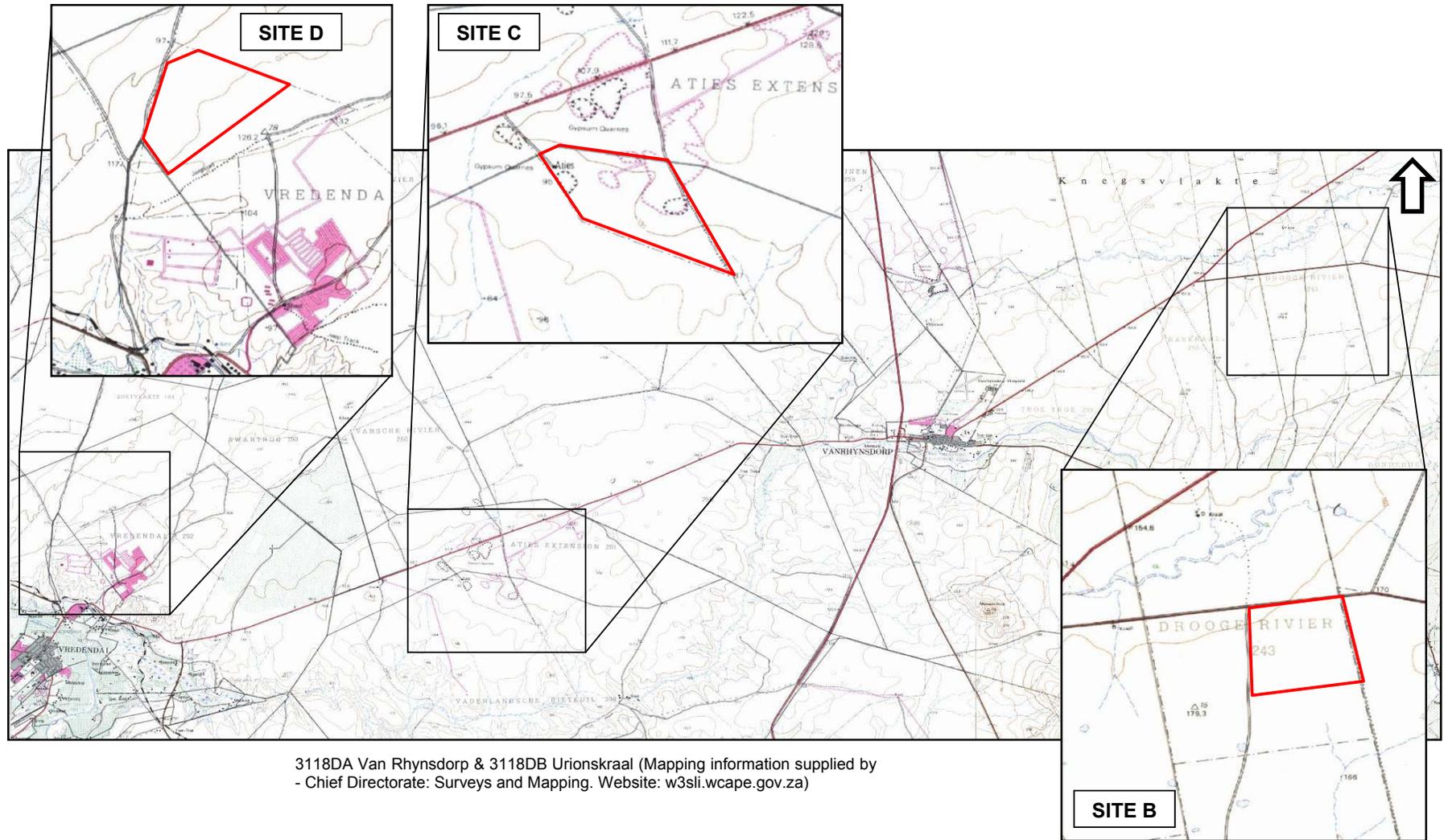
Four alternative sites were originally chosen, but one has since been screened out due to its sensitivity. Three alternative sites are thus assessed in this report, all of them within the Matzikamma Municipality. Also assessed is the no-go alternative which would see no new landfill being developed. They are located east of Vanrhynsdorp (Site B, a part of Droogerivier 243), between Vanrhynsdorp and Vredendal (Site C, a part of Vaderlandsche Rietkuil 308) and just north of Vredendal (Site D, a part of Vredendal 292) respectively (Figure 1). These sites are currently zoned agriculture. Negotiations are still underway with regards to land access but it is likely that subdivision and rezoning will need to take place.

The proposed waste disposal site will be 43 ha in area and will also include a recycling facility, a composting area and an area for the processing of builders' waste. Other proposed infrastructure includes an access road, internal roads, stormwater pipelines, offices, a 1.8 metre high fence, a weighbridge and security infrastructure and waste disposal cells, which will reach a maximum height of 6 metres above the natural ground level.

2. TERMS OF REFERENCE

Undertake a Phase 1 heritage assessment of the property in accordance with the requirements of Section 38(3) of the National Heritage Resources Act, including:

1. A detailed desktop level investigation to identify all known archaeological, cultural and historic sites on the properties;
2. Undertake fieldwork to verify results of desktop investigation;
3. Undertake an assessment of the Aesthetic / Architectural compatibility of the proposed landfill site;
4. Document (using GPS coordinates and maps) all sites, objects and structures;
5. Consultation with Heritage Western Cape;
6. Compile a report, which would include:
 - Identification of archaeological, cultural and historic sites on the site;
 - Evaluation of the potential impacts of construction and operation of the proposed landfill sites on archaeological, cultural and historical resources, in terms of the scale, magnitude and duration of the impacts;
 - Recommendations for mitigating measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.
 - Make recommendations, which would include:
 - a. Any additional investigations that may be required by Heritage Western Cape as a result of finding such resources;
 - b. Identify and describe any formal legal processes which should be followed as a result of finding significant resources;
7. Assessments must take into account the expected community response as well as the applicable South African standards and Western Cape Guidelines;
8. Complete and submit a Notification of Intent to Develop Form to HWC; and
9. Be responsible for follow-up correspondence from Heritage Western Cape until the ROD is issued.



3118DA Van Rhynsdorp & 3118DB Urionskraal (Mapping information supplied by
- Chief Directorate: Surveys and Mapping. Website: w3sli.wcape.gov.za)

Figure 1: Map showing the locations of the three sites near Vredendal (the the west) and Vanrhynsdorp (to the east).

3. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources including palaeontological, prehistoric and historical material (including ruins) more than 100 years old (Section 35), human remains older than 60 years and located outside of a formal cemetery administered by a local authority (Section 36) and non-ruined structures older than 60 years (Section 34). Landscapes with cultural significance are also protected under the definition of the National Estate (Section 3 (3.2d)).

Since the project is subject to an Environmental Impact Assessment, Heritage Western Cape (HWC) is required to provide comment on the proposed project in order to facilitate final decision making by the Department of Environmental Affairs and Development Planning (DEA&DP).

4. STUDY APPROACH

4.1. Information base

Information used in this study was gained from three sources:

- Published information in academic journals;
- Information gleaned from other commercial impact assessment reports;
- Prior knowledge of the area from other commercial projects as well as personal research; and
- A physical inspection of each site and its surroundings.

4.2. Assumptions

The distribution of archaeological resources is assumed to follow patterns already established in other parts of the general region. It is also assumed that some subsurface archaeological resources may have remained invisible during the survey.

4.3. Limitations

Sand may have obscured archaeological resources but this limitation is not regarded as having significantly affected the outcome of this assessment. No other limitations were experienced.

4.4. Methodology

4.4.1. Literature survey

A survey of existing literature, both published and unpublished, was undertaken in order to establish the heritage context described in Section 6 below. This allowed an understanding of what sort of heritage is generally expected to occur in the study area.

4.4.2. Ground truthing

A full ground survey of the three alternative sites was carried out on the 4th, 5th and 6th of October 2010. Heritage resources were described photographed and their position were taken using a hand-held GPS receiver set to the WGS84 datum. In addition, the GPS was used to create track logs for the surveys. Photographs of the three alternative development sites and their physical features were also taken, as well as general views both to and from them. The criteria for recording sites or archaeological occurrences varied between the three alternatives. These criteria were dictated by the archaeology found on each site and will be expounded upon in Section 7 (Findings) below.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The three sites differ quite strongly in physical character. Site B is almost entirely flat, sandy and covered in low bushes and grassland (Figures 2 - 4). The vegetation type is Vanrhynsdorp Gannabosveld (Helme 2010; Mucina *et al* 2010). Several small, ephemeral dried pans occur in low areas (Figure 5) and heuweltjies are present (Figure 3), sometimes extensively burrowed (Figure 6). The nearest river is the Droë River, some 750 m to the northwest. The site has the mountains of the escarpment and Matzikamma Mountain to its east and south respectively.



Figure 2: View across Site B towards the northwest showing the general character of the vegetation. Taller bushes are very rare.



Figure 3: View southwards towards Matzikamma Mountain showing the small shrubs and grassland that are typical of Site B. A heuweltjie supporting different vegetation lies in mid-picture.



Figure 4: View towards the northeast across site B towards the Vanrhynsdorp Pass.



Figure 5: View of one of the small, dried pans on Site B.



Figure 6: One of the heavily burrowed heuweltjies on Site B.

Site C lies in a south-facing, gently sloping environment some 2.5 km north of the Troe-Troe River. It is characterised by very low bushes and plenty of exposed substrate, particularly on the south-facing slope (Figure 7). The more level northern parts are generally sandy but with calcretized termitaria very common. These tend to be vegetated on their upper parts, but have eroding surfaces around their edges (Figure 8). Moving southwards, the site starts to slope and surface gravel becomes evident. At first this is predominantly quartz gravel, but lower down small, dark rock fragments are included. The gravel is largely only visible in areas that have been eroded and/or deflated (Figure 9). An outcrop of what is assumed to be the same rock is present in the southernmost part of the site (Figure 10). Vegetation across the entire site is Vanrhysdorp Gannabosveld (Helme 2010; Mucina *et al.* 2010).

Particularly prominent on Site C is the vast amount of disturbance that has occurred. The site was previously mined for gypsum and has only been partly rehabilitated. These latter parts are present as low mounds that have noticeably fewer species of vegetation present on them. A large area in the eastern part of the site is currently still covered by unrehabilitated slimes dams that stand some 3 to 4 m above the surrounding natural ground level. Site C is also the only site to have structures present on it. The site is also currently used for cattle grazing which is causing further disturbance.



Figure 7: Panoramic view across the southern part of Site C towards the southeast and southwest showing the south-facing part of the site. The photograph was taken from the top of slimes dams. The Troe-Troe River lies in the distance where the pale land surface is visible, just beneath the skyline and the Matzikamma Mountain lies to the left.

Site D is north-facing and predominantly on deep, red sand with the spiny shrub *Cladoraphis spinosa* dominating. This area is Namaqualand Spinescent Grassland (Helme 2010; Mucina *et al.* 2006) and some areas are extensively burrowed by moles (Figures 11 & 12). The south-eastern part, however, has a firmer substrate characterised by abundant calcretized heuweltjies and more varied shrubs (Figure 13). Its vegetation type is Vanrhysdorp Gannabosveld (Helme 2010; Mucina *et al.* 2006).

Ephemeral, dried pans were frequent in this latter area (Figure 14), while just one very large complex of pans was present in the central part of the spinescent grassland area (Figure 15). Although a few vehicle tracks occur in the southern parts of the site, the vast majority is totally undisturbed. Some litter, however, has blown and/or been dropped on the site from the town to the south. Insects, spiders and tortoises, the latter a staple diet of Stone Age people, were particularly abundant on Site D.



Figure 8: View eastwards across the edge of one of the termitaria on Site C showing the hard, eroding area.



Figure 9: View across one of the deflated/eroded areas showing the surface gravel on Site C.



Figure 10: View across the rocky outcrop in the southern part of Site C.



Figure 11: View south-eastwards across Site D with the spiny grass on red sand that characterises much of the site.



Figure 12: View north-eastwards across Site D with spiny grasses and molehills evident.



Figure 13: View to the northeast showing the exposed surface of a heuweltjie within the more varied vegetation in the south-eastern part of Site D.



Figure 14: View to the southeast across one of the large pans in the south-eastern part of Site D.



Figure 15: View of the large complex of pans present in the central part of Site D.

6. HERITAGE CONTEXT

Almond and Pether (2006) identify the Gariep Supergroup sediments that underlie this area as being of low palaeontological significance with few fossils recorded. North of this one finds the Vanrhynsdorp Group which is more significant. Here they note the presence of important trace fossil assemblages spanning the Precambrian / Cambrian boundary.

Stone Age archaeological remains occur abundantly throughout much of Namaqualand, but with the coastal regions providing the richest store of high quality data excavated from *in situ* shell midden sites. Thus far the bulk of the research has been carried out along the central Namaqualand coastline, adjacent to the towns of Kleinsee, Koingnaas and Hondeklipbaai (Dewar 2008; Dewar & Jerardino 2007; Dewar *et al.* 2006; Orton & Halkett 2005, 2006; Orton *et al.* 2005), but some excavation has also taken place along the southern coastline near Brand-se-Baai (Halkett *et al.* 1993; Hart & Halkett 1994; Hart & Lanham 1997). These sites document extensive Later Stone Age (LSA) occupation of the coastline throughout the latter half of the Holocene, a period spanning at least 5500 years. They

reveal a rich store of cultural material including stone artefacts, ostrich eggshell beads, pottery and bone artefacts.

Of more relevance though, is recent research conducted on the Knersvlakte alongside the Varsche Rivier, some 11 to 12 km north of Sites C and D. Although this research is still in progress, one published account of a bifacial point manufacturing site has already been published (Mackay *et al.* 2010). The artefacts found on this site likely date to the Still Bay period of the Middle Stone Age (MSA) which has been dated to between about 74 000 and 69 000 years ago (Jacobs *et al.* 2008). Excavation of a nearby site, seemingly a collapsed rock shelter, has suggested that a deep MSA sequence may yet be obtainable for the area (Steele *et al.* 2010).

Two other rock shelters are also currently under study. These sites have yielded deposits dating within the latter half of the Holocene as well as deposits dating to the historical contact period. Sites documenting the latter period are generally rare and include items of European origin in an otherwise pre-colonial context (Orton *et al.*, in prep.).

Surveys of this and other parts of the Knersvlakte further to the north have shown that archaeological remains are strongly focussed on the river channels and, when out in the open, are usually revealed in eroding and deflating areas (own data). LSA and probably MSA material seems to be most frequent on the floodplains, while further from the river channels Early Stone Age (ESA) artefacts can be found among the river terrace gravels which provided a rich source of material for the manufacture of stone artefacts. A brief survey of part of the northern Drooge River floodplain 1 km northwest of Site B confirmed at least the LSA observation for the southern Knersvlakte.

Elsewhere, 12 km due north of Site D, stone artefacts have been reported away from major rivers, but again these were in deflating contexts and were noted to be alongside small water channels (Kaplan 2010). The artefacts included material from the ESA, MSA and LSA, but with the latter likely predominating. Orton (2008) also found stone artefacts in Vanrhynsdorp some 500 m from the Troe-Troe River.

Historical occupation of the Knersvlakte is very sparse with just three ruins known (own data). Of course, being so dry, it would have been a very harsh environment in which to survive as a farmer. One of these ruins lies just north of Site D along the Drooge River. Archaeological material relating to this ruin was not seen. Along the Sout River, further north, a ruin has an accompanying refuse midden as well as some burials. Another along the Varsche River has an outbuilding, a threshing floor and what is assumed to be a lime kiln (own data; B. Wiese, pers. comm. 2010).

Moving on to recent times, the local landscape is characterised by two overwhelming opposites. Along the river one finds lush vineyards sustained by the waters of the Oliphants River interspersed with settlements of varying size. Vanrhynsdorp is the only town in the area occurring away from the Oliphants River. At the other extreme one finds the vast, dry open spaces of the Knersvlakte, a wilderness landscape that seems to stretch for ever, particularly when viewed from the Vanrhynsdorp Pass that climbs onto the escarpment to the east of Vanrhynsdorp. Namaqualand in general is significant as a scenic destination with throngs of tourists visiting it each year to see the wild flowers.

7. FINDINGS

7.1. Palaeontology

No palaeontological material was found.

7.2. Archaeology

Archaeological remains were generally abundant on the three alternative sites, though in strongly variable frequencies. The three alternatives are discussed in turn. As alluded to previously, the criteria for the recording of archaeological material varied according to need. These criteria are mentioned for each site as appropriate.

7.2.1. Site B

On this site there appeared to be a general light scatter of artefacts present throughout the surveyed area (Figure 16). No actual archaeological sites were found and a decision was taken on site to record a point wherever 4 artefacts could be easily observed within a limited area. One exception occurred where a single ESA artefact was recorded alone (point 18). Whether such concentrations reflect points of occupation seems unlikely. It is more probable that they are merely places where the natural processes of erosion and deflation have resulted in the exposure of more artefacts pertaining to the general background scatter. This would imply some antiquity to the artefacts and, few diagnostic artefacts were noted, it may suggest them to be predominantly MSA in age.



Figure 16: Aerial photograph showing the boundary of Site B (red polygon), the walk paths on site (blue lines) and the positions of recorded finds (numbered yellow circles).

Table 1 summarises the archaeological occurrences indicating some characteristics of the material at each point. Photographs of a representative sample of occurrences from Site B are included below and listed in the Table for convenience.

Table 1: Archaeological occurrences at Site B. No. refers to Figure 16.

No.	Location	Materials observed						Figs.	Comments
		Quartz	Quartzite	Silcrete	CCS	Sandstone	Other		
1	S31 34 24.7 E18 50 08.4	x		x				17	
2	S31 34 23.4 E18 50 15.5			x				18	
3	S31 34 23.6 E18 50 25.0	x		x					
4	S31 34 22.4 E18 50 46.5	x							
5	S31 34 22.2 E18 50 20.1	x	x				x	19	near pan, other = indurated shale
6	S31 34 21.0 E18 50 16.3	x	x	x					
7	S31 34 22.0 E18 50 09.2	x		x				20	
8	S31 34 19.6 E18 50 07.7	x			x				2 x CCS very weathered
9	S31 34 17.1 E18 50 16.0	x		x					broken ?unifacial retouched flake
10	S31 34 18.3 E18 50 21.0	x		x					1 silcrete is very weathered
11	S31 34 15.7 E18 50 39.0	x			x		x		CCS is very weathered
12	S31 34 13.2 E18 50 34.4	x				x			
13	S31 34 16.4 E18 50 21.8	x			x			21, 22	CCS ?adze
14	S31 34 07.4 E18 50 35.4	x	x	x					near pan, material of mixed age
15	S31 34 03.3 E18 50 31.4	x		x					near pan
16	S31 34 06.4 E18 50 20.3	x							
17	S31 34 05.2 E18 50 11.8	x	x	x					
18	S31 34 05.0 E18 50 15.4		x					24	ESA hand-axe, just 1 artefact
19	S31 33 55.7 E18 50 25.5		x	x					
20	S31 33 57.7 E18 50 22.5	x		x	x				
21	S31 34 03.7 E18 50 06.1	x		x					
22	S31 33 55.3 E18 50 07.0	x		x					
23	S31 33 55.6 E18 50 05.3	x		x					



Figure 17: Artefacts from Point 1.



Figure 18: Artefacts from Point 2.

It seems likely that material pertaining to the ESA, MSA and LSA is all present, with at least one diagnostic artefact from each of the first and last period. These are, respectively, a crude cobble hand-axe made from silcrete and an adze made in CCS. The latter are commonly found in areas where trees are more common, but they have also been recorded on the Knersvlakte (own data).



Figure 19: Artefacts from Point 5.



Figure 20: Artefacts from Point 7. The large silcrete flake has one edge retouched.



Figure 21: Artefacts from Point 13. The artifact on the left is an adze made from CCS.



Figure 22: The CCS adze from Point 13 showing the characteristic damage/retouch along the lower margin.



Figure 23: Artefacts from Point 14.



Figure 24: The quartzite hand-axe from Point 18.

7.2.2. Site C

The archaeology on this site was clearly very different to that on Site B, although it was still not really possible to discern specific archaeological sites. Again, therefore, I refer to points recorded on the landscape rather than to sites. Artefactual material here was far denser such that a different criterion was required to record a point. Owing to their great number, no fixed number of artefacts was possible. Instead the recording was somewhat random with points taken wherever increased densities of artefacts seemed present. In some parts of the site there were artefacts occurring continuously for several tens of metres at a time but concentrations were generally present within areas that had been eroded and deflated through the action of water and wind over the years. The densest region was a band running east-west across the site and lying just below the slope break where the site begins to slope downhill towards the Troe-Troe River (Figure 25).

Table 2 summarises the archaeological occurrences indicating some characteristics of the material at each point. Photographs of a representative sample of occurrences from Site C are included below and listed in the Table for convenience.

Table 2: Archaeological occurrences at Site C. No. refers to Figure 25.

No.	Location	Materials observed						Figs.	Comments
		Quartz	Quartzite	Silcrete	CCS	Sandstone	Other		
029A	S31 38 55.5 E18 37 51.6	x	x	x				26	extensive area
029B	S31 38 56.6 E18 37 52.1	x	x	x					
30	S31 38 58.1 E18 37 52.2	x	x	x			x		
31	S31 38 59.3 E18 37 53.9	x	x	x					
32	S31 38 59.9 E18 37 52.6	x	x	x					
33	S31 39 01.6 E18 37 51.7	x	x	x					
34	S31 39 02.7 E18 37 55.7	x		x					dense patch
35	S31 39 03.3 E18 37 53.3	x	x			x	x		other = hornfels
36	S31 39 04.4 E18 37 56.7	x							
37	S31 39 06.2 E18 37 51.9	x		x					
38	S31 39 09.6 E18 37 57.3	x							
39	S31 39 10.4 E18 37 55.3	x							
40	S31 39 12.9 E18 37 55.8	x		x				27	large area, MSA present
41	S31 39 14.3 E18 37 58.9	x		x					MSA present
42	S31 39 11.9 E18 37 35.8	x		x					
43	S31 39 11.9 E18 37 33.8	x							
44	S31 39 08.4 E18 37 34.6	x		x					
45	S31 39 10.6 E18 37 42.7	x	x	x					ephemeral
46	S31 39 07.5 E18 37 37.2	x		x					
47	S31 39 06.0 E18 37 36.9	x		x					
48	S31 39 04.6 E18 37 46.8	x	x	x					
49	S31 39 03.6 E18 37 39.4	x	x	x			x	28	
50	S31 39 02.5 E18 37 40.8	x	x	x					
51	S31 39 02.0 E18 37 42.6	x		x					
52	S31 39 01.8 E18 37 44.2	x		x					
53	S31 39 03.7 E18 37 44.4	x		x					
54	S31 39 00.6 E18 37 47.6	x	x					32	possible unifacial point in quartz
55	S31 38 59.7 E18 37 50.1	x		x					
56	S31 39 00.3 E18 37 48.8	x		x					
57	S31 38 57.9 E18 37 50.9	x							
58	S31 38 56.1 E18 37 30.2	x		x					very ephemeral, very widespread
59	S31 38 58.9 E18 37 34.6	x							Some dense patches

No.	Location	Materials observed						Figs.	Comments
		Quartz	Quartzite	Silcrete	CCS	Sandstone	Other		
60	S31 39 00.9 E18 37 38.0	x	x	x			x	massive area, good density, 1 hammerstone	
61	S31 39 02.5 E18 37 37.2	x	x	x					
62	S31 39 03.3 E18 37 37.1	x	x	x			30, 31	incl. 1 quartzite hand-axe	
63	S31 39 04.7 E18 37 37.0	x	x	x				incl. 1 silcrete hand-axe	
64	S31 39 04.9 E18 37 34.6	x	x	x					
65	S31 39 02.0 E18 37 35.0	x		x				huge area, low density	
66	S31 39 01.0 E18 37 32.4	x	x	x				low density	
67	S31 39 01.4 E18 37 29.4	x	x	x					
68	S31 39 02.8 E18 37 31.5	x		x					
69	S31 39 04.5 E18 37 29.7	x	x	x					
70	S31 39 08.1 E18 37 31.3	x	x	x				extensive area	
71	S31 39 09.8 E18 37 30.4	x	x	x					
72	S31 39 09.9 E18 37 28.3	x	x	x			33		
73	S31 39 07.3 E18 37 25.6	x	x	x				incl. 2 quartzite hand-axes	
74	S31 39 06.0 E18 37 26.5	x	x	x					
75	S31 39 02.8 E18 37 12.2	x		x				very low density	
76	S31 39 04.0 E18 37 24.1	x	x	x					
77	S31 39 02.6 E18 37 25.7	x							
78	S31 39 01.4 E18 37 24.5	x	x	x					
79	S31 39 01.2 E18 37 19.2						29	20th C glass, metal	
80	S31 38 36.9 E18 37 10.9	x						widespread, ephemeral	
81	S31 38 36.3 E18 37 06.6	x	x	x				on side of heuweltjie, several others in vicinity	
081B	S31 38 36.2 E18 37 05.3	x	x	x				as above	
081C	S31 38 37.3 E18 37 05.6	x	x	x				as above	
82	S31 38 34.4 E18 37 04.4	x	x	x					
83	S31 38 35.3 E18 37 01.6	x		x				on side of heuweltjie	
84	S31 38 35.4 E18 37 01.0					x		20th C, 1 sandstone hand-axe	
85	S31 38 38.2 E18 36 59.3	x		x					
86	S31 38 35.9 E18 36 51.3	x		x				on side of heuweltjie	
87	S31 38 39.0 E18 36 53.0	x						on side of heuweltjie	
88	S31 38 41.2 E18 37 01.3	x	x	x				quartzite hand-axe present	
89	S31 38 41.7 E18 37 03.4	x	x	x				on side of heuweltjie	
90	S31 38 45.2 E18 37 07.7	x	x					on side of heuweltjie	
91	S31 38 53.1 E18 37 07.3	x	x					on side of heuweltjie	
091B	S31 38 53.3 E18 37 05.7	x	x					on side of heuweltjie	
091C	S31 38 53.4 E18 37 04.2	x	x					on side of heuweltjie	
92	S31 38 55.3 E18 37 05.9	x	x	x				on side of heuweltjie	
092B	S31 38 54.8 E18 37 06.8	x	x	x				on side of heuweltjie, hammerstone present	
93	S31 38 53.4 E18 37 09.6	x						on side of heuweltjie	
093B	S31 38 52.2 E18 37 10.8	x						on side of heuweltjie	
94	S31 38 47.0 E18 37 12.0	x						on side of heuweltjie	
95	S31 38 40.3 E18 37 04.7	x		x				on side of heuweltjie	
96	S31 38 38.0 E18 37 02.4	x		x				on side of heuweltjie	
97	S31 38 51.2 E18 37 17.2	x		x				on side of heuweltjie	
98	S31 38 53.2 E18 37 13.7	x	x					on side of heuweltjie	
99	S31 38 58.2 E18 37 11.5	x		x				on side of heuweltjie	
100	S31 38 54.7 E18 37 17.4	x		x				on side of heuweltjie	



Figure 25: Aerial photograph showing the boundary of Site C (red polygon), the walk paths on site (blue lines) and the positions of recorded finds (numbered yellow circles). The shaded white areas are disturbed areas (either mined and rehabilitated or slimes dams).



Figure 26: Artefacts from Point 29.



Figure 27: Artefacts from Point 40.



Figure 28: Artefacts from Point 49.



Figure 29: 20th century artefacts from Point 79.



Figure 30: Artefacts from Point 62. Note the hand-axe at lower right.



Figure 31: Typical eroded/deflated area in which artefacts were found. This is Point 62 from the middle part of the site and has sparse gravel cover.

Site C certainly preserves material dating to the ESA and MSA and, although no diagnostic LSA artefacts were found, it seems likely that material of this age will also be present. In other parts of the Knersvlakte where more detailed examination of the artefacts has been undertaken it has been found that LSA material occurs concurrently with MSA material. It does seem possible here, though, that the majority of artefacts could be MSA. Points 40 and 41 did yield diagnostic MSA artefacts. ESA material is represented most definitively by a selection of hand-axes found across the site. These are gathered together at the same scale in Figure 34 for comparative purposes. They show a great deal of variation in both size and form.

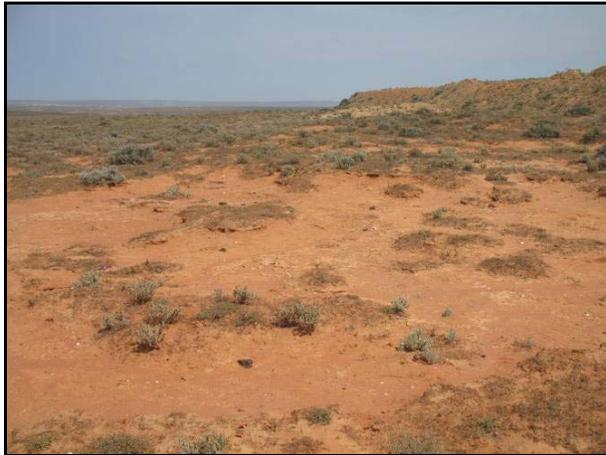


Figure 32: Typical eroded/deflated area in which artefacts were found. This is Point 54 near the slope break where there is little gravel.



Figure 33: Typical eroded/deflated area in which artefacts were found. This is Point 72 in the southern part of the site where quartz gravel was common.

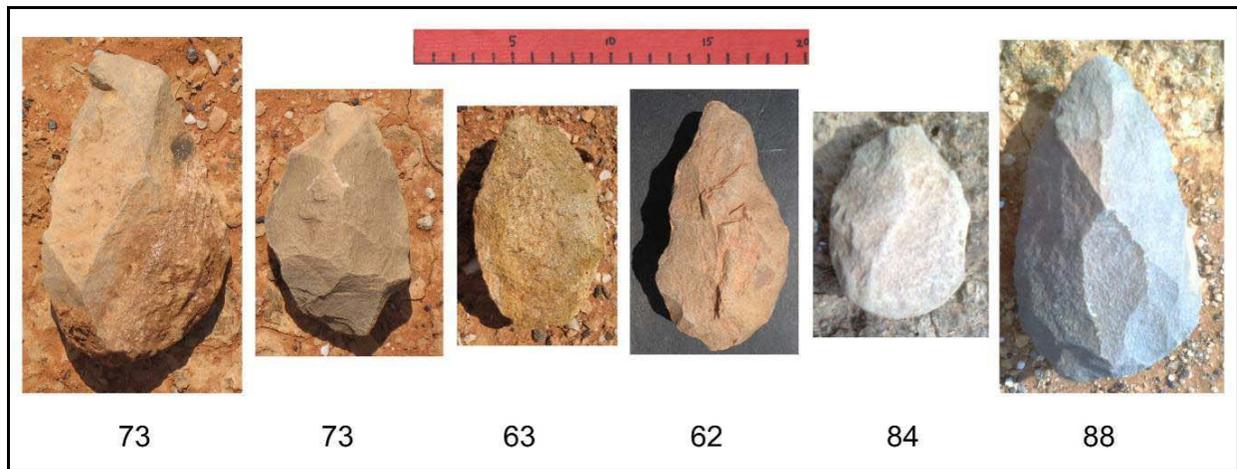


Figure 34: The six hand-axes found on Site B. That from point 63 is on silcrete, Point 84 is on sandstone and the remainder are all on quartzite.

A final comment relevant to Site C is that the visibility of artefacts is dependent on the state of the land. A glance at Figure 25 shows that in the southern area more scatters were recorded in the more eroded area south of the slimes dams, while the better vegetated area in the far south had fewer records. In the north, finds were strongly related to heuweltjies, but, interestingly, only some of them had artefacts present in any numbers. Just west of the slimes dams was a large area that has been impacted by overflow from the dams. As a result archaeological visibility is virtually zero and no artefacts were recorded in this area. In Figure 25 this area is evident through its light green colouration.

7.2.3. Site D

On Site D the distribution of archaeological material was strongly tied to the vegetation patterns. Again no real archaeological sites could be defined, but many artefact scatters were noted, inevitably associated with heuweltjies or pans. The vast majority of these landscape features were located within the Vanrhynsdorp Gannabosveld section of the site, in the far eastern corner of the site (Figure 35). Also located in the vicinity but not present within the actual site are deflation hollows. Such features in the region near Elands Bay frequently contain rich artefact assemblages (Manhire 1987) and, because of this, two hollows outside of but close to Site D were checked. One yielded sparse remains (Point 101), the other nothing. The artefact density here was more like Site B again and so the criterion of four artefacts was once more employed, with one exception where just three were found. This latter was recorded because it fell outside of the Gannabos area. Most occurrences were very ephemeral with just a handful of artefacts.

Table 3 summarises the archaeological occurrences indicating some characteristics of the material at each point. Photographs of a representative sample of occurrences from Site D are included below and listed in the Table for convenience.

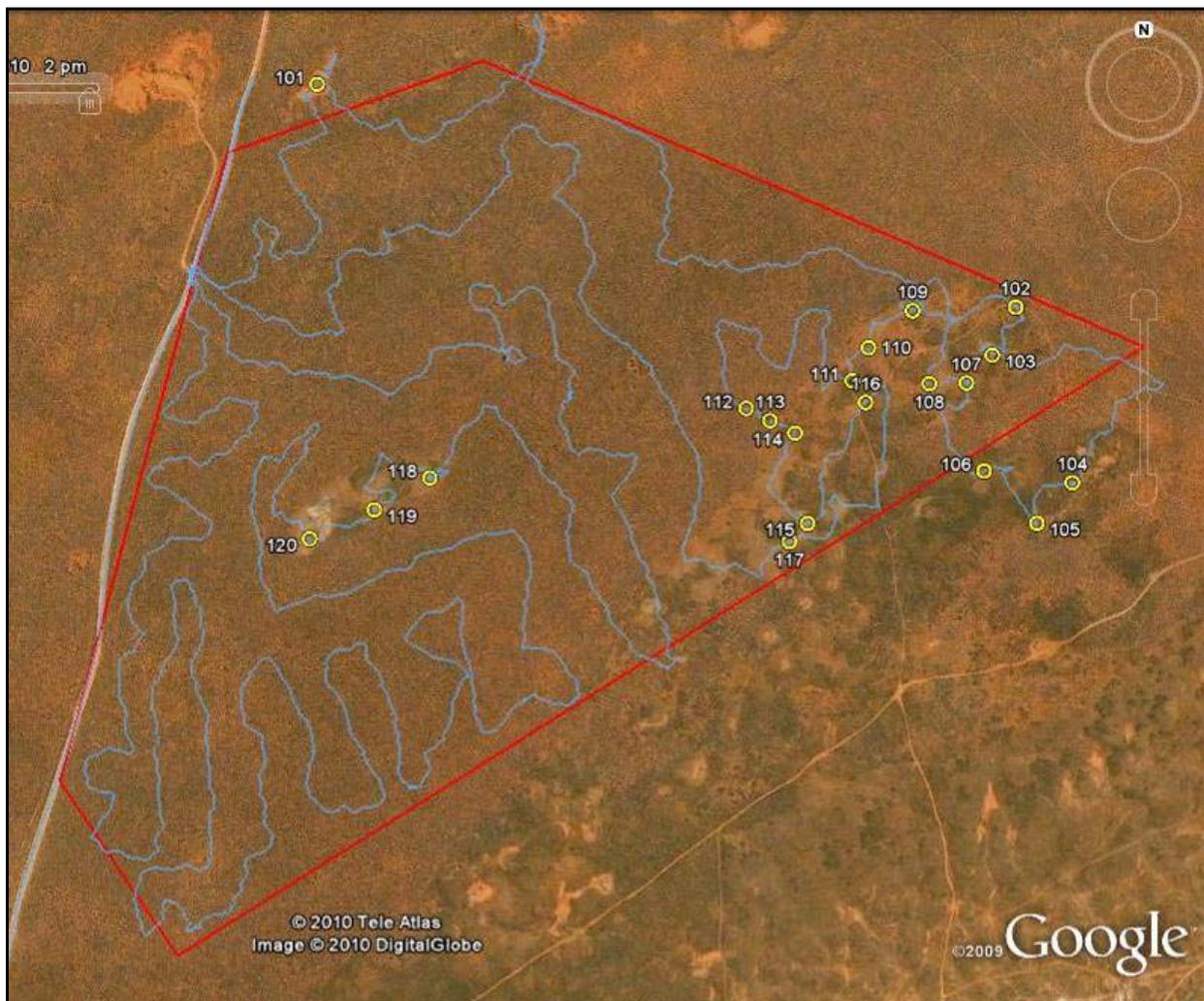


Figure 35: Aerial photograph showing the boundary of Site D (red polygon), the walk paths on site (blue lines) and the positions of recorded finds (numbered yellow circles).

Table 3: Archaeological occurrences at Site D. No. refers to Figure 35.

No.	Location	Materials observed						Figs.	Comments
		Quartz	Quartzite	Silcrete	CCS	Sandstone	Other		
101	S31 37 06.4 E18 30 55.6	x							outside site, deflation hollow, also 1 quartzite cobble
102	S31 37 18.3 E18 31 38.3	x	x	x				36, 37	on side of heuweltjie
103	S31 37 20.8 E18 31 36.9	x	x	x			x	38	on top of heuweltjie
104	S31 37 27.4 E18 31 41.8	x	x	x					outside site, in pan
105	S31 37 29.6 E18 31 39.6	x	x	x					outside site, in pan, ephemeral
106	S31 37 26.8 E18 31 36.4	x		x					outside site, on heuweltjie, ephemeral
107	S31 37 22.3 E18 31 35.3	x	x	x				39	on heuweltjie, good density
108	S31 37 22.3 E18 31 33.0	x	x				x		on heuweltjie, ephemeral, OES present
109	S31 37 18.5 E18 31 32.0	x	x						on heuweltjie, ephemeral
110	S31 37 20.4 E18 31 29.3	x	x	x					on heuweltjie, ephemeral
111	S31 37 22.1 E18 31 28.3	x	x						on heuweltjie, ephemeral
112	S31 37 23.6 E18 31 21.9	x		x					just 3 flakes in Spinescent Grassland
113	S31 37 24.2 E18 31 23.3	x	x	x					on heuweltjie, ephemeral
114	S31 37 24.9 E18 31 24.9	x							on heuweltjie
115	S31 37 29.6 E18 31 25.6	x							in pan near heuweltjie, ephemeral
116	S31 37 23.3 E18 31 29.1	x	x	x					on side of heuweltjie
117	S31 37 30.5 E18 31 24.5	x		x					on side of heuweltjie
118	S31 37 27.2 E18 31 02.5	x		x	x				in pan, 1/2 lower grindstone
119	S31 37 28.9 E18 30 59.1	x		x					in pan, ephemeral
120	S31 37 30.4 E18 30 55.2	x	x	x				15, 40	in large pan , 20th C glass & ceramic incl.



Figure 36: Artefacts from Point 102.**Figure 37:** Typical location on artefacts on the side of a heuweltjie, in the case at Point 102.**Figure 37:** Artefacts from point 103.**Figure 39:** The hard surface of the heuweltjie at Point 107.**Figure 40:** Artefacts from Point 120. Note modern ceramic fragment in upper left corner.

Site D did not yield any ESA material. It seems likely that much of what was found relates to the LSA and possibly the MSA, although nothing diagnostic was seen. Over and above the observations summarised in Table 3, two quartz artefacts were found in a deflation south of Point 101 (Figure 35) and a total of six isolated quartz artefacts were noted across the rest of the site and within the area of Spinescent Grassland. Two reasons for the observed artefact distribution can be advanced: the Gannabos area is more of a deflating environment thus revealing artefacts on the hard pan and heuweltjie surfaces and the prickly Spinescent Grassland environment was less attractive for settlement with the hard, clear patches to the south being favoured. People would still have moved through the area in the course of their daily activities and it may not be purely co-incidental that three of the six isolated artefacts were found close to an extensive colony of *Boophane dysticha*, or Gifbol, a plant used by indigenous people for poison. Another use of this plant is indicated by the presence of a folded fragment of the bulb casing from one of the caves along the Varsche Rivier (own data).

7.3. Built environment

There are no structures or ruins on Sites B and D, while three small modern structures related to the gypsum mining are present on Site C. These structures have no heritage significance.

7.4. Cultural landscapes

7.4.1. Colonial

The overwhelming character of the Knersvlakte is related to the vast open spaces that sweep northwards from the Oliphants River. Due to the extreme aridity of the Knersvlakte little historic settlement ever took place, although some ruins are known, most notably that along the Varsche Rivier as described above. That this small farmstead included a threshing floor hints at a degree of permanence. Nonetheless, the bulk of the Knersvlakte is entirely uninhabited today with farmers electing to live in the nearby towns of Vanrhynsdorp and Vredendal. While the town of Vanrhynsdorp had its origins in 1887 (Van Tonder-Pieterse 2006), Vredendal is far younger having only been laid out in 1933 (Fransen 2004). The original historical settlement of the area does date back beyond this though, with the farm Vredendal having first been acquired as a loan farm in 1748 by Pieter van Zyl (Fransen 2004). Survey diagrams indicate that the three farms of concern to this impact assessment were granted in 1831 (Vredendal and Vaderlandssche Rietkuil) and 1848 (Drooge Rivier). The land has a very low productivity and not much can be done with it besides small stock grazing. The advent of viticulture is far more recent with irrigation and agriculture post-dating 1911 (SA Meanders 2009). As such, there is little colonial cultural landscape to speak of in the vicinity.

7.4.2. Griqua

Of more significance, however, is the fact that the Griqua community own extensive tracts of land in the region after successful claims to the government's land restitution program. The Ratelgat farm, some 35 km north of the study area, is becoming well known (Griqua Ratelgat Trust, n.d.), while to the south, close to Site D, they have recently acquired a second farm via the same process (C. le Fleur, pers. comm. 2010). The Griqua people have for many years used this land for grazing and were living there when Simon van der Stel passed through in 1685 (Waterhouse 1932). Van der Stel helped resolve a dispute between two Griqua groups, thus possibly inspiring the name Vredendal (peace valley). Another possible origin relates to a later bartering expedition that became hostile but also ended amicably. Although the Griqua people are now very much a mixed group, their history is certainly integrally tied to this region. However, there are no obviously related modifications of the environment to create a cultural landscape that are immediately evident. The natural landscape may still hold some cultural significance though.

7.5. Visual impacts and scenic routes

The Knersvlakte is an area of very high visual quality. From the study area the arid plains stretch northwards for many kilometres, interrupted only by occasional river channels, the N7 freeway, the Sishen-Saldanha railway line and a few smaller gravel roads. In Spring numerous people flock to the region to see the displays of wild flowers, while the region's vegetation is of high scientific research value, particularly further north on the quartz gravel plains. Generally, the scenic qualities of the area are important from a tourism point of view.

7.5.1. Site B

The southern, and particularly south-eastern, Knersvlakte are overwhelmingly dominated by the impressive Matzikamma Mountain that looms proudly over the town of Vanrhynsdorp and Site B. East of this is the well-known Vanrhynsdorp Pass that leads to the town of Nieuwoudtville on top of the escarpment (Figure 41). The view west over the Knersvlakte from the top of this pass is truly spectacular and would be impacted by the proposed landfill if Site B was chosen (Figure 42).



Figure 41: View towards the Vanrhynsdorp Pass from Site B. The pass is faintly visible in the main picture but is highlighted in the inset.



Figure 41: Google Earth manipulation showing the view from the escarpment in the vicinity of the Vanrhynsdorp Pass with Site B quite clearly visible to the left.

7.5.2. Site C

Westwards, the R27 extends between Vanrhynsdorp and Vredendal. Here the road runs through flat country, passing by Site C. Much of Site C is well obscured from the road by the presence of a large rehabilitated ridge where gypsum mining previously took place. The old slimes dams on Site C serve as a good example when evaluating the visual impacts of the proposed landfill. The 4 m high dams are only briefly visible from one point on the R27 (Figure 42) and appear quite far away (they are in fact about 2.5 km from this observation point). They do blend with the environment to a limited degree, but their poorer vegetation coverage and abrupt slope break at the southern end identifies them more readily.



Figure 42: View towards Site C from the R27 between Vredendal and Vanrhynsdorp. The mound on the skyline is the old slimes dams.

Looking at Site C from the N7 to the south of Vanrhynsdorp, the slimes dams do not pose a significant visual intrusion as they are too far distant (~7.5 – 9.0 km) and lack sufficient contrast to be readily identifiable. Being south-facing, this site will present no visual impacts to the scenic qualities of the Knersvlakte to the north.

7.5.3. Site D

This alternative lies very close to the town of Vredendal making it potentially highly visually sensitive. However, almost the entire area of the assessed land area is hidden from view by a ridge that extends from northeast to southwest along the southern border of the site. The ridgeline itself more or less follows the south-eastern boundary of the site but loses altitude towards the southwest. Only at the very far south-western corner of Site D does the town come into view, and then only from a very small area (Figure 43). The view gained from this area is shown in Figure 44. The nearest buildings are 1 km distant but the main part of the town remains well hidden from view due its being located down in the Oliphants River Valley. There are no structures of heritage significance in the vicinity that will be negatively impacted by issues of visibility.



Figure 43: Aerial view of the area between Vredendal and Site D. The distance between the edge of the site and the town is 1 km. The green icons denote three places where the town became visible during the survey, while at the red icon the town was completely obscured.



Figure 44: Panoramic view towards the southeast showing the town just visible from the south-westernmost part of Site D.

Of greater visual concern at Site D is the visibility that it enjoys from the plains of the Knersvlakte to the north. The site is on a north-facing slope and is readily visible from some distance. This area, although traversed by a large powerline and the Sishen-Saldanha Railway, is almost entirely unspoilt and can be regarded as a natural landscape with very high scenic qualities. Selection of Site D, although at the very edge of this landscape, would negatively impact on these qualities. The aerial photograph in Figure 45 shows that development and agriculture are tightly concentrated along the Oliphants River valley with the remaining land being completely open.

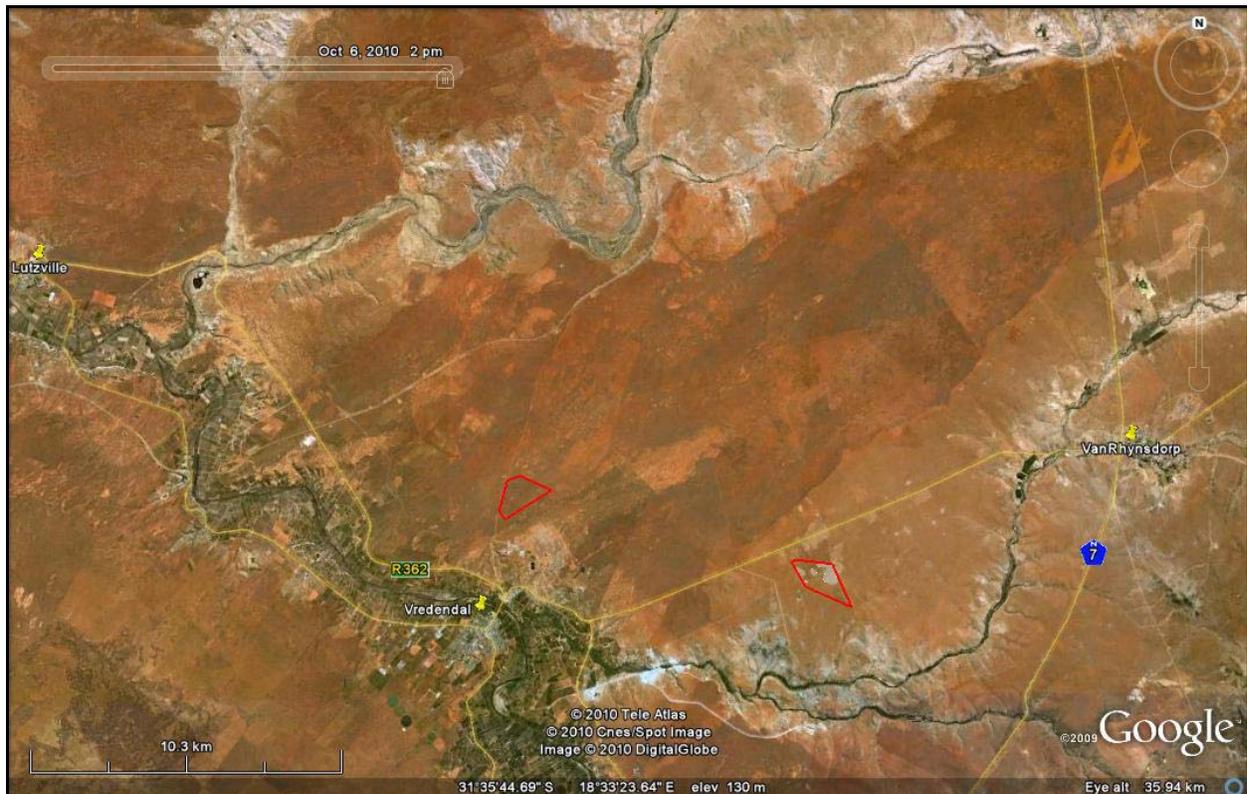


Figure 45: Aerial view of the southern Knersvlakte showing the locations of Sites C and D.

A general concern that pertains to all three sites would be the potential for rubbish to blow out of the landfill and into the surrounding natural environment. This would lead to visual degradation of areas extending beyond the actual footprint.

8. IMPACT ASSESSMENT

Impacts to archaeological heritage resources and visual qualities will occur during both phases, although archaeology will only be impacted during the operation phase should expansions to the landfill area take place. The other two types of heritage considered above, built environment and cultural landscapes, will receive negligible impacts and are thus not considered here. Table 4 summarises the impacts to archaeological heritage for each alternative, while Table 5 looks at impacts to visual qualities and scenic routes.

The standard impact assessment criteria are based on environmental resources and as such are not easily applied to heritage. The reason for this is that heritage resources are unique, non-replaceable resources that occur only at specific locations. Also, due to variations in topography and the distribution of heritage resources the probability of impacts will vary depending on the part of the relevant site selected. As such, some adaptation to the assessment criteria is required. Due to its definition, intensity is usually the most problematic criterion and an alternative understanding of it has been provided by Winter and Baumann (2005:50):

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and

- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

In terms of probability, higher ratings are indicated for sites where heritage resources are more widespread and lower probability for sites with scarce or patchy resources that are less likely to be impacted.

8.1. Archaeology

Table 4: Impacts on archaeological heritage.

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Construction	Site B: Clearance/excavation of land for construction of landfill	Destruction/damage to archaeological material	Local	Permanent	Medium	Definite	High	Low	Low
	Site C: Clearance/excavation of land for construction of landfill	Destruction/damage to archaeological material	Local	Permanent	Medium	Definite	High	Medium	No significance
	Site D: Clearance/excavation of land for construction of landfill	Destruction/damage to archaeological material	Local	Permanent	Medium	Improbable	High	Low	No significance
	No-Go option	n/a	n/a	n/a	n/a	n/a	Improbable	High	Very Low
Operation	Site B: Clearance/excavation of further land for landfill expansion	Destruction/damage to archaeological material	Local	Permanent	Medium	Definite	High	Low	Low
	Site C: Clearance/excavation of further land for landfill expansion	Destruction/damage to archaeological material	Local	Permanent	Medium	Highly probable	High	Low	No significance
	Site D: Clearance/excavation of further land for landfill expansion	Destruction/damage to archaeological material	Local	Permanent	Medium	Improbable	High	Low	No significance
	No-Go option	n/a	n/a	n/a	n/a	n/a	Improbable	High	Very Low

The source and nature of impacts relates to the physical destruction of archaeological material during excavation and earth-moving. Artefacts will be disturbed, damaged and removed from their contexts.

Due to the nature the archaeological material encountered on site, impacts to such resources are generally of low significance. Most of the material recorded during this assessment is likely to be background scatter whose distribution is more strongly determined by natural processes than human action. However, at Site C this scatter is quite dense in places and offers greater potential to reveal information pertaining to the past inhabitants of the area. Sites B and D contain material in far lower densities and their possibilities of revealing useful information is thus more limited.

Mitigation can be very easily achieved through either:

1. Avoiding areas containing the more significant archaeological resources; and/or
2. Controlled sampling of the artefacts at the various localities that appear to offer the greatest potential to reveal useful archaeological data.

In the event of sampling being required, this will involve excavation of the artefacts within an alphanumeric grid so that distributions can be spatially assessed. The material will need to be subjected to a basic analysis in the laboratory which would, to some degree, inform on their age and function. This would enable a better understanding of the prehistoric use of the environment than can be ascertained by merely examining the material on site. The importance of sampling relatively small and/or ephemeral sites has been stated elsewhere (Orton 2007). Briefly, the possibility exists to lose a component of the archaeological record not preserved in other contexts within the region.

At Site B no sampling is suggested. At Site C sampling should occur at Points 29 (A&B), 59, 60 and 61 as appropriate if any are to be impacted. At Site D Points 103 and 107 are identified as suitable for archaeological mitigation.

Under the no-go option, no new impacts to archaeological resources would be experienced.

8.2. Visual impacts and scenic routes

Impacts to the scenic qualities of the landscape and to scenic routes are considered to be the same during construction and operation and as such are assessed together in Table 5. Intensity again follows Winter and Baumann (2005) as described above.

Table 5: Impacts on scenic qualities and scenic routes.

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Construction & Operation	Site B: Construction of the landfill site and related facilities.	Introduction of anthropogenic structures/landforms to the natural environment	Regional	Long term	High	Definite	High	High	High
	Site C: Construction of the landfill site and related facilities.	Introduction of anthropogenic structures/landforms to the natural environment	Off-site	Long term	Low	Definite	High	Low	No significance
	Site D: Construction of the landfill site and related facilities.	Introduction of anthropogenic structures/landforms to the natural environment	Regional	Long term	High	Definite	High	High	Medium-High
	No-Go option	General degradation of the environment around the existing landfill sites	Off-site	Long term	Medium	Definite	High	High	n/a

The source and nature of impacts relates to the introduction of man-made structures and landforms into pristine natural environments.

Sites B and D are both very sensitive and carry high significance ratings. In addition, Site B is in close proximity to a significant scenic route and can be regarded as being of even greater significance than Site D. The low significance attached to Site C is due to the fact that it is largely invisible from scenic routes and a precedent is already in place due to the presence of the slimes dams.

Mitigation of the visual impacts at Site B is basically impossible due to the regional topography and the site should be avoided. Impacts to the scenic qualities of the area are considered a fatal flaw. Site D is marginally less sensitive and locating the landfill at the lowest point of the site (northern corner) would help to manage visual impacts. The aim here would be to ensure that the facility lies below the skyline as presented by the ridge running between the site and the town. This would reduce the excessive contrast that might be created should any part protrude above the natural skyline as viewed from the Knersvlakte. A visual impact assessment (VIA) would most likely be required to assist with planning appropriate mitigation should Site D be selected. It is unlikely that a VIA will be required for Site C since the precedent for large earth mounds is already in place due to past mining activities in the area. Mitigation will involve locating the facility in areas already disturbed and as close to the northeast corner of the site as possible. Rehabilitation of the adjacent slimes dams could be considered in such a way as to further shield the landfill and related facilities.

The no-go option would result in the continuation of impacts currently being experienced through poor management and over use of the current land fill sites. These sites are causing much litter to be spread through their local areas which in turn degrades the local environment reducing scenic value and increasing their visual impacts. These impacts essentially escalate over time as more and more litter enters the environment in an uncontrolled manner.

8.3. Cumulative impacts

The southern Namaqualand region is currently being targeted for various energy-related developments which will result in increased loss of archaeological material. However, the nature and extent of such material means that it is generally of little importance. Cumulative impacts related to archaeology are thus not considered to be significant.

Similar excavation-intensive developments are unknown for this area but the land immediately north of Site D is currently under consideration for a solar energy facility. It is thus only in this area that cumulative impacts are potentially of concern. Should both the landfill and solar facility be constructed there then a cumulative visual impact would occur, but without knowing the extent of the planned solar facility this cannot yet be easily quantified. Should Site D be chosen then cumulative visual impacts would need to be assessed through a VIA.

9. GENERIC MITIGATION

During construction and operation of the proposed landfill site the disturbance footprint should be minimised as far as possible. The maximum possible disturbance footprint should be identified prior to construction so as to enable effective planning of required mitigation as discussed above. After this, the remaining undisturbed area should be protected from any possible impacts. Because the slimes dams were built from the inside, they have intact archaeological material lying very close to their bases. This material will be easily disturbed and damaged should heavy machinery be allowed to drive outside the current slimes dam footprint. For this reason it is suggested that all excavation and earth-moving be restricted to within the currently impacted areas as far as is possible.

No matter which alternative is chosen, it should be ensured that appropriate colouration for the constructed facility is employed so as to reduce visual contrast and thus visual impacts.

10. ALTERNATIVES

Here the three alternatives are considered relative to each other. They are listed in order from least preferred to most preferred.

Site B

This site is the least preferred alternative and the lack of ability to mitigate visual impacts is considered to be a fatal flaw. The site should not be considered further.

Site D

This site is also very sensitive but it is not considered to hold fatal flaws and may be used should other assessments indicate it to be the most suitable. Visual impacts are high but these can be mitigated to some degree through appropriate positioning of the landfill. Archaeological impacts may occur but could be easily mitigated.

Site C

This site is the strongly favoured alternative for the proposed development. Despite this site being the richest archaeologically, it has extensive disturbed areas such that archaeological impacts could be kept very low through appropriate positioning. The most important factor, though, is the greatly reduced visual impact that will occur at this site. This is due partially to the presence of high-lying ground between the R27 road and a portion of the site and partially to the fact that a strong precedent for large mounds of earth has already been set.

11. CONCLUSIONS

This study has assessed three alternative sites for the construction of a new regional landfill for the Matzikamma Municipality. Archaeological impacts are found to be variable but generally of low significance. They can be very easily mitigated and do not strongly influence the decision-making process. The visual impacts to the natural environment and to local scenic routes are significant and are considered to be a fatal flaw at Site B. While Site D will experience fairly high visual impacts, it is likely that they can be effectively managed and absorbed into the surrounding topography. A VIA will probably be required to assist with management of the visual impacts should this site be chosen. Site C is the strongly preferred alternative and mitigation of any negative impacts should be easy to achieve. Its topography is most suited to absorbing the likely visual impacts.

12. RECOMMENDATIONS

Recommendations differ for each site. Overall, it is recommended that Site C be chosen as it presents the least impacts to heritage resources. Site B should not be considered at all.

If Site C is chosen then the following recommendations apply:

- The landfill should be located as close to the northeast corner of the site as possible, preferably maximising use of the already disturbed areas (Figure 46);
- If the archaeological material at Points 29 (A&B), 59, 60 and/or 61 are to be impacted then mitigation should be carried out as required; and
- Should archaeological material other than at the Points mentioned above be impacted, then an archaeological destruction permit may be required by HWC.

If Site D is chosen then the following recommendations apply:

- The landfill should be located as close to the northwest corner of the site as possible maximising use of the lowest-lying ground (Figure 47);
- A VIA should be carried out to inform the mitigation process and determine precisely the best location for the landfill; and
- If the archaeological material at Points 103 and/or 107 are to be impacted then mitigation should be carried out as required.

It should also be noted that a very small chance of intersecting unmarked human burials does exist, particularly in sandy areas. Should human remains be encountered at any stage of development work in the immediate vicinity should stop, the bones should be protected and the find reported to HWC (021 483 9685). An archaeologist will need to be contracted to remove the remains.

The final decision-making on heritage matters rests with HWC and the above recommendations are subject to their approval.

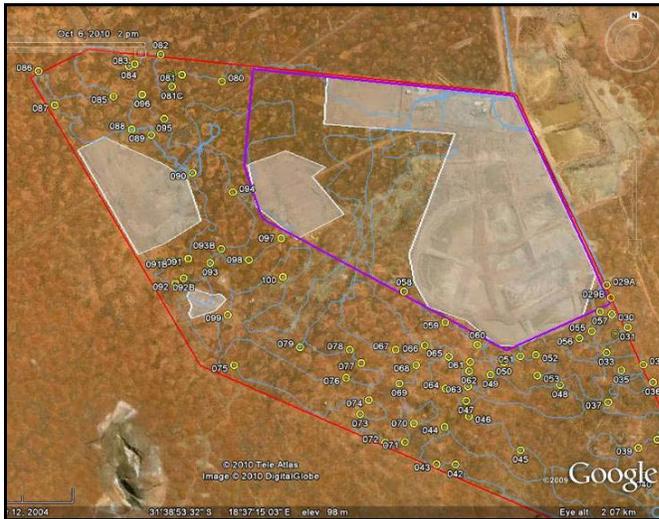


Figure 46: Aerial view of Site C showing the preferred part of the site for the proposed landfill (purple outline). White shaded areas are already disturbed.



Figure 47: Aerial photograph of Site D showing the preferred part of the site for the proposed landfill (purple outline).

13. REFERENCES

- Dewar, G. 2008. The archaeology of the coastal desert of Namaqualand, South Africa: a regional synthesis. Oxford: British Archaeological Reports International Series 1761.
- Dewar, G., Halkett, D., Hart, T., Orton, J. and Sealy, J. 2006. Implications of a mass kill site of springbok (*Antidorcas marsupialis*) in South Africa: hunting practices, gender relations and sharing in the Later Stone Age. *Journal of Archaeological Science* 33: 1266-1275.
- Dewar, G. & Jerardino, A. 2007. Micromammals: when humans are the hunters. *Journal of Taphonomy* 5: 1-14.
- Fransen, H. 2006. Old towns and villages of the Cape. Jeppestown: Jonathan Ball Publishers.
- Griqua Ratelgat Trust. n.d. <http://www.ratelgat.co.za/home.htm>. Website visited on 12th October 2010.
- Halkett, D., Hart, T.J.G. & Parkington J.E. 1993. Excavations at six archaeological sites in the near shore diamond mining area, Brand se Baai, Namaqualand. Unpublished report prepared for De Beers Namaqualand Mines Division. University of Cape Town: Archaeology Contracts Office.
- Hart, T.J.G. & Halkett, D. 1994. Report on Phase 2 archaeological excavations at the Namakwasands project (first phase) Vredendal District Namaqualand. Unpublished report prepared for Namakwa Sands Ltd. University of Cape Town: Archaeology Contracts Office.
- Hart, T. & Lanham, J. 1997. Phase 2 archaeological excavations at two Late Stone Age sites in the Phase II (WOB) mining area, Namakwa Sands, Vredendal District, Western Cape. Unpublished report prepared for Namakwa Sands Ltd. University of Cape Town: Archaeology Contracts Office.

- Helme, N. 2010. Environmental impact assessment: identification of regional landfill site and permit application for the northern West Coast District Municipality. Vegetation component. Unpublished report prepared for Anél Blignaut Environmental Consultants. Scarborough: Nick Helme Botanical Surveys.
- Jacobs, Z, Roberts, RG, Galbraith, RF, Deacon, HJ, Grün, R, Mackay, A, Mitchell, P, Vogelsang, R & Wadley, L. 2008. Ages for the Middle Stone Age of southern Africa: implications for human behaviour and dispersal. *Science* 322: 733 – 735.
- Mackay, A., Orton, J., Schwartz, S. & Steele, T. 2010. Soutfontein (SFT)-001: preliminary report on an open-air site rich in bifacial points, southern Namaqualand, South Africa. *South African Archaeological Bulletin* 65: 84-95.
- Manhire, A. 1987. Later Stone Age settlement patterns in the Sandveld of the south-western Cape Province, South Africa. Oxford: British Archaeological Reports International Series 351.
- Moore, J.M. & Picker, M.D. 1991. *Heuweltjies* (earth mounds) in the Clanwilliam district, Cape Province, South Africa: 4000-year-old termite nests. *Oecologia* 86: 424-432.
- Mucina, L., Jürgens, N., Le Roux, A., Rutherford, M.C., Schmeidel, U. Esler, K.J., Powrie, L.W., Desmet, P.G. & Milton, S.J. 2006b. Succulent Karoo biome. In: Mucina, L. & Rutherford, M.C. (eds) *The vegetation of South Africa, Lesotho and Swaziland*. *Strelitzia* 19. Pretoria: South African National Biodiversity Institute.
- Orton, J. 2007. The sampling of ephemeral shell scatters in Namaqualand, South Africa. *South African Archaeological Bulletin* 62: 74-78.
- Orton, J. 2008. Archaeological monitoring of earthworks at Vanrhynsdorp Prison, Erf 200 Vanrhynsdorp, Vanrhynsdorp Magisterial District, Western Cape. Unpublished report prepared for MLB Architects. Archaeology Contracts Office, University of Cape Town.
- Orton, J. & Halkett, D. 2005. A report on the archaeological mitigation program at De Beers Namaqualand Mines, August to September 2004. Unpublished report prepared for De Beers Consolidated Mines NM. Archaeology Contracts Office, University of Cape Town.
- Orton, J. & Halkett, D. 2006. Mitigation of archaeological sites within the Buffels Marine and Koingnaas Complexes, Namaqualand, September 2005 to May 2006. Unpublished report prepared for De Beers Consolidated Mines NM. Archaeology Contracts Office, University of Cape Town.
- Orton, J., Hart, T. & Halkett, D. 2005. Shell middens in Namaqualand: two hunter-gatherer sites at Rooiwalbaai, Northern Cape Province, South Africa. *South African Archaeological Bulletin* 60: 24-32.
- SA Meanders. 2009. http://www.sa-meanders.co.za/sam/south_africa.php?xprov_id=22&xreg_id=106&xtown_id=918. Website visited on 15th October 2010.
- Steele, T.S., Mackay, A., Orton, J. & Schwartz, S. 2010. Varsche River 3, a new Middle Stone Age site in southern Namaqualand, South Africa. Poster presented at the 75th Anniversary meeting of the Society for American Archaeology, St Louis, Missouri, 14th – 18th April 2010.
- Van Tonder-Pieterse, K. 2006. Heritage statement report Vanrhynsdorp Prison: erf 200, cnr Church & Residential Streets, Vanrhynsdorp. Unpublished report prepared for MLB Architects. Cape Town.

- Waterhouse, G. (ed.) 1932. Simon van der Stel's journal of his expedition to Namaqualand 1685-6. London: Longmans Green and Co. Ltd.
- Winter, S. & Baumann, N. 2005. Guideline for involving heritage specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 E. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.