**McGregor Museum**
**Department of Archaeology**

# Proposed development of the Upington Solar Thermal Plant Three within Portion 3 of the Farm McTaggarts Camp 453 west of Upington, Northern Cape: Archaeological Impact Assessment.

**David Morris**
**February 2014**

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## 1. INTRODUCTION

The McGregor Museum Archaeology Department was appointed by Savannah Environmental, on behalf of the applicant, Abengoa Solar Power South Africa (Pty) Ltd, to provide an archaeological impact assessment of a proposed 125MW solar energy (CSP) facility (parabolic trough plant) to be known as Upington Solar Thermal Plant Three, near Upington in the Northern Cape Province. The proposed development site is located on Portion 3 of the Farm McTaggarts Camp 453 west of Upington, Northern Cape.

### 1.1 Focus and Content of Archaeological Impact Assessment

This heritage impact assessment report is focused on the development footprint of the proposed ington Solar Thermal Plant Three and associated infrastructure.

The 125 MW Trough Plant (Plant Three) will utilise parabolic trough technology with HTF, dry cooling and molten salt storage, is expected to require 500 hectares. Associated infrastructure would include: access roads, plant substation, power line, water abstraction point and supply pipe line, water storage tanks, packaged waste treatment plant, lined evaporation ponds, salt storage tanks, auxilliary fossil fuel boilers and work shop & office buildings. Relative to the anticipated impact of such a development, this impact assessment report presents a brief baseline description and describes observations made on the ground at the site of the proposed development.

### 1.2 Heritage Specialist

The author of this report is a qualified archaeologist (PhD, University of the Western Cape) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. The author has worked as a museum archaeologist in the Northern Cape since 1985 and has since the late 1980s carried out surveys in the general area of Upington (e.g. Morris & Beaumont 1991; Morris 2000 – 2012). In addition the author has a comprehensive knowledge of the province's history and built environment, and received UCT-accredited training at a workshop on *Architectural and Urban Conservation: researching and assessing local (built) environments* (S. Townsend, UCT). He is also Chairman of the Historical Society of Kimberley and the Northern Cape.

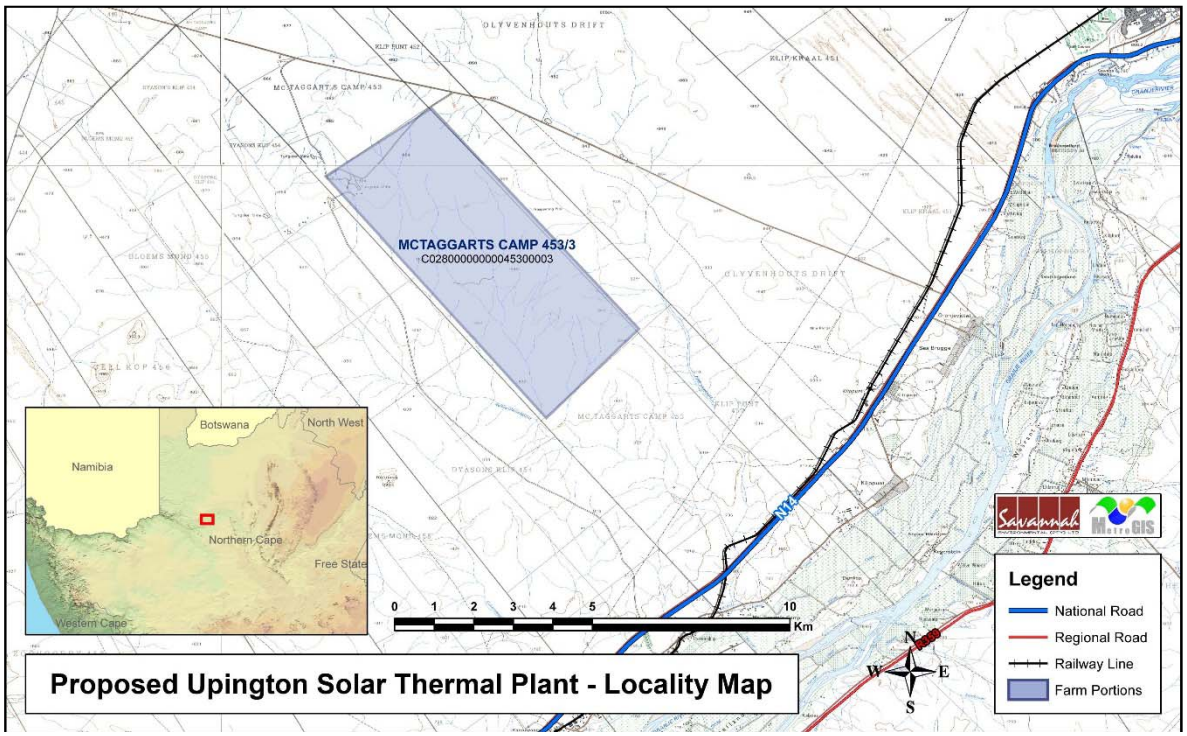
The author is independent of the organization commissioning this specialist input, and provides this Specialist Report within the framework of the National Heritage Resources Act (No 25 of 1999).

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This means that a Heritage Impact Assessment should be

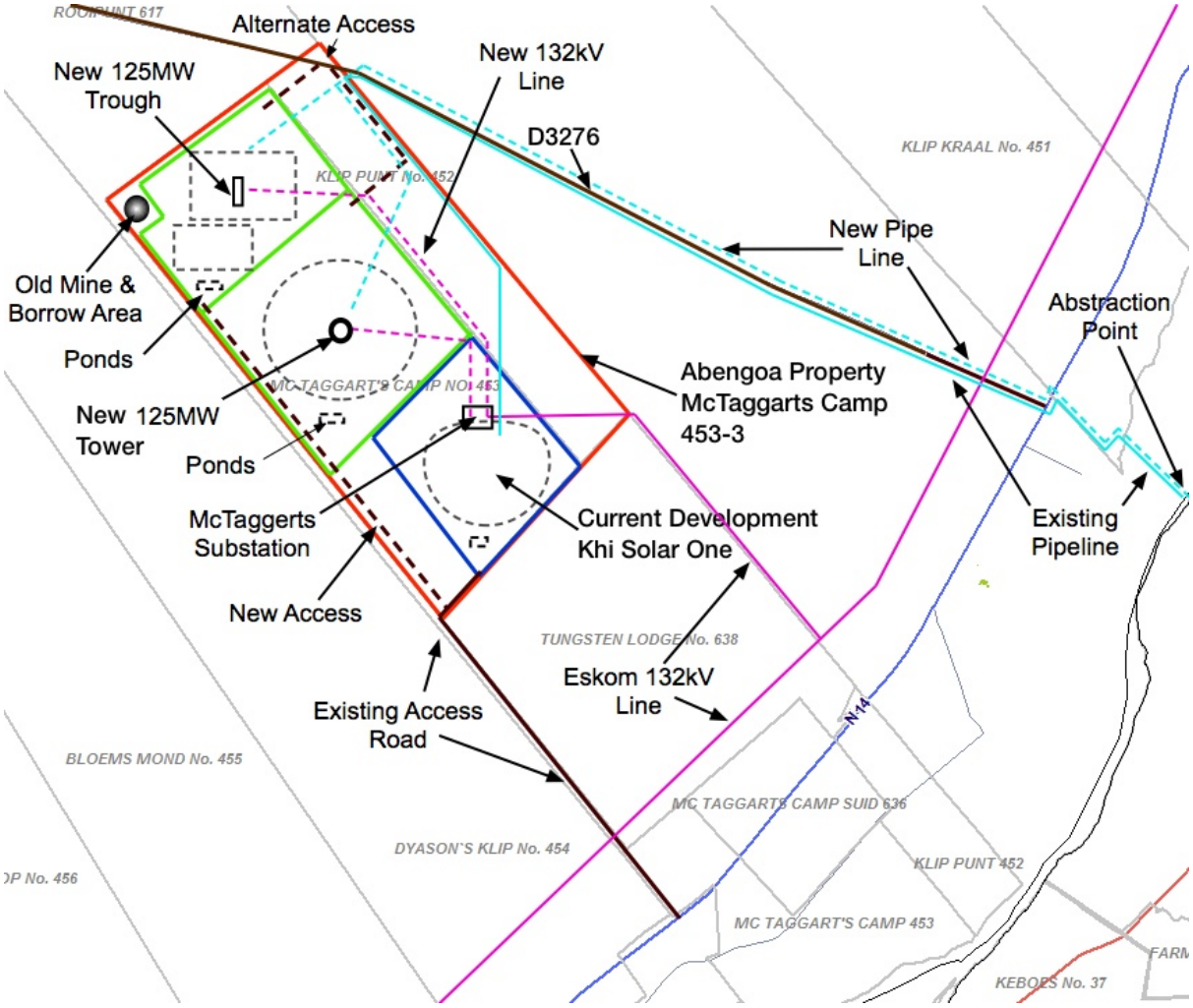
performed, resulting in a specialist report as required by the relevant heritage resources authority/ies to assess whether authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

## 2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The environment in question is arid, comprising relatively flat drainage plains stretching up to 15 km north west of the Orange River. The landscape is sparsely vegetated, with shallow soils, in consequence of which any surface archaeological traces tend to be highly visible.




Location of McTaggarts Camp west of Upington.




Map indicating the proposed Upington Solar Thermal Plant Three (and other phases) and associated infrastructure on Portion 3 of the Farm McTaggarts Camp.

## 2.1 Heritage features of the region

The McGregor Museum has carried out a previous studies on the farm McTaggarts Camp in connection with the Khi Solar One CSP project (Morris 2010, 2012) and prepared a scoping report for the present project. In addition to certain specific observations, the following comments can be made as background information from which heritage predictions were made for testing in the full impact assessment study reported here.

### *2.1.1 Colonial frontier*

The eighteenth- and nineteenth-century records for this region (Penn 2005) pertain mainly to the areas south of and along the Orange River. The travellers Wikar and Gordon followed the river as far as and beyond this region in the 1770s, describing communities living along the river (see Morris & Beaumont 1991 for a summary). Dunn and others describe the situation a century later (Robinson 1978). Frontiersmen such as the colourful Stephanos can be linked with particular places in the landscape (Morris 2002). None of these accounts refer to the specific area of the proposed development.

McTaggarts Camp derives its name from events during the Korana War of 1879-1880, when Captain McTaggart set up his military camp here (Van Vreeden 1961:431). It is not known exactly where this encampment was, though it seems most likely that it was close to the river, hence well away from the proposed solar facilities. The ephemeral

nature of such an event is unlikely to have left much of a discernible archaeological trace.

There was further military activity in the area in the early twentieth century in relation to Jacob Marengo, shot dead on 20 September 1907 near Eensaamheid Pan where, in an incident of “severe overkill”, 5000 rounds were fired to exterminate the resistance leader, five other armed Nama and two accompanying women (Masson 1995). Eensaamheid is about 100 km north west of Upington.

Tungsten mining took place at the north western-most part of McTaggarts Camp in the 1930s (Morris 2012).

### *2.1.2 Later Stone Age*

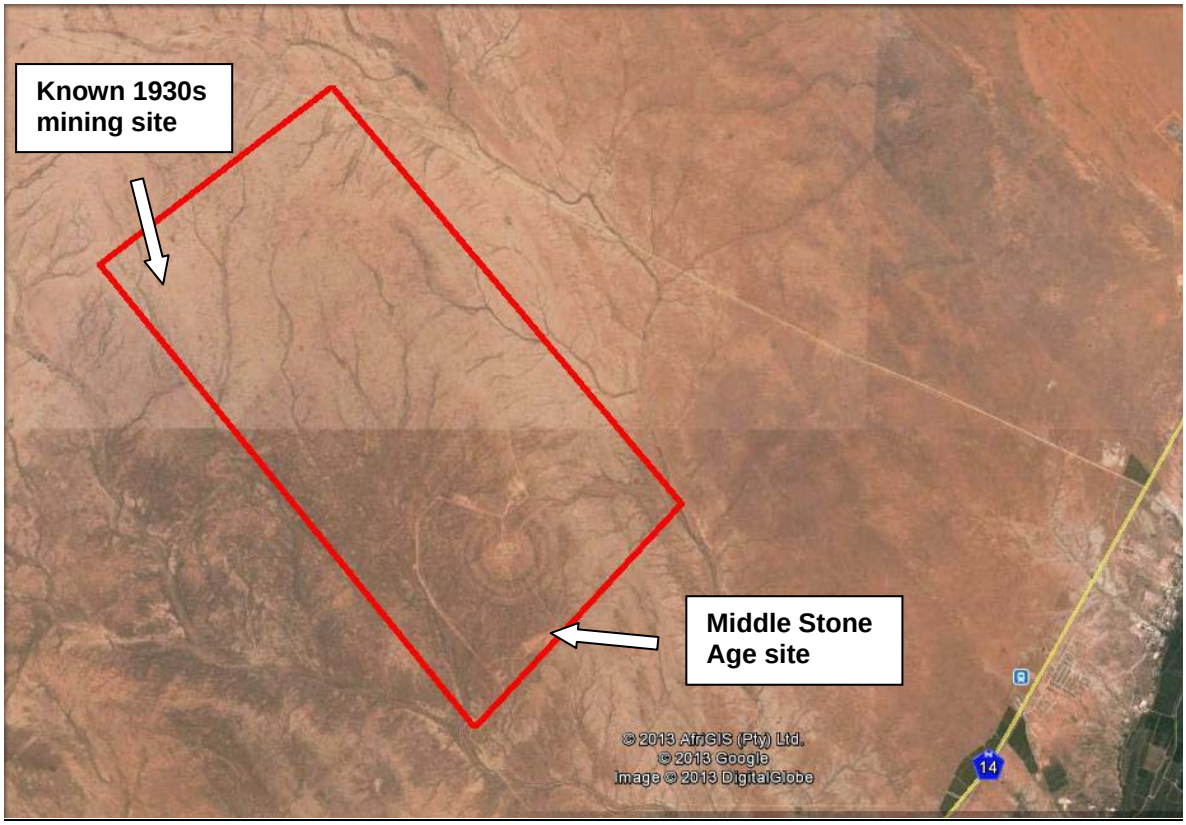
Late Holocene Later Stone Age (LSA) sites are frequently noted in surveys south of and south west of the region of proposed development and along the Orange River (e.g. Morris & Beaumont 1991; Beaumont *et al*. 1995). These are generally short-duration occupations by small groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003). In a range of hills north east of Keimoes, on Zovoorby, a rock shelter and specularite working (a sparkling mineral with known cosmetic and ritual use in the precolonial past) has been excavated (Smith 1995). LSA sites are usually focused on a particular feature in the landscape such as a hill or rocky outcrop and in relation to resources like water and associated habitats richer in animals and plant foods (Morris 2011).

### *2.1.3 Pleistocene: Middle and Earlier Stone Age*

Beaumont *et al*. (1995:240-1) note a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka glacial till. Similar occurrences have been noted north of Upington in situations where raw materials are abundant. Systematic collections of this material at Olyvenkolk south west of Kenhardt and Maans Pannen east of Gamoep could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA) (Beaumont *et al*. 1995).

The ESA included Victoria West cores on dolerite and quartzite (a fine example has been found at Hondeblaf north of Upington), long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

A low density surface scatter of Middle Stone Age material was found on McTaggarts Camp (logged at the McGregor Museum as 2821CA003 McTaggarts Camp 1) in 2010, and this was sampled in Phase 2 mitigation (Morris 2012). It was focused around a bedrock exposure where water would be held for a time after good rain.




The sparsely vegetated drainage plain, otherwise largely featureless, is apparent in this Google Earth image indicating the property (Portion 3 McTaggarts Camp) and known heritage sites. The partial development of Upington Solar Thermal Plant One is visible in the south eastern third of the property.

## 2.2 Description and evaluation of environmental issues and potential impacts

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear developments such as those envisaged can have a permanent destructive impact on these resources. The objective of an EIA would be to assess the sensitivity of such resources where present, to evaluate the significance of potential impacts on these resources and, if and where appropriate, to recommend no-go areas and measures to mitigate or manage said impacts.

Area impacts are possible in the case of the solar development and the proposed substation; the power lines and access roads would represent linear impacts.

### *2.2.1 Direct, indirect and cumulative impacts (in terms of nature, magnitude and extent)*

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity. The Environmental Management Programme should seek to minimize the latter impacts as far as possible.

With respect to the magnitude and extent of potential impacts, it has been noted that the erection of power lines would have a relatively small impact on Stone Age sites, in light of Sampson's (1985) observations during surveys beneath power lines in the Karoo

(actual modification of the landscape tends to be limited to the footprint of each pylon), whereas a road or a water supply pipeline would tend to be far more destructive (modification of the landscape surface would be within a continuous strip), albeit relatively limited in spatial extent, i.e. width (Sampson compares such destruction to the pulling out of a thread from an ancient tapestry).

### *2.2.2 Issues potentially influencing choice of preferred development locales*

*Areas along natural drainage lines – water resources and ecology:* Various considerations including possible concentration of past human activity (and hence archaeological traces) along water courses may suggest that the development footprint not be directly on or near the main drainage channels and vleis.

### *2.2.3 Predictions based on previous observations in the area*

- Based on previous experience, the terrain on which the proposed Upington Solar Thermal Plant would be located is likely not to be rich in archaeological traces of major significance.
- Should there be local sources of Dwyka tillite, these may have served as raw materials often drawn upon in Pleistocene times. If not, it might be expected that any archaeological traces would be sparse. Adjacent terrain, both on McTaggarts Camp and property alongside, surveyed by the McGregor Museum, has minimal Stone Age traces comprising widely scattered/isolated stone artefacts mainly based on jaspilite (banded ironstone) sourced from the banks and terraces of the Orange/Gariep River.
- There appear to be none of the features such as hills or rocky features (such as Spitskop north of Upington) which in other parts of this landscape provide shelters with traces of precolonial Stone Age occupation/activity.
- Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places may be difficult to recover owing to the sparse population. It is not thought likely that any significant intangible heritage values would be attached to the particular terrain in question.
- Apart from the remains of a tungsten mine, noted above, there appear not to be colonial era built environment features in the areas of proposed Solar Development.
- The likelihood of palaeontological features of significance occurring would be subject to an independent desktop enquiry and fieldwork if deemed necessary.

## 3. PROPOSED METHODOLOGY FOR FULL HERITAGE STUDY

A site visit was undertaken in January 2014 to inspect various parts of the terrain on foot, focusing on areas of expected impact (construction of facility, sub-station, and secondary infrastructure such as roads, pipelines and power lines). Heritage traces noted are be evaluated in terms of their archaeological significance (see tables below) and against the predictions set out in section 2.2.3 above.

### 3.1 Assumptions and constraints

It is assumed that, by and large in this landscape, with its sparse vegetation and shallow soil profiles, some sense of the archaeological traces to be found in the area would be readily apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features). Given a prevailing erosion regime, here, as in nearby segments of this landscape already assessed, it was not considered necessary to conduct any excavation as part of the full impact assessment in order to establish the potential of sub-surface archaeology.

A proviso is routinely given, however, that should sites or features of significance be encountered during construction (this could include an unmarked burial, an ostrich eggshell water flask cache, or a high density of stone tools, for instance), specified steps are necessary (cease work, report to heritage authority).

### 3.2 Potentially significant impacts to be assessed

Any area or linear, primary and secondary, disturbance of surfaces in the development locales could have a destructive impact on heritage resources, where present. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by Ngwao Boswa jwa Kapa Bokone (the Northern Cape Heritage Authority). Although unlikely, there may be some that could require preservation *in situ* and hence modification of intended placement of development features.

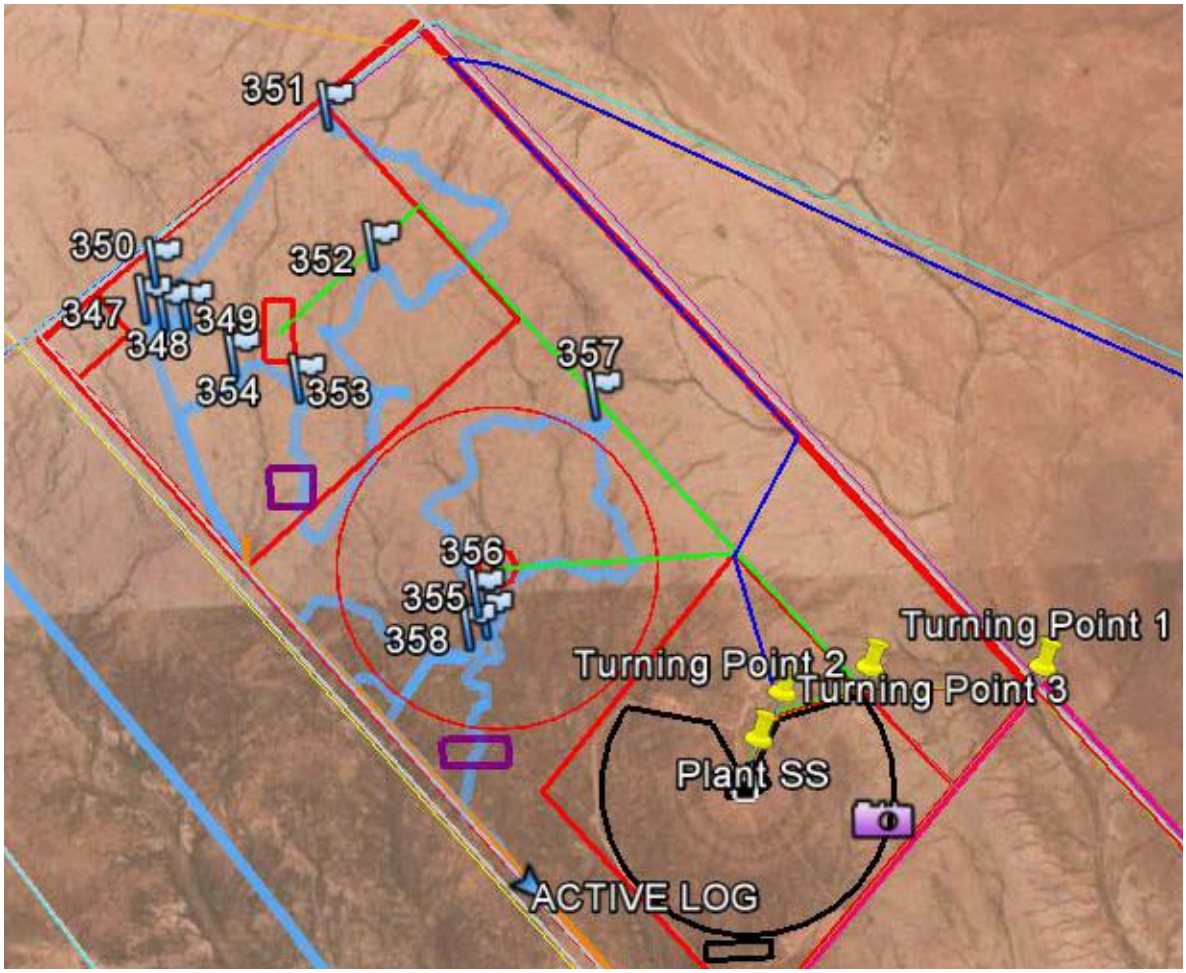
Disturbance of surfaces includes any construction: of a road, a pipeline, erection of a pylon, or preparation of a site for a sub-station, or plant, or building, or any other *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible). Without context, archaeological traces are of much reduced significance. It is the contexts as much as the individual items that are protected by the heritage legislation.

Some of the activities indicated here have a generally lower impact than others. For example, Sampson (1985) has shown that powerlines tend to be less destructive on Stone Age sites than roads since access along the route of the line during construction and maintenance tends to be by way of a 'twee-spoor' temporary roadway (not scraped, the surface not significantly modified). Individual tower positions might be of high archaeological significance (e.g. a grave, or an engraving). Note: the impact of a 'twee-spoor' could be far greater on Iron Age landscapes in other parts of South Africa, where stone walling might need to be breached.

### 3.4 Archaeological observations

The footprint of the proposed development area was traversed and investigated. The landscape in question consists of generally flat and featureless plains with shallow drainage lines running through it. In a very few places bedrock is exposed in outcrops potentially of archaeological interest in that they are places where water may remain for a short time after rains. Temporary water would be available in a few small vleis. Berms had been erected in one instance, probably for retaining water within one such feature. The outcrops/vleis potentially would have been 'magnets' for past human activity and were thus closely examined for evidence of this. The remainder of the terrain is veneered by shallow topsoil supporting sparse vegetation.

The northern extent of the development footprint and especially the north western corner was trenched and mined for tungsten in the 1930s and subsequently. Trenches occur in various locales within the northern part of the development footprint.




Footprint areas of the Upington Solar Thermal Plant Three north-west of the current Khi Solar 1 development, showing GPS tracks.

The following specific observations are relevant:

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 1<br><br>(GPS point 347) | 28.50244<br>21.03226 | Landscape alongside the abandoned tungsten mine (debris heaps adjacent to deep trenching visible in the photograph). | Widely scattered/isolated stone artefacts (<1 per 10x10 m). Predominantly on jaspilite and most likely Middle Stone Age (MSA) | LOW |

Debris heaps from trenches associated with the abandoned tungsten mine.


Stone artefacts are widely scattered (<1 per 10x10 m)

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 2<br><br>(GPS point 349) | 28.50291<br>21.03538 | Plain in north western part of the Upington Solar Thermal Plant Three footprint. | Ruins of tungsten mine infrastructure (Khi Solar One CSP tower in the background) | LOW |

Ruins of tungsten mine infrastructure.

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 3<br><br>(GPS point 350) | 28.49987<br>21.03308 | Plain in north western part of the Upington Solar Thermal Plant Three footprint. | Abandoned tungsten mine infrastructure: explosives magazine | LOW |

Abandoned tungsten mine infrastructure: explosives magazine

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 4<br><br>(GPS point 351) | 28.48949<br>21.04743 | Plain in north eastern part of the Upington Solar Thermal Plant Three footprint. | Examples of stone artefacts occurring in very low density across the plains, generally on quartzite and jaspilite. | LOW |


Examples of stone artefacts (quartzite) occurring in very low density across the plains

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 5<br><br>(GPS point 352) | 28.49950<br>21.05057 | Small vlei features in the Upington Solar Thermal Plant Three footprint. | Small vlei: contrary to expectations, no increase in artefact density in its vicinity was noted. | LOW |

Evidence of rain water retained in small vlei – no increased density of artefacts noted.

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 6<br><br>(GPS point 353) | 28.50858<br>21.04414 | On plain in the Upington Solar Thermal Plant Three footprint. | Piles and alignments of stone adjacent to prospecting trenches associated with tungsten mining. | LOW |

Piles and alignments of stone adjacent to prospecting trenches associated with tungsten mining.

| Obs No | Location | Landscape description | Archaeological features | Significance |
|---|---|---|---|---|
| 7<br><br>(GPS point 354) | 28.50657<br>21.03908 | On plain in the Upington Solar Thermal Plant Three footprint. | Trench prospecting site associated with tungsten mining. | LOW |

Prospecting trench.

## 3.5 Determining archaeological significance

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (nd) and Whitelaw (1997) for assessing archaeological significance has been developed for Northern Cape settings (Morris 2000a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

*Estimating site potential*

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes *any* trace, even of only Type 1 quality, can be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

*Assessing site value by attribute*

Table 2 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

**Table 1. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, National Monuments Council).**

| **Class** | **Landform** | **Type 1** | **Type 2** | **Type 3** |
|---|---|---|---|---|
| L1 | Rocky surface | Bedrock exposed | Some soil patches | Sandy/grassy patches |
| L2 | Ploughed land | Far from water | In floodplain | On old river terrace |
| L3 | Sandy ground, inland | Far from water | In floodplain or near feature such as hill | On old river terrace |
| L4 | Sandy ground, Coastal | >1 km from sea | Inland of dune cordon | Near rocky shore |
| L5 | Water-logged deposit | Heavily vegetated | Running water | Sedimentary basin |
| L6 | Developed urban | Heavily built-up with no known record of early settlement | Known early settlement, but buildings have basements | Buildings without extensive basements over known historical sites |
| L7 | Lime/dolomite | >5 myrs | <5000 yrs | Between 5000 yrs and 5 myrs |
| L8 | Rock shelter | Rocky floor | Sloping floor or small area | Flat floor, high ceiling |
| **Class** | **Archaeo-logical traces** | **Type 1** | **Type 2** | **Type 3** |
| A1 | Area previously excavated | Little deposit remaining | More than half deposit remaining | High profile site |

| Class | Landform | Type 1 | Type 2 | Type 3 |
|---|---|---|---|---|
| A2 | Shell or bones visible | Dispersed scatter | Deposit <0.5 m thick | Deposit >0.5 m thick; shell and bone dense |
| A3 | Stone artefacts or stone walling or other feature visible | Dispersed scatter | Deposit <0.5 m thick | Deposit >0.5 m thick |

**Table 2. Site attributes and value assessment (adapted from Whitelaw 1997)**

| Class | Attribute | Type 1 | Type 2 | Type 3 |
|---|---|---|---|---|
| 1 | Length of sequence/context | No sequence<br>Poor context<br>Dispersed distribution | Limited sequence | Long sequence<br>Favourable context<br>High density of arte/ecofacts |
| 2 | Presence of exceptional items (incl regional rarity) | Absent | Present | Major element |
| 3 | Organic preservation | Absent | Present | Major element |
| 4 | Potential for future archaeological investigation | Low | Medium | High |
| 5 | Potential for public display | Low | Medium | High |
| 6 | Aesthetic appeal | Low | Medium | High |
| 7 | Potential for implementation of a long-term management plan | Low | Medium | High |

In terms of these criteria, all the archaeological observations made fell in the rage of: for Table 1, Landform Class 3 Type 1 (low significance); Archaeological attributes Class A3 Type 1 (low significance); and for Table 2: Type 1 for all Classes 1 to 7 (low significance).

### 3.6 Observations against scoping phase predictions

The manner in which archaeological and other heritage traces might be affected by the proposed Solar Thermal Plant Two and Three has been indicated. In summary, it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any heritage material, object or value (as indicated in the National Heritage Resources Act (No 25 of 1999). The most obvious impact in this case would be land surface disturbance associated with infrastructure construction.

Archaeological and cultural (mining) heritage observations made were assessed as being of low significance (paragraphs 3.4 & 3.5 above). The following further remarks are made relative to the predictions made in the scoping report (Morris, September 2013) which were made on the basis of previous work in the area and tested by way of fieldwork for this full Impact Assessment:

Based on previous experience, the terrain on which the proposed Upington Solar Thermal Plant Three would be located is likely not to be rich in archaeological traces of major significance.

The prediction is sustained: Stone Age traces consist of wide scattered/isolated finds, none of those noted being of major significance.

Should there be local sources of Dwyka tillite, these may have served as raw materials often drawn upon in Pleistocene times. If not, it might be expected that any archaeological traces would be sparse. Adjacent terrain, both on McTaggarts Camp and property alongside, surveyed by the McGregor Museum, has minimal Stone Age traces comprising widely scattered/isolated stone artefacts mainly based on jaspilite (banded ironstone) sourced from the banks and terraces of the Orange/Gariep River.

Many of the stone artefacts found were based on banded ironstone, some on quartzite, the former most likely sourced from the Orange River gravels to the south; no tillites occur in the study area.

There appear to be none of the features such as hills or rocky features (such as Spitskop north of Upington) which in other parts of this landscape provide shelters with traces of precolonial Stone Age occupation/activity.

No shelters occur. Rock outcrops provide for temporary water pools after rain but any increased activity around these features in the Upington Solar Thermal Plant Three is not reflected in increased stone tool densities.

Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places may be difficult to recover owing to the sparse population. It is not thought likely that any significant intangible heritage values would be attached to the particular terrain in question.

Recovery of stories and intangible heritage on this landscape would be difficult in the absence of residual long-term inhabitants.

Apart from the remains of a tungsten mine, noted above, there appear not to be colonial era built environment features in the areas of proposed Upington Solar Thermal Plant Three development.

Several features of the tungsten mine were noted including ruins, an explosives magazine and, for the most part, trenches, pits and debris heaps associated with prospecting/mining.

## 4. Characterising the significance of impacts

The following criteria are used in this Environmental Impact Assessment to characterise the significance of direct, indirect and cumulative impacts (Savannah Environmental (Pty) Ltd):

» The **nature**, which shall include a description of what causes the effect, what will be affected, and how it will be affected.

» The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional:

  * local extending only as far as the development site area – assigned a score of 1;
  * limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
  * will have an impact on the region – assigned a score of 3;

- will have an impact on a national scale – assigned a score of 4; or
- will have an impact across international borders – assigned a score of 5.

» The **duration**, wherein it will be indicated whether:

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5.

» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:

- 0 is small and will have no effect on the environment;
- 2 is minor and will not result in an impact on processes;
- 4 is low and will cause a slight impact on processes;
- 6 is moderate and will result in processes continuing but in a modified way;
- 8 is high (processes are altered to the extent that they temporarily cease); and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:

- Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
- Assigned a score of 2 is improbable (some possibility, but low likelihood);
- Assigned a score of 3 is probable (distinct possibility);
- Assigned a score of 4 is highly probable (most likely); and
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).

» the **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

The **significance** is determined by combining the criteria in the following formula:

**S= (E+D+M) P**; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),

» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

***Impact table summarising the significance of impacts (with and without mitigation): applicable for the development footprint for the Upington Solar Three project***

| ***Nature:*** Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected). | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | n/a |
| ***Duration*** | 5 | n/a |
| ***Magnitude*** | 2 | n/a |
| ***Probability*** | 2 | n/a |
| ***Significance*** | **16 (Low)** | **n/a** |
| ***Status (positive or negative)*** | | n/a |
| ***Reversibility*** | No | n/a |
| ***Irreplaceable loss of resources?*** | Yes, where present – but occurrence is generally extremely low density and of low significance. | n/a |
| ***Can impacts be mitigated?*** | Yes – but not considered necessary. | n/a |
| ***Mitigation:***: Artefact densities are low over the three development footprint areas that were investigated. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the figures given in the "Without mitigation" column err on the side of caution. Even so, the criteria for significance indicated in this matrix give a Low significance weighting (<30 points). Mitigation measures are not considered necessary. | | |
| ***Cumulative impacts:*** Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events. | | |

***Residual Impacts:*** *-*

**MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME**

OBJECTIVE: Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility.

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| **Project component/s** | Any road or other linear construction over and above what is necessary and any spatial extension of other components addressed in this EIA. |
| **Potential Impact** | The potential impact if this objective is not met is that wider areas or extended linear developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects from their current context on the site. |
| **Activity/risk source** | Activities which could impact on achieving this objective include deviation from the planned lay-out of infrastructure without taking heritage impacts into consideration. |
| **Mitigation: Target/Objective** | Mitigation measures are not considered necessary. However, a facility environmental management plan must take cognizance of heritage resources in the event of any future extensions of any infrastructure. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Provision for on-going heritage monitoring in a facility environmental management programme which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of development or operation. | Environmental management provider with on-going monitoring role set up by the developer. | Environmental management plan to be in place before commencement of development. |

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| **Performance Indicator** | Inclusion of further heritage impact consideration in any future extension of infrastructural elements.<br>Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility. |
| **Monitoring** | Officials from relevant heritage authorities (National and Provincial) to be permitted to inspect the operation at any time in relation to the heritage component of the management plan. |

## 5 Conclusion

The manner in which archaeological and other heritage traces might be affected by the proposed Upington Solar Thermal Plant Three has been assessed in this HIA report. In summary, it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any heritage material, object or value (as indicated in the National Heritage Resources Act (No 25 of 1999). The most obvious impact in this case would be land surface disturbance associated with infrastructure construction.

In conclusion, as far as archaeological and cultural heritage is concerned, it is recommended that the project in the proposed Upington Solar Thermal Plant Three development footprint area may proceed with no specific recommendations for mitigation deemed necessary at this point. The management programme for the development should make provision for monitoring (by environmental compliance personnel) in case of accidental disturbance of previously undetected heritage features. In the event of any archaeological deposits or features (such as a grave or an ostrich eggshell cache) being encountered, relevant personnel should halt work and notify SAHRA immediately (Tel: 021 462 4502. Fax: 021 462 4509; 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000) to allow for investigation and possible mitigation.

## References


Beaumont, P. B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.). *Einiqualand: studies of the Orange River frontier*, Cape Town: UCT Press.

Deacon, J. nd. Archaeological Impact Assessment - specialist input to planning and design. Unpublished notes compiled for the National Monuments Council.

Masson, J.R. 1995. A fragment of colonial history: the killing of Jacob Marengo. *Journal of Southern African Studies* 21:247-256.

Morris, D. 2000. Gamsberg Zinc Project environmental impact assessment specialist report: archaeology.

Morris, D. 2002. Archaeological inspection of site for vineyard development at Keboes on the Orange River opposite Kanoneiland, Northern Cape. Unpublished report.

Morris, D. 2005. Reports on a Phase 1 Archaeological Assessments of proposed salt mining areas on the Eenbeker Pan, Opstaan Pan and Goeboe Goeboe Pan north of Upington, Northern Cape.

Morris, D. 2006. Report on a Phase 1 Archaeological Assessment of proposed salt Works areas on the Eenzaamheid Pan north of Upington, Northern Cape.

Morris, D. 2010. Upington Solar Therman Plant: Archaeology: Specialist Input for the Environmental Impact Assessment Phase and Environmental Management Plan for the proposed Upington Solar Thermal Plant, Northern Cape Province.

Morris, D. 2011. Heritage assessment of the proposed PV solar park near Keimoes, Northern Cape.

Morris, D. 2012. Upington solar thermal plant: archaeological study of the site McTaggarts Camp.

Morris, D. 2013. Proposed development of the Upington Solar Thermal Plants Two and Three within Portion 3 of the Farm McTaggarts Camp 435, west of Upington, Northern Cape: Scoping phase heritage input.

Morris, D. 2014. RE Capital 3 Solar Development on the property Dyasons Klip west of Upington, Northern Cape: Archaeological Impact Assessment – proposed 'central' development footprint.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. *South African Archaeological Bulletin* 46:115-124.

Morris, D. & Seliane, M. 2006. Report on a Phase 1 Archaeological Assessment of the site of a proposed Shopping Mall, Erf 19981, Van Riebeeck Street, Upington, Northern Cape.

Parsons, I. 2003. Lithic Expressions of Later Stone Age Lifeways in the Northern Cape *South African Archaeological Bulletin* 58:33-37.

Penn, N. 2005. *The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century*. Athens, Ohio and Cape Town: Ohio University Press and Double Storey Books.

Robinson, A.M.L. (ed) 1978. *Selected articles from the Cape Monthly Magazine NS, 1870-1876*. Cape Town: Van Riebeeck Series Second Series No 9.

Sampson, C. G. 1974. *The Stone Age archaeology of South Africa*. New York: Academic Press.

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In A. B. Smith (ed.). *Einiqualand: studies of the Orange River frontier*, Cape Town: UCT Press.

Van Vreeden, B.F. 1961. Die oorsprong en geskiedenis van plekname in Noord-Kaapland en die aangrensende gebiede. University of the Witwatersrand.

Whitelaw, G. 1997. Archaeological monuments in KwaZulu-Natal: a procedure for the identification of value. Natal Museum Journal of Humanities. 9:99-109.