McGregor Museum
Department of Archaeology

UPINGTON SOLAR THERMAL PLANT

Archaeology

Specialist Input for the Environmental Impact Assessment Phase and Environmental Management Plan for the proposed Upington Solar Thermal Plant, Northern Cape Province

David Morris
September 2010

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SPECIALIST INPUT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED UPINGTON SOLAR THERMAL PLANT, NORTHERN CAPE PROVINCE

ARCHAEOLOGY

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1. INTRODUCTION

A scoping phase evaluation of the full site on the Farm McTaggarts Camp 453, portion 3, which is located approximately 20 km south west of Upington in the Southern Kalahari, Northern Cape, narrowed the choice of site for the proposed development to a development footprint of approximately 6 km^2 in the south eastern portion of the site within the broader site of 22 km^2. The development footprint is the area which will be disturbed during the operational phase.

1.1 Focus and Content of Specialist Report: Archaeology

The archaeology specialist study (commissioned by Savannah Environmental (Pty) Ltd), is focused on the development footprint of the proposed facility and its ancillary infrastructure including steam turbine and generator, generator transformer and substation, overhead power lines, water supply line to the facility and an abstraction point on the Gariep / Orange River, water storage / treatment reservoirs, an evaporation pond, workshops, storage areas and access roads.

This specialist study is a stand-alone report (as per the EIA Regulations) and incorporates the following information:

» Introduction to the Specialist in terms of qualifications, accreditation and experience to undertake the study (1.2, below)
» Description of the affected environment (2)
» Description of heritage features of the region (2.1)
» Description of issues identified during the Scoping process (2.2)
» Methodology of determining the significance of the impacts and assumptions as well as scoping phase predictions (3)
» Observations and Assessment of impacts, including a summary in tabular format (4)

» Comparative assessment of alternatives (4.3.2)
» Recommended measures for draft Environmental Management Plan and site-specific mitigation (5)
» Conclusions (6)

1.2 Archaeology Specialist

The author of this report is a qualified archaeologist (MA cum laude, PhD candidate, 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 (Morris 2002, 2005, 2006; Morris & Beaumont 1991; Morris & Seliane 2006).

The author is independent of the organisation 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, therefore making any surface archaeological traces highly visible.

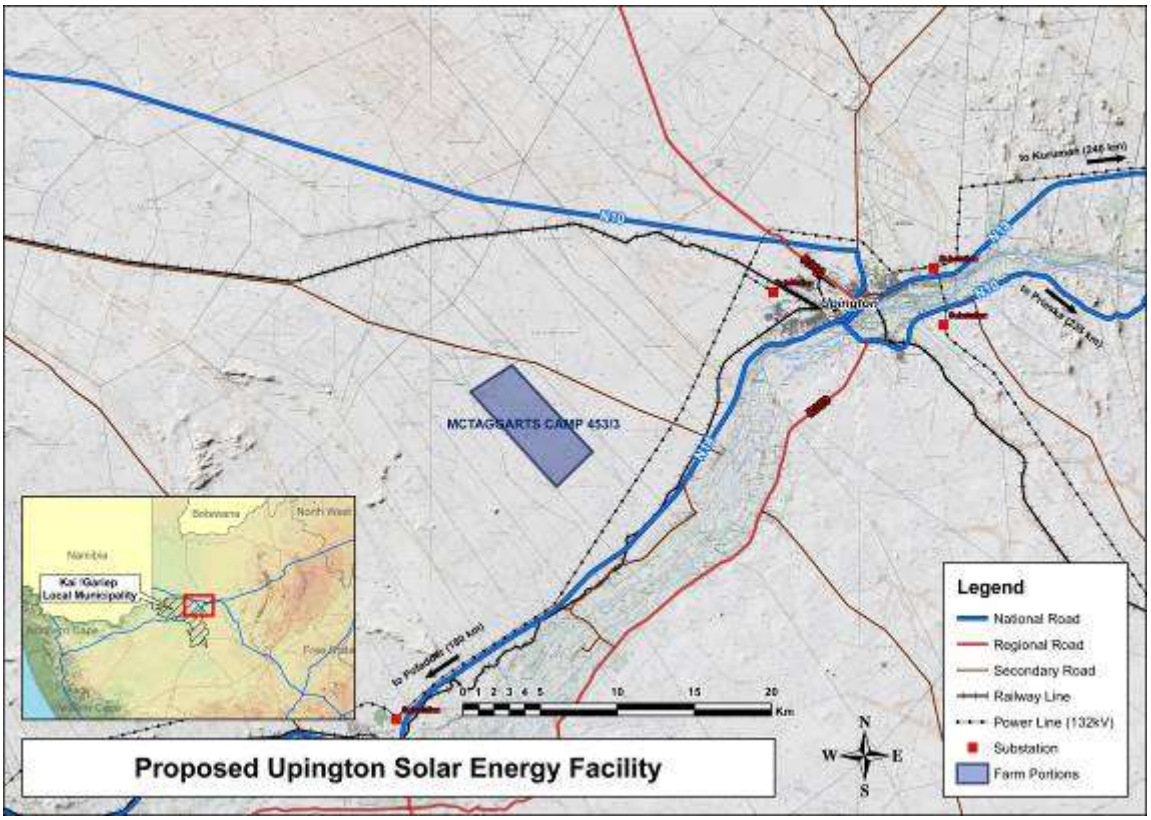


Figure 1: The location of the site identified for the proposed Solar Thermal Plant, located south west of Upington and north-west of the Gariep (Orange) River in the Northern Cape.

2.1 Description of heritage features of the region

No previous archaeological survey work had been carried out in the vicinity of the farm McTaggarts Camp 453. The scoping report therefore referred to heritage features of the broader region as background to the Environmental Impact Assessment Phase.

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 the fact that Captain McTaggart set up his military camp here during the Koranna War of 1879-1880 (Van Vreeden 1961:431). It is not known exactly where this encampment was on the property and it is questionable whether its ephemeral nature would have left any material 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 located about 100 km north-west of Upington.

Tungsten mining took place at the north western-most portion of the McTaggarts Camp property in the 1930's. Because the traces of previous mining, including an old explosives magazine, are greater than 60 years old they could be considered as themselves potentially conservation-worthy.

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 pre-colonial 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.

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.

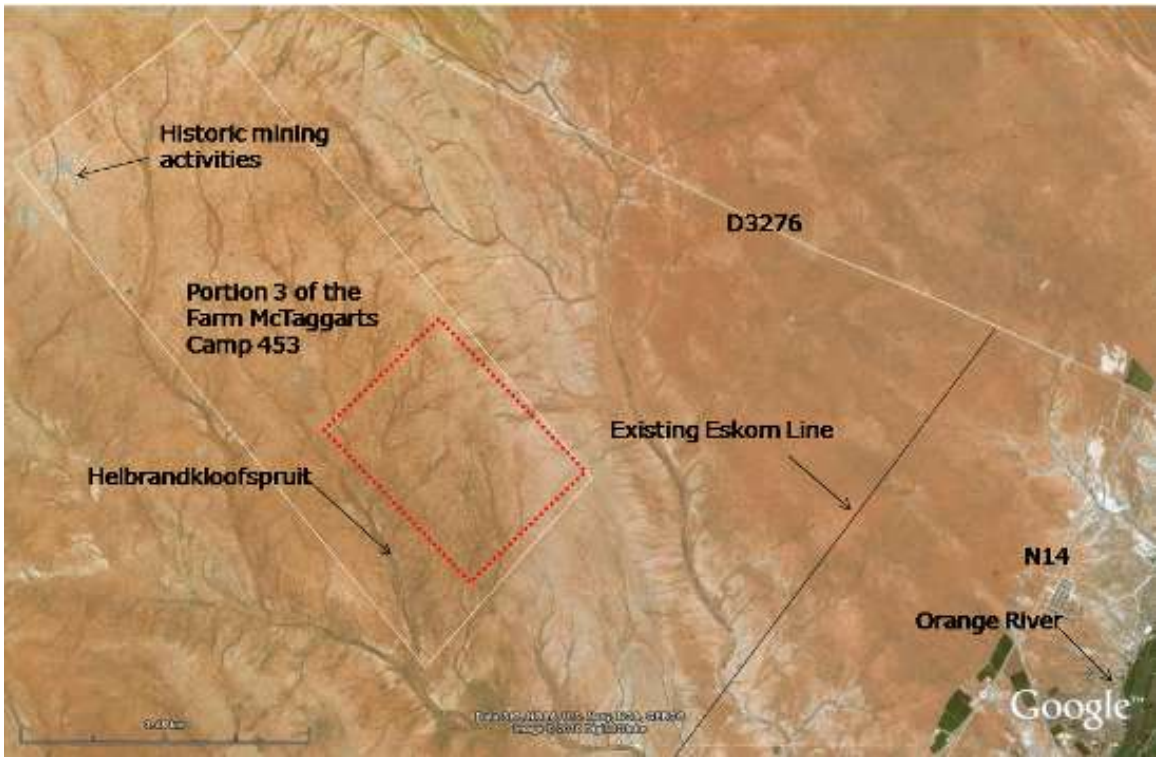


Figure 2: The sparsely vegetated drainage plain, otherwise largely featureless is apparent in this Google Earth image, with property boundary and key features indicated. The red dotted line shows the proposed development footprint in the south eastern part of the property.

2.2 Description and evaluation of environmental issues and potential impacts identified in the scoping phase

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 Upington Solar Thermal Plant itself; the proposed substation; the power lines, water supply 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 Plan should seek to minimise 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). The water pipeline could traverse more sensitive terrain, i.e. affecting a potentially greater density of archaeological sites.

2.2.2 Other issues identified during the scoping process – choice of the south eastern portion of site as preferred development locale

Considering areas of potential sensitivity identified on the site during the scoping phase, the south eastern portion of the site has been identified as the preferred area for the proposed solar thermal plant development on Portion 3 of the Farm McTaggarts Camp 453.

The following points (with additional remarks) have been made in this respect (Savannah Environmental, 2010):

» *Areas along natural drainage lines – water resources and ecology:* Various considerations summarised in the Scoping Report prepared by Savannah

Environmental have suggested that the development footprint not be directly on or near the main drainage channels (e.g. the Helbrandkloofspruit); that, rather, the development footprint be located in the south eastern portion of the proposed site. (To the extent that archaeological traces may tend to be more prevalent near to the more significant water courses, this scoping phase recommendation is endorsed from a heritage perspective).

» *Areas of increased gradient/slope:* Development of such areas could result in erosion and increased potential for storm water runoff. (This would have a potential negative impact on any archaeological/heritage resources where present).

» *Potential occurrence of populations of Red List organisms:* This includes flora and fauna, and protected trees that have been evaluated as having a high chance of occurring within remaining natural habitats within the study area. (Richer habitats would have been magnets for past human activity).

» *Areas previously disturbed through mining activities and potential heritage sites:* While the area previously disturbed through mining activities in the 1930s would be least sensitive in terms of ecological conservation value, those areas in the northern portion of the site degraded from previous mining activities on site could present a stability risk to the development. In addition, the heritage value/quality of the previous activities, being greater than 60 years old, could preclude these areas from future development.

Favourable aspects of the preferred locale in the south eastern part of McTaggarts Camp include:

» *Avoidance of key drainage lines*
» *Lower elevation*
» *Proximity to the extraction point on the Orange (Gariep) River*, minimising length of water supply pipeline, in turn reducing potential for resource (including heritage resource) disturbance by the pipeline.
» *Proximity to the grid connection point,* minimising the length of power line linking the proposed facility with the existing Eskom distribution line, in turn reducing the potential for linear disturbance associated with the power line.
» *Proximity to the N14 National Road for access,* minimising the length of access road and hence reducing the potential for linear disturbance of any heritage resources present.

3. METHODOLOGY

A site visit was necessary to inspect various parts of the terrain on foot, focusing on areas of expected impact (construction of solar plant, power island, and secondary infrastructure such as roads, pipelines, and power lines). Heritage traces would be evaluated in terms of their archaeological significance (see tables below). A set of Scoping phase predictions were made which the study would test with observations made in the field.

3.1 Assumptions and limitations

It was assumed that, largely 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). It was not considered necessary to conduct excavations as part of the EIA to establish the potential of sub-surface archaeology.

A proviso is routinely given, 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 (i.e. cease work, report to heritage authority).

With regard to fossils, a preliminary assessment of the likelihood fossils occurring in this area has been provided by a palaeontologist.

3.2 Scoping phase predictions

During the Scoping phase it was predicted that:

» Based on previous experience in the area, the terrain on which the 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.
» There appear to be none of the features such as hills or rocky features which in other parts of this landscape provide shelters with traces of pre-colonial 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.

3.3 Potentially significant impacts to be assessed in the EIA process

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 Bošwa ya 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 substation, 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). The impact of a 'twee-spoor' could be far greater on Iron Age sites in other parts of South Africa, where stone walling might need to be breached.

3.4 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	**Archaeological traces**	**Type 1**	**Type 2**	**Type 3**
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
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 Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context 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

4. OBSERVATIONS AND ASSESSMENT OF IMPACTS

The manner in which archaeological and other heritage traces or values might be affected by the proposed development may be summed up in the following terms: 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, any archaeological material or object (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.

4.1 Fieldwork observations

The proposed development footprint area and ancillary infrastructure locales were visited on 26 September 2010. In summary the findings can be reported in relation to predictions made in the scoping report (see 3.2 above):

4.1.1 Richness of archaeological traces:

That the development footprint is likely not to be rich in archaeological traces of major significance.

This was found to be the case. As a rule, over almost all the primary development footprint site and along the two alternative powerline and access road routes and the water pipeline route, stone artefacts (by far the predominant heritage resource noted) were found to occur in extremely low densities of less than 1 per 10 x 10 m area. Closer to the Orange River, along the water pipeline route and in the vicinity of the settlement reservoir approximately 0.6 km from the Orange River, however, artefact densities are greater. Here up to a maximum of 1 or 2 artefacts per square metre were found, widely distributed, i.e. low density and not easily construed in any instance as a readily definable "site". Typologically, artefacts noted generally had features such as facetted butts, characteristic of the Middle Stone Age. No scatters were seen that included ostrich eggshell pieces, which often co-occur with stone tools of the Later Stone Age in this region.

Figure 3: Two isolated flakes found in an area about 20 x 20 m within development footprint for the proposed Solar Thermal Plant.

4.1.2 Raw material availability:

That, 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.

Dwyka tillite was not in evidence in the areas investigated and, as predicted, Stone Age archaeological traces are sparse. The raw materials used for stone tool manufacture are exotic to the local environment, carried in by Stone Age people and consisting predominantly of jaspilite (banded ironstone) derived from the gravels along the Orange River. It seems possible that the extremely dispersed individual artefacts reflect opportunistic off-site flaking from nodules of favoured raw materials by hunter-gatherers during foraging excursions over long periods.

Figure 4: The landscape setting of the development footprint, featureless with shallow soil profile and minimal vegetation

4.1.3 Landscape features:

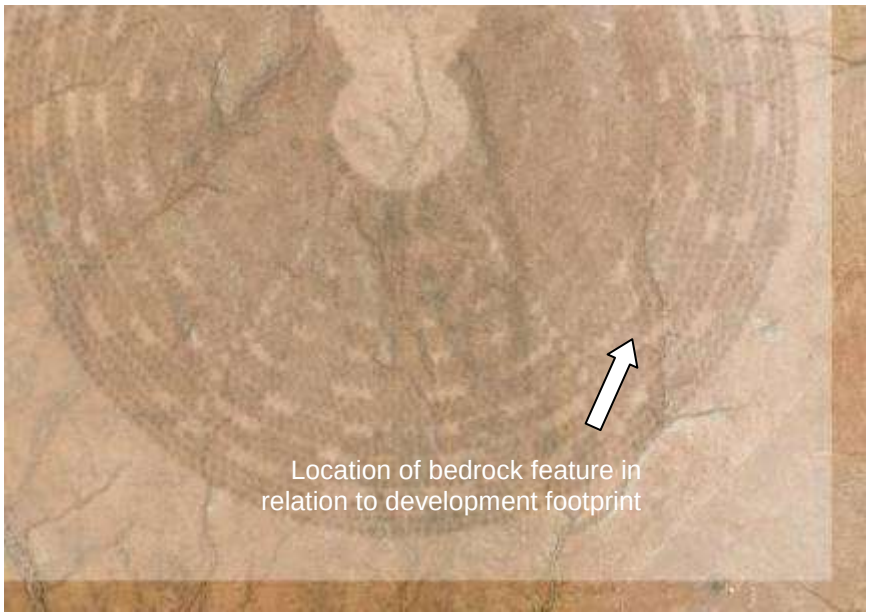
That there appear to be none of the features such as hills or rocky features which in other parts of this landscape provide shelters with traces of pre-colonial Stone Age occupation/activity.

The relatively featureless landscape provides few of the kinds of landscape nodes that typically contain sites elsewhere in the region.

The dry watercourses constitute one exception, although artefact densities were not noticeably greater in areas examined along watercourses.

One other exception noted, where artefact density was markedly greater, was at a low rocky outcrop, where water evidently collects after rains, at 28.54109° S 21.08842 ° E (refer to figures below). Here there were up to 3 or 4 artefacts per m^2 with a greater variety of raw materials, predominantly banded ironstone but also quartzite and quartz. The artefacts can be characterised as Middle Stone Age. No ostrich eggshell pieces were noted. Bedrock grinding grooves sometimes found at such exposures in Bushmanland, south of the Orange River, and usually also associated with herder pottery, were also not seen.

Figure 5: Bedrock outcrop with higher density of artefacts based on banded ironstone as well as other raw materials, all exotic to the local environment.



4.1.4 Intangible heritage values:

That 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 current intangible heritage values would be attached to the particular terrain in question.

Extremely sparse population and very limited material evidence of human activity even of the recent pre-colonial past together suggest that there are not likely to be any significant current intangible heritage values attached to the primary footprint development site on McTaggarts Camp.

4.2 Characterising the archaeological significance (Refer to 3.4 above)

In terms of the significance matrices in Tables 1 and 2 under 3.4 above, most of the archaeological observations fall under Landforms L1 and L3 Type 1 with some L1 Type 2 settings and L3 Type 3 adjacent to the river. In terms of archaeological traces they all fall under Class A3 Type 1. All of these ascriptions (Table 1) reflect poor contexts and likely low significance for these criteria.

For site attribute and value assessment (Table 2), all of the observations noted fall under Type 1 for Classes 1-7, again reflecting low significance, low potential and absence of contextual and key types of evidence.

On archaeological grounds, therefore, the occurrences can be said to be of low significance.

4.3 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:

» 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).

4.3.1 Impact table summarising the significance of impacts (with and without mitigation)

The following table considers the development footprint of the proposed facility with its ancillary infrastructure.

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	1
Duration	5	5
Magnitude	6	4
Probability	4	3
Significance	**48**	**30**
Status (positive or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources	Yes – but the archaeological resources are not of major significance	
Can impacts be mitigated	Yes – but not considered necessary in most instances	See above.
Mitigation: Artefact densities are low over most of the development footprint, so much so that mitigation measures are not considered necessary in most instances. Although the criteria for significance given in this matrix give a Medium significance weighting (unlike biological processes, heritage destruction generally has a once-off permanent impact), it has been shown that the archaeological significance of the materials observed may regarded as low. As indicated above (in this table), it would be worth carrying out a surface collection and record of the site at 28.54109° S 21.08842 ° E, which falls at the edge of the proposed main development footprint, and this could arguably reduce the		

'magnitude' and the 'probability' criteria referred to above.
Cumulative impacts: The impacts are once-off permanent destructive events.

4.3.2 Comparative assessment of alternatives

The very low density of isolated stone artefacts across the various development areas provides no clear pointers for preferring one or another of the alternative routes for the powerline or the external access road. It is recommended that in each case the preferred shorter routes be selected in that they would result in a lower loss or disturbance of the, albeit, low density artefact occurrences.

5. MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

OBJECTIVE: Limit 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 facilityto.

Project component/s	Any road construction over and above what is necessary and any extension of other components addressed in this EIA.
Potential Impact	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 potential impact 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 road/s and infrastructure without taking heritage impacts into consideration.
Mitigation: Target/Objective	• A facility environmental management plan that takes cognisance of heritage resources in the event of any future extensions of roads or other infrastructure. • The impact assessment set out in 4.3.1 provides a recommendation that a surface collection and characterisation of the archaeological site at 28.54109° S 21.08842 ° E be carried out. The work associated with this task should be achievable within a period of not more than two days.

Mitigation: Action/control	Responsibility	Timeframe
Provision for on-going heritage monitoring in a facility environmental management	Environmental management	Environmental management plan to be in

plan 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. Phase 2 (mitigation) surface collection and characterisation of the archaeological site at 28.54109° S 21.08842 ° E as a salvage operation ahead of the development of the facility.	provider with on-going monitoring role set up by the developer. An accredited archaeologist, in terms of a permit issued by SAHRA.	place before commencement of development. It is anticipated that this task could be completed in no more than two days, and this should take place before development of the facility commences.

Performance Indicator	• A report describing the completion of the Phase 2 mitigation work described above • Inclusion of further heritage impact consideration in any future extension of infrastructural elements • 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.

6. CONCLUSIONS

Very sparse heritage traces were found during the EIA Phase of this study and these have proven to be consistent with predictions made during the Scoping Phase.

From an archaeological perspective the observed heritage resources may be regarded as being of generally low significance. Criteria used here for impact significance assessment rate the impacts as medium (mainly because for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

It has been recommended that destruction of one site of greater note in a setting of otherwise generally extremely low density should be mitigated by way of a Phase 2 surface collection.

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