

**McGregor Museum
Department of Archaeology**



**KHOBAB WIND ENERGY FACILITY:
POWER LINE ROUTE OPTIONS, ACCESS ROAD AND SUBSTATION POSITIONS**

**SPECIALIST INPUT FOR THE ENVIRONMENTAL BASIC ASSESSMENT AND
ENVIRONMENTAL MANAGEMENT PROGRAMME FOR PROPOSED POWER LINE
OPTIONS FOR THE LOERIESFONTEIN 1 WIND & LOERIESFONTEIN 3 SOLAR
ENERGY FACILITY AT SOUS AND AAN DE KAREE DOORN PAN, NORTH OF
LOERIESFONTEIN, NORTHERN CAPE PROVINCE**

ARCHAEOLOGY

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January 2013

**SPECIALIST INPUT FOR THE ENVIRONMENTAL BASIC ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAM FOR THE KHOBAB WIND ENERGY FACILITY:
POWER LINE ROUTE OPTIONS, ACCESS ROAD AND SUBSTATION POSITIONS**

**SPECIALIST INPUT FOR THE ENVIRONMENTAL BASIC ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR PROPOSED RE ALIGNMENTS OF POWER LINES FROM THE LOERIESFONTEIN 1 WIND & LOERIESFONTEIN 3 SOLAR ENERGY FACILITIES AT SOUS AND AAN DE KAREE DOORN PAN, NORTH OF LOERIESFONTEIN, NORTHERN CAPE PROVINCE
ARCHAEOLOGY**

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1. INTRODUCTION

The author was approached by Savannah Environmental (Taryn Bigwood: Savannah Environmental (Pty) Ltd, Tel: 27 11 656 3237, Fax: 086 684 0547, Email: taryn@savannahsa.com, Postal address: P O Box 148 Sunninghill 2157) to assess the routes of proposed:

1. Construction of a new 132kV Substation and associated infrastructure within the Loeries 4 Wind Energy Facility, Northern Cape Province;
2. Construction of a new 132kV power line from the Loeries 4 Wind Energy Facility, on site substation, to the Helios Substation, Northern Cape;
3. Re-alignment of the authorised power line from Loeries 3 Solar Energy Facility to the Helios Substation
4. Re-alignment of the authorised power line from Loeries 1 Wind Energy Facility to the Helios Substation

On the farms Sous RE/226, Sous 3/226, , Aan de Karee Doorn Pan 1/213 and Aan de Karee Doorn Pan 2/213, north of Loeriesfontein in the Northern Cape Province.

A previous report (J.A. van Schalkwyk 2011) assessed impacts of the proposed wind farm and solar energy facility itself on the archaeology and heritage of the area.

This report also evaluates alternative sites for the proposed Khobab Substation and ancillary infrastructure including access road on Sous RE/226.

1.1 Focus and Content of Specialist Report: Archaeology

The archaeology specialist study focuses on the routes of proposed power line options and alternative sites for a substation for the proposed solar energy facility. This specialist study is a stand-alone report (as per the EIA Regulations) and incorporates the following information:

- » Introduction (1)
 - Focus and content of report (1.1)
 - Archaeology specialist (1.2)
- » Description of the affected environment (2)
 - Heritage features of the area (2.1)
 - Description and evaluation of environmental issues and potential impacts (2.2)
- » Methodology (3)
 - Assumptions and limitations (3.1)
 - Potentially significant impacts to be assessed (3.2)
 - Description and evaluation of environmental issues (3.3)
 - Determining archaeological significance (3.4)
- » Observations and assessment of impacts (4)
 - Fieldwork observations (4.1)
 - Characterising the archaeological significance (4.2)
 - Characterising the significance of impacts including a summary in tabular format together with Measures for inclusion in the draft EMP (4.3)
- » Conclusions (5)
- » References (6)

1.2 Archaeology Specialist

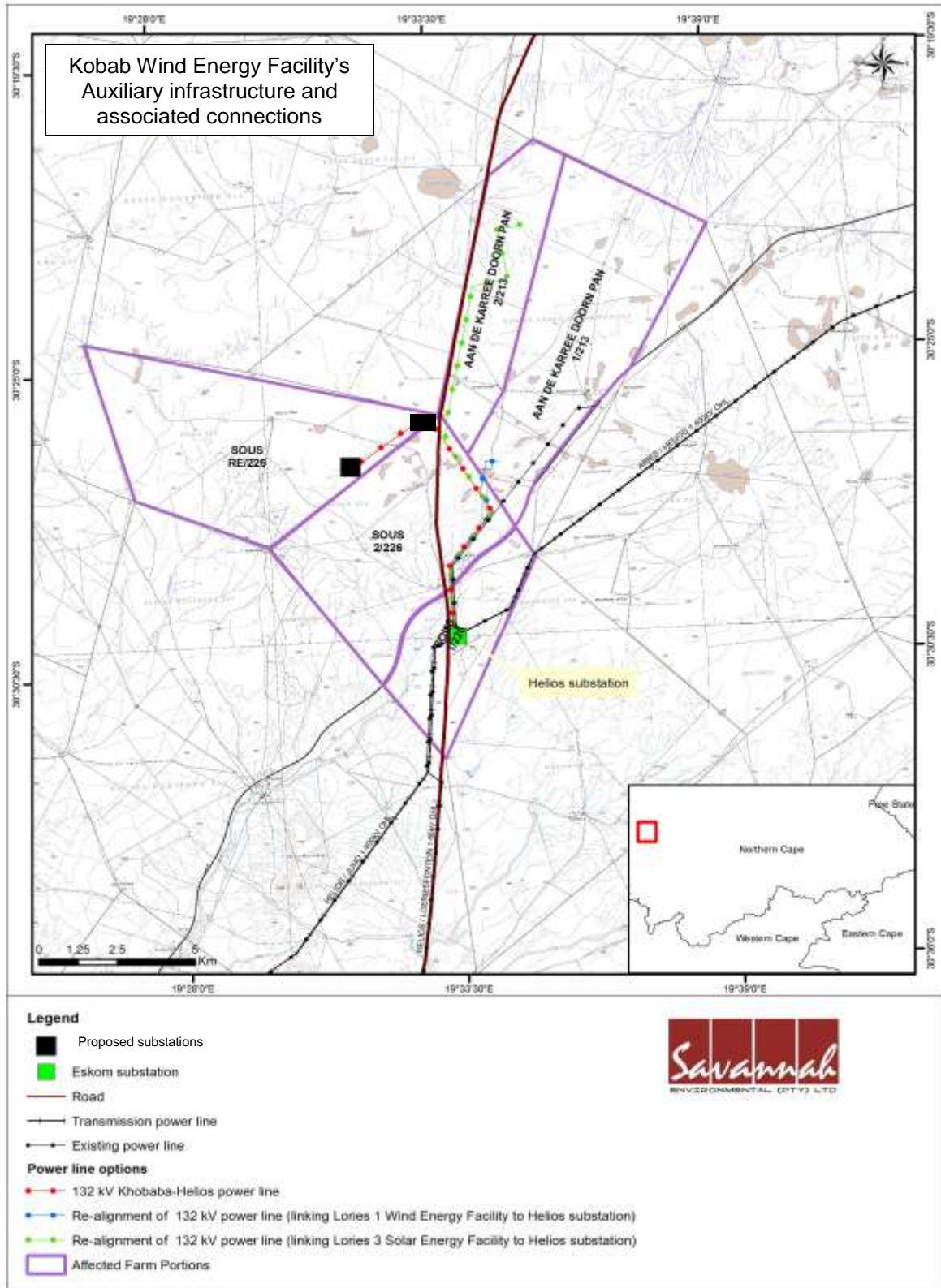
The author of this report is an archaeologist accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists, having previously carried out surveys and fieldwork on sites in the Northern Cape including the Karoo (e.g. Morris 1988; Beaumont & Morris 1990; Morris & Beaumont 2004; Parkington *et al.* 2008).

The author works independently of the organisation commissioning this specialist input, and I provide these preliminary scoping observations 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 a western Karoo landscape north of Loeriesfontein, currently utilized for livestock farming. The landscape comprises relatively flat or gently undulating terrain with shallow soil and shale exposures subject to considerable sheet erosion (highly evident at the time of the site visit following heavy mid-December rains and road wash-aways). Succulent Karoo vegetation is sparse so that archaeological traces, likely to be at the surface in this erosional context, are likely to be highly visible.



Location of proposed Loeriesfontein solar energy facility north of Loeriesfontein, Northern Cape (source: Savannah Environmental).

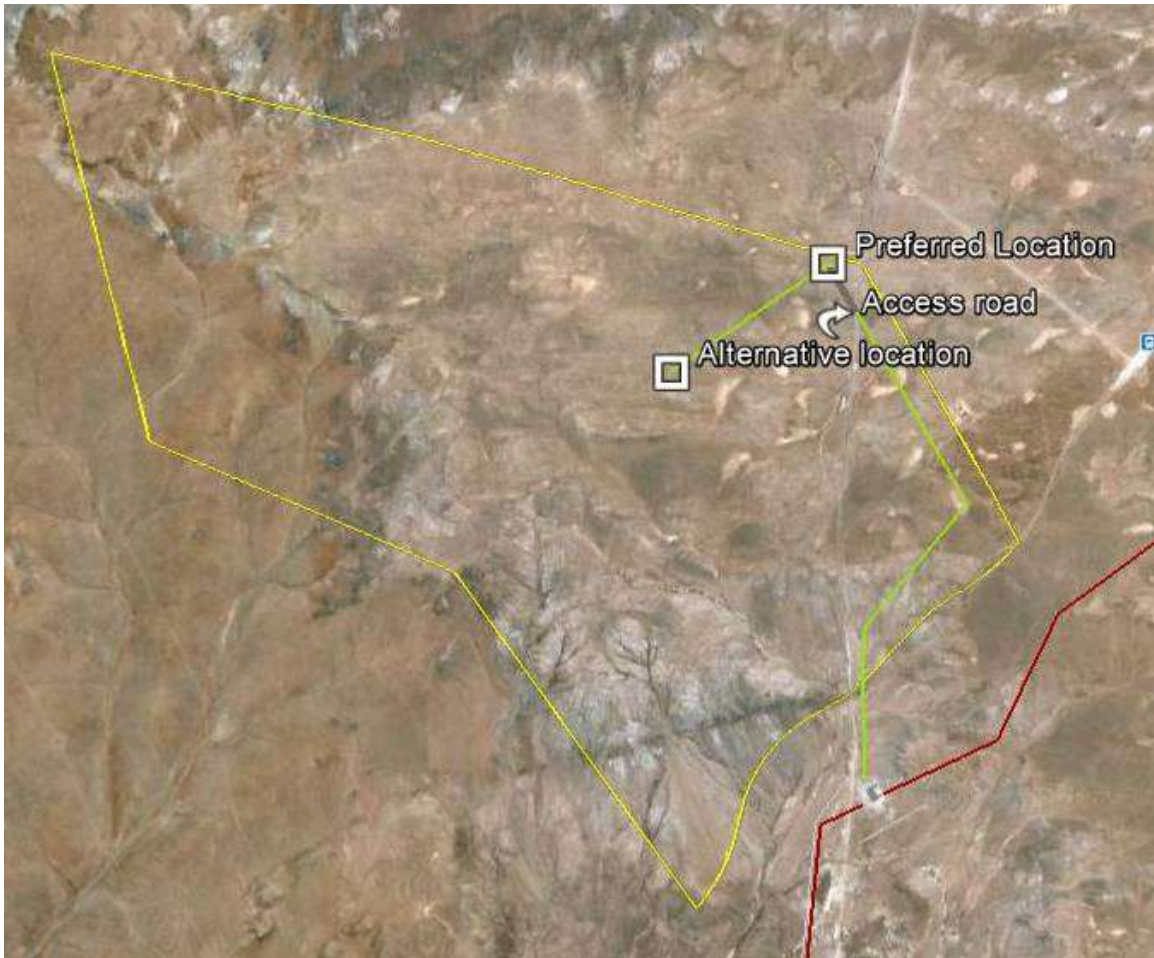


Much erosion in lower-lying areas (above) following storms with swift run-off from sparsely vegetated higher ground (below).





Google Earth image showing the power line options relative to solar energy development footprints.



Property Sous (yellow outline) with alternative locations for the proposed Khobab substation.

2.1. Heritage features of the area

A previous survey of the specific area of the proposed wind and solar energy facility was carried out by van Schalkwyk (2011), who identified a small number of low density surface Middle Stone Age sites. None of these was situated along or close to the proposed power lines which are the subject of the present survey. In the wider region, van der Walt (2012) examined the proposed site for the Hantam PV Solar Energy Facility on the farm Naronsies 228, immediately south east of Sous, finding no sites of heritage significance. A similar paucity of sites is reported by Morris (2007) examining borrow pit sites in the region along the Sishen-Saldanha railway.

In marked contrast to these observations on the relatively featureless, eroded plains north of Loeriesfontein, a wealth of Later Stone Age sites has been recorded on dunes on the fringes of large pans in the wider vicinity, e.g. at Klawer Vlei (farms Commissioners Vley, T'Boop and Tafel Kop – Beaumont & Morris 1985), and at

Waterkuil (Morris 1996) where lithics, ceramics and ostrich eggshell container fragments are densely scattered at numerous sites. E.J. Dunn (1873) described artefacts from Klawervlei in the 1870s, also having met /Xam people still making stone tools in the area. He remarked upon "the enormous quantities of broken eggshells (ostrich) [which] create astonishment, and convey some rough idea of the numbers of Bushmen and the length of time they must have lived in this neighbourhood".

It is clear from previous surveys in the area that the distribution of sites may be highly structured relative to resources, principally water (Beaumont *et al.* 1995). On the basis of previous work, it was not expected that many sites would be encountered in the particular environment subject to the present assessment.

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. Linear, and (in the case of the substation site) area, developments such as those envisaged can have a permanent destructive impact on such resources. The objective of an EIA would be to assess the sensitivity of heritage resources where present to assess the significance of potential impacts on them and to recommend no-go areas and measures to mitigate or manage said impacts.

Area impacts are possible in the case of the Loeriesfontein solar energy facility substation site, with the power line and access road options representing 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.

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 an access road (10 m wide) would tend to be far more destructive (modification of the landscape surface would be within a continuous strip). Sampson compares such destruction to the pulling out of a thread from an ancient tapestry.

3. METHODOLOGY

The EIA phase assessment was carried out by way of a site visit on 28 December 2012, to inspect the terrain on foot, focusing on areas of expected impact. Heritage traces, where present, are evaluated in terms of their archaeological significance (see tables below).

3.1 Assumptions and limitations

It was assumed that, by and large in this landscape, with its sparse vegetation and minimal soil, a good sense of the archaeological traces to be found would be readily apparent from surface observations. Where the landscape is veneered by deeper sediments, as may be possible in places, it is likely that subsurface occurrences, particularly of Pleistocene age stone artefacts, if present, would be masked. In such locales erosion features afford opportunities to evaluate the potential for material below the present surface.

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 (cease work, report to heritage authority).

This report does not address the palaeontological aspects, if any, at the site.

3.2 Potentially significant impacts to be assessed in the EIA process

It was anticipated that topographic features such as higher ground, the foot of any of the low hills, or along dry watercourses/edges of depressions could be locales where sites might occur. In general, however, the landscape proves to be fairly uniform and lacking in features that might have focused past human activity (unlike the dunes at the fringes of the larger pans in the vicinity of the nearby Klawervlei and Waterkuil). No dolerite exposures occur and hence the likelihood of rock engravings occurring is virtually zero (such sites occur at Varkans 63 km east of Sous – Deacon 1988).

Colonial era heritage features have been documented by van Schalkwyk (2011), with none occurring along any of the proposed power line options.

3.3 Description and evaluation of environmental issues and potential impacts

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 of high significance 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, erection of a pylon, or preparation of a site for a plant, substation, 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 activities have a generally lower impact than others. Sampson (1985) has shown that power lines in particular 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 may potentially be of high archaeological significance (e.g. in the event that a grave exists at such a site, or an engraving). The impact of a 'twee-spoor' could be far greater on colonial era sites, or, elsewhere in South Africa, on Iron Age sites, where features such as stone walling could be damaged if conservation/mitigation measures are not implemented.

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	Known early settlement, but buildings have	Buildings without extensive basements over

Class	Landform	Type 1	Type 2	Type 3
		settlement	basements	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
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 power line routes, access road and alternative substation development footprint areas were visited on 28 December 2012. In summary the findings can be reported in relation to predictions made in paragraph 3.2 above:

4.1.1 Occurrences of Stone Age artefacts:

Findings during the walk-through along the proposed 132kV Khobab-Helios power line options and in adjacent areas were consistent with the observations made by van Schalkwyk (2011) and van der Walt (2012): there is a decided paucity of surface traces of Stone Age material. As noted above, this is in striking contrast to earlier observations made on the dunes around the fringes of Klawervlei and Waterkuil some 70 km north east of the Sous area.



Flaked stone in the vicinity of
30.37771° S 19.58042° E

No 'sites' as such were found. A small number of isolated artefacts were noted (e.g. a single hornfels cf. Oakhurst scraper at 30.39238° S 19.57622° E). In a few places isolated pieces of ostrich eggshell were found (30.39481° S 19.57228° E; 30.39390° S 19.57158° E). The evidence of significant sheet erosion and displacement of uprooted plants consequent on heavy thunder storms in the previous week moreover served to suggest that any surface archaeological traces would tend to be in somewhat secondary context.



cf. Oakhurst scraper at
30.39238° S 19.57622° E

In sum, no significant archaeological finds were made. Neither of the proposed substation site alternatives had any heritage traces on them.

4.1.2 Possible engraving occurrences on rock outcrops:

No dolerite exposures similar to those at Varskans, for instance, were found – no suitable topographic features or surfaces exist for rock engravings or paintings.

4.1.3 Colonial era heritage:

No colonial era heritage traces were found along the power line options indicated, with the exception of a dwelling for farm workers currently in use at 30.47565° S 19.56443° E, with a nearby ash-heap.



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, the supporting landforms can be characterised as L3 Type 1. Where any archaeological traces are found they fall under Class A3 Type 1. These Table 1 ascriptions reflect poor contexts.

For site attribute and value assessment (Table 2), none of the observations fall outside of Type 1 for Classes 1 - 7, reflecting low significance, low potential, and absence of contextual and key types of evidence.

None of the archaeological traces noted warrants mitigation.

4.3 Characterising the significance of impacts

The following criteria are used in this EIA to characterise the significance of direct, indirect and cumulative impacts (Jodas 2010):

- » 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) for the Khobab Wind Energy Facility, Loeriesfontein 1 Wind and Loeriesfontein Solar Energy Facilities power line options and alternative sites for the Khobab Substation.

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	Local (1)	Not considered necessary Local (1)
Duration	Permanent (5)	Permanent – if any material disturbed (5)
Magnitude	Minor (2)	Minor (2)
Probability	Very improbable (1)	Very Improbable (1)
Significance	Low (8)	Low (8)
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Not considered necessary	Not considered necessary
Mitigation:		
» Not considered necessary.		
Cumulative Impacts:		
» Where any archaeological contexts occur the impacts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity. Minimal archaeological traces mean that cumulative impacts would be negligible.		
Residual Impacts:		
» Depleted archaeological record – but minimally in this environment.		

MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

OBJECTIVE: To limit primary and secondary impacts on archaeological and cultural heritage materials in the path of powerline and substation infrastructure associated with the development of the planned wind and solar energy facilities.

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 – if and where such objects or resources exist.
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	No mitigation measures are considered necessary. A facility environmental management plan that takes 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 plan which also provides guidelines on what to do in the event of any unexpected heritage feature being encountered during any phase of development or operation. No specific mitigation measures are considered necessary.	Environmental management provider with on-going monitoring role set up by the developer.	To be in place before commencement of the development.

Performance Indicator	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.
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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. CONCLUSIONS

Findings during this survey were consistent with those in previous studies in the vicinity (Morris 2007; van Schalkwyk 2011; van der Walt 2012), indicating a paucity of archaeological traces on arid, highly eroded undulating surfaces and plains which lack features that might have focused past human activity. A contrast is noted between this type of environment and the kinds of settings previously noted around Klawervlei (Beaumont & Morris 1985) and Waterkuil (Morris 1996) in the wider region where Later Stone Age sites on dunes at the fringes of pans are plentiful. No colonial era resources were noted other than a farm-worker dwelling and associated ash-heap near to but not in the path of the proposed power line, near the Sishen-Saldanha ore line.

From an archaeological perspective, the observed heritage resources along the power line routes and at the Substation site are extremely sparse and of minimal significance. No mitigation measures are considered necessary.

Fieldnotes and photographs resulting from this survey are housed at the McGregor Museum in Kimberley.

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