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Department of Archaeology

DAVIDSKRAAL KAROO PV SOLAR ENERGY PROJECT

SPECIALIST INPUT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED DAVIDSKRAAL KAROO PV SOLAR ENERGY PROJECT, NEAR VICTORIA WEST, NORTHERN CAPE PROVINCE

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1. INTRODUCTION

Red Sky Solar (Pty) Ltd has proposed the development of a 12 MW solar power facility at one of two alternative sites on the farm Davidskraal No 116 north east of Victoria West in the Northern Cape (Figure 1). The proposed Davidskraal Karoo Photo Voltaic Solar Power Plant would consist of modules of photovoltaic (PV) solar panels covering a footprint area of approximately 50 – 65 ha. The PV panels would be mounted in concrete pedestals to be cast on top of any outcropping rock or set into the ground. Associated infrastructure entails 'twee spoor' internal access roads, underground or surface cables, a small sub-station and a short, ±250 m long overhead transmission line. Existing gravel farm roads on the property would be upgraded and used to access the site during the construction phase. No new access roads are planned.

The connection to the grid will be via the existing 132 KV power line on Davidskraal No. 116.

Davidskraal is situated about 30 km north east of Victoria West. The proposed site alternatives lie north west of the main Cape to Johannesburg railway, originally constructed in 1884-5 and a major supply line for British forces during the Anglo-Boer War.

SAHRA is likely to request a Phase 1 Archaeological Impact Assessment. The area was visited on 20 February 2012.

1.1 Focus and Content of Specialist Report: Archaeology

The archaeology specialist study is focused on the development footprint options for the proposed solar energy facility and ancillary infrastructure. 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 identified in the scoping phase (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 (PhD) 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).

Under the auspices of Ngwao Boswa ya Kapa Bokone (Heritage Northern Cape) the author has also completed a UCT short course (presented in Kimberley) on heritage: managing the built environment.

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 Karoo landscape north east of Victoria West, currently used for livestock farming. The specific segments of the landscape being investigated comprise relatively flat terrain with dolerite hills in the surrounding landscape. Relatively shallow soil veneers a combination of calcrete, Beaufort Group and dolerite substrates, with relatively sparse vegetation of Karoo scrub and grass. Surface archaeological traces are likely to be highly visible in such contexts. They should also give a good indication of what lies below the surface in situations where soil cover is shallow.

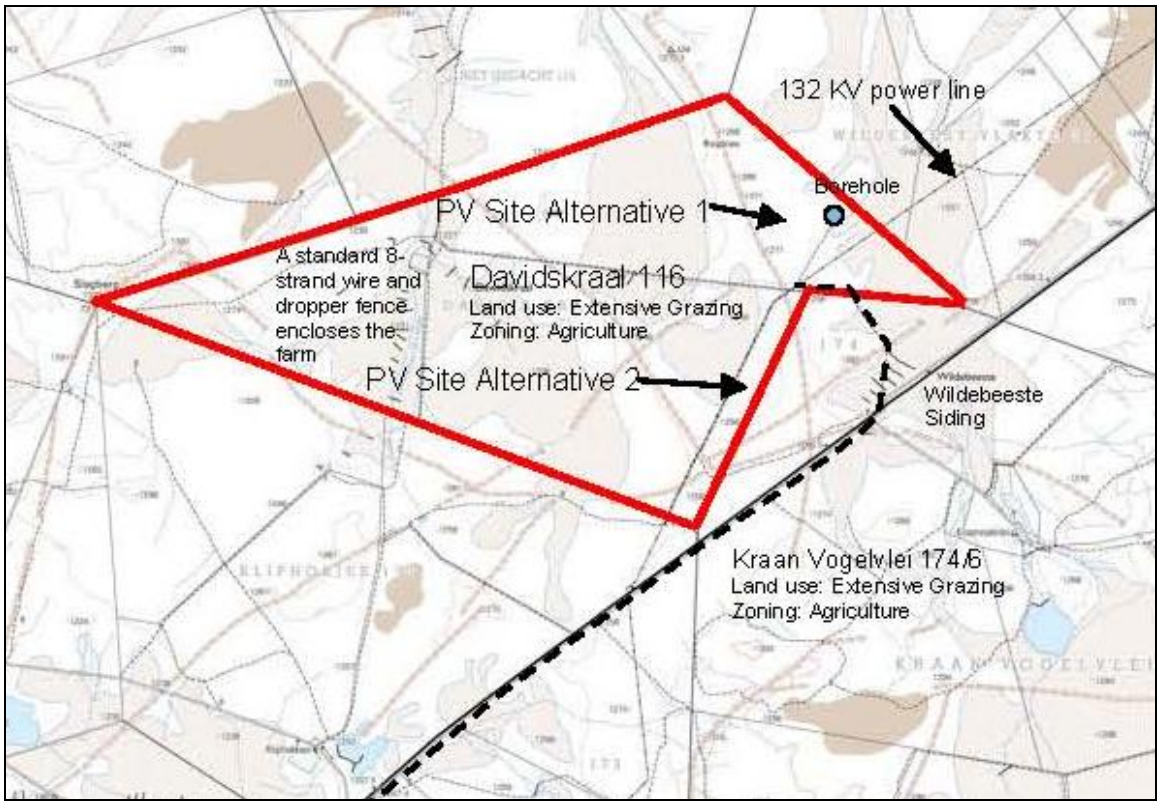


Figure 1: Location of two alternative sites (not to scale) for the proposed PV solar power plant on Davidskraal 116, north east of Victoria West, Northern Cape. Extract from 1:50 0000 sheet 3123AD Brakpoort (provided by Withers Environmental Consultants (Pty) Ltd).

Topographically, the two alternative development footprints are situated on relatively flat terrain, with dolerite koppies (dykes) defining the relief of the surrounding landscape. Where dolerite outcrops occur there is a possibility that rock engravings could be found.

2.1. Heritage features of the area

No archaeological survey work has been carried out in the immediate vicinity of the proposed solar energy facility. Much of the surrounding region has yet to be examined from an archaeological viewpoint. Existing data are summarized by Kaplan (2011).

The following observations may be made:

» That dolerite koppies in the region are known to have rock engravings (Fock & Fock 1989; Morris 1988; Parkington *et al*. 2008).

» That variable spreads (in terms of typology as well as assemblage density) of Stone Age artefacts might occur in these areas (e.g. Beaumont *et al*. 1995). Higher densities of sites would tend to cluster around features in the landscape such as hills and water sources.
» That colonial era material culture may include farm infrastructure and graves. Alongside the nearby railway line there would be remains of the Anglo-Boer War blockhouse line as well as infrastructure relating to railway construction and maintenance such as gangers' huts.

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 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 proposed Davidskraal Karoo Photo-Voltaic Solar Power Plant. Power line and access road development would normally represent linear impacts but in this instance existing roads would be used, and hence such potential linear impacts are not a feature of this project.

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 – tower positions, once known, would need to be assessed for possible mitigation), whereas a road 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).

3. METHODOLOGY

EIA assessment necessitated a site visit to inspect various parts of the terrain on foot, focusing on areas of expected impact. Heritage traces are evaluated in terms of their archaeological significance (see tables below). A set of predictions about possible archaeological resources, indicated above, are tested with observations made in the field.

3.1 Assumptions and limitations

It was assumed that, by and large in this landscape, with its sparse vegetation, some 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, would be masked. In such locales animal burrows and 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).

3.2 Potentially significant impacts to be assessed in the EIA process

It has been predicted that:

» Where dolerite koppies occur there is a possibility that rock engravings might be found.
» Stone Age artefact scatters were likely to occur across much or all of the area but with variable densities.
» Colonial era heritage features of note may exist in the vicinity of farming, railway and past military activities.

3.3 Description and evaluation of environmental issues and potential impacts identified

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 Boŝwa 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, 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 power lines 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

Class	Landform	Type 1	Type 2	Type 3
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 alternative development footprint areas were visited on 20 February 2012, when Mr John Luscombe met the author at Victoria West and guided him to the farm and to the specific development locales. Roads had been washed away and were at one place impassable following torrential rain and flooding the previous week. It is relevant to note that flooding affected a low-lying drainage line well to the east of the proposed developments. Findings are reported in relation to predictions suggested above (see 3.2 above).

4.1.1 Possible engraving occurrences on dolerite koppies or exposures:

Rock engravings are known to exist on dolerite koppies in the region, and occur in hills along the Ongers River, just to the north of the study area (McGregor Museum records; John Luscombe pers. comm.). Such koppies occur as a major feature in the area surrounding the study site but are not present within the specific areas of proposed development. Where these were traversed, no engravings were found.

4.1.2 Occurrences of Stone Age artefacts:

In some parts of the broader landscape surface spreads of Stone Age material can be remarkable for their apparent wealth (though often lacking meaningful context), while others are remarkably bereft of such traces. In part this is a factor of proximity to raw material sources, such as hornfels outcrops. It has been noted above that higher densities of sites often cluster at significant features in the landscape such as hills or ridges or water sources such as drainage channels and pans.

In the case of the proposed Davidskraal Karoo PV solar power plant alternative sites, these are situated on nearly flat plains away from dolerite hills and other features or resources. An extremely low density of artefacts, highly dispersed, was noted in each

case (Figure 2). All examples were heavily patinated hornfels, hence old and very likely in secondary context.

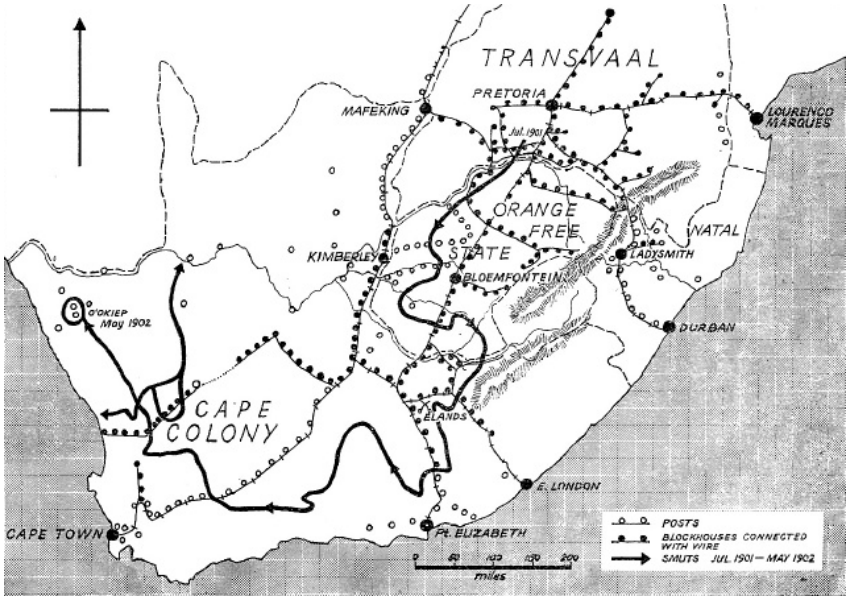
Figure 2: Extremely dispersed, isolated flaked stone pieces were found on the PV site alternative locales, in no instance constituting what could be termed a site.

4.1.3 Colonial era heritage:

Two colonial era sites of interest were noted near to the proposed PV Site Alternatives. The first is a ruin of a stone dwelling at 31.28152° S 23.42729° E, located on the farm Davidskraal No. 116, with a nearby remnant of an ash-heap with porcelain, glass and metal objects but minimal organics (31.28142° S 23.42732° E), suggesting a domestic context for the building.

Figure 3: Ruin of dwelling with adjacent midden.

Further off and nearer to the railway, located on the neighbouring Farm Wildebeest Vlakte No. 51, and situated against a dolerite ridge (dyke) at 31.28132° S 23.44174° E is what might have been a small dry stone fortification, part of the blockhouse line developed to defend the railway during the Anglo-Boer War. This railway was the main supply line for the western campaign, and the towns of Kimberley and Mafeking (Mahikeng).



Map indicating the extent of the blockhouse system (sourced from: http://www.scribd.com/doc/59810639/The-Blockhouse-System-in-South-Africa-With-Special-Reference-to-the-Wolseley-Blockhouses-Western-Cape)

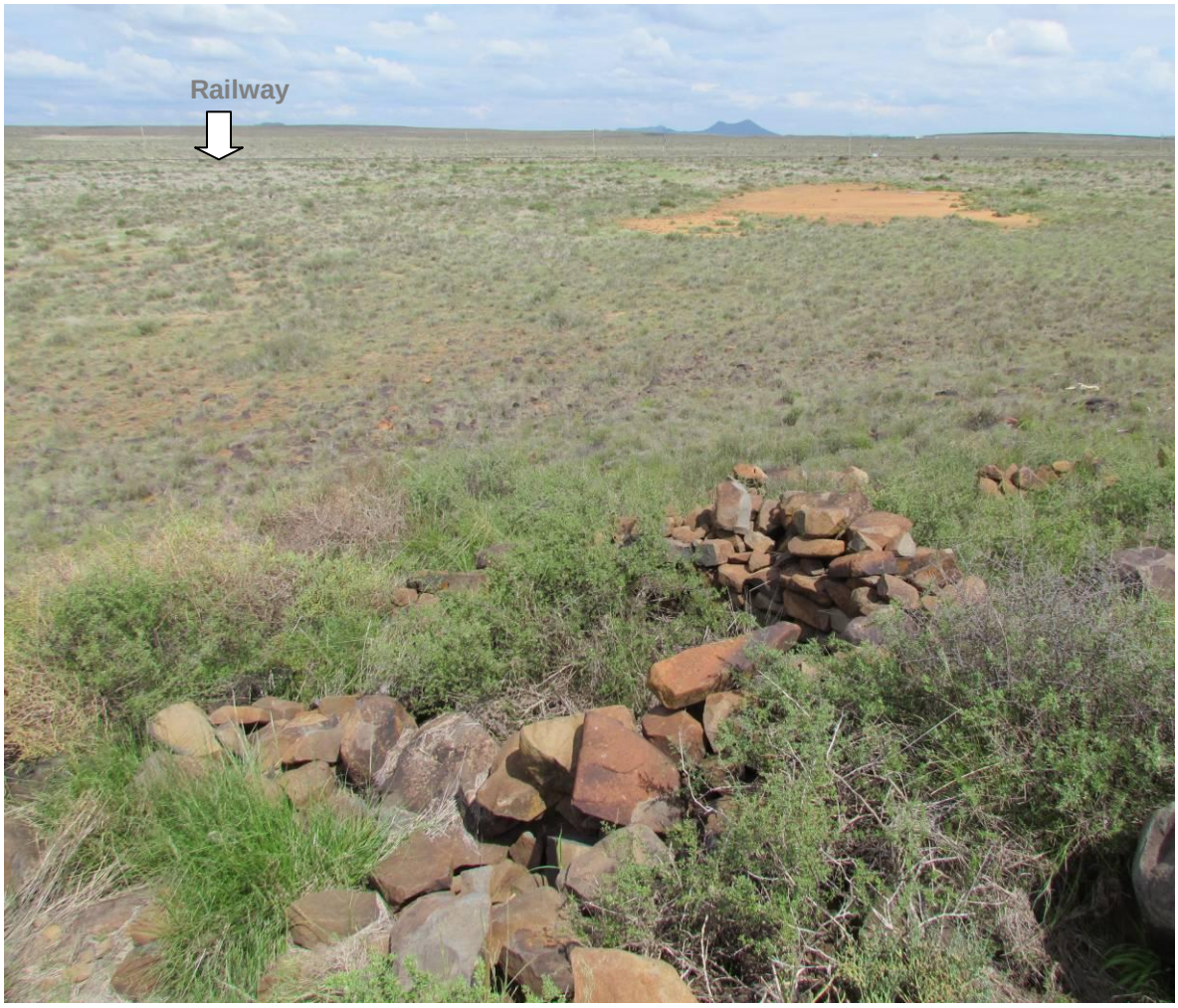


Figure 4: Stone walling at the crest of the dolerite ridge on the neighbouring Farm Wildebeest Vlakte No. 51, most likely associated with the blockhouse line overlooking the railway.

No graves were located during the survey.

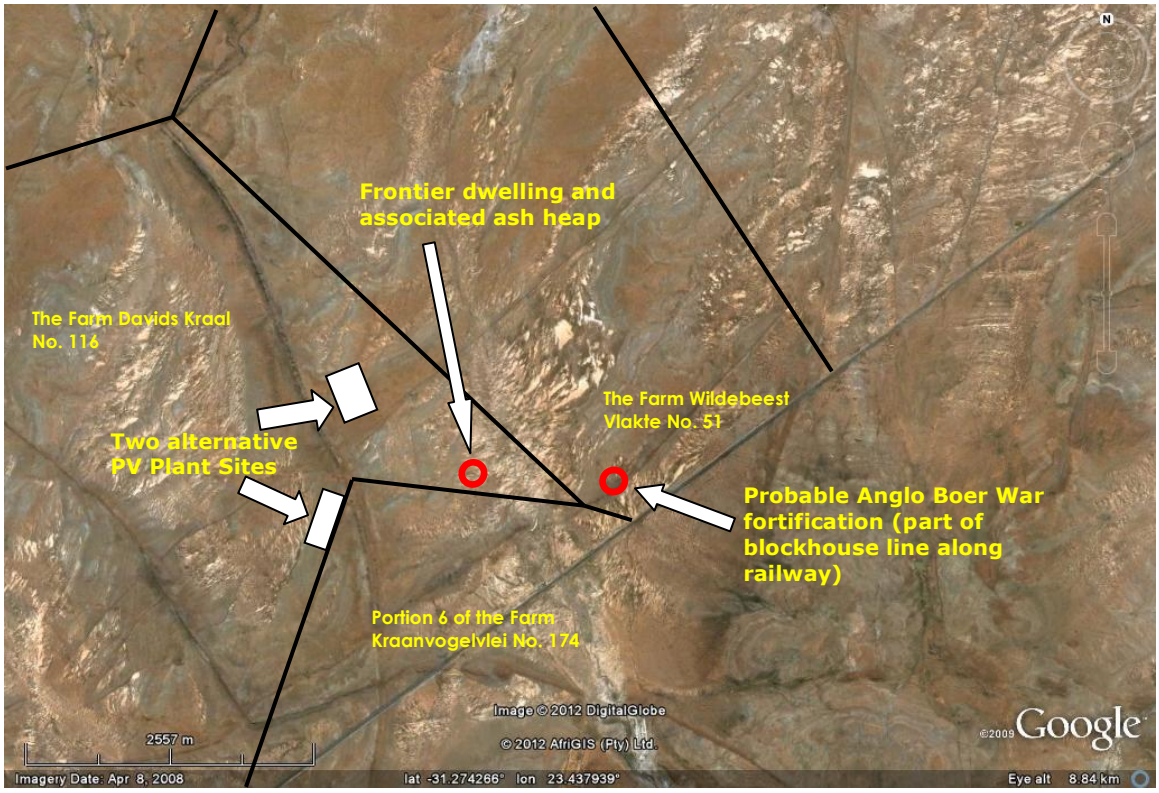


Figure 5: Location of stone dwelling ruin and ridge-top fortification.

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, all of the archaeological observations fall under Landforms L3 Type 1. In terms of archaeological traces they fall under Class A3 Type 1. The midden at the stone walled ruin is not a rich one, with little in the way of organic remains such as bone. These Table 1 ascriptions reflect poor contexts and low significance, especially in regard to precolonial traces.

For site attribute and value assessment (Table 2), most 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. However, higher significance can be attached to colonial era traces. The environmental management plan for the project should provide for the protection of these features.

Table 3: Management measures

Location	Site description	Mitigation/Management action
31.28152° S 23.42729° E	Ruin of stone dwelling with associated small midden.	This site is well to the east of the nearest proposed development. A 100 m radius no-go area should be delineated around it.

4.3 Characterising the significance of impacts

The following criteria may be used to characterise the significance of direct, indirect and cumulative impacts:

- **Nature of impact:** what causes the effect, what will be affected, and how it will be affected.
- **Extent**: whether impact will be local 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.
- **Duration**, 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.
- **Magnitude**, 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.
- **Probability** *of occurrence*: likelihood of the impact actually occurring on a scale 1–5, where 1 is very improbable (probably will not happen);
- 2 is improbable (some possibility, but low likelihood);
- 3 is probable (distinct possibility);
- 4 is highly probable (most likely); and
- 5 is definite (impact will occur regardless of any prevention measures).

» **Significance**, a synthesis of the above characteristics expressed as low, medium or high.
» **Status**, be described as either positive, negative or neutral.
» **Reversibility**: 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) at Davidskraal

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)	Mitigation not regarded as necessary
Duration	Permanent (5)	But mitigation not regarded as necessary.
Magnitude	Minor (2)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (16)**	**N/A**
Status (positive or negative)	Neutral	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	Yes	Manage resources near sites, esp stone dwelling ruin.
Mitigation: N/A		
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.		
Residual Impacts: » Depleted archaeological record.		

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.

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 other than management of nearby heritage resources not considered necessary. It is suggested that management should include clear delineation of no-go areas on the periphery of the proposed development in order to protect sensitive sites. 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 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.	To be in place before commencement of the development.

Performance Indicator	Limiting of impacts to area of proposed development. 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.

5. CONCLUSIONS

The PV Site Alternatives 1 and 2 were found to be remarkably free of precolonial traces. A ruin of a stone dwelling structure with associated albeit limited ash midden located is located well to the east of the proposed PV plant sites, while other local colonial heritage features include possible block house remains. Within the proposed development sites archaeological traces were found to be of extremely low density and low significance, with no mitigation measures considered as necessary.

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