

**McGregor Museum
Department of Archaeology**



**RAMPHELE PV
SOLAR THERMAL FACILITY**

**SPECIALIST INPUT FOR THE EIA PHASE OF THE
ENVIRONMENTAL IMPACT ASSESSMENT FOR THE
PROPOSED RAMPHELE PV SOLAR ENERGY FACILITY,
NEAR RITCHIE, NORTHERN CAPE PROVINCE**

ARCHAEOLOGY

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Background

A scoping phase evaluation provided high-level identification of potential areas of sensitivity together with a recommended methodology for the EIA process. This report is consequent on a site visit and reports on observations made.

The site is on the property Klipdrift and Kookfontein 109/10 south of the Riet River near Ritchie in the Northern Cape.

Specialist

The author of this report is an archaeologist accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. He has previously carried out surveys in the region of the proposed activity. In addition, the author is familiar with the history of the area and has UCT-accredited training on Architectural and Urban Conservation: researching and assessing local (built) environments (S. Townsend, UCT).

Description of environment and potential impacts

The environment in question is a semi-arid one consisting of a relatively flat grassy drainage plain with low hills on the southern portion. The landscape is a largely treeless grassland where archaeological traces may be generally fairly visible. Stone Age traces may potentially occur sub-surface.

The locality is indicated in the following map.

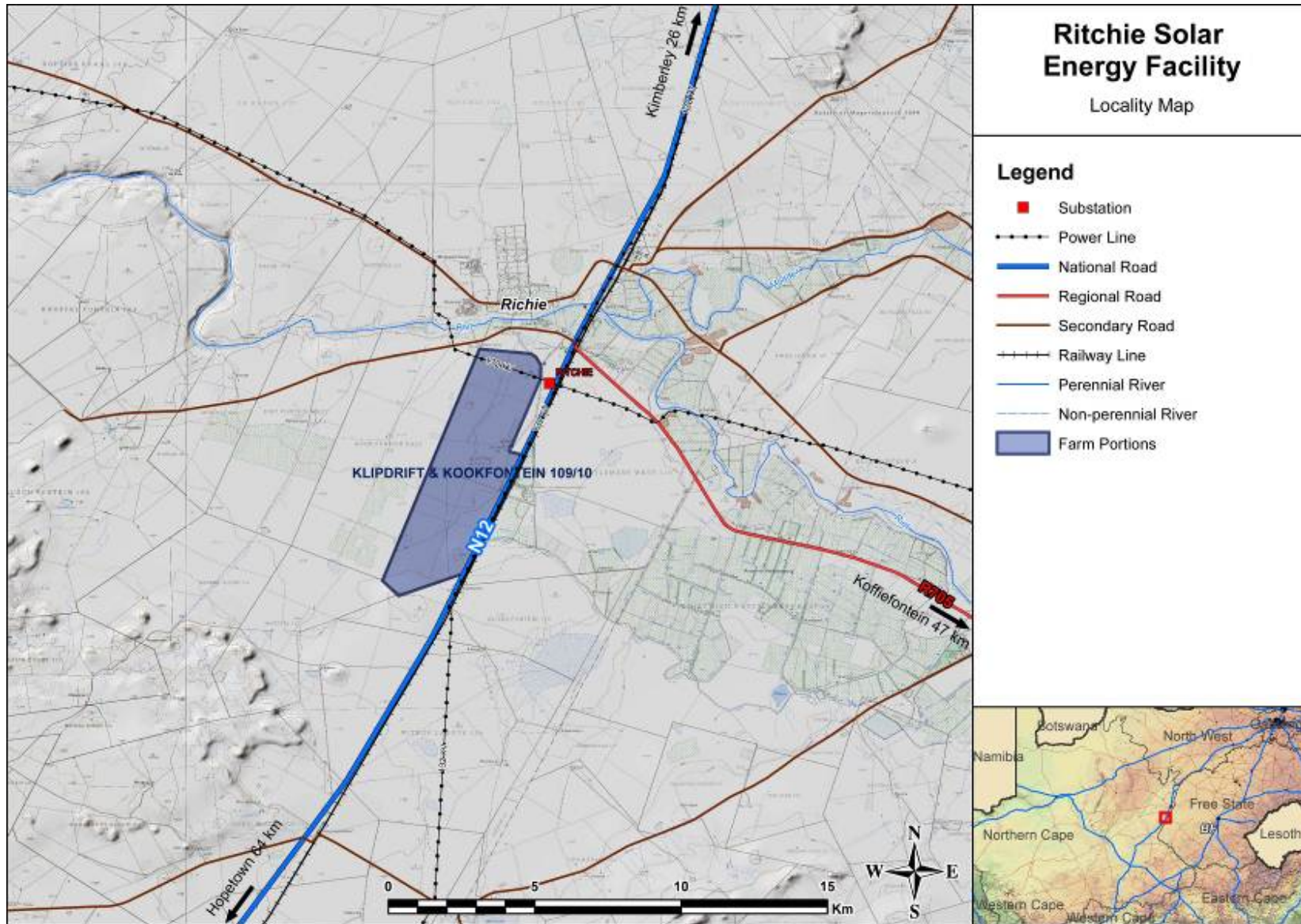


Figure 1: Locality Map

In terms of heritage features of the region, the following introductory comments can be made:

Colonial history

Of greatest significance on the actual terrain under investigation is the history of the South African Anglo-Boer War (1899-1902) and specifically of the Battle of Modder River, 28 November 1899, which was fought in immediate proximity to the site (F.M. Barbour pers. comm.).

Prior to this, the area lay to the north east of the Albania Settlement of the 1860s and it came to greater prominence following the discovery of diamonds around 1870. The northward extension of the railway, to Kimberley, in 1885 saw construction of the main line from Cape Town immediately adjacent to the project area. The railway was subsequently to be of strategic importance for the British forces approaching northwards to Kimberley in November 1899, hence the Battle of Modder River taking place in this vicinity.

Stone Age

Stone Age material found in this area spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times. Of particular interest are Pleistocene sites along the Vaal River (e.g. Beaumont & Morris 1990; Beaumont & McNabb 2000), and similar material is known to occur along the Riet River. Late Holocene material with pottery is known to occur on the river banks, while rock engravings are richly distributed in the region, the site of Driekops Eiland being of particular renown (Wilman 1933; Morris 1988). Engravings occur at Scotchman's Pool, Ritchie, as well as in the hills south of Ritchie, e.g. within the Mokala Park. Near to the project area lies the distribution of "Type R" stone-walled settlements, but these are mainly along the Riet River upstream from Ritchie and generally at the foot of hills close to the river.

Terraces along the rivers have long been known for their association with archaeological and Plio-Pleistocene fossil material (e.g. Helgren 1979).

Description and evaluation of environmental issues and potential impacts

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear developments such as are envisaged can have a permanent destructive impact on these resources in cases where they are impacted. The objective of the EIA is to assess the significance of such resources,

where present, and to recommend no-go or mitigation measures to facilitate or constrain the development.

Potential area impacts are possible in the case of the Solar PV Plant itself and in any associated infrastructure.

Direct, indirect and cumulative impacts (in terms of nature 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 period of the PV plant and associated infrastructure construction. In the longer term the proximity of operations in a given area could result in secondary impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

In this instance there may be a secondary and longer-term visual impact on a significant heritage landscape.

It has been noted that powerline erection has a relatively small impact on Stone Age sites (Sampson 1985), whereas a roadways or a pipelines would tend to be far more destructive, albeit relatively limited in spatial extent. A water pipeline, if water is to be sourced at the river, could traverse more sensitive terrain both in terms of possible Stone Age traces and with respect to the battlefield.

Statement of significance

In addition to guidelines provided by the National Heritage Resources Act, a set of criteria based on Deacon nd and Whitelaw 1997 for assessing archaeological significance has been developed for Northern Cape settings (Morris 2000a).

Estimating site potential

Table 1 is a classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential. There are notable exceptions, such as the renowned rock art site Driekopseiland, near Kimberley, which is on landform L1 Type 1. Generally, moreover, the older a site the poorer the preservation. Estimation of potential, in the light of such variables, thus requires some interpretation.

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Assessing site value by attribute

The second matrix (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. While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

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

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

	archaeological investigation			
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

Potential areas of sensitivity

The most sensitive heritage feature of the area of proposed development is the battlefield associated with the Battle of Modder River which took place here on 28 November 1899 (F.M. Barbour pers. comm. And documentation preserved at the McGregor Museum).

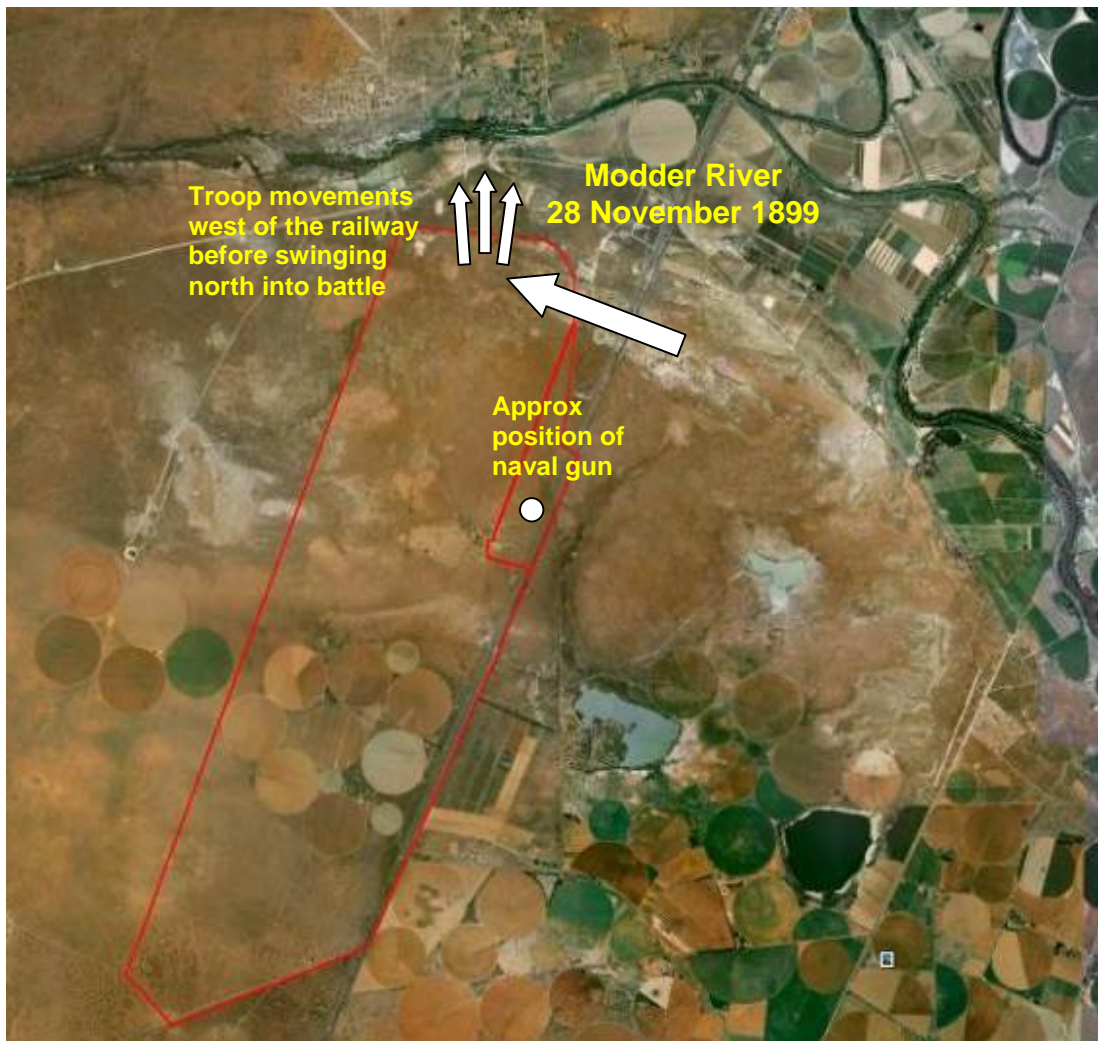
British forces advanced up the railway from the south. A naval gun was placed 3000 yards (about 3 km) south of the river to the west of the railway line. Encountering enemy fire from the Modder River east of the line, a great deal of movement of troops took place from east to west, across the line, taking advantage of lower ground (at the northern end of the area indicated for possible PV facility development) for an attack on Boer forces, who were unexpectedly making use of the south bank of the Riet as a 'trench'-like feature. This was a departure from standard strategic procedures in warfare and makes the Battle of Modder River something of a textbook instance still studied by military strategists (the more usual strategy had been for a defending force to place a river between itself and an approaching aggressor – which is not what the Boers did, providing an element of surprise and a prelude to its even more unexpected use of trenches at Magersfontein a few weeks later).

Battlefields are specifically recognised as a type of heritage site enjoying protection in terms of the National Heritage Resources Act. The Battle of Modder River was one of the pivotal battles of the Western Campaign during the South African Anglo-Boer War. The British suffered heavy casualties here and were forced to halt their northward advance for ten days to evacuate their injured, to recuperate and receive reinforcements. This provided the Boers with the opportunity to entrench at the nearby Magersfontein, where they inflicted a crippling defeat on the British on 11 December – delaying the lifting of the Siege of Kimberley by another two months. The battlefield site at Modder River would clearly be of at least provincial if not national significance, where members of associated British regiments, military history specialists and army strategists continue to make visits and study tours to

this day. There had been substantial provincial investment in the battlefield route as a tourism attraction at the time of the centenary.

In terms of this, the scoping report (and subsequent on-site discussion) suggested preferable situation of the proposed Ramphela PV facility south of the existing powerline that runs east-west across the northern end of the site indicated. This took into consideration the fact that the battlefield is a heritage landscape of continuing relevance to certain constituencies in the present as suggested above. A concern was the visual impact of the development, but a site visit confirmed that this would be reduced if the development was located south of the existing powerline as suggested above.

The various troop movements during the battle and the placement of the naval guns are indicated approximately in the following image:



The scoping report also referred to the possibility of Stone Age traces being present which would need to be assessed in the EIA phase.

Hence, anticipated locations for both area and linear, primary and secondary, developments had been identified to be examined on the ground, as would possible visual impacts on the battlefield heritage landscape. The latter was carried out as an extended phase of the scoping exercise. It was found that placement of the facility south of the existing powerline as indicated above would mitigate visual impacts substantially.

Any disturbance of surfaces in the development area could have a destructive impact on archaeological resources, if and where present. In the event that such resources were found they could very likely be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency. In the (unlikely) case of any built environment features being found, Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) would be the permitting authority.

Methodology for EIA assessment

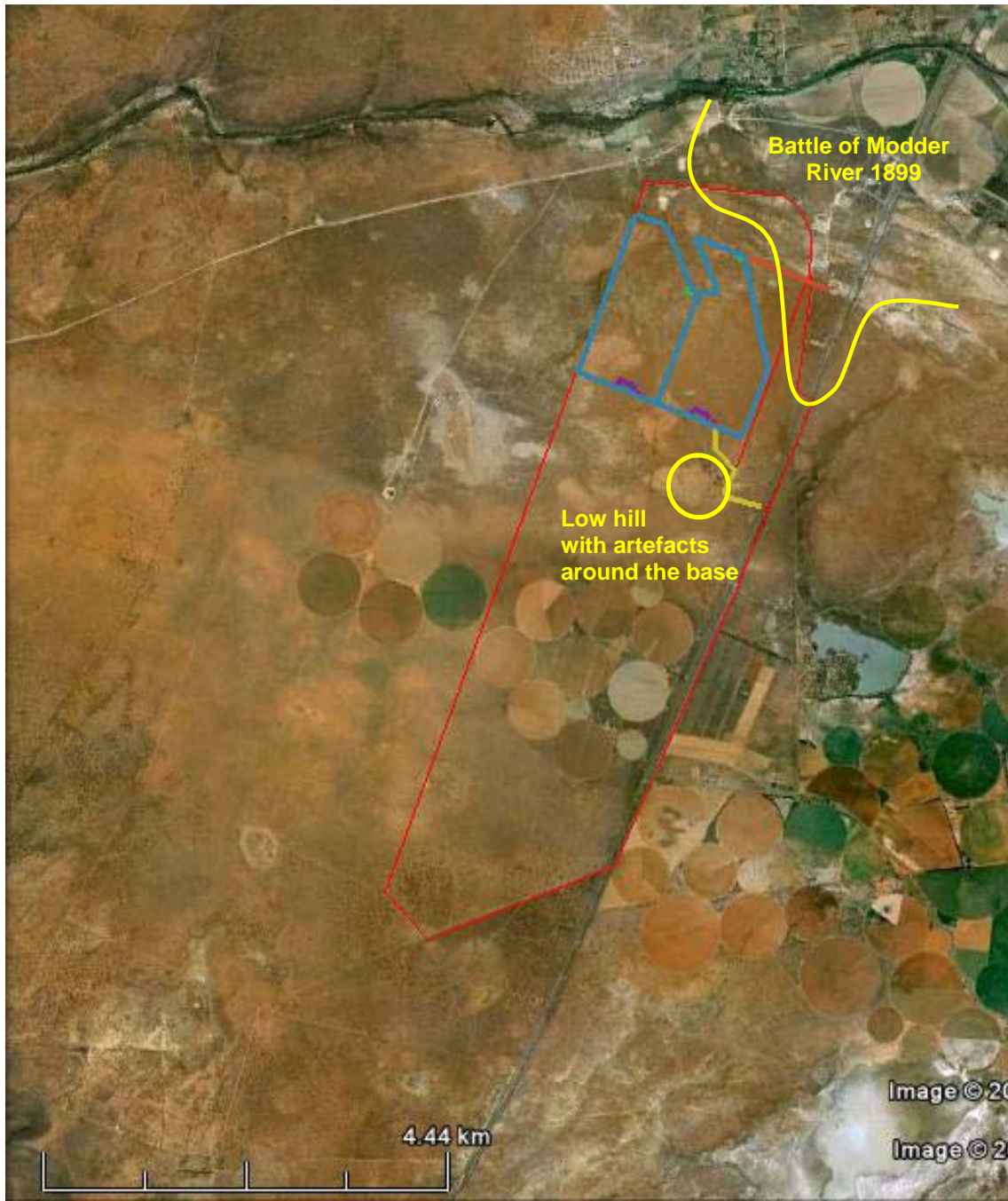
A site visit to inspect various parts of the terrain on foot, focusing on areas of expected impact (construction of PV plant and secondary infrastructure such as roads, and powerlines).

Once sites were plotted they would be assessed in terms inter alia of the tables given above and relative to the known heritage of the region, providing a quantifiable measure for defining significance as a basis for recommendations to be made.

Observations

A field visit was carried out to inspect various parts of the affected environment. Extremely sparse surface traces of any Stone Age material was found on the sandy plain southwards of the existing powerline running westwards from the substation. This was in accord with previous survey work in the vicinity that was carried out ahead of the construction by Eskom of the said substation and powerline (Morris 2005). No significant archaeological traces were noted at the eastern end of the powerline, while Middle Stone Age material of less than significant concentrations was noted at the western extension of the line on the farm Kookfontein.

A low hill of Ventersdorp basement rock lies to the south of the proposed development at the base of which a fair quantity of quartzite Middle Stone Age or older cf Fauresmith material was noted, mainly on the northern and north eastern sides of the hill. The hill is sensitive also from a botanical point of view. This lies beyond the extent of the development as proposed (see the revised solar facility locality in the following Google Earth image).



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 at Ramphela PV site

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)	Local (1)
Duration	Permanent (5) where archaeological material is impacted – but this has been rated as insignificant and not requiring mitigation	Permanent – but mitigation not regarded as necessary (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Improbable (2)
Significance	Low (24)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes, but minimal.	
Can impacts be mitigated?	For physical traces on the ground: Not regarded as necessary other than by way of on-going management as per EMP. Visual impacts on the nearby heritage landscape to be kept minimal.	On-going management as per EMP
Mitigation:		
<ul style="list-style-type: none"> » Specific mitigation measures not regarded as necessary with respect to Stone Age archaeological traces. » Every attempt must be made to limit visual impacts with respect to the nearby battlefield heritage landscape. 		
Cumulative Impacts:		
<ul style="list-style-type: none"> » Where any archaeological contexts occur the impacts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity. EMP provides for on-going monitoring. 		
Residual Impacts:		
<ul style="list-style-type: none"> » Depleted archaeological record. 		

MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

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 construction over and above what is necessary and any 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 road/s and infrastructure without taking heritage impacts into consideration.
Mitigation: Target/Objective	A facility environmental management plan that takes cognizance of heritage resources in the event of any future extensions of roads or other 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.	Environmental management plan to be in place before commencement of 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.
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.

CONCLUSIONS

Very sparse archaeological traces were found during the EIA Phase of this study and these have proven to be consistent with predictions made during the Scoping Phase and with previous findings in the area (Morris 2005).

The positioning of the development relative to the 1899 battle site mitigates initial concerns about physical and visual impacts on the heritage landscape which lies

essentially to the north and north east of the development, with a slight rise separating the two features.

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).

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