

HERITAGE IMPACT ASSESSMENT FOR MULTIPLE PROPOSED SOLAR ENERGY FACILITIES ON DU PLESSIS DAM 179, DE AAR, NORTHERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act (No. 25 of 1999) as part of an EIA etc.)

Prepared for

Aurecon South Africa (Pty) Ltd

Aurecon Centre, 1 Century City Drive, Waterford Precinct, Century City
Phone: 021 526 5737 Email: Karen.Versfeld@aurecongroup.com

1st draft: 20th May 2013
Final version: 10th July 2013



Prepared by

Jayson Orton & Lita Webley

ACO Associates cc

8 Jacob's Ladder
St James
7945

Phone (021) 706 4104
Fax (086) 603 7195
Email: Jayson.Orton@aco-associates.com

EXECUTIVE SUMMARY

ACO Associates cc was appointed by Aurecon South Africa (Pty) Ltd) to assess the potential impacts to heritage resources that might be experienced through construction and operation of several solar energy facilities on the farm Du Plessis Dam 179, just outside De Aar, Northern Cape. Alternative 1 includes the construction of three solar energy facilities and related infrastructure, while Alternative 2 involves construction of a single, far larger, facility and related infrastructure.

The landscape is generally flat but some low hills with occasional rocky areas are present in the far west. The surface is covered in grass and small bushes.

Archaeological resources were encountered on the site. The most significant is an historical homestead and related features located near a spring in the eastern part of the site, while in the west, on the high ground, were several Later Stone Age sites and a number of historical artefact scatters. The latter most likely pertain to the Anglo-Boer War.

This historical farm complex has high significance and cannot be satisfactorily mitigated in a commercial context. It must be avoided. The Later Stone Age sites should be avoided if possible, but it is quite feasible to conduct mitigation if this should be required. This would involve excavation, collection and possibly radiocarbon dating.

The general landscape will also be impacted through loss of context and sense of place. These impacts would be experienced primarily from the surrounding roads which provide access to areas with good scenic qualities – the R48 is particularly relevant here. However, given the many other similar facilities planned for the immediate area (two are already under construction), there is little that one can do to mitigate these impacts.

The proposed project should be allowed to proceed with either Alternative, although Alternative 1 is preferred because it covers less land area. The following recommendations apply:

- Where archaeological sites cannot be avoided, mitigation in the form of excavation and collection of artefacts should be carried out;
- The historical homestead and all surrounding features and artefacts must be avoided (this site is too significant to be effectively mitigated in a commercial context);
- If any human remains are encountered during the development they should be cordoned off and protected from further harm until they can be inspected and removed by an archaeologist under a permit issued for that purpose; and
- Once the exact lines have been identified for the linear components of the project they should be examined from the desktop then subjected to a walk-down if deemed necessary.

Contents

1. INTRODUCTION	4
1.1. Terms of reference	5
2. HERITAGE LEGISLATION	5
3. METHODS.....	6
3.1. Literature survey.....	6
3.2. Field survey.....	6
3.3. Impact assessment	6
3.4. Limitations & assumptions.....	6
4. DESCRIPTION OF THE AFFECTED ENVIRONMENT.....	6
5. HERITAGE CONTEXT	8
6. FINDINGS.....	9
6.1. Archaeology	9
6.2. Built environment.....	16
6.3. Cultural landscapes.....	16
6.4. Scenic routes and sense of place.....	16
6.5. Graves.....	17
7. ASSESSMENT OF IMPACTS	17
8. CONCLUSIONS	22
9. RECOMMENDATIONS	22
10. HERITAGE MANAGEMENT	22
11. REFERENCES	23
APPENDIX 1: Mapping.....	24
APPENDIX 2: List of heritage findings.....	25
APPENDIX 3: Specialist declaration.....	30
APPENDIX 4: Specialist curriculum vitae	32

1. INTRODUCTION

ACO Associates cc was appointed by Aurecon South Africa (Pty) Ltd to assess the potential impacts to heritage resources that might be experienced through construction and operation of several solar energy facilities on the farm Du Plessis Dam 179, just outside De Aar, Northern Cape (Figure 1).

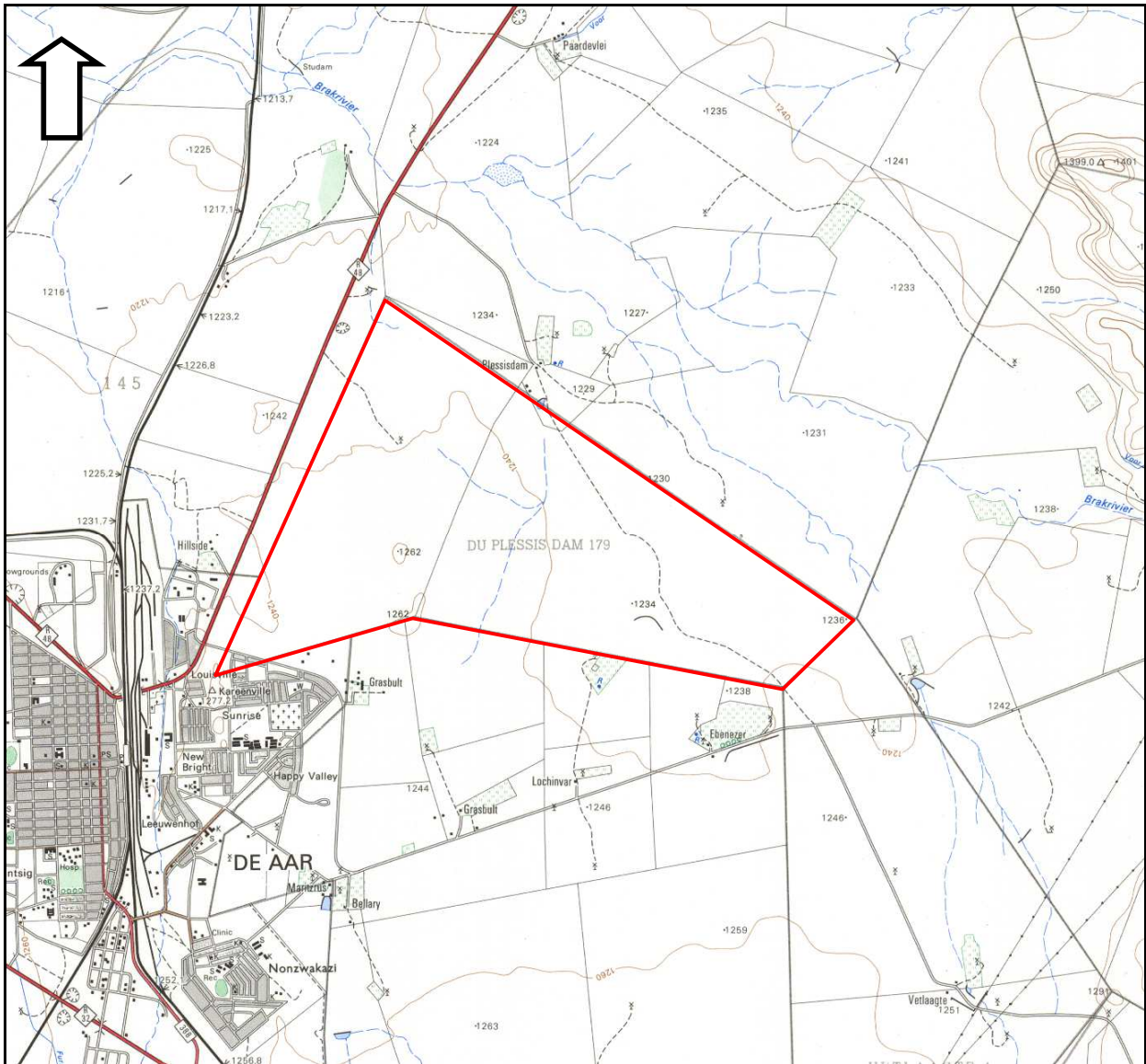


Figure 1: Map showing the location of Du Plessis Dam study area (red polygon) relative to De Aar.

Each of the proposed PV facilities would consist of the following:

- Numerous arrays of PV panels and associated support infrastructure to generate up to 75MW per facility through the photovoltaic effect;
- 132kV overhead transmission lines to connect each facility to the central onsite substation or an existing Eskom substation;
- An onsite 132kV, 3 bay substation; and

- A boundary fence for health, safety and security reasons (Aurecon 2013).

Furthermore, the project as a whole will require the following components which, it is envisaged, could be shared by all four facilities:

- One central 132kV substation and connection to Eskom grid. This central substation will connect the PV facilities with Eskom's De Aar substation via either an existing overhead 132kV Eskom line or by constructing a new 132kV transmission line directly to De Aar substation;
- An access road and internal access roads for servicing and maintenance of the site;
- Water supply infrastructure to carry water to the site and store it there;
- Stormwater infrastructure including drainage channels, berms, detention areas and kinetic energy dissipaters; and
- Buildings that would likely include onsite substations, a connection building, control building, guard cabin, an electrical substation and solar resource measuring substation (Aurecon 2013).

A single 75 MW facility (PV1) has already been approved for the farm and the present study considers a further three such facilities with a total area of 755 ha. These are known as PV2 to PV4. Several alternatives are being considered for the project as follows:

- Layout: At present legislation only permits development of 75 MW solar energy facilities but should this change then an alternative layout would see a single facility with a capacity of up to 400 MW being considered;
- Technology: different types of solar panels and mounting alternatives are being considered, but, since these do not variably affect the impacts to heritage resources, they are not described further;
- Transmission lines and substations: corridors for the siting of these components have been identified for assessment; and
- The No-Go alternative assesses the status quo of the property (including the already authorised PV1; Aurecon 2013).

1.1. Terms of reference

A detailed terms of reference is available in the Draft Scoping Report but, briefly, it was required that ACO Associates identify, map and assess the impacts to heritage resources on the site including archaeology, built environment and cultural landscapes. Palaeontological impacts will be assessed by an independent specialist. Mitigation measures to reduce the significance of impacts should also be recommended as well as details of how heritage resources should be managed on the site.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources including palaeontological, prehistoric and historical material (including ruins) more than 100 years old (Section 35), human remains older than 60 years and located outside of a formal cemetery administered by a local authority (Section 36) and non-ruined structures older than 60 years (Section 34). Landscapes with cultural significance are also protected under the definition of the National Estate (Section 3 (3.2d)). Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Since the project is subject to an Environmental Impact Assessment, Heritage Northern Cape and the South African Heritage Resources Agency (SAHRA) are required to provide comment on the proposed project in order to facilitate final decision making by the Department of Environmental Affairs (DEA).

3. METHODS

3.1. Literature survey

For the original report, a survey of available literature was carried out to assess the general heritage context into which the development was to be set. This literature included published material, unpublished commercial reports and online material. In the present report this same information has been used and updated as necessary.

3.2. Field survey

The site was examined through a combination of driving and walking (see Appendix 1). The latter was employed to examine specific locations considered to be of heritage interest and also to conduct random examination of other areas. The survey was carried out on 04 May 2013. During the surveys the positions of finds were recorded on a hand-held GPS receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape settings of the proposed developments.

3.3. Impact assessment

For consistency among specialists, the impact assessment ratings were done using a scale supplied by Aurecon. Each individual solar energy facility is given an assessment, while a cumulative assessment for all facilities proposed on the farm is also included.

It is also relevant to note that the estimation of mitigation requirements from the original 2011 report has been revised in view of the fact that far larger areas of the landscape will be developed with the current proposal.

3.4. Limitations & assumptions

Due to the large size of the study area it was not possible to cover all the ground via a detailed foot survey. However, given the nature of the site and the heritage resources located thereon, it is believed that the survey has captured a sufficient sample of all heritage resources to enable accurate prediction of impacts. Heritage resources (in particular archaeological ones) were found to be tied to landscape features that are easily located by vehicle. Assuming this pattern to hold true, this suggests that relatively few such resources will have been missed during the survey.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The farm is predominantly flat, but some gently undulating topography in the far western part did allow for a view across the study area (Figure 2). These undulating areas had low hills

that were sometimes rocky but otherwise usually covered in a light scattering of gravel. For the rest, the site had low bushes (Figure 3) and/or dense grass (Figure 4) but frequent open areas, either with or without a gravel coating, allowed improved ground visibility in places. Some of these latter areas were quite large and, when free from gravel, tended to be very silty indicating areas where water formed ephemeral pans (Figure 5). Some power lines also traverse the eastern part of the farm.



Figure 2: View eastwards across the Du Plessis Dam Farm study area from the slightly elevated ground in the far eastern part of the farm. The farmhouse lies on the far left of this view.



Figure 3: Low bushes found across much of the Du Plessis Dam Farm site, particularly in the central areas. An open area is visible by its red soil.



Figure 4: View of the thick grass and power lines found in the eastern part of Du Plessis Dam Farm.



Figure 5: View over one of the open, silty areas on Du Plessis Dam Farm.

5. HERITAGE CONTEXT

The Karoo has a long pre-colonial history as testified by the many thousands of stone artefacts that can be found among surface gravels in many areas. The vast majority of these artefacts are heavily weathered indicating great antiquity and relate to the Early (ESA) and Middle Stone Ages (MSA). However, of more significance, due to their better integrity, are the Later Stone Age (LSA) sites that occur from time to time. The stone artefacts from such sites are generally unweathered or else very slightly weathered and do not occur as widespread background scatters but are more concentrated indicating places where people actually camped. The assemblages also include distinctive retouched forms that can sometimes help to determine more precisely the age of the site. All these types of artefact scatters were located on the earlier survey (Orton 2011), while on other surrounding farms MSA artefacts (Fourie 2011; Kruger 2012) and LSA sites (Morris 2011) have been recorded. Sampson's (1985) work in the Seacow River valley has led to the identification of three phases of LSA archaeology based on the types of stone artefacts found. During the early Holocene larger scrapers typified what Sampson called the "Lockshoek" Industry. The "Interior Wilton" followed with the sorts of microlithic tools commonly found on mid-Holocene sites throughout South Africa. Pottery was present on the latest of these sites and on most of the "Smithfield" sites that followed. These three industries are similar to those described as "late Pleistocene – early Holocene non-microlithic", "Holocene microlithic" and "late Holocene assemblages with pottery" which are more generalised and widely applicable throughout the country (Deacon 1984) though sites dating to the latter period are frequently not associated with pottery and assemblages from this phase are better referred to simply as "Late Holocene assemblages" (Orton 2006).

Probably the most significant aspect of Karoo archaeology is the presence of many prehistoric stone kraals. Most notably, the Seacow River valley to the east of the present study area has revealed many such kraals (Sampson 1984, 1985, 1986, 2010) and enabled a kraal typology to be constructed (Hart 1989). The kraals are typically constructed on sloping ground against dolerite ridges and overlooking water sources. Domestic debris and stone artefacts are seldom associated with them, but when they are, they are taken to represent either the pastoralists camping alongside their kraals or else later re-occupation of the kraals by hunter-gatherer people (Sampson 1985). While no kraals were located during the initial survey, a number of small circular stone features were found (Orton 2011). These could represent domestic spaces. Others have also located small archaeological stone-built features on the landscape (Fourie 2011; Morris 2012). Although pottery is often taken to signify pastoralist occupation, Sampson (2010) and others (Bollong *et al.* 1993, 1997; Rudner 1979) have shown that in the interior some pottery is tempered with fibre and was made by Bushmen hunter-gatherers rather than Khoekhoe pastoralists.

The LSA stone artefacts found in the Karoo are not very well understood, perhaps largely as a result of the general lack of datable occurrences. Very few rock shelters have been found and excavated (e.g. Hart 1989) and the vast majority of occurrences are open scatters of artefacts with no associated organic materials. It appears that the earlier periods of the LSA are poorly represented in the Karoo, if at all, while sites dating to the last few thousand years are routinely located. Most LSA artefacts in the central Karoo region are made from hornfels, a dark-coloured rock that forms through metamorphosis of the country rocks surrounding dolerite intrusions. Small thumbnail and end scrapers are frequently encountered and adzes and spokeshaves also form an important part of the retouched component. Rock art is also known from the area (De Aar, n.d.b) but further details are unknown.

The colonial period history of the area is not that old. While the town of De Aar only dates back to 1903, just after the cessation of the 1899-1902 Anglo-Boer War, farms were given out and surveyed in the 1800s. Unfortunately it was not possible to source the earliest survey diagrams from the Surveyor General, but, from references on later diagrams, De Aar 80 and Du Plessis Dam 179 go back at least to 1863. The railway junction dates to 1881 when Cape Town and Kimberley were linked by rail after diamonds were discovered at the latter town. It was very important to the British during the Anglo-Boer War since railway lines from Cape Town and Port Elizabeth joined here and extended on through Kimberly to Mafikeng (AngloBoerWar.com 2011). De Aar was also the site of the first use of wireless telegraphy in South Africa where the British employed it to maintain communications between their various columns operating in the area. However, owing to the climatic conditions in the Karoo, the wireless sets, which were designed for shipboard use, could not perform properly and were soon withdrawn from inland service (Baker 1998). The town was laid out around the railway junction on the farm De Aar which was purchased in 1889 by Isaac and Wolf Friedlander, who ran a trading store and hotel at the railway junction (Figure 6). After the war, the brothers established the town. Its municipality was formed in 1904 and the first mayor, Dr Harry Baker, was elected in 1907 (De Aar, n.d.a).

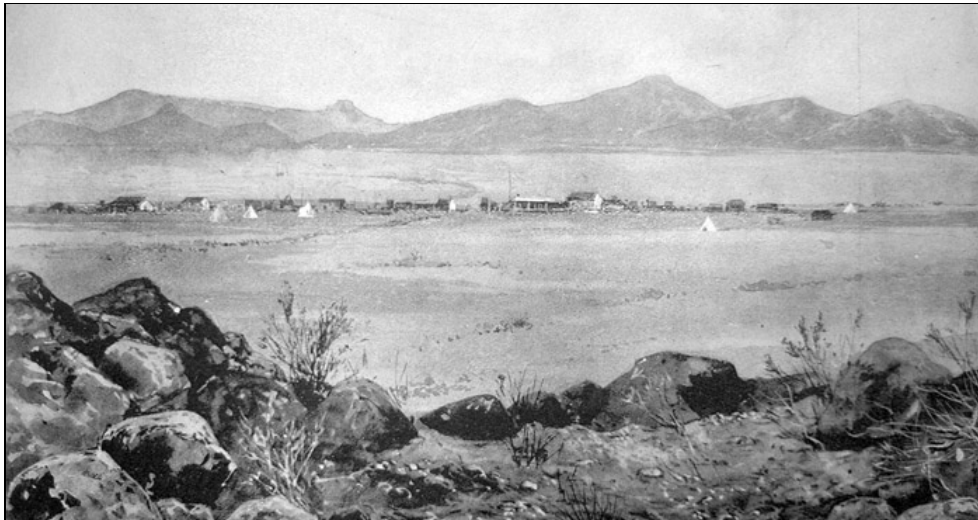


Figure 6: View of De Aar around the time of the Anglo-Boer War and showing the railway line and station hotel at De Aar (Source: AngloBoerWar.com 2011).

6. FINDINGS

The initial survey presented a set of findings from the farm and, while those findings are also directly relevant here, this section illustrates further examples. All finds from both surveys are tabulated together in Appendix 2.

6.1. Archaeology

Archaeological resources were found to be widely scattered across the land. However, the majority are of little or no significance and were not recorded. These occurrences are generally very low density scatters of old (presumably MSA) artefacts. However, some archaeological sites of considerable value were discovered.

These include several scatters of LSA stone artefacts, predominantly on high ground in the western part of the study area. These artefacts are generally far less patinated than the older MSA ones (Figure 7) and include characteristic small retouched items (Figure 8). The most significant site is one that may well have some depth to it and thus, with excavation, might be able to provide temporal data (Figure 9). Some burnt bone fragments were also preserved on this site. With just one exception, all the LSA scatters were either on top of low rises or else along the base of a rocky ridge.



Figure 7: Artefacts from DPD2013/001 (point J021). That at upper left is far older as indicated by the red patination on its surface). Scale in cm.



Figure 8: A crude LSA sidescraper with retouch on the right edge in this view. Scale in cm.



Figure 9: A scatter of LSA artefacts on hornfels (black items) and pottery (light brown items) from DPD2013/006 (point J030). Inset: Fibre tempered pot sherd. Scales in cm.

A rare (possibly unique) archaeological feature in the De Aar area is a ground patch of bedrock (Figure 10). Such occurrences are fairly common in Bushmanland, to the northwest (Anonymous 2001; Orton & Webley 2012a, 2012b), and also on the Vredenburg Peninsula in the south-western Cape, where they manifest as deep grooves (Sadr & Fauvelle-Aymar 2006). In Bushmanland they are typically found alongside water sources (pans or ephemeral streams) and this one at De Aar was right next to an area where water would collect up after rain. They are the result of using another stone to grind some sort of material, perhaps seeds or ochre.



Figure 10: A ground surface at DPD2013/011 (J039). Scale in cm.

Less significant, but nonetheless still of archaeological research value, are the scatters of older MSA artefacts noted in various areas. While most are very low density and not worth much, certain areas have higher density accumulations, perhaps through either the effects of erosion or because people lived very close to or on that spot. Two such dense scatters were recorded as being worthy of mitigation. These older artefacts are characterised by the presence of red patina (weathering) on their outer surfaces. In Figure 11 the artefacts in the centre and that in the upper right hand corner are younger than the rest as evidenced by their lesser degree of patina.



Figure 11: Artefacts from DPD2013/013 (point J048).

A number of historical archaeological sites were also encountered. In some cases these overlapped with LSA sites in that both were found to occupy areas of high ground. Due to the frequent presence of gun cartridges, it is thought likely that many of the historical artefacts relate to the Anglo-Boer War. None of these sites is particularly important, but their recording adds further knowledge to the strategies of the war in that they demonstrate that almost every low hill around the town was likely to have been used at some point during the war as a look out station. Figures 12 to 19 show examples of the finds from such sites, including an example of a stone feature, in this instance circular, from one of the sites. Figures 20 and 21 show further artefacts that are not necessarily military, but through their hilltop location can be inferred to be of similar age and perhaps also related to the War.



Figures 12 & 13: Side and end views of a Westley Richards No. 2 Musket cartridge. This type of rifle was manufactured in the late 19th century.



Figure 14: Cartridge from DPD2013/009 (point J035). Scale in cm.



Figure 15: Two cartridges bearing a sign of the British Military (triangular motif at the top of the right hand cartridge) from point 089.



Figure 16: Isolated cartridge of a Westley Richards No 1 Carbine rifle, probably dating from around 1870.



Figure 17: Isolated Martini Henry cartridge.



Figure 18: Historical artefact bearing what is assumed to be a date (1900) from DPD2013/009 (point J035).



Figure 19: Stone feature at DPD2013/009 (point J035).



Figures 20 & 21: Historical artefacts from DPD2013/010 (point 037). Scales in cm.

Undoubtedly the most significant site of all on Du Plessis Dam is the historical farmstead with features recorded as DPD2011/003 to DPD2011/011. The earlier report (Orton 2011) documented this site in full and this is not repeated here, but in view of the extra development pressure placed on the landscape by the present proposal, the site was re-examined with a view to determining the maximum extent of artefacts associated with it. This was done by walking over the surrounding land and plotting all isolated artefacts found away from the core area. In the original heritage report (Orton 2011) a buffer zone was proposed which circumscribed all the main features, but it is considered better to use the maximum limit of scatter to define this more accurately (Figures 22-25). In addition to isolated artefacts, this walk also revealed the reason for the placement of the homestead at this location – a spring (Figure 26). Although it contained no standing water, the soil around the spring was damp and animals had been digging in it. Figure 27 shows the layout of features at the site.



Figures 22-25: Artefacts from the general landscape around the historical farmstead and dump at DPD2011/003-011. Scales in cm.



Figure 26: The spring (point J044) close to the historic farmstead. Although dry, holes had been dug by animals into the wet soil in the depression in mid-picture.

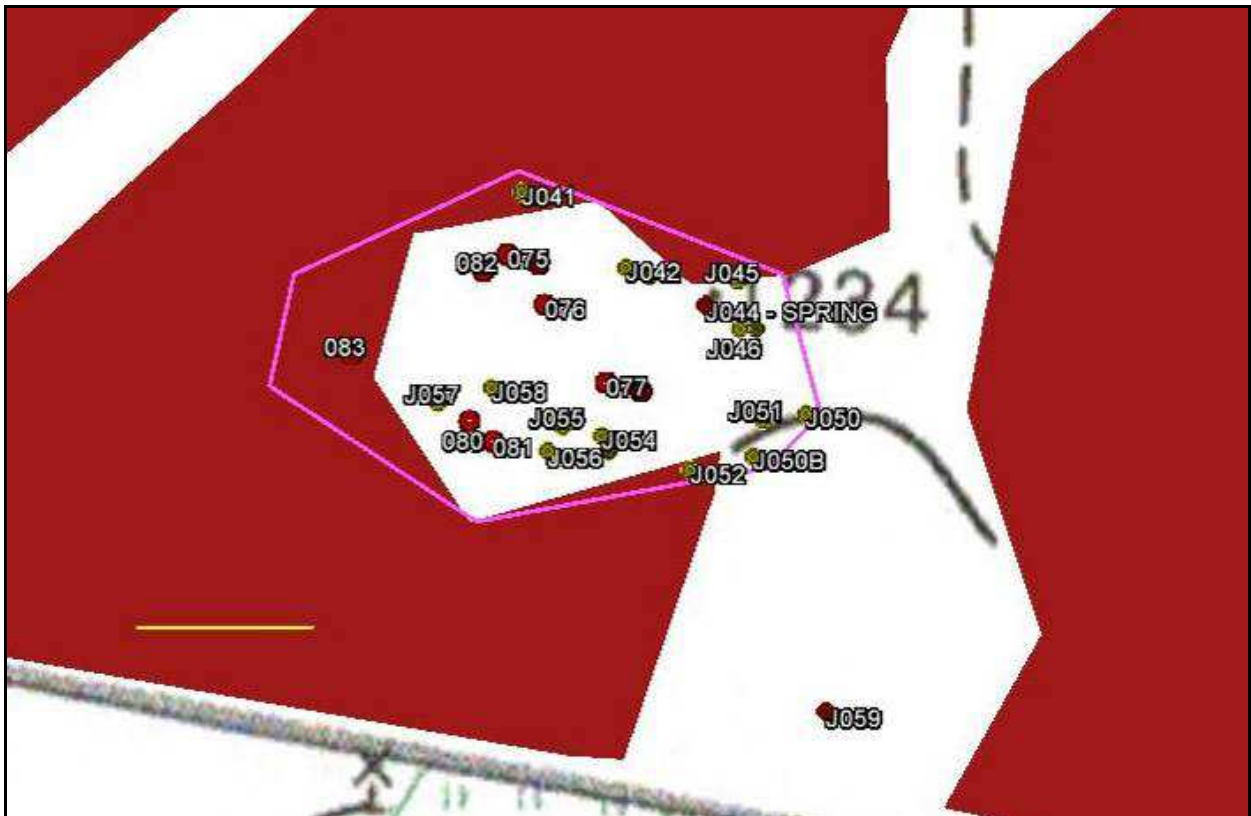


Figure 27: Map showing the locations of finds at and around the historical homestead. Red shading: proposed development footprint, pink polygon: proposed exclusion zone, red symbols: core features of site, yellow symbols: outlying artefacts. Yellow bar for scale is 200 m.

6.2. Built environment

The only “built” items that might be directly impacted are those ephemeral stone features covered under archaeology above. No buildings will be directly affected, although indirect (visual) impacts will be felt. No highly significant buildings were noted in the study area, however.

6.3. Cultural landscapes

The landscape around De Aar and on Du Plessis Dam has only been very minimally altered by humans. However, the town of De Aar lies immediately alongside the proposed development. Although the facility would pose a negative visual impact to the context of the town, the part of town being impacted is entirely modern. At the smaller scale, the many small scatters of artefacts related to the Anglo-Boer War can be considered an archaeological cultural landscape because it is specific features of the landscape that have conditioned the placement of the sites to which the remains relate. However, far more significant Anglo-Boer War sites are known from across the Karoo and this aspect is thus not considered significant here.

6.4. Scenic routes and sense of place

The landscape around De Aar is one of great natural beauty (Figure 28) and has a very distinctive character with grasslands stretching for great distances and punctuated by typical flat-topped Karoo hills. Any road traversing the area can be considered a scenic route. The addition of solar panels (with an industrial character) to a predominantly natural/rural landscape will alter the pervading sense of place and result in a loss of context. The western boundary of the site runs parallel to and about 300 m distant from the R48 which links De Aar and Philipolis. This road can be considered a scenic route. However, another solar energy facility is currently under construction in the space between this road and the present study area (Figure 29). Other renewable energy projects, solar and wind energy, are also planned in the area and together these will produce a new cultural landscape with an industrial character.



Figure 28: View northwards from Du Plessis Dam and across the R48 that links De Aar and Philipolis. This type of view is synonymous with the Karoo.



Figure 29: View westwards towards the town of De Aar showing a solar energy facility under construction between the site (left of the fence) and the R48 (out of picture to the right).

6.5. Graves

No clear graves were located during the study. However, a few suspicious mounds of rocks were noted in places, particularly at the very tail end of the old dam where two, or possibly three, elongated mounds of stones aligned east-west were recorded. The mounds were somewhat dispersed. They are located outside of the currently proposed development footprint. However, it should be noted that pre-colonial graves are often completely unmarked and can be located anywhere where the soil is suitable for digging a grave.

7. ASSESSMENT OF IMPACTS

Impacts to archaeological heritage resources will occur at the construction phase and thereafter remain unchanged through the operational and decommissioning phases. This is because once they are destroyed they cannot be recreated. For cultural landscapes impacts would be experienced during construction and operation but then, with rehabilitation, would revert to the status quo (assessed as the No-Go alternative) after decommissioning.

Archaeological resources are widespread but of generally limited significance. Most with some research value are located in the central and far western parts of the site where PV3 is planned. As such, it is only for this facility that significance ratings are elevated and for which mitigation is proposed. Note that both places with potential graves are currently excluded from the Alternative 1 development area, but the transmission line corridor for Alternative 1 does just cover one potential grave (point J060) and Alternative 2 covers the other potential grave (point L052). These should preferably be avoided but otherwise would need to be tested as appropriate.

The two mitigation measures required are as follows (indexed to Table 1):

1. For either alternative, the layout should avoid the historic farmstead and all its related features and artefacts (see exclusion zone in Figure 27). The historic farmstead site is

- too significant to be mitigated since an extensive excavation and recording program over several weeks would be required;
2. For PV4 archaeological mitigation in the form of excavation, sampling and analysis should be carried out for the LSA sites that will be impacted (Figure 30). Radiocarbon dating may also be required, but this depends on the preservation of the appropriate organic materials that are needed for the dating process. An estimate on the amount of time required on site for each archaeological site is indicated in Appendix 2. Note that avoiding and protecting these sites is always preferred when feasible, but they are not of such a nature that their protection should be required; and
 3. Once the exact lines have been identified for the linear components of the project they should be examined from the desktop then subjected to a walk-down if deemed necessary.

While visual impacts to the local landscape will undoubtedly be the most significant heritage-related impacts that would be experienced through implementation of the proposed developments, the significance of this impact is to a large degree off-set by the similar facility currently being constructed in the area across which the proposed development would be viewed from the R48. This has resulted in a reduction in the significance of the impacts. Furthermore, the proposed PV2 is far from the R48 and has thus been accorded lower significance.

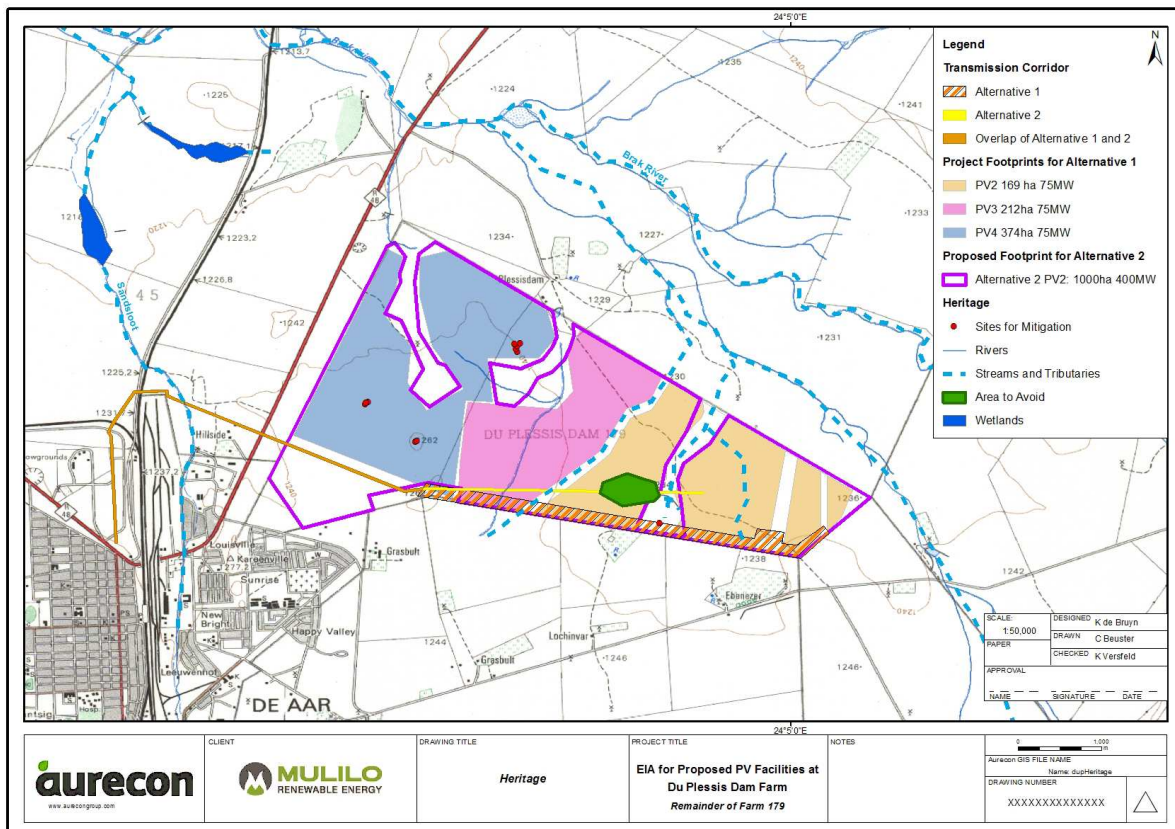


Figure 30: Map showing the locations of archaeological sites requiring mitigation (red symbols) and the homestead that should be avoided (pink polygon). The red shaded areas show the extent of the development footprint for Alternative 1 and the yellow area is a proposed laydown area. The yellow bar at the bottom represents 500 m.

Considering the extent of Alternative 2, the worst-case scenario of all the ratings for PV2-4 (Table 1) would be applicable. The No-Go alternative would result in maintenance of the status quo. Impacts to archaeological resources would continue at a very limited scale through trampling by grazing livestock and possibly collection of artefacts by visitors to the farm, while the cultural landscape would remain entirely unchanged and experience neutral impacts.

The De Aar area is a landscape strongly characterised by electrical infrastructure – many large power lines traverse the landscape and a very large substation occurs to the southeast of the study area. As such, the new set of transmission lines required to link to the De Aar substation will not introduce any new types of impacts. The open land that would be traversed is unlikely to contain many archaeological sites of value, as demonstrated by the field study of the PV site.

Cumulative impacts are not very easy to assess, since archaeological resources, in particular, are point-specific. Each is unique and, while the general locations of sites can often be predicted, there is no guarantee that a site will be found in an expected location. For this reason one cannot be sure how many sites will be lost relative to the number and type of sites occurring in the local and wider regions. A review of reports conducted for other renewable energy projects in the area suggests that the LSA sites found on Du Plessis Dam are likely among the best in the area in terms of research quality – only those recorded by Morris (2011) being equal. The significance of impacts has thus been kept the same at all scales (Table 2).

Table 1: Assessment of heritage impacts for all Alternatives. Mitigation measures as described above.

Impact on Heritage Resources:

project	Key impacts	No mitigation /Mitigation	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Confidence	Reversibility	Mitigation measures
Alt. 1, PV2	Archaeology	No mitigation	Local	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	1
	Cultural landscape	No mitigation	Local	Low	Long term	Low (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Low	Long term	Low (negative)	Definite	Sure	Reversible	None
Alt. 1, PV3	Archaeology	No mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	None
	Cultural landscape	No mitigation	Local	Low	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Low	Long term	Medium (negative)	Definite	Sure	Reversible	None
Alt. 1, PV4	Archaeology	No mitigation	Site specific	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	2
	Cultural landscape	No mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	None
Alt. 2, Ext. PV2	Archaeology	No mitigation	Local	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	1, 2
	Cultural landscape	No mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	None
No-Go	Archaeology	No mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Very low (negative)	Definite	Sure	Irreversible	None
	Cultural landscape	No mitigation	Local	Zero	Long term	Neutral	Definite	Sure	Reversible	
		Mitigation	Local	Zero	Long term	Neutral	Definite	Sure	Reversible	None
Off-site transmission lines	Archaeology	No mitigation	Site specific	Low	Permanent	Low (negative)	Probable	Sure	Irreversible	
		Mitigation	Site specific	Very low	Permanent	Low (negative)	Probable	Sure	Irreversible	3
	Cultural landscape	No mitigation	Local	Low	Long term	Low (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Low	Long term	Low (negative)	Definite	Sure	Reversible	None

Table 2: Cumulative assessment of heritage impacts for all Alternatives.

Cumulative impact on Heritage Resources:

	Key impacts	No mitigation /Mitigation	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Confidence	Reversibility	Mitigation measures
Du Plessis Dam	Archaeology	No mitigation	Site specific	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Low	Permanent	Very low (negative)	Definite	Sure	Irreversible	2
	Cultural landscape	No mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
Local extent	Archaeology	No mitigation	Site specific	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Low	Permanent	Very low (negative)	Definite	Sure	Irreversible	2
	Cultural landscape	No mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Local	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
Regional extent	Archaeology	No mitigation	Site specific	Medium	Permanent	Medium (negative)	Definite	Sure	Irreversible	
		Mitigation	Site specific	Low	Permanent	Very low (negative)	Definite	Sure	Irreversible	2
	Cultural landscape	No mitigation	Regional	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	
		Mitigation	Regional	Medium	Long term	Medium (negative)	Definite	Sure	Reversible	

8. CONCLUSIONS

This heritage impact assessment has found that there will be impacts to heritage resources if the proposed solar energy facilities are constructed. Two major types of heritage resources will be impacted: archaeological sites and the landscape. While archaeological sites can be easily mitigated if they are not protected and conserved, the landscape impacts will be more substantial and cannot easily (if at all) be mitigated. Given the scale of solar energy development planned for the region, there is little sense in attempting to shield the presently proposed developments from view.

Nevertheless, this report finds that construction of the proposed developments is feasible. Either Alternative can be chosen, however, it should be noted that Alternative 1, by virtue of covering a slightly smaller land area, is preferred.

9. RECOMMENDATIONS

The proposed project should be allowed to proceed with either Alternative, although Alternative 1 is preferred. The following recommendations apply:

- Where archaeological sites cannot be avoided, mitigation in the form of excavation and collection of artefacts should be carried out;
- The historical homestead and all surrounding features and artefacts must be avoided (this site is too significant to be effectively mitigated in a commercial context);
- If any human remains are encountered during the development they should be cordoned off and protected from further harm until they can be inspected and removed by an archaeologist under a permit issued for that purpose; and
- Once the exact lines have been identified for the linear components of the project they should be examined from the desktop then subjected to a walk-down if deemed necessary.

10. HERITAGE MANAGEMENT

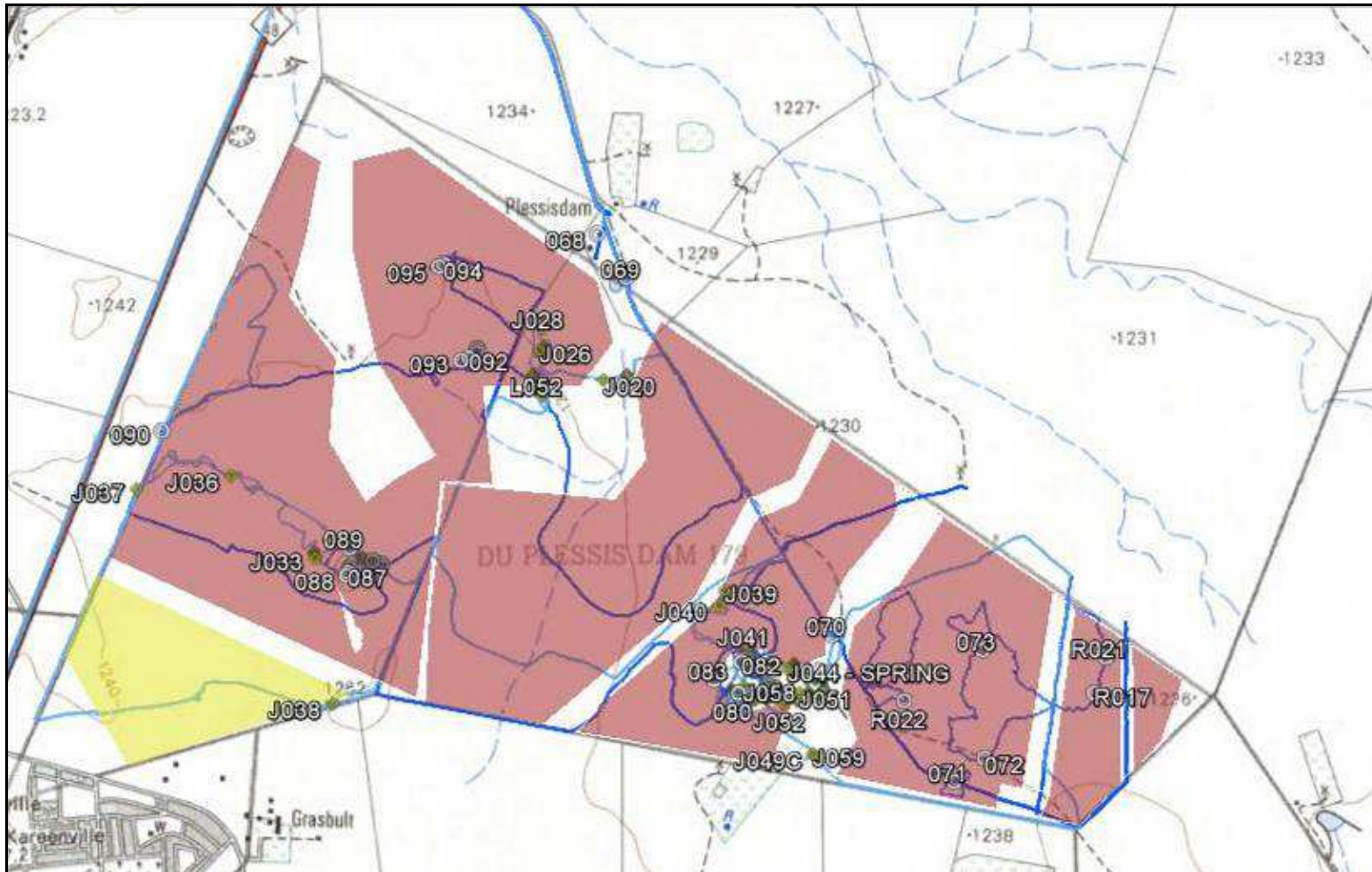
In addition to the recommendations made above, the following management measures are suggested:

- All mitigation-worthy archaeological sites that are avoided by the development and are not mitigated should be protected from incidental damage (for example from vehicles driving over them or through the establishment of power line access tracks);
- Any dense subsurface concentrations of artefacts found during excavations should be protected *in situ* and immediately reported to an archaeologist for assessment; and
- Any areas of the landscape that are not to be developed should be protected so as to minimise unnecessary landscape scarring.

11. REFERENCES

- AngloBoerWar.com 2011. www.angloboerwar.com/forum/6-places/294-de-aar. Accessed 28th December 2011.
- Anonymous. 2001. Cultural resource management plan for Augrabies Falls National Park and surrounding areas. South African National Parks.
- Aurecon. 2013. Proposed photovoltaic energy facilities on Du Plessis Dam Farm near De Aar, Northern Cape: Draft Scoping Report. Report No. 7586.
- Baker, D.C. 1998. Wireless telegraphy during the Anglo-Boer War of 1899 – 1902. *Military History Journal* 11(2). <http://rapidhttp.co.za/milhist/vol112db.html>. Accessed 29th December 2011.
- Bollong, C.A., Sampson, C.G. & Smith, A.B. 1997. Khoikhoi and bushman pottery in the Cape Colony: ethnohistory and Later Stone Age ceramics of the South African interior. *Journal of Anthropological Archaeology* 16: 269-299.
- Bollong, C.A., Vogel, J.C., Jacobson, L., Van der Westhuizen, W. & Sampson, C.G. 1993. Direct dating and identity of fibre temper in pre-Contact Bushman (Basarwa) pottery. *Journal of Archaeological Science* 19: 41–55.
- De Aar. n.d.a. <http://www.deaar.co.za/index.html>. Accessed 24th December 2011.
- De Aar. n.d.b. <http://www.angelfire.com/tv2/deaar/newpage13.htm>. Accessed 29th December 2011.
- Deacon, J. 1984. Later Stone Age people and their descendants in southern Africa. In: Klein, R. G., ed., *Southern African Prehistory and Paleoenvironments*. Rotterdam: A. A. Balkema, pp. 221–328.
- Fourie, W. 2012. Concentrated solar power – De Aar. Heritage Impact Assessment. Unpublished report prepared for SiVEST Environmental Division. PGS Heritage & Grave Relocation Consultants.
- Hart, T.J.G. 1989. Haaskraal and Volstruisfontein: Later Stone Age events at two rockshelters in the Zeekoe Valley, Great Karoo, South Africa. Unpublished M.A. dissertation, University of Cape Town.
- Kruger, N. 2012. Archaeological impact assessment (AIA) of demarcated surface areas on the of the farm Vetlaagte 4, De Aar, Northern Cape Province. Unpublished report prepared for Ennex Developments. Lynnwood: AGES (Pty) Ltd.
- Morris, D. 2011. Paarde Valley Ilanga Lethemba PV Solar Energy Facility. Specialist input for the environmental impact assessment phase and environmental management programme for the proposed Ilanga Lethemba solar energy facility, near De Aar, Northern Cape Province. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Kimberley: McGregor Museum.
- Orton, J. 2006. The Later Stone Age lithic sequence at Elands Bay, Western Cape, South Africa. *Southern African Humanities* 18 (2): 1-28.
- Orton, J. 2011. Heritage impact assessment for three solar energy facilities at De Aar, Northern Cape. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. St James: ACO Associates cc.
- Orton, J. & Webley, L. 2012a. Heritage impact assessment for proposed granite prospecting near Pofadder, Northern Cape. Unpublished report prepared for Sizisa Ukhanyo Trading 830 cc
- Orton, J. & Webley, L. 2012b. Heritage impact assessment for the proposed Kangnas Wind and Solar Energy Facilities, Namakwa Magisterial District, Northern Cape. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. Diep River: ACO Associates cc.
- Rudner, J. 1979. The use of stone artefacts and pottery among the Khoisan peoples in historic and proto-historic times. *South African Archaeological Bulletin* 34: 3-17.
- Sadr, K. & Fauvelle-Aymar, F-X. 2006. Ellipsoid grinding hollows on the west coast of South Africa. *Southern African Humanities* 18: 29-50.
- SAHRA. n.d. South African Heritage Resources Agency website: <http://196.35.231.29/sahra/default.aspx>. Accessed on 24th December 2011.
- Sampson, C.G. 1984. A prehistoric pastoralist frontier in the Upper Zeekoe Valley, South Africa. In: Hall, M., Avery, G., Avery, D.M., Wilson, M.L. & Humphreys, A.J.B (eds) *Frontiers: southern African archaeology today*: 96 – 110. Oxford: British Archaeological Reports International series 207.
- Sampson, C.G. 1985. Atlas of Stone Age settlement in the central and upper Seacow Valley. *Memoirs of the National Museum (Bloemfontein)* 20: 1-116.
- Sampson, C.G. 1986. Model of a prehistoric herder-hunter contact zone: a first approximation. *South African Archaeological Society Goodwin Series* 5: 50-56.
- Sampson, C.G. 2010. Chronology and dynamics of Later Stone Age herders in the Seacow River valley, South Africa. *Journal of Arid Environments* 74:848-848.

APPENDIX 1: Mapping



Map showing the walk and drive paths from 2011 and 2013 and all plotted heritage finds.

APPENDIX 2: List of heritage findings

Field No.	Site No.	Co-ordinates	Description	Significance / Grade / Mitigation
068	DPD2011/001	S30 36 56.3 E24 03 25.6	Kraal, probably not very old but may be an attempt at rescuing an older kraal with modern cement.	Low
069	DPD2011/002	S30 37 04.0 E24 03 31.6	Pile of stones (possible collapsed structure) and a dump of glass, ceramics, metal and ostrich eggshell. Most is recent but some may be mid-20 th century or earlier.	Low
070		S30 38 06.3 E24 04 13.3	Background scatter of MSA and two LSA hornfels artefacts in a silty area with shale gravel.	Very low
071		S30 38 31.8 E24 04 38.0	Background scatter of MSA in a silty area with shale gravel.	Very low
072		S30 38 27.7 E24 04 44.2	Background scatter of MSA in a silty area with shale gravel.	Very low
073		S30 38 08.9 E24 04 43.8	Background scatter of MSA in a silty area with shale gravel.	Very low
074	DPD2011/003	S30 38 10.7 E24 03 57.2	Small rectangular stone foundation with lots of glass, ceramics and metal around it. Made of shale.	Very high (avoid with buffer) Grade 3A
075	DPD2011/004	S30 38 10.4 E24 03 55.9	As above but less artefacts. Made of shale.	
076	DPD2011/005	S30 38 12.2 E24 03 57.5	Stone kraal of packed shale. Approximately 39 m x 41 m with three compartments. Lots of glass bottles around it and various ceramics and metal items. Also a few bricks and many pieces of slag, the latter all along the southern edge.	
077	DPD2011/006	S30 38 15.0 E24 04 00.1	Massive historical dump of 20 m diameter. Huge number of bottles, plenty of ceramics, less metal. One musket ball seen; several bones. Dump seems to be largely ash and looks like it is about 0.4 m – 0.5 m above ground level. Can't tell depth of dump though despite some burrowing. Button noted with "Markhams Cape Town" on it and a bottle with "Rotterdam".	
078	DPD2011/007	S30 38 15.4 E24 04 01.5	House foundation of shale and brick. Quite a lot of brick lying about, some have frogs. Two measured as follows: 21 cm x 10 cm x 6 cm and 22 cm x 10.5 cm x 6 cm. Some glass and ceramics around the house as well. There is an old plough standing on top of the house with "J. Nourse" on it. House 14 m x 7 m but one end has a narrow part assumed to be a hearth.	
079		-	079 points mark development exclusion zone.	

080	DPD2011/008	S30 38 16.4 E24 03 54.3	Two small shale ruins with a few bricks, some glass and ceramics and metal scattered about. They are about 2 m x 1.5 m and 2 m x 2 m.	
081	DPD2011/009	S30 38 17.2 E24 03 55.3	Two pairs of rocks buried in the ground. Potential grave(s)?	
082	DPD2011/010	S30 38 11.0 E24 03 54.9	Small quarry from which they obtained building shale.	
083	DPD2011/011	S30 38 14.0 E24 03 49.3	Small rocky outcrop with a scatter of glass and ceramics on it. Also a rock with an "X" scratched/rubbed onto it.	
084		S30 37 53.9 E24 02 42.0	Tiny LSA hornfels scatter with one core and three flakes.	Very low
085	DPD2011/012	S30 37 53.3 E24 02 40.3	Scatter of LSA hornfels and historical artefacts on a rise (slope break) on the side of a low hill. Some possible stone alignments may indicate something structural here.	Very low
086	DPD2011/013	S30 37 54.6 E24 02 35.6	LSA hornfels scatter on the crest of the hill.	Low
087	DPD2011/014	S30 37 55.3 E24 02 35.2	LSA hornfels scatter on the crest of the hill.	Low
088		S30 37 55.8 E24 02 35.0	Small stone semi-circle of 1 m diameter.	Very low
089		S30 37 51.0 E24 02 35.6	Possible stone structure and some bullet cases.	Very low
090	DPD2011/015	S30 37 30.7 E24 01 57.5	LSA hornfels scatter.	Low
091	DPD2011/016	S30 37 16.4 E24 03 01.4	Grooved lower grindstone and an LSA hornfels scatter. Scatter is low density but quite widespread.	Low-medium
092		S30 37 18.0 E24 02 59.7	Stone alignments/structures on low shale hill. Two areas 15 m apart. Also near here a probable LSA lower grindstone on a bedrock outcrop.	Very low
093		S30 37 18.4 E24 02 58.2	Grooved and double-sided lower grindstone and three hornfels flakes.	Low
094	DPD2011/017	S30 37 01.7 E24 02 54.5	Cleared track over a rocky hill. Rocks pushed to the side but the track, which is no longer visible, still has many small cobbles in it.	Low
095		S30 37 02.1 E24 02 53.6	Possible stone semi-circle. Also many large fresh dolerite flakes here as though someone was dressing stone. Quite widely scattered though.	Very low
R017		S30 38 16.4 E24 05 06.4	Background scatter of MSA in a silty area with shale gravel.	Very low
R021		S30 38 10.1 E24 05 08.8	Background scatter of MSA in a silty area with shale gravel.	Very low
R022		S30 38 17.7 E24 04 27.9	One tin can and three LSA hornfels flakes.	Very low
J019		S30 37 20.9 E24 03 31.7	Furrow. Some stones along the edge at this point.	Very low
J020		S30 37 21.8	West end of furrow.	

		E24 03 26.9		
J021	DPD2013/001	S30 37 20.6 E24 03 14.4	Extensive LSA hornfels scatter. Points are each end of scatter.	Low-medium (8 hours)
J022		S30 37 19.5 E24 03 13.7		
J023	DPD2013/002	S30 37 18.4 E24 03 14.2	LSA hornfels scatter at the base of a low dolerite ridge. Also some historical material here. Bullet case, cans, wire.	Low-medium (4 hours)
J024	DPD2013/003	S30 37 17.7 E24 03 13.3	LSA hornfels scatter above the dolerite ridge.	Low (2 hours)
J025	DPD2013/004	S30 37 17.4 E24 03 15.3	LSA scatter of hornfels including one typical adze. Also some historical material including a spade and some wire.	Low (2 hours)
J026		S30 37 16.6 E24 03 14.0	Recent engraving on two dolerite boulders.	Very low
J027		S30 37 16.1 E24 03 14.8	Possible stone feature.	Very low
J028		S30 37 12.8 E24 03 14.8	Possible stone feature.	Very low
J029	DPD2011/014	S30 37 55.3 E24 02 35.0	LSA hornfels and OES scatter. Also one CCS endscraper. (087 from 2011 survey)	Low (1 hour)
J030	DPD2013/006	S30 37 55.0 E24 02 35.4	LSA hornfels scatter with some burnt bone and grass-tempered pottery. May well be subsurface deposits here. Site is on the summit of a large, low hill. Some dense patches of artefacts over about 10 – 15 m diameter area.	Medium (16 hours)
J031		S30 37 52.7 E24 02 38.3	Low density hornfels scatter of mixed age.	Very low
J032	DPD2011/012	S30 37 53.6 E24 02 40.2	Ephemeral scatter of historical glass. (085 of 2011 survey)	Very low
J033	DPD2013/007	S30 37 52.8 E24 02 28.6	Ephemeral LSA hornfels scatter on low ridge.	Very low
J034	DPD2013/008	S30 37 51.9 E24 02 28.4	Ephemeral LSA hornfels scatter on low ridge.	Very low
J035	DPD2013/009	S30 37 41.0 E24 02 15.3	Three stone features/structures on the crest of a small rocky hill that rises perhaps 2 m from the surrounding plains. Surrounded by historical artefacts likely from Anglo-Boer War. Tin lids, bullet, glass bottles. Also some LSA hornfels artefacts here. (L055 (Scatter of dark green bottle glass) and L056 (glass and tins) are same site).	Low (2 hours)
L055		S30 37 40.2 E24 02 16.5		
L056		S30 37 40.5 E24 02 15.7		
J036		S30 37 38.5 E24 02 11.5	Possible ground rock.	Very low
J037	DPD2013/010	S30 37 40.8 E24 01 52.4	Scatter of historical, probably Anglo-Boer War, remains on crest of low hill. Also some LSA hornfels artefacts. Half the site has been destroyed by the SEF over the fence.	Low
J038		S30 38 18.1	Ephemeral mixed age hornfels	Very low

		E24 02 32.2	scatter on high ground. One OES fragment too.	
J039	DPD2013/011	S30 37 58.5 E24 03 51.5	LSA ground hollow in bedrock close to a dried out puddle.	Very low
J040	DPD2013/012	S30 38 01.1 E24 03 50.4	LSA hornfels scatter in flat area but close to some bushes.	Low (2 hours)
J041		S30 38 08.1 E24 03 56.5	These points all represent outlying artefacts around the historical complex (DPD2011/003-011). 044 is a dry spring.	
J042		S30 38 10.8 E24 04 00.9		
J043		S30 38 11.1 E24 04 01.9		
J044		S30 38 12.2 E24 04 04.3		
J045		S30 38 11.3 E24 04 05.6		
J046		S30 38 13.1 E24 04 05.7		
J047		S30 38 13.1 E24 04 06.4		
J048		S30 38 13.9 E24 04 09.9	Background (MSA) hornfels scatter but in good density.	Low (1 hour)
J048B	DPD2013/013	S30 38 13.8 E24 04 11.4		
J048C		S30 38 15.6 E24 04 11.6		
J049		S30 38 16.8 E24 04 10.5	Historical dam lined with dolerite cobbles and blocks.	Very low
J049B		S30 38 16.8 E24 04 08.0		
J049C		S30 38 27.5 E24 04 09.9		
J049D		S30 38 21.5 E24 04 16.9		
J050		S30 38 16.2 E24 04 08.5	These points all represent outlying artefacts around the historical complex (DPD2011/003-011).	See 2011 records above.
J050B		S30 38 17.7 E24 04 06.3		
J051		S30 38 16.4 E24 04 06.7		
J052		S30 38 18.2 E24 04 03.6		
J053		S30 38 17.5 E24 04 00.2		
J054		S30 38 17.0 E24 03 59.9		
J055		S30 38 16.6 E24 03 58.2		
J056		S30 38 17.5 E24 03 57.6		
J057		S30 38 15.8 E24 03 53.0		
J058		S30 38 15.2 E24 03 55.2	Historical ruin (probably documented in 2011)	See 2011 records above.
J059	DPD2013/014	S30 38 27.0 E24 04 09.3	Background (MSA) hornfels scatter but in good density. Inside the very back end of the dam.	Low (1 hour)

J060	DPD2013/015	S30 38 27.0 E24 04 09.3	Same area as 059. Two or three probable graves. Seem aligned east-west.	?High (Avoid / test)
L052	DPD2013/016	S30 37 24.4 E24 03 14.5	Stone cairn? Heap of boulders 3m x 2m.	?High (Avoid / test)
L053		S30 37 23.2 E24 03 13.4	Large boulder on top of the ridge with a smooth grinding surface. Used as possible lower grindstone?	Very low
L054		S30 37 20.9 E24 03 12.6	Two rocks, about 3m apart, both with evidence of grinding	Very low
L057		S30 38 11.0 E24 03 55.3	Small hollow/dam with a shale base which shows evidence of shale quarrying. Presumably the dam was formed by the quarrying of the shale to construct the nearby stone kraal.	See 2011 records above.