

HERITAGE IMPACT ASSESSMENT: PROPOSED KENHARDT PHOTO-VOLTAIC SOLAR POWER PLANT ON REMAINDER OF THE FARM KLEIN ZWART BAST 188, NORTHERN CAPE PROVINCE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act 25 of 1999)

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EXECUTIVE SUMMARY

ACO Associates cc was appointed by Digby Wells Environmental, on behalf of the client Orlight South Africa, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on the farm Klein Zwart Bast 188, in the Siyanda District Municipality, Northern Cape Province.

The proposed facility will be located to the north of the Kenhardt – Bossiekom District Road, opposite the Aries substation and some 40km west of Kenhardt.

This assessment forms part of the EIA process. The Notice of Intent to Develop and Scoping phase was undertaken by Digby Wells Environmental. The NID was submitted to SAHRA (SAHRA file number: 9/2/048/0001) in January 2012 and they have requested a palaeontological and archaeological impact assessment. They also asked that the “archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance”.

Background research, including a review of two recent assessments conducted on adjoining properties, as well as fieldwork on the 19th and 20th April 2012, inform the following conclusions:

Heritage Findings:

Palaeontology:

- The palaeontological sensitivity of the rock units within the study area is generally low.

The Pre-colonial Archaeology:

- Archaeological sites are present in the form of stone artefact scatters from the Early Stone Age (ESA) and Middle Stone Age (MSA);
- Artefact scatters tend to be widespread rather than discrete and are found on extensive gravel pavements between scrub vegetation;
- The absence of associated organic material, and lack of discrete individual sites reduces the significance of the material overall;
- Thousands of square kilometres of Bushmanland are covered by these low density artefacts scatters;
- Further mitigation of the material is considered unnecessary in view of a collection which has already been made on the adjoining property of Olyven Kolk;
- A permit will be needed for the destruction of archaeological material.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- A few cairns were identified. They could possibly be graves. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:

- The proposed solar plant is positioned opposite the Aries substation on district gravel road linking Kenhardt with Bossiekom in the Northern Cape. It is an isolated area and will not be visible from any scenic route;
- The cultural landscape of the surrounding area is a flat arid landscape utilised for the grazing of livestock; A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered by the Visual Impact specialist.

The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended.

SPECIALIST TEAM AND DECLARATION OF INDEPENDENCE

David Halkett (BA, BA Hons, MA (UCT)) is an Archaeologist and Member of the Association of Professional Archaeologists of Southern Africa (ASAPA) accredited with Principal Investigator status. He has been working in heritage management for 23 years and has considerable experience in impact assessment with respect to a broad range of archaeological and heritage sites including those in the Northern Cape. He is a member of the Archaeology, Palaeontology and Meteorites Committee and the Impact Assessment Committee of the Heritage Western Cape (HWC), the Provincial Heritage Resources Authority.

Lita Webley (BA, BA Hons, MA (Stellenbosch), PhD (UCT)) is an Archaeologist and member of ASAPA accredited with Principal Investigator status. She has been involved with heritage and archaeological impact assessments on a part-time basis since 1996 and full time since 2008. Her PhD thesis was concerned with the archaeology of the Namaqualand region of the Northern Cape and she is familiar with the heritage of the region.

John Pether (MSc. Pr. Sci. Nat.(Earth Sci)) is an independent consultant/researcher and authority on coastal-plain and continental-shelf palaeoenvironments.

Mr David Halkett, Dr Lita Webley and Mr John Pether are independent specialist consultants who are in no way connected, financially or otherwise, with the proponent, other than in the delivery of consulting services on the project.

Terminology

Archaeology: *Remains resulting from human activity which is in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.*

Crypto-crystalline silica (CCS): *Cryptocrystalline silicates include lithic materials such as chert or flint and were widely used by prehistoric peoples to manufacture stone tools.*

Early Stone Age: *The archaeology of the Stone Age between 700 000 and 2500 000 years ago.*

Fossil: *Mineralised bones of animals, shellfish, plants and marine animals.*

Heritage: *That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).*

Holocene: *The most recent geological time period which commenced 10 000 years ago.*

Late Stone Age: *The archaeology of the last 20 000 years associated with fully modern people.*

Middle Stone Age: *The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.*

National Estate: *The collective heritage assets of the Nation.*

Palaeontology: *Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.*

SAHRA: *South African Heritage Resources Agency – the compliance authority which protects national heritage.*

Structure (historic): *Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.*

Trace fossil: *The track or footprint of a fossil animal that is preserved in stone or consolidated sediment.*

Acronyms

BP	Before the Present
DEA	Department of Environmental Affairs
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act, No 25 of 1999
SAHRA	South African Heritage Resources Agency

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1. INTRODUCTION

ACO Associates cc was appointed by Digby Wells Environmental, on behalf of the client Orlight SA (Pty) Ltd, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on the Remainder and Portion 1 of the farm Klein Zwart Bast 188, in the Siyanda District Municipality, Northern Cape Province. This is to meet the growing demand for electricity generation and cleaner energy production in South Africa.

The proposed facility will be located to the north of the Kenhardt – Bossiekom District Road, opposite the Aries substation and some 40km west of Kenhardt.



Figure 1: The location of the Kenhardt solar facility to the west of Kenhardt, Northern Cape.

2. DEVELOPMENT PROPOSALS

The Kenhardt project will have a generation capacity of 70MW resulting in the physical alteration of approximately 350ha of range land on the farm Klein Zwart Bast 188. Three alternative layout designs (Options A, B & C) have been suggested (Figure 2). They differ only marginally from each other in the position of the laydown areas and the substation. The facility will connect to the Aries substation via a 66kV or 132kV overhead powerline. Where possible the transmission route will be situated within, or parallel to, an existing servitude. The project will require the establishment of a ground mounting system, solar PV panels, inverters, switchboard and transformers. Access roads to the facility from the nearest public road onto the site will be required. Internal site roads will also be required to access the solar panels for maintenance purposes. The solar panel plant will be fenced off from the surrounding farms. The site will need to be cleared of vegetation.

The following associated infrastructure will be required:

- Temporary container homes during the construction phase
- Office and technical service buildings
- Electricity distribution lines (from substation to Eskom power line)

- A perimeter high security fence
- Roads within the development footprint

The “no go” option (no development of the site) will also be considered.

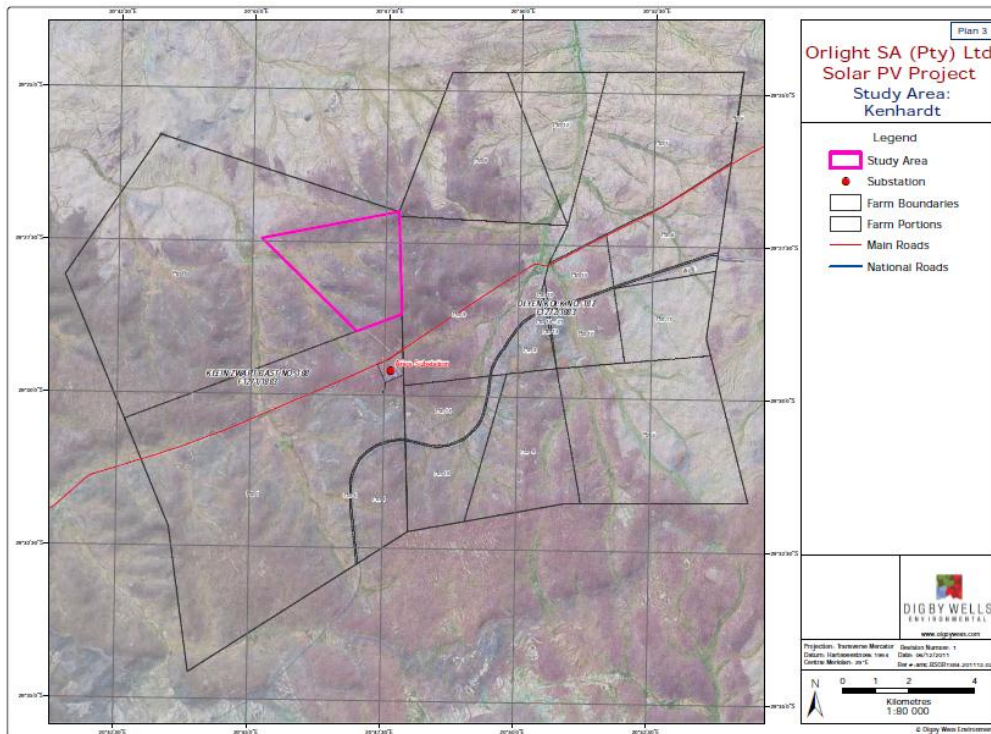


Figure 2: Map of the proposed facility in relation to the Aries substation and the District Road.

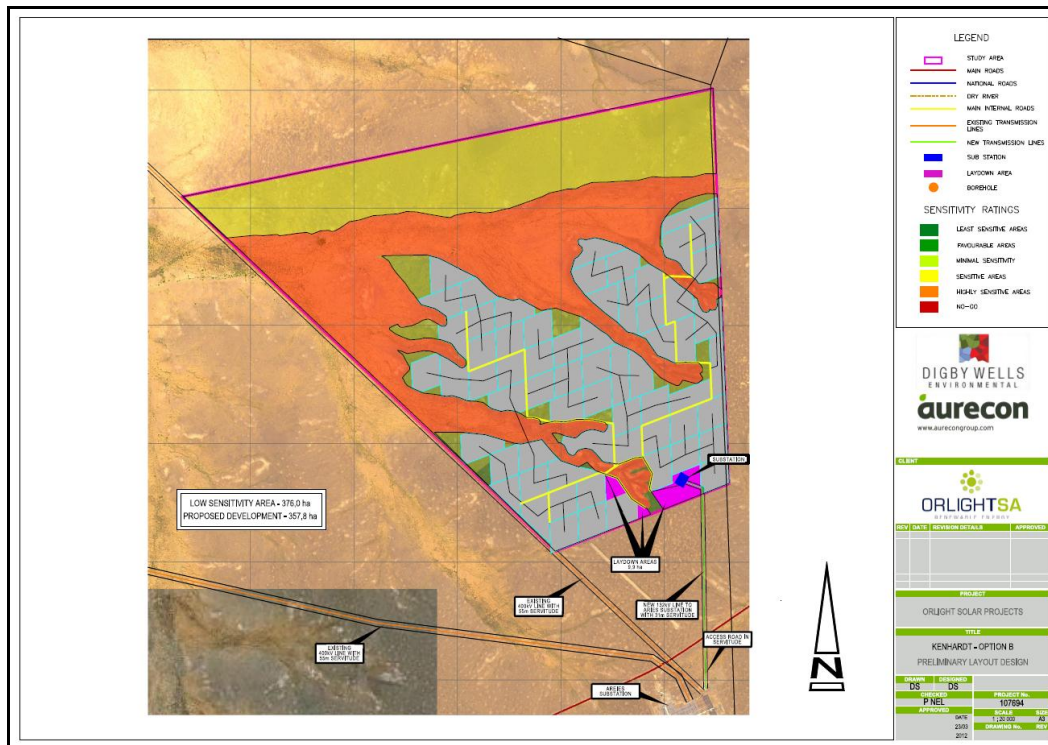


Figure 3: Preliminary layout design for Option B. Options A and C are similar except for the position of the substation and lay down areas.

3. TERMS OF REFERENCE

This assessment includes:

- A site visit and desk top study to determine the pre-history and history of the property;
- The rating of significance of heritage resources on the property;
- An assessment of whether the development of the property will result in a loss of significant heritage resources;
- Recommendations for mitigation if necessary.

4. LEGISLATION

The National Heritage Resources Act, No 25 of 1999 (Section 38 (1)) makes provision for a compulsory notification of the intent to development when any development exceeding 5000 m² in extent, or any road or linear development exceeding 300m in length is proposed.

The NHRA provides protection for the following categories of heritage resources:

- Cultural landscapes (Section 3(3))
- Buildings and structures greater than 60 years of age(Section 34)
- Archaeological sites greater than 100 years of age(Section 35)
- Palaeontological sites and specimens
- Shipwrecks and aircraft wrecks
- Graves and grave yards (Section 36).

Only the Western Cape and Kwa-Zulu Natal have functioning Provincial Heritage Authorities, and consequently SAHRA administers heritage in the remaining provinces particularly where archaeology and palaeontology are the dominant concerns. Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with built environment issues at this stage. Amongst other things the latter administers:

- World Heritage Sites
- Provincial Heritage Sites
- Heritage Areas
- Register Sites
- 60 year old structures
- Public monuments & memorials

Archaeology, including rock art, graves of victims of conflict and other graves not in formal cemeteries are administered by the national heritage authority, SAHRA.

Digby Wells Environmental submitted a cultural resources pre-assessment report or Notice of Intent to Develop to SAHRA in January 2012.

SAHRA (SAHRA file number: 9/2/048/0001) have requested a palaeontological and archaeological impact assessment. Further, they have asked that the archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The town of Kenhardt is located about 115km south of Upington on the R27 which links Keimoes to Brandvlei in the Northern Cape. The study area is situated some 40km west of Kenhardt on the Kenhardt - Bossiekom District road. The Aries substation is situated 1km south of the study area (Figure 2).



Plate 1: View of the landscape.

According to the Draft Scoping Report (Digby & Wells Environmental 2012) the study area displays an elevation of between 910 and 940 mamsl. It is characterised by a relatively flat, slightly undulating surface bisected by a number of shallow drainage basins. The vegetation can be classified as Bushmanland Basin Shrubland comprising dwarf shrubland dominated by low sturdy and spiny shrubs. The knee high bushy vegetation is sparse and there is numerous bare gravel and rock covered pavements on which the archaeological material is found (Plate 3). The types of rock are variable but include grey quartzitic material in slabs often tilted vertically. Dolomite and banded ironstone are also present.



Plate 2: View of the shallow drainage channel which crosses the site from west to east. The drainage channel has been excluded from the proposed facility (see Figure 3). The transmission lines which cross the property are visible in the distance.

Stock farming is practiced on the farm. There is a small concrete reservoir and wind pump on the property and the property is fenced. The farm house of Klein Swartbas is located 1.3km to the west of the proposed facility. Access to the proposed facility will be from the local District Road.

In terms of visibility, the solar facility will be visible from the Kenhardt-Bossiekom District gravel road. There is an existing Cross Rope Suspension (CRS) 400kV transmission lines

which crosses the SW corner of the site and there is a service track which runs below the transmission line. The Aries substation is located on the opposite side of the road. The landscape has therefore already been subjected to some “industrialization”.

6. METHODOLOGY

The property was visited by Lita Webley and David Halkett. The locations of the proposed PV arrays were loaded onto handheld GPS receivers (set to the WGS84 datum) to facilitate the identification of the search area during field work undertaken on 17 & 18 April 2012. Walk paths and site locations were recorded with GPS and finds were photographed and described. The assessment was primarily concerned with palaeontology and archaeology (as per the recommendations of SAHRA), but consideration was also given to the built environment where appropriate.

Previous work done on adjoining properties such as Portions 14 and 15 of Olyven Kolk 187 (Halkett & Orton 2011) and on Portion 1 of Klein Swart Bast 118 (Pelser 2011), and in the wider region (Beaumont et al 1995), provides a good basis for comparison with our observations. Beaumont et al (1995) has described making collections of artefacts on Olyven Kolk but has not indicated the exact location of his sample, or whether it was ever analysed.

Based on the low sensitivity of the site determined by its geological context, the palaeontological study was limited to a desktop study. In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area were determined from geological maps. The known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author’s field experience.

An independent Visual Assessment forms part of the EIA.

6.1 Limitations

There were no significant physical limitations encountered when undertaking the field study and surface visibility was excellent. Although there are few roads across the property, the low shrub and the level topography meant that were able to access all areas of the proposed facility (Figure 4; Plate 1).

We have made certain assumptions about the archaeology based on the specific landscape characteristics of the site, and knowledge of the broader archaeological issues. The lack of significant landscape features such as rock outcrops, caves, pans *etc*, greatly reduces the likelihood of finding significant sites.

As with all archaeological surveys, it is not possible to be completely confident that all archaeological sites were identified during the fieldwork. Surface distributions give only a general indication of sub-surface remains. It is always possible that sub-surface archaeological sites may be present which were not identified during the survey

From a palaeontological point of view, the lack of any natural exposures of bedrock on the site have meant that conclusions are broad, based on existing literature and observations elsewhere.

7. BACKGROUND TO THE AREA

7.1 Palaeontology

The detailed palaeontological report is presented in Appendix 2. In summary, the study area is on the edge of the Karoo Supergroup and is underlain by the Dwyka Group, the lowermost unit of the Karoo Supergroup. To the north are ancient basement rocks of the Bushmanland Subprovince or terrane of the Namaqua Province. The Bushmanland terrane here consists of metasediments and metavolcanics, De Kruis gneisses and De Bakken granites. These are very old sediments and are not of palaeontological interest.

Quaternary sand is minimal and the thin stony soil has mainly formed from the weathering of the conglomerate Dwyka diamictites.

7.2 Archaeological Background

The archaeological background of the area is based on a single published and a number of unpublished reports. Beaumont et al. (1995:240), who undertook a surface collection of artefacts from the adjoining property of Olyven Kolk, have the following to say “the material separates out on the basis of abrasion state, into a fresh component, with advanced prepared cores, blades, and convergent points, that is ascribable to the Middle Stone Age, and a larger fraction of moderately to heavily weathered Early Stone Age. This is typified by the presence of long blades, Victoria West cores (mainly on dolerite) and an extremely low incidence of formal tools (handaxes and cleavers)..”

In his 2006 report, Morris indicates that the terrain in the vicinity of Olyven Kolk and **Klein Zwart Bast** is characterized by Dwyka tillite, known to be a favourite source of raw materials in Early Stone Age times.

At least two other recent CRM studies have been conducted in the immediate vicinity of the proposed facility, adjacent to the Aries substation, and they further inform our discussions and conclusions below.

Halkett & Orton (2011) undertook the HIA for the Olyven Kolk Solar Power Plant located to the south of the Aries substation and diagonally south of the proposed facility. They recorded a potential 50 “sites” although they describe these as: “gravel pavement, low density artefact scatter esa/msa gravel pavement”. These scatters of ESA and MSA material do not have discrete boundaries and it is not possible to talk of sites. Neither is it possible to record every artefact as there are thousands. They describe the material as including a few isolated large implements which resembled sub-classic bifaces (ESA) but the items were very weathered and observations remain equivocal and one clear biface of a size suggestive of Fauresmith type. Most of the material was ascribed to the Middle Stone Age and distinctive flakes were noted some of which some were retouched.

Pelser recorded both Early and Middle Stone artefact scatters on Portion 1 of Klein Zwart Bast, opposite the portion of the farm assessed in this report. He described the widespread distribution of material and emphasised in his report that “although GPS coordinates were taken on many locales (Sites), many more sites (scatters and concentrations of stone tools) were not recorded as it became clear during the assessment that most of the area is covered by Stone Age material and that it would be a near impossible task taking the scope and time-frame of the assessment into consideration to mark all the finds. The whole area can therefore be marked as a Stone Age site, with potentially millions of artefacts present”.

The Draft Scoping Assessment (Digby Wells Environmental) also describes that “Stone Age lithics were consistently noted along the drainage lines and the rim of the depression. Although no source material was found, both formal and informal tools were found, however these were surface scatters with little context”.

Pelser describes a small rocky outcrop with MSA/LSA tools (small flakes and tools) and ostrich eggshell as a potential Later Stone Age site. Similarly, Halkett & Orton (2011) have also recorded a single LSA site with an upside down grindstone. The Scoping Report points out that many of the informants that Lucy Lloyd and Wilhelm Bleek interviewed came from the Kenhardt area. Nevertheless, few Later Stone Age sites have to date been recorded from this part of Bushmanland.

Previous work therefore suggests that the study area would contain a widespread distribution of Early and Middle Stone Age material with perhaps a few Later Stone Age sites, depending on topography and proximity to water.

5.2 Historical Background

According to the Scoping Report, there were many skirmishes between Boers and San people in the area around Kenhardt. De Jong (2011) describes the arrival of the first Trekboers along the lower Orange River by 1730. The interior of Bushmanland was only settled much later. Even around the 1830’s missionaries such as Barnabas Shaw reported that large areas were deserted because of a lack of adequate grazing and water. This region was used after the summer rains, with many farmers moving seasonally between Namaqualand and Bushmanland. Shaw and later travellers described groups of “Basters” living in wagons around the pans on Bushmanland in the second half of the 19th century.

Increasing competition for land and resources between the Trekboers and Khoisan groups resulted in increasing tensions and ultimately to violence during the First Korana War of 1868-9. The Cape Colonial Government sent a special magistrate and border police force to the Kenhardt area in 1868 to serve as a buffer against the Koranas (a Khoekhoen group). For a long time it was the most remote white settlement in the North-Western Cape. The spread of white colonial settlement led to the formal surveying and proclamation of farms, amongst them the farm Klein-Zwart-Bast. Many of these farms could only be settled permanently after the introduction of the wind pump after 1870.

Little is known about the history of Klein Zwart Bast. According to de Jong (2011), the farm was named after the occurrence of the bladder-nut or swartbas (*Diospyros whyteana*). The farm was formally surveyed in 1883 (SG 1271/1883). The “brakdak” farmhouse on Klein Swarbas probably dates to this period. De Jong speculates that the presence of a Martini-Henry cartridge case on the farm suggests that it was primarily used for hunting and seasonal grazing.

De Jong (2011) notes that the Anglo-Boer War (1899-1902) affected the Kenhardt region directly. By March 1900 Boer forces had taken Prieska, Kenhardt, Kakamas and Upington, attracting rebel support in the process. British columns were able to recapture the towns and the invasion had ended by June 1900. Local militias, including the Border Scouts (Upington), Bushmanland Borderers (Kenhardt) and Namaqualand Border Scouts (from the west) were established and patrolled the area. De Jong (2011) describes the remnants of a stone-walled structure on the farm adjoining the proposed facility, which resembles the type of military enclosures favoured for watch-keeping purposes, although their exact origin still must be established. Pelser (2011) in his survey report described a small semi-circle of packed stone as a possible Boer War structure or related to the 1st Koranna War. The structure in the photograph, however, closely resembles 20th century “skerms” used by local herdsmen and

an approximate date can only be determined from associated historic material (not described in the report).

The Scoping Report (Digby Wells Environmental) also contains references to the Anglo-Boer War, possibly because of comments by de Jong (2011).

8. FINDINGS

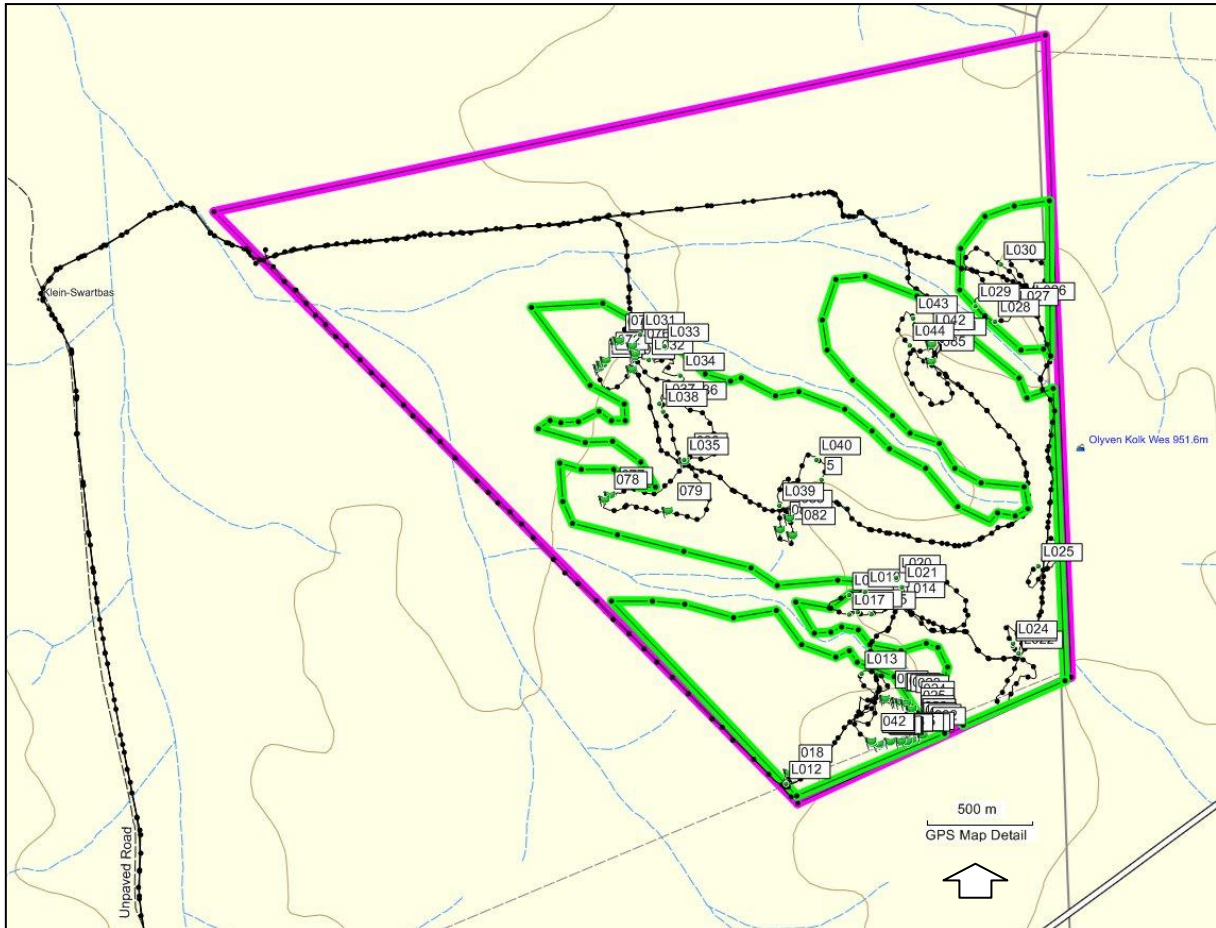


Figure 4: Map of tracks and sites recorded during field survey. The green lines indicate the boundaries of the proposed facility. Note the position of the farm house of Klein Swartbas to the west of the area.

8.1 Pre-Colonial Archaeology

Descriptions of the artefacts provided in the text, apply to the entire study area (Appendix 1). Numerous stone artefacts were recorded across the surface of the property on extensive gravel pavements (Plate 3). In fact there were only few areas where surface traces were absent, largely due to the surface being obscured by windblown sand. In some areas density appeared higher but it would be difficult to define individual sites and scatters. All observations are of the surface and there were no indicators that would suggest there would be deeply stratified material anywhere on the site. No associated organic remains (such as bone or ostrich eggshell) were noted with any of the stone scatters.



Plate 3: View of the gravel pavements where ESA and MSA artefacts occur in abundance. Many of the large cobbles have signs of being knapped.

A number of large implements were recovered which resembled classic bifaces (ESA). They are very weathered and occur in isolation (Plate 4). They are made on very weathered hornfels and while occasional flakes and cores may occur, there is no evidence of ESA knapping sites.

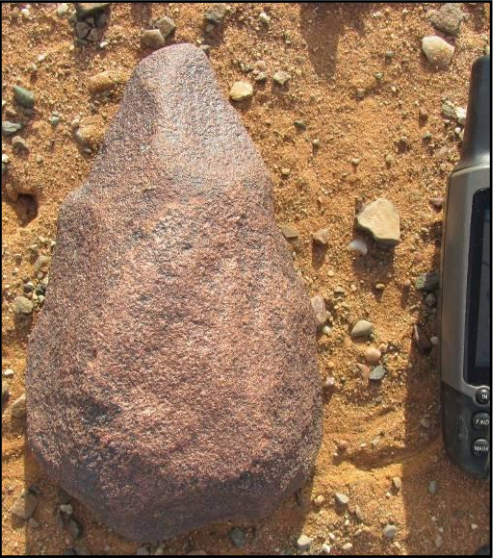


Plate 4: Large weathered handaxe; **Plate 5:** Large weathered flake (scale in centimetres).



Plate 6: Weathered flake; **Plate 7:** Handaxe on quartzite; **Plate 8:** Weathered flake and core.

Most of the material we observed can probably be ascribed to the Middle Stone Age (MSA) (Plates 10, 11). Flakes, blades, chunks and cores make up the majority of the scatters, and retouch was present on some items. The most predominant raw material was pale grey/white quartzite, although red quartzite, banded ironstone, quartz and agate lumps were also recorded.



Plate 9: Characteristic collection of grey quartzite cores, chunks and flakes with few diagnostic elements. **Plate 10:** Typical triangular MSA flakes with convergent flake scars on the dorsal surface.

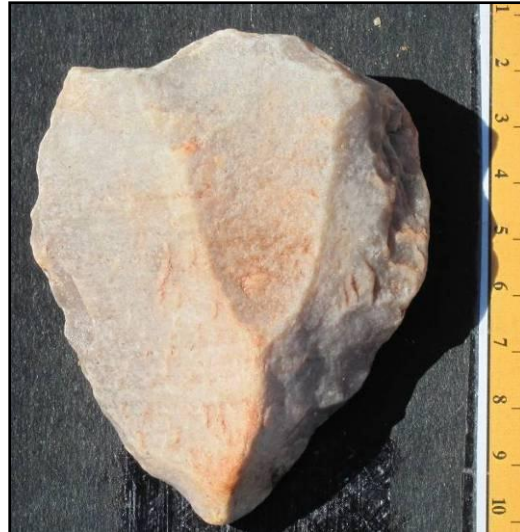


Plate 11: Blade on red quartzite; **Plate 12:** Triangular grey quartzite flake.



Plates 13 & 14: Retouched pieces. The flake on the left has a more classic scraper retouch, while the artefact on the right has steep step flaking.

There is also some evidence of the knapping (flaking) of stone artefacts on site, from local sources of raw material. It was observed that some quartzite chunks, cores and flakes made on a particular shade of quartzite, occurred in close proximity. For example, there is a dense scatter of pink quartzite flakes within a 5m radius of the block of quartzite (Plate 15).



Plates 15 & 16: Block of pink quartzite (left) and grey quartzite (right), both with evidence of knapping of stone artefacts in the immediate vicinity.

No Later Stone Age artefact scatters were recorded.

8.2 Built Environment

Apart from a concrete reservoir and a wind pump, there are no elements of the built environment present on the property. The farm house complex of Klein Swartbas, which is located 1.3km to the west of the proposed facility, comprises a modern farmhouse as well as a fine example of a late 19th century “brakdak” farmhouse with decorative moulding and a Victorian verandah. This house is not threatened by the development as long as access to the facility is from the District road (as proposed).

8.3 Graves/Cairns

The proposed facility is some 1.3km from the farm house of Klein Swartbas. Due to the distance from the farm buildings, coupled with the rocky nature of the site in general, it was considered unlikely that graves would be found on site.



Plate 17: A few stone cairns were recorded in the study area.

While there is considerable evidence for stone age use of the area, formal burials have never been found in South Africa that date to the MSA, and while graves from the LSA are found from time to time, these tend to be found in softer soils, as would also have been the case in the colonial period. Although a few stone cairns were recorded, no typical surface grave markers were observed and we consider it highly unlikely that any graves are present on the site.

8.4 Cultural Landscape

The affected portions of Klein Zwart Bast 188 represent a very typical landscape in this area. It is flat and featureless with scrubby low vegetation and bare patches of gravel pavement. The farm continues to be used for small stock farming. Man-made features in the form of the Aries sub-station, an overhead powerline and an Eskom service road are the most visible features located within the site or in close proximity. The non-industrial built environment on the farm is marginal. The cultural landscape of the solar plant site is therefore considered to be of low significance.

9. IMPACT IDENTIFICATION AND ASSESSMENT

9.1 Palaeontology

The site of the proposed solar power plant is underlain by glacial-related sediments of the Dwyka Group that are generally of low palaeontological sensitivity. The fossil content of the

Dwyka Group is generally poor. Fossils are found mainly in interglacial, laminated mudrocks. These are trace fossils, organic-walled microfossils, rare marine shells, fish and plants. The scale of subsurface disturbance and exposure is quite limited, comprising mainly “post holes” to support the PV panel frames. These holes will mainly affect the weathered soil profile and regolith on the Dwyka outcrop.

Quaternary sediments as well as alluvial gravels, sands and calcretes of comparable age, all of low palaeontological sensitivity, are also represented within the study area.

The activities likely to result in impacts to surface and subsurface material include: site preparation, creation of roads, and construction of buildings and installation of cables. Installation of the solar panel frames will be secondary to the previous activities and so would the impacts would be minor. Drilling or screwing frames into place would however represent a possible threat to palaeontological resources if they existed on site.

9.2 Archaeology

The construction of the proposed facility will result in the physical disturbance and potential destruction of the context of surface and sub-surface archaeological material.

Scatters of ESA and MSA artefacts were recognised (Appendix 1), mainly on extensive gravel pavements. Some of the scatters (which lack discrete boundaries) will be impacted by construction and are likely to be disturbed. While some discrete knapping sites were recognised, the majority of the stone artefacts are probably not in original context, and not associated with organic remains such as bone, which could provide valuable information on prehistoric lifeways.

With respect to Olyven Kolk (the adjoining farm) Beaumont et al (1995:240) note that “thousands of square kilometres of Bushmanland are covered by a low density lithic scatter. The raw materials (mainly quartzite cobbles) are derived from the Dwyka till which is ubiquitous across this peneplain...” He indicates that these stone artefact scatters are common in this part of Bushmanland.

In addition, Beaumont et al have undertaken a systematic collection of material on the broader Olyven Kolk Farm (indicated as site 13 on their distribution map), although a precise location for the collection is unknown (1995:24). A collection of stone artefacts from this area therefore exists.

Construction (surface clearing, cables, frames, operation facilities and laydown areas) will be limited to a relatively small area of the total site and other areas will remain relatively undisturbed.

In general, the stone scatters are considered to be of low to medium significance. They have been given an “ungraded” rating. It is our opinion that the impact of disturbance of Stone Age material in the affected zones will be small.

Table 1: Summary of impacts to archaeological material

Nature of Impact: Impacts to archaeological material could involve destruction of material at solar panel footings, underground cabling, access roads, etc.		
	Pre- Mitigation	Post- Mitigation
Extent	Local	Local
Magnitude	On-site	On-site
Duration	Permanent	Permanent
Intensity	Negligible	Negligible

Probability	Definite	Definite
Significance	Low - Medium	Low - Medium
Mitigation: Although scatters of archaeological material will be impacted, the impact is considered Low. Lack of site boundaries or associated organic remains or reduces scientific value greatly. In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation. No mitigation has been suggested.		
Cumulative Impacts: The cumulative impact of several such facilities will result in the potential destruction of large scatter of archaeological material.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

* Once archaeological material is destroyed, it cannot be renewed or replaced.

9.3 Built Environment

There are no buildings or structures on that portion of the property identified for the development of the facility. The impacts to the Built Environment are considered to be negligible.

9.4 Cultural Landscape

Table 2: Summary of impacts to Cultural Landscape

Nature of Impact: The proposed facility may have a limited visual impact on the cultural landscape and its archaeological significance		
	Pre- Mitigation	Post- Mitigation
Extent	Local	Local
Magnitude	Local	Local
Duration	Long term	Long term
Intensity	Medium	Medium
Probability	Definite	Definite
Significance	Low	Low
Mitigation: A Visual Impact Assessment by a specialist which considers the proposed impact of the development on the Cultural Landscape.		
Cumulative Impacts: The cumulative impact of several such facilities will result in "industrialization" of the landscape.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

10. MITIGATION AND ASSESSMENT OF ALTERNATIVES

No Palaeontological mitigation will be required. The PIA report (Appendix 2) recommends that "an alert for the uncovering of fossil bone and implements be included in the construction EMP for the project".

No archaeological mitigation is proposed for the following reasons:

- Thousands of square kilometres of Bushmanland are covered by these low density artefacts scatters;
- A stone artefact collection has already been made by Beaumont et al (1995) from the adjoining property of Olyven Kolk;

- The lack of *in situ* archaeological surface sites or indications of stratified archaeological deposits means that the archaeological material on site has limited scientific value;
- We have photographed and recorded small collections of material across the solar plant site and believe that these are representative of the material as a whole;
- Further mitigation is unlikely to result in a greater understanding of the material and the various time periods, and as a result we do not believe further intervention from an archaeological point of view is necessary.

It is important to remember that a permit for the destruction of archaeological remains will have to be obtained from SAHRA.

In the event that human remains are uncovered beneath the soil surface during the construction of the facility, work in that location should stop, and the heritage authorities (SAHRA) should be notified. They may recommend exhumation.

There are no issues relating to the Built Environment (e.g. buildings or structures older than 60 years which are protected by the NHRA). There is a significant late 19th century “brakdak” farmhouse some 1.3km to the west of the proposed facility. If the proposed access road to the facility should be re-located in future to pass the house, then further studies of the Built Environment will be necessary. However, with regard current access plans, no mitigation is required.

SAHRA have requested that the assessment should whether the “cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance”. There are no significant issues relating to the Cultural Landscape. The landscape comprises typical Bushmanland scrub. There are no prominent geological features such as hills or valleys. The farm is used for grazing livestock. The area has already been transformed by a substation and transmission lines.

The Visual Impact Specialist should consider the cumulative visual impact of several solar facilities in this area.

At least two other applications for solar energy facilities are proposed on the same property and the cumulative impact of several facilities may be high.

The “no-go” alternative would mean that the status quo is retained and that the heritage resources of the area are maintained in their current condition.

11. CONCLUSIONS

In conclusion, the following heritage indicators were considered:

Palaeontology:

- The bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The Pre-colonial Archaeology:

- Stone artefacts scatters from the Early and Middle Stone Age are sparsely distributed across the study area and are found on gravel pavements between the vegetation;
- The absence of associated archaeological material, and lack of discrete individual sites reduces the significance of the material overall;

- The artefact scatters were given a low significance rating, with the knapping (factory) sites of low-medium significance;
- Thousands of square kilometres of Bushmanland are covered by these low density artefacts scatters;
- Further mitigation of sites is considered unnecessary in view of a collection which has already been made on the adjoining property of Olyven Kolk;
- A permit will be required for the destruction of archaeological material.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- A few cairns were identified. They could possibly be graves. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:

- The proposed solar plant is positioned opposite the Aries substation on district gravel road linking Kenhardt with Bossiekom in the Northern Cape;
- A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered;
- The cultural landscape of the surrounding area a flat arid landscape utilised for the grazing of livestock;

The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended. However, the potential cumulative impact of a number of such facilities on the Cultural Landscape should be examined by the Visual Impact specialist.

12. REFERENCES

Beaumont, P.B., Smith A.B. and Vogel J.C. 1995. Before the Einiqua: The archaeology of the frontier zone. In Smith A.B. ed. Einiqualand: Studies of the Orange River frontier. UCT Press: 236-264.

de Jong, R & Associates. 2011. Heritage Impact Assessment Report: Proposed solar power station on the remainder of Portion 1 (known as Die Hoek) and a portion of Portion 2 of the farm Klein Zwart Bast 188, Kenhardt Registration Division, Siyanda District Municipality, Northern Cape Province. Unpublished report for eScience Associates (Pty) Ltd.

Digby Wells Environmental. January 2012. Draft Scoping Report. Proposed development of five solar photovoltaic power plants in the Northern Cape and Western Cape Provinces. Unpublished report for Orlight SA (Pty) Ltd.

Halkett, D. & Orton, J. 2011. Heritage Impact Assessment (Archaeology and Palaeontology): Proposed Olyven Kolk Solar Power Plant, Northern Cape. Unpublished report for AES Solar Energy Limited.

Morris, David. 2006. Archaeological Specialist Input to the EIA Phase for the proposed Aries-Garona ESKOM Transmission Power Line, Northern Cape and Comment on the Garona Substation Extension. Unpublished Report September 2006 for Tswelopele Environmental.

Pelser, A.J. 2011 A report on an archaeological impact assessment (aia) for the proposed solar energy plant on Klein Zwart Bast 188, Kenhardt district, northern Cape. Unpublished report AE1104 prepared for Robert De Jong & Associates. Archaetnos.

Nienaber, G.S., & Raper, P.E. 1977. *Toponymica Hottentotica*. SA Naamkundesentrum RGN Naamkudesreeks 6.

Webley, L. & Halkett, D. 2010. An Archaeological Impact Assessment (Report 3): Proposed construction of a substation between Aries-Helios and associated loop in and loop out lines, west of Brandvlei in the Northern Cape. Unpublished report for Nzumbululo Heritage Solutions.

SAHRA 2009. Archaeology, Palaeontology & Meteorite Unit. Report Mapping Project. Version 1.0

Appendix 1: Location of archaeological sites.

LABEL	LATITUDE (S) (dec deg)	LONGITUDE (E) (dec deg)	DESCRIPTION	SIGNIFICANCE
018	-29.48167000	20.78256800	Biface (quartzite) - part of general, low density, widespread artefact scatter	Low
019	-29.47854500	20.78752400	ESA/MSA quartzite artefacts as part of general widespread, low density, artefact scatter (sub-sample photographed)	Low
020	-29.47865600	20.78805600	Core	Low
021	-29.47864500	20.78813800	Core	Low
022	-29.47869100	20.78832500	Big flake	Low
023	-29.47873400	20.78859700	Big ESA core	Low
024	-29.47898700	20.78887900	Core	Low
025	-29.47926300	20.78885000	Big flake	Low
026	-29.47959300	20.78887200	Retouched flake	Low
027	-29.47972600	20.78893700	Flake	Low
028	-29.47972600	20.78893600	Big flake	Low
029	-29.47988700	20.78894600	Biface	Low
030	-29.47989600	20.78897700	Big core	Low
031	-29.47996700	20.78922600	Big core	Low
032	-29.48009100	20.78945500	Flake	Low
033	-29.48029000	20.78886900	Big core	Low
034	-29.48035900	20.78865200	Flake	Low
035	-29.48034600	20.78832700	Big retouched flake	Low
036	-29.48036200	20.78777300	Flake	Low
037	-29.48049800	20.78726600	Retouched flake	Low
038	-29.48049100	20.78722800	Retouched blade (NBK-like) - hornfels	Low
039	-29.48045700	20.78717300	Localised artefact scatter flakes and cores, , 1 retouched flake, of moderately higher density (subsample photographed)	Low-medium
040	-29.48042600	20.78685400	Big core	Low
041	-29.48034400	20.78683200	Flakes and cores - of same quartzite material (knapping area?)	Low-medium
042	-29.48034300	20.78680000	Flakes and cores - of same quartzite material (knapping area?)	Low-medium
043	gps error	gps error	Big single platform core	Low
044	gps error	gps error	Blade (retouched?), few cores and flakes	Low
045	gps error	gps error	Flak	Low
046	gps error	gps error	Big core	Low
047	gps error	gps error	Flakes, quartzite and banded ironstone	Low
048	gps error	gps error	Core	Low
049	gps error	gps error	Core	Low
050	gps error	gps error	Big retouched flake	Low
051	gps error	gps error	Big flake and big core	Low
052	gps error	gps error	Weathered flake	Low
053	gps error	gps error	Core and flake	Low
054	gps error	gps error	2 cores	Low
055	gps error	gps error	Localised artefact scatter flakes and cores, 1 retouched flake, of moderately higher density (sub-sample photographed). Quartzite fresh looking but also older weathered material	Low
056	gps error	gps error	Big single platform core, flakes, possible biface/core	Low
057	gps error	gps error	Fresh flake area (knapping?)	Low-medium
058	gps error	gps error	Core	Low
059	gps error	gps error	Core	Low
060	gps error	gps error	Flakes and cores	Low
061	gps error	gps error	Localised artefact scatter flakes and cores, 1 retouched flake, of moderately higher density (subsample photographed). Quartzite fresh looking but also older weathered material	Low
062	gps error	gps error	Localised artefact scatter flakes and cores, 1 retouched flake, of moderately higher density (subsample photographed). Quartzite fresh looking	Low

			but also older weathered material, some retouch	
063	gps error	gps error	Cores and flakes	Low
064	gps error	gps error	Very patinated biface, big retouched flake (scraper-like) and 2 cores	Low
065	gps error	gps error	Stone cairn (beacon/boundary marker?)	Low
066	gps error	gps error	Localised artefact scatter of flakes and cores incl retouched flake, of moderately higher density (subsample photographed). Butt preparation noted on occasional flakes	Low
067	gps error	gps error	Possible cairn (stones somewhat dispersed)	Low
068	-29.46410900	20.77458900	A number of quarried quartzite bedrock outcrops. A number of chunks of the material scattered about though little evidence of further knapping.	Low-medium
069	-29.46463800	20.77444200	Localised artefact scatter of patinated flakes and cores of moderately higher density (subsample photographed).	Low
070	-29.46457500	20.77275800	Fresh looking flakes and a number of quarried quartzite bedrock outcrops. Also patinated material.	Low
071	-29.46442900	20.77291400	Broken biface/core and some flakes	Low
072	-29.46424300	20.77310000	Patinated biface	Low
073	-29.46347900	20.77361000	Patinated flake showing signs of more recent re-use	Low
074	-29.46341200	20.77378900	A quarried quartzite bedrock outcrop. A number of flakes of the material scattered about the area	Low-medium
075	-29.46365100	20.77446200	Possible small biface	Low
076	-29.46397400	20.77461500	Small biface (Fauresmith?)	Low
077	-29.46994500	20.77331100	Large circular stone cairn (beacon/marker)	Low
078	-29.47013100	20.77303200	"Linear" cairn	Low
079	-29.47060500	20.77630100	Small knapping area with fresh looking quartzite flakes (same material and colour)	Low-medium
080	-29.46850500	20.77716300	Large chunks of surface rock scree in this area. "Bedrock" types are highly variable and include dolomite, ironstone, quartzite, dolerite?	Low
081	-29.47140900	20.78208900	Large chunk of banded ironstone	Low
082	-29.47164000	20.78272500	Localised artefact scatter of patinated flakes and cores of moderately higher density (subsample photographed).	Low
083	-29.47091800	20.78257500	Dolomite/ccs "bedrock"	Low
084	-29.46358000	20.78990800	Conglomerite "bedrock"	Low
085	-29.46429600	20.78989000	Small knapping area with fresh looking quartzite flakes (same material and colour)	Low-medium
L012	-29.48205440	20.78244660	Site under the transmission lines. Many artefacts including red jasper flake with retouch, large core, quartzite flakes with retouch, large blade with retouch, a single biface.	Low
L013	-29.47740350	20.78634620	On the slope overlooking a tributary of the river crossing the property. White/grey quartzite flakes very visible on the plains of black/dark rocks (igneous? Dolerite and dolomite). MSA	Low
L014	-29.47440740	20.78836170	On the other side of the tributary. 2 white/grey quartzite flakes and two reddish ones.	Low
L015	-29.47488760	20.78684810	2 white quartz chunks and 1 white quartzite flake. 2 very large quartzite flakes	Low
L016	-29.47479650	20.78614340	Very large quartzite cores and at least 7 flakes on red and white quartzite	Low
L017	-29.47490270	20.78570600	Quartzite cores and flakes	Low
L018	-29.47407980	20.78570730	Quartzite cores and flakes	Low
L019	-29.47394560	20.78651580	Quartzite cores and flakes	Low
L020	-29.47334920	20.78812380	3 white irregular quartzite cores and one flake. 8 white quartzite flakes (one small circular "scraper").	Low
L021	-29.47374460	20.78843010	Another distribution of white quartzite cores and flakes.	Low
L022	-29.47655150	20.79445290	MSA (?) quartzite flake with retouch. 1 white quartzite flake with backing along one side and retouch on the other. Dolerite flake with flakes struck off radially (Levallois?).	Low
L023	-29.47623020	20.79414220	Collection of large white quartzite flakes and cores. A	Low

			collection of 9 (photo only has 6) flakes and cores of a green/brown quartzite, looks freshly struck. A knapping site.	
L024	-29.47612780	20.79416480	Red quartzite core	Low
L025	-29.47285970	20.79546040	1 very large quartzite core; 1 white quartzite flake. 1 red jasper core.	Low
L026	-29.46182880	20.79506730	Large white quartzite core and flake.	Low
L027	-29.46206920	20.79421250	Very large quartzite core.	Low
L028	-29.46253370	20.79322430	Very large red quartzite flake	Low
L029	-29.46187520	20.79221570	3 quartzite cores	Low
L030	-29.46011470	20.79353240	Grey quartzite flake with radial flakes removed (Levallois?).	Low
L031	-29.46308430	20.77491320	5 artefacts in a rubble area Very weathered handaxe (ESA) on a black dolerite (?) Collection of 6 white quartzite artefacts including 1 core	Low
L032	-29.46413740	20.77536370	1 large core and 3 flakes, one is a quartzite blade 5 quartzite cobbles, chunks and cores flaked Quartzite flake with retouch Typical MSA flake/blade with retouch	Low
L033	-29.46357210	20.77617160	1 very large quartzite core and only radial core	Low
L034	-29.46480390	20.77697960	2 types of flakes with retouch 1 well defined white quartzite MSA flake	Low
L035	-29.46837180	20.77718920	5 white quartzite flakes, one square with retouch along two margins 2 white flakes, one is a snapped blade	Low
L036	-29.46603100	20.77708860	Many white quartzite cores	Low
L037	-29.46600270	20.77591350	Factory site, on side of the hill, comprising a large outcrop of pink quartzite, which has had several large blocks removed, and many smaller flakes within a 5m radius of site.	Low-medium
L038	-29.46632960	20.77609730	Late 19 th century green bottle glass, with base distributed in small area on top of the hill. No sign of retouch.	Low
L039	-29.47029760	20.78210800	1 large white quartzite core, 5 flakes, one being red quartzite. 1 MSA flake with prepared platform Several flakes with signs of retouch	Low
L040	-29.46836640	20.78401140	1 large quartzite blade 1 large triangular flake (typical MSA) with prepared platform 1 large, white quartzite scraper	Low
L041	-29.46333090	20.79049770	Quartzite flakes, cores, etc. One large squarish white quartzite flake with retouch along both margins. Pink quartzite core.	Low
L042	-29.46308600	20.78986950	Fine grained banded-ironstone core; very large weathered hornfels flake with retouch along one margin.	Low
L043	-29.46238920	20.78900210	Two MSA flakes on quartzite and one very weathered ironstone flake.	Low
L044	-29.46353540	20.78883150	MSA flake; large core, large group of white quartzite implements.	Low

Appendix 2: Brief Palaeontological Impact Assessment.

Appendix 3: Visual Impact Assessment.