# INTEGRATED HERITAGE AND ARCHAEOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED SOL INVICTUS 132kV POWERLINE WEST OF AGGENEYS, NORTHERN CAPE

**SAHRA case number: 16729**

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report prepared for:

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## EXECUTIVE SUMMARY

### Background

ACO Associates cc has been requested by WSP on behalf of Sol Invictus (Pty) Ltd to compile an Integrated Heritage Impact Assessment (HIA) of the impacts on heritage resources of the proposed construction of a 132kV powerline across the following cadastral land portions: 1 & 2 (s/s) /56 (Farm name: Aggeneys), 2, 5 & 6 /62 (Farm name: Zuurwater), 5/66 (location of the PVSEF), 6 & 14 /66 (Farm name: Ou Taaibosmond) off the N14 to the south west of Aggeneys in the Northern Cape Province.

ACO Associates cc was appointed to compile an Integrated HIA and AIA, while Dr M Bamford was appointed to undertake the required specialist Palaeontological desktop Assessment (Bamford 2021).

Although we had requested permission from SAHRA to undertake a desktop assessment, this was rejected and a field based archaeological assessment was undertaken.

### Project motivation and technical data

Applicant / Project Company: Sol Invictus (Pty) Ltd
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The Overhead powerline (OHL) will be 132kV utilising steel single poles or double pole structures with kingbird conductor over a distance of ~22.7km, between the existing Aggeneis sub-station and the sub-station/s on the Sol Invictus PVSEF. The Standard overhead line construction methodology will be used i.e. drill holes, plant poles and string the conductor. It is not envisaged that any large excavations and stabilized backfill will be required, however this will only be verified on site once the Geotechnical assessment of ground conditions has been undertaken at each pole position (as part of the construction works). The construction period for the OHL is estimated at ~12-24 months. Pole positions will only be available after the preferred bidder for the construction is awarded, once the powerline design has started. The Bend points of OHPL indicated on Figures 2-4 in the report will apply. A 200m corridor must be assessed to find the best alignment meeting the terms of all specialist requirements.

### Data gathering

The fieldwork component of the Archaeological Impact assessment was conducted by Mr D Halkett and Mr J Gribble of ACO Associates cc on the 6th – 8th September 2021. Visibility of the ground surface in the project site was considered to be good to excellent and there were no limitations in terms of access to the powerline route.

Prior to embarking on the fieldwork, aerial photographs from a range of periods had been examined to determine if any heritage indicators that may need to be inspected could be identified on the images. Apart from

Search tracks were recorded by means of a Garmin GPS receiver to document the searched area. Identified heritage resources were assigned Lat-Lon co-ordinates, described and photographed. The few identified heritage resources observed are also plotted on maps and described in text. Heritage resources have been provisionally graded for significance according to the system used by Heritage Western Cape.

### Findings and Recommendations

### Palaeontology

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old

and the wrong type to contain fossils, or young enough but without traps such as palaeo-pans or paleo-springs. Furthermore, the footprint of each powerline pole is very small. Since there is an extremely small chance that fossils from the pans/springs in Tertiary Calcrete may be disturbed a Fossil Chance Find Protocol has been added to this report.

**Pre-colonial archaeological heritage**

A very small number of pre-colonial heritage resources are located in the powerline corridor and the proposed activities are not expected to result in the loss of significant heritage resources. Very limited mitigation of two sites (D008 and D009) has been proposed through imposition of 15 meter diameter buffer areas around each. If any human burials are found during construction, they should not be further disturbed until reported to the Heritage Authority for further action and mitigation.

**Built environment**

The built environment is largely limited to a single probable historical kraal. Mitigation consists of the imposition of a 30 meter diameter buffer area around that structure.

**Impact Assessment**

The findings of the impact assessment evaluated in terms of the Impact Methodology, suggests that impacts on palaeontological/archaeological and historic built environment heritage resources will be **low negative** without mitigation, and **low positive** with mitigation. Limited mitigation has been proposed in the form of buffer areas around two archaeological, and one built environment resources. A chance finds protocol has been included in the PIA, to cover the very low possibility of fossil material being recognised during construction or geotechnical work.

**Conclusion**

Overall we find that the proposed powerline (and any position within the corridor) will result in little loss of any significant heritage resources. Mitigation is of 3 heritage resources of marginal significance has been proposed in the form of buffer areas. Pending the desktop inspection of final pole positions, we find no reason to reject the powerline development on heritage grounds provided to proposed mitigation is implemented.

## GLOSSARY

| | |
|---|---|
| Archaeological | 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. |
| Baseline | Information gathered at the beginning of a study which describes the environment prior to development of a project and against which predicted changes (impacts) are measured. |
| Construction Phase | The stage of project development comprising site preparation as well as all construction activities associated with the development. |
| Cumulative Impacts | Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors. |
| Environment | The external circumstances, conditions and objects that affect the existence of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects. |
| Environmental Authorisation | Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014. |
| Environmental Impact Assessment | A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project. |
| Environmental Impact Assessment Report | The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment. |
| Environmental Management Programme | A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity. |
| Fossil | Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment |
| 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 |
| Impact | A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities. |
| Mitigation measures | Design or management measures that are intended to minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage. |
| Operational Phase | The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation. |
| Palaeontological | 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. |
| Scoping | A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an EIA and EMP (one of the phases in an EIA and EMP). This process results in the development of a scope of work for the EIA, EMP and specialist studies. |
| Specialist study | A study into a particular aspect of the environment, undertaken by an expert in that discipline. |
| Stakeholders | All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others. |
| 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. Generally protected structures are those which are over 60 years old. |

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BA | Basic Assessment Process |
| CRM | Cultural Resource Management |
| EA | Environmental Authorisation |
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| ESA | Early Stone Age >~3000 0000 years –~ 1.1 Million years |
| GPS | Global Positioning System |
| HIA | Heritage Impact Assessment |
| HWC | Heritage Western Cape – Provincial Heritage Authority |
| kV | Kilo Volt |
| LSA | Later Stone Age <~20 000 years |
| MSA | Middle Stone Age – between ~300 000 and ~20 000 years |
| MVA | Megavolt amperes |
| NEMA | National Environmental Management Act 107 of 1998, as amended |
| NHRA | National Heritage Resources Act of 1999 |
| NID | Notice of intent to Develop – application to HWC at inception of the project |
| PHRA | Provincial Heritage Resources Authority |
| SAHRA | South African Heritage Resources Agency – the National Heritage Authority |
| SAHRIS | South African Heritage Resources Information System |
| S&EIR | Scoping and Environmental Impact Reporting |
| SRK | SRK Consulting (South Africa) (Pty) Ltd |
| ToR | Terms of Reference |
| VIA | Visual Impact Assessment |

# 1. INTRODUCTION

## 1.1 Background

ACO Associates cc has been requested by WSP on behalf of Sol Invictus (Pty) Ltd to compile an Integrated Heritage Impact Assessment (HIA) of the impacts on heritage resources of the proposed construction of a 132kV powerline across the following cadastral land portions: 1 & 2 (s/s) /56 (Farm name: Aggeneys), 2, 5 & 6 /62 (Farm name: Zuurwater), 5/66 (location of the PVSEF), 6 & 14 /66 (Farm name: Ou Taaibosmond) off the N14 to the south west of Aggeneys in the Northern Cape Province as indicated on Figure 1. See also Section 2.3 for further details about land ownership.

ACO Associates cc was appointed to compile an Integrated HIA and AIA, while Dr M Bamford was appointed to undertake the required specialist Palaeontological desktop Assessment (Bamford 2021).

Although we had requested permission from SAHRA to undertake a desktop assessment, this was rejected and a field based archaeological assessment was undertaken. Further detail can be found in Section 3.2

## 1.2 Terms of Reference

The generic ToR and principal objectives for study is to:

To submit a notification of the proposed development to the responsible Heritage Authority (SAHRA) via the SAHRIS system, and based on their feedback, undertake an HIA with particular reference to Archaeological and Palaeontological resources, and some consideration of heritage as referred to in S38 (3) of the National Heritage Resources Act (No. 25 of 1999). As the powerline appears to be in an area of low archaeological and palaeontological sensitivity (based on numerous existing studies in the area), we have requested the study to be based on desktop analyses.

The main deliverable from each specialist will be an impact assessment report with appropriate maps, drawings and figures. Reports will include the following components:

- Prepare an Integrated Heritage Impact Assessment which includes a specialist Desktop Palaeontological Impact Assessment (PIA) and field based Archaeological Impact Assessment (AIA);
- Baseline description: a description of the environment of the study area in its current state, relevant to the specialist's field of study; and
- Impact assessment: an assessment of how the proposed project will alter the *status quo* as described in the baseline description, and recommended measures to mitigate and monitor impacts.

The report must take cognizance of, and comply with, the substantive content requirements outlined within Appendix 6 of GN R982, which outlines the legal minimum requirements for specialist studies in terms of the 2014 NEMA EIA Regulations.

## 1.3 Content of the Report

The EIA Regulations, 2014 (R982 of 2014, as amended by R326 of 2017), prescribe the required content of a specialist report prepared in terms of the EIA Regulations, 2014. These requirements, and the sections of this HIA in which they are addressed, are summarised in Table 1.

**Table 1:** Required content of a specialist report

| App 6 | Item | Section |
|---|---|---|
| (a) (i) | Details of the specialist who prepared the report; | App A |
| (a) (ii) | Expertise of that specialist to compile a specialist report, including a curriculum vitae | App A |
| (b) | A declaration that the specialist is independent in a form as may be specified by the competent authority; | App B |
| (c) | An indication of the scope of, and the purpose for which the report was prepared; | 1.2 |
| (cA) | An indication of the quality and age of base data used for the specialist report; | 2.6, 4.2 |

| | | |
|---|---|---|
| (cB) | A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | 4.2 |
| (d) | The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; | 2.6 |
| (e) | A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | 4 |
| (f) | Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | 6 |
| (g) | An identification of any areas to be avoided, including buffers; | 6 |
| (h) | A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Fig 1-4 |
| (i) | A description of any assumptions made and any uncertainties or gaps in knowledge; | 1.4 |
| (j) | A description of the findings and potential implications of such findings on the impact of the proposed activity or activities; | 4,5,6 |
| (k) | Any mitigation measures for inclusion in the EMPr; | 6.2, 6.2.1 |
| (l) | Any conditions for inclusion in the environmental authorisation; | n/a |
| (m) | Any monitoring requirements for inclusion in the EMPr or environmental authorisation; | n/a |
| (n) (i) | A reasoned opinion whether the proposed activity or portions thereof should be authorised; | 8 |
| (n) (iA) | A reasoned opinion regarding the acceptability of the proposed activity or activities; | 8 |
| (n) (ii) | If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | 6.2, 6.2.1 |
| (o) | A description of any consultation process that was undertaken during the course of preparing the specialist report; | 3.3, 3.4 |
| (p) | A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | 3.4, App C |
| (q) | Any other information requested by the competent authority. | n/a |

## 1.4 Assumptions and limitations

- We assume that the information provided by WSP is accurate;
- We assume that the information provided in consulted reports and publications is accurate;

There were however no perceived significant limitations in conducting this archaeological assessment.


**Figure 1:** The regional location of the powerline (green)south west of Aggeneys

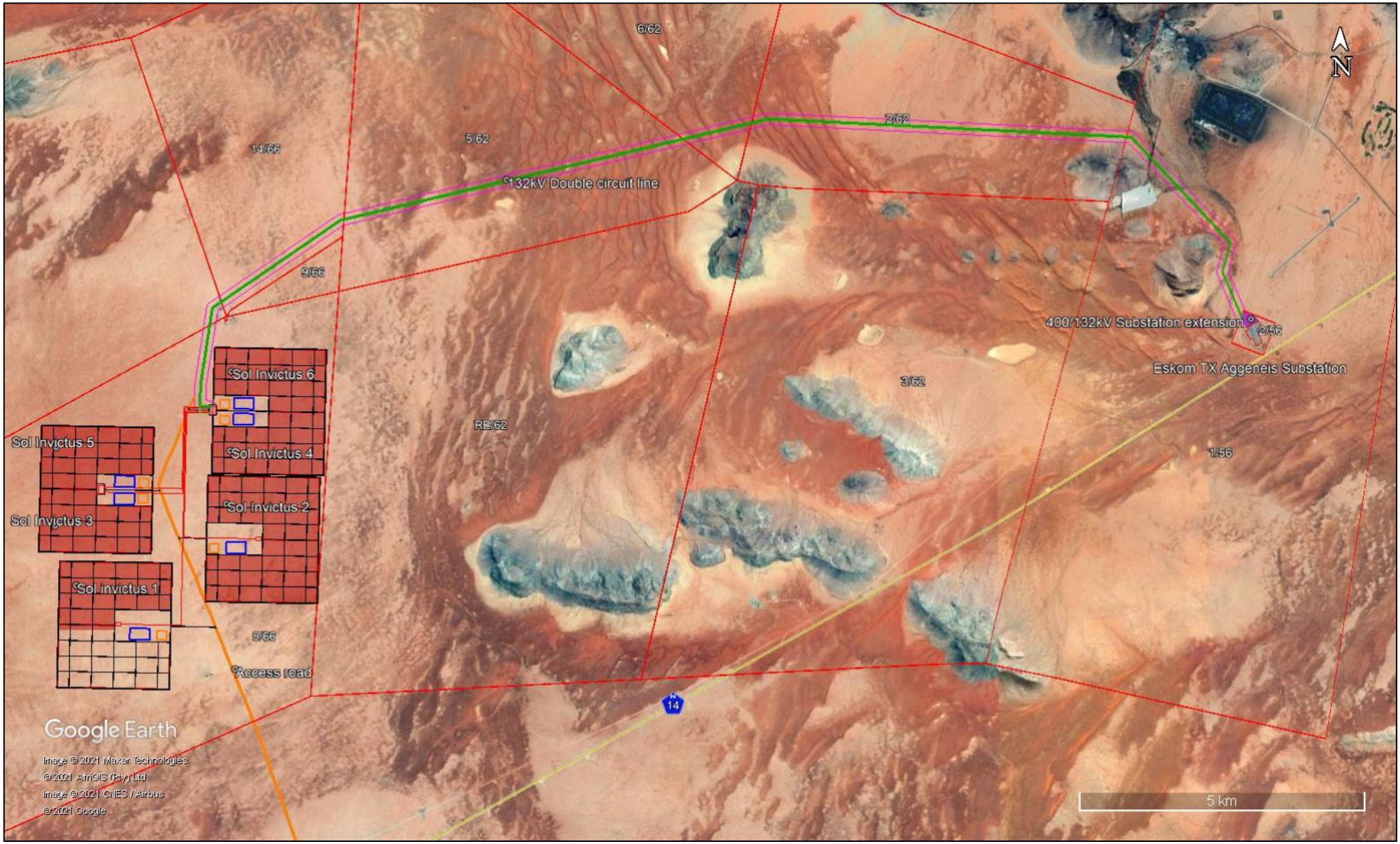


**Figure 2:** The study area showing the authorised Sol Invictus PVSEF infrastructure on Ptn 5/66, and the proposed 132kV double circuit powerline (green), 200m corridor (purple) and the existing access road (yellow line) off the N14 (blue line). The existing Aggeneis substation can be seen at the eastern end of the powerline on Ptn 2/56.

## 2. PROJECT DESCRIPTION

### 2.1 Project motivation and technical data

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Address: Postnet Suite 150, Private Bag X3, Roggebaai, Cape Town, 8012
Contact Person: Matteo Brambilla
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The Overhead powerline (OHL) will be 132kV utilising steel single poles or double pole structures with kingbird conductor over a distance of ~22.7km, between the existing Aggeneis sub-station and the sub-station/s on the Sol Invictus PVSEF. The Standard overhead line construction methodology will be used i.e. drill holes, plant poles and string the conductor. It is not envisaged that any large excavations and stabilized backfill will be required, however this will only be verified on site once the Geotechnical assessment of ground conditions has been undertaken at each pole position (as part of the construction works). The construction period for the OHL is estimated at ~12-24 months. Pole positions will only be available after the preferred bidder for the construction is awarded, once the powerline design has started. The Bend points of OHPL indicated on Figures 2-4 in the report will apply. A 200m corridor must be assessed to find the best alignment meeting the terms of all specialist requirements.

### 2.2 Sol Invictus PVSEF background

In terms of the PVSEF, four PV projects of 150MW each were originally assessed by J. Orton (2016a-d). Sol Invictus 1,2,3 & 4 were planned and authorised on Ptn 5/66 (OuTaaibosmond), approximately 25km south west of the mining town of Aggeneys. Later, the Sol Invictus 3 & 4 PVs were each split into two 75MW projects, and are now named Sol Invictus 3 (75MW) and Sol Invictus 5 (75MW). Sol Invictus 4 which was also split into two and are known as Sol Invictus 4 (75MW) and Sol Invictus 6 (75MW). These projects were assessed by J Orton (2016 a-d).

Authorisations: Sol Invictus1 EA; Sol Invictus 2; 2202 SI 3 Environmental Authorisation 14 Feb 2019; 14-12-16-3-3-2-871-1; 2202 SI 5 Environmental Authorisation 14 Feb 2019; 14-12-16-3-3-2-871-2.

### 2.3 Receiving Environment

As can be seen on a number of the maps in the report, but particularly Figures 2 - 4), the bulk of the powerline lies in a remote, flat, sandy area ranging from 4 - 10km north to north west of the National Road 14 (N14). A ~4km section heads in a north westerly direction from the Aggeneis sub-station on the western edge of the Black Mountain Mine at Aggeneys. Three other powerlines exit the sub-station, one of which (servicing Black Mountain Mine) runs “parallel” with the proposed Sol Invictus powerline for the initial ~3km. Local farms tend to be large, and primarily used for small stock grazing and buildings are sparse. Only one cluster of farm buildings is located on the route at the junction of a number of farm portions at the north eastern corner of the PVSEF site (i.e. Ptns 5/66, 6/66, 9/66 & 14/66).

Starting at the Aggeneys sub-station, the route on Ptn 1/56 crosses gravel pavements and marginal dunes, in an area where there are existing powerlines, tracks and some mining related infrastructure in the form of runoff channels and settling ponds. Vegetation is present but sparse, and artificially thick around water runoff channels from the mine. Two prominent rocky inselbergs (Kranskop and Platjiesvlei se Kop) lie to the west.

Beyond this on the farming land staring with Ptn 2/62, gravel surfaces with sparse vegetation persist for ~5km until the rolling transverse dunes of the central part of the site are encountered I the wewst of 2/62, and covering most of Ptns 5 and 6/62. These dunes are of relatively significant height and are sparsely vegetated. Dune slacks are similarly sparsely vegetated, and sometimes contain evidence of true pans, while in other cases, these have likely been covered by aeolian sand. Hoedkop, a distinct landscape feature and visible for many kilometres is located south of the dunes and a number of farm boundaries converge at this landmark.

The prominent dunes once again give way to extensive gravelly planes charactering Ptns 5/62, and 5, 6 and 14/66. Occasional depressions suggest old pans but vegetation is very sparse.


Western end of the corridor


Near Aggeneys sub-station


Dune fields in the central part of the corridor.

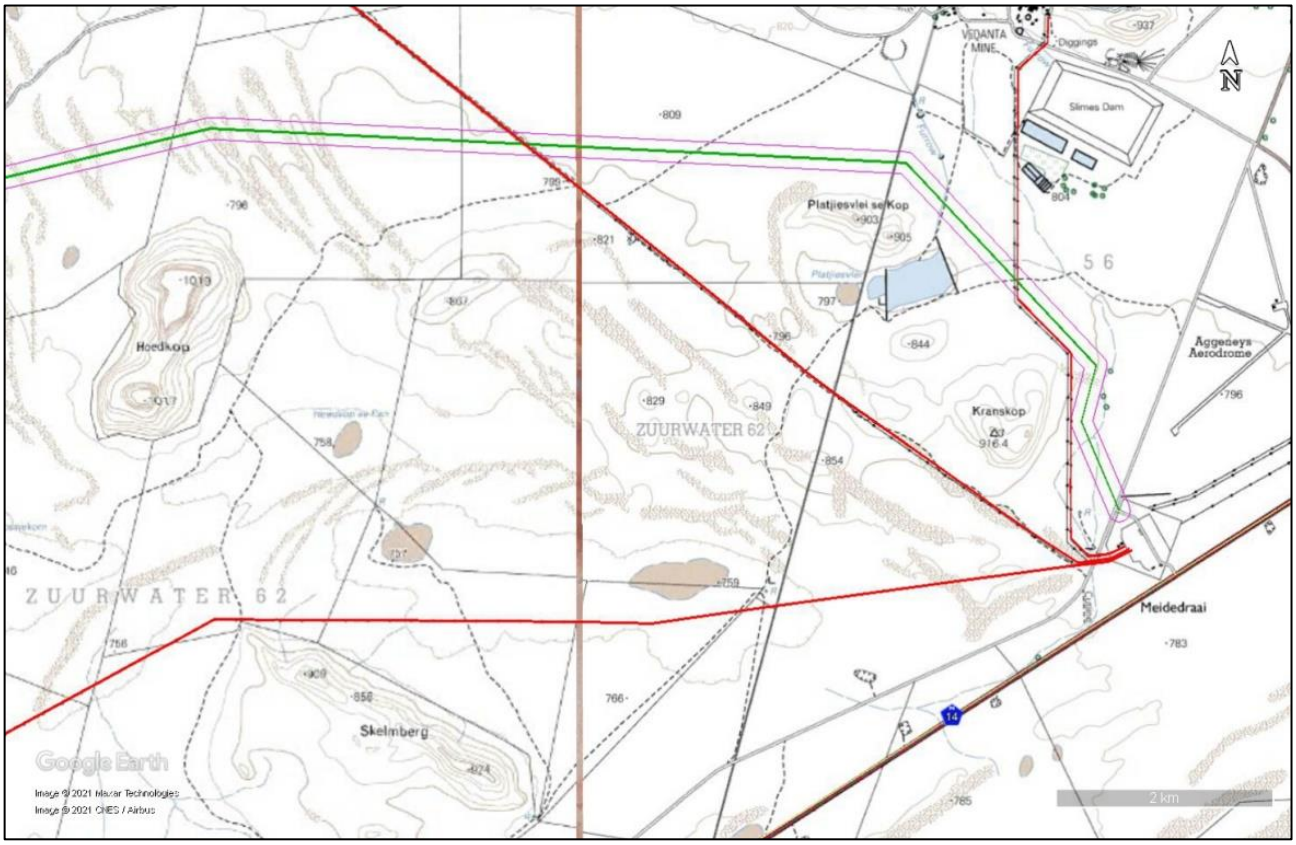


**Figure 3:** The eastern end of the proposed powerline and corridor (Green and purple) overlaid on a section of the topographic map (2918BD Aggeneys (South) 2011ed) (source: Chief Directorate: National Geo-spatial Information: Geospatial Portal http://www.cdngiportal.co.za/cdngiportal/)

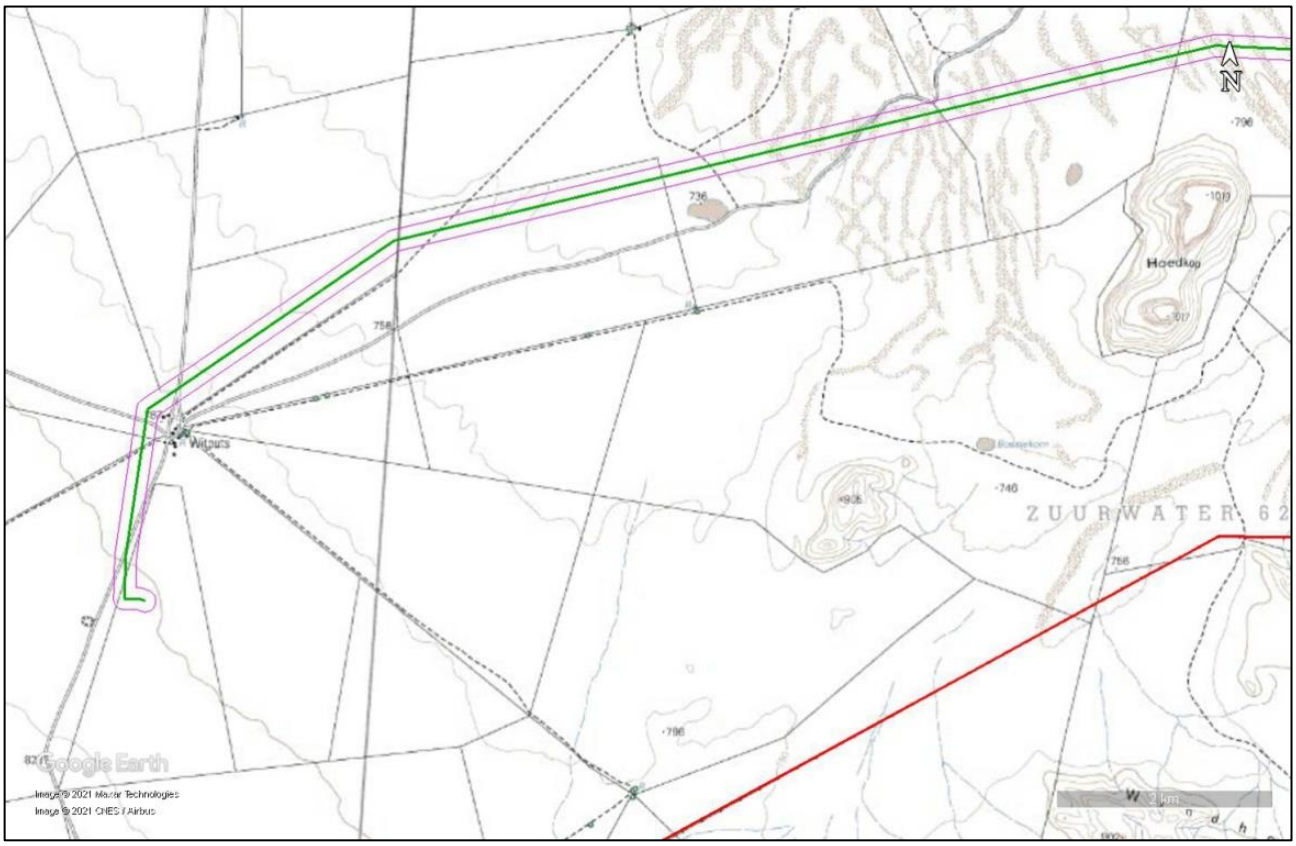


Figure 4: The western end of the proposed powerline and corridor (Green and purple) overlaid on a section of the topographic map (2918BC Hunites 2011ed) (source: Chief Directorate: National Geo-spatial Information: Geospatial Portal http://www.cdngiportal.co.za/cdngiportal/)

Based on field observations, we describe the receiving environment thus:

## 2.4 List of affected properties

The affected properties are listed in Table 2 while cadastral boundaries are shown in Figures 1.

**Table 2:** List of affected properties and associated information

| Organisation | Name/Surname | Designation | Farm name | Ptn | Phone | email | Address |
|---|---|---|---|---|---|---|---|
| Blommeland Boerdery | Jasper Mostert | Landowner | Zuurwater | 2/62 | 082-8802578<br>082-8802578<br>082-8802578<br>082-8802578 | blommelandboerdery@gmail.com | PO Box 262<br>Garies 8220 |
| | | | Zuurwater | 5/62 | | | |
| | | | Zuurwater | 6/62 | | | |
| | | | Ou Taaibosmond | 5/66 | | | |
| | | | Ou Taaibosmond | 6/66 | | | |
| | | | Ou Taaibosmond | 14/66 | | | |
| Black Mountain Mining (Pty) Ltd | Pieter Venter Environmental Manager | Landowner | Aggeneys | 1/56 | 082-8089132 | pieterdavidventer@blackmountain.co.za | PO Box X1<br>Aggeneys<br>8893 |
| ESKOM | | s/s | Aggeneys | 2/56 | | | |

## 2.5 Alternatives

No alternative routes have been proposed

## 2.6 Date and season of the site investigation

The site was surveyed on the 6th and 7th September 2021. In this dry area ground visibility is always good and seasonality does not affect the outcomes of the report due to vegetation growth. The survey was conducted predominantly on foot assisted by some driving through the study area. During the survey, 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 setting of the proposed development.

## 3. HERITAGE LEGISLATION

In terms of the National Environmental Management Act (Act No. 107 of 1998 as amended; NEMA), the powerline project is subject to an EIA. That being the case, an investigation of heritage resources must be undertaken in terms of S38 (8) of the National Heritage Resources Act (Act No. 25 of 1999; NHRA) to inform the decision of the National DEA.

The NHRA protects a variety of heritage resources as follows:

- S34: Structures older than 60 years;
- S35: Palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- S36: Graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- S37: Public monuments and memorials.

The definitions in Section 2 of the Act applicable to the above protections are as follows:

- Structures: “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”;
- Palaeontological material: “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”;
- Archaeological material: a) “material remains resulting from human activity which are 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”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was

wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";

- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

Landscapes with cultural significance are protected under the definition of the National Estate in S(3), more specifically S3 (2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, S3 (3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes. S 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.

### 3.1 Heritage authorities

The relevant heritage authorities are Ngwao-Boswa Ya Kapa Bokoni (Provincial Heritage resources Authority of the Northern Cape) who are responsible for built environment and cultural landscapes, and the South African Heritage Resources Agency (SAHRA) the National Heritage Resources Authority, who comment on archaeological and palaeontological resources.

### 3.2 Grading of heritage resources

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the National and Provincial heritage resources authorities respectively, while Grade 3 resources are managed by the relevant NHRA, PHRA or local planning authority.

It is intended that the various Provincial Heritage authorities would formulate a system for the further detailed grading of heritage resources of local significance but have generally not yet complied. Heritage Western Cape (2012) uses a system in which resources of local significance are sub-divided into Grade IIIA, IIIB and IIIC i.e. high, medium and medium low local significance, while sites of low or very low significance (and generally not requiring mitigation or other interventions) are referred to as "not conservation worthy" (NCW) or "Ungradeable". Although not prescribed in the law, the Heritage Western Cape system is also employed here as the sub-division of Grade III resources is preferred.

**Table 3:** Grading of heritage resources (only categories I, II and III are defined in the NHRA), but HWC have introduced additional categories under III).

| Grade | Level of significance | Description |
|---|---|---|
| I | National | Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources. |
| II | Provincial | Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources. |
| IIIA | Local | Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3a heritage resources. |
| IIIB | Local | Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3b heritage resources. |
| IIIC | Local | Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3c heritage resources. |
| NCW | | Not conservation-worthy - The Heritage Authority has applied its mind and the resource does not have enough heritage significance to be included in the National Estate. i.e. Insufficient Heritage Significance or "Ungradeable". This category is important as not all old places or structures are significant in terms of the NHRA. |

| | | |
|---|---|---|
| Not yet graded | | The Heritage Authority has not yet applied its mind in order to determine a grading for the resource or there is not, yet, sufficient information to determine the grading. |

### 3.3 Consultation

The Basic Assessment report will be circulated to interested and affected parties and other Municipal and Statutory bodies for comment. Any comments with respect to heritage can only be addressed once such comments are received.

### 3.4 SAHRA notification of the project and requirements

SAHRA was notified of the proposed project on the 5th July 2021 by way of registering a description of the project via the SAHRIS online system. A cover letter was submitted describing a number of previous archaeological and palaeontological projects in the vicinity of the proposed powerline and, based on the review of the findings of those reports, a request was made for the powerline archaeological assessment to be based on a desktop study. We requested exemption from having to do a Palaeontological assessment based on the relatively low impact of a powerline on such resources, in the light of existing findings.

An interim comment was received from the SAHRA case officer on the 4th August 2021 (see Appendix 1): "A field-based HIA must be conducted that complies with section 38(3) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). The assessment must include an assessment of the impact to archaeological and palaeontological resources. The assessment of archaeological resources must be conducted by a qualified archaeologist and the report comply with the SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports.

As the proposed development footprint is underlain by areas of moderate palaeontological sensitivity, a desktop PIA must be conducted as part of the HIA. The assessment of palaeontological resources must be conducted by a qualified palaeontologist and the report comply with the SAHRA 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments.

The draft EA documents inclusive of appendices must be provided with the above requested reports so that an informed comment may be issued."

## 4. METHODOLOGY

### 4.1 Literature review

A survey of available literature was carried out to assess the general heritage context of the area and a background search of other Cultural Resource Management (CRM) projects in the area was made via the South African Heritage Resources Information Systems (SAHRIS) database. Reference to specific consulted reports and publications is made in the text where relevant.

### 4.2 Baseline information from previous work in the area

The baseline desktop study describes what is already known about heritage resources of the broader vicinity of the study site, as described in the literature. The locations of other heritage assessments around the proposed powerline are shown in Figure 5. Also shown by different coloured pins are archaeological occurrences found during those surveys. Some sites could not be shown as a result of the map scale, but the most relevant do appear.

### 4.3 Palaeontology

The SAHRIS Palaeo sensitivity map indicates that the majority of the eastern part of the powerline crosses areas of 'low' palaeontological sensitivity, while only a relatively small section at the western end crosses areas of 'moderate' sensitivity (Figure 3).

Almond (2015) in his desktop study of the Sol Invictus PVSEF notes that most of the study area is underlain by unfossiliferous metamorphic basement rocks (gneisses etc), or is mantled by superficial

sediments of far more recent age than the underlying rocks which are of low palaeontological sensitivity. Most fossils within the superficial deposits are likely to be of widespread occurrence (i.e. not unique), with the exception of occasional rare vertebrate remains. Igneous and metamorphic hard rocks, mainly gneisses, schists, quartzites and amphibolites, crop out at the surface only in the southwestern part of the study area. The overall impact significance of the proposed Sol Invictus Solar PV development on fossil heritage was therefore considered to be 'very low'.

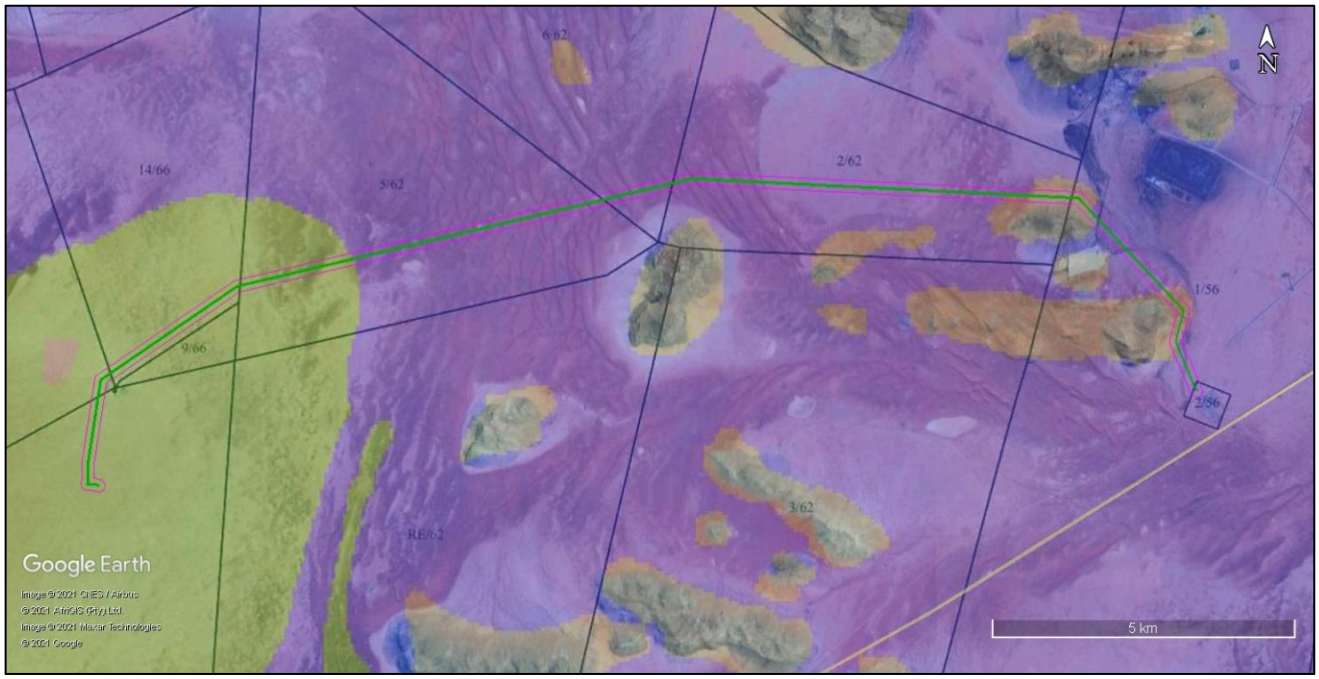


**Figure 4:** Extract from the SAHRIS Palaeo sensitivity map indicating the palaeontological sensitivity of the area. Green denotes moderate sensitivity, while blue denotes low sensitivity.

Almond (2011) assessed the initial area for the proposed Sato Energy Holdings PV project on Portion 3/62 Zuurwater. He concluded that: *"The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low. (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. For these reasons, no further specialist palaeontological studies or mitigation are recommended for this development."*

Almond (2012) also assessed the Boesmanland 75MW Solar Facility on 2/62 Zuurwater south west of Aggeneys. He sated the following: *"It is concluded that overall impact significance of the proposed 75 MW solar plant development on fossil heritage is considered to be* ***very low*** *because:*

- *Most of the study area is underlain by unfossiliferous metamorphic basement rocks (granite-gneisses etc) or mantled by superficial sediments of low palaeontological sensitivity;*
- *Extensive, deep excavations are unlikely to be involved in this sort of solar park project.*

*It is therefore recommended that exemption from further specialist palaeontological studies and mitigation be granted for this solar plant development."*

Pether(2012) assessment of the proposed Orlight SA Development of a solar photovoltaic power plant on Portion 1 of Farm Aroams 57. He concluded: *"The bedrock underlying the property is unfossiliferous and of no palaeontological interest. The overall potential for fossils in the Quaternary sand cover is very low. Furthermore, the scale of subsurface disturbance and exposure is quite limited, comprising mainly "post holes" to support the PV panel frames. In view of the low fossil potential it is proposed that only a basic degree of mitigation is required."* His mitigation consisted of an alert for the uncovering of fossil bone be included in the Construction Phase EMP for the project.

Butler (2016) prepared a Palaeontological desktop assessment for the proposed Koa Valley prospecting right to the north of the proposed powerline. As with other surveys, Butler also noted: "*The broader area near Aggeneys is underlain by the Mid-Proterozoic (Mokolian) basement rocks of the Namaqua-Natal*

*Metamorphic Province (Bushmanland Group) as well as Cenozoic superficial deposits. The Proterozoic granite-gneiss basement rocks of the Namaqua-Natal Metamorphic Province do not contain any fossils because they are igneous in origin, or too highly metamorphosed, and their palaeontological sensitivity is similarly low. The low palaeontological sensitivity of the Cenozoic superficial deposits can be attributed to the scarcity of fossil heritage in these deposits. In Palaeontological terms the significance is thus rated as Low (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.*"

In 2007, Rubidge also undertook a desktop assessment of the KOA Valley area and his summarised comments included in a letter prepared for Zibula Xploration were as follows: "*The entire area is situated in the Namaqua-Natal Metamorphic Complex where rocks of the Bushmanland and Orange River groups and Precambrian granites outcrop in places,but most of the terrain is covered by Quaternary calcretes and sands. Farm Nooiasbes 51; Portion 5 of the farm Amam 46; Farm 609; Remainder of the farm Onab no 52, Remainder of the farm Naroep no 45; Remainder and portion 1 of the farm Haramoep no 53: This area is underlain by rocks of the Bushmanland Group; Orange River Group,Little Namqualand Geneiss Suite, Bantamberg and Naab Granite suites, Gareskop Dyke swarm, and is covered by Quaternary calcretes and sands. Portion 14 of the Farm Outaaibosmond no 66, Remainder, portion 1,2,3,5 and 6 of the Farm Zuurwater no 62: This area is underlain by rocks of the Bushmanland Group, which is covered byQuaternary calcretes and sands.*

*The Precambrian rocks would have the potential to contain microfossils, but as they have been highly metamorphosed there is very little chance of fossils being preserved in these rocks. No fossils have yet been reported from the Quaternary sands and calcretes. There is a possibility that bones, wood or leaves could be preserved in these Quaternary sediments. There is very little chance of fossils being present in the area studied. Should any fossils be discovered or unearthed in the Quaternary sands and calcretes in the process of prospecting or mining, Zibula Xploration (Pty) Ltd must contact a South African Museum or University which employs palaeontologists so that the necessary palaeontological salvage operations can take place."*

The recommendation in Rubidge's report is similar to the common rider in many of the PIA's i.e. that should substantial fossil remains be exposed during construction/mining, then the ECO (Environmental Control Officer) and/or SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist, or as in the case of the Boesmanland PVSEF, Almond (2012) concluded that most of the study area is underlain by unfossiliferous metamorphic basement rocks (granite-gneisses etc) or mantled by superficial sediments of low palaeontological sensitivity and that extensive, deep excavations are unlikely to be involved in this sort of solar park project and that exemption from further specialist palaeontological studies and mitigation be granted for this solar plant development.

No fossils are known to have been found within the study area. Although isolated examples of fossil sites are found in the broader region, for example at Bundu Pan near Copperton (Kibberd 2006), the fossil record of the Kalahari Group as a whole is sparse and limited in its diversity. While the basement rocks are unfossiliferous, the kinds of fossils that may be expected to occur in the sand deposits are of very low significance and would be sparsely distributed. Overall, the palaeontological sensitivity of the study area is thus considered to be low.

### 4.3.1 Findings of the palaeontological assessment of the Sol Invictus powerline

Prof M. Bamford undertook the desktop palaeontological impact assessment (Appendix D) for the route as per SAHRA's requirements. She concluded that the proposed powerline route lies on non-fossiliferous volcanic rocks of the Namaqua-Natal Province and aeolian Quaternary sands in the eastern part. The shorter western part the route is along moderately sensitive Tertiary Calcretes that would only preserve fossils in such features as palaeo-pans and palaeo-springs. None of these features is evident in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the environmental officer when excavations commence. As far as the palaeontology is concerned, it is recommended that the project be authorised.

## 4.4 Archaeology

### 4.4.1 Earlier and Middle and Stone Age

Morris (2011b) noted that Beaumont et al. (1995:240-1) described a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland where raw materials, mainly quartzite cobbles, were derived from Dwyka till. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and Maans Pannen, and east of Gamoep, could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately, to heavily weathered Earlier Stone Age (ESA). Beaumont et al. have shown that “substantial MSA sites are uncommon in Bushmanland” (1995:241) and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Beaumont et al 1995). The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites. No substantial sites have been found previously in the survey area. Only very sparse localized scatters of stone tools have been seen in places, with limited traces in the hills (e.g. an MSA site at the top of Gamsberg) or at the bases of hills. ESA including a Victoria West core on quartzite has been noted within the Gamsberg basin (Morris 2010).

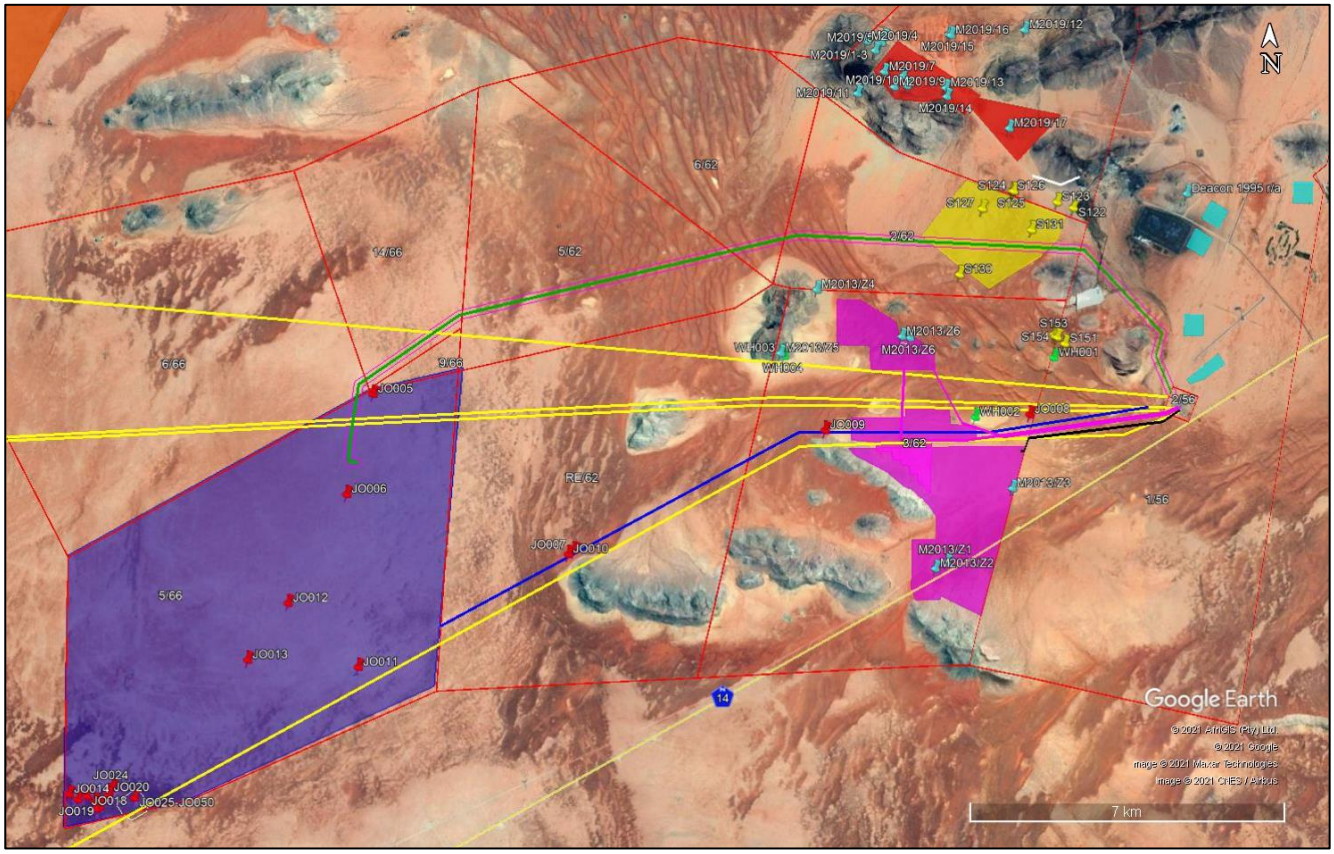


**Figure 5:** The locations of other heritage assessments around the proposed powerline discussed in the report. Purple polygon and lines - Sato PVSEF on Zuurwater 3/62 (Almond 2011, Morris 2011, 2013), Yellow polygon - Boesmanland PVSEF on Zuurwater 3/62 (Almond 2012, De Kock 2012, Smith 2012), dark blue polygon and line - Sol Invictus PVSEF on Ou Taaibosmond 5/66 (Almond 2015, Orton 2016), turquois polygons – Black Mountain CSP (Morris 2011), red polygon (Morris et al 2019), white line – Black Mountain Mine haul road (Lavin 2019), yellow lines – Aggeneys-Oranjemond 400kv powerline and alternatives (Webley and Halkett 2011), orange polygon (partial – only corner visible in north west corner) - KOA valley prospecting (Butler 2016, Rubidge 2007, Van Ryneveld 2017), off diagram to the east – Orlight PVSEF on 1/57 Aroams.

### 4.4.2 Later Stone Age

Morris (2011b) notes that generally speaking, Late Holocene Later Stone Age (LSA) sites are the predominant archaeological trace noted in past surveys in the Aggeneys-Pofadder region (Morris 1999a-

b, 2000a-c, 2001, 2010). Beaumont et al. (1995) have shown, with reference to the LSA, that “virtually all the Bushmanland sites so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river” (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991), which reflected the “much higher productivity and carrying capacity of these bottom lands.” “Given choice, the optimal exploitation zone for foragers would have been the Orange River.” The appearance of herders in the Orange River Basin, Beaumont et al. argue, led to competition over resources and ultimately to marginalisation of hunter-gatherers, some of whom then occupied Bushmanland, probably mainly in the last millennium, and focused their hunting and gathering activities around the limited number of water sources in the region. Surveys have located signs of human occupation mainly in the shelter of granite inselbergs, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont el al. 1995:264). Possibly following good rains, herders moved into the Orange River hinterland, as attested archaeologically at sites with ample pottery near Aggeneys and, east of Pofadder.

A number of surveys have been carried out in the Aggeneys area and have reported a variety of finds directly relevant to the proposed powerline. Morris surveyed a CSP at Aggeneys (east of the powerline) and also undertook the initial survey of the Zuurwater PVSEF site (south of the powerline) (2011a, 2011b), while Smith (2012) surveyed the site of the proposed Boesmanland PVSEF (never built) through which a section of the the Sol Invictus powerline will pass. According to De Kock (2012, Annexure 4) the alternative powerline routes for the PV were also assessed. One of these (Alt 1) is similar to the orientation of the Sol Invictus powerline. No archaeological sites are shown on the route however. Smith and Morris each reported finding only a small number of isolated quartz artefacts in the surveys, possibly due to the prevalent sand cover in those areas. Smith’s comments about his survey are relevant given that the line crosses the surveyed farm. He sated the following: “Tracks, dry pans and sub-surface indications using spring-hare and aardvark holes all produced widely scattered material with no concentrations of note. The potential access routes were also inspected, with similar results. The conclusions are that the flat, open terrain has a low archaeological signature, and that there are no inhibitors, from an archaeological perspective, preventing the solar facility from proceeding with construction”. Although Morris (2011a) found few other sites, he does note the presence of a rock painting (first reported by Deacon 1995) on a boulder inside the mining area at Aggeneys. The finger painting is of a type believed to be associated with the Khoekhoen, and similar to paintings found in very low densities on granite outcrops throughout Namaqualand and Bushmanland (Orton 2013).

Morris (2013) later surveyed changes to the layout of the Zuurwater PVSEF and recorded two important observations, one of which was outside of the PV site. He found bedrock grinding hollows and grooves with associated scatters of stone artefacts, pottery and ostrich eggshell where bedrock protruded through the sand at one site (Zuurwater 6), and artefact scatters associated with boulders at the foot of a mountain at another (Zuurwater 5). Co-incidentally, a part of Zuurwater 5 was reported during a survey of alternative powerline routes for a 400kV powerline to Oranjemund by Webley and Halkett (2011) and is referred to in this report as WH003, while another site was found at an isolated boulder, contained a small concentration of quartz flakes and is referred to as WH004. Few significant archaeological sites were found on sections of the routes in the vicinity of the Sol Invictus powerline apart from those specifically mentioned above.

Elsewhere, Orton and Webley (2012a,b) also recorded sites with grinding hollows at Kangnas ~33 km to the west of the study area, and also at a site to the south east of Pofadder. To the north east of Pofadder, Orton (2015) located a number of LSA stone artefact scatters directly associated with small surface rock outcrops at which hollows in the rock caught rainwater which seems to have attracted settlement. Bedrock grooves also occurred at some of these sites. Webley and Halkett (2016, 2017) also recorded grinding groves on flat rock exposures at a pan ~26km to the south east of Aggeneys during the assessment of the Enamandla PV 3 solar facility where an LSA artefact scatter is associated and the artefacts are mostly on quartz, and a few fine grained rocks. A single potsherd was also noted.

A variety of archaeological traces are preserved within the Ghaamsberg ~25 km to the east of the study area. Scatters of Early Stone Age (ESA) artefacts are noted in open erosion contexts, while ~30 cm of LSA deposit is present in a small rock shelter, and rock paintings are found in a kloof on the north eastern edge of the mountain (Orton 2014).

Out of seventeen sites recorded by Morris et al (2019) in an area where extension of the Black Mountain mine was planned, ~3km to the north of the closest part of the powerline, only one site (site 11) had high heritage significance and was associated with rock outcrops and koppies, while two sites, (12 and 14), were indicated as having medium significance. The former contains colonial era walling associated with LSA artefacts, while the latter consists of a relatively higher density scatter of ESA flakes.

In 2016, Orton assessed the sites of 4 proposed PV arrays as part of the Sol Invictus PVSEF (2016a-d). In fact he intensively surveyed not only the PV sites, but the whole of the farm (Ptn 5/66). With respect to the searched area, Orton (2016a) indicated that: "…all finds were included and described regardless of whether they were found within the Sol Invictus 3 PV development footprint, along the transmission line alternatives or elsewhere on the farm portion. This is because there were generally very few heritage resources present and describing everything aids in a broader understanding of the heritage of the area."

His search tracks showing the detailed survey of Ptn 5/66 are shown in Figure 6


**Figure 6:** Aerial view of the study area showing the site (red polygon), the proposed Sol Invictus 3 PV footprint (blue polygon) and the other three arrays (1,2,and 4), are symmetrically positioned next to, and below array 3 (see figure 2). The survey tracks (yellow lines) and heritage finds (numbered symbols). Other archaeological sites on record to the northeast are marked.

The PVSEF lies at the western end of the proposed powerline route, where the last 1.5km of the line and associated infrastructure such as on site substations lie in areas already assessed by Orton. His survey failed to produce many significant archaeological sites except in the very far south west of the farm. The area where the PVSEF with its associated infrastructure is located, was however found not to contain any resources requiring mitigation. Orton also assessed a powerline alternative between the southern part of the farm and the Aggeneis substation, rejected in favour of the new proposed alignment. He found four archaeological sites on the ~17km powerline alignment. According to his site listing (Table 1), two of these (007, 008) are listed as being of very low significance. The remaining sites (009, 010) are equivocal as Orton cannot say with certainty if they are graves or not, and significance is therefore questionable. In the text however, no mention is made of the possibility of graves and he describes the powerline sites as follows: "The only place outside of the south western part of the study area was a minor concentration of artefacts found at waypoints 007 and 010, both located atop a red sand dune within the transmission corridor. At 007 were two CCS flakes and an ostrich eggshell fragment while at

010 there were two quartz flakes. These two points were 150 m apart from one another and are unlikely to be related. They are all LSA artefacts." His waypoint 005 represents a fairly modern ash dump on the southern end of the Ou Taaibosmond farm werf.

In any event, what is more useful to note is that three of the four sites on the powerline are found on the edges of rock outcrops.

Orton concluded the following about the site and surroundings: "The vast majority of the study area was found to be a flat, featureless plain that is completely unconducive to finding traces of Stone Age archaeological settlement. Even isolated artefacts attributable to background scatter were very rarely encountered. This would be unusual in parts of Bushmanland, but is unsurprising here, given that the surface is either sandy or else, when rocks are found, they are totally unsuited to the production of stone artefacts and isolated artefacts found were all in quartz. No part of the broader study area seemed more likely to produce isolated artefacts than any other. In terms of age, the majority of the artefacts are likely to date from the MSA, and no ESA material was seen. All the important archaeology was found in the south western corner of the study area in association with pan-like depressions in the sand, usually with exposed gneiss rock slabs. A few low density scatters of artefacts were found in surrounding sandy areas, while a few smaller depressions with exposed gneiss contained low density scatters. The largest of the depressions held standing water at the time of assessment and, after good summer rains, probably serves as a water source for several months and is probably the reason for the settlement around it. Although the periphery of the pan was not completely surveyed, it is likely that the majority of the archaeological occurrences scattered around it were recorded. Certainly, all the rock outcrops were visited."

He included the following rider: "If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution."

Van Ryneveld (2017) assessed thirty-four prospecting drill positions on the farms Haramoep 53, Oonab-Noord 609, Amam 46 and Nooisabes 51 as part of the so-called KOA Vallety prospecting right application. This is a very large area and drilling locations were widespread. Van Ryneveld notes: "Low density MSA and LSA artefacts are present in surface gravel lenses, as has been identified at drill positions BH0221 (Site KOA-01) and BH031 (Site KOA-02) on the south-eastern peneplain of Haramoep. Similar type anthropogenic lenses have been identified elsewhere on the peneplains of Haramoep and Nooisabes, but with these not affected by the proposed drill positions. At drill position BH0071 (Site KOA-04) low density MSA and LSA artefacts were found (in) a workshop context, indicating that more mountainous areas may well be, from a Stone Age archaeological point of view, more significant than the peneplains. Site KOA-03 represents the Colonial Period Haramoep farmstead. Two drill positions were not accessed, including BH0111 and BH0081, due to accessibility constraints. Both drill positions are situated in the Koa Valley dune system. It is recommended that development (drilling) at the locales proceed, based on the assumption that the Koa Valley dune system is largely anthropogenically sterile, as has been identified at nine (9) drill positions proposed and assessed, situated in the dune system."

The survey of a new haul road at Black Mountain Mine (Lavin 2019) was located in an area largely disturbed by mining activity and the field assessment identified no heritage resources.

More generally, it can be noted that archaeological sites in the area tend to be more commonly encountered around the fringes of granite hills, rocks and koppies, on sand dunes or in or around pans (Beaumont *et al.* 1995). Other surveys in the region support this contention (Halkett 2010; Morris 2011a, 2013; Orton & Webley 2012).

### 4.5 Graves

Orton (2016) notes: "On a large red sand dune, close to waypoint 010 (but not specifically recorded by GPS) was an isolated stone of about 30 cm length lying on the surface. It displayed no evidence of any use. Only after later recording of the two quartz flakes was it considered that it might represent a precolonial grave marker. A far more likely grave was located on another red sand dune further east, but

just outside the Alternative 1 transmission line corridor. It was very close to the foot of a rocky mountain and was comprised of a slightly elongated mound of rocks aligned in an east-west direction (Plate 1). Within the PV study area, a small collection of stones was noted at waypoint 013 (Plate 2). They would not ordinarily have attracted attention except that the ground surface in the area is devoid of rocks suggesting that these were all carried there for some purpose – to cover a grave seems the most likely, although the substrate is not generally suitable for the excavation of graves of any depth and there do not seem to be enough rocks present to cover a shallow grave. They may more likely have been unearthed by burrowing animals. Similar collections of stone are sometimes found along boundary lines, but the nearest farm track and fence is 120 m to the south of this point. Such isolated graves, when present, might relate to precolonial occupation of the area or could be from the early farmers ('trekboers') who colonised the area during the 19th century."

**Plate 1:** Possible grave at an unspecified waypoint outside the original transmission corridor (After Orton 2016a, Figure 21). **Plate 2:** Possible grave at waypoint 013 (After Orton 2016a, Figure 22).

Webley and Halkett (2012:15) found a number of small stone cairns during the survey of the Aggeneis PV to the east of Aggeneys, but the context of the observations suggested that these might have been related to prospecting, rather than graves. Identifying stone cairns as graves is not without problems. It is much easier to identify more recent burials marked with more conventional elongated mounds and foot and/or headstones The context of the location is very important, with graves being more likely around signs of extended habitation or other activities.

### 4.6 Built environment

As noted previously, farm werfs and other buildings are very scarce in the area to the west of Aggeneys probably because settlement is only possible where water is available. No significant structures are therefore recorded in the majority of heritage assessments, with the exception of the farm discussed by Orton (2016,a-d). He notes: "No built structures are present within the proposed PV development footprint. Although the farm complex occurs in the far north of the study area, it will not be impacted and does not require further assessment. Its structures are all 20th century in age with two adjoining structures likely to be early to mid-20th century (Plate 3), and the other two likely to be from the 1940s (Plate 4) and 1950s (Plate 5). An aerial photograph from 1961 shows both the newest structures to be present, while that which visually appears oldest is not clear in the image, possibly due to its smaller size. There is some sort of disturbance of the natural surface, however, and this probably indicates the presence of the house."

**Plate 3:** Ou Taaibosmond farm buildings (After Orton 2016a, figure 23)

**Plate 4:** Ou Taaibosmond farm buildings (After Orton 2016a, figure 24)

**Plate 5:** Ou Taaibosmond farm buildings (After Orton 2016a, figure 25)

A very large ash dump was found adjacent to a ruined structure at Orton's waypoint 005 to the south of the Ou Taaibosmond werf. Based on the likely age of surrounding buildings, the ash heap is unlikely to be more than 100 years of age. It contained many fragments of animal bone and glass as well as various metal items and a large marine limpet shell (*Scutellastra barbara*).

A small ruined farm complex with three widely dispersed structures was found along the Alternative 1 transmission corridor at waypoint 008. These include a cottage with an external hearth, probably used itinerantly by farm workers (Plate 6), and a circular cement reservoir and a livestock loading ramp. Historical aerial photography shows it to have been present in 1962/63 and probably actually dating to the mid-20th century.

**Plate 6:** A small werf with widely dispersed structures was found at Orton's waypoint 008 (After Orton 2016a, figure 29). **Plates 7 & 8:** The remains of two Colonial era stone walled dwelling structures at Morris's site 12 (after Morris 2019, figure 16)

De Kock (2012) reported that no buildings, ruins or any other structures were noted on the Boesmanland PVSEF site and that no structures considered to be of cultural significance were located within the proximity of the proposed development site boundaries. Van Ryneveld (2017) indicated that one of the drilling sites in the Koa Valley project was close to the Colonial Period Haramoep farmstead (Site KOA-03) which is part of a cluster of buildings, but this is 18km to the north. Morris (2019) refers to two Colonial era stone walled dwelling structures at his site 12 (Plates 7, 8) He suggests that these represent farmer/veepos settlement in the form of stone-walled dwellings and associated features including the remains of a bakoond, and associated debris including remnants of an ash midden and bottle glass (Old Brookes Lemon Ltd dating to the 1920s).

### 4.7 Other heritage

There is always the small possibility of encountering unmarked graves in sandy substrates. However, because of the low density of occupation sites in the area, the chances of locating graves is deemed to be very small indeed. If present, they are likely to be around farm werfs, or at dense archaeological occurrences.

According to Orton (2016a-d) some of the place names in the region reflect the living heritage of the Khoekhoen. Ghaamsberg (also Gamsberg), for example, derives from the Khoekhoen word meaning 'grassy spring' (Raper n.d.). There are unconfirmed historical reports that a massacre of Bushmen may have occurred in a kloof of the Ghaamsberg (Robinson 1978) but surveys have failed to yield any evidence.

### 4.8 Cultural Landscape

This vast area is characterised by wide open flat plains with extruding rocky hills, koppies and larger massifs with a significant mining and alternative energy layer superimposed. There is a low population density with farms being large, and farm werfs widely spaced. Denser population is found at mining sites and towns (e.g. Aggeneys). Small stock farming is the predominant agricultural activity, while mining provides employment to many and contributes to the local economy. A number of powerlines cross the landscape converging and originating at the Aggeneys sub-station. To date, few of the PVSEF's discussed in the text have yet to be built.

#### 4.8.1 Scenic routes

The N14 is the only major road in the area and runs to the south of the powerline site can probably be classified as a scenic route because of the aesthetic qualities of the landscape through which it runs. The proposed powerline development is mostly very distant from the road and shielded by significant topography. The bulk of the route is remote and there will be few receptors. Some views of the powerline will be possible in the vicinity of the Aggeneis substation, but here it is in the context of existing powerlines and other mining related infrastructure. We do not believe that significant new visual impact will arise from this development.

### 4.9 Archaeological assessment - data gathering

The fieldwork component of the Archaeological Impact assessment was conducted by Mr D Halkett and Mr J Gribble of ACO Associates cc on the 6th – 8th September 2021. Visibility of the ground surface in the project site was considered to be good to excellent and there were no limitations in terms of access to the powerline route.

Prior to embarking on the fieldwork, aerial photographs from a range of periods had been examined to determine if any heritage indicators that may need to be inspected could be identified on the images. Apart from

Search tracks were recorded by means of a Garmin GPS receiver to document the searched area and are presented in Figure 7a and b. Identified heritage resources were assigned Lat-Lon co-ordinates, described and photographed. The few identified heritage resources observed are also plotted on Figures 7a/b and described in Table 4. Heritage resources have been provisionally graded for significance according to the system used by Heritage Western Cape as defined in the Table 2.

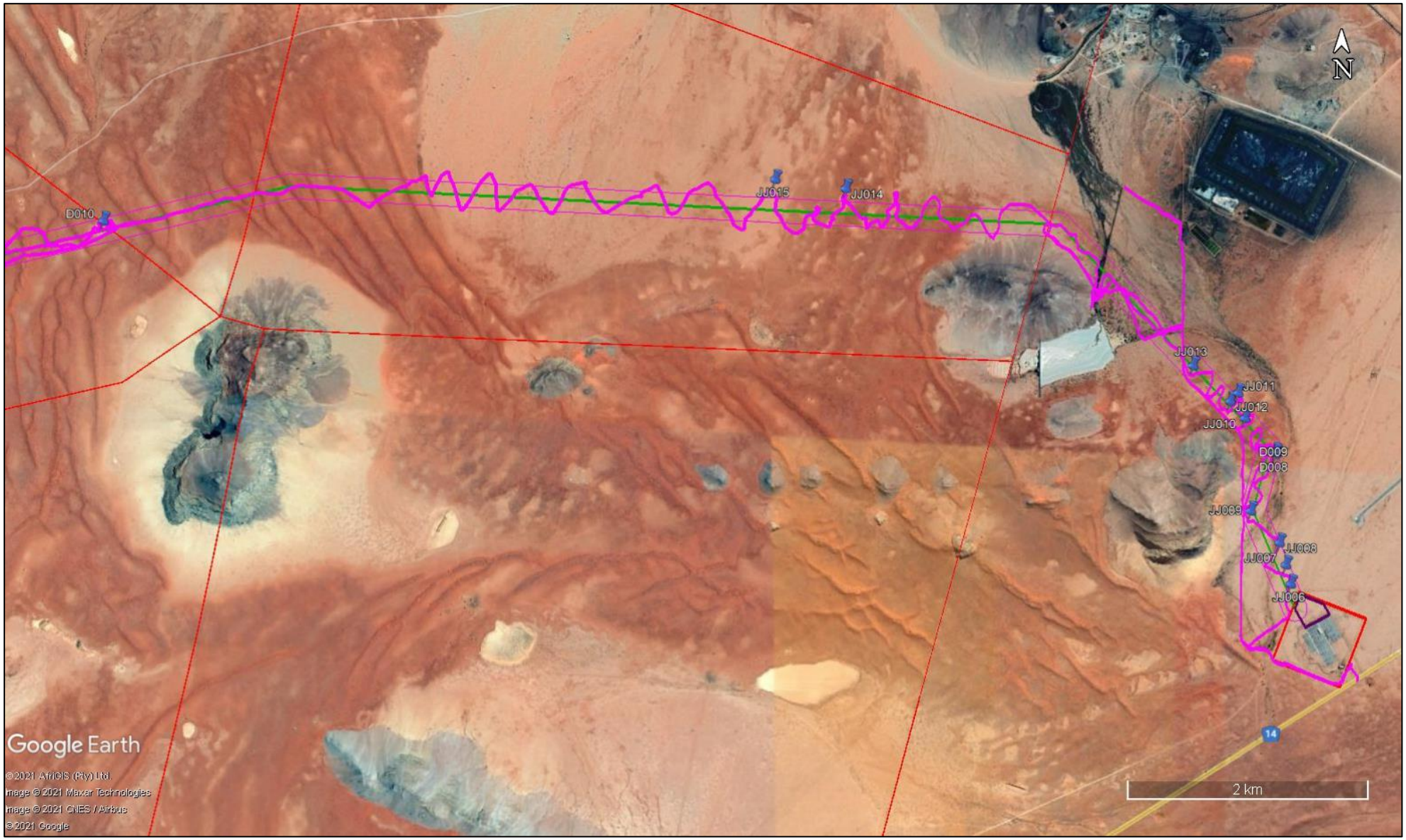


**Figure 7a:** Sites and track paths map (2021) – eastern end of the powerline. Farm portions (red), heritage sites (blue numbered pins), tracks (magenta lines), powerline (green), powerline corridor (thin purple).

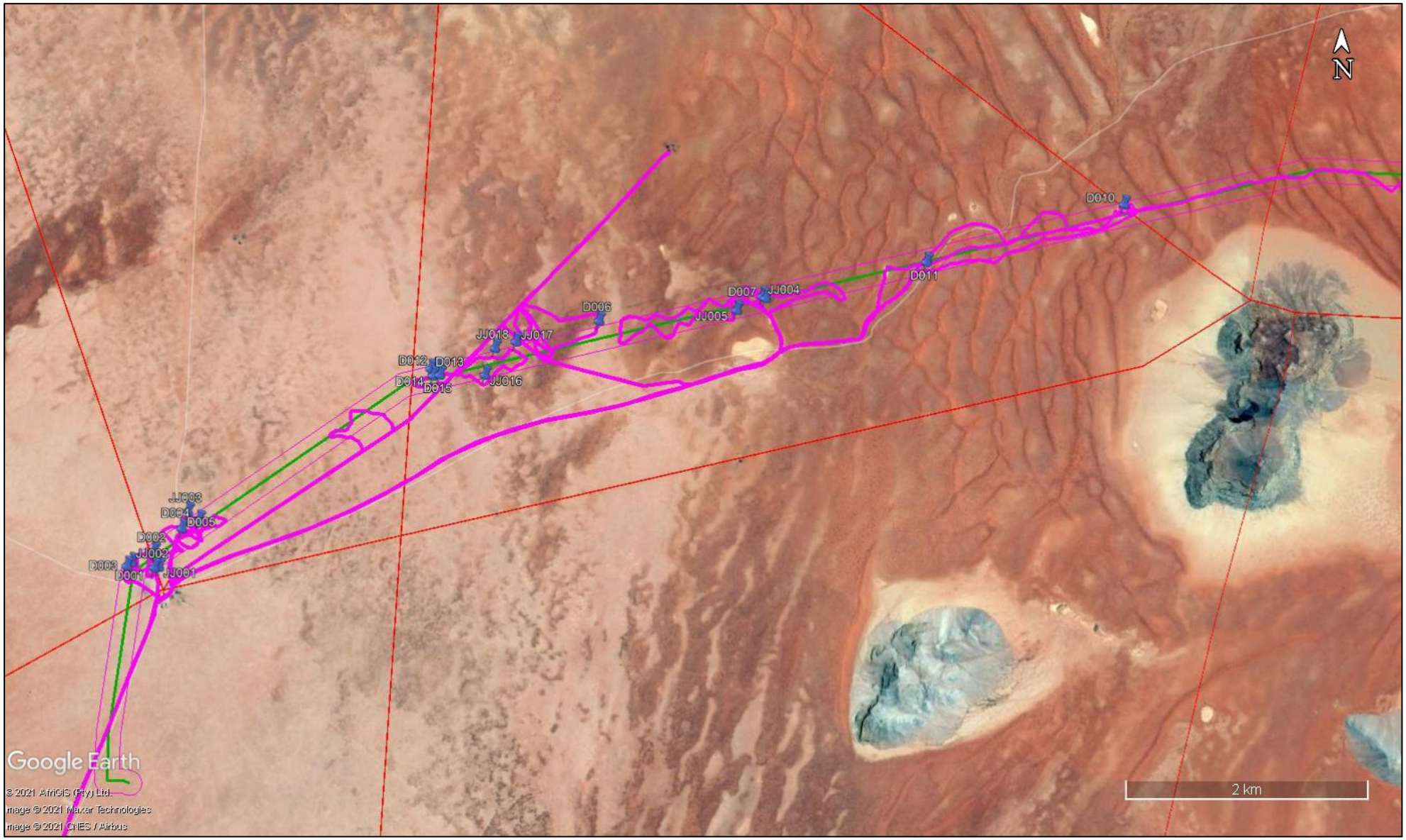


**Figure 7b:** Sites and track paths map (2021) – western end of the powerline. Farm portions (red), heritage sites (blue numbered pins), tracks (magenta lines), powerline (green), powerline corridor (thin purple).

## 5. ARCHAEOLOGICAL FIELDWORK OBSERVATIONS

Our observations made during the survey of the powerline corridor is largely in agreement with observations of other studies made in the area, but there were far fewer LSA resources on the powerline route. The observations are presented in Table 4.

**Table 4:** Archaeological/built environment observations from the current 2021 survey within the Sol Invictus powerline corridor

| Observation | Lat | Lon | Description | Grading |
|---|---|---|---|---|
| D001 | -29.29290899 | 18.6140300 | Isolated hornfels flake MSA - patinated | NCW |
| D002 | -29.29208999 | 18.61590302 | Kraal built from calcrete chunks surrounded by refuse | NCW |
| D003 | -29.29317897 | 18.61362096 | Isolated large quartz MSA flake | NCW |
| D004 | -29.289747 | 18.61973598 | A number of alignments of calcrete possibly the stones placed at the base of fenced kraals | NCW |
| D005 | -29.29041797 | 18.61828096 | Isolated quartz core MSA - patinated | NCW |
| D006 | -29.27495504 | 18.65387798 | A few quartz artefacts at the edge of a pan-like area. Probably MSA | NCW |
| D007 | -29.27328503 | 18.66814599 | Quartz chunk and a few other MSA pieces of very low density - patinated at the edge of a “pan” | NCW |
| D008 | -29.28371698 | 18.79869497 | A circular arrangement of rock ~1.5m diam, with 1 fragment of clear glass (see also D009). We believe this to be the base of a “skerm”. | IIIC |
| D009 | -29.28358999 | 18.79868299 | A number of fragments of khoe-khoe pottery and 3 quartz flakes likely to be of LSA age. It is likely that this material is associated with D008. | IIIC |
| D010 | -29.26635596 | 18.69873298 | Isolated quartz MSA flake patinated in a pan | NCW |
| D011 | -29.27061103 | 18.68190296 | Isolated quartz MSA flake | NCW |
| D012 | -29.27840503 | 18.63994198 | Isolated quartz MSA flake | NCW |
| D013 | -29.27851098 | 18.63944803 | Isolated quartz core MSA patinated | NCW |
| D014 | -29.27903996 | 18.63967904 | Isolated quartz core MSA patinated | NCW |
| D015 | -29.278989 | 18.64024096 | Isolated quartz MSA flake | NCW |
| JJ001 | -29.29325198 | 18.61633996 | Mudbrick storeroom (small) | NCW |
| JJ002 | -29.29330202 | 18.61596202 | Mudbrick barn (medium) | NCW |
| JJ003 | -29.289157 | 18.61877901 | Isolated quartz MSA flake patinated | NCW |
| JJ004 | -29.27313097 | 18.66789797 | Isolated quartz MSA flake patinated | NCW |
| JJ005 | -29.27416798 | 18.66567903 | Surface scatter of quartz and “silcrete” MSA in pan-like depression | NCW |
| JJ006 | -29.293371 | 18.80004496 | Isolated quartz MSA flake patinated | NCW |
| JJ007 | -29.29195404 | 18.79961899 | Isolated quartz MSA core patinated | NCW |
| JJ008 | -29.29030197 | 18.79906897 | Isolated quartz MSA flake patinated | NCW |
| JJ009 | -29.28793098 | 18.79662498 | Low density MSA artefacts | NCW |
| JJ010 | -29.28105203 | 18.79609399 | Widely scatterd quartz, quartzite , chert MSA | NCW |
| JJ011 | -29.279176 | 18.79550097 | Large quartz flake with some polish | NCW |
| JJ012 | -29.279795 | 18.79483704 | Low density scatter of MSA | NCW |
| JJ013 | -29.27715202 | 18.79165996 | Large isolated MSA quartz core | NCW |
| JJ014 | -29.26403702 | 18.762057 | Few quartz MSA flakes and chunks in a pan | NCW |
| JJ015 | -29.26336002 | 18.75605598 | Large quartz MSA flake in deflated area “pan-like” | NCW |
| JJ016 | -29.27899503 | 18.64409496 | Quartz MSA core and a few flakes in a pan | NCW |
| JJ017 | -29.27650502 | 18.64674096 | Quartz MSA flake in pan | NCW |
| JJ018 | -29.27698798 | 18.64494799 | Quartz MSA flake in pan | NCW |

### 5.1 Pre-colonial sites

We did not identify any typical Earlier Stone Age artefacts. Rather, the bulk of observations consisted of Middle Stone Age cores, flakes and chunks made predominantly on quartz (chunks of which are strewn in abundance across the peneplain – Plates 9 - 11). Most of the artefacts are clearly wind abraded attesting to long surface exposure. Few concentrations were found and the majority of these

were isolated finds. In rare occasions small scatters were found to contain silcrete-like material. The material is widespread throughout the region. None of these occurrences are all rated (NCW) and do not require mitigation.

**Plate 9 - 11:** Typical MSA artefacts identified in the powerline corridor. The large flake in Plate 9 is made on hornfels and shows typical patination from long surface exposure.

Later Stone Age material was also very limited in the corridor with only one unequivocal observation in the vicinity of the Aggeneys sub-station. This observation (D008/009) consists of a circular arrangement of stone (~1.5m diam – probably marking the base of an informal shelter/skerm, Plate 12) associated with a piece of patinated clear glass, and slightly further away, a number of indigenous pot sherds (probably fragments of a single pot, Plate 13) and 3 small quartz flakes. We have graded this as (IIIC) but the content does not warrant mitigation.

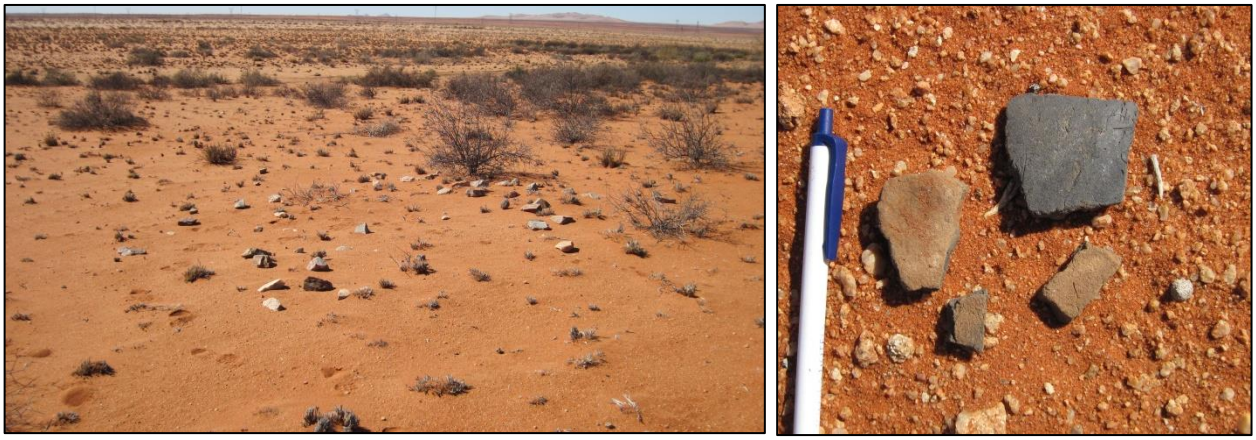

**Plate 12:** A circular arrangement of stone probably marks the base of a small informal hut/skerm at D008.
**Plate 13:** Some of a number of indigenous pot sherds found at D009.

### 5.2 Built environment

The built environment of powerline corridor is limited to the Witputs farm werf at -29.294573° 18.616970° (Plates 14, 15). The powerline corridor crosses to the north and west of the werf, and only site D002, an “old” disused stone kraal, is crossed by the line (Plates 18, 19). Historical aerial photographs of the werf (though resolution is poor) suggest that the shed and barn (JJ001 and JJ002, Plates 20, 21) post-date 1961, with the larger shed in place by 1976. Both structures lie just outside the powerline corridor and are unlikely to be impacted by the powerline.

Other structures in the vicinity of JJ001/002 are informal wooden pole and corrugated iron structures (Plate 21).

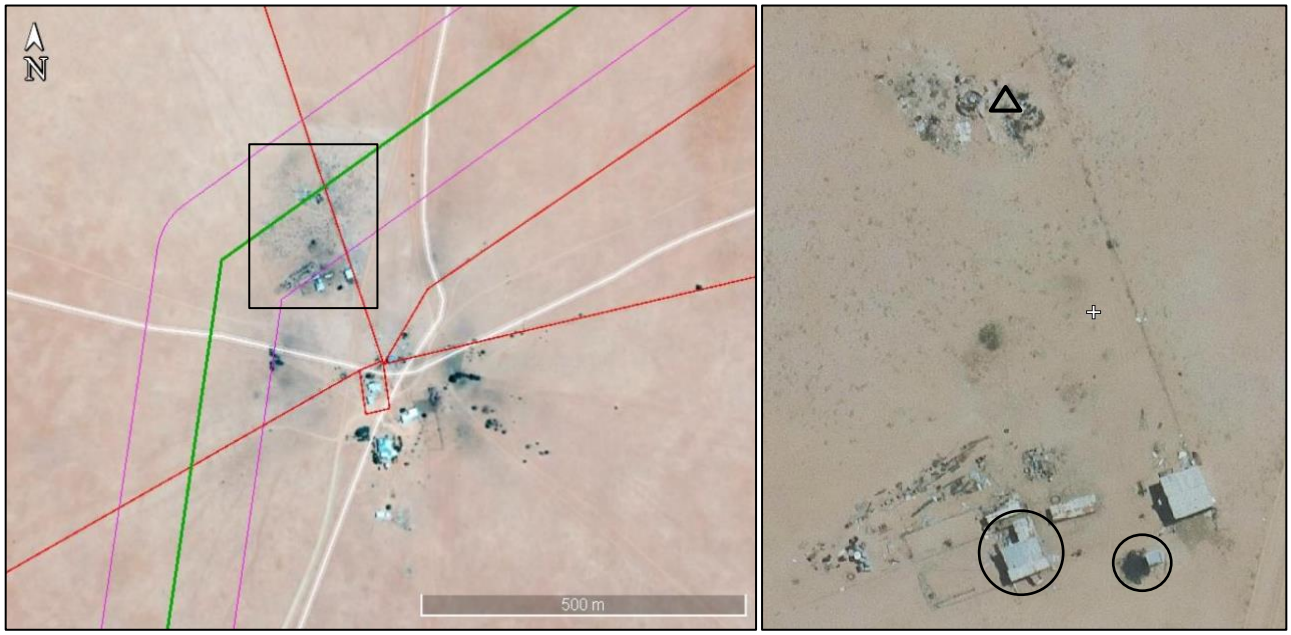


**Plate 14:** Google Earth 2021 showing the Witputs werf (farm boundaries - red, powerline green, corridor – purple). The area in the black rectangle is enlarged in Plate 15. The triangle symbol marks the old kraal at D002, while circles indicate JJ001 and JJ002. **Plate 15:** NGI 2918BC_3 1:10 000 (2021)

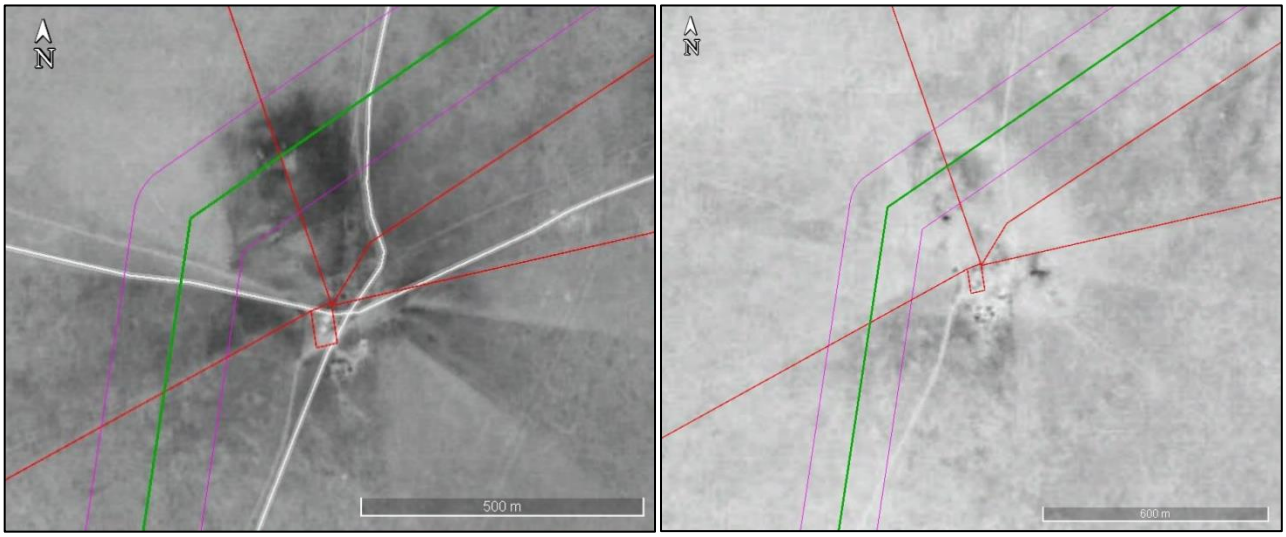


**Plate 16:** 1961 aerial photo (464_011_08541) section overlaid on Google Earth (farm boundaries - red, powerline green, corridor – purple). **Plate 17:** 1976 aerial photo (763_008_08479) section overlaid on Google Earth (farm boundaries - red, powerline green, corridor – purple).

**Plate 18-19:** An older disused kraal (D002) made from clacrete blocks also serving as a farm dump


**Plate 20:** A small storeroom (JJ001). **Plate 21:** A medium sized barn (JJ002).

**Plate 21:** broader view of structures along the edge of the powerline corridor showing pole and corrugated iron structures

## 6. IMPACT ASSESSMENT

### 6.1 Methodology for assessing impact

Potential impacts of the proposed project were identified based on the baseline data, project description, review of other studies for similar projects and professional experience.

The significance of the impacts was assessed using the impact rating methodology provided by the EAP and included as Appendix E. The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

Only one powerline alignment has been presented for assessment but within a 200 meter corridor to allow moderate changes if required.

### 6.2 Potential impacts: construction phase

- Impacts on pre-colonial archaeological resources during the construction phase – construction of the powerline and associated infrastructure in the identified corridor;
- Impacts on built environment resources during the construction phase – construction of the powerline and associated infrastructure in the identified corridor.
- Although bend points are likely to remain as is, specialists have not been presented with the pole positions in between those points. Our assessment of the heritage is likely to remains as is, but desktop assessment of final pole positions must be done to ensure buffers around heritage resources are respected.

### 6.2.1 Impacts on pre-colonial archaeological resources during construction

Few significant pre-colonial archaeological resources are present in the project area. Many of the artefacts are likely to be in secondary context with poor context, and are not considered to be significant resources. A single Later stone age site has limited significance but can be easily mitigated by avoidance through imposition of a buffer.

**Table 5:** Impacts on pre-colonial archaeological resources during construction

| **Potential Impact**<br>**Pre-colonial archaeological material** | **Magnitude** | **Extent** | **Reversibility** | **Duration** | **Probability** | **Significance** | | **Character** | **Confidence** |
|---|---|---|---|---|---|---|---|---|---|
| **Without Mitigation** | 2 | 2 | 5 | 5 | 2 | **28** | **Low** | (-) | High |
| **With Mitigation** | 1 | 2 | 3 | 5 | 1 | **22** | **Low** | (+) | High |
| **Mitigation and Management Measures** | — Site D008 & D009 must be avoided during construction. No towers can be placed in this area. Buffers of 15 meters diameter must be established around each site centerpoint (S-29.283590° E18.798683°) and (S-29.283717° E18.798695°). No disturbance of these areas must occur;<br>— Final pole positions must be presented to the heritage practitioner for desktop assessment and approval;<br>— If any human burials are found during construction, they should not be further disturbed until reported to the Heritage Authority for further action and mitigation. | | | | | | | | |

The impact on Pre-colonial resources is assessed to be ***low negative*** without mitigation and ***low positive*** with the implementation of mitigation.

### 6.2.2 Impacts on historic built environment during powerline construction

There is very limited historical built environment resources in the project area. The “old” kraal (date uncertain) may have some history, while 2 structures (the latter just outside the corridor) are believed to be less than 60 years old and not considered to be highly significant heritage resources. They lie just outside the corridor and are unlikely to be impacted.

**Table 6:** Impacts on the built environment during powerline construction

| **Potential Impact**<br>**Historic built environment** | **Magnitude** | **Extent** | **Reversibility** | **Duration** | **Probability** | **Significance** | | **Character** | **Confidence** |
|---|---|---|---|---|---|---|---|---|---|
| **Without Mitigation** | 2 | 2 | 5 | 5 | 2 | **28** | **Low** | (-) | High |
| **With Mitigation** | 1 | 2 | 3 | 5 | 1 | **22** | **Low** | (+) | High |
| **Mitigation and Management Measures** | — Site D002 be avoided during construction. No towers can be placed in this area. A buffer of 30 meters diameter must be established around the site centerpoint (S-29.283590° E18.798683°) and (S-29.292090° E18.615903°) No disturbance inside this area must occur;<br>— Final pole positions must be presented to the heritage practitioner for desktop assessment and approval. | | | | | | | | |

The impact on historic built environment resources is assessed to be **low negative** without mitigation, and **low positive** with mitigation.

### 6.2.3 Impacts on palaeontological resources during powerline construction

| Potential Impact / Palaeontological resources | Magnitude | Extent | Reversibility | Duration | Probability | Significance | | Character | Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Without Mitigation** | 2 | 2 | 5 | 5 | 2 | **28** | **Low** | (-) | High |
| **With Mitigation** | 1 | 2 | 3 | 5 | 1 | **22** | **Low** | (+) | High |
| **Mitigation and Management Measures** | — The footprint of each powerline pole is very small;<br>— Since there is an extremely small chance that fossils from pans/springs in Tertiary Calcrete may be disturbed, a Fossil Chance Find Protocol has been added in the event any fossil material is recognised during construction or geotechnical work. | | | | | | | | |

### 6.3 Potential impacts: operational phase

- Impacts on palaeontological/archaeological/heritage resources resulting from ongoing use of the powerline;

Although impacts would most likely occur at the construction phase, impacts at the operational phase in the form of occasional maintenance are considered to be unlikely in the light of the findings of the assessment.

### 6.4 Cumulative impacts

Cumulative impacts on palaeontological/archaeological and built heritage resources appear to be limited overall due to the existence of very few such resources. Baseline information suggests that the existing powerlines in the vicinity appear to have had limited impact on physical heritage resources as far as we can determine. Farming and mining will have had some impact, but based on our findings, are likely to have been limited in the vicinity of the project site. The installation of the Sol Invictus PVSEF is unlikely to impact significant heritage resources provided that the mitigation of Later Stone Age archaeological sites proposed by Orton (2016 a-d) are implemented.

### 6.4.1 The “No Go” option

If the no-go option is invoked, the status quo would be maintained and natural and man-made processes would continue to act on the heritage resources. Based on the findings, we do not believe that the “no-go” option is warranted in this case.

## 7. FINDINGS AND RECOMMENDATIONS

### 7.1 Palaeontology

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old and the wrong type to contain fossils, or young enough but without traps such as palaeo-pans or paleo-springs. Furthermore, the footprint of each powerline pole is very small. Since there is an extremely small chance that fossils from the pans/springs in Tertiary Calcrete may be disturbed a Fossil Chance Find Protocol has been added to this report.

### 7.2 Pre-colonial heritage

A very small number of pre-colonial heritage resources are located in the powerline corridor and the proposed activities are not expected to result in the loss of significant heritage resources. Very limited mitigation of two sites (D008 and D009) has been proposed through imposition of 15 meter diameter buffer areas around each. If any human burials are found during construction, they should not be further disturbed until reported to the Heritage Authority for further action and mitigation.

### 7.3 Built environment

The built environment is largely limited to a single probable historical kraal. Mitigation consists of the imposition of a 30 meter diameter buffer area around that structure.

### 7.4 Impact Assessment

The findings of the impact assessment evaluated in terms of the Impact Methodology (Appendix E), suggests that impacts on palaeontological/archaeological and historic built environment heritage resources will be **low negative** without mitigation, and **low positive** with mitigation. Limited mitigation has been proposed in the form of buffer areas around two archaeological, and one built environment resources. A chance finds protocol has been included in the PIA, to cover the very low possibility of fossil material being recognised during construction or geotechnical work.

## 8. CONCLUSION

Overall we find that the proposed powerline (and any position within the corridor) will result in little loss of any significant heritage resources. Mitigation of 3 heritage resources of marginal significance has been proposed in the form of buffer areas. Pending the desktop inspection of final pole positions, we find no reason to reject the powerline development on heritage grounds provided to proposed mitigation is implemented.

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## Appendix A: Specialist CV

### Details

Name: Mr David John Halkett
ID number: 5807235148080
Date of Birth: 23.07.1958
Company: ACO Associates cc (Registration 2008/234490/23)
Principal business: Archaeological/Heritage Impact Assessment
Position: Director (Principal investigator)
Profession: Archaeologist, Heritage Impact Assessor
Years with Firm: 8
Years' experience: 27
Previous employment: Archaeology Contracts Office, UCT, 24 years
Nationality: South African
HDI Status: White Male
Physical work address: 8 Jacobs Ladder, St James, 7945
Postal address: 8 Jacobs Ladder, St James, 7945
E-mail: david.halkett@aco-associates.com

### Education

1991: M.A. (Archaeology) University of Cape Town
1982: B.A. (Hons) (Archaeology) University of Cape Town
1980: B.A. University of Cape Town
1976: Pinelands High School (matric exemption)

### Professional Qualifications

MA (Archaeology) UCT
Registered member of the Association of Southern African Professional Archaeologists (ASAPA)

### Languages

First language – English
Second language – Afrikaans (speaking, reading and writing).

### Expertise

Having co-directed the Archaeology Contracts Office at the University of Cape Town for 24 years (one of the first heritage resource management companies in South Africa), David is now a director of ACO Associates cc, which has taken over from the UCT operation and retains most of its staff. ACO Associates provides Heritage and Archaeological Impact Assessment services to a range of clients in order for them to comply with Environmental and Heritage Legislation. He is a long standing member of the Association of Southern African Professional Archaeologists (ASAPA) and an accredited Principal Investigator of the Cultural Resource Management (CRM) section. With 28 years of working experience in heritage impact assessments, conservation and archaeological research, he has worked in a wide variety of contexts and participated in over a thousand heritage projects ranging from Heritage and archaeological impact assessments, to mitigation of archaeological sites in suburban, rural and industrial (mining) situations. He is an accredited with ASAPA to act as a Principal Investigator on Earlier Middle and Later Stone Age sites, especially coastal shell middens and rock painting sites, and Colonial period sites. David's broad experience in heritage management has led to his participation as an advisor to the National Monuments Council up until 2000, and more recently he served as a member of two Heritage Western Cape regulatory committees, the Impact Assessment Review Committee (IACOM) and the Archaeology, Palaeontology and Meteorites Committee (APM), and he has served on occasion as a forensic consultant to the Missing Persons Unit of the National Prosecuting Authority (NPA). He has led field projects on behalf of both local and overseas research organisations, and continues to participate in archaeological research on an ad

hoc basis. Research interests include aspects of the Middle Stone Age, Later Stone Age and Colonial era of southern Africa. He has co-authored a number of peer reviewed journal articles on these topics. ACO Associates cc has assisted on numerous renewable energy projects in the Northern, Eastern and Western Cape and David has been personally involved in a number of these projects.

**Summary of other experience**

2008-present: Director and Principal Investigator: ACO Associates cc. Projects undertaken in the Eastern, Northern and Western Cape Provinces.
1988-2012: Principal Investigator and director: Archaeology Contracts Office, University of Cape Town. Projects undertaken in the Eastern, Northern and Western Cape Provinces.
1997: Junior Research Officer: Palaeoanthropology Research Unit, University of the Witwatersrand, (part time apt for one year) Cape Town based.
1984: Part time research assistant: Spatial Archaeology Research Unit, University of Cape Town

**Relevant experience**

Employment since 1988 has required management of all aspects of heritage projects, and management of the day to day functions of the business (including Financial, HR).

**Selected recent commercial Heritage management projects:**

Halkett, D. 2020. heritage impact assessment: proposed bentonite and zeolite mining activities on Portion 1 of Farm 585, Uitspanskraal, Heidelberg. Unpublished report prepared for Enviro-Eap (Pty) Ltd on behalf of Imerys Refractory Minerals South Africa (Pty) Ltd t/a Cape Bentonite Mine. ACO Associates cc.

Halkett, D. 2020. heritage impact assessment: proposed bentonite and zeolite mining activities on Erf 1412, Heidelberg. Unpublished report prepared for Enviro-Eap (Pty) Ltd on behalf of Imerys Refractory Minerals South Africa (Pty) Ltd t/a Cape Bentonite Mine. ACO Associates cc.

Halkett, D. 2020. NID application: TR 28/1 (R43) and directly affected adjacent properties between Vermont and Hermanus. Application to HWC prepared for SLR Consulting (South Africa) (Pty) Ltd on behalf of Road Network Management: Western Cape Government – Dept. of Transport and Public Works. ACO Associates cc.

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Halkett, D. 2020. Heritage impact assessment of the proposed ~150mw Kruispad Pvsef on Kruispad 120, east of Velddrif, Western Cape. Unpublished report prepared for Terramanzi Group (Pty) Ltd on behalf of Kruispad Solar (Pty) Ltd. ACO Associates cc.

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Halkett, D. 2017. Specialist archaeological assessment of the proposed Habata agricultural expansion project near Robertson, Western Cape. Unpublished report prepared for Holland and Associates Environmental Consultants on behalf of Habata Agri. ACO Associates cc.

Halkett, D. 2017. Heritage Impact Assessment of the proposed Eskom Romansrivier to Ceres 132kv overhead powerline. Unpublished report prepared for SRK Consulting (South Africa) (Pty) Ltd on behalf of Eskom Holdings SOC Limited. ACO Associates cc.

Halkett, D. 2017. Heritage Impact Assessment of the proposed 150 mw Heuningklip Pvsef on Farm 1076, north east of Vredenburg, Western Cape. Unpublished report prepared for Terramanzi Group (Pty) Ltd on behalf of Doornfontein Solar (Pty) Ltd. ACO Associates cc.

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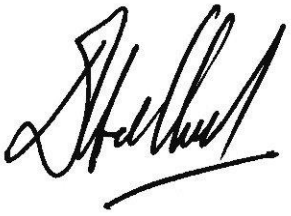
**Books**

Malan A., Halkett D., Hart T. and Schietecatte L. 2017. Grave Encounters. Archaeology of the burial grounds, Green Point, South Africa.

## Appendix B: Declaration of Independence

**Declaration of Independence**

I, David John Halkett, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application, or appeal. There are no circumstances that compromise the objectivity of my performing such work.



David John Halkett
Heritage Impact Assessor and Archaeologist
ACO Associates cc

## Appendix C: SAHRA interim comment

**Sol Invictus Pv powerline**

**Our Ref:**

an agency of the
Department of Arts and Culture

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South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Natasha Higgitt
Tel: 021 462 4502
Email: nhiggitt@sahra.org.za
CaseID: 16729

Date: Wednesday August 04, 2021


### Interim Comment

**In terms of Section 38(3), 38(8) of the National Heritage Resources Act (Act 25 of 1999)**

Attention: ACO Associates CC

ACO Associates CC
8 Jacobs Ladder
St James
7945

**Basic Assessment process for the 22.7km, 132kV powerline to evacuate power from the Sol Invictus PV's on Ptn5/66 to the Aggenies sub-station, Northern Cape**

ACO Associates CC have been appointed to undertake heritage specialists studies as part of an Environmental Authorisation (EA) application for the proposed Sol Invictus 132kV powerline, near Aggeneys, Northern Cape Province.

The proposed powerline will be approximately 22.7 km long with a 200 m wide corridor and will run from the Sol Invictus PV Solar Energy Facility to the Aggeneys Substation.

A letter from ACO Associates CC has been provided requesting that a desktop AIA be conducted.

*Halkett, D. 2021. Sol Invictus Powerline West of Aggeneys: Request for Desktop AIA*

The author notes that the surrounding area has been surveyed many times in the past and has not uncovered highly significant heritage resources that would require mitigation. Based on the previous assessments conducted in the area, the author proposed that a desktop HIA and a brief Palaeontological study/Exemption letter be submitted for the proposed powerline.

**Interim Comment**

The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes the previous assessments in the area, and while these reports can contribute to providing context and insight into the significance of any heritage identified within the area, they do not replace the application specific field-based assessment required to effectively assess the impacts of the current development on heritage resources that may occur within the

an agency of the
Department of Arts and Culture

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Tel: 021 462 4502
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CaseID: 16729



impact area. Additionally, all previous assessments were conducted over 5 years prior, and an updated field assessment is required.

A field-based HIA must be conducted that complies with section 38(3) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). The assessment must include an assessment of the impact to archaeological and palaeontological resources. The assessment of archaeological resources must be conducted by a qualified archaeologist and the report comply with the SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports

As the proposed development footprint is underlain by areas of moderate palaeontological sensitivity, a desktop PIA must be conducted as part of the HIA. The assessment of palaeontological resources must be conducted by a qualified palaeontologist and the report comply with the SAHRA 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments.

The draft EA documents inclusive of appendices must be provided with the above requested reports so that an informed comment may be issued.

Further comments will be issued upon receipt of the above.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

Natasha Higgitt
Heritage Officer
South African Heritage Resources Agency

# Palaeontological Impact Assessment for the proposed Aggenys – Sol Invictus 132 kV powerline, Northern Cape Province

**Desktop Study (Phase 1)**

**For**

**ACO Associates**

**09 September 2021**

**Prof Marion Bamford**
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

**Expertise of Specialist**

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

**Declaration of Independence**

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by ACO Associates (Pty) Ltd, Cape Town, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

## Executive Summary

A Palaeontological Impact Assessment was requested (SAHRA Case Id: 16729) for the proposed 132 kV powerline between Aggeneys sub-station and the Sol Invictus PVSEF, Northern Cape Province. The line will be about 22 km long with a 200m corridor.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed powerline route lies on non-fossiliferous volcanic rocks of the Namaqua-Natal Province and aeolian Quaternary sands in the eastern part. The shorter western part the route is along moderately sensitive Tertiary Calcretes that would only preserve fossils in such features as palaeo-pans and palaeo-springs. None of these features is evident in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the environmental officer when excavations commence. As far as the palaeontology is concerned, it is recommended that the project be authorised.

**TABLE OF CONTENTS**

## 1. BACKGROUND

The proposed ~22.7 km long (200m corridor), 132kV powerline to evacuate power from the authorised Sol Invictus PVSEF (Photo Voltaic Solar Energy Facility) on Ptn 5/66 to the Aggeneys sub-station, is mostly through dune fields or flat featureless landscape (Figure 1). The farms in the project area are Ou Taaibosmund 66 (portions 4, 5, 6, 9), Zuurwater 62 (portions 2, 3, 5, 6, RE) and Farm Aggenys 56 (portions 1, 2) as indicated on the map.

A Palaeontological Impact Assessment was requested for the above project (SAHRA Case Id:16729). To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

| | **A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:** | **Relevant section in report** |
|---|---|---|
| ai | Details of the specialist who prepared the report | Appendix B |
| aii | The expertise of that person to compile a specialist report including a curriculum vitae | Appendix B |
| b | A declaration that the person is independent in a form as may be specified by the competent authority | Page 49 |
| c | An indication of the scope of, and the purpose for which, the report was prepared | Section 0 |
| ci | An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report | Yes |
| cii | A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change | Section 5 |
| d | The date and season of the site investigation and the relevance of the season to the outcome of the assessment | N/A |
| e | A description of the methodology adopted in preparing the report or carrying out the specialised process | Section 0 |
| f | The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure | Section 4 |
| g | An identification of any areas to be avoided, including buffers | N/A |
| h | A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | N/A |
| i | A description of any assumptions made and any uncertainties or gaps in knowledge; | Section 0 |
| j | A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment | Section 0 |
| k | Any mitigation measures for inclusion in the EMPr | Section 8, Appendix A |
| l | Any conditions for inclusion in the environmental authorisation | N/A |
| m | Any monitoring requirements for inclusion in the EMPr or environmental authorisation | Section 8, Appendix A |
| ni | A reasoned opinion as to whether the proposed activity or portions thereof should be authorised | Section 6 |

| | | |
|---|---|---|
| nii | If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan | Sections 6, 8 |
| o | A description of any consultation process that was undertaken during the course of carrying out the study | N/A |
| p | A summary and copies if any comments that were received during any consultation process | N/A |
| q | Any other information requested by the competent authority. | N/A |

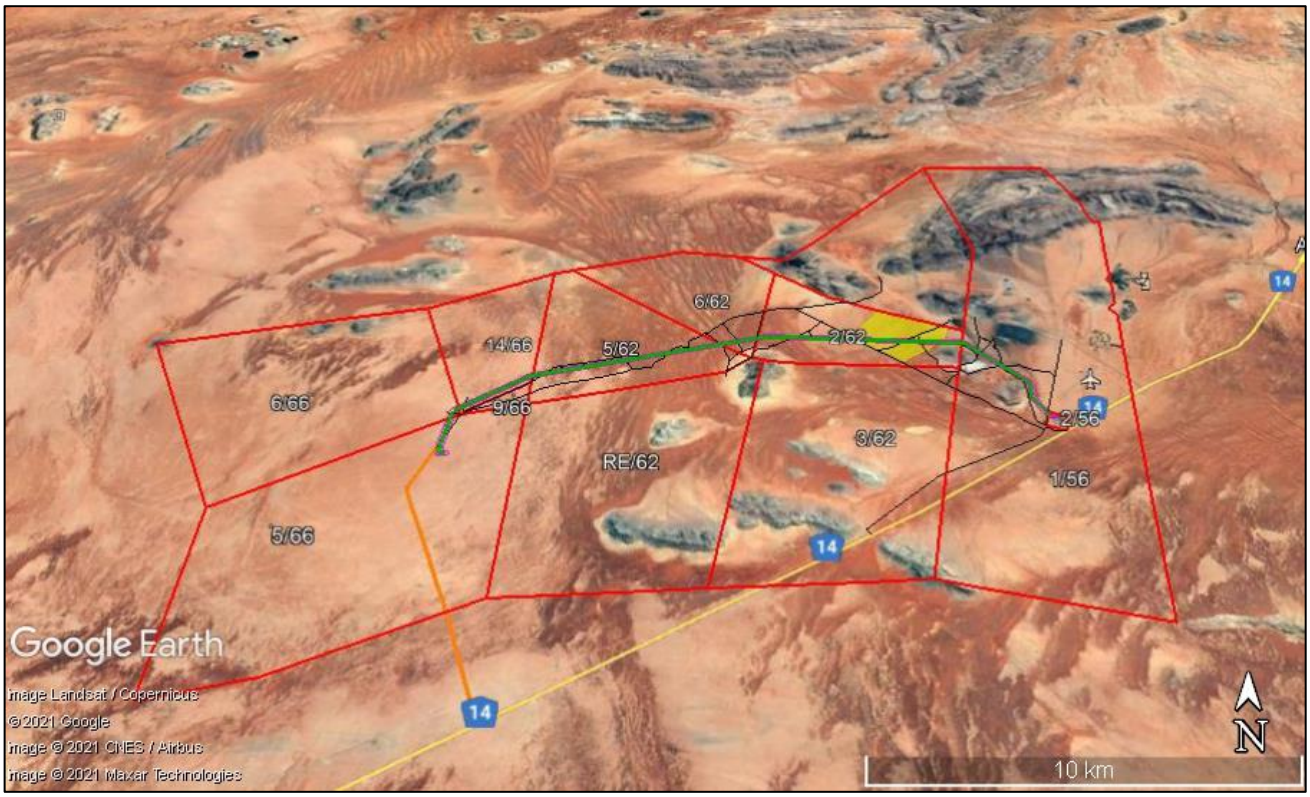

Figure 1: Google Earth map of the proposed construction of a 132 kV powerline from Sol Invictus PVSEF to Aggenys Substation with farm boundaries shown by the red outline. Map supplied by ACO Associates.

## 2. METHODS AND TERMS OF REFERENCE

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

- Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
- Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this* assessment);
- Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
- Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

## 3. GEOLOGY AND PALAEONTOLOGY

### 3.1 Project location and geological context

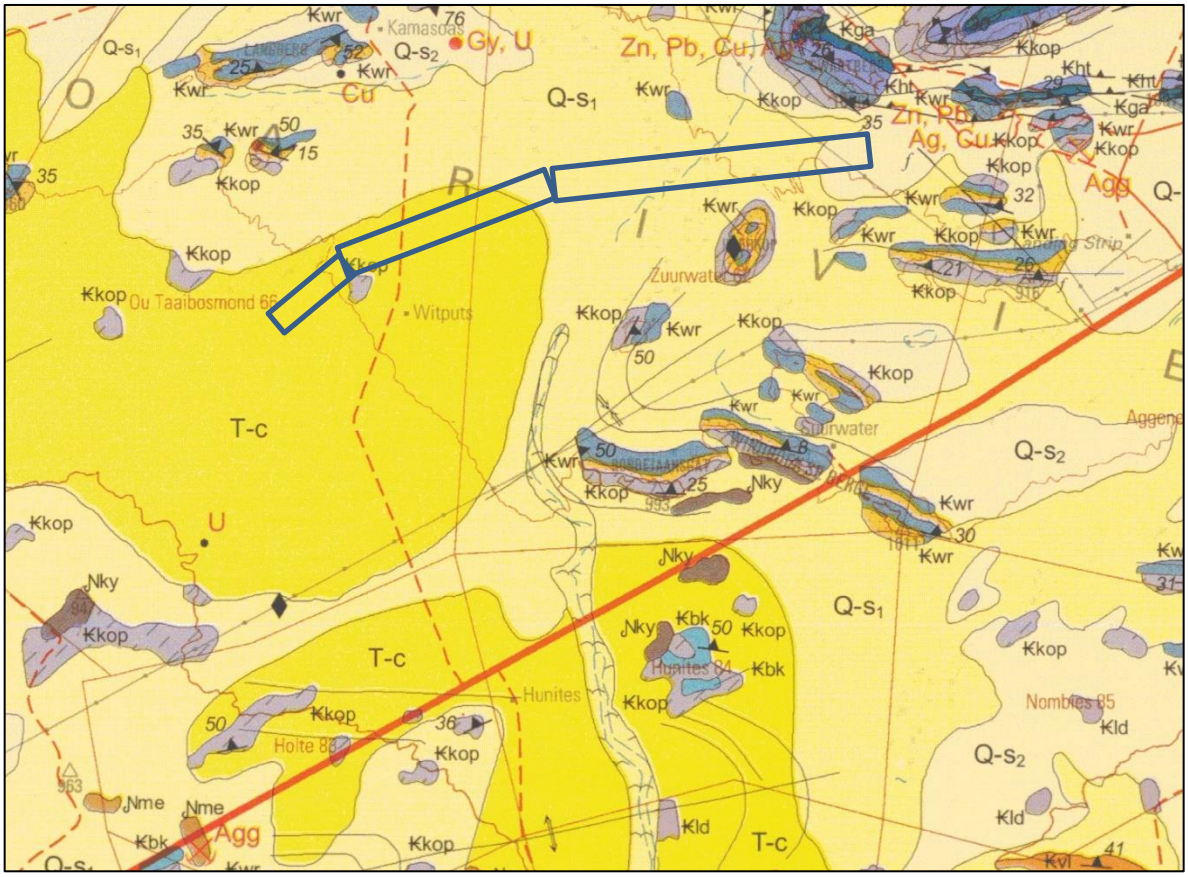


Figure 2: Geological map of the area around the Farms Ou Taaibosmund 66, Zuurwater 62 and Aggenys 56 with the proposed powerline route indicated within the blue rectangles. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2918 Pofadder.

Table 2: Explanation of symbols for the geological map and approximate ages (Cornell et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

| Symbol | Group/Formation | Lithology | Approximate Age |
|---|---|---|---|
| Qs1 | Quaternary sand | Aeolian sand, sand dunes | Late Quaternary, ca last 50ka |
| Qs2 | Quaternary sand | Sand, scree, rubble | Late Quaternary, last ca 50 ka |
| T-c | Tertiary Calcrete | calcrete | Late Tertiary |
| Nky | Klondip Gneiss, Little Namaqualand Group | Meta-crystic biotite gneiss, augen gneiss | Ca 1200 Ma |
| Kkop | Koeiput Gneiss | Leucogneiss | |
| Kwr | Wortel Fm, Aggenys Subgroup, Bushmanland Group, Namaqua-Natal Province | Quartzite and pellitic schist | Ca 1200 Ma |
| Kbk | Brulkop Fm | Calc-silicate gneiss, amphibolite, biotite gneiss | >1200 Ma |

The power line route lies in the Namaqua-Natal Province in the Namaqua section (Figure 2, Table 2). The Namaqua-Natal Province is a tectono-stratigraphic province and forms the southern and western boundary of the ancient Kaapvaal Craton, and extends below the Karoo Basin sediments to the south (Cornell et al., 2006). It comprises rocks that were formed during the Namaqua Orogeny (mountain-building) some 1200 – 1000 million years ago. It has been divided by geologists into a number of terranes (similar lithology and bounded by shear zones). There are three main lithologic units used to separate the terranes as well as the shear zones but still

there is some debate about the terranes (ibid). Very simply, the lithologic units are older reworked rocks, juvenile rocks formed during tectonic activities and metamorphosed, and intrusive granitoids.

According to Cornell et al. (2006) the five terranes are:

A - Richtersveld Subprovince (undifferentiated terranes)
B – Bushmanland Terrane (granites)
C – Kakamas Terrane (supracrustal metapelite ca 2000 Ma
D – Areachap Terrane (supracrustal rocks and granitoids)
E – Kaaien Terrane (Keisian aged metaquartzites and deformed volcanic rocks).

The project lies in the Bushmanland Terrane with its northern boundary against the Richtersveld Subprovince and the eastern boundary against the Kakamas Terrance (ibid). According to Moore et al. (1990, in Cornell et al., 2006), the Bushmanland Terrane rocks can be divided into three distinct age group:

- A basement complex (Achab Gneiss, Gladkop Suite) that is mainly composed of granitic rocks of Kheisian age (2050 - 1700 Ma).
- A variety of supracrustal sequences of mixed sedimentary and volcanic origin and probably fitting into three broad age groups (ca 1900, 1600 and 1200 Ma).
- Suites of syn- and late-tectonic Namaquan intrusive rocks, generally of granitic to charnockitic composition. This group includes the Little Namaqualand Suite (ca 1200 Ma), the Spektakel Suite (ca 1060 Ma) and the basic rocks of the Koperberg and Wortel Suites and Nouzees Complex (1060 – 1030 Ma), as well as the ca 950 Ma pegmatites.

The Namaqua-Natal Province rocks are volcanic in origin and frequently metamorphosed. Several outcrops occur on the farms along the route and probably underlie the Gordonia sands and Tertiary Calcretes.

Tertiary calcretes cover large parts of the Northern Cape but they are difficult to date and there are several schools of thought (see Partridge et al., 2006). Nonetheless, it is accepted that calcretes form under alternating cycles humid and arid climatic conditions in strata that have calcium carbonate (Netterberg, 1969). More recent research using geophysical techniques to measure uplift of the continent during the Cretaceous and tertiary, combined with the fossil record (Braun et al., 2014) suggest that there were two predominant humid periods during the Tertiary. The whole of the Eocene (56-33 Ma) and a short period during the early Miocene (ca 20-19 Ma) were humid according to their estimation. It is possible that the Northern Cape calcretes formed during one of these periods.

Overlying many of these rocks are loose sands and sand dunes of the Gordonia Formation, Kalahari Group of Neogene Age. The Gordonia Formation is the youngest of six formations and is the most extensive, stretching from the northern Karoo, Botswana, Namibia to the Congo River (Partridge et al., 2006). It is considered to be the biggest palaeo-erg in the world (ibid). The sands have been derived from local sources with some additional material transported into the basin (Partridge et al., 2006). Much of the Gordonia Formation comprises linear dunes that were reworked a number of times before being stabilised by vegetation (ibid).

**3.2 Palaeontological context**

The rocks of the Namaqua-Natal Province are volcanic in origin and have been metamorphosed so they do not preserve any fossils.

The **Tertiary calcretes** can trap fossils and artefacts when associated with palaeo-pans or palaeo-springs (Partridge et al., 2006). Where deflation has occurred, for example along the west coast of South Africa, any

trapped materials in the different levels can be concentrated in the depo-centre of the pan or dune and thus it can be challenging to interpret the deposit (Felix-Henningsen et al., 2003).
The Aeolian sands of the **Gordonia Formation** do not preserve fossils because they have been transported and reworked, but in some regions these too may have covered pan or spring deposits and these can trap fossils, and more frequently archaeological artefacts. Usually these geomorphological features of pans and springs can be detected using satellite imagery. No such features are visible.

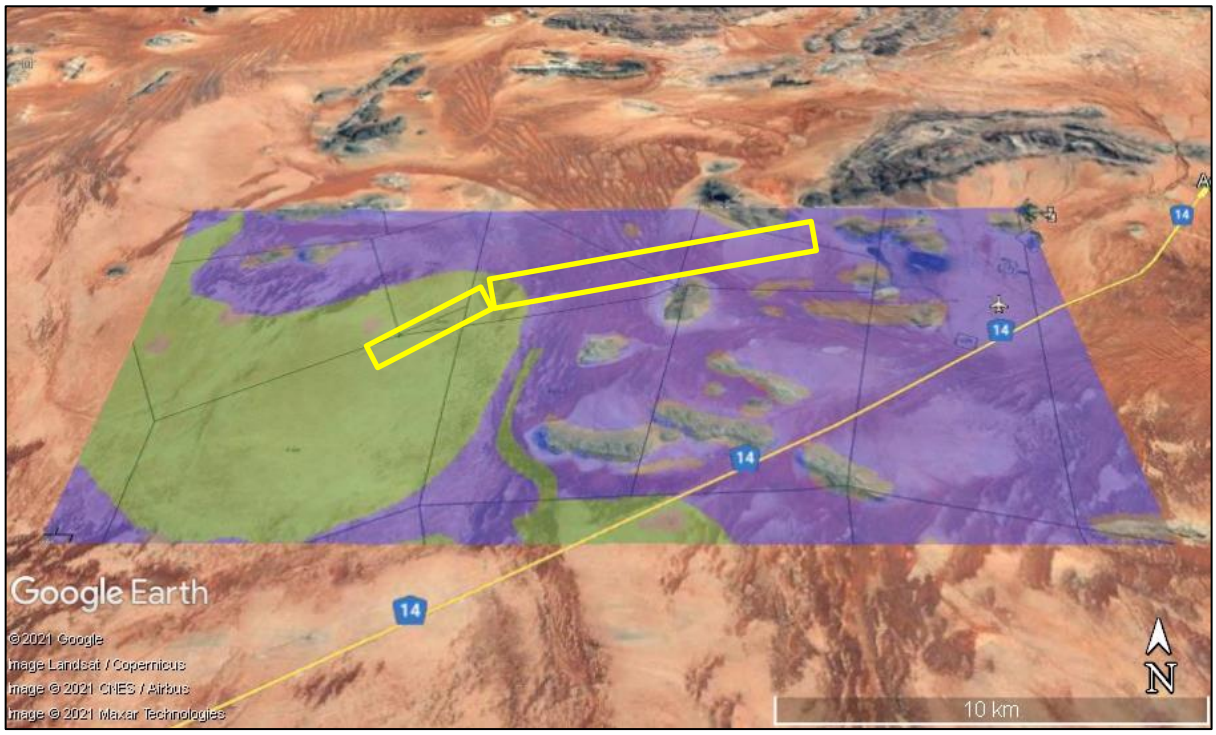


Figure 3: SAHRIS palaeosensitivity map for the route for the proposed Aggenys – Sol Invictus 132 kV power line shown within the yellow rectangles. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map (Figure 3) the area is indicated as having low sensitivity (blue) for the eastern part and this applies to the metamorphosed volcanic rocks of the Namaqua-Natal Sequence. The western section occurs on Tertiary Calcretes and is indicated as moderately sensitive (green) so a desktop study is required and presented here.

**4. IMPACT ASSESSMENT**

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3.

Table 3a: Criteria for assessing impacts

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** The degree of alteration of the affected environmental receptor | Very low: No impact on processes | Low: Slight impact on processes | Medium: Processes continue but in a modified way | High: Processes temporarily cease | Very High: Permanent cessation of processes |
| **Impact Extent (E)** The geographical extent of the impact on a given environmental receptor | Site: Site only | Local: Inside activity area | Regional: Outside activity area | National: National scope or level | International: Across borders or boundaries |

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Reversibility (R)** The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change | Reversible: Recovery without rehabilitation | | Recoverable: Recovery with rehabilitation | | Irreversible: Not possible despite action |
| **Impact Duration (D)** The length of permanence of the impact on the environmental receptor | Immediate: On impact | Short term: 0-5 years | Medium term: 5-15 years | Long term: Project life | Permanent: Indefinite |
| **Probability of Occurrence (P)** The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation | Improbable | Low Probability | Probable | Highly Probability | Definite |
| **Significance (S)** is determined by combining the above criteria in the following formula: | $[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | 0 – 30 | | 31 to 60 | | 61 – 100 |
| **Environmental Significance Rating (Negative (-))** | **Low (-)** | | **Moderate (-)** | | **High (-)** |
| **Environmental Significance Rating (Positive (+))** | **Low (+)** | | **Moderate (+)** | | **High (+)** |

Table 3b: Impact Assessment

| Potential Impact / Palaeontological resources | Magnitude | Extent | Reversibility | Duration | Probability | Significance | | Character | Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Without Mitigation** | 2 | 2 | 5 | 5 | 2 | **28** | **Low** | (-) | High |
| **With Mitigation** | 1 | 2 | 3 | 5 | 1 | **22** | **Low** | (+) | High |
| **Mitigation and Management Measures** | — The footprint of each powerline pole is very small;<br>— Since there is an extremely small chance that fossils from pans/springs in Tertiary Calcrete may be disturbed, a Fossil Chance Find Protocol has been added in the event any fossil material is recognised during construction or geotechnical work. | | | | | | | | |

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old and the wrong type to contain fossils, or young enough but without traps such as palaeo-pans or paleo-springs. Furthermore, the footprint of each powerline pole is very small. Since there is an extremely small chance that fossils from the pans/springs in Tertiary Calcrete may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

The impact on palaeontological resources is rated as **low negative** without mitigation and **low positive** with mitigation.

## 5. ASSUMPTIONS AND UNCERTAINTIES

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the gneiss, sandstones, shales and sands are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The metamorphosed volcanic rocks of the Namaqua-Natal Sequence would not preserve fossils. Only if there are palaeo-pans or palaeo-springs in the Tertiary

Calcretes and Quaternary aeolian sands, would any fossils be trapped. From the satellite imagery no such features are present along the route for the powerline.

## 6. RECOMMENDATION

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Tertiary Calcretes or aeolian sands of the Quaternary. There is a very small chance that fossils may occur if features such as palaeo-pans or palaeo-springs are present but none is evident in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer or other responsible person once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

## 7. REFERENCES

Braun, J., F. Guillocheau, Robin, C., Baby, G., Jelsma, H., 2014. Rapid erosion of the Southern African Plateau as it climbs over a mantle superswell, Journal of Geophysical Research. Solid Earth 119, 6093–6112, doi:10.1002/2014JB010998.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 325-379.

Felix-Henningsen, P., Kandel, A.W., Conard, N.J., 2003. The significance of calcretes and paleosols on ancient dunes of the Western Cape, South Africa, as stratigraphic markers and paleoenvironments. In: G. Füleky (Ed.) Papers of the 1st International Conference on Archaeology and Soils. BAR International S1163, pp. 45-52.

Moore, J.M., Watkeys, M.K., Reid, D.L., 1990. The regional setting of the Aggenys-Gamsberg base metal deposits, Namaqualand, South Africa. In Spry, G.P. and Bryndzia, L.T., (Eds), Regional Metamorphism of Ore Deposits and Genetic Implications. VSP, Utrecht, 77-95.

Netterberg, F., 1969. The interpretation of some basic calcrete types. South African Archaeology Bulletin 24, 117-122.

Partridge, T.C., Maud, R.R., 2000. Macroscale geomorphic evolution of southern Africa. In: Partridge, T.C. and Maud, R.R. (eds). The Cenozoic of Southern Africa. Oxford University Press, New York. 406pp.

**8. CHANCE FIND PROTOCOL**

## Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

- The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
- When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
- Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 4, 5). This information will be built into the EMP's training and awareness plan and procedures.
- Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
- If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
- Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
- If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
- If no fossils are found and the excavations have finished then no further monitoring is required.

# Appendix A – Examples of fossils from the Tertiary and Quaternary

Figure 4: Examples of fragmentary bones from a Quaternary fluvial deposit.


Figure 5: Examples of transported fragments of silicified woods from a Pleistocene fluvial deposit. Scale = 12 cm.

# Appendix B – Details of specialist

## Curriculum vitae (short) - Marion Bamford PhD
## July 2021

**i) Personal details**


| | | |
|---|---|---|
| Surname | : | **Bamford** |
| First names | : | **Marion Kathleen** |
| Present employment | : | Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa- |
| Telephone | : | +27 11 717 6690 |
| Fax | : | +27 11 717 6694 |
| Cell | : | 082 555 6937 |
| E-mail | : | marion.bamford@wits.ac.za ; marionbamford12@gmail.com |


**ii) Academic qualifications**

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

**iii) Professional qualifications**

*Wood Anatomy Training (overseas as nothing was available in South Africa)*:
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

**iv) Membership of professional bodies/associations**

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

**vii) Supervision of Higher Degrees**

All at Wits University

| Degree | Graduated/completed | Current |
|---|---|---|
| Honours | 11 | 0 |
| Masters | 10 | 4 |
| PhD | 11 | 4 |
| Postdoctoral fellows | 10 | 5 |

**viii) Undergraduate teaching**
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

**ix) Editing and reviewing**
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –

Review of manuscripts for ISI-listed journals: 25 local and international journals

**x) Palaeontological Impact Assessments**

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC

- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for EnviroPro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for EnviroPro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

**xi) Research Output**

Publications by M K Bamford up to July 2021 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 29; Google scholar h-index = 35; -i10-index = 92
Conferences: numerous presentations at local and international conferences.

**xii) NRF Rating**

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

# Appendix E: Impact Assessment Methodology

## BASIC ASSESSMENT PROCESS

### OBJECTIVES OF THE BASIC ASSESSMENT PROCESS AS PER THE PROCEDURAL FRAMEWORK

As defined in Appendix 1 of the EIA Regulations, 2014 (as amended), the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—
    - The nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
    - The degree to which these impacts—
        - Can be reversed;
        - May cause irreplaceable loss of resources; and
        - Can be avoided, managed, or mitigated.
- Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to–
    - Identify and motivate a preferred site, activity and technology alternative;
    - Identify suitable measures to avoid, manage or mitigate identified impacts; and
    - Identify residual risks that need to be managed and monitored.

### BASELINE ENVIRONMENTAL ASSESSMENT

The description of the environmental attributes of the project area was compiled through a combination of desktop reviews and site investigations. Desktop reviews made use of available information including existing reports, aerial imagery, and mapping.

### IMPACT ASSESSMENT METHODOLOGY

### ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in **Table 9-1**.

**Table 9-1: Impact Assessment Criteria and Scoring System**

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** The degree of alteration of the affected environmental receptor | Very low: No impact on processes | Low: Slight impact on processes | Medium: Processes continue but in a modified way | High: Processes temporarily cease | Very High: Permanent cessation of processes |
| **Impact Extent (E)** The geographical extent of the impact on a given environmental receptor | Site: Site only | Local: Inside activity area | Regional: Outside activity area | National: National scope or level | International: Across borders or boundaries |
| **Impact Reversibility (R)** The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change | Reversible: Recovery without rehabilitation | | Recoverable: Recovery with rehabilitation | | Irreversible: Not possible despite action |
| **Impact Duration (D)** The length of permanence of the impact on the environmental receptor | Immediate: On impact | Short term: 0-5 years | Medium term: 5-15 years | Long term: Project life | Permanent: Indefinite |
| **Probability of Occurrence (P)** The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation | Improbable | Low Probability | Probable | Highly Probability | Definite |
| **Significance (S)** is determined by combining the above criteria in the following formula: | $[S = (E + D + R + M) \times P]$ <br> $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | 0 – 30 | | 31 to 60 | | 61 – 100 |
| **Environmental Significance Rating (Negative (-))** | **Low (-)** | | **Moderate (-)** | | **High (-)** |
| **Environmental Significance Rating (Positive (+))** | **Low (+)** | | **Moderate (+)** | | **High (+)** |

## IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form

[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure 9-1** below.

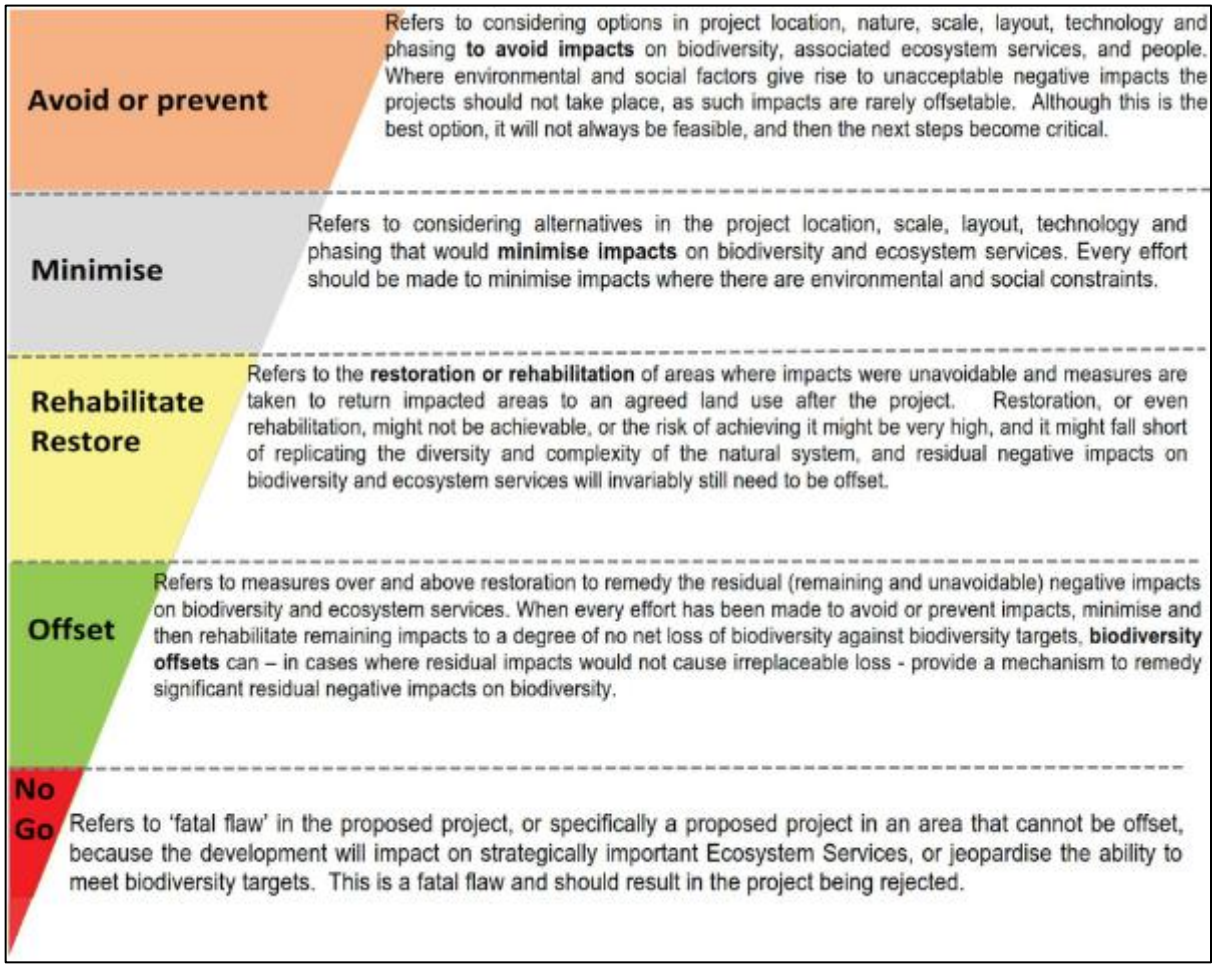


**Figure 9-1: Mitigation Sequence/Hierarchy**

## ENVIRONMENTAL IMPACT ASSESSMENT

This Chapter identifies the perceived environmental and social effects associated with the proposed Project. The assessment methodology is outlined in **Section 0**. The issues identified stem from those aspects presented in **Chapter 6** of this document as well as project description provided. The impact assessment will be based on the preferred alternative at all project phases. This section only assesses the preferred option along with the no-go section. The mitigation hierarchy criteria for each mitigation measure are indicated in brackets after each measure indicated.

Furthermore, decommissioning assessment will be considered as part of the decommissioning process that will be subject to a separate authorisation and impact assessment process. Any decommissioning impacts will be assessed at this stage. The impact assessment in this section encompasses the geographical, physical, biological, social, economic, heritage and cultural aspects in accordance with Appendix 1 of GNR 326.

Example:

## AIR QUALITY

## CONSTRUCTION PHASE

### Dust and Particulate Matter

The National Dust Control Regulations (GNR 827) prescribe general measures for the control of dust in both residential and non-residential areas and will be applicable during construction of the OHPL. **Table 9-2** provides the acceptable dust fall rates as prescribed by GNR 827.

**Table 9-2: Acceptable dust fall rates (GNR 827)**

| RESTRICTION AREAS | DUST FALL RATE (D) (MG/M$^2$/DAY – 30 DAYS AVERAGE) | PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE |
|---|---|---|
| Residential area | D < 600 | Two within a year, not sequential months |
| Non-residential area | 600 < D < 1200 | Two within a year, not sequential months |

During the construction phase, dust and vehicular emissions (carbon monoxide (CO), hydrocarbons, particulate matter (PM) and nitrogen oxides ($NO_x$) will be released as a result of vegetation clearing activities, transportation of equipment and materials to site, and the installation thereof, all of which involves the movement of large plant and trucks along unpaved roads and exposing of soils. The emissions will, however, have short-term impacts on the immediate surrounding areas that can be easily mitigated and thus the authorisation of such emissions will not be required. All construction phase air quality impacts will be minimised with the implementation of dust control measures contained within the EMPr (**Appendix** Error! Reference source not found.).

The impact of the construction phase on the generation of dust and particulate matter (PM) is shown in **Table 9-3** below.

**Table 9-3: Construction Impact on Generation of Dust and PM**

| Potential Impact / GENERATION OF DUST AND PM | Magnitude | Extent | Reversibility | Duration | Probability | Significance | | Character | Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Without Mitigation** | 2 | 2 | 3 | 1 | 4 | **32** | **Moderate** | (-) | High |
| **With Mitigation** | 1 | 1 | 3 | 1 | 3 | **18** | **Low** | (-) | High |
| **Mitigation and Management Measures** | — Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and soil/material stockpiles especially. This includes wetting of exposed soft soil surfaces and not conducting activities during high wind periods which will increase the likelihood of dust being generated;<br>— All stockpiles (if any) must be restricted to designated areas and may not exceed a height of two (2) metres;<br>— Ensure that all vehicles, machines and equipment are adequately maintained to minimise emissions;<br>— It is recommended that the clearing of vegetation from the site should be selective, be kept to the minimum feasible area, and be undertaken just before construction so as to minimise erosion and dust potential;<br>— All materials transported to, or from, site must be transported in such a manner that they do not fly or fall off the vehicle. This may necessitate covering or wetting friable materials.<br>— Enforcing of speed limits. Reducing the dust generated by the listed activities above, putting up signs to enforce speed limit in access roads.<br>— No burning of waste, such as plastic bags, cement bags and litter is permitted; and<br>— All issues/complaints must be recorded in the complaints register. | | | | | | | | |

## OPERATIONAL PHASE

There are no anticipated air quality impacts during the operational phase as maintenance activities will occur as and when required and will be extremely short term.