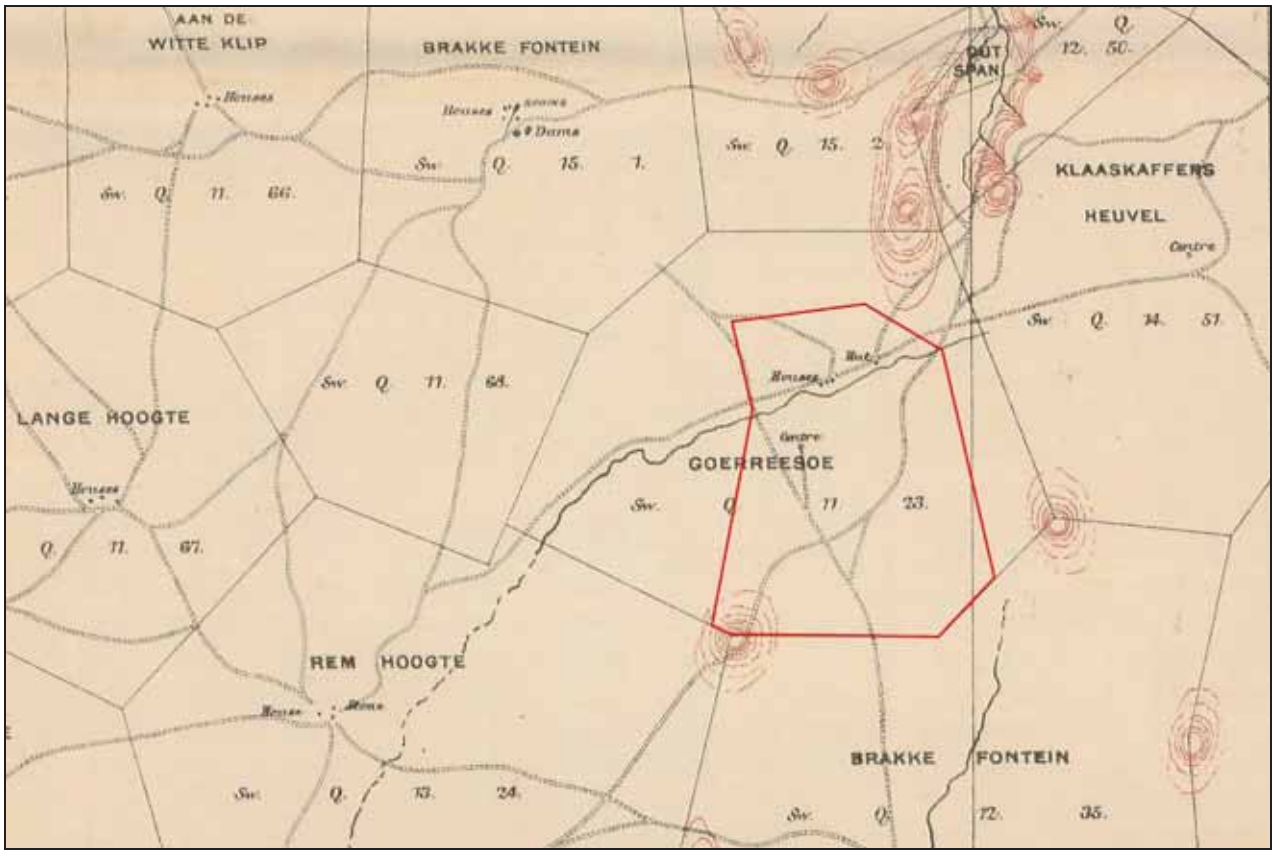
DRAFT

INTEGRATED HERITAGE IMPACT ASSESSMENT IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT, 1999 (ACT 25 OF 1999)

PROPOSED GOEREESOE WIND ENERGY FACILITY: PORTIONS OF THE FARMS GOEREESOE 432/ REM, 2, 4 & 5, SWELLENDAM DISTRICT



ON BEHALF OF: IE Swellendam Wind (Pty) Ltd

FEBRUARY 2013

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PERCEPTION

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REFERENCES and ACKNOWLEDGEMENTS:

1. Almond, J (August 2012). Palaeontological Specialist Asssessment (Desktop Study): Inca Goereesoe Wind Farm near Swellendam, Western Cape Province
2. Savannah Environmental (2012). Final Scoping Report: Proposed Goereesoe Wind Farm near Swellendam in the Western Cape Province. Cape Town
3. Chief Directorate: Surveys and Mapping
4. Cape Town Archives
5. Cape Town Deeds Office
6. MetroGIS (Pty) Ltd (November 2012). Visual Impact Assessment – Goereesoe Wind Farm. Pretoria
7. Nilssen, P (July 2011). Scoping Archaeological Impact Assessment - Proposed Mossel Bay Wind Farm, Western Cape Province. Mossel Bay
8. Webley, L (ACO Associates) (December 2012). Archaeological Impact Assessment – Goereesoe Wind Farm, Swellendam, Western Cape. Cape Town

ABBREVIATIONS:

1. CDSM – Chief Directorate Surveys & Mapping
2. DEA – Department of Environmental Affairs (National)
3. DEADP – Department of Environmental Affairs & Development Planning
4. EA – Environmental Authorisation
5. HIA – Heritage Impact Assessment
6. HWC – Heritage Western Cape
7. NHRA - National Heritage Resources Act, 1999 (Act 25 of 1999)
8. NID – Notice of Intent to Develop
9. PHRA – Provincial Heritage Resources Agency
10. PHS – Provincial Heritage Site
11. PPP – Public Participation Process

COVER: *Approximate site boundaries transposed onto extract from 1880-1900 SG mapping for relevant area (Source: CDSM)*

1. INTRODUCTION

PERCEPTION Heritage Planning was appointed by *IE Swellendam* Wind *(Pty) Ltd* to compile and lodge an Integrated Heritage Impact Assessment (HIA) to Heritage Western Cape (HWC) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999) in relation to proposed development of the study area. Sanction for submission of this HIA was provided by *IE Swellendam* Wind *(Pty) Ltd*, (as developer/ on behalf of registered property owners) and is attached hereto as part of Annexure 1.

This report serves as an ***Integrated Heritage Impact Assessment (HIA)*** and includes inputs from the following specialist reports sanctioned as part of the HIA:

- Visual Impact Assessment – MetroGIS (Lourens du Plesses)
- Scoping Archaeological Impact Assessment – Dr. Peter Nilssen
- Final Archaeological Impact Assessment – ACO Associates (Dr. Lita Webley)
- Palaeontological Impact Assessment – Dr. John Almond
- Historical background research – Ms. Kathleen Schulz

2. INDEPENDENCE OF ASSESSOR

The developer appointed *SE de Kock (PERCEPTION Heritage Planning)* as an independent professional heritage practitioner to compile the Integrated Heritage Impact Assessment, coordinate the public participation process and submit the report to the relevant provincial heritage resources authority, being Heritage Western Cape.

With relation to the author's appointment to compile and submit to Heritage Western Cape an Integrated Heritage Impact Assessment in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999), it is hereby declared that:

- This consultancy (including the author) is not a subsidiary, legally or financially, of the proponents;
- Remuneration for professional services by the proponent in relation to this proposal is not linked to approval by any decision-making authority responsible for permitting this proposal;
- Nor this consultancy, nor the author has any interests in secondary or downstream activities as a result of the authorisation of this project.

It is further hereby certified that the author has 15 years professional experience as urban planner (3 years of which were abroad) and 7 years professional experience as heritage practitioner. The author holds the following qualifications:

- Urban and Regional Planning (B-Tech, CPUT, 1997)
- Environmental Impact Assessment Management – Heritage, Environmental (Dipl/ Masters, Dublin University, 2002)
- Architectural & Urban Conservation (CDP, UCT, 2007)
- Urban Design (CPD, UCT, 2009)

The author is professionally registered as follows:

- Accredited Heritage Practitioner – Association for Professional Heritage Practitioners
- Registered as Professional Planner with South African Council for Planners

3. BACKGROUND

Following submission of a Notice of Intent to Develop (NID) regarding the proposed development by *us* during August 2011, HWC issued the following Interim Comments (HWC Comment dated 7th September 2011 attached as Annexure 2):
"A *Heritage Impact Assessment is required consisting of a historic background analysis, a built environment and cultural landscape analysis, a visual impact study including cumulative impact*

against similar developments in the Swellendam area, an archaeological study and palaeontological study, with an integrated set of recommendations and specialist studies appended in full. Recommendations must in each instance address the impacts and advantages/ disadvantages of the alternative models (10 to 20 turbines).”

4. METHODOLOGY

As part of the compilation of this Integrated HIA report the author has studied, visited, photographed and assessed the subject site and its environs, which more specifically involved the following (also refer to Figure 1):

- Field work carried out on 14th August 2011, 27th November 2012 and 11th December 2012;
- Assimilating findings and recommendations emanating from specialist inputs into HIA by historian, cultural landscape assessor, archaeologist, palaeontologist and visual specialist;
- Identification of heritage-related issues and concerns;
- Analysis of development site and its environs;
- Identification of contextual spatial informants;
- Establishing cultural significance, based on criteria set out in NHRA;
- Identification of heritage-related design informants based on the above;
- Assess conformity of final proposed site layout to design informants identified.

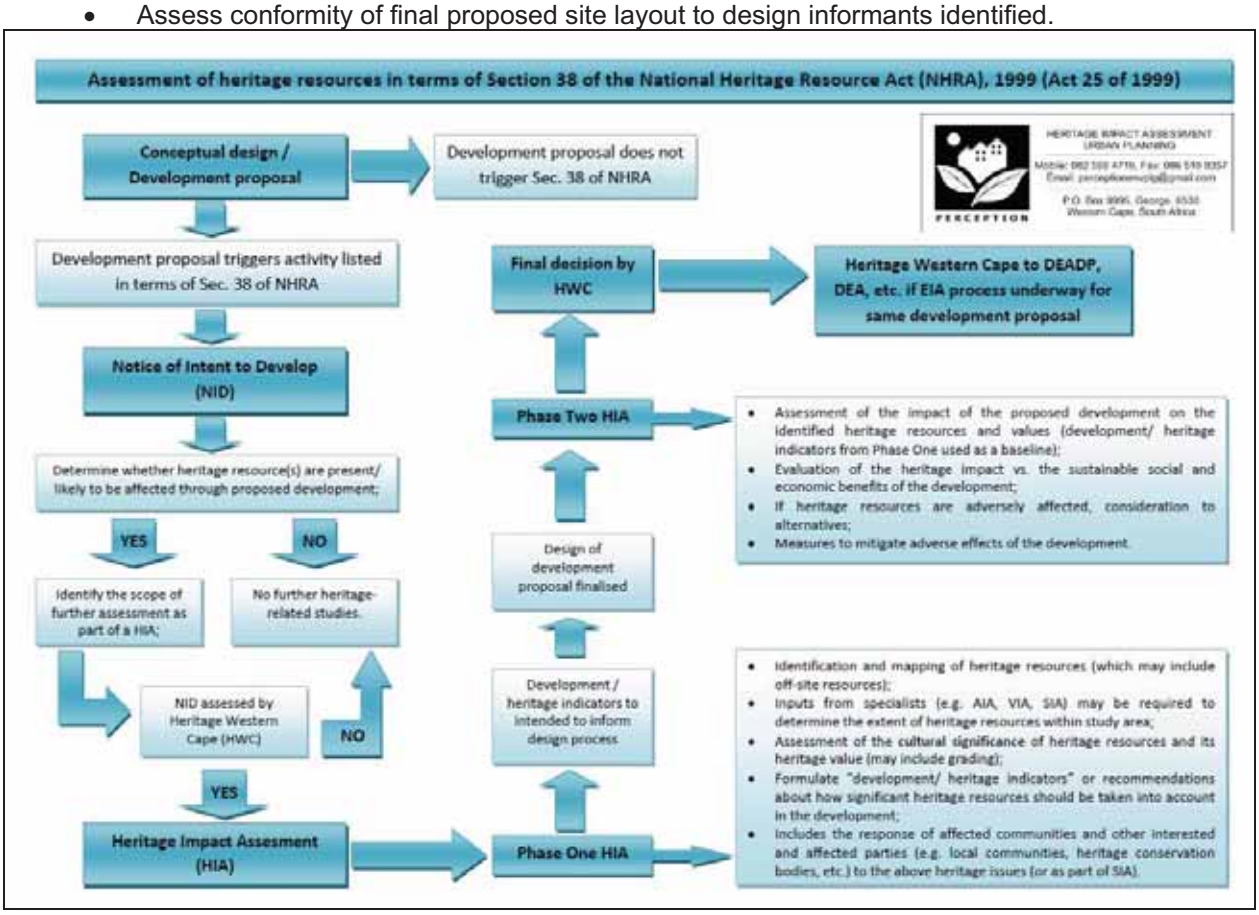


Figure 1: *Flowchart describing the HIA process in terms of Section 38 of the NHRA (Act 25 of 1999). The HIA process is now at its final stage, prior to submission to HWC*

Aspects to be dealt with in the Final HIA will include (refer Figure 1):

- Focussed public participation process aimed at soliciting heritage-related comments from local conservation bodies – refer Section 10);
- Negotiations, discussions with consultant team regarding nature and detailed design of proposed development.

5. DESCRIPTION OF STUDY AREA

The proposed development site (c. 1,315ha in extent) forms part of portions of the farms Goereesoe 432/ Remainder, 2, 3 and 4. The site is located approximately 34km southwest of Swellendam as indicated with the locality plan (Figure 2).

Access to the site is directly from the R319 (between N2 and Bredasdorp), which also effectively divides it into two distinguishable portions:

The ***northeast portion*** is located within a gently undulating rural landscape within which the predominant land use is agriculture/ cultivation as illustrated through photographs attached as Annexure 3. Apart from the current (modern) farmstead and associated outbuildings at least two historic building precincts, each containing a number of now derelict structures, mostly constructed with mud bricks, were noted. Landscape features noted included linear planting of trees along one of the primary approach roads to the farmstead as well as within the proximity of historic farmsteads – mostly likely serving as wind breaks.

While much of the site located ***southwest of the R319*** is also used for agriculture/ cultivation, this landscape is more rugged and consists of deep valleys/ steeper sloping areas as illustrated through recent aerial photography of the site (Figure 3). Small pockets of indigenous vegetation remaining along narrow, inaccessible valleys were noted to the southeast. A number of dams and water reservoirs were noted.

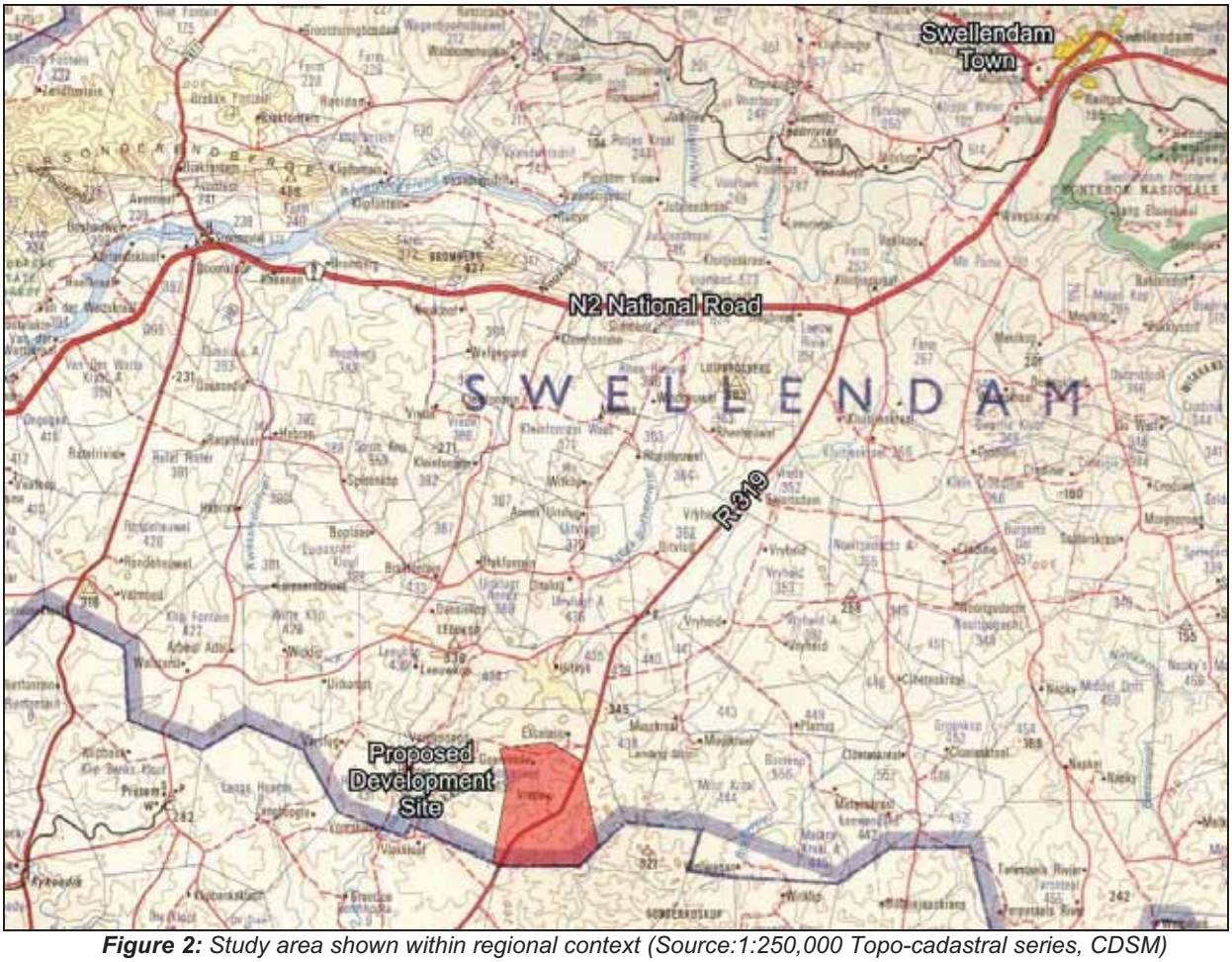


Figure 2: *Study area shown within regional context (Source:1:250,000 Topo-cadastral series, CDSM)*

No gravesites/ burial grounds were noted anywhere on the site. Various farm roads, the alignment of which seems to correspond with that of roads noted on early mapping, we noted. Also refer to recent aerial photography for the study area (Figure 3).

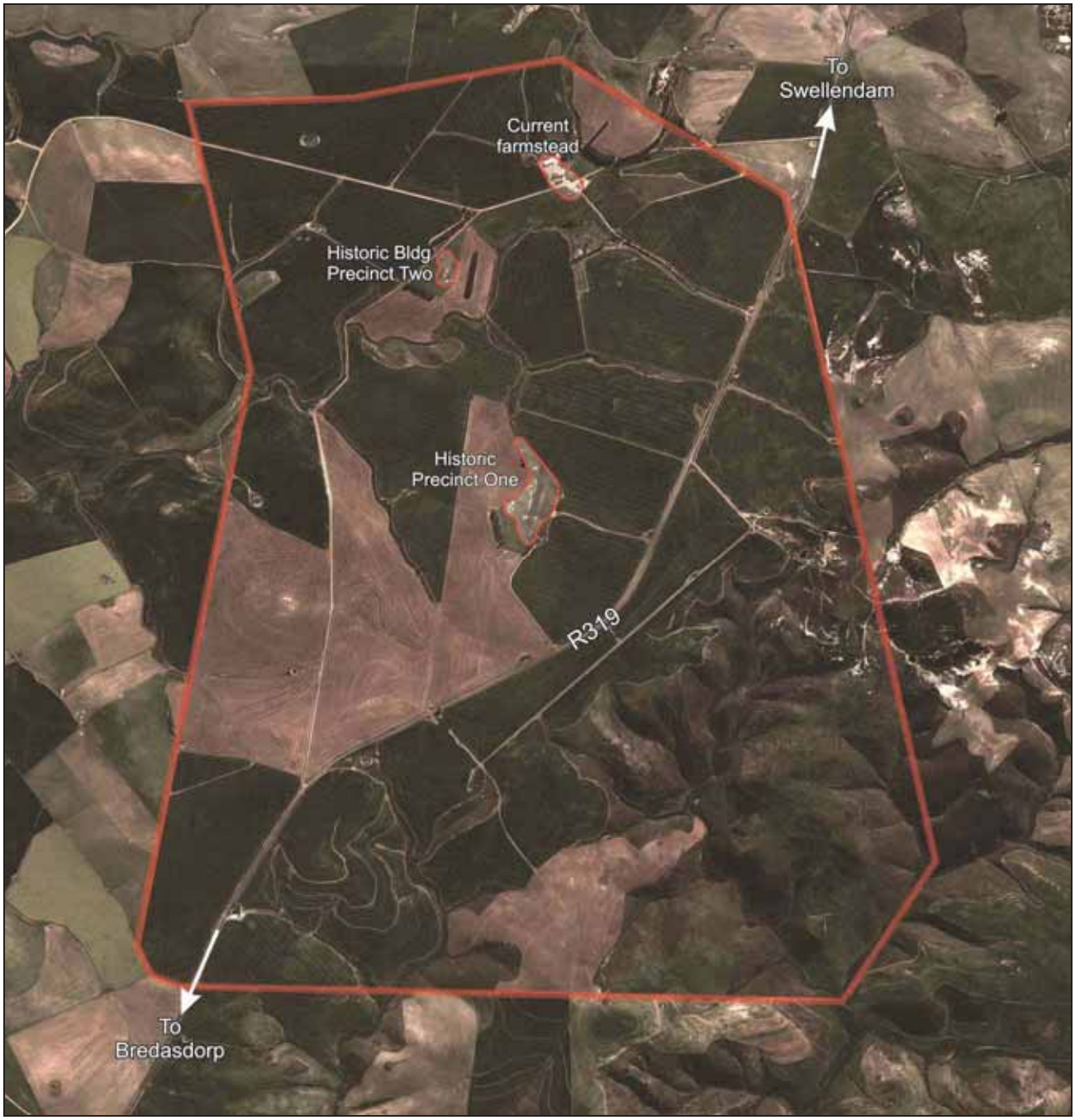


Figure 3: *Study area imposed on recent aerial image of surrounding areas (Source: Google Earth, 2011)*

6. DEVELOPMENT PROPOSAL AND ALTERNATIVES

The proposal is for construction of a wind energy generation facility and associated engineering services and infrastructures within the study area. According to information made available by the Savannah Environmental, as presented through the Final Scoping Report (April 2012), Project Alternatives (including Site Alternatives, Technology Alternatives, Site-specific or Layout design Alternatives), will be considered as part of the Environmental Impact Assessment Phase.

6.1 Alternative One

Put forward as part of NID submission during August 2011, initial proposal was for a wind energy facility allows for 30MW to be joined to an existing 66KV Eskom line traversing traversing the northwest quadrant of the site and following its western boundary as illustrated (blue line) with Figure 4 below. The number of turbines envisaged at that stage would depend on whether 1.5MW or 3MW turbines were to be used (Estimated height of 80m – 100m). The maximum number of wind turbines envisaged would be between 10 (all 3MW turbines) – 20 (all 1.5 MW turbines) turbines, depending on a number of factors e.g. wind strength at the specific point of location of each turbine. See layout, Annexure 4.1.

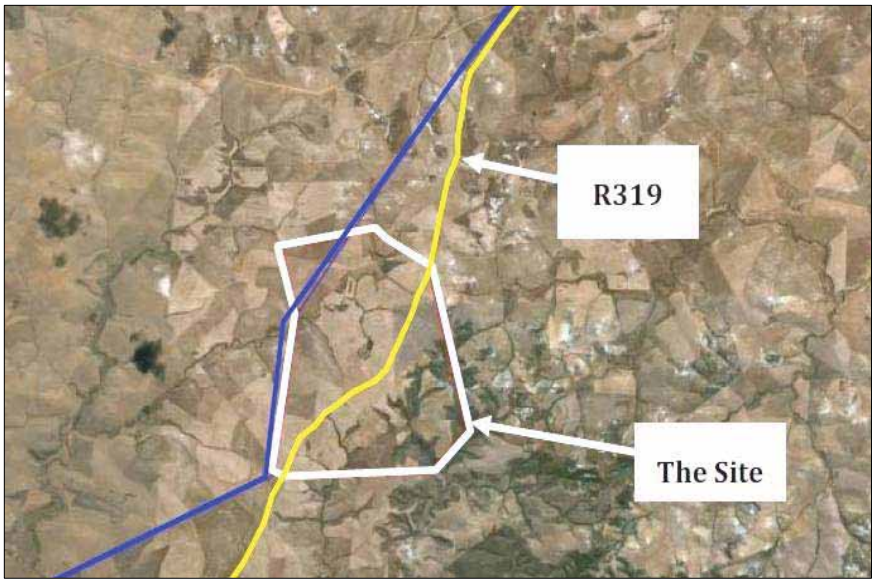


Figure 4: *Alignment of existing 66kV Eskom power line (blue) in relation to site boundaries (white) and R319 road (yellow) (Source: NID Submission, August 2011)*

6.2 Alternative Two

The current alternative is for the construction of 13 wind turbines, varying between 2 – 3MW in capacity and of up to 110m in height as illustrated through the site layout plan compiled from data provided by Savannah Environmental and attached to this report as Annexure 4.2. Further infrastructure and services proposed to be constructed as part of the proposed development would include the following:

- Concrete foundations to support the turbines;
- Cabling between the turbines, to be laid underground where practical;
- An on-site substation to facilitate the connection between the wind farm and the electricity grid. Two options are being considered:
  - Option A, adjacent to the north of proposed with turbine 1;
  - Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Vredasdorp 66kV power line.
- An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which crosses the north-west corner of the site;
- Internal access roads to each turbine (Up to ±13m wide during construction phase and ±6m width during operation phase);
- Workshop area / office for control, maintenance and storage;
- Flat and hardened lay-down area (±40m x 40m) for each turbine during construction phase.

6.3 No-Go Alternative

Since the core business area of the project proponent is the development of renewable and wind energy facilities, the fundamental alternative of a development type other than the proposed facility is therefore not technically feasible in this instance, and will not be considered further in the EIA process. Similarly, different energy generation technology alternatives are not assessed.

This would mean that the property will be used in accordance with its current zoning, being Agricultural zone I. This alternative would result in no environmental impacts as contemplated as part of the current development proposal other than that associated with its current zoning. This alternative would however mean that an additional 30MW would not be generated for integration into the Eskom national grid.

7. HISTORICAL BACKGROUND

Historical background research focussed on available primary sources relating to the farm Goereesoe 432, Swellendam and its environs as obtained from the Cape Town Archives, Deeds Office and Surveyor General's Office. The historical background was compiled by Ms. Kathleen Schulz and assisted by the author.

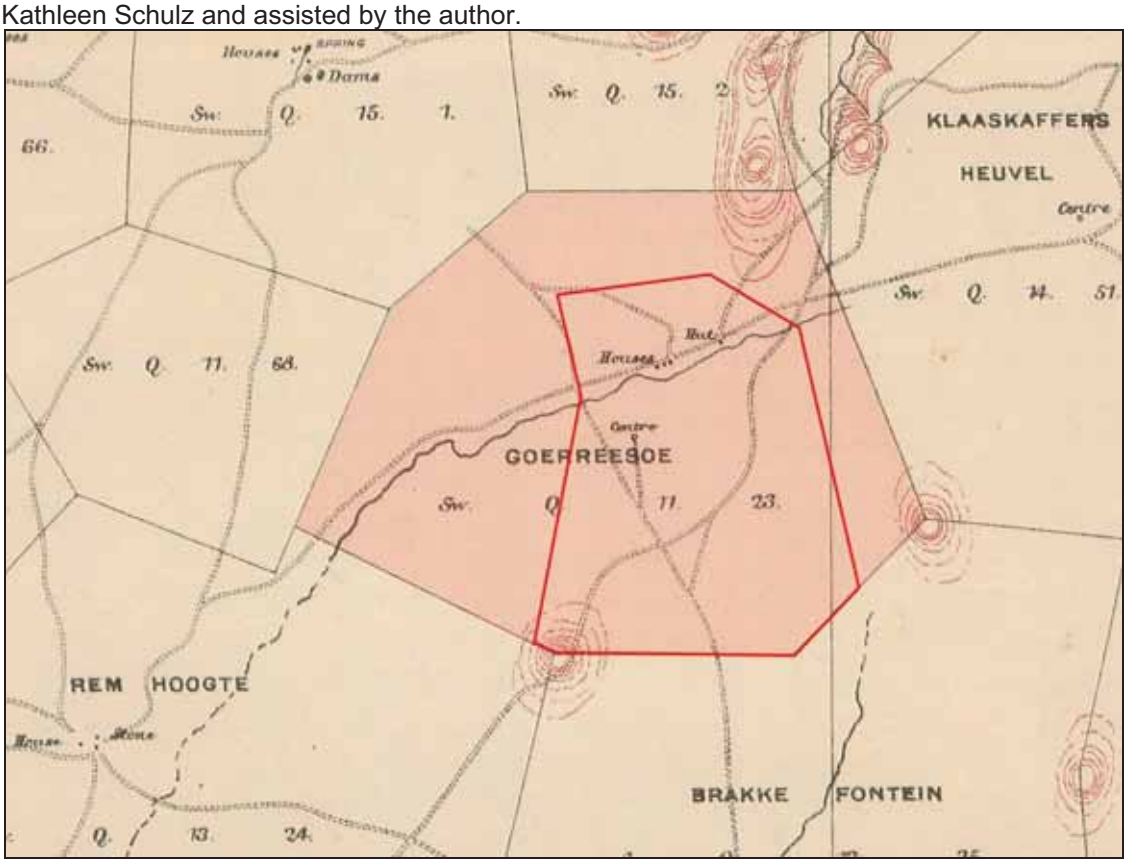


Figure 5: *Location of the site in relation to early (1880-1900) farm boundaries for the farm Goereesoe, Swellendam. Note annotations referring to built environment, roads/ tracks shown (Source: CDSM)*

7.1 Introduction

From a Pre-Colonial historical perspective it is considered highly likely that the area within which the site is located had been used for grazing by indigenous groups prior to colonial occupation.

No evidence could be found in loan farm records of eighteenth century occupation of the farm Goereesoe. It may be possible that the farm was run under another name, although unlikely. No cemeteries or burial grounds were found on maps or in archival records.

7.2 Earliest Census Record

Census records for Swellendam 1809 and 1811 were badly water damaged and the full record could not be read. Eighteenth century Swellendam census records unfortunately do not record

the farm name. The first census records for Goereesoe were found in 1821 by which time the farm appears to have been well established and jointly loaned by:
1.) Jacobus Stephanus de Wet (married to Susanna Magdalena du Toit.) and
2.) Jacobus Johannes Swart (married to Maria Swart).

De Wet family
The son of Jacobus S de Wet and Susanna M. du Toit, also named Jacobus Stephanus, died in 1873. His death certificate states that he was baptized in Graaf Reinet in 1809, indicating that his parents settled in the Swellendam district after this date. Jacobus and Susanna were married in Stellenbosch in 1806 according to Dutch Reformed church records captured on the Church of the Latter Day Saints, Genealogy web site. It was not established what Jacobus Stephanus de Wet senior was doing in Graaff Reinet at the time his son was born, or when they arrived in Swellendam.

Swart family
No link could be found through the normal channels of research between the De Wet family and the Swart family who co-owned Goereesoe. In all probability there was some family connection.
Interrogating desktop and de Villiers Pama genealogical records it appears that many early members of the Swart family lived in the Bredasdorp area. For example Pieter Swart lived on Uilkraal, before his death in 1756.

7.3 Time Line of relevant Dutch Inventory ("Opgaaf") Entries

DATE	DESCRIPTION OF SOURCE	REFERENCE
1813	No Census Records found for Goereesoe	J.330 (SWD)
1815	No Census Records found for Goereesoe	J.330 (SWD)
1816	**Slaves registered to Jacobus Johannes Swart and his wife Maria Swart (between 1816 to 1832):** **1816 (Enregistering of slaves compulsory at this time)** Silvia from Mozambique, Housemaid. About 30 Sara, this Colony, about 12 Carolina, this colony, about 10 (sold 10/3/1832 to Jacobus Nicolas Swart) Louisa, this colony, about 8 (sold 18/2/1825 to Johannes Gert. Laurens) Annette, this colony, about 3. Sold to Jacobus Nicolas Swart 1831) Sylvia born 15th August 1816, mother's name Sylvia. Sold 30/10/1824 to Matthys Johannes Taljaard. **1819** Philida. Born 14th May 1819. Mother Sylvia. Sold to Pieter Arnoldus Swart 1/5/1830. **1822** Mozes. Born 13th October 1821. Mother Sylvia. Died 15th August 1824. **1824** David. Born 13th April 1822. Mother Carolina Sold to Jac. Nicolas Swart 10/3/1832. **1826** Jassemein. Born 28th April 1826 (No commentary) Why was she registered 2 years after her birth? **1827** October. Born 22nd January 1826. Mother Sara (No commentary) **1830** Isac. Born 30th November 1827 reported to have died 15th October 1830. (late registration) **1831** Jacob. Born 12th December 1829. Mother Sara. Sara died 15th October 1830. **1832** Sylvia. Born 15th November 1830 (late registration) Mother Carolina.	J.330 (SWD)

DATE	DESCRIPTION OF SOURCE		REFERENCE
	Sold/transferred to Jacobus. Nicolas Swart 10th March 1832. **1832** Sylvia. Born 20th January 1832. Mother Sara. (No commentary)		
1821	**Census Record (Dutch "Opgaaf record")**		J.339 (SWD)
	½ share of property registered to Jacobus Stephanus de Wet married to Susanna Magdalena du Toit (3 sons 2 daughters):		
	Labour 1 - Adult male Hottentot 1 - Adult female Hottentot 1 - child male Hottentot 1 - child female Hottentot 1 - Adult male slave 1 - Adult female slave 1 - child male slave 1 - child female slave **Livestock** 2 - wagon and riding horses	14 - other horses 14 - wagon oxen 40 - sheep 80 - goats **Crops** Wheat 5 muids sown, 10 reaped. 1 Wagon **Deaths on the farm. 1 male slave**	
	Jacobus Johannes Swart married to Maria Swart ½ share (No children):		
	Labour 1 adult female slave 6 child female slaves **Livestock** 1 - Wagon and riding horse 10 - other horses 10 - wagon oxen	**Crops** 6 muids wheat sown, 20 reaped 1 ½ muids barley sown, 10 reaped. 1- Wagon 6 hours from the Drostdy	
1824	**Census Record (Dutch "Opgaaf record")**		J. 345 (SWD)
	½ of the farm Goeree Zoe occupied by **Johannes Jacobus Swart** married to **Maria Swart** (No children)		
	Labour 1- Adult male Hottentot 1 - Adult female Hottentot 2 - male child Hottentot 1 - female child Hottentot 1 - Male adult slave 1 - Female adult slave 6 - Female child slaves **Livestock** 4 - Wagon or riding horses	3 - Horses 12 - 'Trek' oxen 10 - Hamels (male sheep) 100 - Goats **Crops** Wheat 6 Muids sown, 10 reaped 1 Wagon 1 One male slave died.	
	½ of the farm Goree Zoe occupied by Jacobus Stephanus de Wet, married to Susana Magdelena du Toit (3 sons 2 daughters)		
1825	Census Record same as for 1824 above		J.330 (SWD)
1835	**Slave Records:** Slave owner Jacobus Johannes Swart (Pieter's son) married to Maria Swart. On the death of her husband transferred the following slaves according to their will drawn up in 1832: David born 13th April 1822 (13 years old) Silvia born 18th November 1830 Transferred to: Jacobus Nicolaas Swart (Jacobus's son) Also Jacobus Nicolas Swart transferred to Johannes Jochesmus Swart Regina about 22 ¼ years old (from this Colony)		1/SWM 16/8
1873	**Jacobus Stephanus de Wet** Death Notice: Died 9th August 1873 at his home "Goeresoe'. Born in Graaff Reinet. His parents were Jacobus Stephanus de Wet and Susanna Magdelena du		MOOC 6/9/144 f.9672.

DATE	DESCRIPTION OF SOURCE	REFERENCE
	Toit. He was 64 years old at the time of his death. Surviving children: 1. Jacobus Gabriel Stephanus 2. Johannes gerhardus 3. Johanna Dorothea 4. Willem Daniel 5. Daniel Stephanus 6. Wynand Jacobus Wilhelm	
1875	**Goereesoe Valuation** Land: 3174 morgen 311 sq.rds. value £900 (Remainder after portion 1 taken off in 1872. 609m. 489 sq rds) 5/8 share (3174 morgen 311 sq.rds.) belonging to Widow J.S. de Wet £1250. J.C and D.C. Uys owned unspecified shares of 609 morgen 589 sq.rds, valued at £498. Widow J.S. de Wet also owned a ¾ portion of Klaas Kaffers Heuvel situated east of Goereesoe, valued for the same amount as Goeresoe - £1250.	4/SWM 7/1/1/1
1885	**Goereesoe Valuation** Widow J.S. de Wet appears to have transferred her Goeresoe shares to Willem de Wet, but still owned Klaas Kaffirs Kraal	4/SWM 7/1/1/3

7.4 Early Deeds records

The following represent a time line for transfers of the farm Goereesoe that could be recorded from available archival sources:

1836	**Goereesoe Quitrent farm** granted to Christiaan Lourens Herman, married to Maria Clementina de Wet. Granted in two portions A and B. A measuring 794 morgen and B 2990 morgen. The ravine, running east west divided the two portions.	SG Diagram 498/1836
1857	**Goereesoe 432/1 (Title Deed 335/1857)** 609 morgen 489 sq.rds. J.S. de Wet and another to Petrus Johannes Uys. (No record found of when Christiaan Lourens transferred to Johannes Stephanus de Wet.)	SG Diagram 1011/1855
1872	**Goereesoe 432/1 (Title Deed 365/1872)** 609 morgen 489 sq. rds P.J. Uys and 3 others to Johannes Cornelis Uys and Dirk Cornelis Uys.	
1876	**Goereesoe 432/2 (Title Deed 335/1876)** 1419 morgen 75 sq rds Estate de Wet and others to Johannes Cornelis Uys.	Deeds Office erf register.
1890	**Goereesoe 432/2** 1419 morgen 75 sq rds Sale of portion 2 from Johannes Cornelis Uys to Pieter Langendyk.	Deeds Office erf register.
1926	**Goereesoe 432/5 (Title Deed 6853/1926)** 760 morgen 200 sq. rds. This property includes portions measuring 131 sq.rds, 7 morgen 28sq rds and 753 morgen 41 sq.rds. No individual diagrams exist for the smaller portions, nor were they mentioned in the erf register in the deeds office. Estate late P.P. de Wet to Pieter de Wet Title 12631/1926. P. de Wet to Willem Jacobus de Wet. Title 17739/1955 W.J de Wet to Willem Daniel de Wet.	SG Diagram 1024/1921
1929	**Goereesoe 432/? Valuation Records (775 morgen 450 sq.rds.)** Owner and occupier Phillipus de Wet Sowing lands - £150 Stables, stores - £75 Stable, wagon house - £150 Kraal - £20 Dams - £150 Fencing - £270 Site - £2,500 Buildings - £375 Total - £3,690 **Goereesoe 432/? Valuation Records (Portion 550 morgen)**	4/SWM 7/1/2/3

	Owner and occupier Willem J. de Wet		
	Sowing lands - £300 Stable - £50 Wagon House - £150 Shed - £25 Dams - £100 Fencing - £225	Boreholes - £150 Site - £1,900 Buildings - £650 Total - £3,650	
	Goereesoe 432/? Valuation Records (Portion 1328 morgen) Owner Johannes Giliomee/ Occupier Dirk C. Giliomee		
	Sowing lands - £450 Stable and wagon house - £180 Dams - £160 Fencing - £360 Site - £4,450		

7.5 Conclusions

Pre-Colonial:
Archival sources relating to pre-colonial history for the farm Goereesoe and its environs were not available. However, secondary sources suggest that the region between the Hottentots Holland Mountains and Keurbooms River included traditional grazing lands of the Hessequa and Chainouqua Khoekhoen people (Clift, 2001) and that in particular, various kraals were scattered along the southern foothills of the Riviersonderend mountains during the early eighteenth century.

Cultivation:
Census records dating back to 1821 confirm that the farm Goereesoe was cultivated (wheat, barley, oats). These records also indicate that there was a communal bailing area northeast of Goreesoe (on the neighbouring farm Klaaskaffirsheuvel, now Muurkraal).
While livestock was kept (cattle, horses, sheep and goats), the numbers kept were not considerable and appear to be more for domestic use than commercial production (Refer to Section 7.4 for detail).

Water scarcity:
Water resources were clearly always limited within the general farming community within the environs as described through one of the conditions applied on a 1837 Quitrent Title for the farm Muurkraal with reference to water rights/ usage: "*By mutual consent of the ….applicants, the pools at the upper end of the Botha's ravine marked 1,2 and 3 although separately measured and included in the different portions of the respective parties, are to be used by them in community as long as the Water lasts*".

Slavery:
Another important historic theme is slavery. Joint owners, de Swart and de Wet families owned slaves according the 1821 census and slaves were presumably employed with caring for livestock, domestic help and other farm duties. Hottentot workers were also listed as present on the farm on the 1821 census.

Built environment:
From Surveyor General diagrams it would appear that an historic road from Swellendam traversed the property east to west and north of the ravine. The first diagram dated 1836 shows three dwelling houses along the historic road on the northern side of the ravine as well as a hut, north east of the homesteads. The location of these three homesteads appears to correlate with the location of the current 'modern' farmstead used by the land owner (Figure 4). The remains of the hut were not located during field work investigation. No buildings were found on diagrams for the remaining portions, but this does not mean that buildings did not exist.

From the above it is therefore evident that the farm Goereesoe and environs have significant historic associations with agriculture, cultivation and the slave trade.

8. HERITAGE RESOURCES AND ISSUES

With relation to the integrated mapping of heritage resources and/ or occurrences noted on and within the proximity of the study area please note that:

- The outcomes of archival research, archaeological investigation, analysis of built environment, cultural landscape and visual spatial issues are presented through the Integrated Heritage Resource Mapping (Annexure 5) as well as further supportive figures included in the text below where appropriate;
- Heritage resources and issues highlighted through the respective specialist inputs have been assimilated into this report. However, please also refer to the detailed mapping and visual presentations contained in these specialist reports.

8.1 Landscape setting

8.1.1 Regional landscape context

The study area is located ±34km southwest of Swellendam and ±40km northeast of Bredasdorp along the R319, an important tourism route stretching between the N2 and coastline. It is set within the wide undulating rural landscape between the Riviersonderend mountains and coastline, broadly referred to as the Overberg. This landscape has for the most part, been completely transformed through agriculture/ cultivation save for small, isolated clusters of indigenous vegetation located in steeper areas such as deep ravines or high-lying koppies, not suitable for cultivation.

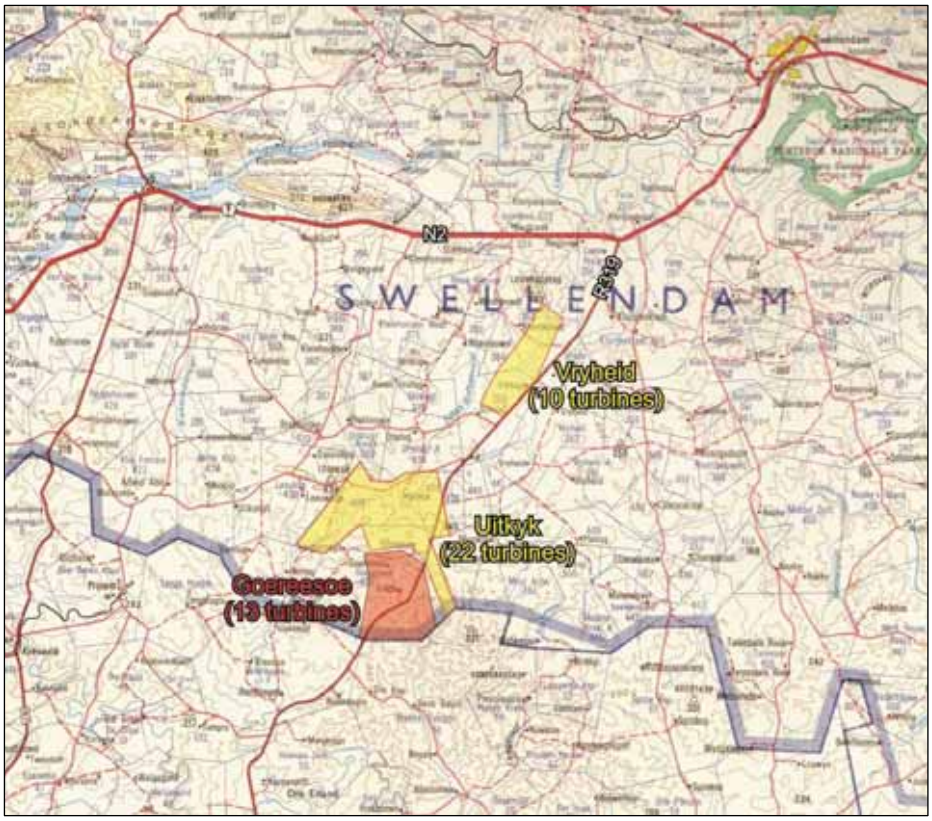


Figure 6: *Location of two authorised wind farms within direct proximity of the study area*

Note however that the Department of Environmental Affairs (DEA) recently authorised two wind farms within the direct proximity of the study area, which will inevitably introduce modern infrastructure and therefore alter this portion of the landscape. Details concerning permissions granted are as listed below (also refer Figure 6):

- The *Biotherm Wind Energy Project*, a 50MW facility consisting of up to 22 wind turbines was approved by the DEA on 29th September 2011 (EA 12/12/20/1798) and is situated on portions of the farm Uitkyk (also "Excelsior") directly north of Goereesoe;
- The *Innowind Wind Energy Facility,* a max. 20MW facility consisting of up to 10 wind turbines was approved by the DEA on 2nd November 2011 (EA 12/12/20/1815) and is situated on portions of the farms Kluitjeskraal and Uitvlucht (also "Vryheid") north of Goereesoe.

The site certainly contributes to the overall rural landscape setting along the R319 though we do not consider the landscape quality along this stretch of the road to be of the same significance as further south, closer towards the coastline. Furthermore, having regard to the nature and extent of development permitted within its direct proximity, elements within the study area contributing to the regional landscape character is considered to be of ***low local aesthetic cultural significance***.

8.1.2 *Cultural landscape context*

The term "*cultural landscape*" refers to the imprint created on a natural landscape through human habitation and cultivation over an extended period of time. While the Cape has been inhabited for many hundreds of thousands of years (pre-colonial history) prior to Western settlement (colonial history), the nomadic lifestyles of early inhabitants are not always as evident within the landscape as the significant imprints made by humans during the last two – three hundred years and more. Unlike ancient landscapes in parts of the world where intensive cultivation over periods much longer than locally have allowed natural and cultural components of the landscape to become interwoven, landscape components within the Overberg area have not yet developed in such a manner. The fact that natural and cultural landscape components in the region is therefore more distinguished means that the cultural landscape is likely to be very vulnerable to the cumulative impact of any large-scale development.

Ultimately however, definition of a cultural landscape can be informed by the following elements, weighed through professional opinion, public values and statutory (legal) framework:

- Natural Landscape
- Public Memory
- Social History
- Historical Architecture
- Palaeontology
- Archaeology

Most of the study area falls just outside the area between Swellendam and the coastline covered by the earliest available aerial photography (Flight Survey 170/ 1942). Fortunately, a single image covers the northeast portion of the study area and provides some insight into traditional (i.e. Pre-Modern) cultural landscape patterns legible within the landscape (refer Figure 6):

Aerial survey 170 of 1942 (Figure 7):

- Image highlights strong agricultural landscape character present within this quadrant of the Goereesoe site, which is consistent with current land use pattern. Note cultivation extending right up to the easternmost property boundary of the farm;
- The early alignment of the historic road between Swellendam (to the north) and Bredasdorp/ Agulhas (to the south), winding through the landscape and traversing the site, is clearly visible in this image;
- Linear landscape features recorded during fieldwork (i.e. wind break/ rows of blue gum trees) are distinguishable in this early aerial imagery;
- At least three building precincts, the locations of which correspond with most of those recorded through field work can be seen in this image:
  - While a group of buildings are visible within the proximity of the current primary farmstead and large outbuildings, these are all modern structures except for the old outbuilding (#081) described elsewhere in this report;

- An old labourer's cottage (#080), as well as several other small structures, which no longer remain, are visible;
- All historic structures recorded as part of "Historic Bldg Precinct One" are present;
- The farmstead on the adjoining "Excelsior" property is shown.

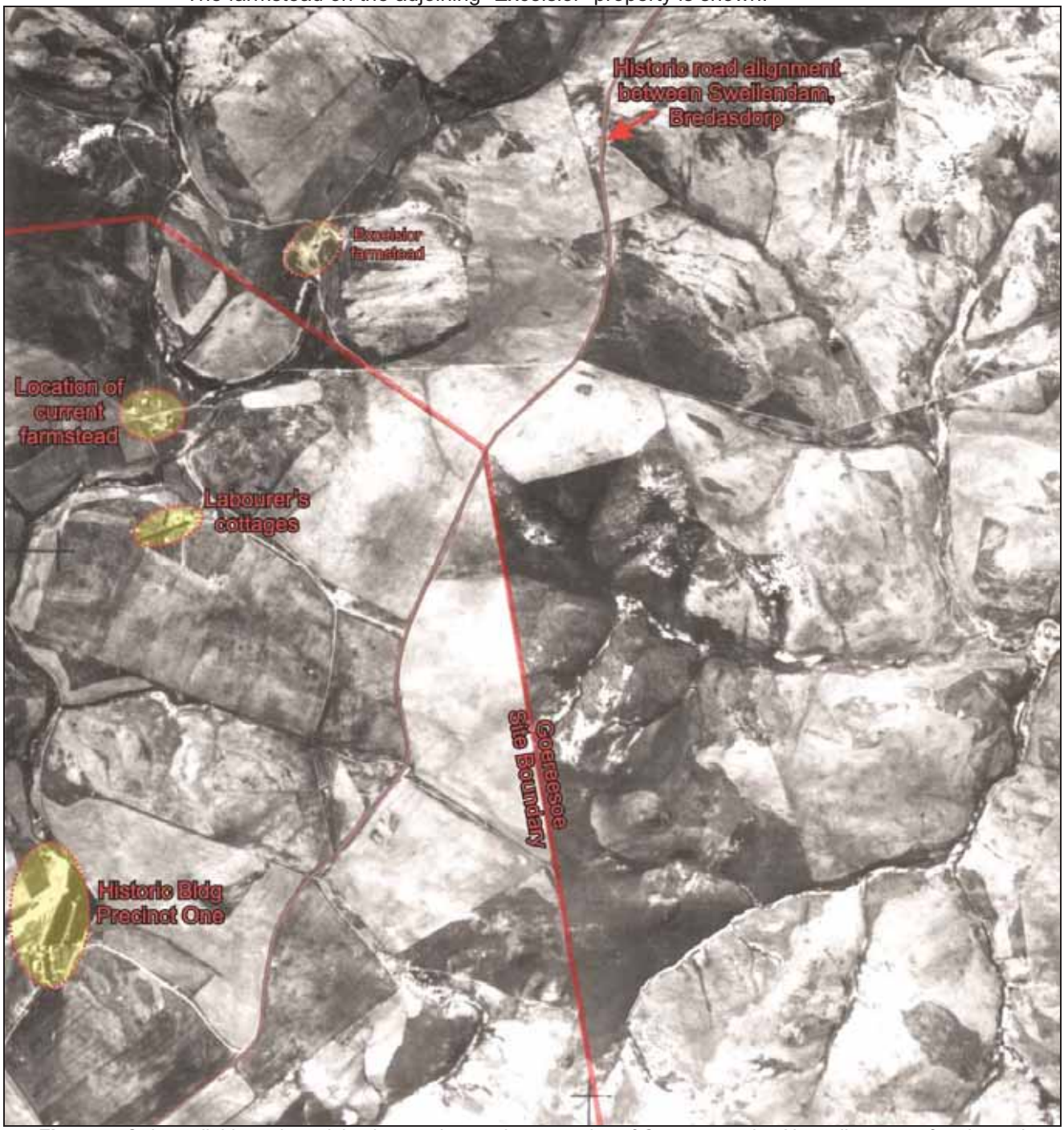


Figure 7: *Only available early aerial only covering northeast portion of Goereesoe site. Note alignment of early roads and building precincts (Source: Aerial survey 170 of 1942, Flight strip 15, Image 42493, CDSM)*

These site-specific land use patterns contributed to the structure and character of the present landscape within the study area over an extended period of time. In addition to the predominant agricultural landscape character of the site, the ruins of a substantial number of historic buildings remain evident within the landscape, all of which provide a sense of continuity. It is unfortunate that few of these structures were maintained and that they were allowed to become derelict (refer Section 8.2). Having regard to the above, elements

contributing to the cultural landscape character evident within the study area are considered to be of ***moderate to high local historic cultural significance***.

8.2 Built environment

A number of historic buildings and structures older than 60 years, arranged in four clusters within the study area, were recorded during fieldwork and are listed in Table 1 below (also refer Integrated heritage resource mapping, Annexure 5). These clusters can be described as:

- The current (modern) farmstead with one remaining historic outbuilding;
- Labourer's cottage (abandoned) set within cluster of more recent cottages;
- Historic building precinct One including the ruins of at least six historic structures sited within the proximity of what had once been a significant farmstead;
- Historic building precinct Two including the ruins of at least seven historic structures located around what would have once been another significant farmstead.

Table 1: List of historic structures and landscape features older than 60 years recorded during fieldwork (also refer Heritage resource mapping, Annexure 5)

Bldg Precinct	GPS #	Description of Heritage Resource	Photo Ref, Annexure 3
	71	Linear-planted gum trees perpendicular to R319	-
Building Precinct One	72	Copse of blue gum trees/ wind break	-
	73	Remains old water trough	6
	74	Old livestock keep, low, flat roof with corrugated iron roof sheeting and water reservoir to side.	6
	75	Ruin of two-roomed outbuilding, pit latrine (mud brick walls, corrugated iron flat roof)	9
	76	Ruin of substantial U-shaped, single-storey farmstead with stoep to front, two entrances to attic along front facade, later additions to side and rear. Mud brick construction with pitched (corrugated iron) roofing. Former sash windows, timber flooring and timber ceilings sadly removed and building allowed to deteriorate significantly – repair probably no longer feasible. Interior of building was not accessible due to presence of bee colony.	5, 7, 8
	77	Agricultural outbuilding with pitched roof and flat-roofed addition to side as well as an attic space. Mud brick construction and corrugated iron roofing with modern extensions to rear. North-facing gable replaced, building in neglected state. Interior not accessible due to presence of bee colony. Two circular modern silo structures to side.	10 – 13
	78	Agricultural outbuilding with pitched roof and flat-roofed extensions to side. More recent but >60 yrs with corrugated iron roofing. North-facing gable replaced in same style and (most likely) during same period as for #77 above.	14, 15, 16
	78 a	Copse of blue gum trees	-
	78 b	Copse of blue gum trees	-
	79	Derelict labourer's cottage (mud brick)	18, 19
	80	Labourer's cottage older than 60 years in picturesque setting along slope and amongst row of bluegums and small dam. Pitched roof with attic and corrugated iron roofing and lean-to addition – also of corrugated iron sheeting. Small addition (bathroom) to side and previously fitted with water, electricity though now abandoned. In fair condition though requiring urgent maintenance.	20, 21, 22
	80 a	Row of blue gum trees lining approach road from R319	17
	80 b	Linear-planted blue gum trees (Y-shaped wind breaks)	-
	81	Agricultural store with kraal directly south. Mud brick construction, corrugate iron roofing, reed ceiling, still in use though in poor condition requiring urgent maintenance.	23, 24, 25
	82	Labourer's cottage, age uncertain	28
Building Precinct Two	83	Building rubble dumped on top of foundations. Location corresponds with that of former structure visible on 1942 aerial photography.	29
	84	Small ruined outbuilding set within copse of bluegum trees (mud brick construction, square with simple but quaint northeast-facing gable)	30
	85	Ruin of substantial single-storey farmstead. U-shaped but with centrally-orientated flank to rear. Stoep to front (east-facing) elevation as well as two stoeps to rear elevation. Two entrances to attic along front facade. Mud brick construction with pitched (corrugated iron) roofing. Former sash windows, timber flooring and timber ceilings sadly removed and building allowed to deteriorate significantly – restoration probably no longer feasible. Interior of building not accessible due to presence of bee colony.	33 – 36
	86	Derelict secondary homestead of simpler but similar mud-brick construction as #85. Corrugated iron roofing and attic. Poor condition though presently used as storage.	31, 32
	87	Two ruined agricultural outbuildings (mud brick construction, corrugated iron roofing) set to side of stonewalled kraal. Restoration probably no longer feasible.	37
	88	Linear-planted blue gum trees (wind break)	-
	89	Linear-planted blue gum trees (wind break)	-
	90	Linear-planted blue gum trees (wind break)	-
	91	Linear-planted blue gum trees (wind break)	-

	92	Rubbish dump	-
	93	Linear-planted blue gum trees (landscape framing/ wind break)	-

Figure 8: *Mapping of heritage resources in Historic Bldg Precinct One (Source: GoogleEarth)*

Figure 9: *Mapping of heritage resources in Historic Bldg Precinct Two (Source: GoogleEarth)*

Most of the historic structures noted in the table above would appear to date to roughly the same period (estimate late eighteenth century) though some were clearly altered or added at a

later stage. Details concerning former occupation or reasons for abandoning these historic structures could not be found. The high concentration and generally dilapidated condition of historic structures noted within the study area were disconcerting. Although early (1880-1890) mapping (refer Figure 5) shows the locations of three "Houses" and a "Hut", it was unfortunately not possible to reconcile this with what remains in present day.

While unfortunately mostly ruined, the former historic farmsteads, outbuildings, labourer's cottages and associated structures recorded within the study area are strongly associated with agriculture and therefore considered to be of ***low local historic and architectural cultural significance***. The clustering, siting and orientation of these historic buildings within the landscape, taking cognisance of micro-climatic conditions and providing for linear-planting of bluegum trees serving as effective windbreaks are considered of ***moderate to high local historic and aesthetic cultural significance***.

8.3 Archaeology

This Section has been transposed from the Archaeological Impact Assessment dated December 2012, compiled by *Dr. Lita Webley (ACO Associates)*, attached to this report as Annexure 6. This Section of the HIA should therefore be read in conjunction with said documents and respective appendixes. Archaeological occurrences identified in the AIA are spatially referenced in Annexure 5 (Heritage resource mapping).

8.3.1 Executive Summary

"No Early or Middle Stone Age implements or Historical archaeological material was recorded during the survey. Two Later Stone Age sites were identified. They are Site 001-005 (a single site) and Site 006. It is concluded that the position of Turbine 6 will result in the destruction of Site 001-005. This Later Stone Age (LSA) site with silcrete adzes is unusual and has been allocated a medium to high significance because of the potential information it may provide of the late Wilton period in the Southern Cape. The access road to Turbines 8, 9 and 10 passes within 10m of Site 006. As an isolated occurrence it is considered of low significance, but together with Site 001-005, may inform on LSA settlement patterns in the area."

Table 2: Archaeological sites recorded during survey (also see Annexure 5)

Site Number	Unique Site Number	GPS Co-ordinates	Description	Significance	Mitigation (est)
001	GRS002	S34 15.937 E20 14.827	Few silcrete cores and flakes	Medium	1 hour
002	GRS003	S34 15.937 E20 14.826	LSA. Dense surface distribution of silcrete flakes, cores, 2 adzes and one retouch piece	Medium-High	2 hours
003	GRS004	S34 15.939 E20 14.823	Spread of silcrete flakes and cores	Medium	1 hour
004	GRS005	S34 15.941 E20 14.821	LSA. Collection of silcrete flakes and cores including scraper	Medium-High	2 hour
005	GRS006	S34 15.927 E20 14.821	Diffuse spread of silcrete flakes and cores	Medium	1 hour
006	GRS007	S34 16.328 E20 15.003	Diffuse spread of silcrete cores and chunks next to two large boulders	Low	1 hour

Based on results from the current study it is recommended that;

- *"Turbine 6 may be moved away from the koppie and further into the field. The full extent of the archaeological site at this location needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient but the full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape.*
- *Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required. Alternatively a new road will have to be constructed.*
- *If any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.*

- *If, in the opinion of ACO Associates, there are any significant changes to the layout of the Goereesoe Wind Farm as presented through this HIA, further archaeological survey work may be necessary".*

Table 3: Summary of likely impacts on pre-colonial archaeology

Nature: Disturbance and destruction of pre-colonial archaeological material by turbine footings, sub-stations, access roads and power lines		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (5)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	Medium < 52	Low < 30
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	Yes (Site 001-005) at Turbine 6.	No
Can impacts be mitigated?	Yes	
Mitigation: There are two alternatives to conserving the archaeological sites recorded during the survey. Turbine 6 may be moved further into the field and away from the koppie. This will ensure the site is not impacted at all. Alternatively, the site is sampled by an archaeologist/s with a permit issued by Heritage Western Cape. The estimated number of hours for mitigation is provided in Table 1. With regard Site 006, it will not be possible to move the access road as it is located on a steeply sloping hillside. Mitigation in the form of archaeological sampling is the only alternative. The number of hours for mitigation is provided in Table 2 above.		
Cumulative impacts: The cumulative impact is not likely to differ from the above.		
Residual impacts: N/A		

8.4 Palaeontology

This Section has been transposed from the Palaeontological Impact Assessment (Desktop PIA) compiled by *Dr. John Almond*, attached to this report as Annexure 7, and should therefore be read in conjunction with said document and its appendixes.

8.4.1 Introduction

"The gently undulating landscape in the study area is largely underlain by Early to Middle Devonian sediments of the Bokkeveld Group (Ceres and Bidouw Subgroups). These marine to estuarine rocks were probably highly fossiliferous originally, containing rich assemblages of shelly invertebrates and trace fossils, as well as drifted land plant remains, fish and microfossils. However, on the southern coastal plain their fossil content has been largely destroyed by intense tectonic deformation during the Permo-Triassic Cape Orogeny (mountain-building event) as well as by deep chemical weathering beneath the so-called "African Surface" under humid tropical climates during the Late Cretaceous to Tertiary period. Exposure of these Palaeozoic rocks is very limited due to extensive cover by superficial sediments (mainly pedocrete lag gravels, soils, alluvium) that are themselves very poorly fossiliferous to unfossiliferous. A variety of Paleogene (Early Tertiary) to Quaternary duricrusts - tough, secondarily cemented superficial deposits (soils, gravels etc), including silcretes and ferricretes of the Grahamstown Formation as well as younger calcretes - are present in the study area, but are also largely unfossiliferous. Recent palaeontological field studies in the region have failed to yield significant fossil remains, apart from sparse, low-diversity trace fossils".

8.4.2 Conclusions

"Because the sedimentary rocks in the Goereesoe wind farm study area are either poorly fossiliferous, or their original fossil content has been largely destroyed by tectonic deformation and weathering, it is concluded that the proposed wind farm development will have a very low impact on the very limited local fossil heritage, whether during the construction phase or later. No further specialist studies or mitigation of palaeontological heritage for this project are recommended. However, should substantial fossil remains be exposed during development, the responsible ECO should alert Heritage Western Cape so that appropriate mitigation measures may be considered. Mitigation in the form of fossil recording and collection will have a positive impact on our appreciation of local fossil heritage."

8.5 Visual – Spatial Issues

This Section has been transposed from the Visual Impact Assessment (VIA) compiled by *MetroGIS (Pty) Ltd*, attached to this report as Annexure 8, and should therefore be read in conjunction with said document and its appendixes.

8.5.1 Summary of potential Visual Impacts

"The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

- *The potential visual impact of the facility on observers travelling along arterial and secondary roads in close proximity to the proposed facility (i.e. within 8km) will be of high significance;*
- *The anticipated visual impact on residents of settlements and homesteads within an 8km radius of the proposed facility will be of high significance;*
- *Within the greater region (i.e. beyond 8km from the proposed facility), the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of settlements and homesteads) will be of moderate significance;*
- *In terms of ancillary infrastructure, the anticipated visual impact of the access roads, workshop / office and substation will be of low significance. The anticipated visual impact of the proposed power lines will be of moderate significance in close proximity to the proposed facility;*

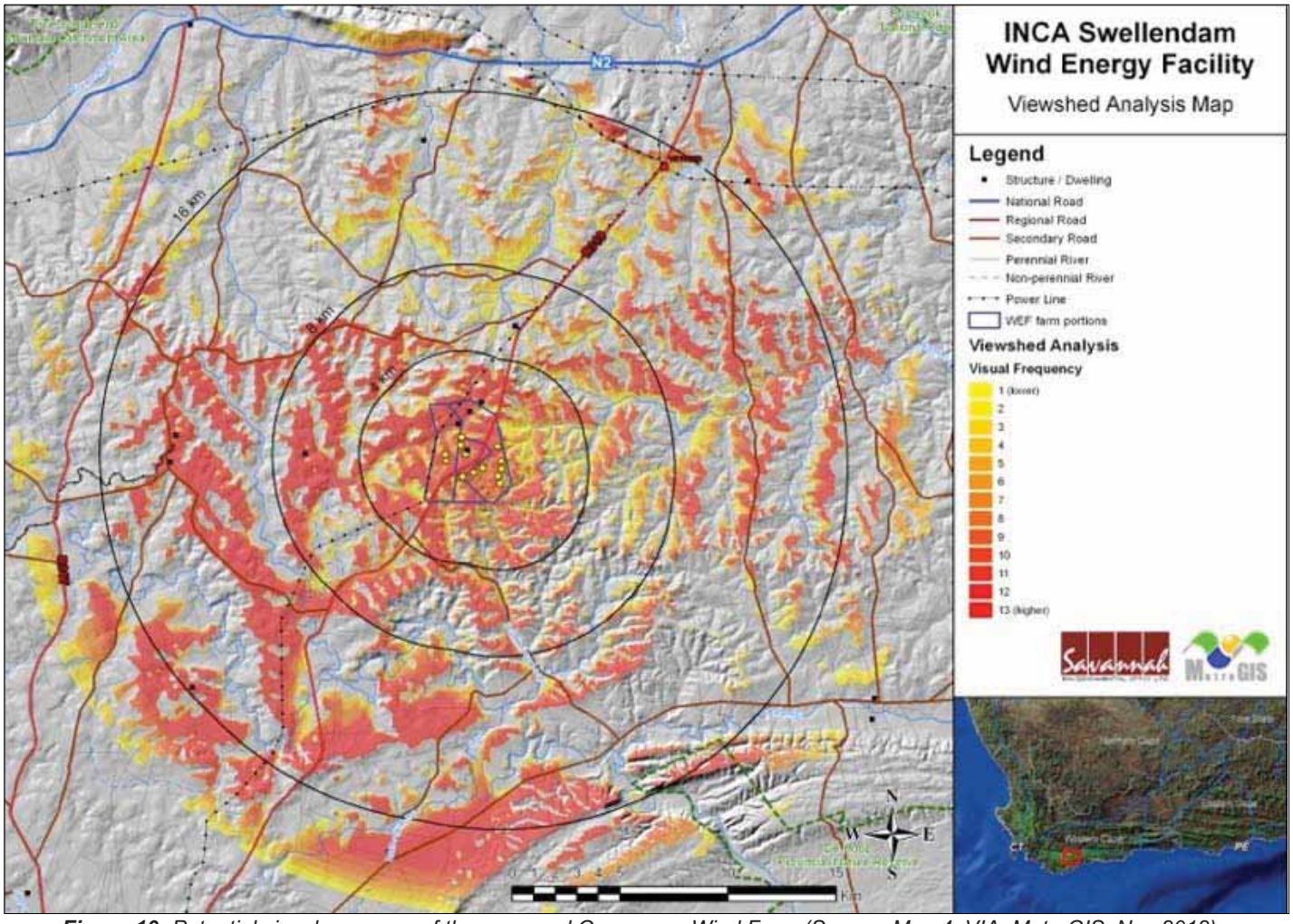


Figure 10: *Potential visual exposure of the proposed Goereesoe Wind Farm (Source: Map 4, VIA, MetroGIS, Nov 2012)*

- *Anticipated visual impacts related to lighting and shadow flicker will be of moderate significance;*
- *The visual impact of construction is expected to be of low significance;*

- *In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place of the region will be of moderate significance;*
- *In terms of secondary visual impacts, the significance of the anticipated impact on tourist routes and tourist destinations will be of low significance, as will the anticipated impact on;*
- *The visual impact on conservation areas within the region is also likely to be of low significance.*

The anticipated visual impacts listed above (i.e. post mitigation impacts) are mostly of moderate or low significance. Anticipated visual impacts on sensitive receptors in close proximity to the proposed facility remain high, but are, nonetheless not considered to be fatal flaws for the proposed GWF.

The main consideration in this regard is the small scale of the proposed GWF and the fact that limited tourist routes, coastal holiday towns and conservation areas are likely to be affected.

In addition, the anticipated visual impacts of high significance (i.e. where high frequencies of visual exposure correspond with sensitive visual receptors) are quite limited in extent.

Considering all factors, it is recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (Chapter 5.9) and management programme (Chapter 9).

Where sensitive visual receptors are likely to affected (i.e. residents of farmsteads in close proximity), it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or event the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself."

8.5.2 Mitigation measures

"While the overall potential for mitigation is generally considered low or non-existent, the following mitigation is recommended:

- *That vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.*
- *Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction / upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.*
- *In terms of on-site ancillary buildings, it is recommended that the substation and workshop / office be planned so that clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.*
- *The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.*
- *Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed GWF and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:*
  - *Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);*
  - *Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;*
  - *Making use of minimum lumen or wattage in fixtures;*
  - *Making use of down-lighters, or shielded fixtures;*
  - *Making use of Low Pressure Sodium lighting or other types of low impact lighting.*

  - *Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.*
- *Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:*
  - *Ensure that vegetation is not unnecessarily cleared or removed during the construction period.*
  - *Reduce the construction period through careful logistical planning and productive implementation of resources.*
  - *Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.*
  - *Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.*
  - *Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.*
  - *Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).*
  - *Restrict construction activities, whenever possible, to daylight hours in order to negate or reduce the visual impacts associated with lighting.*
  - *Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.*
- *During operation, the maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.*
- *Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.*
- *Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.*
- *All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.*
- *Secondary impacts anticipated as a result of the proposed GWF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on tourist routes, tourist destinations and conservation areas within the region.*
- *Where sensitive visual receptors are likely to be affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or event the construction of screens. Ultimately, visual screening is most effective when placed as close to the receptor self."*

The VIA contains detailed management programme tables aimed at (a) summarising key findings of the visual impact report and (b) to suggest possible management actions with relation to the Planning, Construction, Operational and Decommissioning Phases of the project, in order to mitigate the potential visual impacts (Refer Section 9 of VIA).

9. HERITAGE INFORMANTS AND INDICATORS

According to the requirements of Section 38(3) of the NHRA it is crucial that the land use planning and EIA processes be informed by and incorporate heritage informants and indicators as done through the mapping and grading of relevant heritage resources in Section 8 of this report. It is the purpose of this Section to define heritage informants and indicators pertaining to the way in which heritage resources must be incorporated into the overall design of the

proposed development and should therefore be read in conjunction with Annexure 5 (Integrated heritage resource mapping).

9.1 Landscape issues (Regional, Cultural)

- Given recent approval of the 22 turbine 50MW Biotherm WEF and 10 turbine 20MW Innowind WEF, both directly north of the study area, the potential cumulative impact of similar developments, particularly from a regional landscape perspective as well as local cultural landscape perspective, need to be assessed;
- The R319 is considered a tourist route and the proposed development is likely to be highly visible for a section of this road to traffic north and southbound. Some modification of the overall rural landscape character along a section of this road is therefore inevitable and would need to be assessed;
- Elements identified within the study area as being part of the cultural landscape (e.g. treelines, bluegums, landscape framing, wind breaks) shall be retained and adequate setbacks be allowed for.

9.2 Historic themes

- Available primary archival sources indicate that the farm Goereesoe and its environs have significant historic associations with agriculture, cultivation and slavery and the way in which these themes would be acknowledged through the proposed development need to be assessed.

9.3 Built environment

- The proposed development shall provide for adequate setbacks from all historic structures and the two historic building precincts;
- The registered property owner shall retain historic buildings worthy preservation and ensure restoration of historic building nos. 81, 82 and 86 listed in Table 1, Section 8.2 of this report in accordance with Section 34 of the NHRA;
- Accurate measured drawings, including ground floor plans, elevations and photographic record of each historic building precinct shall be compiled and submitted to Heritage Western Cape prior to the commencement of the development.

9.4 Visual-spatial issues

- Detailed Mitigation measures set out in Section 5.9 of the VIA as well as Management Programme set out in Section 9 of the VIA (also refer Section 8.5.2 of this report) shall be implemented as part of the proposed development.

9.5 Archaeology

- Turbine 6 may moved away from the koppie and further into the field. The full extent of the archaeological site needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient. The full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape;
- Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required. Alternatively a new road will have to be constructed;
- In the event of exposing human remains during construction, the matter will fall into the domain of Heritage Western Cape (021 483 9685) or the South African Heritage Resources Agency (021 462 4502) and will require a professional archaeologist to undertake mitigation if needed.

9.6 Palaeontology

- The ECO responsible for the development should be alerted to the possibility of fossils being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert Heritage Western Cape so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from Heritage

Western Cape. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. These recommendations should be incorporated into the EMP for the Goereesoe Wind Energy Project.

10. PUBLIC PARTICIPATION

In addition to the Public Participation Process (PPP) facilitated by *Coastal Environmental Services* as part of the EIA Process in terms of the National Environmental Management Act, 1998 (Act 107 of 1998), *Perception Heritage Planning* will engage with the following local conservation body:

- Swellendam Heritage Association
  PO Box 349
  SWELLENDAM
  6740
  Attention: Danie de Wet (Chairman)

Said conservation body will be provided with a digital copy of the Draft Integrated HIA, including respective specialist inputs, via registered mail and be invited to submit to us ***heritage-related comments*** regarding the proposal within a period of 30 calendar days from date of registration (proof of PPP, any written comments submitted to form part of Final Integrated HIA).

A further Public Participation Process will be invoked through the Land Use Planning Ordinance, 1985 (Ord. 15 of 1985) as part of the land use planning application to be submitted to Swellendam Municipality in due course.

11. ASSESSMENT OF IMPACTS

This Section serves to assess conformity of the proposed Layout Option 2 (Preferred Alternative, Annexure 4) to the key heritage design informants and indicators identified in Sections 9 and 10 above. Where possible, each indicator has been assessed individually for ease of reference. A comparative analysis of the perceived significance of impacts on heritage resources is attached as Annexure 11 to this report.

11.1 Indicators relating to Landscape issues (Regional, Cultural)

a.) INDICATOR LA-1: *Cumulative impact of similar development within proximity of study area from regional landscape perspective (both alternatives).*

Assessment:
From a regional landscape perspective, the study area forms part of a rural landscape well south of Swellendam though not visible from this town or the N2 National Road. Development of a wind farm on the study area would have an impact on the rural landscape character of the site and its environs – irrespective of which alternative layout is implemented. However, in addition to the anticipated visual impact of the approved Innowind and Biotherm wind farms directly adjoining, approval of another wind farm is therefore likely have some cumulative impact. The risk of space crowding (high spatial density of impacts on a rural environment) of wind developments in the region does exists if they all reach an operational state.

However, taken in conjunction with permitted development within the direct environs of the site and furthermore do not consider the landscape quality along this stretch of the road to be of the same significance as e.g. further south, closer towards the coastline. The regional landscape character is considered to be of ***low local aesthetic cultural significance.***

A moderate cumulative impact is expected, although there are large uncertainties involved in the cumulative impact assessment since the effect of large wind farms on the South African landscape is still unknown (Moderate impact).

b.) INDICATOR LA-2: *Impact of the proposed wind farm on the rural landscape character along the R319 (a tourism route) must be assessed (both alternatives).*

Assessment:
Views of the proposed wind farm would be possible from a section along the R319 (north and southbound), irrespective of which alternative layout option is implemented. The severity of this anticipated impact is likely to be only marginally less with the Alternative Layout Two (13 turbines) than with Alternative Layout One (10 to 20 turbines) but either layout would ultimately alter the landscape character of the study area.

Taken in conjunction with two similar developments authorised directly north of the study area, we do not believe that the impact of the subject proposal would significantly exacerbate same impacts that may be expected from the already approved wind farms. It is however recommended that the detailed Mitigation measures and Management plan set out in the VIA be implemented as part of the proposed development.

At least partial views of all the proposed turbines would be possible for traffic north and southbound for a distance of up to c. 20km north and south of the study area, though findings from the VIA indicate that views from the N2 would not be possible. We do not consider this impact warrants refusal of the proposed development (Moderate impact).

c.) INDICATOR LA-3: *Elements identified within the study area as being part of the cultural landscape shall be retained and adequate setbacks be allowed for.*

Assessment:
None of the tangible heritage resources forming part/ defining the local cultural landscape, including bluegum tree lines/ wind breaks/ landscape framing or historic structures would be impacted through either one of the alternative layout options put forward. It is imperative that all landscape features mapped as part of this Integrated HIA (Annexure 5) be retained.

Both Alternative Layouts One and Two adequately addresses this indicator (Neutral impact).

11.2 Indicators relating to Historic themes

a.) INDICATOR HT-1: *Historical background research highlights associations between the study area and agriculture, cultivation and slavery. The manners in which these historical themes would be acknowledged through the proposed development needs to be assessed.*

Assessment:
Dutch census records from 1816 onwards (earlier records not available or water damaged) indicate that slaves were used as labourers and sold/ transferred by early colonial occupant of Goereesoe. Hottentot workers were also listed as present on the farm on the 1821 census. However, due to insufficient information, it is not possible to spatially relate this information to a specific portion of the study area and therefore this aspect is not as easy to acknowledge as with the agricultural/ cultivation theme, which is still practised to present day.

Consideration should be given to display the finding of research arising from early census records pertaining to the farm Goereesoe in a meaningful manner in the Office proposed to be constructed as part of the proposed development (Condition of approval).

11.3 Indicators relating to Built environment issues

a.) INDICATOR BE-1: *Proposed development shall provide for adequate setbacks from all historic structures and the two historic building precincts.*

Assessment:
None of the tangible (built environment) heritage resources situated within the study area would be impacted through either one of the alternative layout options put forward. It is imperative that all built environment elements mapped as part of this Integrated HIA (Annexure 5) be retained.

Both Alternative Layouts One and Two adequately addresses this indicator (Neutral impact).

b.) INDICATOR BE-2: *Registered property owner shall retain historic buildings worthy preservation and ensure restoration of historic building nos. 81, 82 and 86 listed in Table 1, Section 8.2 of this report.*

Assessment:
The registered property owner is obliged in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999) to retain and maintain all structures other than 60 years situated on land owned by such owner. The high concentration of historic structures (former farmsteads, labourer's cottages and associated outbuildings) within the study area that have been allowed to significantly deteriorate and most of which are now in a dilapidated condition, of concern.

The registered property owner shall retain historic buildings worthy preservation and ensure restoration of historic building nos. 81, 82 and 86 listed in Table 1, Section 8.2 of this report in accordance with Section 34 of the NHRA to the satisfaction of Heritage Western Cape (Condition of approval).

c.) INDICATOR BE-3: *Accurate measured drawings, including ground floor plans, elevations and photographic record of each historic building precinct shall be compiled and submitted to Heritage Western Cape prior to the commencement of the development.*

Assessment:
Following from Indicator BE-2, this heritage indicator is intended as a condition of approval.

Accurate measured drawings, including ground floor plans, elevations and photographic record of each historic building precinct shall be compiled to the satisfaction of Heritage Western Cape prior to the commencement of the development (Condition of approval).

11.4 Indicators relating to Visual-Spatial issues

Detailed Mitigation measures set out in Section 5.9 of the VIA as well as Management Programme set out in Section 9 of the VIA (also refer Section 8.5.2 of this report) shall be implemented as part of the proposed development.

11.5 Indicators relating to Archaeology

All recommendations contained in AIA, as summarised in Section 9.5 of this HIA report shall be adhered to, subject to any amendments to the significance assessment and heritage indicators that may be required by the findings of recommended mitigation during archaeological mitigation as recommended.

11.6 Indicators relating to Palaeontology

Recommendations contained in PIA, as summarised in Section 9.6 of this HIA report shall be adhered to, subject to any amendments to the significance assessment and heritage indicators that may be required by the findings of recommended mitigation during construction (i.e. possible fossil finds).

11.7 Summary/ Recommended conditions of approval

From the assessment set out in this Section, we conclude that while the proposed wind energy facility would have an impact on the rural landscape character of the area it would not have any impact on the built environment or palaeontological resources. It would have an impact on pre-colonial archaeological for which appropriate mitigation would be required as recommended in the AIA.

Alternative Layout Two, which is the preferred alternative, is recommended as this layout have been developed through inputs obtained through the EIA process thus far and because this 13 turbines are proposed as opposed to up to 20 turbines with Alternative Layout One. Purely based on the number of turbines proposed, we are of the view that the overall impact of the first alternative layout would be more than that of the second.

Therefore, having regard to the detailed analysis and finding with relation to the potential impact of the proposed wind energy facility on heritage resources on the study area and its environs, we

are of the view that the proposal may be supported, subject to the conditions summarised in the table below:

Indicator Ref	*Recommended HWC Conditions of Approval*
HT-1	*Consideration should be given to display the finding of research arising from early census records pertaining to the farm Goereesoe in a meaningful manner in the Office proposed to be constructed as part of the proposed development.*
BE-2	*The registered property owner shall retain historic buildings worthy preservation and ensure restoration of historic building nos. 81, 82 and 86 listed in Table 1, Section 8.2 of this report in accordance with Section 34 of the NHRA to the satisfaction of Heritage Western Cape.*
BE-3	*The registered property owner shall retain historic buildings worthy preservation and ensure restoration of historic building nos. 81, 82 and 86 listed in Table 1, Section 8.2 of this report in accordance with Section 34 of the NHRA to the satisfaction of Heritage Western Cape.*
VS-1	*Detailed Mitigation measures set out in Section 5.9 of the VIA as well as Management Programme set out in Section 9 of the VIA (also refer Section 8.5.2 of this report) shall be implemented as part of the proposed development.*
AIA-1	*All recommendations contained in AIA, as summarised in Section 9.5 of this HIA report shall be adhered to, subject to any amendments to the significance assessment and heritage indicators that may be required by the findings of recommended mitigation during archaeological monitoring.*
PIA-1	*Recommendations contained in PIA, as summarised in Section 9.6 of this HIA report shall be adhered to, subject to any amendments to the significance assessment and heritage indicators that may be required by the findings of recommended mitigation during construction (i.e. possible fossil finds).*

12. RECOMMENDATIONS

Having regard to the above assessment, it is recommended:

12.1 That this report fulfils the requirements of a Heritage Impact Assessment (HIA);

12.2 That the report be subject to focussed public participation to solicit heritage-related comments for a period of 30 days;

12.3 That the recommendations emanating from the Draft Integrated HIA and outcomes of focussed public participation be incorporated into a Final Integrated HIA, to be submitted to Heritage Western Cape for adjudication

PERCEPTION Heritage Planning
14th February 2013

SE DE KOCK
B-Tech (TRP) EIA Mgmt (IRL) Pr Pln MAPHP

Annexure 1:
Power of Attorney

POWER OF ATTORNEY

I, Ian McGregor, the undersigned being the Client/ Developer IE SWELLENDAM WIND (PTY) LTD, in my capacity as person holding power of attorney for ***IE SWELLENDAM WIND (PTY) LTD***, as Developer of portions of the properties ***GOEREESOE 432/ 2, 4, 5 & REMAINDER, DISTRICT SWELLENDAM***, hereby nominate Stéfan de Kock of *PERCEPTION Heritage Planning*, with power of substitution, to be my agent in name, place and stead, (as set out in their quotation dated 6th August 2012) to sign on my behalf and submit to the appropriate authorities the following application, which mandate shall, without limiting the generality of the a foregoing, include:

a.) Integrated Heritage Impact Assessment (HIA), as required by the competent authority (Heritage Western Cape) in their correspondence dated 7th September 2011, for development of a wind energy facility on portions of the abovementioned properties as required in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999).

I hereby accept the Terms of Agreement as set out in abovementioned quotation dated 6th August 2012.

Signed at MELROSE ARCH on 19 NOVEMBER 2012

IE SWELLENDAM WIND (PTY) LTD

Client/ Developer

Witness

Witness

Annexure 2:
HWC Interim Comments dated 7th September 2011

Our Ref: **HM\OVERBERG\SWELLENDAM\GOEREESOE 432 REM 2, 4, 5**

iLifa leMveli leNtshona Koloni
Erfenis Wes-Kaap
Heritage Western Cape

Tracking No: **110826JL20**
Case ID: **1517**
Unique Letter ID: **1439**
Enquiries: Jenna Lavin
Tel: 021 483 9685
E-mail: jlavin@pgwc.gov.za

7 September 2011
Mr S. De Kock
Perception Heritage Planning
PO Box 9995
George
6530

RESPONSE TO NID

NID: PROPOSED WIND FARM DEVELOPMENT ON GOEREESOE 432 REM 2, 4 AND 5, SWELLENDAM

The above matter was discussed at the Heritage Western Cape staff meeting held on 2 September 2011. In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999):

It was noted that:

1. The application is for a Wind Energy Facility proposed covering 1485ha and consisting of 10 to 20 turbines
2. Access to the site is from R319, which runs through the site
3. Numerous derelict homesteads are located within the site boundaries
4. Heritage that may be impacted by this development includes the rural cultural landscape southwest of Swellendam, possible pre-colonial and colonial archaeological resources, possible palaeontological resources and possible gravesites.

Heritage Western Cape (HWC) agreed that:

An HIA is required consisting of a historic background analysis, a built environment and cultural landscape analysis, a visual impact study including cumulative impact against similar developments in the Swellendam area, an archaeological study and a palaeontological study, with an integrated set of recommendations and specialist studies appended in full. Recommendations must in each instance address the impacts and advantages/disadvantages of the alternative models (10 to 20 turbines).

Yours faithfully

A. B. Hall

Andrew Hall
Chief Executive Officer
Heritage Western Cape
Tel: 021 483 5959
abhall@pgwc.gov.za

Annexure 3:
Photographs

Photo 1: *South-facing view from northern site boundary (viewed along R319)*

Photo 2:*North-facing view illustrating agricultural landscape character along narrow farm track where T4, T5 are proposed*

Photo 3: *Northeast facing view along narrow track where T11, 12, 13 are proposed. Narrow strip of dark vegetation in top left corner of image denotes R319 alignment*

Photo 4: *North-facing view of landscape where T2, 3 are proposed (Directly northwest of Building Precinct One)*

START: BUILDING PRECINCT ONE

Photo 5: *East-facing view of Bldg Precinct One*

Photo 6: *Old livestock enclosure (#73,74)*

Photos 7, 8*: Derelict farmstead (#76)*

Photo 9: *Ruined outbuilding (#75)*




Photos 10, 11, 12, 13: *Agri outbuilding showing interior and various elevations (#77)*



Photos 14, 15, 16: *Second agri outbuilding – exterior, interior views (#78)*

Photo 17: *Row of bluegum trees (#80a)*


Photos 18, 19: *Ruined labourer's cottage (#79)*

<u>END: BUILDING PRECINCT ONE</u>

START: PROXIMITY OF CURRENT (MODERN) FARMSTEAD

Photo 20: *Southwest facing panoramic view incorporating current farmstead (visible on right) and two ruined labourers' cottages (left)*

Photos 21, 22: *Ruined labourer's cottages (#80)*

Photos 23, 24: *Dilapidated agri outbuilding, silos (#81)*

Photo 25: *Agri-outbldg with kraal (#81)*

Photo 26: *Modern labourers' cottage*

Photo 27: *Current (modern) farmstead*

Photo 28: *Labourer's cottage age uncertain (#82)*

END: PROXIMITY OF CURRENT (MODERN) FARMSTEAD

START: BUILDING PRECINCT TWO

Photo 29: *Foundation/ age uncertain (#83)*

Photo 30: *Ruined outbuilding (#84)*

Photos 31, 32: *Ruined secondary dwelling front, rear elevations (#86)*

Photos 33, 34, 35, 36: *Front and rear elevations of substantial farmstead now ruined (#85)*

Photo 37: *Two ruined agri outbuildings with stonewall enclosure (#87)*

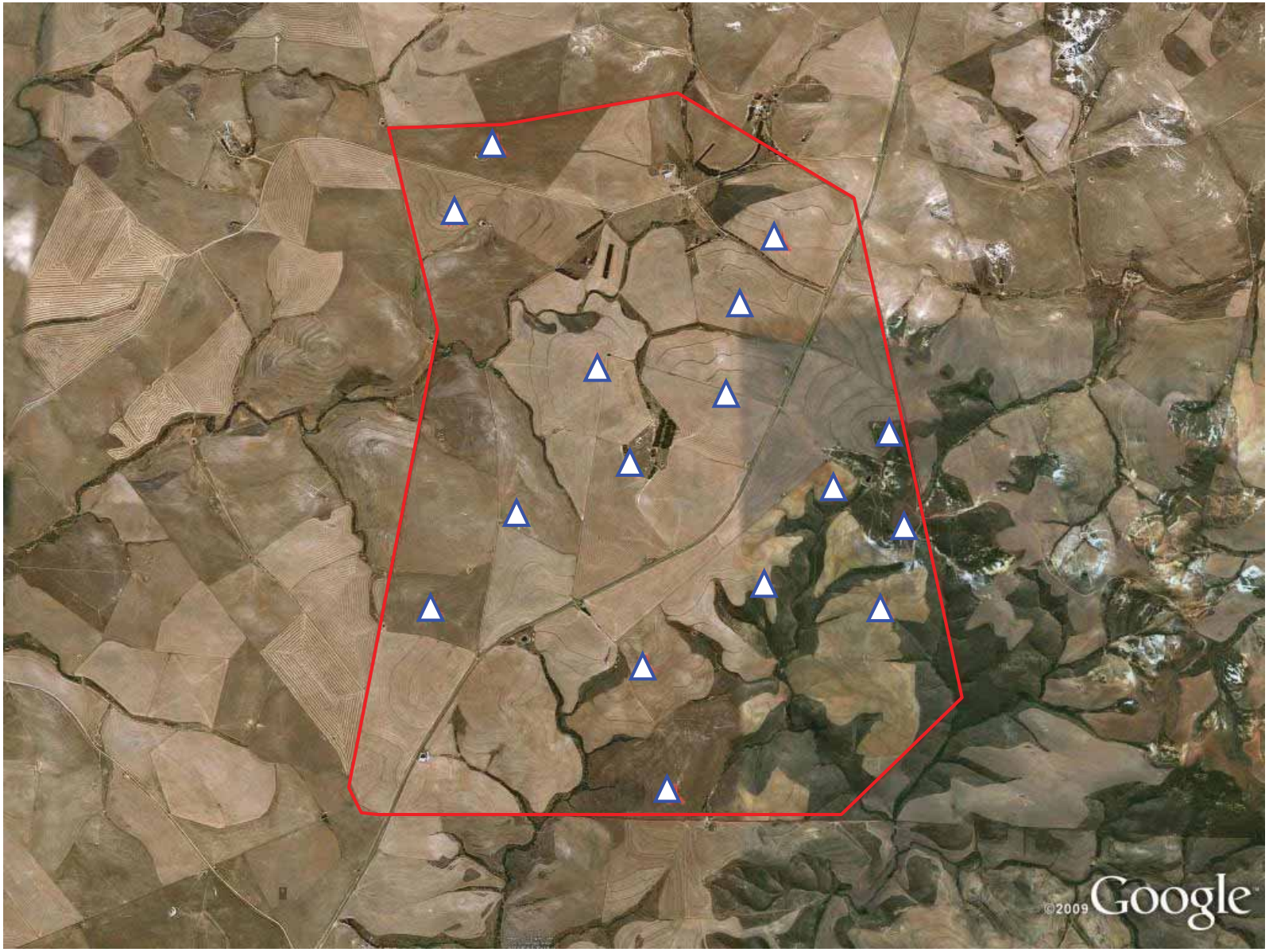
END: BUILDING PRECINCT TWO

Photo 38: *Southeast facing view of approximate area where T8, 9, 10 are proposed*

Photo 39: *Northwest facing view of approximate area where T6, 7 are proposed*

Annexure 4.1:
Alternative Layout One

WIND FARM ON PORTIONS 0, 2, 4 AND 5 OF FARM 432 GOEREESOE, SWELLENDAM



SITE CO-ORDINATES

34° 16.305' S
20° 13.573' E

The Site

Turbines

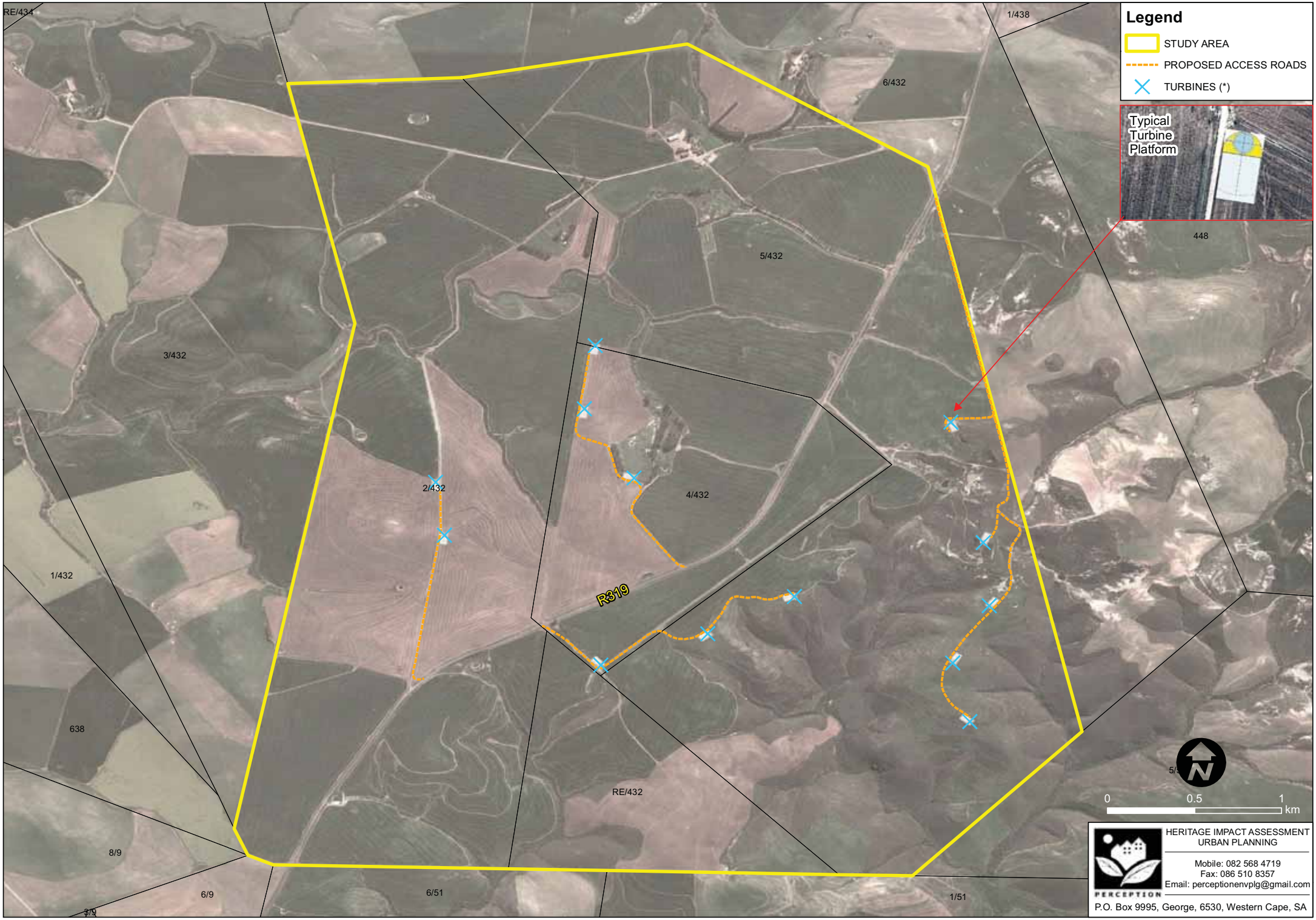
N

DJEC REF. 2010/29

MAY 2011

DOUG JEFFERY
Environmental Consultants (Pty) Ltd

Annexure 4.2:
Alternative Layout Two (Preferred)

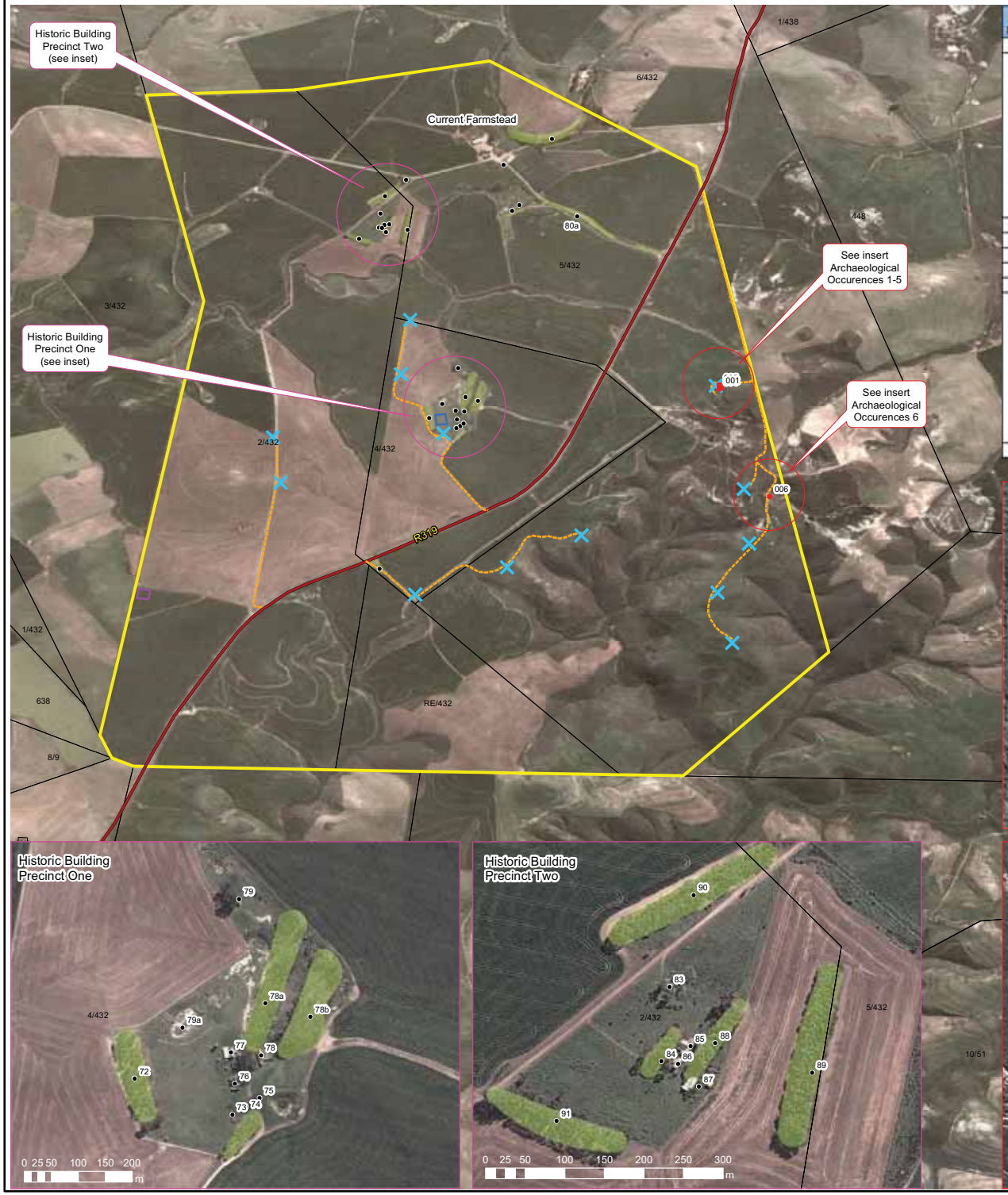


HERITAGE IMPACT ASSESSMENT
URBAN PLANNING

Mobile: 082 568 4719
Fax: 086 510 8357
Email: perceptionenvplg@gmail.com

P.O. Box 9995, George, 6530, Western Cape, SA

Annexure 5:
Integrated Heritage resource mapping



Bldg Precinct	GPS #	Built Environment - Description
	71	Linear-planted gum trees perpendicular to R319
Building Precinct One	72	Copse of blue gum trees/ wind break
	73	Remains old water trough
	74	Old livestock keep, outbuildings
	75	Remains two-roomed outbuilding, pit latrine (mud brick)
	76	Remains substantial farmstead (mud brick, modern additions)
	77	Agricultural outbuildings (mud brick, modern extensions)
	78	Further agricultural outbuilding (more recent but >60 yrs)
	78 a	Copse of blue gum trees
	78 b	Copse of blue gum trees
	79	Derelict labourer's cottage (mud brick)
	79 a	Rubbish dump
	80	Labourer's cottage (mud brick, corrugated iron lean-to)
	80 a	Row of blue gum trees lining approach road
	80 b	Linear-planted blue gum trees (Y-shaped wind breaks)
	81	Agricultural store with kraal (mud brick, still in use)
	82	Labourer's cottage (age uncertain)
Building Precinct Two	83	Foundations (age uncertain)
	84	Derelict outbuilding (mud brick, square with simple but quaint gable)
	85	Remains substantial farmstead (mud brick, >60yrs additions)
	86	Derelict homestead (mud brick)
	87	Two ruined agricultural outbuildings (mud brick) set to side of stonewalled kraal
	88	Linear-planted blue gum trees (wind break)
	89	Linear-planted blue gum trees (wind break)
	90	Linear-planted blue gum trees (wind break)
	91	Linear-planted blue gum trees (wind break)
	92	Rubbish dump
	93	Linear-planted blue gum trees (landscape framing/ wind break)

PROJECT:
Swellendam Wind Energy Facility: Goereesoe 432/RE, 2, 4 & 5 Swellendam District

PLAN:
Integrated Heritage Impact Assessment

NAME:
Integrated Heritage Resource Mapping

LEGEND:
- STUDY AREA
- SUBSTASION A
- SUBSTASION B
- LINEAR PLANTING/WIND BREAKS
- PROPOSED ACCESS ROADS
- TURBINES (*)
- BUILT ENVIRONMENT
- ARCHAEOLOGICAL OCCURENCES

NOTES:
- (*) Alternative Layout Option 2
- Turbine localities as provided by Savannah Environmental (Pty) Ltd Swellendam_Layout_09Oct12.kmz
- Aerial photography: Google Aug2011

A3 SCALE: 1:20 000

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DEC 2012 | ANNEXURE 5

Annexure 6:
Archaeological Impact Assessment

ARCHAEOLOGICAL IMPACT ASSESSMENT: PROPOSED GOEREESOE WIND FARM, SWELLENDAM, WESTERN CAPE

(Assessment conducted under Section 38 (8) of the National Heritage Resources Act as part of an EIA.)

Prepared for:

Savannah Environmental (Pty) Ltd
December 2012

Prepared by:

Lita Webley
ACO Associates cc
8 Jacobs Ladder
St James
Tel: 021 706 4104
Email: lita.webley@aco-associates.com

EXECUTIVE SUMMARY

ACO Associates CC was appointed by Savannah Environmental (Pty) Ltd on behalf of the client, Inca Energy (Pty) Ltd, to undertake an Archaeological Impact Assessment, as part of the EIA process, for the establishment of a wind energy facility on the Remainder and Portions 2, 4 and 5 of Farm Goereesoe 432, Swellendam, Western Cape.

A total of thirteen (13) wind turbines, two possible alternative substations, access roads, underground cabling and laydown areas are planned for the facility. The wind farm will link into an existing 66kV power line which crosses the property.

This archaeological impact assessment forms part of a larger Heritage Impact Assessment which is being undertaken by Perception Heritage Planning in response to the Notice of Intent to Develop submitted to Heritage Western Cape (Case ID:1517; Unique Letter ID: 1439 dated September 2011).

The Scoping for the wind farm was undertaken by Dr P Nilssen of CHARM in July 2011. His initial fieldwork was undertaken while the fields were under crops, resulting in poor visibility. Subsequent fieldwork by Lita Webley of ACO Associates cc was undertaken in December 2012, after crops were harvested and visibility was good.

Heritage Indicators:

No Early or Middle Stone Age implements or Historical archaeological material was recorded during the survey. Two Later Stone Age sites were identified. They are Site 001-005 (a single site) and Site 006. It is concluded that the position of Turbine 6 will result in the destruction of Site 001-005. This Later Stone Age (LSA) site with silcrete adzes is unusual and has been allocated a medium to high significance because of the potential information it may provide of the late Wilton period in the southern Cape.

The access road to Turbines 8, 9 and 10 passes within 10m of Site 006. As an isolated occurrence it is considered of low significance, but together with Site 001-005, may inform on LSA settlement patterns in the area.

Recommended mitigation

- Turbine 6 may moved away from the koppie and further into the field. The full extent of the archaeological site needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient. It is calculated that the sampling will take a total of 8 hours (at both Site 001-005 and Site 006). The full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape.

- Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required. Alternatively a new road will have to be constructed.

- If any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.

If there are any significant changes to the layout of the Goereesoe Wind Farm, then further archaeological survey work may be necessary.

Declaration:

Lita Webley (PhD) is an archaeologist with 16 years of working experience in heritage consultancy. She is also accredited with Principal Investigator status with the Association of Professional Archaeologists of Southern Africa.

Dr Lita Webley is an independent specialist consultant who is in no way connected with the proponent, other than delivery of consulting services.

GLOSSARY

Archaeology: *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.*

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

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

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

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

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

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

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

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

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

Acronyms

BP	Before the Present
DEA	Department of Environmental Affairs
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency

TABLE OF CONTENTS

1. INTRODUCTION

ACO Associates cc have been appointed by Savannah Environmental (Pty) Ltd on behalf of the client, Inca Energy (Pty) Ltd, to undertake Archaeological Impact Assessment, as part of the EIA process, for the establishment of a wind energy facility on the Remainder and Portions 2, 4 and 5 of Farm Goereesoe 432, Swellendam, Western Cape.

The proposed wind energy facility is located on both sides of the R319 which links Swellendam with Bredasdorp. It is situated 34km south-west of Swellendam (Figure 1).

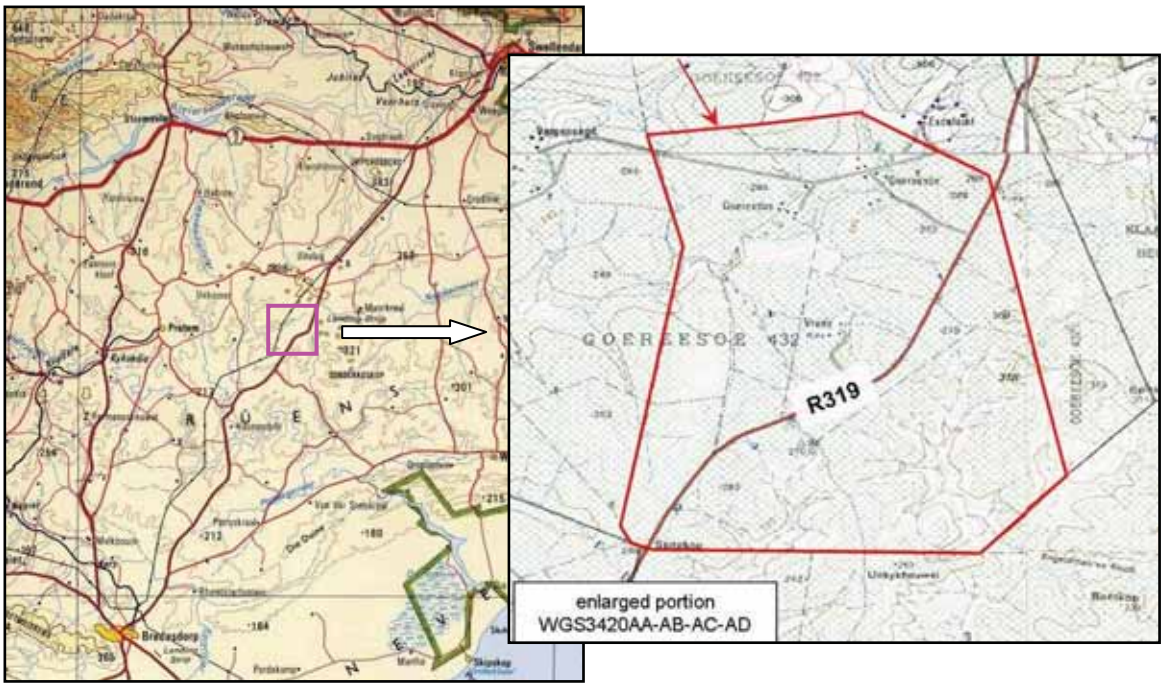

Figure 1: Approximate location of the Goereesoe Wind Farm on the 1:250 000 map sheet 3420. It is located on the R319 to the south-west of Swellendam. The enlarged 1:50 000 map (3420AA-AB-AC-AD) is after Nilssen (2011).

1.1 Development Proposal

A total of thirteen (13) wind turbines, two possible alternative substations, access roads, underground cabling and laydown areas are planned for the facility. The wind farm will link into an existing 66kV power line which crosses the property.

Figure 2: Proposed wind turbine layout and route of access roads indicated (Map supplied by Savannah Environmental (Pty) Ltd.). The red squares show the location of two possible sub-station positions.

1.2 Terms of Reference

The aim of the AIA is to provide:

- Description of the affected environment;
- Description of the range of archaeological resources which may be impacted;
- Description of the significance of archaeological resources which may be impacted;
- An assessment of the potential loss of archaeological resources;
- Recommendation of mitigation procedures which may include avoidance.

2. LEGISLATION, POLICIES AND GUIDELINES

The basis for all heritage impact assessment is the National Heritage Resources Act 25 (NHRA) of 1999, which in turn prescribes the manner in which heritage is assessed and managed. The National Heritage Resources Act 25 of 1999 has defined certain kinds of heritage as being worthy of protection, by either specific

or general protection mechanisms. In South Africa the law is directed towards the protection of human made heritage, although places and objects of scientific importance are covered. The National Heritage Resources Act also protects intangible heritage such as traditional activities, oral histories and places where significant events happened. Generally protected heritage which must be considered in any heritage assessment includes:

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

A NID was submitted to Heritage Western Cape and they made the following response (Case ID: 1517; Unique Letter ID: 1439):

"An HIA is required consisting of a historic background analysis, a built environment and cultural landscape analysis, a visual impact study including cumulative impact against similar developments in the Swellendam area, an archaeological study and a palaeontological study, with an integrated set of recommendations and specialist studies appended in full. Recommendations must in each instance address the impacts and advantages/disadvantages of the alternative models (10 to 20 turbines)".

3. RECEIVING ENVIRONMENT

The landscape can be described as an agricultural landscape consisting of rolling hills covered in crops such as wheat and canola. The fields had been harvested a few months prior to the survey, and the lands were covered in short yellow stubble. The soil surface is very stony, comprising thick shale deposits. Large heaps of stone are found on the edges of the fields.

The lands to the south and east of the R319 exhibited a more rugged topography with a deep gorge bisecting the terrain. There are a number of small hills topped with sandstone outcrops. Some of these hills were covered in indigenous vegetation.

There are groves of Eucalyptus sp. trees near settlements and on the edges of fields. The farm is covered in a good network of roads and most of the proposed turbines are located close to these existing roads.

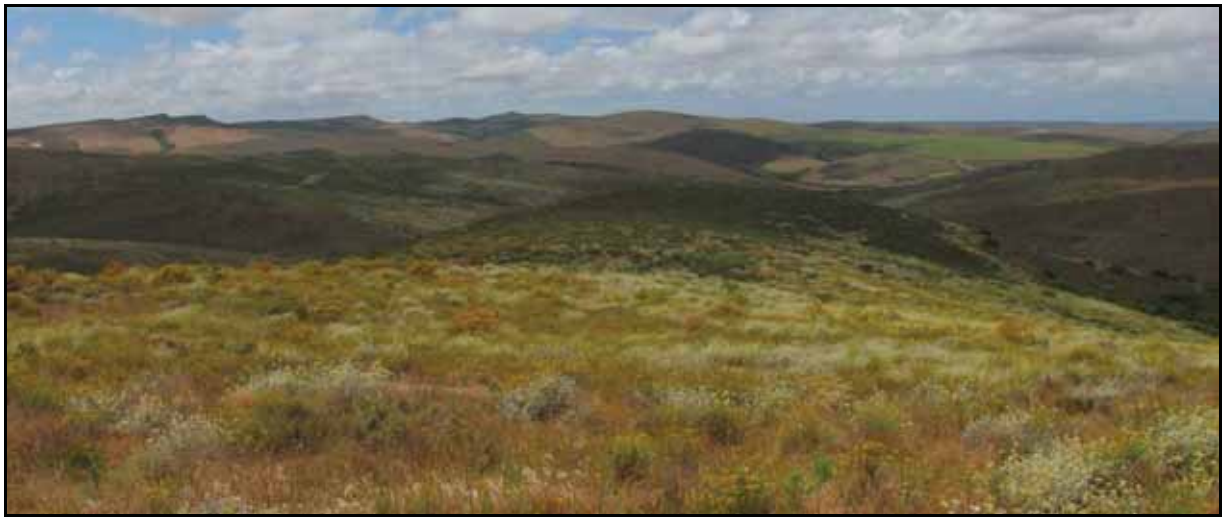

Plate 1: View from Turbine 13 looking in an easterly direction.

Plate 2: View from Turbine 5 in an easterly direction toward the neighbouring farmhouse.

Plate 3: View to the east, from Turbine 10. Note the low vegetation.

3.1 Pre-Colonial Archaeology

The southern Cape is known for its rich archaeological heritage. However, most archaeological research has been concentrated along the coastal margin. Little is known of the archaeology of the Riviersonderend and Swellendam areas. The archaeological record shows that prehistoric archaeological settlement is predominantly represented by open sites in these areas. Arthur (2008) claims to have recognised pastoralist sites from low density distributions of archaeological material around the Breede River (inside the Bontebok National Park) at Swellendam.

A review of the Report Mapping Projects of the South African Heritage Resources Agency (2009) was undertaken and it was determined that few archaeological studies had been conducted in the Swellendam area prior to 2009.

Kaplan (1990) reported on scatters of Early and Middle Stone Age implements, made predominantly on quartzite, in ploughed fields outside of Riviersonderend. He concluded that the sites had been disturbed and the artefacts were no longer in primary context. He therefore did not propose any mitigation. Webley & Orton (2009) reported fairly dense concentrations of Early Stone Age material in the vicinity of Heidelberg and Riversdale but did not recommend mitigation. Webley (2010) reported on ephemeral scatters of Early Stone Age artefacts in ploughed fields near the banks of the Freek Bothas River which cross the N2 to the west of Swellendam. There are also scatters of possibly Middle Stone Age artefacts on a ridge overlooking the drainage line. However, no artefact scatters appear to be in context and the significance rating for these artefact scatters is very low.

Nilssen (2011) during his two (2) day Scoping survey of the Goereesoe property found a single quartzite radial core/disc core which he thought could be either of LSA or MSA origin. The artefact was found in a cleared area between a crop field and a fence line and the matrix surrounding the artefact locality was clearly disturbed. Nilssen considered the find in secondary context and of low significance.

3.2 Colonial Heritage

According to historic accounts, this area was settled by Khoekhoen pastoralist groups at the time of European contact.

Historically, the region between the Hottentots Holland Mountains and the Keurbooms River was the traditional grazing lands of the Hessequa and Chainouqua Khoekhoen. Clift (2001) in her review of the literature noted various kraals scattered along the southern foot of the Riviersonderend mountains circa 1700. Loan farms in this area were granted from the beginning of the 18th century. However, the escalating number of loan farms granted in the Overberg had the effect of greatly limiting the movement of the Khoekhoen pastoralists, and they were increasingly forced to move on, or to go into the service of the freeburger farmers.

While Clift (2001) was unsuccessful in identifying pastoralist sites in the Genadendal area, we may anticipate the discovery of pastoralist sites in undisturbed areas which have not been subject to cereal cultivation.

4. METHODOLOGY

Nilssen (2011) spent two days in July 2011, undertaking a Scoping level Archaeological Impact Assessment of the proposed wind farm. However, he reported poor archaeological visibility due to the fact that the vast majority of the study area was covered in crops at the time of the survey. He therefore considered his Scoping report to be inadequate and he therefore recommended that an Archaeological Impact Assessment should be conducted after the crops had been harvested and when ground visibility was improved.

Nevertheless, of the 16 proposed turbine location assessed in July 2011, at least 7 localities were not considered archaeologically sensitive. In fact, Nilssen identified only a single isolated stone artefact suggesting that the area is of low archaeological sensitivity.

Prior to the fieldwork for the EIA phase of the work, the locations of the proposed turbines were loaded onto handheld GPS receivers (set to the WGS84 datum) to facilitate the identification of the search area during field work. Fieldwork was undertaken by Lita Webley and Norman Schneider on 10 December 2012. Walk paths and site locations were recorded with GPS and finds were photographed and described. We examined the proposed locations of all 13 proposed turbines (Figure 2), the two alternative locations for a substation and the access roads/underground cabling routes.

4.1 Limitations

While the majority of the proposed turbines will be placed in agricultural lands, the crops had been harvested by the time the second survey took place and archaeological visibility in the old fields was excellent.

Other turbines will be placed on the ridge lines which are covered in indigenous vegetation. While the vegetation was quite dense, it reached a maximum height of around 30cm which made fieldwork relatively easy.

5. FINDINGS

Our track paths are shown on Figure 3.

All the heaps of stones at the side of fields in the study area, which had been collected as a result of agricultural activities, were examined. These stone piles in the Botrivier and Caledon areas are frequently found to contain archaeological material. However, no artefacts were found.

Although Early and Middle Stone Age material have been reported from elsewhere around the Swellendam area, none were found on Goereesoe.

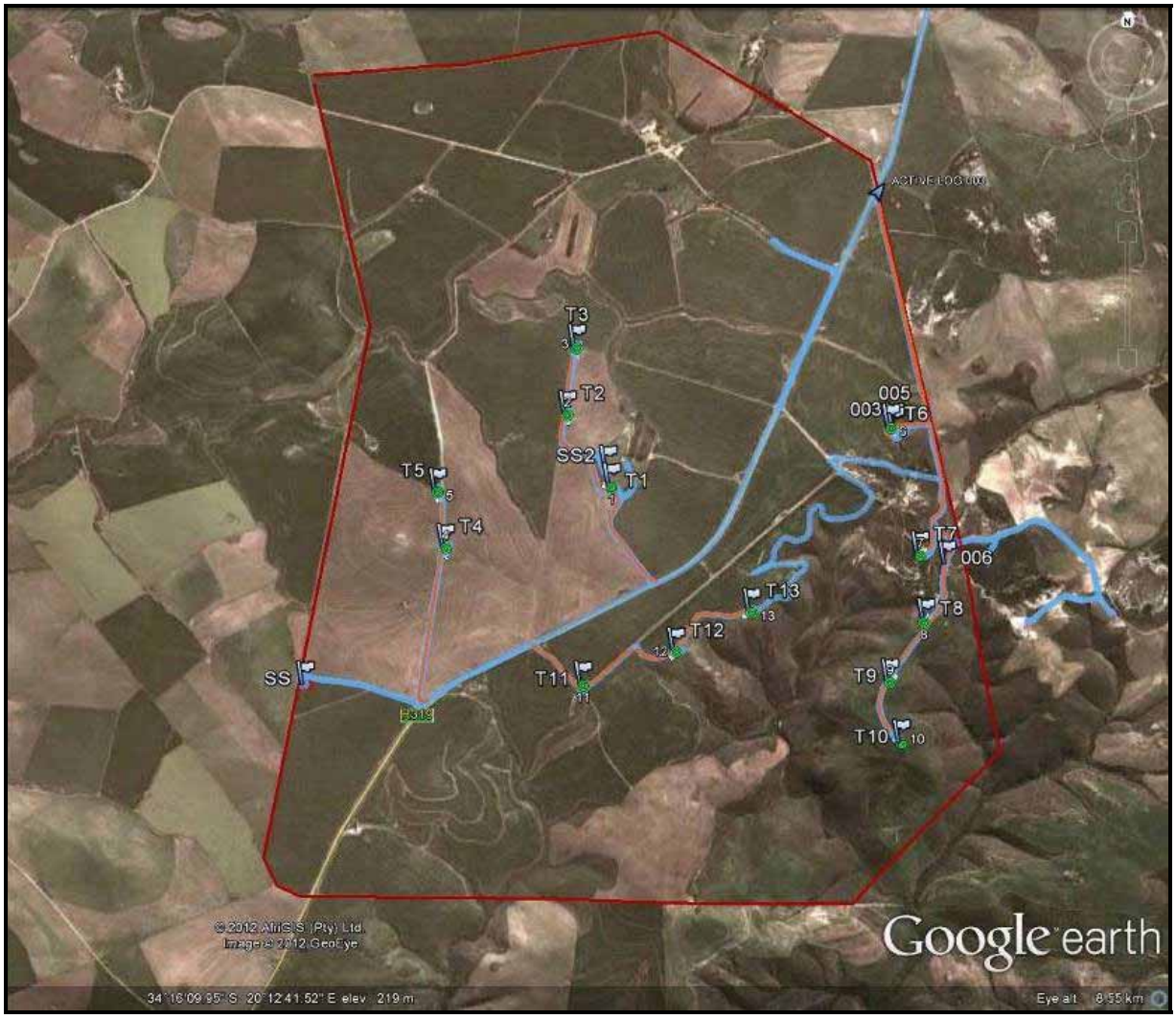

Figure 3: The tracks recorded during the survey are in pale blue and the location of the archaeological sites shown by site numbers (001-006).

However, scatters of Later Stone Age (LSA) archaeological material were found spread in a number of small hollows between rocks on the lower slopes of a little hill at Turbine 6 (Table 1). At least five such clusters were identified and it is possible that more may occur between the bushes. Although the collections of artefacts were recorded as Sites 001 to 005, these clusters of artefacts probably represent a single archaeological site. The distribution of the artefacts on the lower slopes of the hill, seem to suggest that they have been washed down from higher up the koppie. The koppie is topped by a small outcrop of reddish rock, which has formed a number of small holes or caves (Plate 5). These seem to have served as porcupine lairs. The caves were examined but there is no evidence of human occupation in the holes. However, it is possible that there are archaeological sites between the large boulders on the upper slopes of the koppie and they are presently covered in dense bush (Plate 4).


Plate 4: View of the koppie at Turbine 6. Note the calcrete sub-strate which has been exposed by the farm road and the geo-tech excavations.

Plate 5: The sandstone koppie has a number of small caves/holes.


Plate 6: Location of Site 002 between boulders; **Plate 7:** View of adze from Site 002.

The artefacts were all made on a grey silcrete and consisted on cores, flakes and bladelets with formal tools including two adzes and some retouched pieces. A few chunks of quartz were recovered which appear to have been informally utilised as cores. The artefacts are <u>not</u> associated with pottery and probably date to the period 3 000 – 2 000 years ago (see discussion below).

Plate 8: Selection of stone artefacts from Site 002. Note the two adzes outlined in red.

Plate 9: Selection of stone artefacts from Site 004. Note the scraper outlined in red.

Figure 4: Location of archaeological Sites 1 – 5 with respect to the location of Turbine 6.

A further diffuse of stone artefacts was found at Site 006. They consist of silcrete cores and chunks, next to a small boulder. The site is next to the access road to Turbines 8, 9 and 10.

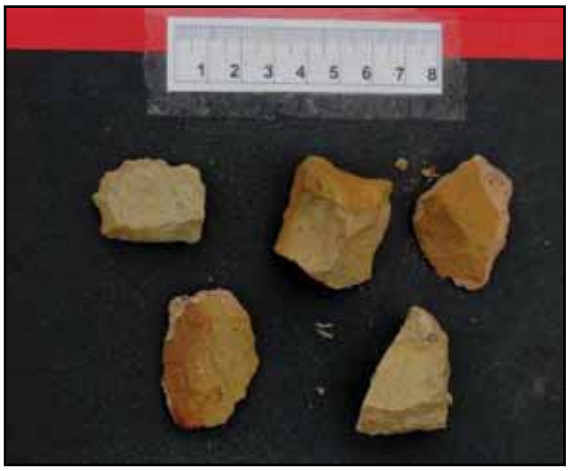

Plate 10: Site 006; Plate 11: Stone artefacts from Site 006.

No historical archaeological material was discovered around the old farmhouse complex.

Table 1: Archaeological sites recorded during the survey.

Site Number	Unique Site Number	GPS Co-ordinates	Description	Significance	Mitigation
001	GRS002	S34 15.937 E20 14.827	Few silcrete cores and flakes	Medium	1 hour
002	GRS003	S34 15.937 E20 14.826	LSA. Dense surface distribution of silcrete flakes, cores, 2 adzes and one retouch piece	Medium-High	2 hours
003	GRS004	S34 15.939 E20 14.823	Spread of silcrete flakes and cores	Medium	1 hour
004	GRS005	S34 15.941 E20 14.821	LSA. Collection of silcrete flakes and cores including scraper	Medium-High	2 hour
005	GRS006	S34 15.927 E20 14.821	Diffuse spread of silcrete flakes and cores	Medium	1 hour
006	GRS007	S34 16.328 E20 15.003	Diffuse spread of silcrete cores and chunks next to two large boulders	Low	1 hour

* GRS001 refers to the single artefact which Nilssen (2011) recorded on the property.

6. IMPACT ASSESSMENT AND MITIGATION

Sites 001-005 probably represent a single Later Stone Age site. The distribution of artefacts along the lower slopes of the hill suggests that they may be in a secondary context and have been washed down from higher up the koppie. However, it was not possible to be certain of this during the survey, because of the dense vegetation on the top of the koppie. The stone age material is distributed between a number of boulders. They have been disturbed by a farm road which has cut through the site in the historic past. Both the farm road and the geo-tech excavations on the site suggest that the sub-strate of this area comprises a thick white clay/calcrete material. Silcrete may occur in this calcrete in the form on nodules. However, there is no evidence that this is a factory site.

These microlithic stone artefacts are characteristic of the Wilton Complex, which was widely distributed across southern Africa during the mid to late Holocene (last 10 000 years). The relative frequencies of different kinds of microlithic artefacts define successive phases in the Wilton. In the case of Goereesoe, the occurrence of the silcrete adzes may suggest a late-Wilton occupation. In the Western Cape, increasing numbers of adzes after 3 500 years have been ascribed by archaeologists to an increase in the manufacture of digging tools which were used to harvest edible, below-ground plant resources such as bulbs (Mitchell 2002).

However, the reason that the Later Stone Age site at Goereesoe is potentially of importance to archaeologists is that very little is known of the Later Stone Age in

the southern Cape. *This is the first description of adzes from the area, and this information increases our knowledge of the spread of these artefacts*. *The site is therefore of medium to high potential for archaeologists.*

Site 006 is a very diffuse scatter of silcrete material next to the access road to Turbines 8, 9 and 10. The type of raw material and the range of chunks and cores, suggests that this site probably dates to the same period as Site 001-005. There are no formal tools present, and the *site has low significance, as an isolated occurrence.* However, it may potentially inform on LSA site distribution when considered together with Sites 001-005.

5.2.1 Nature of impact

The placement of the Turbine 6, the laydown area and access roads will result in the destruction of at least a portion of the archaeological site (001-005).

The access road to Turbines 8, 9 and 10 passes within 10m of Site 006. If the road is widened to allow access for heavy truck and cranes, then the site will be destroyed.

5.2.2 Extent of impact

There is only one extensive spread of archaeological material (Site 001-005) which is threatened by the construction of Turbine Number 6 and associated infrastructure. The site is of medium to high significance for archaeologists and the destruction of the site will result in the loss of important archaeological information. Potential mitigation measures are outlined below.

Site 006 is threatened with destruction if the access road to Turbines 8, 9 and 10 is widened. Although the site is of low significance, it may potentially inform on LSA site distribution in this area.

There is a chance that the deep excavations for the turbine bases as well as the foundations for the substation could potentially impact buried archaeological material such as graves. Similarly the construction of access roads could impact material that lies buried in the surface sand.

Table 2: Impacts to pre-colonial archaeology

Nature: Disturbance and destruction of pre-colonial archaeological material by turbine footings, sub-stations, access roads and power lines		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (5)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	Medium < 52	Low < 30
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	Yes (Site 001-005) at Turbine 6.	No
Can impacts be mitigated?	Yes	
Mitigation: There are two alternatives to conserving the archaeological sites recorded		

during the survey. Turbine 6 may be moved further into the field and away from the koppie. This will ensure the site is not impacted at all. Alternatively, the site is sampled by an archaeologist/s with a permit issued by Heritage Western Cape. The estimated number of hours for mitigation is provided in Table 1. With regard Site 006, it will not be possible to move the access road as it is located on a steeply sloping hillside. Mitigation in the form of archaeological sampling is the only alternative. The number of hours for mitigation is provided in Table 1.
Cumulative impacts: The cumulative impact is not likely to differ from the above.
Residual impacts: N/A

6.1 Archaeological heritage

It is concluded that the position of Turbine 6 will result in the destruction of Site 001-005. This site is of medium to high significance because of the potential information it may provide of the late Wilton period in the southern Cape. The Turbine may be moved away from the koppie and further into the field. The full extent of the site needs to be determined and marked off, to ensure that the site is not impacted during construction. This will protect the site from destruction.

Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient. It is calculated that the sampling will take a total of 8 hours (at both Site 001-005 and Site 006). The full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape.

Site 006 is only 10m from the access roads to Turbines 8, 9 and 10 and will be destroyed if the road is widened. It seems there is no alternative to sampling the site, unless the road is re-routed following a different alignment. This may not be feasible considering the rugged topography. Archaeological collection (with a permit) may be the most cost-effective alternative.

6.2 Un-identified archaeological material, fossils and fossil bone

There is always a possibility that archaeological material may be exposed during excavations for turbine foundations, substations, access roads and transmission pylons. All archaeological material over 100 years of age is protected by Section 38.5 of the NHRA, 1999 and it is an offence to destroy material. If archaeological material is uncovered, all work must cease and the HWC archaeology unit must be consulted immediately so that mitigation action can be determined and be implemented if necessary. Mitigation is at the cost of the developer, while time delays and diversion of machinery/plant may be necessary until mitigation in the form of conservation or archaeological sampling is completed.

6.3 Graves

If any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.

7. CONCLUSIONS

The survey of the layout of the proposed wind energy facility provided prior to fieldwork, failed to identify the Early and Middle Stone Age implements which had been anticipated. However, two Later Stone Age sites were identified on rocky outcrops to the east of the R319.

These sites are unexpected in this area. Site 001-005 contains adzes which are particularly interesting as they have not been reported from this area before.

It is concluded that the position of Turbine 6 will result in the destruction of Site 001-005. This Later Stone Age (LSA) site with silcrete adzes is very unusual and has been allocated a medium to high significance because of the potential information it may provide of the late Wilton period in the southern Cape.

The access road to Turbines 8, 9 and 10 passes within 10m of Site 006. As an isolated occurrence it is considered of low significance, but together with Site 001-005, may inform on LSA settlement patterns in the area.

Two possible mitigation measures were recommended for the site at Turbine 6.

Turbine 6 can moved away from the koppie and further into the field. The full extent of the archaeological site needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient. It is calculated that the sampling will take a total of 8 hours (at both Site 001-005 and Site 006). The full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape.

Avoidance of Site 006 is not possible as the road follows a steeply sided hill in this area. Mitigation will be required if this route for the road is followed.

If any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.

If there are any significant changes to the layout of the Goereesoe Wind Farm, then further archaeological survey work may be necessary.

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Annexure 7:
Desktop Palaeontological Impact Assessment

PALAEONTOLOGICAL SPECIALIST ASSESSMENT: DESKTOP STUDY

Inca Goereesoe Wind Farm near Swellendam, Western Cape Province

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August 2011

1. EXECUTIVE SUMMARY

The Goereesoe wind farm project proposed by the company Inca Swellendam 1 Wind (Pty) Ltd, Houghton, is situated some 30km southwest of Swellendam, Western Cape. Land parcels involved straddle the R319 linking the N2 and Bredasdorp and include Portions 0, 2, 4, and 5, of Farm 432 Goereesoe. This project will comprise some 10 to 20 wind turbines. The gently undulating landscape in the study area is largely underlain by Early to Middle Devonian sediments of the Bokkeveld Group (Ceres and Bidouw Subgroups). These marine to estuarine rocks were probably highly fossiliferous originally, containing rich assemblages of shelly invertebrates and trace fossils, as well as drifted land plant remains, fish and microfossils. However, on the southern coastal plain their fossil content has been largely destroyed by intense tectonic deformation during the Permo-Triassic Cape Orogeny (mountain-building event) as well as by deep chemical weathering beneath the so-called "African Surface" under humid tropical climates during the Late Cretaceous to Tertiary period. Exposure of these Palaeozoic rocks is very limited due to extensive cover by superficial sediments (mainly pedocrete lag gravels, soils, alluvium) that are themselves very poorly fossiliferous to unfossiliferous. A variety of Paleogene (Early Tertiary) to Quaternary duricrusts - tough, secondarily cemented superficial deposits (soils, gravels *etc*), including silcretes and ferricretes of the Grahamstown Formation as well as younger calcretes - are present in the study area, but are also largely unfossiliferous. Recent palaeontological field studies in the region have failed to yield significant fossil remains, apart from sparse, low-diversity trace fossils.

It is concluded that the proposed wind farm development will not have any significant impact on the very limited local fossil heritage either in the construction phase or later. No further specialist studies or mitigation of palaeontological heritage for this project are recommended. However, should substantial fossil remains be exposed during development, the responsible ECO should safeguard these, preferably *in situ*, and alert Heritage Western Cape so that appropriate mitigation measures may be considered.

2. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

2.1. Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed wind farm 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.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

3. INTRODUCTION

The company Inca Swellendam 1 Wind (Pty) Ltd, Houghton, is proposing to develop a wind farm with a total capacity of approximately 30 MW and comprising from 10 to 20 wind turbines on a site situated *c*. 30 km southwest of Swellendam in the Western Cape. The study area straddles the R319 tar road linking the N2 trunk road to Bredasdorp and comprises portions 0, 2, 4, and 5, of Farm 432 Goereesoe, currently zoned for agriculture (Figs. 1, 2). The wind farm would be connected to the existing Vryheid substation adjacent to the R319 some 16 km to the northeast by a 66 kV transmission line.

The proposed wind energy project involves the following major components:

- Wind Turbines (with concrete spread foundations, maximum 18m x 18m x 4m deep);
- Construction of hard standing areas (maximum 40m x 20m) for use by cranes during construction and retained for maintenance purposes;
- An electrical transformer for each turbine;
- Gravel access roads on site (using existing roads as far as possible);
- Power line connections (underground cables between wind turbines and possible overhead cables to the existing substation off-site);
- Permanent 80m wind measuring mast (already erected);
- Control Room building (10m x 10m);
- During Construction:
    - Site office *etc*.
    - Temporary lay down areas while setting up the wind turbines.

3.1. Scope of study

An Environmental Impact Assessment is to be undertaken in accordance with the National Environmental Management Act 1998 (Act 107 of 1998), as amended, for the proposed Swellendam, Goereesoe Wind Farm.

The present report forms part of the Basic Assessment Process and EIA for the proposed Goereesoe Wind Farm, falling under Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the Environmental Management Plan for this project. The various categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

A desktop palaeontological assessment as part of the EIA and EMP for the wind farm project has been commissioned by Mr Stefan de Kock of Perception Heritage Planning, George, on behalf of Doug Jeffery Environmental Consultants (Pty) Ltd, Klapmuts. The brief for this study includes:

- A baseline analysis of the palaeontological heritage resources of the property to be developed. The baseline report must include a map of the identified heritage indicators as well as indications of important constraints on the property.
- An indication must be given of how the fossil heritage resources of the site relate to those of the greater area.
- An outline of any further studies that may be required during or after the EIA process.
- Identification of all relevant legislation, permits and standards that would apply to the development.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) are currently being developed by SAHRA. The latest version of the SAHRA guidelines is dated May 2007.

3.2. Assumptions and limitations

In inferring the palaeontological sensitivity of rock units underlying a development from field and other data obtained outside the study area it is assumed that fossil heritage is fairly uniformly distributed throughout the outcrop area of a given formation. Experience shows that this assumption does not always hold. This is because the original depositional setting across a formation that may extend over hundreds of kilometres may vary significantly, with palaeoecological implications (*e.g.* from a shallow to deeper water environment), while fossils are often patchy in their occurrence. Furthermore, the levels of tectonic deformation (folding, cleavage development *etc*), as well as the intensity and nature of metamorphism and weathering experienced by a given formation may change markedly across its outcrop area. These factors may seriously compromise the preservation of fossil remains present within the original sedimentary rock – as is certainly the case for the present project.

3.3. Gaps in knowledge

The major limitation constraining an accurate assessment of subsurface fossil heritage within the present study area is the lack of well-exposed, fresh (*i.e.* unweathered) bedrock in the general region. Few field surveys have been carried out here by professional palaeontologists (*cf* Almond 2010a, 2010b, 2010c).

4. METHODOLOGY

This PIA report provides an assessment of the observed or inferred palaeontological heritage within the study area in particular, with recommendations for specialist palaeontological mitigation where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, (2) published geological maps and accompanying sheet explanations, (3) previous palaeontological assessments of developments in the region (*e.g.* Almond 2010a, 2010b, 2010c); (4) the author's extensive field experience with the formations concerned and their palaeontological heritage.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following scoping during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

On the basis of the desktop and field-based assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Mitigation by a professional palaeontologist – normally

involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) – is usually most effective during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority (*e.g.* Heritage Western Cape for the Western Cape). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

5. DESCRIPTION OF THE SITE

The Goereesoe study area is situated some 30 km southwest of the town of Swellendam, Western Cape. It straddles the R319 tar road linking the N2 trunk road to Bredasdorp and comprises portions 0, 2, 4, and 5, of Farm 432 Goereesoe, currently zoned for agriculture (Figs. 1, 2). The study area is located in the southern coastal plain in a gently undulating, hilly region known as the *rûens* with an altitude range of about 150 to 290m amsl (Fig. 2). The area is dissected by the incised tributaries of small river systems such as the Potbergsrivier that flows southeastwards into the Indian Ocean at Die Mond.

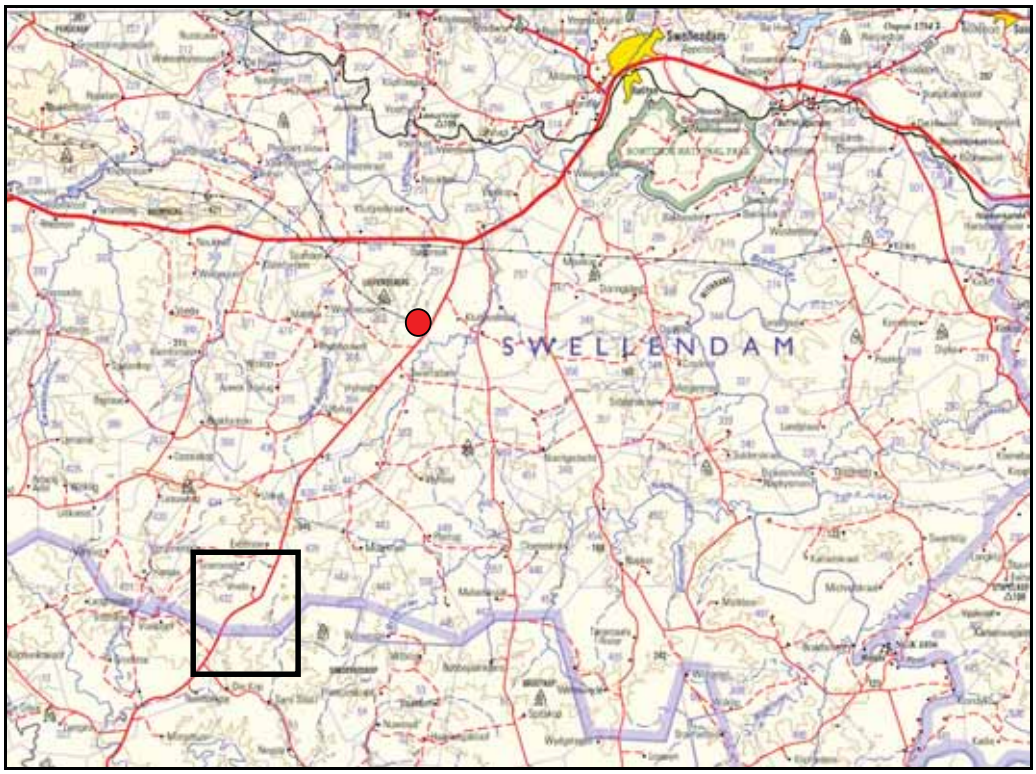

Fig. 1. Abstract from 1: 250 000 topographical map 3420 Riversdale (Courtesy of the Chief Directorate of Surveys & Mapping, Mowbray) showing the approximate location (black rectangle) of the proposed Goereesoe Wind Farm straddling the R319 Bredasdorp tar road *c.* 30 km southwest of Swellendam. The red dot shows the position of the existing Vryheid electricity substation to which the wind farm will be connected.

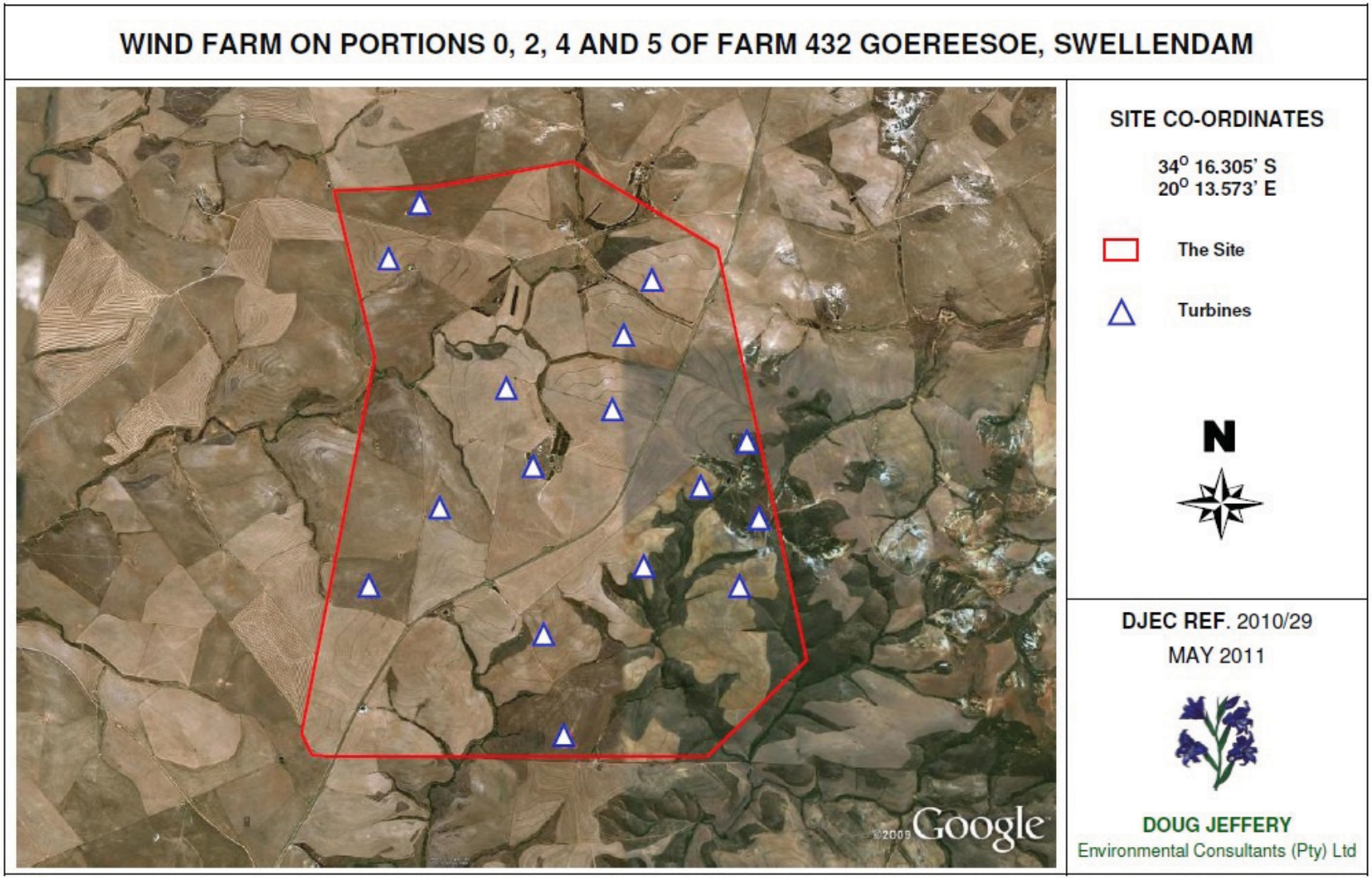

Fig. 2. Outline and provisional wind turbine site plan for the proposed Goereesoe Wind Farm spanning the R319 N2 to Bredasdorp tar road *c.* 30 km southwest of Swellendam (Image prepared by Doug Jeffery Environmental Consultants (Pty) Ltd).

5.1. Geological description of the site

The geology of the study area is depicted on the 1: 250 000 scale geological sheet 3420 Riversdale (Malan *et al.* 1994) (Fig. 3). The *rûens* region is largely underlain by highly deformed and deeply-weathered sedimentary rocks of the Early to Mid Palaeozoic **Cape Supergroup**. The study area is mostly underlain by marine to near-coastal mudrocks and sandstones of the Early to Middle Devonian **Bokkeveld Group**. Beneath the northern half of the study area are sedimentary rocks of the **Ceres Subgroup** (= Lower Bokkeveld Group, Dc) while the southern half is underlain by slightly younger, Mid Devonian sediments of the **Bidouw Subgroup** (= Upper Bokkeveld Group, Dbi). Much of the following account has been abstracted from recent studies on the same region by the author (Almond 2010a, 2010b).

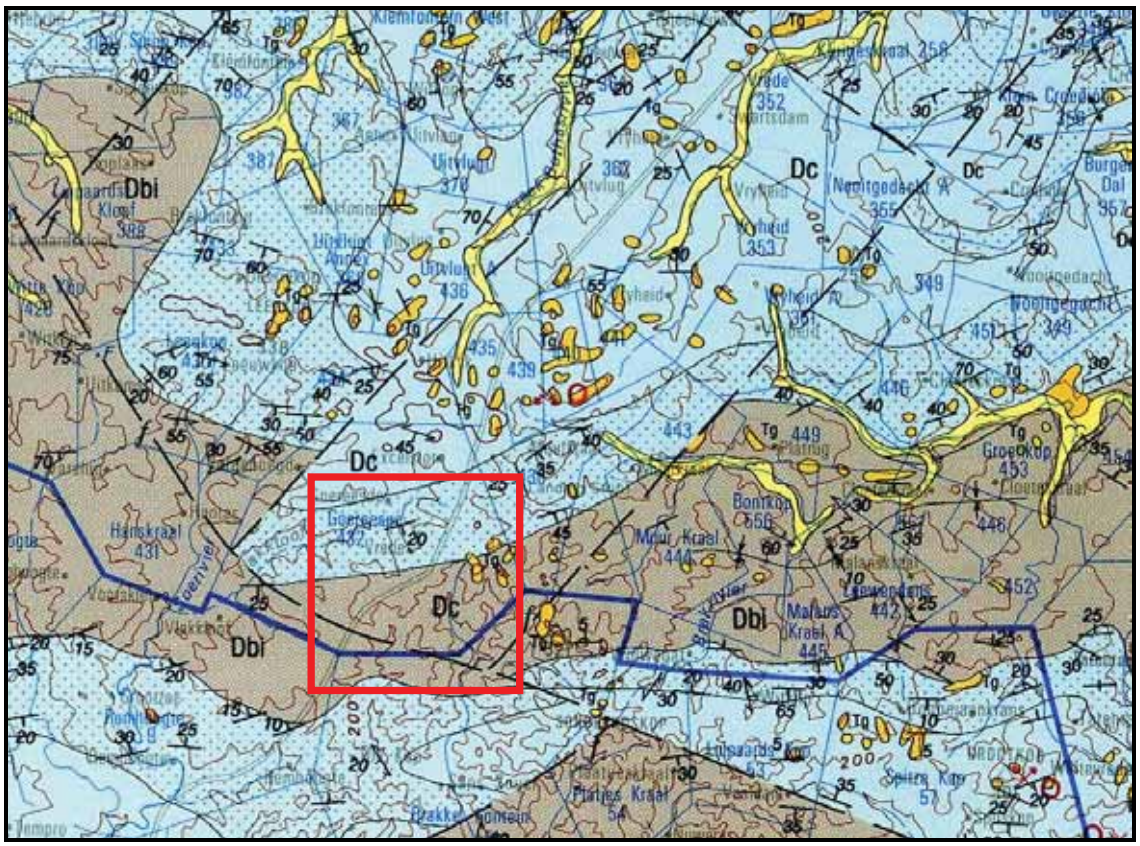

Fig. 3. Geological map of the study area *c.* 30km southwest of Swellendam, Western Cape Province (red square), extracted from 1: 250 000 geological map sheet 3420 Riversdale (Council for Geoscience, Pretoria). The main geological units shown here are:

Dc (pale blue) = Ceres Subgroup of Bokkeveld Group (dotted areas = sandstone-rich zones); Dbi (grey-brown) = Bidouw Subgroup of Bokkeveld Group; Tg (deep yellow) = Grahamstown Formation; pale yellow = Quaternary to Recent alluvium. Note the major NW-SE trending fault line (black dashed line) passing through the southern sector of the study area.

The Bokkeveld Group, the middle unit of the Cape Supergroup, is a thick (*c.* 1.5 to 3.5km) succession of fossiliferous sedimentary rocks which was deposited in shallow marine to coastal settings during the Early to Middle Devonian Period, about 400 to 375 million years ago These sediments accumulated on an area of continental shelf – the Cape Basin – which then lay towards the southern edge of the supercontinent Gondwana at moderately high palaeolatitudes (*c.* 70°S). Key accounts of Bokkeveld Group geology and sedimentology are given by Theron (1972),

Tankard and Barwis (1982), Theron and Loock (1988), Theron and Thamm (1990), Theron and Johnson (1991), Broquet (1992) as well as Thamm and Johnson (2006). An outline of the Lower Bokkeveld Group rocks in the Riversdale sheet area is given by Malan *et al.* (1994). Due to extensive drift cover (alluvium, lag gravels, soils) as well as deep weathering and tectonic deformation, outcrops of fresh Bokkeveld bedrock are not available in this area. For these reasons, as well as the southwards thinning of key sandstone marker horizons, it has not proved possible to distinguish individual formations within the Ceres Subgroup for mapping purposes. However, two sandstone-dominated zones are differentiated on the 1: 250 000 geology map (stippled areas, Fig. 3), the uppermost of which is probably equivalent to the early Mid Devonian (Eifelian) Boplaas Formation.

According to classical, broad-scale studies of the geomorphic (landscape) evolution of southern Africa much of the southern coastal plain south of the Cape Fold Belt forms part of the so-called **African Surface** (King 1962, Partridge & Maud 1987, 2000, Partridge 1998, Marker & McFarlane 1997) (Fig. 4). This ancient, relict land surface is considered to have developed over a period of some 40 to 60 million years following the break-up of the supercontinent Gondwana, *i.e.* during the Cretaceous to Paleogene (Early Tertiary) Periods, and to have been affected by subsequent tectonic movements, crustal warping and erosional dissection. As a result of deep chemical weathering under humid, tropical climates and long periods of tectonic stability, the surface is characterized by deeply weathered *saprolite* (*in situ* weathered bedrock) and capped by *duricrusts* of silcrete and/or ferricrete reflecting the increased mobility of silica and iron under these circumstances (Marker & McFarlane 1997, Marker *et al.* 2002). Purported remnants of the African Surface are concentrated in the Caledon-Swellendam, Heidelberg-Riversdale, Albertinia-Mossel Bay and Grahamstown areas along the south and southeast coast. Detailed studies in the Albertinia area recognise elements of this composite surface lying between 120 and 400m+ above sea level and demonstrate that it is multiple in nature, with at least four subcomponents (here at 120-140m, 200m+, 330m +, and 380-400m+ asl), and that it is clearly polycyclic in origin (Marker & McFarlane 1997). Indeed, the existence of an extensive, recognisable African Surface has been questioned by recent workers such as Roberts (2003). He argues that multiple episodes of landscape erosion and duricrust formation, influenced by a complex interplay of tectonic, eustatic and climatic factors, have occurred during the Late Mesozoic to Pleistocene interval, several of which are conflated within the classic concept of the African Surface. In his view "This term should be confined to the (very) few instances where a surface can be demonstrated to have undergone only one cycle of erosion and weathering since the dismemberment of Gondwana".

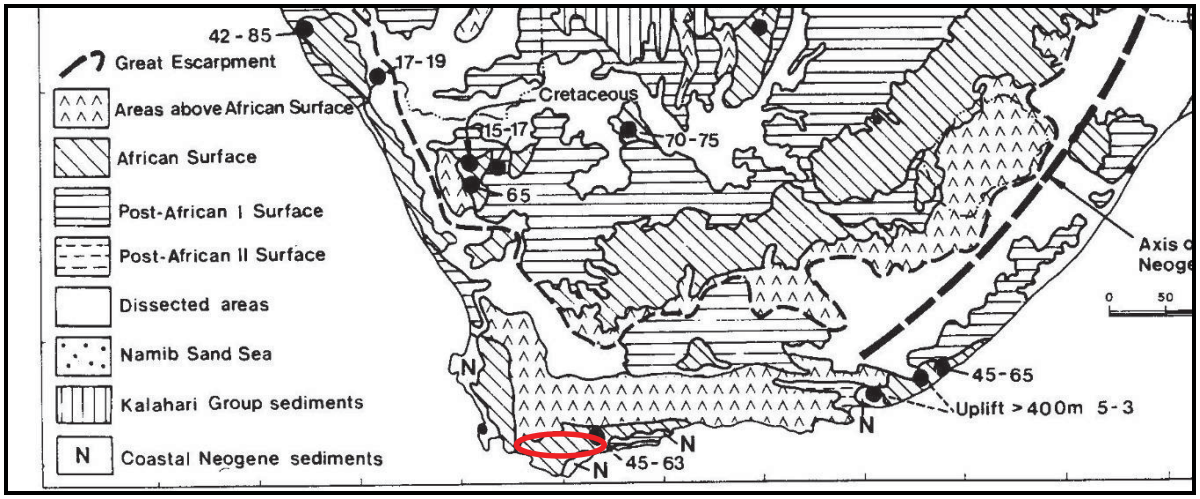

Fig. 4. Major geomorphic regions in southern Africa (Modified from Partridge 1998). Note southern Cape coastal belt study region (red ellipse) is assigned here to the so-called African Surface.

The most extensive exposures of Bokkeveld Group rocks in the study area are found in several roadcuts along the R319 as well as a number of small dams and streams and rocky koppies (Almond 2010a, 2010b) (Figs. 5-6). Due to deep chemical weathering beneath the "African Surface" - which may extend to depths of 40-100m beneath the land surface in the southern coastal belt (Marker *et al.* 2002) – fresh Bokkeveld bedrock is almost nowhere seen in this region. The clay-rich Bokkeveld mudrocks have been extensively altered to kaolinite-rich saprolite showing variously white, khaki, ochreous, maroon to pinkish hues. Recently exposed sections through these relatively incoherent rocks may develop honeycomb weathering. Lateritic weathering has also led to the segregation of iron-rich minerals as dark blackish to purple or rusty veins and patches within the generally pallid saprolite (Marker *et al.* 2002). Original medium- to small-scale sedimentary and tectonic features such as bedding, cleavage and lamination are often preserved, but occasionally the saprolite is massive. Greyish to buff sandstone-rich successions often show distinctive swaley to hummocky cross-lamination indicating deposition by major storms in an offshore / lower shoreface setting. Most sandstones are fine to medium-grained, micaceous "impure" wackes with a tabular to lenticular geometry. Thinner tempestite sandstones with wave-rippled tops are interbedded with wavy laminated siltstones to form heterolithic intervals which may contain small-scale coarsening-upwards (shoaling) parasequences. Fresher mudrocks are mainly grey to grey-green, wavy rippled to flat-laminated siltstones. Small-scale "rhythmitites" consisting of stacked coarsening-upwards cycles a few cm thick represent distal turbidites or tempestites deposited on the offshore shelf.

Bokkeveld mudrock facies here generally display a pronounced tectonic cleavage, usually but not always dipping steeply southwards, and this is also developed in clay-rich "dirty" sandstones or wackes. Cleavage facilitates penetration and movement of groundwater and hence chemical weathering. High levels of tectonic deformation (folding and faulting) of the original well-bedded Bokkeveld succession is also indicated by convolute to crumpled bedding, steep and variable dips, numerous small-scale faults (including low-angle thrusts), extensive quartz veining, boudinage of more competent sandstones, and brecciated zones.

Several small, relictual patches of *in situ* Tertiary-age silcretes, ferricretes and associated lag gravels capping deeply weathered Bokkeveld saprolite are assigned to the **Grahamstown Formation** (Tg), often capping flat-topped *koppies* (Fig. 7). These appear as small, dark yellow blobs on the geological map, for example in the eastern part of the study area (Fig. 3). These resistant-weathering duricrusts represent secondarily cemented fluvial and other superficial drift deposits, as well as downwasted gravels derived from older or higher-lying weathering profiles (Summerfield 1983, Malan *et al.* 1994, Marker & McFarlane 1997, Botha 2000, Marker *et al.* 2002, Roberts 2003). The genesis of South African near-surface silcretes on alluvial plains and terraces has been discussed extensively by Roberts (2003) who relates them to episodes of poor-drainage and moist, humid climates following long periods of tectonic stability. The majority of silcretes on the coastal platform of the southeastern Cape are inferred to be Paleogene in age, though some may well be Neogene. They reflect multiple periods of silica solution and precipitation. Their complex, polycyclic origin is indicated by the wide spectrum of contracting facies seen within the silcrete cappings. They range from massive, grey to buff fine-grained silcretes showing a well-developed conchoidal fracture (extensively exploited for stone tools in the study area) that are formed from fine-grained sands and silicified saprolite, to vein quartz - rich gravelly silcretes and spectacular silcretized breccio-conglomerates containing cobble and boulder-sized megaclasts of reworked, older silcrete. The rounding of some silcrete intraclasts implies a measure of current transport (but may be enhanced by conchoidal fracture). Silcrete duricrusts in the study afrea reach thicknesses of several meters, with sheet-like geometries, and may show a crude bedding. Vuggy silcretes are common, and cavernous weathering is seen locally. Typically the silcrete cappings overlie pallid to ferruginised saprolite.

Within a given duricrust capping, buff silcretes often grade laterally or vertically into darker brown ferruginised silcrete and full-blown ferricrete facies. Well-developed, *in situ* ferricretes are relatively uncommon within the study area, though ferricretised silcretes are certainly observed, varying from massive, fine-grained forms with a dark brown to rusty hue and conchoidal fracture to coarse,

ferruginised breccio-conglomerates. However, abundant nodular ferricrete blocks (*e.g.* within stone heaps at the edge of fields) and ferruginous gravels point to the previous abundance of ferricrete horizons within higher levels of lateritic weathering profiles here. Beneath ferricrete horizons the saprolite is often ochreous rather than white. According to Roberts (2003) and Roberts *et al.* (2008) the formation of silcretes and ferricretes was often contemporaneous and controlled by fluctuating hydrological and geochemical conditions, with low (acidic) pH favoring ferricrete and higher (alkaline) pH favouring silcrete genesis. The widespread occurrence of laterite weathering, with leaching of bases and silica and enrichment in iron, on the southern coastal plain is documented by Marker *et al.* (2002) and attributed to a protracted period of humid climates in the Tertiary. Silcretes may be preferentially preserved over ferricretes because the latter often occur higher in the weathering profile and are less indurated, so they are more prone to subsequent denudation.

Calcretes (limestone pedocretes) are much less abundant than silcretes or ferricretes in the study area but they are also found locally. Near-surface networks of calcrete veins invade well-cleaved Bokkeveld mudrocks in several road cuttings. These carbonate-rich pedocretes reflect the semi-arid climates of the Pliocene to Recent interval and are therefore younger than most of the silcretes and ferricretes that formed under earlier humid, subtropical climatic regimes.

A wide spectrum of **superficial deposits** or “drift” mantles the weathered Bokkeveld bedrocks in the study area and may reach depths of a meter or more. Surface gravels are locally dominated by milky (vein) quartz, Table Mountain quartzites, slaty Bokkeveld mudrocks, platy to irregular Bokkeveld sandstone clasts, brown silcretes, and spotted black, dark red to ochreous nodular ferricretes (mainly goethite with subordinate haematite). These gravels often have a reddish ferruginous, fine-grained matrix. Many of the pedocrete clasts (*e.g.* most ferricretes) are downwasted lags from duricrust horizons that once lay higher up within the, now deeply denuded, “African Surface” weathering profiles. This is clearly seen in the case of aprons of colluvial ferricrete gravels mantling hillslopes below relict duricrust caps. Rounding of many clasts as well as shallow channel incision of gravels into weathered bedrock point towards a degree of current transport, but downslope gravity-driven colluvial processes also play a role in their accumulation. Larger float blocks have often been collected by farmers into heaps at the edges of fields. Sections through finer-grained soils and silty to gravely alluvium are exposed around dams as well as in stream banks and excavations into stream beds.

Fig. 5. Multi-hued saprolite (*in situ* weathered bedrock) showing folding and faulting of the well-bedded Ceres Subgroup rocks, road cutting along R319 just north of the Goereesoe study area (From Almond 2010a).

Fig. 6. Ceres Subgroup sandstone-dominated succession (possibly the Boplaas Formation) showing low angle thrust fault (dashed line) and décollement, R319 road cutting a few km north of the Goereesoe study area (From Almond 2010a).

Fig. 7. Crudely-bedded silcrete capping near Uitkyk farmstead just to the north of the Goereesoe study area (Hammer = 30cm) (From Almond 2010a).

6. PALAEONTOLOGICAL HERITAGE

In this section of the PIA report the recorded fossil record of each geological unit that is mapped within the study area, as listed in Section 3 above, is outlined, together with an indication of its overall sensitivity to development (See also summary in Table 1 herein). Much of this data has been derived from previous impact studies on similar rocks in the Overberg region by the author (*e.g.* Almond 2010a, 2010b, 2010c).

6.1. Ceres Subgroup (Palaeontological sensitivity generally HIGH, but VERY LOW in study area due to deformation and weathering)

The lower part of the Bokkeveld Group in the Western Cape (Ceres Subgroup *plus* lowermost Bidouw Subgroup) is known for its rich fossil assemblages of shallow marine invertebrates of the Malvinokaffric Faunal Province of Gondwana (Cooper 1982, Oosthuizen 1984, Hiller & Theron 1988, Theron & Johnson 1991, MacRae 1999, Almond *in* De Beer *et. al*. 2002, Thamm & Johnson 2006, Almond 2008). Key fossil groups here include trilobites, brachiopods, various subgroups of molluscs (bivalves, gastropods, nautiloids *etc*), and echinoderms (starfish, brittle stars, crinoids, carpoids *etc*), with several minor taxa including corals, conulariids, tentaculitids and rare fish remains, among others. These shelly fossil assemblages – generally preserved as impressions or moulds, but occasionally in the Gydo Formation also embedded within phosphatic or siliceous nodules – are especially abundant within the mudrock-dominated units such as the Gydo, Voorstehoek and Waboomberg Formations in their more distal (offshore) outcrop areas. Remarkably diverse and well-preserved assemblages of marine trace fossils (burrows, trackways *etc*) occur in heterolithic (*i.e.* interbedded sandstone and mudrock) facies of the northern, more proximal outcrop area of the Ceres Subgroup (Swart 1950, Theron 1972, Oosthuizen 1984, Almond 1998a, 1998b, De Beer *et al*. 2002, Almond 2008). However, these have not been extensively recorded from the more distal, southern outcrop area.

No shelly or trace fossils at all were observed during the field studies of Lower Bokkeveld Group sandstones and mudrocks in the Swellendam area by Almond (2010a, 2010b). Malan *et al.* (1994) only record lycopod (clubmoss) impressions, indeterminate trace fossils and occasional crinoid moulds within sandstones of the Ceres Subgroup in the Riversdale sheet area. The rarity of Bokkeveld fossil records here may be attributed to several factors, notably:

- deep chemical weathering of sediments beneath the “African Surface” which has obliterated fossil moulds
- intensive tectonic deformation of the Bokkeveld succession, with pervasive cleavage formation within the normally fossiliferous mudrocks (*N.B.* Most fossils are preserved and seen on bedding planes, which are rarely exposed here, rather than secondary cleavage planes which cut across fossil-rich layers)
- the extensive mantle of drift deposits (including lag gravels, soil and pedocretes) covering the Bokkeveld bedrock

It is also possible that the more distal, offshore, muddy settings within Agulhas Sea where these Bokkeveld Group sediments were deposited were somehow less favourable for the development of a thriving shelly benthos, perhaps due to frequent bottom anoxia, but this is largely speculative. Even where small scale sedimentary features such as ripple cross-lamination are preserved, no clear evidence for bioturbation or discrete trace fossils was observed (including on float slabs collected in stone heaps).

6.2. Bidouw Subgroup (Palaeontological sensitivity generally HIGH, but VERY LOW in study area due to deformation and weathering)

The lowermost part of the Bidouw Subgroup in the Western Cape is known for its rich fossil assemblages of shallow marine invertebrates of the Malvinokaffric Faunal Province of Gondwana (Cooper 1982, Oosthuizen 1984, Hiller & Theron 1988, Theron & Johnson 1991, MacRae 1999, Almond *in* De Beer *et. al*. 2002, Thamm & Johnson 2006, Almond 2008). Key fossil groups here include trilobites, brachiopods, various subgroups of molluscs (bivalves, gastropods, nautiloids *etc*), and echinoderms (starfish, brittle stars, crinoids, carpoids *etc*), with several minor taxa including corals, conulariids, tentaculitids and rare fish remains, among others. These shelly fossil assemblages – generally preserved as impressions or moulds – are especially abundant within the finer-grained, mudrock-dominated units such as the Waboomberg Formations in their more distal (offshore) outcrop areas. Remarkably diverse and well-preserved assemblages of marine trace fossils (burrows, trackways *etc*) occur in heterolithic (*i.e.* interbedded sandstone and mudrock) facies of the northern, more proximal outcrop area of the Bokkeveld Group (Swart 1950, Theron 1972, Oosthuizen 1984, Almond 1998a, 1998b, De Beer *et al*. 2002, Almond 2008). However, these have not been extensively recorded from the more distal, southern outcrop area.

An important, albeit low-diversity, fossil biota has been recorded from the Bidouw Subgroup (Klipbokkop and upper Kanies Formations in the western Bokkeveld outcrop area) as well as from laterally equivalent Middle Devonian sediments to the east (the Adolphspoort Formation of the Traka Subgroup; Plumstead 1977, Chaloner *et al.* 1980, Anderson & Anderson 1985, Almond 1997, Anderson *et al.* 1999a, 1999b, Anderson *in* MacRae 1999, Almond 2008b, 2009). The Klipbokkop / Adolphspoort fossil assemblages are mainly preserved as moulds and comprise:

- Fragmentary vascular plants, including several species of lycopods (the club mosses *Archaeosigillaria*, *Haplostigma*) *plus* possible psilopsids.
- Non-marine, thin-shelled bivalves (possibly unionids), often preserved in dense clumps.
- Rare marine invertebrates (*e.g.* the articulate brachiopod *Australospirifer*).
- A limited variety of trace fossils including rare trilobite burrows (*Cruziana*), and unusually small versions of the complex helical burrow *Spirophyton*.
- A low-diversity assemblage of bony and cartilaginous fish, including acanthodians ("spiny sharks"), several primitive sharks, bony-plated jawed fish known as placoderms (Fig. 20), and rare crossopterygians (lobe-finned bony fish). These important Middle Devonian fossil fish have been described and illustrated in detail by Chaloner *et al.* (1980), Almond (1997), Anderson *et al.* (1999a, 1999b) and Long *et al*. (in prep). General accounts of Devonian fish groups from Gondawana are given by Anderson *in* MacRae (1999) and Long (1995).

Klipbokkop fish fossils mainly consist of disarticulated placoderm plates as well as isolated teeth and fin spines of antarctilamnid sharks and acanthodians. The fossils are found scattered throughout the succession within silty mudrocks and occasionally within ferruginous carbonate-rich concretions. Thin conglomeratic layers of transported mudflakes mixed with fish teeth, spines and other skeletal elements are recorded from the mid to upper Klipbokkop Formation in the Cederberg region. Those parts of the succession with unionid-like bivalves, low-diversity trace assemblages dominated by small *Spirophyton*, vascular plants and fish fossils are considered to be non-marine in origin, perhaps accumulated on an extensive delta platform or prograding (advancing) shoreline zone. A mixture of fish originally from brackish to freshwater bodies near to the coastline (estuaries, lagoons, rivers. lakes) as well as salinity-tolerant marine forms may be represented in the fossil assemblages.

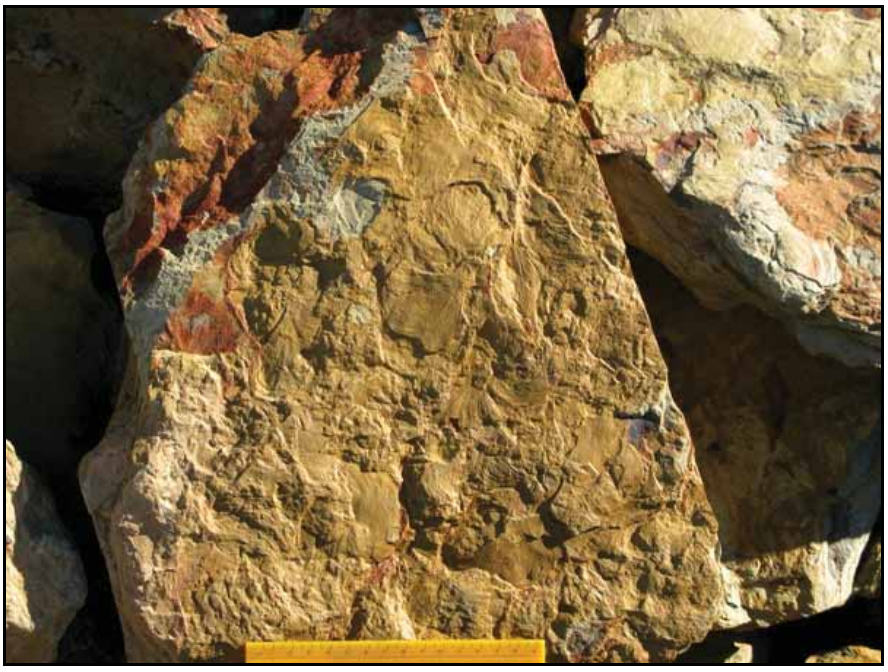

Fig. 8. Abundant feathery burrow systems of the ichnogenus *Spirophyton* covering bedding plane of Bidouw Subgroup sandstone, Riversdale area (Scale = *c.* 15cm) (From Almond 2010c)..

No shelly invertebrate, vascular plant or fish fossils at all were observed during the previous field study of Upper Bokkeveld Group sandstones and mudrocks in the nearby Heidelberg area by Almond (2010c), and there are no fossil records from these rocks mentioned in the Riversdale sheet explanation by Malan *et al.* (1994). The striking rarity of Bokkeveld fossil records here may be attributed to the same factors outlined above for the Ceres Subgroup. Where small scale sedimentary features such as ripple cross-lamination are preserved evidence for *bioturbation* (sediment churning by infaunal animals) and occasionally discrete trace fossils may be present (Almond 2010c). The most prominent trace fossils are the small to large (5-15cm diameter) deep tier burrow systems of the ichnogenus *Spirophyton* (Fig. 8). *Spirophyton* burrows characterise much of the marine-influenced upper part of the Cape Supergroup. These complex, helical burrow systems are interpreted as *agrichnia* ("gardening burrows") that were generated by an unknown group of invertebrate "worms" and during the Palaeozoic Era and are frequently associated with episodes of low oxygen supply on the sea bed. The size of the burrow system may be related to the level of environmental stress, with smaller "whorls" associated with more challenging inshore settings such as brackish estuaries and deltas whereas more predictable offshore habitats supported larger-diameter burrow systems (Miller 1991, Seilacher 2007).

6.3. Caenozoic duricrusts (Overall palaeontological sensitivity = LOW)

Sparse fossil remains have been recorded from Tertiary or younger silcretes of the Grahamstown and equivalent formations by Roberts (2003) and earlier authors. These include a small range of trace fossils (*e.g.* rhizoliths or plant root casts and invertebrate burrows such as *Skolithos*), charophyte algae (calcareous stoneworts), reed-like wetland plants resembling the extant *Phragmites* (*fluitjiesriet*), and reworked Late Permian silicified wood from the Beaufort Group (See also Adamson 1934, Du Toit 1954, and Roberts *et al.,* 1997). Silicified termitaria might also be expected here, although termite activity is inhibited by waterlogged soils that probably prevailed in areas where silcrete formation occurred. Narrow, regularly-spaced vertical tubes seen within many silcretes, including examples in the study area, are apparently abiogenic and not relictual root structures (Roberts 2003, p. 3 and his fig. 2.6).

No fossils were observed within the Caenozoic duricrusts of the study region by Almond (2010a, 2010b).

6.4. Caenozoic drift deposits (Overall palaeontological sensitivity = LOW)

Neogene to Recent alluvial deposits may also contain fossil remains of various types (Table 1). In coarser sediments (*e.g.* conglomerates) these tend to be robust, highly disarticulated and abraded (*e.g.* rolled bones, teeth of vertebrates) but well-preserved skeletal remains of plants (*e.g.* wood, roots) and invertebrate animals (*e.g.* freshwater molluscs and crustaceans) as well as various trace fossils may be found within fine-grained alluvium. Human artefacts such as stone tools that can be assigned to a specific interval of the archaeological time scale (*e.g.* Middle Stone Age) can be of value for constraining the age of Pleistocene to Recent drift deposits like alluvial terraces. Ancient to modern alluvial and colluvial "High Level Gravels" tend to be coarse and to have suffered extensive reworking (*e.g.* winnowing and erosional downwasting), so they are generally unlikely to contain useful fossils.

No fossils were observed within the Caenozoic drift deposits in the study region by Almond (2010a, 2010b).

TABLE 1. Fossil record of the main rock units represented in the study area. The palaeontological sensitivity of all the rock units is rated as low to very low. This is often due to high levels of tectonic deformation and chemical weathering (*e.g.* Bokkeveld Group)

GROUP		FORMATION & AGE	ROCK TYPES	FOSSIL BIOTA	COMMENTS
LATE CAENOZOIC SUPERFICIAL SEDIMENTS		**Alluvial & colluvial gravels, soils, silty alluvium, calcretes** Neogene - Recent	Bouldery to pebbly or gravelly alluvial gravels, sands, silts, near-surface calcretes	disarticulated to well-articulated skeletal remains (bones, teeth) or mammals, reptiles (*e.g.* tortoises), ostrich egg shells, freshwater molluscs, crabs, plant remains, trace fossils (*e.g.* rhizoliths, termitaria and other invertebrate burrows, vertebrate tracks), microfossils (*e.g.* pollens, spores, ostracods)	"High Level Gravels" are coarse, often semi-consolidated, ancient fluvial deposits at high elevations above the modern drainage systems. These are often mapped as part of the Grahamstown Formation.
		Grahamstown Formation (Tg) Paleogene (majority) to Neogene	Silcretes & ferricretes - cemented superficial deposits (gravels, sands, muds *etc*) overlying deeply-weathered and silicified bedrock (*saprolite*)	rare fossil plants (*e.g.* reedy *Phragmites*), charophyte algae (stoneworts), invertebrate burrows (*e.g. Skolithos*) occasional derived fossils (*e.g.* silicified wood from the Permian Beaufort Group)	Composite unit incorporating pedocretes of varying ages and origins, often polycyclic in origin (*i.e.* several phases of silica cementation, solution and erosion)
BOKKEVELD GROUP	BIDOUW SUBGROUP	**Several poorly differentiated formations (Dbi)** Middle Devonian	Shallow marine to coastal (deltaic / estuarine) wackes and micaceous mudrocks as well as clean-washed tempestite sandstones	Rich, diverse shelly biotas in lowermost part of succession, dominated by trilobites, brachiopods, molluscs and echinoderms *plus* various minor groups. Microfossils within mudrocks (*e.g.* organic-walled acritarchs). Upper Bidouw succession (*e.g.* Klipbokkop Fm) with important non-marine fish (sharks, placoderms, acanthodians *etc*), primitive vascular plants (*e.g.* lycopods), non-marine bivalves, trace fossils (especially *Spirophyton*).	In study area fossil remains have been largely obliterated by intense tectonic deformation and chemical weathering. Bedrock exposure here very poor due to extensive superficial deposits.
	CERES SUBGROUP	**Several poorly differentiated formations (Dc)** Early – Mid Devonian	Shallow marine wackes ("dirty" sandstones) as well as clean-washed tempestite sandstones, predominantly grey, silty or clay-rich mudrocks	Rich, diverse shelly biotas dominated by trilobites, brachiopods, molluscs and echinoderms plus various minor groups (*e.g.* fish) Primitive vascular plants in some sandstones. Microfossils within mudrocks (*e.g.* organic-walled acritarchs).	In study area fossil remains have been largely obliterated by intense tectonic deformation and chemical weathering. Bedrock exposure here very poor due to extensive superficial deposits.

7. ASSESSMENT OF IMPACTS ON FOSSIL HERITAGE

The proposed Goereesoe Wind Farm is located in an area that is underlain by potentially fossil-rich sedimentary rocks of Palaeozoic and younger, Tertiary or Quaternary age (Sections 5, 6). The construction phase of the development will entail substantial excavations into the superficial sediment cover as well as the underlying bedrock. These notably include excavations for the turbine foundations (18m x 18m x 4m deep) and a new 66 kV power line, as well as new gravel access roads. In addition, substantial areas of bedrock will be sealed-in or sterilized by infrastructure such as hard standing areas for each wind turbine, any lay down areas (these may well be temporary, however) as well as the new gravel road system. All these developments may adversely affect potential fossil heritage within the study area by destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

The Goereesoe study area is largely underlain by Early to Mid Devonian marine sediments of the Bokkeveld Group (Ceres and Bidouw Subgroups). By comparison with coeval sediments inland and to the north, these rocks were probably once highly fossiliferous, containing rich assemblages of shelly invertebrates and trace fossils as well as drifted land plant remains, fish and microfossils. However, on the southern coastal plain their fossil content has been largely destroyed by intense tectonic deformation in the Permo-Triassic Cape Orogeny (mountain-building event) as well as by deep chemical weathering under humid tropical climates during the Late Cretaceous to Tertiary period beneath the so-called “African Surface”. Exposure of these Palaeozoic rocks is very limited due to extensive cover by superficial sediments (mainly lag gravels, soils, alluvium) that are themselves very poorly fossiliferous to unfossiliferous. A variety of Paleogene (Early Tertiary) to Quaternary duricrusts - tough, secondarily cemented superficial deposits including silcretes, ferricretes and calcretes - are present in the study area but these are also largely unfossiliferous. No fossil remains were noted within this region during previous field-based studies (Almond 2010a, 2010b) and there are very few records of fossils from this region in the literature. The effective paleontological sensitivity of the Bokkeveld Group and younger sedimentary rocks in the study area is consequently now very low.

The overall impact significance of the construction phase of the proposed wind farm project is correspondingly low (*negative*) (Table 2). However, should fossils be discovered during construction and reported by the responsible ECO to a heritage management authority (Heritage Western Cape) for possible recording and collection, as recommended, the overall impact significance of the project would change to low (*positive*).

The operational and decommissioning phases of the wind energy facility will not involve further significant adverse or other impacts on palaeontological heritage.

8. RECOMMENDATIONS

Given the low significance of the proposed wind farm development on fossil heritage, no further specialist palaeontological studies or mitigation measures are considered necessary.

However, should substantial fossil remains be exposed during development, the responsible ECO should alert Heritage Western Cape so that appropriate mitigation measures may be considered.

9. CUMULATIVE IMPACTS

Cumulative impacts cannot be assessed unless details of all relevant development projects in the study region are available. There are at least two other small wind farm proposals for the region southwest of Swellendam (*cf* Almond 2010a, 2010b).

10. IMPACT TABLES

Inferred impacts during the construction phase of the proposed Goereesoe wind farm project on local palaeontological heritage are summarized in Table 2 below.

Note that the operational and decommissioning phases of the wind energy facility will not involve further significant adverse or other impacts on palaeontological heritage.

Alternative layouts for the wind farm are not currently being considered.

11. MANAGING & MONITORING REQUIREMENTS

The ECO responsible for this development should be alerted of the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered or exposed during development, the responsible ECO should alert Heritage Western Cape so that appropriate mitigation measures may be considered.

These recommendations should be incorporated into the EMP for the development.

12. CONCLUSIONS

Because the sedimentary rocks in the Goereesoe wind farm study area are either poorly fossiliferous, or their original fossil content has been largely destroyed by tectonic deformation and weathering, it is concluded that the proposed wind farm development will have a very low impact on the very limited local fossil heritage, whether during the construction phase or later. No further specialist studies or mitigation of palaeontological heritage for this project are recommended. However, should substantial fossil remains be exposed during development, the responsible ECO should alert Heritage Western Cape so that appropriate mitigation measures may be considered. Mitigation in the form of fossil recording and collection will have a *positive* impact on our appreciation of local fossil heritage.

13. ACKNOWLEDGEMENTS

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TABLE 2: Summary of impacts on fossil heritage during the construction phase

Alternative	**Nature of impact**	**Extent of impact**	**Duration of impact**	**Intensity**	**Probability of occurrence**	**Status of the impact**	**Degree of Confidence**	**Level of Significance**	**Significance After mitigation**
N/A	Destruction, disturbance or sealing-in of buried fossils during bedrock excavations and construction work	Local, restricted to immediate development footprint	Permanent	Low, since local fossil heritage is very sparse	Improbable, since local fossil heritage is very sparse	Negative (without mitigation) Positive (with mitigation)	High, based on extensive field experience of the rocks involved	LOW, since local fossil heritage is very sparse	Low, since any mitigation measures, *e.g.* recording and collection of newly exposed fossils, will reduce the impacts further

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