Botanical Assessment for a proposed wind energy facility at Copperton, Northern Cape

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REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Wind Energy Facility at Copperton, Northern Cape

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4.2 The specialist appointed in terms of the Regulations_

I, **David Jury McDonald** , declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Bergwind Botanical Surveys and Tours CC.

Name of company (if applicable):

26 October 2011

Date:

CONTENTS

1. Introduction

Aurecon South Africa (Pty) Ltd has been appointed by Plan 8 Infinite Energy (Pty) Ltd (the applicant) to conduct the environmental assessment process for a possible wind energy facility on Struisbult Farm (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5), near Copperton in the Northern Cape. The study is conducted in terms of the National Environmental Management Act (No.7 of 1998) as amended. Bergwind Botanical Surveys & Tours CC was appointed by Aurecon on behalf of the applicant, to carry out a botanical assessment of the designated property to support the environmental impact assessment process. The purpose of the botanical impact assessment is to inform the environmental assessment on (a) the suitability of the site from a botanical viewpoint and (b) to determine any constraints that should be implemented to conserve the vegetation and flora (sensitivity analysis) while permitting the development to continue.

The wind energy facility would consist of fifty-six (56) horizontal-axis wind turbines that would be connected by underground cables to a main cable that will link to Cuprum Substation which in turn would link to the National Grid. Furthermore, an existing airstrip would be moved east of its current location and re-established on Portions 1 and 2 of Farm No. 105. The location of each turbine and the underground cables will be assessed as to their potential impact on natural vegetation. The impacts on the vegetation of the proposed layout of wind-turbines, access roads, cable-runs and airstrip are discussed below.

The principles, guidelines and recommendations of CapeNature [Western Cape] (although the study is in the Northern Cape) and the Botanical Society of South Africa for proactive assessment of the biodiversity of proposed development sites are followed (Brownlie 2005, De Villiers *et al*. 2005).

2. Terms of Reference

- Gather information on the botanical status of the project area through a review of existing and available information;
- Provide a broad description of the botanical characteristics of the site and surrounds;
- Identify and describe biodiversity patterns at community and ecosystem level (main vegetation type, plant communities in vicinity and threatened/ vulnerable ecosystems species), at species level (Red Data Book species, presence of alien species) and in terms of significant landscape features;
- Compile an assessment of the potential direct and indirect and cumulative impacts

resulting from the proposed development (including the wind turbines, associated infrastructure e.g. access roads), both on the footprint and the immediate surrounding area during construction and operation;

- Comment on whether or not biodiversity processes would be affected by the proposed project, and if so, how these would be affected;
- Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and improve positive impacts for each phase of the project, where required; and
- Cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005) as well as the requirements of the Botanical Society of South Africa (BotSoc) and CapeNature in developing an approach to the botanical investigation.

Figure 1. Location of Copperton (black dot) in the Northern Cape Province.

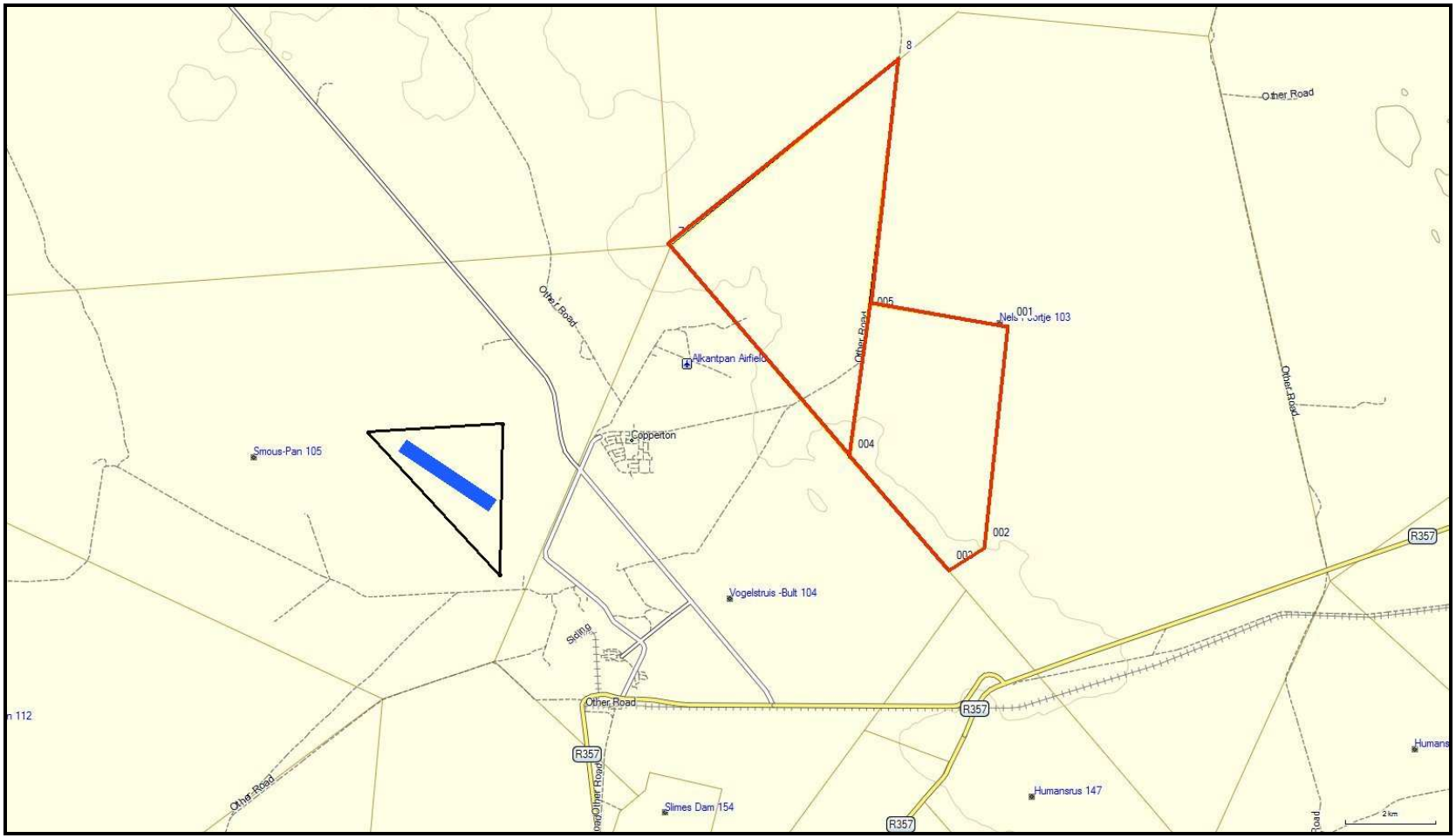


Figure 2. Topographic map of the study site at Struisbult Farm (red boundary) and the proposed new airstrip (black triangle with blue strip) in relation to Copperton. Note the low relief with altitude around 1 100 m above mean sea level.

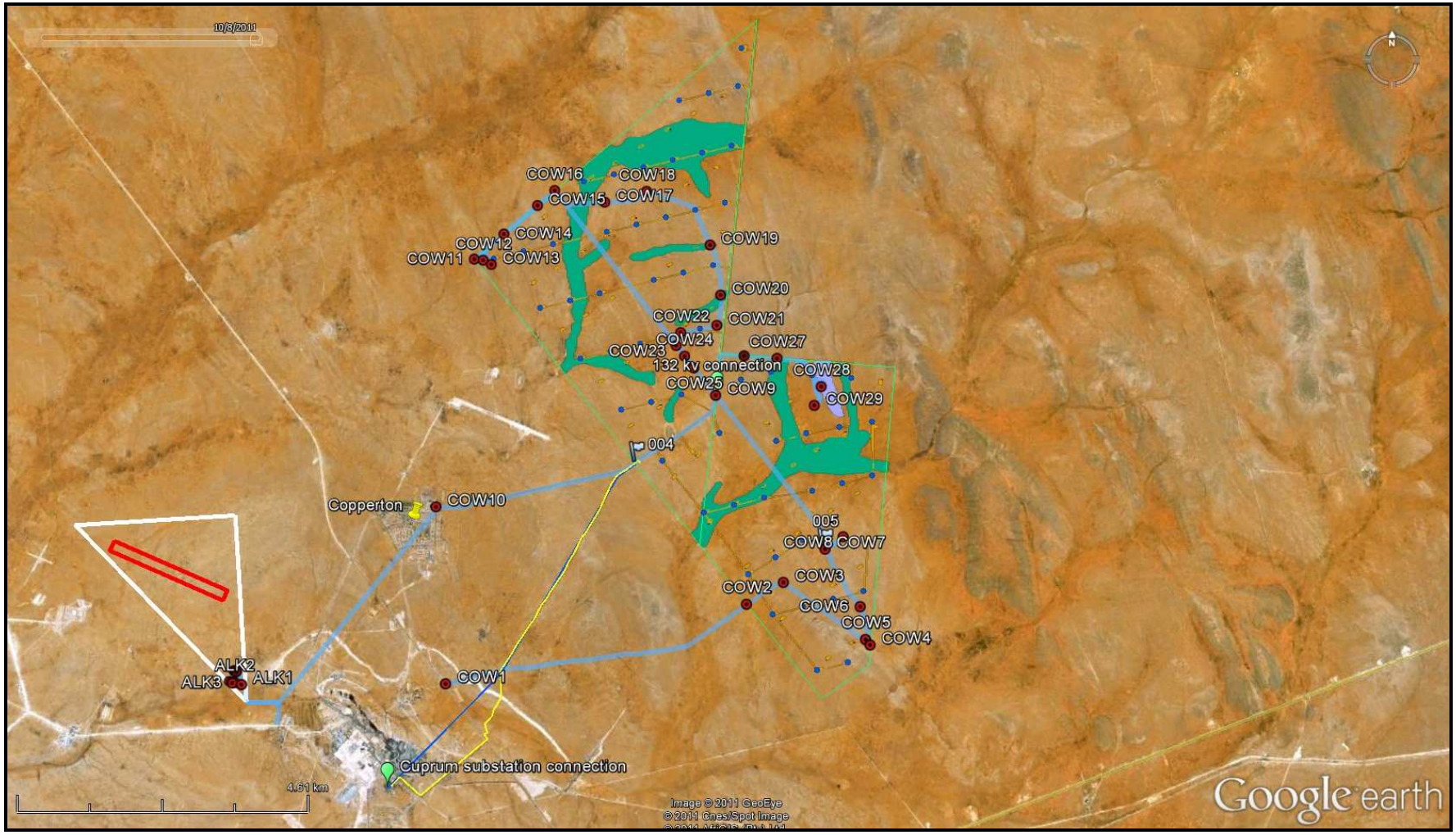


Figure 3. Aerial image (Google Earth ™) of the study area (green boundary) and the proposed area for the new Alkantpan airfield (white boundary). The botanical sample waypoints are shown as COW# with red dots. The sample track followed is indicated as a light blue line. Proposed turbine positions are shown as blue dots.

3. Study Area

3.1 Locality

The study area, Struisbult Farm lies approximately 3 km northeast of the small town of Copperton (45 km directly south-west of Prieska) in the Northern Cape Province (Figure 1). The northern sector of the site is triangular and the southern sector trapezoidal in shape. The area covered is approximately 3 000 ha. The area within which the relocated airstrip would be located is approximately 385 ha.

The site falls within the Nama Karoo Biome that covers a large part of the Northern Cape Province. Struisbult Farm falls within the Bushmanland Bioregion which extends from the eastern part of Namaqualand in the west to near Prieska in the east and from Upington in the north to the Brandlvlei / Sak River area in the south (Rutherford, Mucina & Powrie, 2006).

3.2 Topography and geology

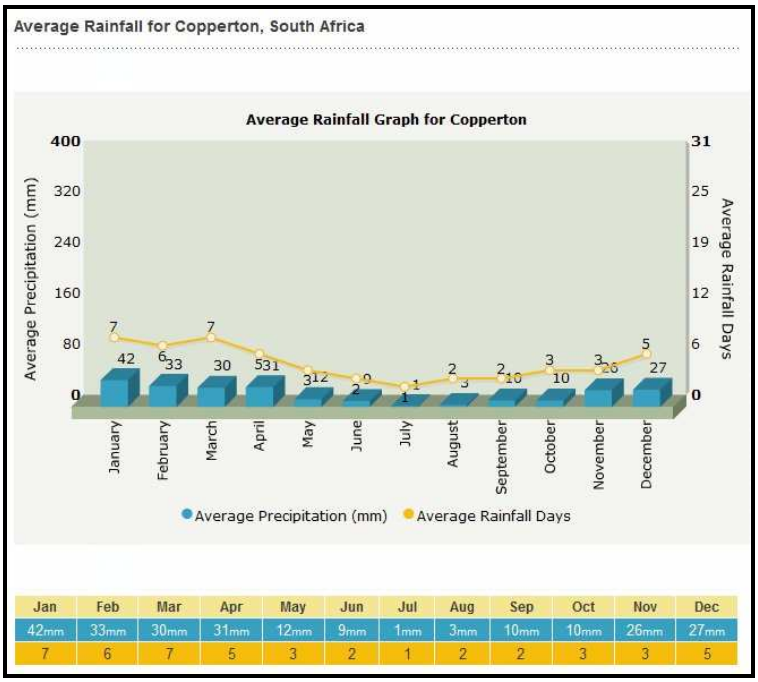
As can be seen in the topographic map (Figure 2) the study site falls within a region of low relief. There are shallow undulations in the landscape with watercourses forming shallow depressions. The site is located between 1 100 m and 1 200 m altitude.

The geology of the Copperton area is complex with the Copperton Formation comprising three members: Vogelstruisbult Member, Prieska Copper Mines Member and Smouspan Member. These rocks are of volcanic origin and comprise various gneiss and amphibolite complexes (Cornell *et al*. 2006). On the surface is alluvial material and calcrete (Quaternary deposits) as well as red sand of the Kalahari Group (Mucina *et al.* 2006; Partridge, Botha & Haddon, 2006). It is the superficial sediments that influence the vegetation.

3.3 Climate

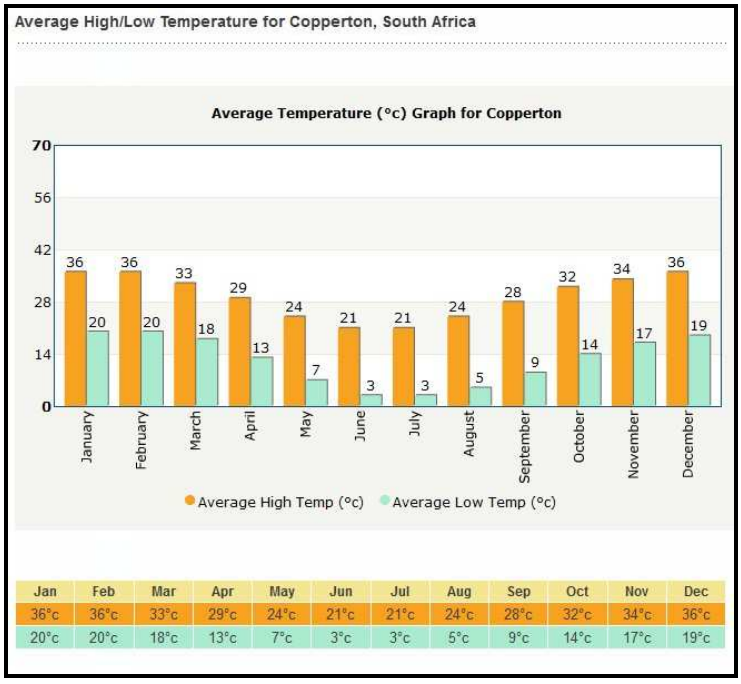
The climate of the study area is classified as ‘arid’ with mean annual precipitation of around 200 mm. Rain occurs mainly from late summer to autumn (January to April). The winter to spring months (May to October) are generally dry (Figure 4). Daytime temperatures regularly exceed 30℃ in the summer whereas in the winter daytime temperatures are usually in the mid 20℃ range (Figure 5). Winds can be strong with whirlwinds occurring in summer due to thermal convection. Frost occurs up to 35 days a year (Mucina *et al.* 2006). Comparison of climate diagrams for Bushmanland Basin Shrubland, Bushmanland Arid Grassland and Lower Gariep Broken Veld, vegetation types found in the general area,

shows that there is a strong similarity in the climate where these types occur (Figure 6 a, b & c – from Mucina *et al.* 2006)



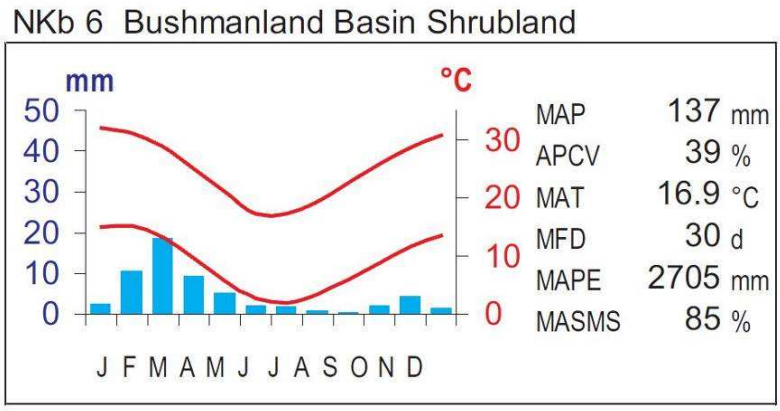
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
42mm	33mm	30mm	31mm	12mm	9mm	1mm	3mm	10mm	10mm	26mm	27mm
7	6	7	5	3	2	1	2	2	3	3	5

Figure 4. Rainfall for Copperton (http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Copperton/2611549/info.aspx)

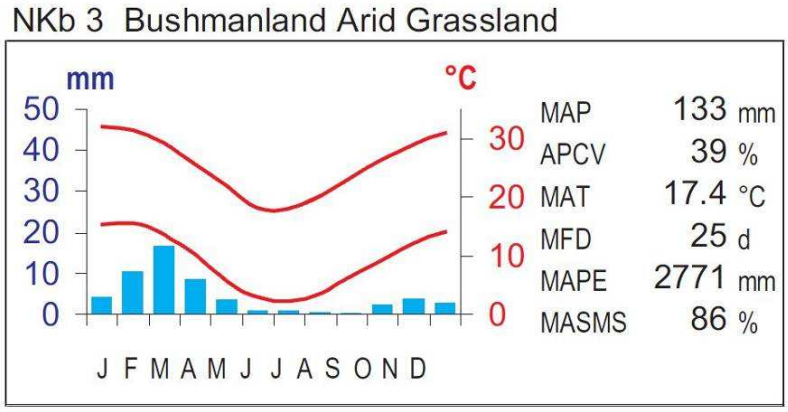


Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
36°c	36°c	33°c	29°c	24°c	21°c	21°c	24°c	28°c	32°c	34°c	36°c
20°c	20°c	18°c	13°c	7°c	3°c	3°c	5°c	9°c	14°c	17°c	19°c

Figure 5. Temperatures for Copperton http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Copperton/2611549/info.aspx)



a.



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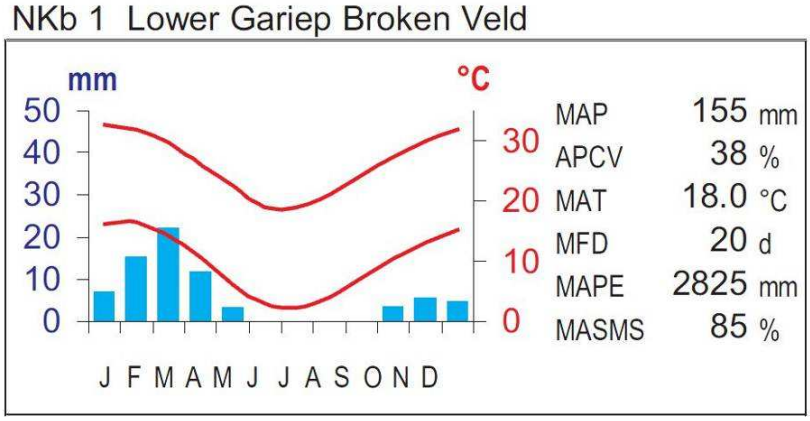

c.

Figure 6. Climate diagrams for (a) Bushmanland Basin Shrubland, (b) Bushmanland Arid Grassland and (c) Lower Gariep Broken Veld.

4. Methods

The study area was visited from 5 -- 8 October 2011 with the main field days being 6 & 7 October 2011. The site was traversed by vehicle and on foot with a hand-held Garmin ® GPSMap 62S used to track the route and record waypoints. Apart from the site designated for the wind energy facility, the proposed site for relocation of the Alkantpan Airfield was also visited and assessed. Observations were made at the respective waypoints and recorded with a photographic record of the vegetation and selected plant species. As is standard practice, particular attention was given to the possibility of finding endemic and 'Red Data' species.

Aerial photography, mainly from Google Earth ©, was used to assist with interpretation of the landscape and the distribution of plant communities and vegetation types.

5. Limitations and Assumptions

The study area was extremely dry at the time of the field visit. The result was that many of the plants were not in optimal condition. This was a distinct limitation but nevertheless an adequate level of identification to genus level was achieved, with a reasonable number of species identified. Some species were undoubtedly missed due to their absence in the dry conditions. The grasses were particularly dry and this limited the accuracy of identification.

6. Disturbance regime

Livestock agriculture is practiced on Struisbult Farm with both cattle and sheep. Overall the vegetation (veld) is in fair condition with only certain areas such as at watering points more heavily trampled than elsewhere. This, however, will have little bearing on the wind energy project.

7. The Vegetation

7.1 The vegetation in context

According to the national classification of the vegetation of South Africa (Mucina et al. 2006 in Mucina & Rutherford, 2006) the natural vegetation found in the study area is mainly Bushmanland Arid Grassland (NKb3). It is, however, indicated that patches of Lower Gariep Broken Veld (NKb1) are found scattered through the arid grassland vegetation. This is the case at Struisbult Farm where a ridge with Lower Gariep Broken Veld was identified.

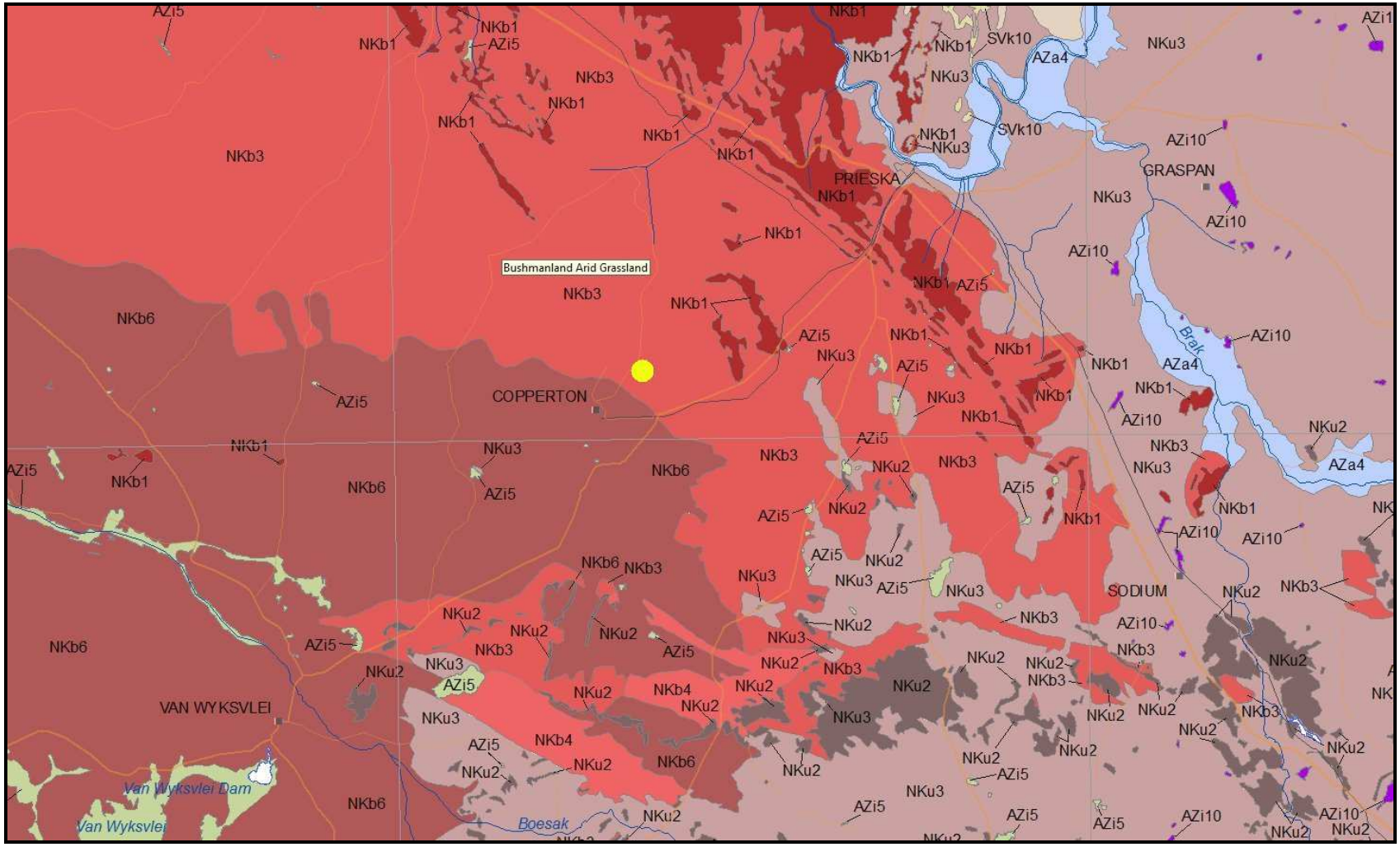

Figure 7. Portion of the vegetation map of southern Africa (Mucina *et al*. 2005) showing the vegetation of the study area (yellow dot) classified as Bushmanland Arid Grassland.

The area immediately around Copperton and for some distance to the west, including the area earmarked for the alternative Alkantpan airfield, was mapped by Mucina *et al*. 2005 as Bushmanland Basin Shrubland (NKb6). It is my view, resulting from field-work during this project, that the boundary as given on the vegetation map of southern Africa (Mucina *et al.* 2005) between Bushmanland Arid Grassland and Bushmanland Basin Shrubland in the vicinity of Copperton cannot be defined rigidly between these two types. Field observations indicate that apart from the Lower Gariep Broken Veld, the vegetation at Struisbult Farm and Alkantpan (where the airstrip is to be relocated to) is mainly Bushmanland Arid Grassland but includes areas of Bushmanland Basin Shrubland as well. This is discussed further below.

6.2 The vegetation of Struisbult Farm

Five distinct vegetation communities or plant associations are recognized at Struisbult Farm and at the proposed Alkantpan Airfield site. Since the climate is relatively uniform over the entire area, the distribution of these communities is related to soils and drainage patterns (topography). Two of the communities fall within the Bushmanland Basin Shrubland type, two within the Bushmanland Arid Grassland type whereas in Lower Gariep Broken Veld one community is recognized (Table 1). The sample waypoint co-ordinates and respective plant communities found at the waypoints are given in Table 2.

Table 1.

Vegetation Type	Community or Association	Substrate
6.2.1 Bushmanland Basin Shrubland	**6.2.1.1 *Rhigozum trichotomum* Shrubland**	Sandy soil at least 150 mm deep
	6.2.1.2 Asteraceous Shrubland	Shallow soil over bedrock, often calcrete
6.2.2 Bushmanland Arid Grassland	**6.2.2.1 *Stipagrostis* Grassland**	Deep > 200 mm red sandy soil
	6.2.2.2 *Lycium cinereum*. – *Galenia africana* Watercourse Shrub Community	Deep sandy soil in low-lying drainage lines
6.2.3 Lower Gariep Broken	**6.2.3.1 *Acacia mellifera* var.**	Broken quartzitic rocky ridge

Veld	***detinens* Open Woodland**	

Table 2. Recorded waypoints with their co-ordinates and the vegetation community found.

Waypoint	Latitude	Longitude	Vegetation Community (see Table 1 for numeric code)
COW1	29°56'42.12"S	22°18'34.66"E	6.2.1.2
COW2	29°56'1.37"S	22°21'34.33"E	6.2.2.1
COW3	29°55'50.13"S	22°21'56.48"E	6.2.1.2
COW4	29°56'22.28"S	22°22'48.21"E	6.2.2.2
COW5	29°56'19.49"S	22°22'45.53"E	6.2.1.2
COW6	29°56'2.63"S	22°22'42.54"E	6.2.1.2
COW7	29°55'32.90"S	22°22'21.70"E	6.2.1.2
COW8	29°55'26.43"S	22°22'32.63"E	6.2.1.2
COW9	29°54'12.15"S	22°21'15.75"E	6.2.1.2
COW10	29°55'10.81"S	22°18'26.79"E	---
COW11	29°52'59.08"S	22°18'47.23"E	6.2.1.2
COW12	29°52'59.67"S	22°18'52.71"E	6.2.1.2
COW13	29°53'1.99"S	22°18'57.77"E	6.2.2.2
COW14	29°52'45.46"S	22°19'5.20"E	6.2.1.2
COW15	29°52'29.95"S	22°19'25.69"E	6.2.1.2
COW16	29°52'21.75"S	22°19'36.18"E	6.2.1.2
COW17	29°52'28.15"S	22°20'7.18"E	6.2.1.2
COW18	29°52'22.17"S	22°20'32.94"E	6.2.1.2
COW19	29°52'51.45"S	22°21'12.22"E	6.2.1.2
COW20	29°53'18.54"S	22°21'18.76"E	6.2.2.2
COW21	29°53'34.79"S	22°21'16.44"E	6.2.1.2
COW22	29°53'38.70"S	22°20'54.29"E	6.2.2.1
COW23	29°53'45.63"S	22°20'51.55"E	6.2.1.1
COW24	29°53'51.28"S	22°20'56.74"E	6.2.1.1
COW25	29°53'57.59"S	22°21'2.40"E	6.2.1.2
COW26	29°53'51.12"S	22°21'33.12"E	6.2.1.2
COW27	29°53'52.48"S	22°21'53.18"E	6.2.2.1
COW28	29°54'7.50"S	22°22'20.03"E	6.2.3.1
COW29	29°54'17.50"S	22°22'15.75"E	6.2.2.1
ALK1	29°56'42.41"S	22°16'32.84"E	6.2.2.1
ALK2	29°56'41.31"S	22°16'28.62"E	6.2.1.2
ALK3	29°56'41.63"S	22°16'27.34"E	6.2.2.2
ALK4	29°56'40.51"S	22°16'26.71"E	6.2.1.1
ALK5	29°56'40.64"S	22°16'25.28"E	6.2.1.1
ALK6	29°56'35.32"S	22°16'28.19"E	6.2.1.2
ALK7	29°56'35.82"S	22°16'29.51"E	6.2.1.2

6.2.1 Bushmanland Basin Shrubland

6.2.1.1 Rhigozum trichotomum Shrubland

Rhigozum trichotomum (granaatbos) is a tough, woody shrub ranging in height from 0.5 – 1.2m. This species is scattered throughout the study area but tends to be concentrated and dominant in areas where there are slight depressions and accumulation of red sand. Other low shrubs are found only in low numbers whereas *Stipagrostis* spp. and other grasses are co-dominant with *R. trichotomum* (Figure 8).

Figure 8. *Rhigozum trichotomum* Shrubland – coarse mid-high shrubland on sandy-loam soils.

The *Rhigozum trichotomum* shrubland is extensive in the central area west surrounding waypoints COW 23 and COW 24. Its uniform appearance and similar 'signature' on aerial photos to the Asteraceous Shrubland makes it difficult to map as a separate unit. It is not considered to be ecologically sensitive.

6.2.1.2 Asteraceous Shrubland

The Asteraceous Shrubland is the most extensive vegetation type in the study area. It also has the greatest diversity of species, mainly low shrubs but grasses occur patchily and other herbaceous species are present. The vegetation is typically low < 0.4 m and coarse, being dominated by low shrubs in the family Asteraceae. It may be described as

"bossieveld" to distinguish it from areas of grassland (Figure 9). This vegetation occurs on shallow sandy-loam soils often with bedrock, mostly as hardpan calcrete (Figure 10) and is the most extensive vegetation type in the study area. It is not ecologically sensitive.

Figure 9. Low Asteraceous Shrubland – "bossieveld" typical of a large part of the study area on shallow soils.

Figure 10. Exposed calcrete with a thin capping of red sandy soil and associated "bossieveld"

The asteraceous bossieveld is dominated by *Pentzia incana* (ankerkaroo) and *Pteronia* spp. Other species recorded include *Berkheya* cf. *annectens* (disseldoring), *Enneapogon desvauxii* (eight day grass), *Eriocephalus microphyllus* var. *pubescens (wild rosemary), Lycium* sp. – low, almost prostrate, spiny shrublet, *Monechma* sp. (Boesmanlandse bloubos), *Plinthus karooicus* (silwerkaroo)*, Ruschia* cf. *intricata, Salsola tuberculata*

(blomkoolganna) *Sarcocaulon* sp. (bushman's candle), *Stipagrostis* sp. (boesmansgras) and *Zygophyllum microphyllum* (muishondbos).

Only one very old specimen of *Boscia foetida* 'Shepherd's tree' was found, at waypoint COW18 (Figure 11).

Figure 11. Rocky, broken landscape with bossieveld and a single specimen of *Boscia foetida* (Shepherd's tree).

6.2.2 Bushmanland Arid Grassland

6.2.2.1 Stipagrostis Grassland

The *Stipagrostis* Grassland typically has a mid-dense (occasionally dense) cover of "white grasses" (*Stipagrostis* spp.) with scattered shrubs (Figures 12 & 13). The soil is deep red sand of the Kalahari Group. Species recorded in this plant community include *Aptosimum sp. (*doringviooltjie)*, Galenia africana (*kraalbos)*, Lycium sp.* (kriedoring)*, Monechma sp., Pentzia incana, Pteronia incana* (Scholtzbos)*, Pteronia sp., Rhigozum trichotomum* (driedoring), *Ruschia sp. (doringvygie), Salsola sp., Sarcocaulon sp., Stipagrostis ciliata* (langbeenboesmansgras), *Stipagrostis obtusa* (beesgras, fyntwa).

This vegetation is not ecologically sensitive although care should be taken not to make unnecessary roads and tracks.

Figure 12. *Stipagrostis* Grassland on deep red well-drained sandy soils

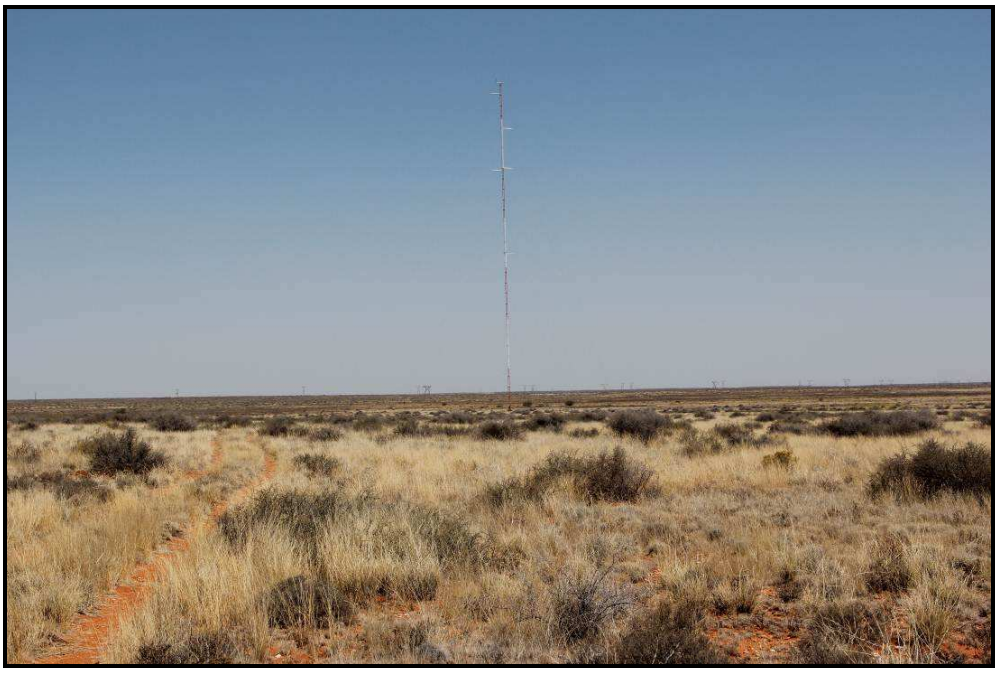

Figure 13. *Stipagrostis* Grassland with scattered clumps of *Lycium cinereum* at the wind test mast at Struisbult Farm.

6.2.2.2 Lycium cinereum – Galenia africana Watercourse Shrub Community

Although the relief of the study area is low, there is a general shallow downward slope towards the west. Drainage lines of watercourses have formed in low-lying areas and these are typified by dense stands of tall shrubs together with a high cover of grasses. The dominant species are *Lycium cinereum* (bloukaree; kriedoring) and *Galenia africana* (kraalbos) (Figure 14; see also Figure 9). These areas are probably selectively grazed by cattle and sheep which may account for the presence of *Galenia africana* which tends to become abundant in disturbed areas.

The drainage lines or watercourses with higher plant biomass also provide cover and a more hospitable habitat for small mammals and birds, compared with the open, exposed bossieveld and grasslands. For this reason these habitats, although not floristically important, are more ecologically sensitive and should be observed as 'No Go' areas.

Figure 14. Mid-high to tall *Lycium cinereum – Galenia africana* Shrubland in drainage line.

6.2.3 Lower Gariep Broken Veld

6.2.3.1 Acacia mellifera var. *detinens* Open Woodland

A relatively small area of *Acacia mellifera* var. *detinens* (swaarthaak) Open Woodland occurs on a north-south-trending rock ridge in the area of waypoint COW28. The red sandy soil surface is strewn with quartzite pebbles and boulders. The low stratum is typical of the asteraceous bossieveld described above, with similar species, however here there is an emergent small trees stratum dominated by *A. mellifera* var. *detinens* (Figure 15). Although this is not a rare or ecologically sensitive community, this is the only area where it occurs in the study area. For this reason it is advised that this koppie should be avoided and no turbines constructed in areas where *A. mellifera* var. *detinens* occurs.

Figure 15. Asteraceous Shrubland in foreground with *Acacia mellifera* var. *detinens* Open Woodland on a rocky ridge.

6.3 The vegetation of the Alkantpan Airfield

The vegetation of the proposed alternative site for the Alkantpan Airfield is made up of the same communities as found at Struisbult. Although only a small area in the southern corner of the proposed site was sampled, this was adequate to compare with the vegetation of Struisbult Farm. The vegetation is relatively uniform (the only variation is between the communities as described) and not ecologically sensitive. Therefore no botanical constraints were determined that would indicate that the airfield should not be constructed in the proposed area.

7. Conservation status

All the vegetation types described occur over extensive areas. Although there are few statutory conservation areas in these types, they form agricultural rangelands and are conserved for their grazing potential. According to the National Spatial Biodiversity Assessment (Rouget *et al.* 2004) all these vegetation types are classified as **LEAST THREATENED**. None are listed in the Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No. 32689).

Even though a vegetation type may be rated as **LEAST THREATENED** it is still important to observe caution when developing an area where undisturbed vegetation occurs. No rare plant species or plant species of special concern were found during the survey. Some endemic species may occur but the very dry condition of the vegetation at the time of the survey made a comprehensive survey impossible.

9. Qualitative sensitivity analysis

Most of the Struisbult Farm is not ecologically or, more specifically, botanically sensitive. However, it is advised that the low-lying depressions and watercourses should be avoided as much as possible for turbine location, construction of roads and hard-standing areas and laying of cables. Water seasonally accumulates in these areas and although they dry out rapidly the wetness can cause temporary access difficulties. The watercourses are also identified as habitat for small mammals and birds due to the greater vegetative cover. These areas are shown in Figure 15. In addition, it is advised that the area with Lower Gariep Broken Veld should also be treated as sensitive and avoided (Figure 15).

8. Development layouts

A layout of 56 possible locations for wind-turbines is proposed for Struisbult Farm (Figure 16). Each location would require an access road and hard-standing area for construction purposes. The roads would also be used for maintenance during the operational phase. Cables would be run across the site underground to the linking roads (already in place) ultimately to the Cuprum Substation or would cut into the grid on site, with minimal overhead cables.

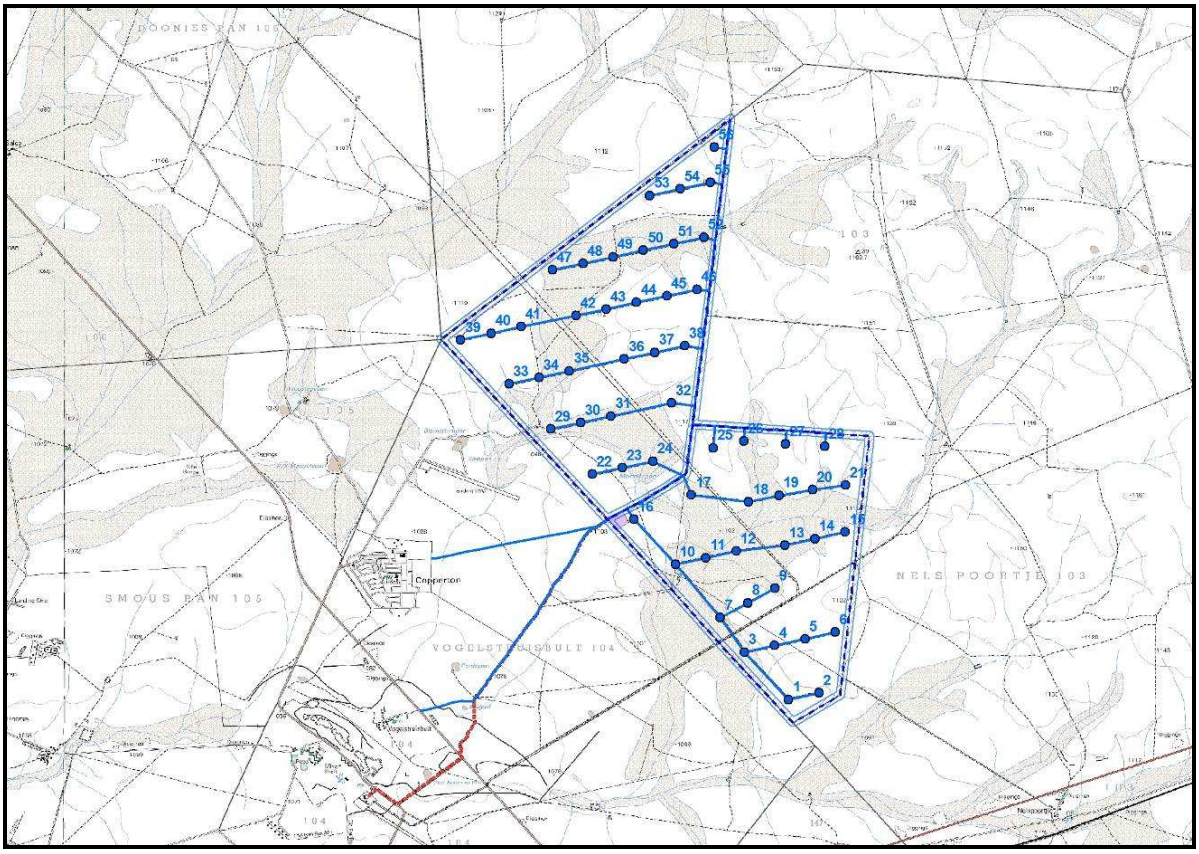

Figure 16. Proposed layout of wind-turbines, roads and cables at Struisbult Farm near Copperton (Map: Aurecon / Plan 8 Infinite Energy)

Location of the proposed turbine, road and cable layout and crane areas on a Google Earth © aerial photo (Figure 17) indicates that some of the proposed turbine locations and numerous of the crane areas fall within the zones of low-lying watercourses or drainage lines. As noted above the first mitigation measure would be to avoid these areas by development of an alternative layout.

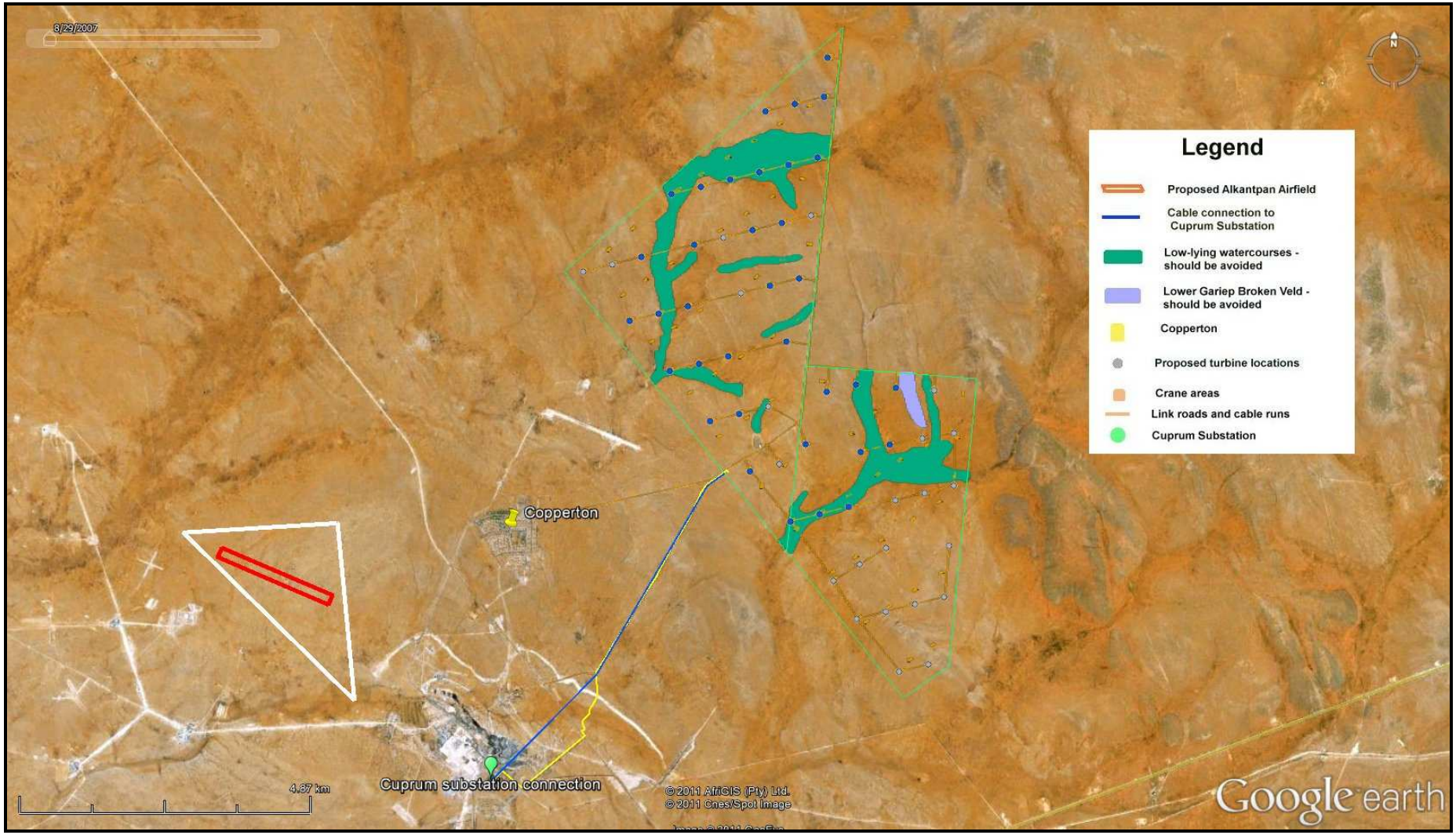

Figure 17. The Struisbult Farm study area (green boundary) near Copperton. The legend shows the important features. Note the coincidence of the proposed wind turbines (blue and grey dots) and roads etc. with areas identified for avoidance.

10. Impact Assessment

Impacts on the vegetation are assessed for the development of a wind energy facility at Struisbult Farm, near Copperton. Only one development alternative and the No Go alternative are assessed since no other area is proposed as an alternative. The only variation would be an altered layout (configuration) of the wind-turbines, which is likely to be necessitated once sufficient wind data has been recorded, which is not yet considered.

10.1 Direct Impacts

Direct impacts are those that would occur directly on the vegetation of the site as a result of the proposed development. The rating system used is given in Appendix 1. In addition to determining the individual impacts using various criteria, mitigation is also brought into the assessment.

The impacts of the proposed development at Struisbult Farm on the vegetation and habitat are considered with respect to:

- Loss of vegetation type and habitat including plant species due to construction and operational activities.
- Loss of ecological processes due to construction and operational activities.

10.1.1 Loss of vegetation type and habitat including plant species due to construction and operational activities

In the case of the **"No Go" option** where there would be no development at Struisbult Farm, the *status quo* would persist and the farming operation would continue in much the same way as at present. The 'no development' alternative or 'No Go' alternative would thus have a **LOW NEGATIVE** impact on the natural vegetation with no significant loss in the long-term.

If the **development option** is followed there would be a **MODERATE NEGATIVE** impact at the turbine sites if some are retained within drainage lines or watercourses, with their associated access roads and cables. If, however, the turbines proposed for locations in within drainage lines or watercourses are repositioned the overall impact would be reduced to **LOW NEGATIVE** (Table 3).

Table 3 Impact and Significance – Loss of natural vegetation and habitat in general during construction and operational phases

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 1 Some sites in watercourses	Loss of & natural vegetation	Local	Long- term	Moderate	Moderate	-ve	Probable	High
With mitigation	Alt 1 No sites in watercourses	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High

10.1.2 Mitigation

The **development option** would have a high physical impact at each turbine site that would be negative. However, over a broad scale the vegetation has been described as generally being not sensitive and it has a **LEAST THREATENED** conservation status (Rouget *et al.* 2004). Therefore at the majority of sites, construction of wind turbines will not raise much concern botanically and the impact (broadly speaking) would be **LOW NEGATIVE.** The only locations of concern would be those turbine sites in watercourses or drainage line. Mitigation would be to move those turbines to higher ground where there is no chance of influencing drainage. Other mitigation measures such as re-alignment of roads so as not to cross directly across drainage lines should be investigated. Notwithstanding the probable overall **LOW NEGATIVE** impact, there will still be a need for rehabilitation of hard-standing areas and any access roads that are not needed post-construction.

9.2.1 Loss of ecological processes

As a general rule ecological processes are closely linked to vegetation and habitat and therefore can only function where the habitat is in reasonable condition. Ecological processes operate over a wide area so it is not anticipated that the proposed wind-turbines, which will have a low spatial impact, would have a strong negative effect on ecological processes closely linked to the flora and vegetation.

The **'No Go' option** would allow the *status quo* to continue and the ecological processes in the areas of natural vegetation to continue unhindered. Grazing by sheep could have long-term negative effects and probably more so than wind-turbines. The impact of the 'No-Go' option would therefore be **LOW NEGATIVE**. Construction of turbines according to the layout in Figures 14 & 15 would also have a **LOW NEGATIVE** impact on ecological processes except for those located close to drainage lines that would influence the *Lycium cinereum – Galenia africana* Shrubland and could affect ecological processes associated with this habitat. At these locations the effect would be a **MODERATE NEGATIVE** impact (Table 4).

Table 4. Impact and Significance – Loss of ecological processes in natural habitat areas during construction and operational phases

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of ecological processes	Local	Long term	Low	Low	Neutral	Probable	High
Without mitigation	Alt 1 Sites in watercourses	Loss of ecological processes	Local	Long term	Moderate	Moderate	-ve	Probable	High
With mitigation	Alt 1 Sites in watercourses	Loss of ecological processes	Local	Long term	Low	Low	-ve	Probable	High

10.2.2 Mitigation

The main mitigation measure would be to avoid turbine construction in zones associated with drainage lines. This could be achieved by developing an alternative layout where these areas are buffered and avoided. If this is done the impacts would be minimized from **MODERATE NEGATIVE** to **LOW NEGATIVE** at the sites with the consequence that the overall impact in terms of loss of ecological processes would be **LOW NEGATIVE.**

10.3 Indirect impacts

By definition indirect impacts occur away from the 'action source' i.e. away from the development site. The impact assessed here is specifically how the proposed development

would have an indirect impact on vegetation and flora away from the development site. Possible but minimal indirect impacts could be caused by the construction of wind turbines on Struisbult Farm by influencing water runoff into areas south and west of the farm. However, this impact would probably be insignificant.

10.4 Cumulative impacts

The vegetation types in which the Copperton Wind Energy Facility would be constructed are widespread and in no way threatened. The cumulative impact of loss of these vegetation types as a result of the proposed wind energy facility and other proposed developments such as photovoltaic and wind energy facilities on nearby farms would be negligible.

11. General Assessment and Recommendations

- Three vegetation types comprising five plant communities are found at Struisbult Farm and the proposed site for the new Alkantpan Airfield near Copperton. The vegetation types are Bushmanland Basin Shrubland, Bushmanland Arid Grassland and Lower Gariep Broken Veld. They are all classified as **LEAST THREATENED** in the National Spatial Biodiversity Assessment.

- In general construction of wind turbines on Struisbult Farm would result in **MODERATE NEGATIVE** impact. However, at a local scale it would be important to observe the existence of relatively more sensitive vegetation and habitat along drainage lines and in depressions. These areas have been mapped and should be avoided. If this can be achieved the impact would be **LOW NEGATIVE**.

- Wherever turbines are constructed, caution must be exercised and construction access roads designed for minimal impact. The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require rehabilitation in the post-construction phase. The restoration of those areas must follow the construction phase. A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to.

- The overall result of the impact assessment is that the 'No Go' option would allow the *status quo* to continue which would have a **LOW NEGATIVE** impact on the site. The proposed renewable energy infrastructure development would have a **LOW NEGATIVE** impact, after mitigation, on most of the study area and can in general be supported

from a botanical perspective. Caution must be exercised in the areas identified as relatively more sensitive. Alternative layout options should be explored.

12. Conclusions

The vegetation found at Struisbult Farm and the proposed new area for Alkantpan Airfield was extremely dry at the time of the survey. These negatively influenced the ability to positively identify many of the plant species. However, an adequate survey was possible and acceptable results were achieved to determine the acceptability or otherwise of a wind energy facility at Struisbult Farm and the proposed new airfield site.

In general construction of the wind energy facility is botanically acceptable except that note should be taken of those areas where vegetation and habitat could be negatively influenced above acceptable levels. Mitigation should be applied whereby these areas are avoided by developing an alternative turbine layout.

The proposed new airfield (runway) would have much the same impact wherever it may be aligned within the proposed triangular study area. No extensive areas of relatively important habitat were noted so no constraints should be placed on the airfield development.

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Appendix 1: Impact Assessment Methodology

The assessment of impacts needs to include the determination of the following:

- The nature of the impact – see Table 1.1
- The magnitude (or severity) of the impact – see Table 1.2
- The likelihood of the impact occurring - see Table 1.2

The degree of confidence in the assessment must also be reflected.

Table 1.1 Impact assessment terminology

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Assessing significance

There is no statutory definition of '*significance*' and its determination is, therefore, somewhat subjective. However, it is generally accepted that significance is a function of the magnitude of the impact and the likelihood of the impact occurring. The criteria used to determine significance are summarized in *Table 1.2*

Table 1.2 Significance criteria

Impact magnitude	
Extent	*On-site* – impacts that are limited to the boundaries of the rail reserve, yard or substation site. *Local* – impacts that affect an area in a radius of 20km around the development site. *Regional* – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. *National* – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.
Duration	*Temporary* – impacts are predicted to be of short duration and intermittent/occasional. *Short-term* – impacts that are predicted to last only for the duration of the construction period. *Long-term* – impacts that will continue for the life of the Project, but ceases when the Project stops operating. *Permanent* – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.

Intensity	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, species or communities).* **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.* SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood (Probability)	
Negligible	The impact does not occur.
Low	The impact may possibly occur.
Medium	Impact is likely to occur under most conditions.
High	Impact will definitely occur.

Once a rating is determined for magnitude and likelihood, the following matrix can be used to determine the impact significance.

Table 7.5 Example of significance rating matrix

SIGNIFICANCE RATING					
	LIKELIHOOD	**Negligible**	**Low**	**Medium**	**High**
MAGNITUDE	**Negligible**	**Negligible**	**Negligible**	**Low**	**Low**
	Low	**Negligible**	**Negligible**	**Low**	**Low**
	Medium	**Negligible**	**Low**	**Medium**	**Medium**
	High	**Low**	**Medium**	**High**	**High**

In *Table 7.6*, the various definitions for significance of an impact is given.

Table7.6 Significance definitions

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.