Environmental Scoping: The Potential Impacts on the Vegetation of the Proposed Kleinzee 300MW Wind Farm, Northern Cape

Botanical Surveys & Tours

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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 Kleinzee 300MW Wind Farm in the Northern Cape Province

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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 & Tours CC

Name of company (if applicable):

5 July 2011

Date:

CONTENTS

1. INTRODUCTION

Savannah Environmental (Pty) Ltd has been appointed by Eskom Holdings Limited to carry out an Environmental Impact Assessment process in support of an application for authorisation for construction of a wind energy facility (or wind farm) (WEF) and associated infrastructure, including power transmission lines located south and east of Kleinsee in the Northern Cape. The transmission lines will link the WEF to Gromis Substation that is approximately 16 km north-east of the site. For this purpose several specialist studies are required including a study of the impacts of the proposed facility on the vegetation of the local area.

Bergwind Botanical Surveys and Tours CC was appointed by Savannah Environmental (Pty) Ltd to conduct a botanical impact assessment of the study area. This desk-top scoping report is part of the first phase of this process. The main objective of the scoping assessment is to determine if there are any 'red flag' issues or potential fatal flaws from a botanical perspective that may negatively influence the outcome of the application for authorisation of the project.

This is a desktop assessment for the scoping assessment and as such has limitations since a first-hand field assessment of the actual site is yet to take place.

2. TERMS OF REFERENCE

The terms of reference for the scoping assessment are:

- To broadly describe the terrestrial vegetation and flora of the study area that will be affected by the proposed wind farm project;
- To provide a description of possible impacts (direct, indirect and cumulative) that are anticipated;
- The impacts are to be evaluated in terms of (1) the **nature** of the impact i.e. what would cause the impact, what would be affected and how it would be affected, and (2) the **extent and scale** of the impact i.e. whether the impact will be **local** (limited to the study area), **biome-wide**, **regional**, **national** or **international**.
- To provide recommendations for the methods to be employed for assessment of potentially significant impacts in the EIA phase

3. METHODOLOGY

The approach to the assessment of the vegetation and flora of the proposed Eskom Kleinzee Wind Energy Facility is a two-step approach which will be applied to both the site and the transmission lines route. The first instance is a desktop Scoping Phase assessment (this report) which was carried out to review the literature and accumulate information e.g. a plant species checklist, maps etc. to inform the second phase which will be an Environmental Impact Assessment phase, based on a site visit where data and additional information is to be obtained first-hand will be integrated into the assessment. The methods employed in the field will be standard vegetation survey methods developed to conduct rapid appraisal of the vegetation found on any given site. This entails recording of geo-referenced 'sample waypoints' where lists of plant species are compiled and a photographic record made of the vegetation. Condition of the site in terms of historical and current disturbance is also assessed. The recorded information provides a basis for the description of the site, physiognomy and floral composition of the vegetation and for the assessment of potential impacts.

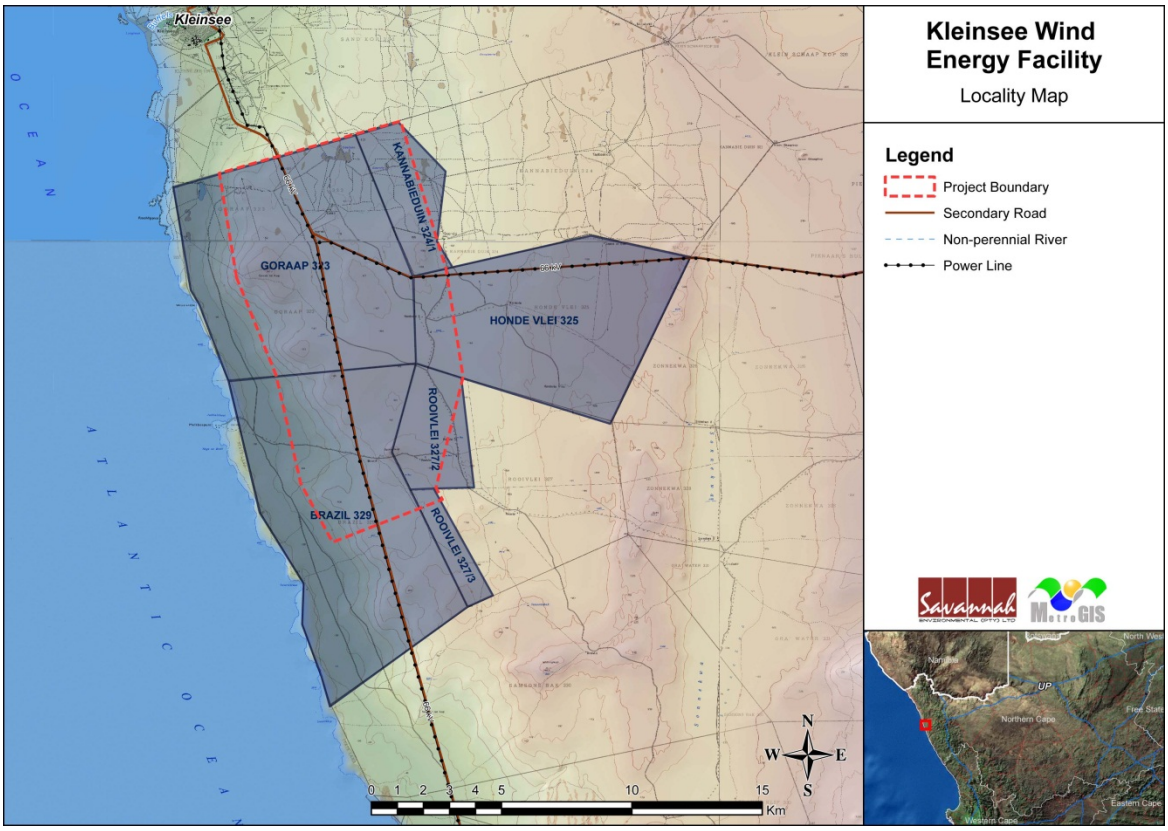

Figure 1. Location of the proposed Kleinzee Wind Energy Facility and power lines on the Namaqualand coast, Northern Cape Province.

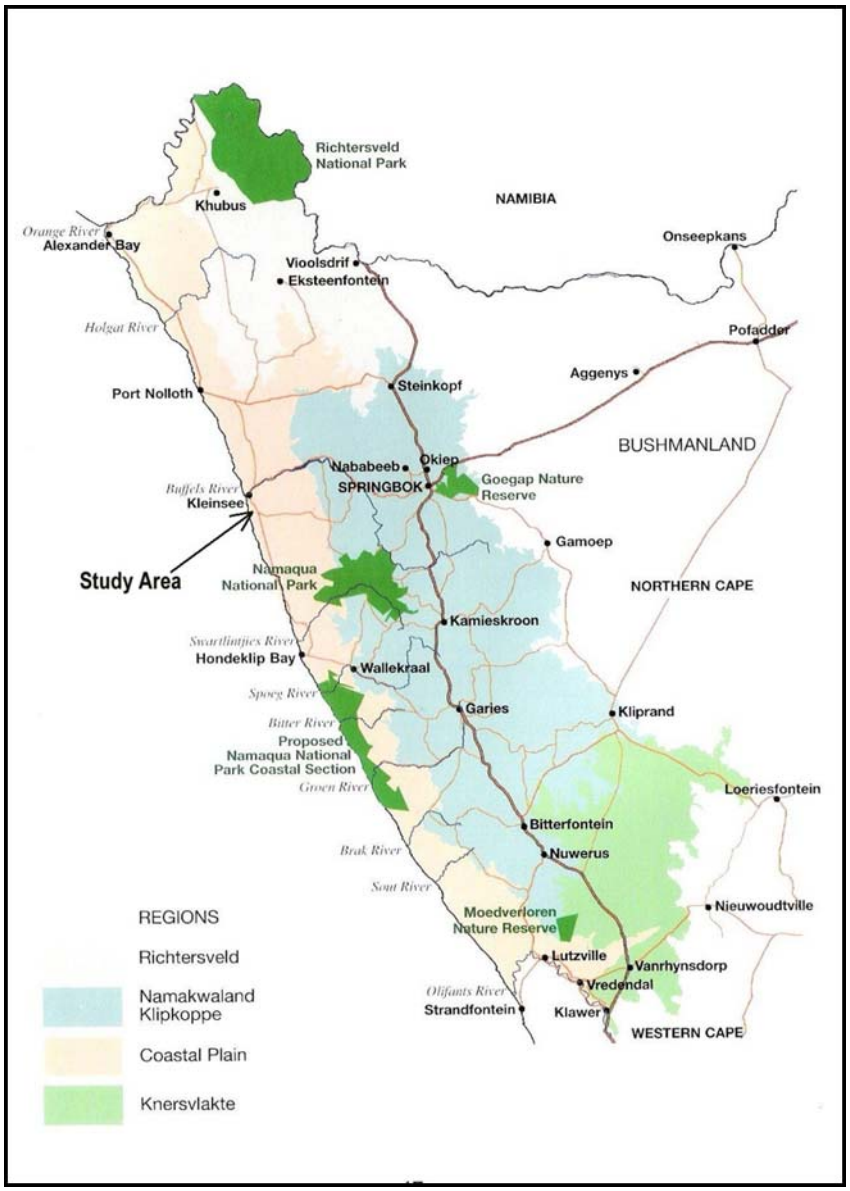

Figure 2. Broad regions of Namaqualand after Le Roux (2005), showing the position of the study area.

4. STUDY AREA

4.1 LOCATION

At a broad scale the study area is located in Namaqualand in the Nama Khoi Local Municipality, Northern Cape Province. At a more specific scale the WEF study area is located approximately 6 km south of the town of Kleinzee within the De Beers Diamond Mine area on the coast of Namaqualand, inland of Melkbospunt, Jakkalsbaai and Thys se Baai. It comprises the farms RE Brazil 329; RE Goraap 323; RE Honde Vlei 325; RE Kannabieduin 324 and Portions 2 & 3 of Rooivlei 327,

together covering an area of ~9300 ha (Figure 1). The area falls within the Succulent Karoo Biome south of the Buffels River on the 'Coastal Plain' which also is often called the Sandveld or Namaqualand Sandveld Bioregion (Figure 2) (Van Wyk & Smith, 2001; Le Roux, 2005; Rutherford, Mucina & Powrie, 2006).

4.2GEOLOGY, TOPOGRAPHY AND SOILS

The region of the study area is underlain by rock of the Namaqua-Natal Metamorphic Belt (Cornell *et al.* 2006). On the coast the surface geology consists of deep stabilized aeolian sands (Quaternary) that are white to grey and calcareous, overlying marine sediments that are composed of calcrete or dorbank hardpans. Immediately above the high-water mark the coastline has exposed granite of the Dikgat and Brazil Formations (Goraap Suite) (Marais, 2001). Further inland the soils are yellow sands becoming either red or yellowish-red overlying granite and gneisses. The undulating coastal plain is about 30 km wide and separates the coast from the inland Namaqualand Klipkoppe comprising Mokolian granites and gneisses that form domes and rock sheets and weather to form yellow-brown to brown loamy sand (Mucina *et al.* 2006). Le Roux (1991) described the coastal Sandveld topography as consisting of three major landforms, based on the presence or absence of dunes: unstable dunes, semi-stable dunes and shallow, flat sand.

Low and Desmet (2007) describe the coastal zone incorporating the study area as having parabolic dune fields stretching south-north parallel to the coast. The dunes are further described as undulating with gentle hummocking and are partially vegetated.

The study site for the proposed Eskom wind farm is located in a zone consisting of grey calcareous sands (supporting coastal duneveld) transitional to yellowish sands (supporting strandveld) (see below).

4.3 CLIMATE

The Namaqualand coastal region is arid and experiences winter rainfall. A rainfall gradient from the coast to inland has been described for the area south of Kleinzee where mean annual precipitation is 75 mm on the coast increasing to 160 mm in the inland uplands. This information is extrapolated from meteorological data collected at Koingnaas, much further south than the study

area (Burger 2007 in Arcus Gibb 2008). Le Roux (2005) states that the coastal belt between Port Nolloth and Groen River, which includes the study area, receives between 50 and 100 mm rain per annum. However, climate diagrams published for Namaqualand Coastal Duneveld (Figure 3) and Namaqualand Strandveld (Figure 4) (Mucina *et al.* 2006) indicate that the rainfall is in excess of 100 mm for the areas where these vegetation types occur. This suggests that the mean annual precipitation (MAP) values shown in Figures 3 and 4 represent areas further south than Kleinzee.

A rainfall graph for Kleinzee obtained from www.worldweatheronline.com (Figure 5) indicates that Kleinzee experiences 98 mm rainfall *per annum* which agrees more closely with the figures quoted by Le Roux (2005).

The mean maximum temperature does not vary much throughout the year whereas there is a slightly greater amplitude in mean minimum temperature (Figure 6). This is due to the proximity to the Atlantic Ocean and the effect of the Benguela Current with regular fog occurring over the coastal zone. However, there are extremes with summer temperatures as high as 40 °C having been recorded at Koingnaas (November 2006) and regularly above 30 °C away from the coast inland from Brazil. Winter temperatures can fall to 4 °C (Koingnaas: June 2006).

Temperatures can also be influenced by easterly berg wind conditions (off shore flow) in winter when the temperature may exceed 35 °C.

The prevailing surface winds are mostly from the south and south-east in the summer when winds are strong and speeds can exceed 10 m/s. Strong winds can also occur from the west and north-west, mainly in winter.

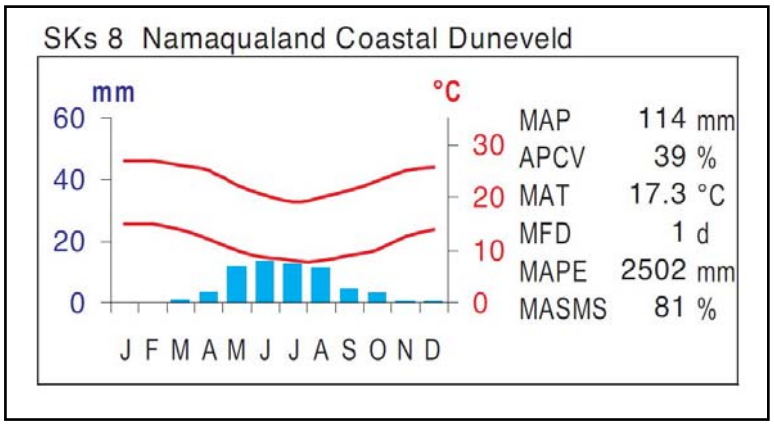

Figure 3. Climate diagram for Namaqualand Coastal Duneveld (from Mucina *et al.* 2006).

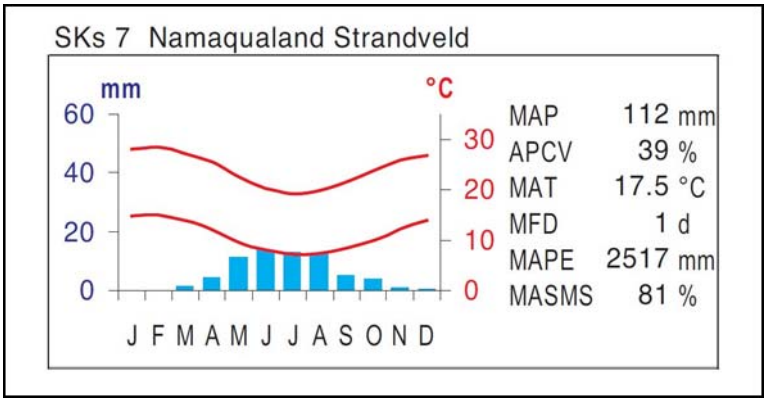

Figure 4. Climate diagram for Namaqualand Strandveld (from Mucina *et al.* 2006).

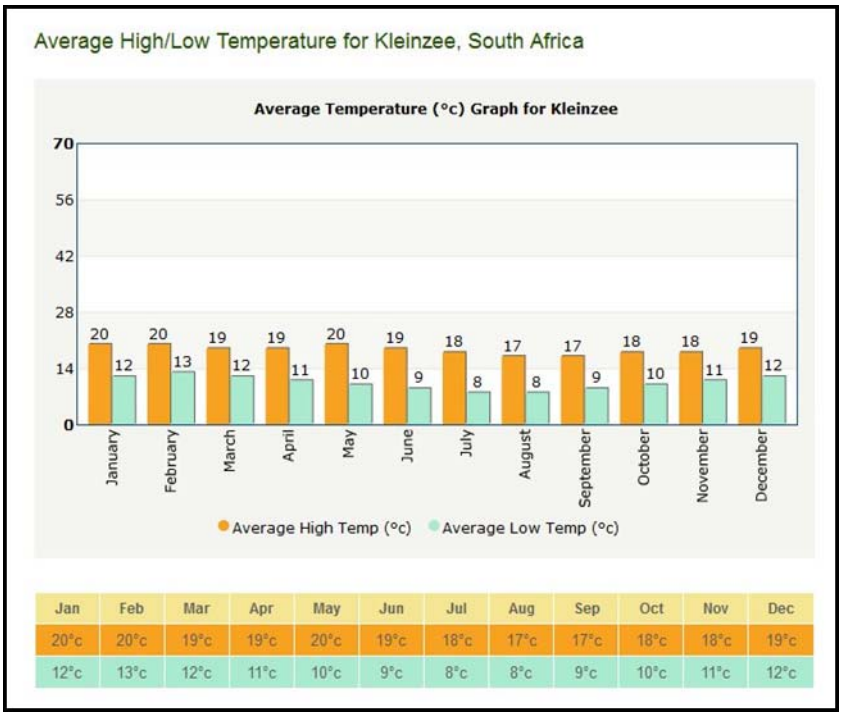

Figure 5. Average monthly temperatures for Kleinzee (source: http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Kleinzee/2614644/info.aspx)

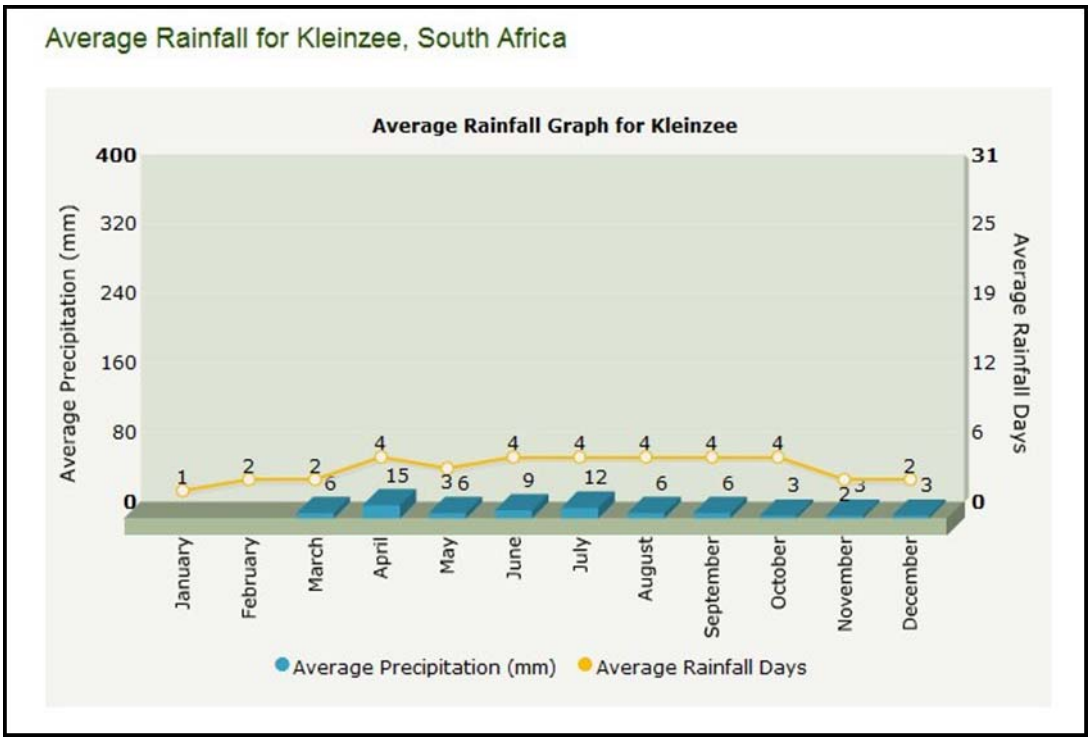

Figure 6. Average monthly rainfall for Kleinzee
(source: http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Kleinzee/2614644/info.aspx)

5. THE VEGETATION

5.1 Broad context

Nationally the study area falls within the extensive, arid Succulent Karoo Biome (Rutherford & Westfall, 1994; Mucina *et al.* 2006 in Mucina & Rutherford, 2006) and regionally within the Namaqualand Sandveld Bioregion (Figure 7). At a local scale, apart from azonal Namaqualand Seashore Vegetation (AZd2) and the vegetation associated with salt pans (AZi2), two main vegetation types are found in the study area, Namaqualand Coastal Duneveld (SKs8) on the semi-mobile coastal dunes and Namaqualand Strandveld (SKs7) found on red to yellow stabilized aeolian sand overlying a basement of marine sediments and granite-gneisses.

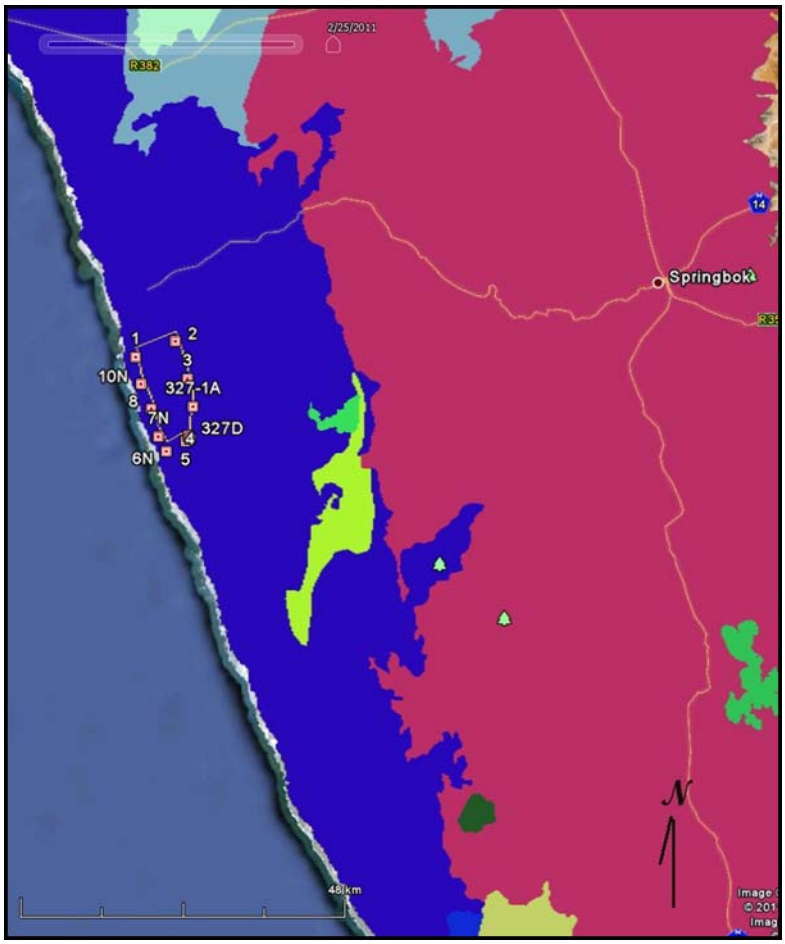

Figure 7. Portion of the bioregions map from Mucina, Rutherford and Powrie (2005) with the dark blue indicating the Namaqualand Sandveld bioregion. The footprint of the proposed wind energy facility is shown with position markers near the coast.

5.2 Local vegetation communities

Owing mainly to restricted access to the diamond-mining area along the Namaqualand coast there have been few detailed botanical studies in the coastal sandveld of Namaqualand. Le Roux (1991) in a study of Brazil recognized three major plant communities: *Zygophyllum cordifolium–Drosanthemum marinum* Shrubland with *Stoeberia beetzii-Wooleya farinosa* Shrubland on flat, shallow sands and *Zygophyllum morgsana-Arctotis scullyi* (syn. *A. merxmuelleri*) Shrubland on unstable to semi-stable white dunes. Low & Desmet (2007) observed that the dunes in the south of the Brazil area are unstable and poorly vegetated but overall the vegetation is in medium to good condition with 43 species found in the above communities. These species include *Fenestraria*

rhopalophylla subsp. *aurantiaca* the "window succulent", also of conservation importance.

The broad vegetation types recognized by Low & Desmet (2007) are shown in Figure 8 as determined for their study at Brazil and Schulpfontein. Their map has been modified to show the location of the footprint of the proposed wind farm in relation to the vegetation types (Figure 8). The wind farm will affect only Namaqualand Coastal Duneveld and Namaqualand Inland Duneveld following the classification of Low & Desmet (2007).

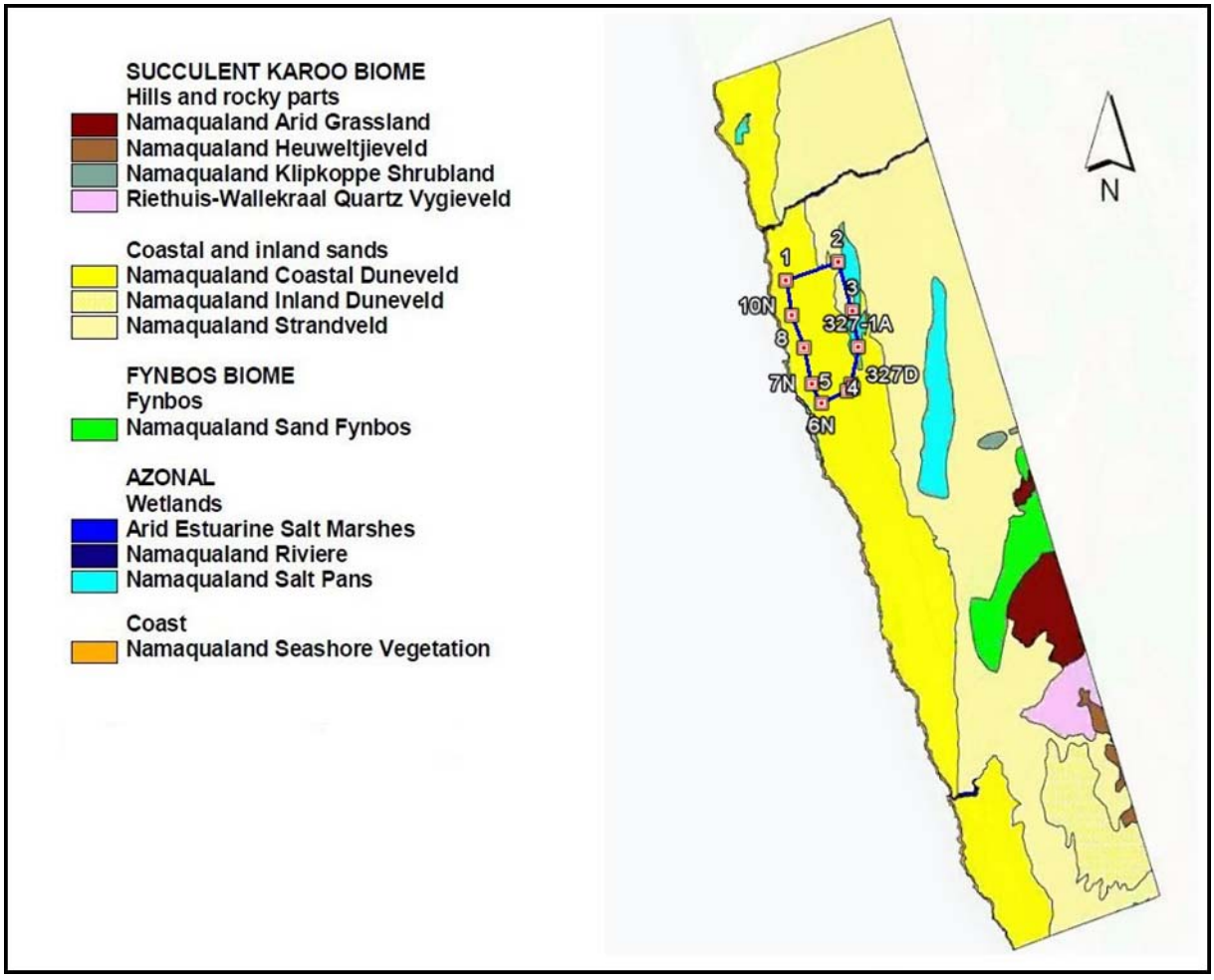

Figure 8. Vegetation map of the area immediately south of Kleinzee, modified from Low & Desmet (2007). The footprint of the proposed wind energy facility is shown with position markers near the coast and impinges on two vegetation types, Namaqualand Coastal Duneveld and Namaqualand Inland Duneveld.

5.3 Plant species

A checklist of plant species recorded from the quarter degree grids where the study area is located was obtained from the South African National Biodiversity Institute SIBIS database (*Accessed through the SIBIS portal, sibis.sanbi.org, 2009-06-01)* – Appendix 1. The status of the species listed was obtained from the Red List of South African Plants (Raimondo *et al.* 2009).

Wooleya farinosa (Figure 9) is a Namaqualand Coastal Sandveld endemic species and therefore has important conservation value. It has been impacted by diamond-mining along the Namaqualand coast and is listed as RARE (Raimondo *et al.* 2009) although locally dominant not only on sandy dune substrates but also on granite-gneisses (Low & Desmet, 2007).

Several Namibian endemic plant species may occur in the vegetation found at Brazil (Low & Desmet, 2007) and by interference could occur on the remainder of the site being considered for the proposed Eskom Kleinzee Wind Farm. Particular attention must therefore be paid during the EIA process to the possibility of encountering endemic plant species and to the conservation value of the vegetation of the area.

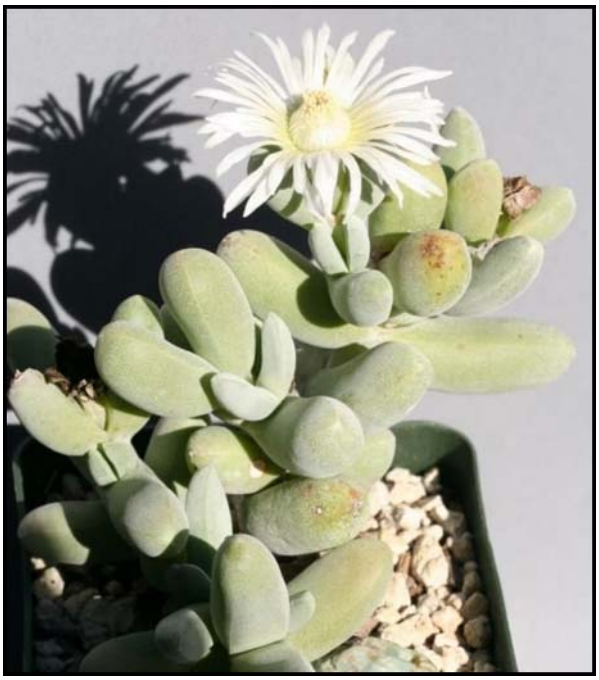

Figure 9. *Wooleya farinosa* – a rare endemic species from the Namaqualand Sandveld bioregion. (Photo: http://www.succulentguide.com)

5.4 Condition of the vegetation and conservation status

Low & Desmet (2007) found that despite the high impact of diamond mining on the coast south of Kleinzee, the vegetation has survived well. They state for the area they surveyed at Brazil that,

"Vegetation along this coastline is in remarkably good condition given the ravages of diamond mining over the years. However, vegetation types in the area are poorly conserved …. Except for the southern section, most of the site is rated highly (mainly 60 – 80%) for conservation importance."

It is anticipated that the further away from the mining operations the better the condition of the vegetation. Therefore it is expected that in the 'inland' areas of Brazil and Goraap and in the areas of Kannabieduin, Rooivlei and Honde Vlei falling within the designated footprint, the vegetation will be in good condition.

5.4.1 Restoration activity

Restoration intervention is in progress to restore mined areas back to natural vegetation. This activity is being undertaken under the Namaqualand Restoration Initiative, championed by the Dr Peter Carrick and the Plant Conservation Unit, University of Cape Town (UCT, 2007). If any of the proposed wind turbines in the Eskom Wind Farm layout would impact any of the restored areas, particular attention should be directed at mitigating any negative effect on the restoration work.

5.4.2 Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) within the Namaqualand District Municipality (NDM) were mapped by Desmet and Marsh (2008). The footprint of the study area including the power line route falls outside any CBA but does fall within the coastal corridor that has conservation importance. This is supported by the view of Low & Desmet (2007) that had the Nuclear 1 project proceeded, at either Brazil or Schulpfontein, the surrounding area that would have been conserved would have been highly beneficial for conservation of the Namaqualand coastal vegetation which is otherwise poorly conserved in formal conservation areas.

The compatibility of the proposed Eskom Kleinzee Wind Farm with conservation objectives of the coastal corridor should be carefully assessed in the EIA phase of the project.

Figure 10. Portion of the mapped Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESAs) for Namaqualand District Municipality – shown together as green shading. The wind-farm footrpint is outlined by the numbered position markers.

6. RISKS AND POTENTIAL IMPACTS

Potential impacts examined here will be restricted to those impacts that would affect vegetation communities, their habitats and their constituent plant species. The impacts could affect ecological processes and consequently ecosystem function. The possible impacts identified are:

- Impacts on plant species of high conservation value i.e. Red List species and endemics whereby their population dynamics would be negatively affected.
- Impacts on plant communities through fragmentation that would lead to loss of constituent species and negatively impact the cohesiveness of the communities.
- Loss of habitat due to degradation of plant communities.
- Loss of ecosystem function due to changes in such factors as hydrological regime, increased edge effect, disturbance of successional processes, disturbance of pollination processes and possible invasion by alien plant species.

The greatest risk to the vegetation and flora would be during the construction phase of the wind energy facility when the following activities would be required:

- Construction of access roads
- Clearing of vegetation for the turbine pedestals and construction lay-down areas
- Trenches for cables and the requirement for construction of pylons for overhead power-lines.
- Operation of machinery and vehicles which could result in undesirable soil compaction.
- Possible fuel and chemical (cement) contamination.

Maintenance of the wind energy facility (operational phase) would pose lower risks to the vegetation. Only the access roads, immediate area around each turbine and the power transmission lines would need to be accessed, leaving the remaining area within the footprint relatively undisturbed.

7. PROPOSED EIA METHODOLOGY

The potential impacts on the plant communities in the study area that will initially be identified and described will be assessed according to standard assessment practice. The Nature, Duration, Extent, Magnitude, Probability and Significance of each of the identified impacts will be assessed. In addition the presence of Red List and endemic species will be given special attention to ensure that they are carefully taken into consideration when designing layouts of the proposed turbines. This information will be summarized together with the sensitivity of plant communities and habitats in a sensitivity map that would be crucial to inform the design phase of the proposed project.

8. CONCLUSIONS

The vegetation of the coastal zone of Namaqualand between Koingnaas and Kleinzee is not well-documented. However, enough literature is available, as referred to above, to obtain a good overview of the vegetation and habitat that is to be found in the area of the wind energy facility footprint. No fatal flaws are anticipated from a botanical viewpoint but there are a few 'red flags'. The latter concerns the possible presence of rare and endemic plant species in the study area. This requires attentive field-work and the highlighting of possible "no go" areas in the EIA phase. Once the assessment of potential impacts is carried out, suitable mitigation measures to deal with any negative impacts will be recommended for implementation. These mitigation measures will address any instances where turbine location and other infrastructure such as roads and underground cables may impact on areas where vegetation restoration has taken place.

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Appendix 1: Preliminary plant species checklist for the area of the Kleinzee Wind Energy Facility

LC= Least concern; VU = Vulnerable; DDD = Data deficient, declining; DDT – Data deficient – taxon uncertain; NT= Near threatened; RARE = rare species; ?? = Status unknown

Family Name	Species Name	Status
AIZOACEAE	Galenia crystallina var. crystallina	LC
AIZOACEAE	Galenia fruticosa	LC
AIZOACEAE	Galenia sarcophylla	LC
AIZOACEAE	Galenia secunda	LC
AIZOACEAE	Malephora crocea var. crocea	LC
AIZOACEAE	Mesembryanthemum serotinum	??
AIZOACEAE	Tetragonia distorta	DDT
AIZOACEAE	Tetragonia fruticosa	LC
AIZOACEAE	Tetragonia microptera	LC
AIZOACEAE	Tetragonia pillansii	VU
AIZOACEAE	Tetragonia sarcophylla	LC
AIZOACEAE	Tetragonia spicata	LC
AIZOACEAE	Tetragonia virgata	LC
AMARYLLIDACEAE	Brunsvigia bosmaniae	LC
AMARYLLIDACEAE	Gethyllis britteniana subsp. britteniana	LC
AMARYLLIDACEAE	Gethyllis grandiflora	VU
AMARYLLIDACEAE	Haemanthus coccineus	LC
AMARYLLIDACEAE	Haemanthus pubescens subsp. arenicola	RARE
AMARYLLIDACEAE	Haemanthus unifoliatus	LC
ANACARDIACEAE	Searsia glauca	LC
ANACARDIACEAE	Searsia incisa var. incisa	LC
ANACARDIACEAE	Searsia undulata	LC
ANTHERICACEAE	Chlorophytum undulatum	LC
APIACEAE	Cynorhiza typica	DDT
APOCYNACEAE	Ceropegia occidentalis	NT
APOCYNACEAE	Microloma namaquense	LC
APOCYNACEAE	Microloma sagittatum	LC
APOCYNACEAE	Microloma tenuifolium	LC
APOCYNACEAE	Quaqua armata subsp. maritima	LC
APOCYNACEAE	Quaqua parviflora subsp. parviflora	LC
ASPARAGACEAE	Asparagus capensis	LC
ASPARAGACEAE	Asparagus capensis var. litoralis	LC
ASPHODELACEAE	Aloe arenicola	NT
ASPHODELACEAE	Aloe krapohliana	DDD
ASPHODELACEAE	Aloe melanacantha	LC
ASPHODELACEAE	Aloe microstigma subsp. framesii	NT
ASPHODELACEAE	Gasteria sp.	

Family Name	Species Name	Status
ASTERACEAE	Amellus alternifolius subsp. alternifolius	LC
ASTERACEAE	Amellus flosculosus	LC
ASTERACEAE	Amellus microglossus	LC
ASTERACEAE	Amellus sp.	
ASTERACEAE	Amellus tenuifolius	LC
ASTERACEAE	Arctotheca calendula	LC
ASTERACEAE	Arctotis auriculata	LC
ASTERACEAE	Arctotis decurrens	DDT
ASTERACEAE	Arctotis diffusa	LC
ASTERACEAE	Arctotis fastuosa	LC
ASTERACEAE	Arctotis revoluta	LC
ASTERACEAE	Arctotis sp.	
ASTERACEAE	Athanasia flexuosa	LC
ASTERACEAE	Berkheya fruticosa	LC
ASTERACEAE	Chrysanthemoides incana	LC
ASTERACEAE	Chrysocoma ciliata	LC
ASTERACEAE	Chrysocoma longifolia	LC
ASTERACEAE	Chrysocoma schlechteri	LC
ASTERACEAE	Cotula coronopifolia	LC
ASTERACEAE	Cotula leptalea	LC
ASTERACEAE	Didelta carnosa var. carnosa	LC
ASTERACEAE	Dimorphotheca pluvialis	LC
ASTERACEAE	Dimorphotheca sinuata	LC
ASTERACEAE	Eriocephalus microphyllus var. pubescens	LC
ASTERACEAE	Eriocephalus racemosus var. affinis	LC
ASTERACEAE	Eriocephalus racemosus var. racemosus	LC
ASTERACEAE	Euryops dregeanus	LC
ASTERACEAE	Felicia dregei	LC
ASTERACEAE	Felicia dubia	LC
ASTERACEAE	Felicia merxmuelleri	LC
ASTERACEAE	Gazania leiopoda	LC
ASTERACEAE	Gazania rigida	LC
ASTERACEAE	Gazania sp.	
ASTERACEAE	Gorteria diffusa subsp. diffusa	LC
ASTERACEAE	Helichrysum hebelepis	LC
ASTERACEAE	Helichrysum marmarolepis	NT
ASTERACEAE	Helichrysum micropoides	LC
ASTERACEAE	Hirpicium echinus	LC
ASTERACEAE	Lasiopogon muscoides	LC
ASTERACEAE	Leucoptera nodosa	VU
ASTERACEAE	Leysera gnaphalodes	LC
ASTERACEAE	Leysera tenella	LC
ASTERACEAE	Monoculus hyoseroides	LC
ASTERACEAE	Monoculus monstrosus	LC
ASTERACEAE	Norlindhia amplectens	LC

Family Name	Species Name	Status
ASTERACEAE	Oncosiphon grandiflorum	LC
ASTERACEAE	Oncosiphon suffruticosum	LC
ASTERACEAE	Osteospermum grandiflorum	LC
ASTERACEAE	Othonna carnosa	LC
ASTERACEAE	Othonna coronopifolia	LC
ASTERACEAE	Othonna cylindrica	LC
ASTERACEAE	Othonna floribunda	LC
ASTERACEAE	Othonna perfoliata	LC
ASTERACEAE	Othonna retrorsa var. spektakelensis	RARE
ASTERACEAE	Othonna sedifolia	LC
ASTERACEAE	Othonna sp.	
ASTERACEAE	Pteronia divaricata	LC
ASTERACEAE	Pteronia glabrata	LC
ASTERACEAE	Pteronia incana	LC
ASTERACEAE	Pteronia onobromoides	LC
ASTERACEAE	Pteronia undulata	LC
ASTERACEAE	Rhynchopsidium pumilum	LC
ASTERACEAE	Senecio abbreviatus	LC
ASTERACEAE	Senecio aloides	LC
ASTERACEAE	Senecio cakilefolius	LC
ASTERACEAE	Senecio corymbiferus	??
ASTERACEAE	Senecio laxus	LC
ASTERACEAE	Senecio sarcoides	LC
ASTERACEAE	Senecio scapiflorus	LC
ASTERACEAE	Tripteris microcarpa subsp. microcarpa	LC
ASTERACEAE	Tripteris oppositifolia	LC
ASTERACEAE	Ursinia calenduliflora	LC
ASTERACEAE	Ursinia chrysanthemoides	LC
BORAGINACEAE	Lobostemon pearsonii	LC
BRASSICACEAE	Brassica tournefortii	??
BRASSICACEAE	Heliophila arenaria var. glabrescens	LC
BRASSICACEAE	Heliophila juncea (was Brachycarpaea juncea)	LC
BRASSICACEAE	Heliophila lactea	LC
BRASSICACEAE	Heliophila seselifolia var. seselifolia	LC
CAMPANULACEAE	Wahlenbergia annularis	LC
CAMPANULACEAE	Wahlenbergia capensis	LC
CAMPANULACEAE	Wahlenbergia oxyphylla	LC
CAMPANULACEAE	Wahlenbergia thunbergiana	LC
CARYOPHYLLACEAE	Dianthus namaensis	LC
CARYOPHYLLACEAE	Dianthus namaensis var. dinteri	LC
CARYOPHYLLACEAE	Dianthus namaensis var. junceus	LC
CARYOPHYLLACEAE	Silene burchellii var. angustifolia	??
CARYOPHYLLACEAE	Silene cretica	??
CARYOPHYLLACEAE	Spergularia media	??
CELASTRACEAE	Gymnosporia buxifolia	LC

Family Name	Species Name	Status
CHENOPODIACEAE	Atriplex cinerea subsp. bolusii var. adamsonii	LC
CHENOPODIACEAE	Atriplex cinerea subsp. bolusii var. genuina	??
CHENOPODIACEAE	Atriplex eardleyae	??
CHENOPODIACEAE	Atriplex lindleyi subsp. inflata	??
CHENOPODIACEAE	Atriplex semibaccata var. appendiculata	LC
CHENOPODIACEAE	Atriplex vestita var. appendiculata	LC
CHENOPODIACEAE	Chenopodium murale var. murale	??
CHENOPODIACEAE	Manochlamys albicans	LC
CHENOPODIACEAE	Salsola aphylla	LC
CHENOPODIACEAE	Salsola sericata	LC
CHENOPODIACEAE	Salsola sp.	
CHENOPODIACEAE	Salsola zeyheri	LC
CHENOPODIACEAE	Sarcocornia natalensis var. natalensis	LC
CHENOPODIACEAE	Sarcocornia pillansii var. pillansii	LC
CRASSULACEAE	Adromischus alstonii	LC
CRASSULACEAE	Cotyledon cuneata	LC
CRASSULACEAE	Cotyledon orbiculata var. orbiculata	LC
CRASSULACEAE	Crassula brevifolia subsp. brevifolia	LC
CRASSULACEAE	Crassula campestris	LC
CRASSULACEAE	Crassula elegans	LC
CRASSULACEAE	Crassula elegans subsp. elegans	LC
CRASSULACEAE	Crassula expansa subsp. expansa	LC
CRASSULACEAE	Crassula expansa subsp. pyrifolia	LC
CRASSULACEAE	Crassula nudicaulis var. herrei	LC
CRASSULACEAE	Crassula subaphylla var. subaphylla	LC
CRASSULACEAE	Crassula tomentosa var. tomentosa	LC
CRASSULACEAE	Crassula whiteheadii	LC
CRASSULACEAE	Tylecodon buchholzianus subsp. buchholzianus	LC
CRASSULACEAE	Tylecodon decipiens	RARE
CRASSULACEAE	Tylecodon pygmaea	THR*
CRASSULACEAE	Tylecodon racemosus	LC
CRASSULACEAE	Tylecodon reticulatus subsp. phyllopodium	??
CRASSULACEAE	Tylecodon reticulatus subsp. reticulatus	LC
CYPERACEAE	Ficinia sp.	
EBENACEAE	Euclea tomentosa	LC
EUPHORBIACEAE	Euphorbia chersina	LC
EUPHORBIACEAE	Euphorbia decussata	LC
EUPHORBIACEAE	Euphorbia ramiglans	LC
EUPHORBIACEAE	Euphorbia rectirama	LC
EUPHORBIACEAE	Euphorbia sp.	
EUPHORBIACEAE	Euphorbia tuberculata var. tuberculata	LC
FABACEAE	Acacia karroo	LC
FABACEAE	Argyrolobium velutinum	EN
FABACEAE	Calobota angustifolia	??
FABACEAE	Calobota halenbergensis	??

Family Name	Species Name	Status
FABACEAE	Calobota lotononoides	??
FABACEAE	Crotalaria excisa subsp. excisa	LC
FABACEAE	Indigofera nigromontana	LC
FABACEAE	Lebeckia sericea	LC
FABACEAE	Lessertia diffusa	LC
FABACEAE	Lessertia falciformis	LC
Fabaceae	Lessertia frutescens (syn. Sutherlandia frutescens)	LC
FABACEAE	Lessertia sp.	
FABACEAE	Medicago laciniata var. laciniata	??
FABACEAE	Melolobium adenodes	LC
FABACEAE	Sutherlandia frutescens	LC
FABACEAE	Wiborgia monoptera	LC
FABACEAE	Wiborgia sericea	LC
FRANKENIACEAE	Frankenia repens	LC
GERANIACEAE	Erodium cicutarium	??
GERANIACEAE	Erodium moschatum	??
GERANIACEAE	Pelargonium adriaanii	??
GERANIACEAE	Pelargonium crithmifolium	LC
GERANIACEAE	Pelargonium dasyphyllum	LC
GERANIACEAE	Pelargonium echinatum	LC
GERANIACEAE	Pelargonium fulgidum	LC
GERANIACEAE	Pelargonium gibbosum	LC
GERANIACEAE	Pelargonium pulchellum	LC
HYACINTHACEAE	Albuca namaquensis	LC
HYACINTHACEAE	Albuca sp.	
HYACINTHACEAE	Albuca spiralis	LC
HYACINTHACEAE	Lachenalia anguinea	LC
HYACINTHACEAE	Lachenalia barkeriana	RARE
HYACINTHACEAE	Lachenalia sp.	
HYACINTHACEAE	Lachenalia valeriae	RARE
HYACINTHACEAE	Lachenalia violacea var. violacea	LC
HYACINTHACEAE	Lachenalia xerophila	LC
HYACINTHACEAE	Ornithogalum canadense (syn. Albuca canadensis)	LC
HYACINTHACEAE	Ornithogalum pruinosum	LC
HYACINTHACEAE	Ornithogalum unifolium	LC
HYACINTHACEAE	Veltheimia capensis	LC
IRIDACEAE	Babiana curviscapa	LC
IRIDACEAE	Babiana hirsuta	??
IRIDACEAE	Babiana lanata	VU
IRIDACEAE	Babiana namaquensis	LC
IRIDACEAE	Babiana sp	
IRIDACEAE	Babiana thunbergii	NT
IRIDACEAE	Ferraria divaricata subsp. divaricata	LC
IRIDACEAE	Ferraria schaeferi	LC
IRIDACEAE	Ferraria variabilis	LC

Family Name	Species Name	Status
IRIDACEAE	Gladiolus scullyi	LC
IRIDACEAE	Gladiolus sp	
IRIDACEAE	Lapeirousia macrospatha	LC
IRIDACEAE	Lapeirousia silenoides	LC
IRIDACEAE	Lapeirousia tenuis	RARE
IRIDACEAE	Moraea gawleri	LC
IRIDACEAE	Moraea miniata	LC
IRIDACEAE	Moraea rivulicola	RARE
JUNCACEAE	Juncus acutus subsp. leopoldii	LC
LAMIACEAE	Ballota africana	LC
LAMIACEAE	Salvia africana-lutea	LC
LAMIACEAE	Salvia dentata	LC
LAMIACEAE	Salvia lanceolata	LC
LOBELIACEAE	Monopsis debilis var. gracilis	LC
LORANTHACEAE	Tapinanthus oleifolius	LC
LYTHRACEAE	Nesaea sp.	??
MALVACEAE	Hermannia amoena	LC
MALVACEAE	Hermannia cuneifolia var. cuneifolia	LC
MALVACEAE	Hermannia disermifolia	LC
MALVACEAE	Hermannia incana	LC
MALVACEAE	Hermannia pfeilii	LC
MALVACEAE	Hermannia trifurca	LC
MELIANTHACEAE	Melianthus elongatus	LC
MESEMBRYANTHEMACEAE	Amphibolia laevis	LC
MESEMBRYANTHEMACEAE	Amphibolia rupis-arcuatae	LC
MESEMBRYANTHEMACEAE	Amphibolia succulenta	LC
MESEMBRYANTHEMACEAE	Antimima compacta	LC
MESEMBRYANTHEMACEAE	Antimima dolomitica	??
MESEMBRYANTHEMACEAE	Antimima maleolens	LC
MESEMBRYANTHEMACEAE	Antimima sp.	
MESEMBRYANTHEMACEAE	Aridaria brevicarpa	LC
MESEMBRYANTHEMACEAE	Aspazoma amplectens	LC
MESEMBRYANTHEMACEAE	Astridia cf. citrina	LC
MESEMBRYANTHEMACEAE	Astridia sp.	
MESEMBRYANTHEMACEAE	Brownanthus sp.	??
MESEMBRYANTHEMACEAE	Cephalophyllum ebracteatum	LC
MESEMBRYANTHEMACEAE	Cephalophyllum fulleri	RARE
MESEMBRYANTHEMACEAE	Cephalophyllum herrei	LC
MESEMBRYANTHEMACEAE	Cephalophyllum inaequale	LC
MESEMBRYANTHEMACEAE	Cephalophyllum rigidum	LC
MESEMBRYANTHEMACEAE	Cephalophyllum sp.	
MESEMBRYANTHEMACEAE	Cheiridopsis denticulata	LC
MESEMBRYANTHEMACEAE	Cheiridopsis namaquensis	LC
MESEMBRYANTHEMACEAE	Cheiridopsis robusta	LC
MESEMBRYANTHEMACEAE	Cheiridopsis sp.	

Family Name	Species Name	Status
MESEMBRYANTHEMACEAE	Conicosia elongata	LC
MESEMBRYANTHEMACEAE	Conicosia pugioniformis subsp. alborosea	LC
MESEMBRYANTHEMACEAE	Conophytum bilobum subsp. bilobum	LC
MESEMBRYANTHEMACEAE	Conophytum flavum subsp. flavum	LC
MESEMBRYANTHEMACEAE	Conophytum hians	LC
MESEMBRYANTHEMACEAE	Conophytum meyeri	RARE
MESEMBRYANTHEMACEAE	Conophytum sp.	
MESEMBRYANTHEMACEAE	Drosanthemum floribundum	LC
MESEMBRYANTHEMACEAE	Drosanthemum luederitzii	LC
MESEMBRYANTHEMACEAE	Drosanthemum oculatum	LC
MESEMBRYANTHEMACEAE	Drosanthemum sp.	
MESEMBRYANTHEMACEAE	Eberlanzia dichotoma	LC
MESEMBRYANTHEMACEAE	Fenestraria rhopalophylla subsp. aurantiaca	LC
MESEMBRYANTHEMACEAE	Jordaaniella cuprea	LC
MESEMBRYANTHEMACEAE	Jordaaniella spongiosa	LC
MESEMBRYANTHEMACEAE	Lampranthus brachyandrus	DDT
MESEMBRYANTHEMACEAE	Lampranthus suavissimus	DDT
MESEMBRYANTHEMACEAE	Lampranthus uniflorus	LC
MESEMBRYANTHEMACEAE	Leipoldtia frutescens	VU
MESEMBRYANTHEMACEAE	Leipoldtia sp.	
MESEMBRYANTHEMACEAE	Malephora framesii	LC
MESEMBRYANTHEMACEAE	Mesembryanthemum amplectens	Not listed
MESEMBRYANTHEMACEAE	Mesembryanthemum arenosum	Not listed
MESEMBRYANTHEMACEAE	Mesembryanthemum hypertrophicum	LC
MESEMBRYANTHEMACEAE	Mesembryanthemum nodiflorum	LC
MESEMBRYANTHEMACEAE	Mesembryanthemum pellitum	LC
MESEMBRYANTHEMACEAE	Mesembryanthemum sp.	
MESEMBRYANTHEMACEAE	Meyerophytum meyeri	LC
MESEMBRYANTHEMACEAE	Mitrophyllum clivorum	LC
MESEMBRYANTHEMACEAE	Mitrophyllum dissitum	LC
MESEMBRYANTHEMACEAE	Mitrophyllum sp.	
MESEMBRYANTHEMACEAE	Phyllobolus sinuosus	LC
MESEMBRYANTHEMACEAE	Phyllobolus spinuliferus	LC
MESEMBRYANTHEMACEAE	Phyllobolus trichotomus	LC
MESEMBRYANTHEMACEAE	Psilocaulon dinteri	LC
MESEMBRYANTHEMACEAE	Psilocaulon foliosum	LC
MESEMBRYANTHEMACEAE	Psilocaulon subnodosum	LC
MESEMBRYANTHEMACEAE	Ruschia cymosa	LC
MESEMBRYANTHEMACEAE	Ruschia festiva	??
MESEMBRYANTHEMACEAE	Ruschia fugitans	DDT
MESEMBRYANTHEMACEAE	Ruschia muelleri	LC
MESEMBRYANTHEMACEAE	Ruschia paripetala	LC
MESEMBRYANTHEMACEAE	Ruschia sp.	
MESEMBRYANTHEMACEAE	Ruschia versicolor	LC
MESEMBRYANTHEMACEAE	Ruschia viridifolia	LC

Family Name	Species Name	Status
MESEMBRYANTHEMACEAE	Stoeberia beetzii	LC
MESEMBRYANTHEMACEAE	Stoeberia frutescens	LC
MESEMBRYANTHEMACEAE	Stoeberia utilis	LC
MESEMBRYANTHEMACEAE	Vanzijlia annulata	LC
MESEMBRYANTHEMACEAE	Wooleya farinosa	VU
MOLLUGINACEAE	Adenogramma glomerata	LC
MOLLUGINACEAE	Hypertelis salsoloides	LC
MOLLUGINACEAE	Hypertelis salsoloides var. salsoloides	LC
MOLLUGINACEAE	Hypertelis sp.	
MOLLUGINACEAE	Limeum africanum subsp. africanum	LC
MOLLUGINACEAE	Limeum africanum subsp. canescens	LC
MOLLUGINACEAE	Pharnaceum albens	LC
MOLLUGINACEAE	Pharnaceum confertum var. confertum	LC
MOLLUGINACEAE	Pharnaceum microphyllum var. microphyllum	LC
MORACEAE	Ficus ilicina	LC
NEURADACEAE	Grielum grandiflorum	LC
NEURADACEAE	Grielum humifusum var. humifusum	LC
NEURADACEAE	Grielum sinuatum	LC
OROBANCHACEAE	Hyobanche glabrata	LC
OROBANCHACEAE	Hyobanche sanguinea	LC
PLUMBAGINACEAE	Limonium dregeanum	LC
POACEAE	Bromus sp.	??
POACEAE	Chaetobromus involucratus subsp. dregeanus	LC
POACEAE	Chaetobromus involucratus subsp. involucratus	LC
POACEAE	Chaetobromus involucratus subsp. sericeus	LC
POACEAE	Cladoraphis cyperoides	LC
POACEAE	Cladoraphis spinosa	LC
POACEAE	Ehrharta brevifolia var. cuspidata	LC
POACEAE	Ehrharta delicatula	LC
POACEAE	Ehrharta longiflora	LC
POACEAE	Ehrharta longifolia	LC
POACEAE	Eragrostis curvula	LC
POACEAE	Fingerhuthia africana	LC
POACEAE	Hordeum murinum subsp. glaucum	??
POACEAE	Karroochloa schismoides	LC
POACEAE	Pentaschistis tomentella	LC
POACEAE	Phalaris minor	??
POACEAE	Phragmites australis	LC
POACEAE	Schismus barbatus	LC
POACEAE	Schmidtia kalahariensis	LC
POACEAE	Sporobolus virginicus	LC
POACEAE	Stipagrostis ciliata var. capensis	LC
POACEAE	Stipagrostis geminifolia	LC
POLYGONACEAE	Emex australis	??
PORTULACACEAE	Anacampseros albissima	??

Family Name	Species Name	Status
PORTULACACEAE	Anacampseros filamentosa subsp. namaquensis	LC
PTYCHOMITRIACEAE	Ptychomitrium crispatum	??
RUBIACEAE	Galium spurium-aparine	LC
RUBIACEAE	Nenax arenicola	LC
RUTACEAE	Diosma acmaeophylla	LC
SANTALACEAE	Thesium lineatum	LC
SAPINDACEAE	Dodonaea angustifolia	LC
SCROPHULARIACEAE	Diascia batteniana	LC
SCROPHULARIACEAE	Hebenstretia repens	LC
SCROPHULARIACEAE	Hebenstretia sp.	
SCROPHULARIACEAE	Jamesbrittenia fruticosa	LC
SCROPHULARIACEAE	Jamesbrittenia merxmuelleri	LC
SCROPHULARIACEAE	Lyperia tristis	LC
SCROPHULARIACEAE	Nemesia bicornis	LC
SCROPHULARIACEAE	Nemesia sp.	
SCROPHULARIACEAE	Peliostomum virgatum	LC
SCROPHULARIACEAE	Phyllopodium pumilum	LC
SCROPHULARIACEAE	Zaluzianskya affinis	LC
SCROPHULARIACEAE	Zaluzianskya benthamiana	LC
SOLANACEAE	Lycium amoenum	LC
SOLANACEAE	Lycium cinereum	LC
SOLANACEAE	Lycium decumbens	??
SOLANACEAE	Nicotiana glauca	EXOTIC
TECOPHILAEACEAE	Cyanella hyacinthoides	LC
TELOSCHISTACEAE	Xanthoria flammea	??
THYMELAEACEAE	Passerina truncata subsp. truncata	LC
URTICACEAE	Forsskaolea candida	LC
VISCACEAE	Viscum capense	LC
ZYGOPHYLLACEAE	Sisyndite spartea	LC
ZYGOPHYLLACEAE	Zygophyllum cordifolium	LC
ZYGOPHYLLACEAE	Zygophyllum morgsana	LC
ZYGOPHYLLACEAE	Zygophyllum spinosum	LC