



NICK HELME BOTANICAL SURVEYS

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**SPECIALIST IMPACT ASSESSMENT FOR PROPOSED
RHEBOKSFONTEIN WIND ENERGY FACILITY NEAR
DARLING, WESTERN CAPE: VEGETATION
COMPONENT**

Prepared for: Savannah Environmental (Pty.) Ltd., Johannesburg

Client: Moyeng Energy (Pty) Ltd.

26 August 2010

EXECUTIVE SUMMARY

This botanical impact assessment was requested in order to help inform decisions regarding the establishment of a proposed private wind energy facility (WEF) on a site in the Darling area (Western Cape). The 3900ha study area consists of the Remaining extent of Farm 568 (Rheboksfontein), Farm 567 (Nieuwe Plaats), Remaining extent of Farm 571 (Bonteberg), Portion 1 of Farm 574 (Doornfontein), Portion 1 of Farm 551 (Plat Klip), Farm 1199 (Groot Berg) and Portion 2 of Farm 552 (Slang Kop). The study area lies east of the R27 and straddles the Yzerfontein to Darling road (R315). The proposal is to install a total of up to 80 wind turbines. The proposed WEF would also include 3 substations, a 32km long 132kV power line linking to the transmission grid at Dassenberg substation near Atlantis, access roads and a maintenance/control building.

The study area lies at the western edge of the Swartland section of the Cape Lowlands Renosterveld Project study area. This project identified the majority of the natural vegetation in the study area as part of the core conservation area, and as part of the immediate 5 year priority area for conservation action (von Hase *et al* 2003).

There are two natural vegetation types in the study area – Swartland Granite Renosterveld (which would originally have covered 80% of study area) and Hopefield Sand Fynbos. Both are nationally recognised as threatened, with the former being Critically Endangered and the latter Endangered in terms of the National Spatial Biodiversity Assessment (Rouget *et al* 2004). The Draft National List of Threatened Ecosystems lists Swartland Granite Renosterveld as Critically Endangered and Hopefield Sand Fynbos as Vulnerable (DEA 2009). Thus all remaining natural vegetation in the study area is of High sensitivity and conservation value. Natural vegetation covers an estimated 50% of the southern section of the site, but only about 10% of the northern section. The higher percentage of natural vegetation on the southern section is due to the fact that this is the part of the site dominated by infertile sandy soils, which are not suitable for most cultivation.

The vegetation in the study area ranges in condition from totally transformed agricultural land (about 70% of the area, or 2730ha) to partly disturbed (about 350ha) to largely pristine (about 550ha). All the largely pristine areas, but also the more natural sections of the partly disturbed areas, can be expected to support varying and significant numbers of threatened or localised plant species,

and it is possible that upwards of 35 plant species of conservation concern occur within the study area. This exceptionally high figure is indicative of the sensitivity and conservation importance of both the general area and the study area.

Disturbance in the area includes dryland cultivation (mainly for cereals and grazing for sheep and cattle), dairy farming and associated effluent drainage, heavy grazing and trampling by cattle and sheep, and alien vegetation invasion. The most heavily disturbed areas are those that have been regularly ploughed and sown with crops, plus those where dairy farming is undertaken, and these areas generally have no botanical value. Alien invasive vegetation is most severe in seasonally and permanently damp places, around homesteads, and in areas where there has been previous soil disturbance.

The following potentially negative ecological issues have been identified:

- Direct loss of vegetation at the construction phase (tower installation requires special cranes on heavy tracks; crane standpads; substations; access roads; powerline footings; concrete mixing sites).
- Temporary loss of vegetation at the construction phase (laydown areas; underground cabling; disturbance around towers; building material storage areas; access route along 32km powerline).
- Indirect ecological impacts at the operational phase (possible introduction of invasive alien ants and plants; possible disruption of natural fire regimes; possible fragmentation of natural habitat and ecological corridors).

The following potentially positive ecological impacts have been identified:

- Opportunity to formally conserve and manage significant priority areas of natural habitat on site (basically on-site offsets), preferably as Contract Reserves with CapeNature's Stewardship Program.
- Opportunity to reduce damaging effluent inflow into the important Tienie Versfeld Wildflower Reserve from the dairy farm on the property immediately upslope (Farm 552).

The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation (<10ha) in development footprints, and direct, long term loss of natural vegetation (<10ha) in areas that will be disturbed by heavy construction machinery and power line installation, temporary dumping of sand and supplies, etc. Most of these impacts can be

avoided by very minor changes to the turbine and road positions (usually requiring layout shifts of less than 50m), and these are duly recommended as mandatory mitigation.

Indirect impacts are often difficult to quantify and avoid. The indirect botanical impacts of the proposed development are fortunately likely to be negligible in relation to the existing and ongoing agricultural impacts on the site (*e.g.* grazing, fertiliser and pesticide usage and drift).

Cumulative effects are in many respects regional effects, and the impacts of this type of development will be significantly less than for various existing and ongoing agricultural operations in the region, as well as for the many unmanaged and expanding alien plant invasions on numerous properties in the region.

The proposed 32km power line to the Dassenberg substation crosses many areas of High botanical sensitivity (totalling 26km in length) but will have an acceptable overall Low-Medium negative impact overall, and the expected botanical impacts are difficult to mitigate. Substations 2 and 3 are in acceptable locations, but Substation 1 will have significant negative impacts on the Renosterveld in this area, and should thus be moved (300m north) into a nearby area of agricultural land. This also means that a number of proposed cable trenches through the Renosterveld will have to be rerouted, and in most cases these can easily be located within agricultural land, where they will have minimal botanical impact.

The possible positive direct impact depends to a large degree on the management of the remaining natural vegetation within the study area (about 900ha in moderate or good condition) as a conservation area (Sand Fynbos and Renosterveld are both very under-conserved, with less than 1% conserved), and the removal of livestock from these Renosterveld and Sand Fynbos areas during the main flowering season (May – September). A second positive indirect impact could be realized if current nutrient-rich effluent flows from the farm adjacent to the Tienie Versfeld Reserve are reduced or eliminated. An indirect positive impact is obviously the small contribution that this WEF will make to reducing CO₂ emissions, and the associated very small reduction in global warming effects.

Overall the proposed WEF is likely to have a Medium – High negative local (site scale; 1600ha site) and Medium regional (Darling Hills; < 100 000ha) negative impact on the vegetation on site, prior to mitigation. This could be reduced to

Low negative (site) and Very Low negative (regional) with proper mitigation, although the likelihood of all proposed mitigation taking place is considered only moderate, and a more likely post-mitigation significance is Low – Medium negative (at both site and regional scales). The most important unknown variables in this regard are the likelihood of being able to mitigate the current negative agricultural impacts on the adjacent Tienie Versfeld Wildflower Reserve, the likelihood of being able to manage the 32km long power line servitude appropriately, and the likelihood of most High sensitivity vegetation areas on site being managed under CapeNature's Stewardship program.

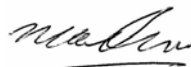
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DECLARATION OF INDEPENDENCE

In terms of Chapter 5 of the National Environmental Management Act of 1998 specialists involved in Impact Assessment processes must declare their independence and include an abbreviated Curriculum Vitae.

I, N.A. Helme, do hereby declare that I am financially and otherwise independent of the client and their consultants, and that all opinions expressed in this document are substantially my own.



NA Helme

Abridged CV:

Contact details as per letterhead.

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Date of birth : 29 January 1969

University of Cape Town, South Africa. BSc (Honours) – Botany (Ecology & Systematics). 1990.

Since 1997 I have been based in Cape Town, and have been working as a specialist botanical consultant, specialising in the diverse flora of the south-western Cape. Since the end of 2001 I have been the Sole Proprietor of Nick Helme Botanical Surveys.

A selection of recent, relevant projects undertaken in the region include:

- Scoping study of Proposed Wind Energy Facility near Swellendam (CSIR 2010)
- Scoping study of proposed Wind Energy Facility near Britannia Bay (Savannah Environmental 2010)
- Scoping study of Proposed Wind Energy Facility near Bredasdorp (CSIR 2010)
- Scoping study of Proposed Wind Energy Facility near Caledon (Arcus Gibb 2009)
- Scoping and Impact Assessment of proposed Wind Energy Facility near Hopefield (Savannah Environmental 2008 & 2009)
- Scoping study of Proposed Wind Energy Facility near Vredendal (DJ Environmental 2009)
- Scoping study of Proposed Wind Energy Facility west of Bitterfontein (DJ Environmental 2009)
- Botanical Scoping and Impact Assessment of proposed St Helena Hills development (DJ Environmental 2009)
- Botanical Impact Assessment of Portion 4 of Farm 560, Yzerfontein (EnviroLogic 2009)
- Botanical Impact Assessment of Portion 9 of Farm 957, Saldanha (EnviroLogic 2008)
- Botanical Impact Assessment of proposed development on Portion 87 of the Farm Witteklip 123, Vredenburg (CCA Environmental 2008)
- Botanical Sensitivity study of Portion 4 of Farm Yzerfontein 560 (De Villiers family 2008)
- Botanical Scoping and Impact Assessment of proposed overnight sites in the West Coast National Park (SANParks 2008 & 2010)
- Fine Scale Vegetation Mapping for Saldanha Municipality (CapeNature 2007)
- Botanical Assessment of Rem. Erf 460 Ptn A, St Helena (Envirodinamik 2007)
- Stewardship assessment of Rainbow Chicken Sites (CapeNature 2007)

1. INTRODUCTION

This botanical impact assessment was requested in order to help inform decisions regarding the establishment of a proposed private wind energy facility (WEF) on a large site in the Darling area (Western Cape). The 3900ha study area consists of the Remaining extent of Farm 568 (Rheboksfontein), Farm 567 (Nieuwe Plaats), Remaining extent of Farm 571 (Bonteberg), Portion 1 of Farm 574 (Doornfontein), Portion 1 of Farm 551 (Plat Klip), Farm 1199 (Groot Berg) and Portion 2 of Farm 552 (Slang Kop). The study area lies east of the R27 and straddles the Yzerfontein to Darling road (R315). The proposal is to install a total of up to 80 wind turbines. The proposed WEF would also include 3 substations, a 32km 132kV powerline linking to the transmission grid at the Dassenberg substation near Atlantis, access roads and a maintenance /control building. Each turbine would be connected to the on-site substations by underground cabling and accessed via 6m wide access roads, with further footprints associated with the construction phase crane tracks, *etc.* The total area spanned by the turbine and road network is calculated to amount to about 2900ha.

The botanical Scoping study for this project was completed in March 2010 (Helme 2010). No alternative infrastructure layouts have been presented for assessment.

2. LIMITATIONS AND ASSUMPTIONS

The baseline information about the vegetation of this site is contained in Helme (2010) and is not comprehensively repeated in this Impact Assessment report. No fieldwork was specifically undertaken for this study, the primary reason being that all areas of natural vegetation in this area are considered to be no go areas for development (see below), and aerial image mapping was likely to be sufficiently accurate. The author is familiar with large parts of the study area, and was able to confidently interpret the Nov 19 2009 Google Earth imagery for this area, which was used as a basis for the sensitivity mapping in Helme (2010). The author has previously studied and sampled the vegetation in various localities within the study area, mostly as part of the fieldwork undertaken for the Cape Lowlands Renosterveld Project (Von Hase *et al* 2003), and on some adjacent sites (Helme 2010a). Given that all natural vegetation in the study area is classified either as Critically Endangered or Endangered on a national basis (Rouget *et al* 2004) it was assumed that all remaining areas of natural vegetation on site are of High botanical sensitivity and conservation value. Conservation value and sensitivity of habitats are a product of diversity, rarity of habitat, rarity of species, ecological viability and connectivity, vulnerability to impacts, and

reversibility of threats. The confidence level in the botanical sensitivity mapping is regarded as high. A site visit at the Impact Assessment stage is unlikely to have significantly increased the accuracy of the initial findings of Helme 2010.

It is assumed that the layout provided by Moyeng Energy is 90% spatially accurate, although it is clear that certain infrastructure is not optimally situated from a botanical point of view, and the identification of such is one of the primary aims of this report. It is assumed that wind turbine foundations will permanently disturb an area of up to 20m by 20m; that permanent gravelled roads will be 6m wide; that adjacent laydown areas will temporarily disturb areas of up to 40m by 40m (or 20m by 70m), and possibly permanently disturb areas of up to 20m by 20m; and that the compacted area (long term to permanent disturbance) for crane travel will be up to 13m wide and parallel to and inclusive of the 6m wide gravelled roads (and thus 3m either side of the gravel roads). Disturbance corridors for underground cabling are estimated at up to 6m wide (3m for the trench and digger track, 3m for the temporary placement of soil). It is assumed that the three proposed substations will be constructed on site, and that the total footprint for each will be less than 0.5ha. The proposed 32km power line connection to the Dassenberg substation near Atlantis is not technically part of the study area, but is part of the proposed development and is here assessed. No alternative power line routes were provided.

It is not known where concrete will be sourced from (presumably from authorised areas near Saldanha) and the impact on limestone surface deposits (important botanical areas) is a potential indirect impact in those areas. It is assumed that the gravel, if needed (deemed unlikely, as most soils on site are not sandy), will come from existing, authorised borrow pits off-site. The former may have a significant impact on vegetation and should ideally have been clarified as part of this study (although not technically part of the study area), as impacts are relevant and indirectly related to this project – wherever they occur.



Figure 1: Proposed infrastructure layout for the northern area (north of R315). Brown lines are internal access roads, green lines are cable trenches, blue lines are internal, above ground electrical connections between the three substations, and white marks and numbers are turbine positions and numbers.

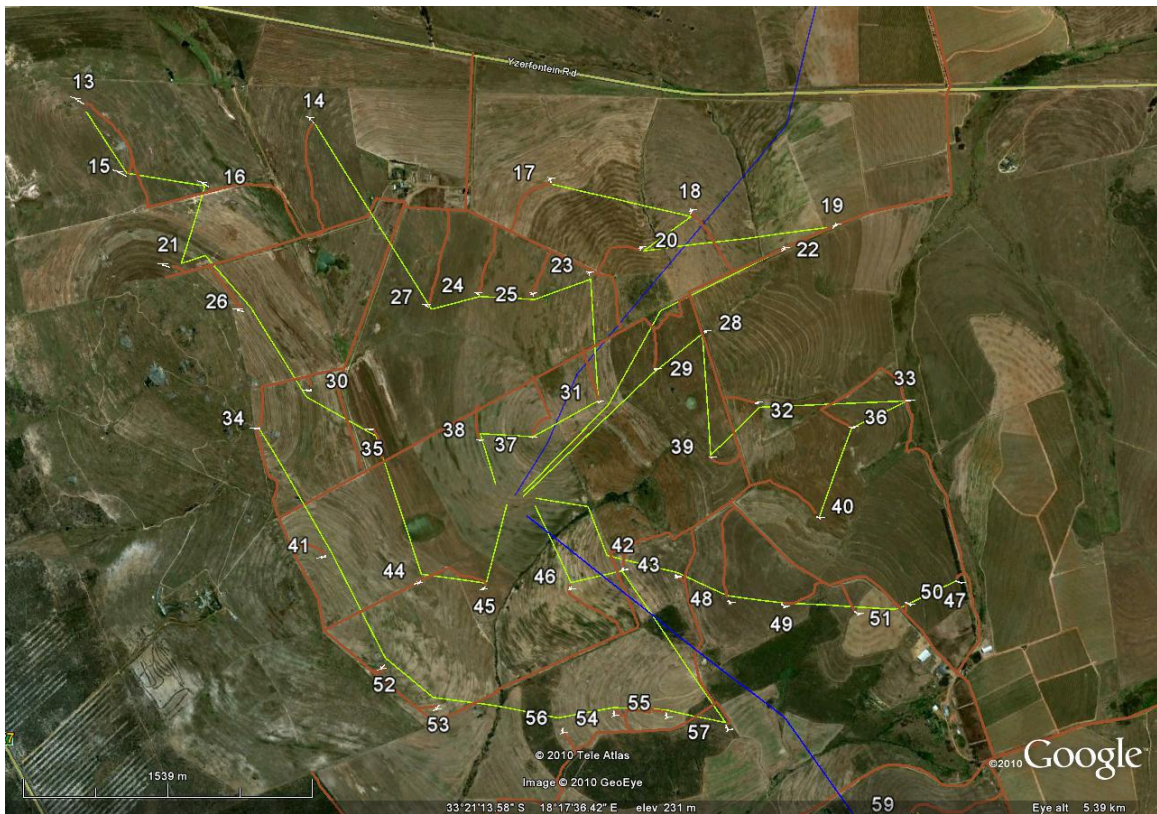


Figure 2: Proposed infrastructure layout for the central area.

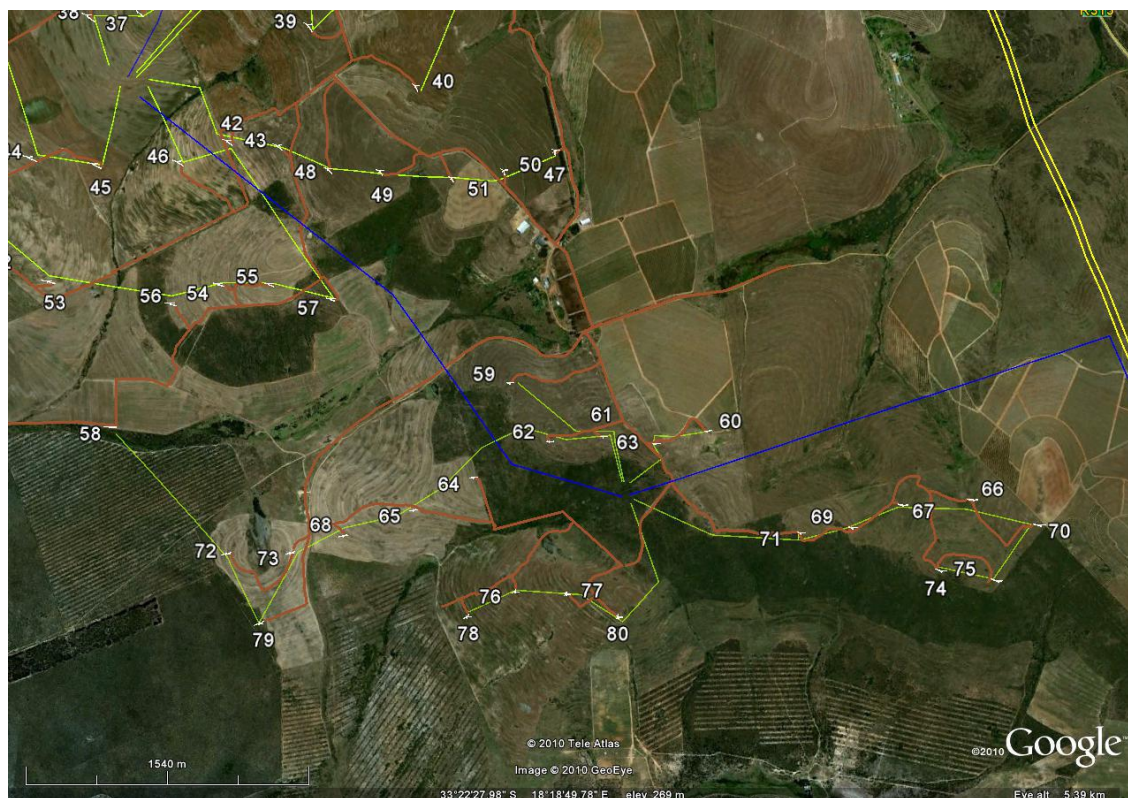


Figure 3: Proposed infrastructure layout for the southern area.

3. TERMS OF REFERENCE

Terms of reference (TOR) for the Scoping and IA phases were the standard TOR as proposed by CapeNature, and DEA&DP's guidelines for biodiversity assessment (Brownlie 2005) were also adhered to. The CapeNature TOR are as follows:

- Produce a baseline analysis of the botanical attributes of the property as a whole (see Helme 2010).
- This report should clearly indicate any constraints that would need to be taken into account in considering the development proposals further (see Helme 2010).
- The baseline report must include a map of the identified sensitive areas as well as indications of important constraints on the property. It must also (see Helme 2010 for most of below information):
 - Describe the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

- In terms of biodiversity pattern, identify or describe:

Community and ecosystem level

- a. The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- b. The types of plant communities that occur in the vicinity of the site
- c. Threatened or vulnerable ecosystems (*cf. new SA vegetation map/National Spatial Biodiversity Assessment, etc.*)

Species level

- d. The presence of any plant Species of Conservation Concern (SCC)
- e. The viability of and estimated population size of the plant SCC present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- f. The likelihood of other SCC occurring in the vicinity (include degree of confidence).

Other pattern issues

- g. Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- h. The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- i. The condition of the site in terms of current or previous land uses.
- j. In terms of **biodiversity process**, identify or describe:
- k. The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- l. Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)
- m. Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- n. Would the conservation of the site lead to greater viability of the adjacent ecosystem?

- Would the site potentially contribute to meeting regional conservation targets for both biodiversity pattern and ecological processes?
- Is this a potential candidate site for conservation stewardship?
- What is the significance of the potential impact of the proposed project – with and without mitigation – on biodiversity pattern and process at the site, landscape, and regional scales? Include comment on cumulative impacts.
- Provide a map, at suitable scale, of key conservation areas and corridors.
- Recommend actions that should be taken to prevent or mitigate impacts. Indicate how these should be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
- Indicate limitations and assumptions, particularly in relation to seasonality.

4. METHODOLOGY

The study approach was partly informed by the guidelines prepared by Brownlie (2005), and also by the TOR. Vegetation types used are as defined in the SA vegetation map (Mucina & Rutherford 2006), and ecosystem status is as per the National Spatial Biodiversity Assessment (Rouget et al 2004) and the subsequent Draft National List of Threatened Ecosystems (DEA 2009). Red List status of plant species is according to Raimondo et al (2009). Reference was made to extensive, detailed work done in similar habitats in the region for the Saldanha and Sandveld Fine Scale Vegetation Mapping Projects (Helme & Koopman 2007, Helme 2007a), and to the Darling Phase 2 WEF (Helme 2010a).

For previous records of rare plants in the area I was able to access the GIS based information on the Cape Rares database (Spatial layer of rare and threatened plant localities managed by the Threatened Species Programme of SANBI (January 2007). I was also able to access the GIS data collected by the Protea Atlas Project for the Proteaceae (Protea Atlas Project 2004).

Subsequent to the baseline report of Helme (2010) all areas of elevated botanical sensitivity (areas of natural vegetation) were mapped on the Nov 2009 Google Earth imagery and saved as .kmz files, and were then forwarded to the planning team, which has subsequently endeavoured to avoid most of these areas.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 Regional context and ecological drivers

The primary description and mapping of the vegetation in the area can be found within the scoping study (Helme 2010), and is not repeated here in full.

The study area lies at the western edge of the greater Swartland bioregion, but is better described as being part of the Darling Hills. The sandy south-western portion of the site is part of the sandy coastal forelands commonly known as the Sandveld. The Swartland is a major grain producing area, whilst the Darling Hills support mixed farming, including grazing of livestock, cereal cultivation, dairy farming, and production of wine grapes. Due to the high agricultural potential of the granite-derived soils in the area the loss of natural vegetation to agriculture has been severe (>80% lost), and the Swartland and Darling Hills bioregion has a very large number of threatened plant species (probably more than 300; Raimondo *et al* 2009). Two extremely important conservation areas border the study area – Tienie Versfeld Wildflower Reserve in the northwest, and Rondeberg Private Nature Reserve in the south. The former is managed by SANBI (South African National Biodiversity Institute) and the latter is privately owned and managed. Both reserves are amongst the most important botanical conservation areas in the west coast area, with exceptionally high numbers of threatened plant species recorded from both reserves.

The vegetation in the study area ranges in condition from totally transformed agricultural land (about 70% of the area, or 2730ha) to partly disturbed (about 350ha) to largely pristine (about 550ha).

As can be seen from Figure 4 there were originally two vegetation types in the study area, and these two are both still present, although the Renosterveld is much reduced in extent due to extensive agriculture. Note that Figure 4 shows the original vegetation patterns, prior to human influence. About 80% of the overall study area supported Swartland Granite Renosterveld, with the sandy southwestern corner supporting Hopefield Sand Fynbos (Mucina & Rutherford 2006).

Swartland Granite Renosterveld has been very heavily impacted by agriculture within the region where it occurs (Darling to Malmesbury) and today less than 20% of its original extent remains (Rouget *et al* 2004). The vegetation type is regarded as a **Critically Endangered vegetation type**, with an

unachievable national conservation target of 26%, and only 1% conserved (virtually all of this in private reserves; Rouget *et al* 2004). Intact examples of this vegetation type are typically home to a high number of rare and threatened plant species, many of which are endemic (restricted) or near endemic to the vegetation type. The Draft National List of Threatened Ecosystems (DEA 2009) has also classified this vegetation type as **Critically Endangered** (due to high levels of species endemism, and due to extent of habitat loss). About 20% of the remaining vegetation in the study area is of this type.

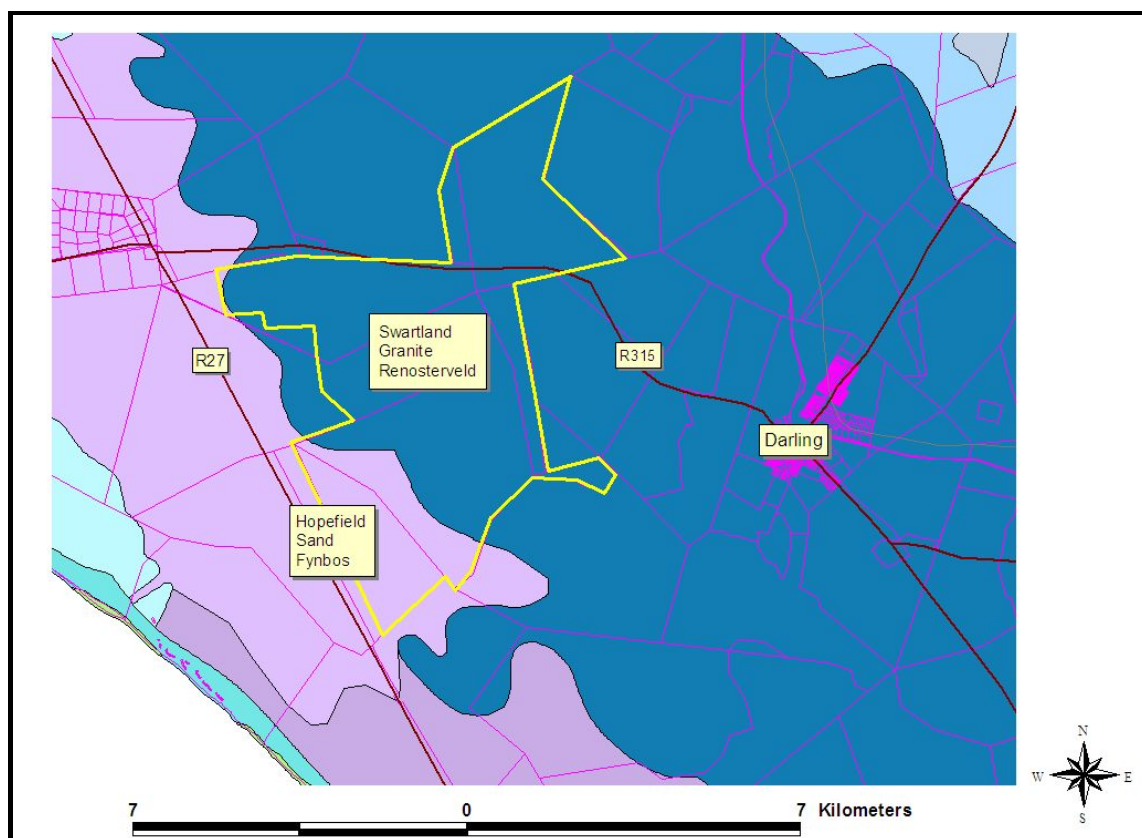


Figure 4: Extract of the SA Vegetation Map (Mucina & Rutherford 2006), showing that most of the area would have originally supported Swartland Granite Renosterveld, with a significant patch of Hopefield Sand Fynbos in the southwestern corner. Approximate study area outlined in yellow.

Hopefield Sand Fynbos is, as its name suggests, restricted to sandy soils in the Hopefield region, extending as far south as the study area. Some 41% of this vegetation type has been lost, with a conservation target of 30%. Nothing (0%) is formally conserved (Rouget *et al* 2004), although recent acquisitions by the West Coast National Park have incorporated sections of this habitat. The unit is classified as **Endangered** on a national basis by the national Spatial Biodiversity Assessment (Rouget *et al* 2004). The Draft National List of Threatened

Ecosystems (DEA 2009) has recently classified this vegetation type as **Vulnerable** (due to irreversible loss of habitat and high levels of species endemism), and this takes precedence over all preceding classifications. About 80% of the remaining vegetation in the study area is of this type.

Fire is a key ecosystem driver of both Renosterveld and Sand Fynbos (De Villiers 2005). It is essential that these vegetation types burn once every 12 to 25 years, as many of the species are adapted to regular fires and will only flower or germinate from seed after a fire. Fires at a frequency greater than this will dramatically reduce overall species diversity, and fires less often than once every 25 or 30 years will lead to gradual senescence of many species, and hence local extinctions.

An additional ecological driver is soil moisture; with distinct plant communities (and many rare species) associated with seasonally damp drainage lines, which comprise less than 10% of the overall site. Unfortunately some of these drainage lines have generally been heavily invaded by *Acacia saligna* (Port Jackson willow), which has resulted in reduced water availability, and increased shading, and others have been impacted by runoff from farming operations, leading to alien grass invasions, notably *Lolium* species (ryegrass).

5.2 Plant Species of Conservation Concern

As many as 35 threatened plant species may occur within the study area or its immediate surrounds, and the vast majority would occur within the areas of remnant natural vegetation. This is an exceptionally high figure, even for the Fynbos biome, and is indicative of the conservation importance and sensitivity of all remaining natural habitat in the area. An additional ten or more threatened plant species may occur within the area traversed by the proposed power line to the Dassenberg substation.

6. DESCRIPTION OF ISSUES IDENTIFIED AT THE SCOPING STAGE

Most of the key issues were included within the conclusions of the vegetation scoping document (Helme 2010), and the relevant ones are repeated here, and some are expanded:

- Loss of natural vegetation during the construction stage is the primary botanical impact. About half will be permanent, and the other half will be temporary, as trampled and partly disturbed areas should eventually

recover. It is estimated (based on current layouts shown in Figures 1-3) that the total amount of vegetation lost would be less than 10ha of each category (<10ha temporary and <10ha temporary). Some of the direct negative effects associated with construction of the 32km long power line servitude could be significant, and the impact associated with the construction of Substation 1 would be significant, as it is within an area of natural vegetation.

- The least sensitive areas are the previously cultivated areas, which have a Low sensitivity on a regional scale. In order to minimise direct impacts on the vegetation these are the areas where the bulk of the infrastructure (such as the substations, turbines, roads, construction camp, and operations base) should be placed, if possible.
- Indirect negative effects (habitat fragmentation, disruption of natural fire regime, possible introduction and spread of alien invasive plants and insects) are likely to be relatively insignificant, especially in the context of the ongoing farming operations in the area. However, some of the indirect effects associated with construction and maintenance of the 32km long power line servitude could be significant.
- Cumulative negative effects are likely to be negligible, at least after mitigation.
- It is recommended that roads through areas of natural vegetation be kept to a minimum during planning, construction and operational stages, as this will be one of the primary sources of direct vegetation loss, alien plant and insect introduction, and habitat fragmentation (the latter both indirect effects). The proposed new power line would presumably require almost 32km of new access track for the heavy offroad vehicles required to install this line, even though it is adjacent to an existing 400kV line.
- Indirect botanical impacts after mitigation could be positive if all recommended mitigation is put in place, and all areas of natural vegetation are managed according to an OEMP and formally conserved within the Stewardship Program of CapeNature.
- It is strongly recommended that as part of the OEMP there be no livestock permitted in mapped areas of natural vegetation during the period May to end September. One of the primary reasons for this recommendation is that removal of grazing pressure will have a beneficial effect on the natural vegetation, particularly in terms of natural rehabilitation, in that flowering and seed set of the remaining natural plants (especially pioneers such as the annuals) will be significantly better in the absence of grazing

(which removes the flowers). If the nearby annuals and other plants are not grazed this means that natural rehabilitation of the areas disturbed by the project will be significantly improved, as there will be more locally indigenous seed available nearby for establishment in the disturbed areas.

6. METHODOLOGY FOR DETERMINING SIGNIFICANCE OF IMPACTS

Direct, indirect and cumulative impacts of the above issues, as well as all other issues identified, are assessed in terms of the following criteria:

- » The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, where it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score between 1 and 5 will be assigned as appropriate (with a score of 1 being low (site only) and a score of 5 being high (national or international extent)).
- » The **duration**, where it will be indicated whether:
 - * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - * medium-term (5–15 years) – assigned a score of 3;
 - * long term (> 15 years) - assigned a score of 4; or
 - * permanent - assigned a score of 5.
- » The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
 - * 0 is small and will have no effect on the environment;
 - * 2 is minor and will not result in an impact on processes;
 - * 4 is low and will cause a slight impact on processes;
 - * 6 is moderate and will result in processes continuing but in a modified way;
 - * 8 is high (processes are altered to the extent that they temporarily cease); and
 - * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:
 - * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
 - * Assigned a score of 2 is improbable (some possibility, but low likelihood);

- * Assigned a score of 3 is probable (distinct possibility);
 - * Assigned a score of 4 is highly probable (most likely); and
 - * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
 - » the **status**, which will be described as either positive, negative or neutral.
 - » the *degree* to which the impact can be *reversed*.
 - » the *degree* to which the impact may cause *irreplaceable loss of resources*.
 - » the *degree* to which the impact can be *mitigated*.

The **significance** is determined by combining the criteria in the following formula:

$S=(E+D+M)P$; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

7. IMPACT ASSESSMENT

Impacts may be both direct and indirect, with the former occurring mostly at the construction stage and the latter mostly at the operational stage.

In the case of this project the primary direct impact is loss of natural vegetation (and associated possible Species of Conservation Concern) within some of the development footprints. All hard infrastructure located within or partly within natural vegetation will result in the permanent loss of that vegetation. The primary sources of permanent loss include (in descending order of importance, based on the proposed layout) the Substation 1, access roads, the turbine

footprints (including permanent crane standpads), and power line tower footprints. The primary sources of temporary, long-term vegetation loss include excavation and sand piles for very large foundations and the cabling, the lay down areas, crane tracks, and roads alongside the power line.

Loss of regionally rare plant species would have a regional impact, as would loss of regionally endemic vegetation types (Swartland Granite Renosterveld and Hopefield Sand Fynbos). Although both these are direct impacts at the site scale they may have indirect consequences (impacts) at the regional scale.

The indirect, negative botanical impacts are not likely to be important, but may include a small degree of habitat fragmentation, and introduction of invasive alien plants and insects (mainly along tracks, due to introduced gravel required). A further potential (but unlikely) indirect impact relates to the source of the gravel for the roads (sources have not yet been identified, although it is assumed that a commercial source will be used) – many gravel quarries are located close to or in Renosterveld areas (pers. obs.). This impact has been deemed to be unlikely as the soils in the area are not deep sands and should not need to be extensively graveled. However, large amounts of concrete will be needed for the turbine foundations (~375m³ each), and the limestone and crushed stone needed to produce this concrete may be derived from surface deposits in sensitive areas (e.g. near Saldanha), but as the concrete suppliers are currently undetermined the impacts cannot be assessed. Although it is not often appreciated, even though these suppliers have been authorized, the key point is that many of the suppliers are mining limestone resources which currently support numerous rare, localised and threatened plant species (Helme & Koopman 2007), and any increased demand results in further habitat loss in these sensitive areas.

The indirect impacts noted above are thus a mix of those that occur at the site and the regional scale.

7.1 Direct Impact: Permanent loss of natural vegetation

About 98% of the proposed development footprints within the study area will impact primarily on disturbed areas of no or very low botanical significance, but the infrastructure will also impact on small areas (<20ha in total) of Swartland Granite Renosterveld – a Critically Endangered vegetation type. Almost no loss of Hopefield Sand Fynbos is likely as a result of the proposed internal access roads, substation and turbine placements, but the proposed 32km power line and the

access road to the R27 will have negative direct impacts on this vegetation type. The bulk of the loss of Granite Renosterveld would occur in the footprint of Substation 1, where cable trenches cross natural vegetation, and in areas where existing farm tracks through the strips of natural vegetation have to be widened to accommodate the large construction and transport vehicles (vehicles are long, wide and heavy). Direct impacts will also occur in the few places where turbines have been provisionally placed either partly or fully within natural vegetation. All areas where important direct vegetation impacts occur within the study site have been identified in Figure 5.

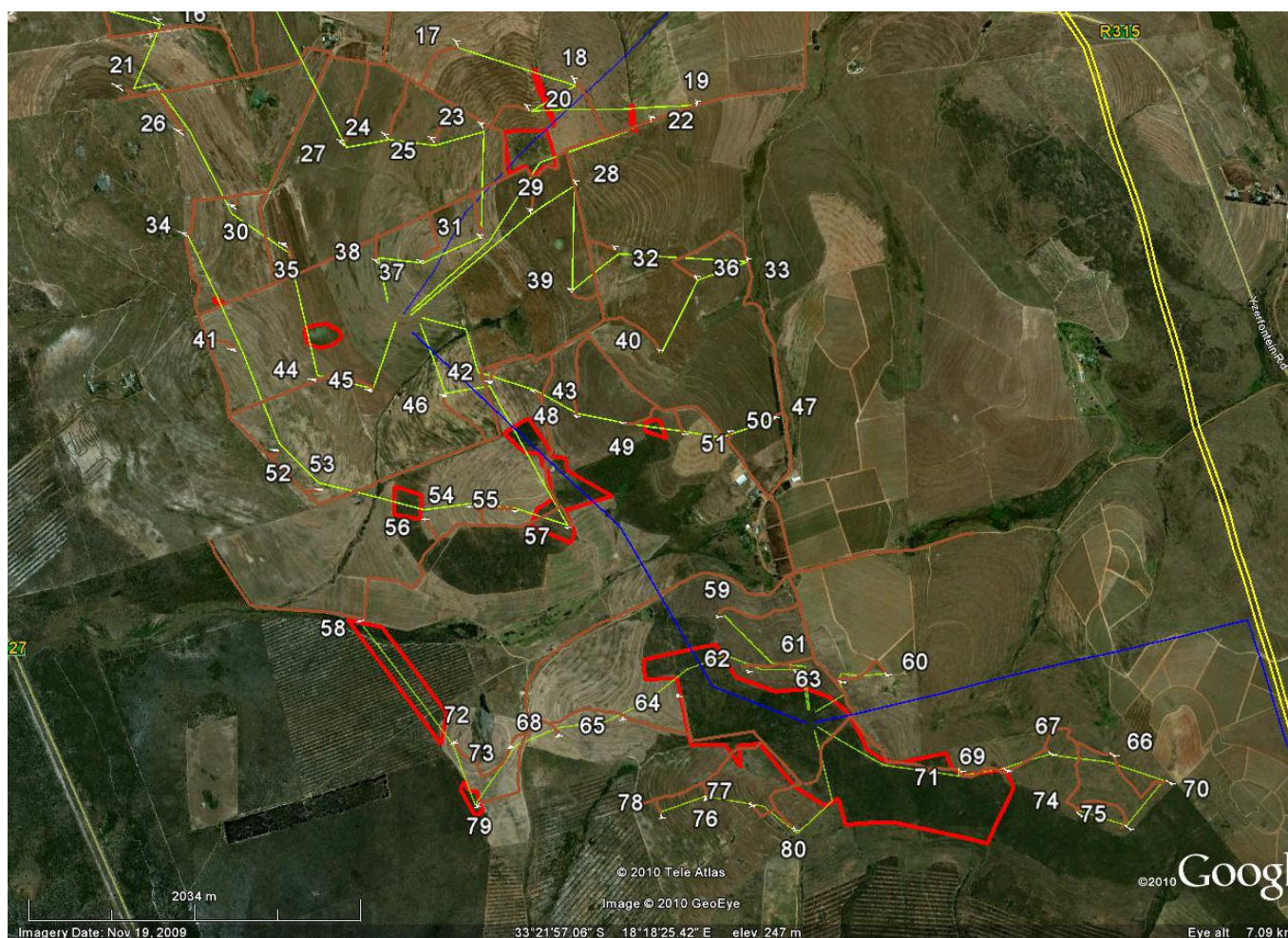


Figure 5: Red outlines (polygons) are 11 problem areas where proposed infrastructure currently intrudes into High sensitivity natural vegetation. The large area in the southeast (between turbines 62 and 71) includes the proposed position of Substation 1, and at least five associated cable trenches. These polygons are also available as .kmz files for use in Google Earth.

Direct impacts on individuals of some of the possible plant Species of Conservation Concern are likely within the development footprints which occur in

the Renosterveld areas (9 of 11 polygons in Figure 5) and the Sand Fynbos areas (2 of 11 polygons in Figure 5), which will result in a reduction in total number of these species on site by between 1 and 10% (estimated). In a regional context, these losses range from insignificant to low-medium significance.

Table 1:

Nature: Permanent loss of vegetation in development footprint				
	Without mitigation	Score	With Mitigation	Score
Extent	Local and regional	2	Local and regional	2
Duration	Permanent	5	Permanent	5
Magnitude	Moderate	6	Low	4
Probability	Definite	5	Definite	5
Significance	Medium - High	65	Medium – High*	55
Status	Negative		Negative	
Is impact reversible?	No		No	
Irreplaceable loss of vegetation?	Technically - yes		No	
Can impacts be mitigated?	NA		Yes	
Mitigation: See all points in Sections 10 and 12. Most notably the position of Substation 1 needs to be moved out of the High sensitivity vegetation.				
Cumulative impacts: The loss of vegetation is cumulative in that there is ongoing, regional habitat loss within the two Critically Endangered and Vulnerable vegetation types on site – mainly to agriculture, urbanization and alien plant invasion.				
Residual impacts: The residual impacts (some habitat will be lost) are best mitigated by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site.				

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for a definite probability. A more realistic overall assessment would be Low negative.

7.2 Direct Impact: Long term but temporary loss of natural vegetation

The existing natural vegetation will be severely disturbed (but not totally lost) in various areas, mostly as a result of heavy machinery movement through some sensitive areas, road construction, cable trench excavation through sensitive areas, the power line construction where this goes through areas of natural

vegetation, and the associated piling and scraping of soil for foundations where this is close to or in natural vegetation. Most of these areas should eventually recover to a significant degree (if natural vegetation is retained in the adjacent areas), but the crushed and dug up vegetation will take at least 12 years (and possibly much longer if rainfall is below normal) in order to recover to a point where at least 80% of the original diversity is once again present. Certain species may not return for many additional years, due to changes in soil structure (compaction or chemical changes). The impacts in this case thus rate as being long term.

Primary sources of disturbance will be the large crane that is used to put up the machinery, which has caterpillar tracks and a width of 13m; laydown areas next to the turbines; turning circles for long trucks; the construction of the new 32km long power line; and the burying of the underground cabling on site. Areas where most of the on site impacts are likely to occur are illustrated in Figure 5.

Table 2:

Nature: Long term but temporary loss of vegetation in footprint				
	Without mitigation	Score	With Mitigation	Score
Extent	Local and regional	2	Local and regional	2
Duration	Long term	4	Long term	4
Magnitude	Low - Moderate	5	Low	4
Probability	Definite	5	Definite	5
Significance	Medium - High	55	Medium	50
Status	Negative		Negative	
Is impact reversible?	Mostly		Mostly	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	NA		Partially	
Mitigation: See all points in Sections 10 and 12.				

Cumulative impacts: The loss of vegetation is cumulative in that there is ongoing regional habitat loss within these Critically Endangered and Endangered vegetation types – to agriculture, urbanisation and alien plant invasion, but long term impacts do not typically contribute to cumulative impacts as they are technically reversible.

Residual impacts: The residual impacts (habitat will be lost or degraded) are best mitigated by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site.

7.3 Direct Impact: Power line infrastructure

A new 132kV power line will need to be constructed between the 3 proposed new WEF substations and the existing Dassenberg substation that is located some 32km to the south, near Atlantis (see Figure 2). The proposed route runs parallel to the existing Koeberg to Aurora 400kV power line, and traverses mostly Atlantis Sand Fynbos, which is listed as a Critically Endangered vegetation type (DEA 2009). Because the proposed power line is so long it traverses numerous areas of High botanical sensitivity, and these are estimated to cover at least 26km of the proposed route. The only Low sensitivity areas along the proposed route are in the initial 10km where it crosses extensive agricultural lands (totalling almost 8km).

Power lines usually have relatively small footprints and have little influence on the vegetation, except where the servitude is too frequently and inappropriately bushcut. Servitude maintenance will presumably be carried out by Eskom contractors or Eskom staff, and is hence not possible to regulate in terms of a Record of Decision for the current application. Duration of impact is likely to be short to medium term, as even bushcut areas may recover to some extent, depending on the regularity and severity of the bushcutting. Temporary tracks required for installation should recover over a period of 5 years, but ideally the same permanent service road will be used for the power line installation as well.

It is possible and likely that many populations of threatened plant species will be negatively impacted by the proposed power line, although it is unlikely that regionally significant populations will be lost.

Table 3:

Nature: Permanent and Long term but temporary loss of vegetation in power line and servitude footprint				
	Without mitigation	Score	With Mitigation	Score
Extent	Local and regional	2	Local	1
Duration	Long term	4	Long term	4
Magnitude	Low - Moderate	5	Low	4
Probability	Definite	5	Highly probable	4
Significance	Medium - High	55	Medium	36
Status	Negative		Negative	
Is impact reversible?	Mostly		Mostly	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	NA		Partially	
Mitigation: No regular bushcutting of vegetation in servitude (this would require cooperation from Eskom); annual removal of all invasive alien vegetation in servitude using standard DWA approved methodology (this would require cooperation from Eskom).				
Cumulative impacts: Low; habitat will be lost, and is ongoing within the region.				
Residual impacts: The residual impacts (habitat will be lost or degraded) are not easily mitigated, other than by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site.				

7.4 Indirect impacts

Indirect ecological impacts are often difficult to identify, and even more difficult to quantify. Some possible indirect negative effects on the vegetation (shading, disturbance of wind flow, etc.) are likely to be minimal and are not assessed further.

Other indirect impacts are likely to be only moderately important, notably the likely disruption in optimal/natural fire regimes in the conservation areas, although this has probably already been partly disrupted by agriculture on site.

Sand Fynbos and Renosterveld are both **fire** driven vegetation types that require fire at least once every 15 years, and fire dependant vegetation types are not compatible with embedded and costly infrastructural developments. If Sand Fynbos and Renosterveld are not burnt for over 40 years it can be assumed that at least 30% of the species will become locally extinct, including many of the Species of Conservation Concern. This is one of the many reasons why infrastructure should not be placed within areas of natural vegetation, and developments that take this into account (such as the current one) largely avoid this issue.

The effects of **habitat fragmentation** may also be important in some cases, but the proposed development (after mitigation) should not result in significant further fragmentation of the remaining natural habitat on this site.

Further possible indirect effects include the source of road surfacing **material**, and the source of concrete. The former is usually quarried from borrow pits, which may be in sensitive ecological areas (often Renosterveld areas), and the large quantities needed could have significant negative impacts if not sourced from an appropriate area. However, at this stage the source, or indeed the need, has not been confirmed (and is deemed unlikely), and material would presumably be only from approved sites (although this does not mean that they are without impact).

Large quantities of concrete will be needed for the turbine foundations, and this could also have a significant negative effect on natural vegetation if this is sourced from an area where limestone and stone quarries have a negative impact on surrounding natural vegetation. Unfortunately no source has as yet been identified, and thus an accurate assessment of this possible indirect impact cannot be made. It is however likely that it will be sourced from nearby Saldanha quarries, some of which impact negatively on remaining natural vegetation in that botanically sensitive area (see Helme & Koopman 2007).

Table 4:

Nature: Various indirect impacts: mainly fire regime disruptions and minor habitat fragmentation.				
	Without mitigation	Score	With Mitigation	Score
Extent	Local	2	Local	2
Duration	Long term to Permanent	4	Long term	4
Magnitude	Low to Moderate	5	Low	4
Probability	Probable	3	Improbable	2
Significance	Medium	33	Low	28
Status	Negative		Negative	
Is impact reversible?	Partly – in the case of fire.		Partly	
Irreplaceable loss of vegetation?	Unlikely		Unlikely	
Can impacts be mitigated?	NA		Partially	
Mitigation: Controlled fires in conservation areas once every 15 years, according to EMP; remove most infrastructure from the 11 areas identified in Figure 5; keep access roads as narrow as possible where these cross conservation areas.				
Cumulative impacts: Very Low				
Residual impacts: The residual impacts are best mitigated by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site.				

7.5 Cumulative impacts

To some extent a cumulative impact is a regional impact, rather than the local site scale impact, *i.e.* if something has a regional impact it also has a cumulative impact.

The impacts of this type of development will be significantly less than for various existing and ongoing agricultural operations in the region, as well as for the many unmanaged and expanding alien plant invasions on numerous properties.

The proposed WEF thus has a fairly small but still important Low negative cumulative impact in the region, but this can be effectively mitigated on site by

redesigning the layout to avoid the 11 High sensitivity areas identified in Figure 5, and by formal conservation and active management of the natural area on site. If effectively mitigated (by management and layout redesign), the overall effect could be positive.

The cumulative impacts of the proposed 32km power line are difficult to assess, as it depends on whether the servitude management is optimal from a conservation perspective or not. The impacts are likely to be significant (Medium negative) if the servitude management is not optimal from a conservation perspective, as at least 80% of the route is through a Critically Endangered vegetation type (Atlantis Sand Fynbos) in medium to good condition. If the servitude management is good then the cumulative impact may be reduced to Low negative.

7.6 Positive impacts

The proposed WEF could have a slight positive impact, in addition to the small global scale positive impact of helping to reduce CO₂ emissions by generating “clean energy”. As climate change is predicted to hit the west coast particularly hard it is perhaps appropriate that wind energy facilities should be located in this area.

The second potentially positive impact will only come about if recommendations noted under Mitigation (Sects. 10 & 12) are effectively implemented and enforced.

Seasonal removal of livestock from High sensitivity areas of vegetation on the site could have a positive effect on the natural vegetation, in that it would allow plants to flower and set seed more readily, without being heavily grazed. Disturbed areas will not only rehabilitate faster without livestock grazing but many rarer, currently heavily grazed species may have a chance of increasing their numbers. Heavy grazing and trampling can also lead to erosion, eutrophication of wetlands, etc.

If the approximately 900ha of natural vegetation on the site are managed as a formal conservation area this would be a positive local and regional impact. Hopefield Sand Fynbos and Swartland Granite Renosterveld are both poorly conserved vegetation types (2.2% of original extent conserved, with national

target of 30% for the former, and 1% and 26% for the latter), and thus any addition to the total areas conserved is to be welcomed. Formal conservation of these natural areas is best achieved by signing these areas up as a Contract Reserve within the Stewardship Program of CapeNature, and details of this are provided in the Mitigation section.

8. IMPACT STATEMENT AND SUMMARY TABLE

Overall the proposed WEF is likely to have a Medium local (site scale; 3900ha site) and Low to Medium regional (Darling Hills area; < 100 000ha) negative impact on the vegetation on site, prior to mitigation. This could be reduced to Low negative (local) and Low negative (regional) after mitigation.

The primary negative impacts on the site are mainly the result of direct impacts, including loss of natural vegetation (<20ha) in the development footprints, and medium to long term loss of natural vegetation (<10ha) in adjacent areas that will be disturbed by heavy construction machinery, temporary dumping, etc. Most of these impacts can be avoided / mitigated, by simply re-aligning the proposed layout in the 11 identified areas.

Additional direct impacts will occur off-site, in the area associated with the proposed 32km power line. About 80% of the proposed route is through natural vegetation that is classified as Critically Endangered.

Indirect impacts are often difficult to quantify and measure, and are often equally difficult to avoid or mitigate. If the mitigation recommendations (See Sects. 10 & 12) are all implemented then indirect impacts on the vegetation on site could be reduced to Low negative.

The primary and important potential positive impact of the development will depend to a large degree on the proper management of the remaining natural vegetation on site (about 900ha) as a formal conservation area under the Stewardship Program of CapeNature. An indirect positive impact is obviously the small contribution that this WEF would make to reducing CO₂ emissions, and the associated very small reduction in global warming effects.

Table 5: Overall summary table of proposed WEF impacts on vegetation on site (local scale)

Nature: Long term to permanent loss of vegetation and threatened species, as well as disruption of ecological processes				
	Without mitigation	Score	With Mitigation	Score
Extent	Local and regional	2	Local	1
Duration	Long term to Permanent	4	Mostly long term; some permanent	4
Magnitude	Moderate	6	Low - Moderate	3
Probability	Definite	5	Highly probable	4
Significance	Medium - High	60	Low	32
Status	Negative		Negative	
Is impact reversible?	Not in direct building footprints (<20ha), but some are in other disturbance areas (<10ha), although will take many years; many indirect impacts difficult to reverse.		Not in direct building footprints (<20ha), but some are in other disturbance areas (<10ha), although will take many years; many indirect impacts difficult to reverse.	
Irreplaceable loss of vegetation?	Yes, but relatively small areas		No	
Can impacts be mitigated?	NA		Partially and to a large extent	
Mitigation: See all points in Sections 10 & 12.				
Cumulative impacts: Low to Medium negative; but Low after mitigation				
Residual impacts: The residual impacts (some habitat will be lost or degraded, notably in the 32km power line route) are best mitigated by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site (about 900ha).				

9. ASSESSMENT OF ALTERNATIVES

No alternative development sites or layouts were considered in this process. Three substation positions (not alternatives, as all three are needed) were however proposed, and these are assessed below.

Substation 1

High negative botanical impact, as is located in an area of High sensitivity Renosterveld, with various Species of Conservation Concern likely to be present.

Impacts before mitigation: High negative direct impacts, plus Medium negative indirect impacts.

Recommended mitigation: Move 300m to the north, which would put it between turbines 61 and 63, in an area of agricultural land (Very Low botanical sensitivity).

Impacts after mitigation: Very Low negative

Substations 2 and 3

Both located in agricultural areas of Very Low botanical sensitivity, and thus there are negligible botanical impacts, and the substations do not need to be relocated.

10. REHABILITATION GUIDELINES AND CEMP & OEMP REQUIREMENTS

Areas requiring rehabilitation will include all areas of natural or partly natural vegetation disturbed during the construction phase and that are not required for regular maintenance operations, or for cultivation. The main areas thus requiring rehabilitation will be recent disturbance to the edges of roads that pass through natural vegetation, the crane tracks alongside the permanent 6m roads, and any cable routings where these fall within areas of natural vegetation.

Rehabilitation should only commence once all construction related disturbance associated with the project has been completed.

Most of the ecological management of the site refers only to the High Sensitivity vegetation areas identified in the baseline report of Helme (2010). As the applicant does not plan to buy the land these requirements will thus involve contracts between the applicant and the landowners, who will presumably continue to farm most of the land.

Detailed requirements for the Construction Phase Environmental Management Plan (CEMP) are as follows:

1) If any infrastructure is to be placed within the identified areas of High botanical sensitivity (Renosterveld or Sand Fynbos) all these development footprints (for roads, buildings, underground cables, laydown areas and turbine footings) should be surveyed and fenced off with two strand wire and clearly indicated with flags and/or danger tape strips. Only once this has been done can anything else proceed. It should be made very clear to all contractors that there is to be no disturbance outside these demarcated areas, at least not without the permission of the ECO.

Objective: Fencing of development footprints in sensitive areas is in order to minimise disturbance to adjacent sensitive areas and to make it clear to contractors where they should and should not go.

Project component/s	All phases of construction
Potential impact	Substantially increased damage to adjacent sensitive vegetation, due largely to ignorance of where such areas are located.
Activity risk/source	There is no reason why this objective should not be achieved, although it will carry cost implications.
Mitigation: target/objective	No loss of or damage to sensitive vegetation in areas outside immediate development footprint; <1ha of construction related disturbance in sensitive areas outside fenced footprints; measured monthly during duration of construction.

Mitigation: Action/control	Responsibility	Timeframe
Two strand wire fencing with droppers every 10m, around all development footprints in areas of natural vegetation; wire to be inter-threaded with danger tape, and signage saying "Sensitive Area – Keep Out" placed on fences every 50m.	ECO	To be completed prior to any construction related activity on site; auditing monthly.

Performance indicator	No damage to surrounding natural vegetation
Monitoring	ECO to monitor all construction areas on a weekly and

	monthly basis until all construction is completed; immediate report backs to site manager; and ECO to speak to contractors responsible for any infringements
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2) Prior to any earthworks within High sensitivity Renosterveld areas a major plant Search and Rescue program should be undertaken. Search and Rescue (S&R) of certain translocatable, selected succulents, shrubs and bulbs occurring in long term & permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, laydown areas, and turbine positions) should take place. All such development footprints must be surveyed and pegged out as soon as possible, and then a horticulturist with West Coast Search and Rescue experience should be appointed to undertake the S&R. All rescued species should be bagged (and cuttings taken where appropriate) and kept in an on-site shade nursery (if water can be provided; otherwise off site) and should be returned to site once all construction is completed and rehabilitation of disturbed areas is required. Replanting should only occur in autumn or early winter (April – May), once the first rains have fallen, in order to facilitate establishment. Genera that can be considered for rescue are all bulbs and tuberous species (*Haemanthus*, *Brunsvigia*, *Babiana*, *Trachyandra*, *Albuca*, *Veltheimia*, *Arctopus*, etc.), plus selected specimens of succulents such as *Ruschia* and *Lampranthus* species, and shrubs and restios such as *Phyllica harveyi* and *Thamnochortus* species.

Objective: Search and Rescue of all translocatable indigenous plants from development footprints prior to any development, and maintenance of these in a nursery (on site) for use in rehabilitation in disturbed areas on completion of all construction.

Project component/s	All phases of construction; replanting during main post construction phase
Potential impact	Substantially increased loss of natural vegetation at construction phase and waste of on-site plant resources, and lack of locally sourced material for rehabilitation of disturbed areas; increased cost of having to buy in material for rehabilitation.
Activity risk/source	There is no reason why this objective should not be achieved, although it will carry cost implications (and savings)
Mitigation:	Rescue, maintenance and subsequent replanting of at

target/objective	least 20% of the natural vegetation in all development footprints within any areas of High sensitivity natural vegetation on site.
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Mitigation: Action/control	Responsibility	Timeframe
Genera that can be considered for rescue are all bulbs and tuberous species (<i>Haemanthus</i> , <i>Brunsvigia</i> , <i>Babiana</i> , <i>Trachyandra</i> , <i>Albuca</i> , <i>Veltheimia</i> , <i>Arctopus</i> , etc.), plus selected specimens of succulents such as <i>Ruschia</i> and <i>Lampranthus</i> species, and shrubs and restios such as <i>Phyllica harveyi</i> and <i>Thamnochortus</i> species. Material to be bagged up or stored in suitable conditions in an on-site greenhouse (with irrigation where needed); to be replanted in areas requiring rehabilitation in May/June following cessation of all construction related disturbance in particular area.	ECO and appointed horticultural subcontractor	Search and Rescue to be completed in all areas of natural vegetation prior to any construction related activities in these areas; maintenance of material in nursery until May following cessation of disturbance, and replanting of material in May/June.

Performance indicator	Establishment of greenhouse; horticulturist to submit list of target species to botanist for approval; rescue of material; replanting in rehabilitation areas to cover 20% of these areas within 3 months of replanting
Monitoring	ECO to monitor Search and Rescue; horticulturist to liase with botanist; botanist to review rehabilitation success after 3 months of replanting of rehabilitation areas.

- 3) An ECO must be present during the duration of the construction phase.
- 4) Any excavation within designated High sensitivity areas, including those for cables, must be supervised by the ECO. No excavations may be left open for more than 1 week, and they should preferably be closed up within 1 day, using the carefully stockpiled soil that came out of the trench.

Objective: Minimise disturbance associated with cabling and trench digging in High sensitivity areas; maximise rehabilitation success of these disturbed areas

Project component/s	All phases of construction; rehabilitation immediately post disturbance cessation
Potential impact	Substantially increased disturbance to areas around cabling trenches and reduced rehabilitation success; open trenches have negative impact on fauna
Activity risk/source	There is no reason why this objective should not be achieved
Mitigation: target/objective	Minimise period of sand stockpiling alongside trenches and make sure that it is less than one week before trenches are infilled and rehabilitated; target should be one day.

Mitigation: Action/control	Responsibility	Timeframe
All cable trenches, etc., through sensitive areas should be dug carefully in order to minimise damage to surrounding areas; all stockpiled sand should be replaced within one week of trench opening; all disturbed areas to be immediately mulched and sown with previously stockpiled local mulch containing indigenous seed.	ECO and appointed horticultural subcontractor	Infilling to be complete within one week of cable trench commencement (ideally within 1 day); rehabilitation to be undertaken within one week of infilling.

Performance indicator	Trenches should ideally not disturb an area more than 8m wide in total (including tracks and sand pile areas); trenches should not lie open for more than 7 days and should ideally be closed up the same day; sowing of mulch and seed in rehabilitation areas to cover at least 30% of these areas within 3 months of trench infilling
Monitoring	ECO to monitor trenching and rehabilitation; horticulturist to liaise with botanist about rehabilitation; botanist to review rehabilitation success after 3 months of sowing in rehabilitation areas, and to recommend

	additional measures if rehabilitation deemed insufficient.
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5) No dumping or temporary storage of any materials may take place outside designated and demarcated laydown areas.

6) Compacted areas that are no longer needed after construction (e.g. parts of the laydown areas, and the crane tracks) may need to be ripped or scarified to break up the compacted surface (at the discretion of the horticultural / rehabilitation contractor). The areas should then be sown with seed mix collected on site (see point 7).

Objective: Maximise rehabilitation potential of compacted areas of natural vegetation not needed beyond the construction phase

Project component/s	All phases of construction; rehabilitation immediately post disturbance cessation
Potential impact	Reduced long term rehabilitation success in areas of compacted soil such as around turbines on crane standpands
Activity risk/source	There is no reason why this objective should not be achieved
Mitigation: target/objective	Rip selected compacted areas after end of disturbance to provide better medium for rehabilitation; well established natural vegetation within two years of ripping

Mitigation: Action/control	Responsibility	Timeframe
ECO should liaise with botanist and horticulturist after completion of main construction phase to identify main areas of compaction in need of ripping and discuss best methodology; ripping may need to be done by tractor, followed by immediate mulching and sowing of previously stockpiled local mulch containing indigenous seed, and possibly hydroseeding with selected local seed.	ECO and appointed horticultural subcontractor, in liaison with botanist	On cessation of main construction disturbance; ripping to be undertaken in April or May, with mulching and sowing immediately thereafter.

Performance indicator	Compacted areas should be restored to an indigenous vegetation cover of at least 30% within 1 year of rehabilitation commencement
Monitoring	ECO to monitor ripping very closely; horticulturist to liaise with botanist about priority areas in need of ripping and rehabilitation; botanist to review rehabilitation success after 1 and 2 years, and to recommend additional measures if rehabilitation deemed insufficient.

7) The appointed horticulturist must collect a locally indigenous seed mix from the natural vegetation on site (preferably by means of vacuum harvesting) and must store this for later use in areas in need of rehabilitation, being any areas of ground that are not under cultivation.

8) Only suitable locally indigenous Hopefield Sand Fynbos or Swartland Granite Renosterveld species should be used for rehabilitation or planting anywhere on site. This means that no exotic or invasive species should be used for rehabilitation, and this includes commonly used invasive grass species such as ryegrass (*Lolium* spp).

9) The applicant should appoint an expert environmental manager to plan, coordinate and carry out the required block burns in the main patches of High sensitivity natural vegetation on site, which should ideally be undertaken prior to infrastructure development. This should be done in conjunction with and in line with the management plan to be prepared by CapeNature as part of the Stewardship Program. All areas of existing natural vegetation should be burnt on a cycle of once every 12 to 25 years. The best time to undertake block burns is in late autumn, as plant recovery will then be best. All areas to be burnt must be cleared of alien vegetation at least one year before.

Objective: Undertake controlled fires in identified blocks of natural vegetation to reduce the risk of wildfires and to allow for vital ecological processes such as regeneration and flowering of fire dependant plant species.

Project component/s	Prior to construction phase. Ideally undertaken prior to infrastructure development, but can also be undertaken afterwards (at higher risk); needs to be done every 12-25 years, with most of the areas currently overdue for a fire.
Potential impact	Substantially increased risk of wildfire; probable local

	extinction of fire dependant plant species
Activity risk/source	There is no reason why this objective should not be achieved, although it is a hazardous undertaking and needs to be carefully coordinated by an expert, and clearly would require cooperation from the landowners.
Mitigation: target/objective	Ecologically functional natural vegetation in the High sensitivity areas on site; reduced risk of wildfires in very old, woody vegetation.

Mitigation: Action/control	Responsibility	Timeframe
<p>Areas that need fire include most High Sensitivity areas of natural vegetation identified in scoping report of Helme 2010. All areas due to be burnt <u>must</u> be properly cleared of all invasive alien vegetation at least one year prior to fire.</p> <p>Extensive inputs needed from fire specialist. Local authority fire services should assist, as should local landowners and CapeNature. A windless day in March or April is recommended, with no wind predicted for following two days. Minimum areas burnt at any one time should be 10ha, in order to reduce edge effects. Site can be burnt sequentially in blocks, over a period of 5 years.</p>	ECO and appointed specialist fire subcontractor	<p>Ideally before construction (less risky to infrastructure), but can be done afterwards.</p> <p>Best regeneration after a late summer fire. All areas of natural vegetation currently older than 15 yrs must be burnt within 4 yrs of project authorisation.</p>

Performance indicator	All areas of natural vegetation currently older than 15 years should be burnt within 4 years of project authorisation. Natural vegetation re-establishment within burnt areas should be substantial within 2 yrs (>30% cover).
Monitoring	ECO and specialist fire consultant to monitor and coordinate process, in liaison with botanist; botanist to review regeneration success 2 years after fire.

Operational Phase EMP Requirements:

10) It is strongly recommended that the landowners should refrain from grazing livestock in the High sensitivity vegetation areas in the main winter and spring growing and flowering periods (1 May – end October). One of the primary reasons for this is that removal of livestock grazing pressure will have a beneficial effect on the natural vegetation, particularly in terms of natural rehabilitation, in that flowering and seed set of the remaining natural plants (especially pioneers such as the annuals) will be significantly better in the absence of grazing (which removes the flowers). If the nearby annuals and other plants are not grazed this means that natural rehabilitation of the areas disturbed by the project will be significantly improved, as there will be much more locally indigenous seed available nearby for establishment in the disturbed areas, and the site may also act as a seed source for some nearby overgrazed areas.

Objective: No grazing of livestock in the High sensitivity vegetation areas in the main winter and spring growing and flowering periods (1 May – end October).

Project component/s	Construction and Operational phase; ongoing
Potential impact	Grazing and trampling substantially decreases rehabilitation success, posing a risk of erosion and biodiversity loss; grazing and trampling impacts negatively on flowering and seed set of many rare plant species
Activity risk/source	There is no reason why this objective should not be achieved, but it would require cooperation from the landowners
Mitigation: target/objective	Ecologically functional and flourishing natural vegetation in the area, with rare species flowering and setting seed successfully.

Mitigation: Action/control	Responsibility	Timeframe
Removal of all livestock from all High sensitivity areas of natural vegetation on site from 1 May to end October.	ECO (construction phase) and CapeNature, site manager and landowners (operational phase)	Ongoing from construction into operational phase

Performance indicator	No livestock on site in High sensitivity areas of natural vegetation during period 1 May to end October. No evidence of grazing or trampling in these areas during this period, and good flowering and seed set in palatable plant species.
Monitoring	Botanist to review regeneration and seed set success in palatable species every two years, and to check site for compliance in terms of livestock.

12) A botanist familiar with the vegetation of the area should monitor the rehabilitation success on an annual basis in August or September (for the first five years after construction commences), and make recommendations to the applicant (and landowners) on how to improve any problem areas. This monitoring need not take more than two days annually (one day on site, one day writeup).

13) All temporary fencing and danger tape should be removed once the construction phase has been completed.

14) Ongoing alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis. DWA approved methodology should be employed for all alien clearing operations. Areas should not be burnt until an area has been clear for at least two years, in order to prevent coppicing and massive seed germination. *Acacia cyclops* (rooikrans) and *Acacia saligna* (Port Jackson) are the primary invasive aliens, and both provide valuable firewood that can be sold to defray costs. No bulldozing or mechanical removal is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. All stems must be cut as close to ground level as possible, using loppers or chainsaws (depending on size), and stumps must be immediately hand painted with a suitable Triclopyr herbicide (e.g. Garlon, Timbrel, with colour dye) to prevent resprouting. If this is not done within 5 minutes of being cut Port Jackson will resprout, wasting the original effort. Rooikrantz does not usually resprout, but it may do so in some situations, and it is safer to paint herbicide on all stumps. No herbicide spraying should be undertaken anywhere within natural vegetation, due to the extensive collateral damage. All cut branches should be stacked into a pyramid (cut ends up) and left to dry – where rodents will eat the available seed under the pile, reducing seed germination. Annual follow ups are required in all areas that have been previously cleared. Small seedlings may be hand pulled.

Objective: Removal of all woody alien invasive vegetation on the site within two years of project commencement, and particularly within the High sensitivity areas of natural vegetation. To be undertaken from project inception, on an ongoing basis.

Project component/s	Construction and Operational phase; ongoing
Potential impact	Alien invasive vegetation is currently a moderate threat to the priority natural vegetation on site, and may displace rare species, dry out wetlands, and result in habitat loss, as well as increasing the fuel load and the consequent risk of a wildfire. If unchecked the alien vegetation could come to dominate the entire site within 20 years, with loss of rare species.
Activity risk/source	There is no reason why this objective should not be achieved, although it will be costly, and adequate budget must be made available for ongoing clearing costs.
Mitigation: target/objective	Ecologically functional natural vegetation in High botanical sensitivity portions of site; all High Sensitivity areas are clear of alien vegetation within 2 years of project inception.

Mitigation: Action/control	Responsibility	Timeframe
DWA approved methodology should be employed for all alien clearing operations, and it is strongly suggested that someone who has extensive training in this regard be employed to manage the program. Dense areas should be tackled last – the priority is to prevent their spread, and then gradually clear the entire area, maximising cost efficiency. Areas should not be burnt until an area has been clear for at least one year, in order to prevent coppicing and massive seed germination. <i>Acacia cyclops</i> (rooikrans) and <i>Acacia saligna</i> (Port Jackson) are the primary invasive aliens, and both provide firewood that can be sold to defray costs. No bulldozing or	ECO (construction phase) and appointed alien clearing contractors (operational phase and perhaps also overlapping with construction phase)	Ongoing from construction into operational phase. High sensitivity areas should be cleared initially only from November - April; and all follow ups only from Oct – April, to minimise damage to seasonal species

<p>removal by any machinery is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. All stems must be cut as close to ground level as possible, using loppers or chainsaws (depending on size), and stumps must be immediately hand painted with a suitable Triclopyr herbicide (e.g. Garlon, Timbrel, with colour dye) to prevent resprouting. If this is not done within 5 minutes of being cut Port Jackson will resprout, wasting the original effort. Rooikrantz does not usually resprout, but it may do so in some situations, and it is safer to paint herbicide on all stumps. No herbicide spraying should be undertaken anywhere, due to the extensive collateral damage. All cut branches should be stacked into a pyramid (cut end up) and left to dry – where rodents will eat the available seed under the pile, reducing seed germination. Annual follow ups are required in all areas that have been previously cleared (to be undertaken Oct-April). Small seedlings may be hand pulled.</p>		
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<p>Performance indicator</p>	<p>All High Sensitivity areas of vegetation to be cleared of invasive aliens within 2 years of project inception (initial clearing); <1% alien cover in these areas in following years</p>
<p>Monitoring</p>	<p>Annual audits of alien clearing by botanist or CapeNature representative to determine compliance, and to suggest any changes to program</p>

15) Objective: Significant reduction in effluent and fertiliser inflows into wetlands on Tienie Versfeld Nature Reserve, establishment of 50m buffer along Reserve southern edge; and reduction in pesticide drift into the Reserve.

Project component/s	Construction and Operational phase; ongoing
Potential impact	Current effluent inflows from dairy farming operations pose a severe threat to the wetlands in the Reserve; fertilizer inflows supplement this; pesticide drift from adjacent crops impacts on important insects (pollinators, etc.) in the Reserve.
Activity risk/source	There is no reason why this objective should not be achieved, but it would require cooperation from the landowner
Mitigation: target/objective	>75% reduction in current levels of nutrient (fertiliser and effluent) inflows into wetlands in the Reserve from adjacent property; minimal pesticide drift into Reserve

Mitigation: Action/control	Responsibility	Timeframe
Fence off a 50m buffer from southern boundary of Reserve and rehabilitate this area over time, using Renosterveld seed mix provided by botanist approved restoration ecologist; freshwater biologist to advise and implement on effluent control and purification; no pesticide spraying within buffer area	ECO and landowner (construction phase; fencing); freshwater biologist & landowner (effluent control measures); CapeNature, site manager and landowners (operational phase)	Fencing, rehabilitation and effluent control to be undertaken within one year of project initiation; monitoring and modification to be ongoing

Performance indicator	Observable and measurable reductions in nutrient inflows into reserve; visible establishment of Renosterveld species in 50m cultivation buffer
Monitoring	Freshwater ecologist and botanist to review situation annually after implementation.

16) The applicant must ensure that there is sufficient budget to implement all management recommendations noted above.

11. CONCLUSIONS

- There are two natural vegetation types on site, both of which are regarded as threatened on a national basis. About 900ha of the 3900ha study site supports vegetation in medium to pristine condition, and was mapped as being of High sensitivity in the baseline study of Helme (2010). Ideally no development should occur within identified High sensitivity areas, and all infrastructure should be located at least 30m from the edge of any High sensitivity areas. The remainder of the study area (about 3000ha) is of Low botanical sensitivity, and presents no botanical constraints to the proposed facility. The proposed 32km power line to Dassenberg substation would run through at about 26km of High sensitivity vegetation, most of which is Atlantis Sand Fynbos (Critically Endangered).
- Overall the proposed WEF is likely to have a Medium – High negative local (site scale; 1600ha site) and Medium regional (Darling Hills; < 100 000ha) negative impact on the vegetation on site, prior to mitigation. This could be reduced to Low negative (local) and Very Low negative (regional) with proper mitigation although the likelihood of all proposed mitigation taking place is considered only moderate, and a more likely post-mitigation significance is **Low – Medium negative** (at both site and regional scales). The most important unknown variables in this regard are the likelihood of being able to mitigate the current negative impacts on the adjacent Tienie Versfeld Wildflower Reserve, the likelihood of being able to manage the 32km long power line servitude appropriately, and the likelihood of most High sensitivity vegetation areas on site being managed under CapeNature's Stewardship program.

12. RECOMMENDED SITE SPECIFIC MITIGATION

- It is recommended that all hard infrastructure be located within existing areas of Low sensitivity, as far as possible. This means that some relocation of infrastructure will be necessary, and all problem areas are identified in Figure 5. Where infrastructure is located within the red areas in Figure 5 this must be re-designed so that these sensitive areas are not impacted.
- It is recommended that all turbines and substations be located at least 30m from any mapped High sensitivity areas on site (see sensitivity maps in baseline study of Helme 2010).
- Substation 1 must be moved out of its current location in a High sensitivity area, along with all infrastructure feeding into it. It is suggested that it be moved 300m north, into a Low sensitivity area in the space between turbines 61 and 63.
- An ECO must be permanently on site throughout the road construction, cable laying, turbine foundation excavation, and during the erection of the turbines, and at other times should visit the site at least once a week until the construction phase is completed.
- Any excavation, including those for cables, must be supervised by the ECO. No excavations may be left open for more than 1 week, and they should preferably be closed up within 1 day, using the carefully stockpiled soil that came out of the trench. In the case of turbine footings some 45m³ of soil will presumably be displaced by the concrete, and this should not be dumped on any natural vegetation.
- No dumping or temporary storage of any materials may take place outside designated and demarcated laydown areas, and these must all be located within areas of Low botanical sensitivity (agricultural areas).
- No agriculture should be allowed to take place within 50m of the southern boundary of the Tienie Versfeld Wildflower Reserve, and this area should be gradually rehabilitated to Renosterveld, with professional input from a restoration ecologist. This buffer is the minimum required to ensure that fertilizer and pesticide drift from the adjacent fields does not further harm the vegetation in this important Reserve. In addition, no nutrient – rich effluent should flow into this Reserve from the study area, as the current effluent inflows from the dairy farming operations are severely degrading the wetland areas in the Reserve. Specialist input should be obtained from a freshwater biologist on how to control this, and their recommendations must be implemented within 1 year of project authorisation.

- All feasible (as determined by CapeNature) areas of High botanical sensitivity (identified in Helme 2010) must be formally declared and registered as a Contract Nature Reserve with CapeNature's Stewardship Program, within one year of project initiation (defined as installation of the first project related infrastructure; subject to CapeNature capacity). This may entail a rezoning of these areas (to Open Space), and will require that a management plan for these areas is drawn up, which should include the clause that these areas may not be grazed by livestock between 1 May and end October. In some cases small, isolated patches or strips of mapped High sensitivity habitat may not be deemed feasible or suitable by CapeNature, and in this case these areas could then be excluded from the final Contract Reserve. Significant financial incentives are available for landowners who register land as a Contract Reserve, including write-offs of the management costs and portions of the capital costs, and a reduction in annual Land Tax. Associated with these benefits are requirements for a management plan and environmental auditing to ensure that management is adequately carried out. In this case all costs associated with rezoning and management of these areas will remain the responsibility of the applicant and/or landowners.
- A CEMP and OEMP should be drawn up, which must outline management steps for all the areas of natural vegetation on the site. See Section 10 for detailed guidelines.
- A botanist familiar with the vegetation of the area should ensure that adequate botanical inputs are made into the construction and operational phase EMPs.
- It is recommended that all areas of identified High sensitivity natural vegetation older than 15 years within the study area be burned in a controlled fire prior to any construction. This can be done in three or four blocks (possibly over a period of two years), and should be undertaken by a professional team with experience in block burning. The best time to undertake block burns is in late autumn, as plant recovery will then be best, and it will minimise the erosion of the exposed soils. All areas to be burnt must be cleared of alien vegetation at least one year before.
- If not burnt prior to construction all the above noted areas of natural vegetation older than 15yrs should be burnt within five years of the start of construction. Renosterveld and Sand Fynbos areas should be burnt once every 12 to 15 years.

- It is recommended that the proposed 32km power line servitude not be bushcut, and that alien vegetation management be undertaken in the area on an annual basis.

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