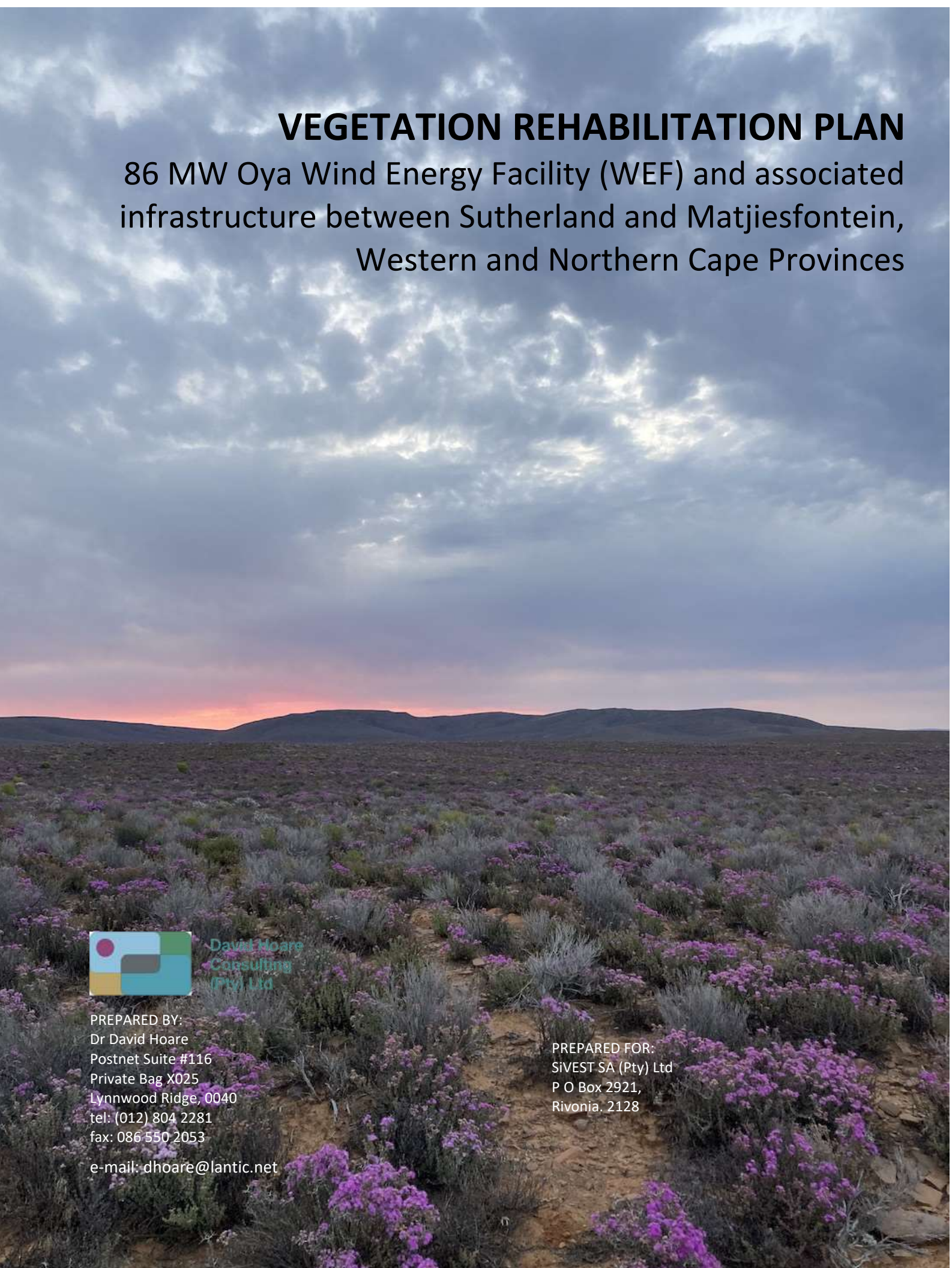
VEGETATION REHABILITATION PLAN

86 MW Oya Wind Energy Facility (WEF) and associated infrastructure between Sutherland and Matjiesfontein, Western and Northern Cape Provinces



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Vegetation Rehabilitation Plan for the proposed 86 MW Oya Wind Energy Facility between Sutherland and Matjiesfontein in the Western and Northern Cape Provinces.

Location:
Witzenberg Local Municipality within the Cape Winelands District Municipality

Prepared for

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Appointment of specialist

Oya Energy (Pty) Ltd appointed SiVEST Environmental Division as the Environmental Assessment Practitioners (EAPs) to undertake the required Basic Assessment process for the proposed construction of an 88kV transmission powerline, switching station and associated infrastructure for the 50MW De Wildt Photovoltaic (PV) Solar Park in North West Province. David Hoare of David Hoare Consulting (Pty) Ltd was commissioned by SiVEST Environmental Division to develop a Rehabilitation Plan for the proposed infrastructure. This report serves as a Rehabilitation Plan for the construction of the proposed infrastructure.

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- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting (Pty) Ltd, an independent consultancy, in 2001.
- Ecological consultant since 1995, with working experience in Gauteng, Mpumalanga, Limpopo, North West, Eastern Cape, Western Cape, Northern Cape and Free State Provinces, Botswana, Tanzania, Kenya, Mozambique and Swaziland.
- Conducted, or co-conducted, over 330 specialist ecological surveys as an ecological consultant. Areas of specialization include general ecology, biodiversity assessments,

vegetation description and mapping, plant species surveys and remote sensing of vegetation. Has undertaken work in grassland, thicket, forest, savannah, fynbos, coastal vegetation, wetlands and nama-karoo vegetation, but has a specific specialization in grasslands and wetland vegetation.

- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

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Introduction

This document presents the Rehabilitation Plan for the proposed construction of the 86 MW Oya Wind Energy Facility (WEF) and associated infrastructure in the Western and Northern Cape Provinces.

As part of the authorisation process, a Rehabilitation Plan is required to be formulated. This is to ensure that an acceptable plan is in place before construction activities take place on site, and to ensure that affected areas are adequately rehabilitated in accordance with the sustainability

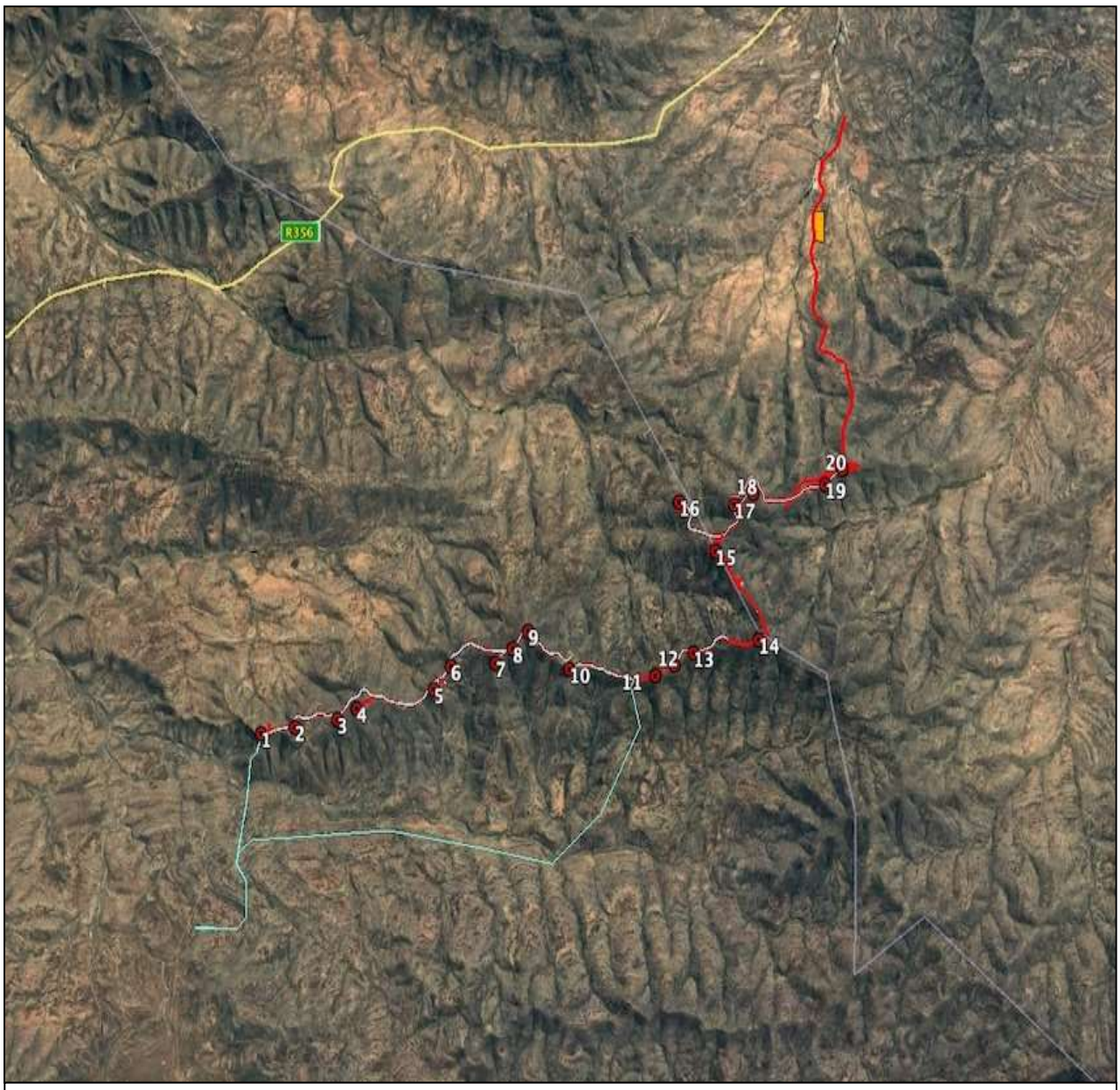

Figure 1: Location and extent of the study area.

principles of Integrated Environmental Management, promoted by the National Environmental Management Act (Act No.107 of 1998) (NEMA).

An infrastructure footprint was provided for the purposes of compiling the Rehabilitation Plan and is provided in Figure 1 below. Recommendations relating to rehabilitation have been provided here on the basis of the plans provided here. It is expected that this Vegetation Rehabilitation Plan could potentially be reviewed and updated when Project designs are finalised, should the final design deviate significantly from that shown in Figure 1.

Purpose of the Rehabilitation Management Plan

The site contains natural vegetation with moderate biodiversity value and is currently used for tourism and partially also in places for live-stock grazing purposes. The purpose of the vegetation rehabilitation plan is to ensure that any areas that will be cleared of vegetation or that will be impacted in some way by construction activities on site are rehabilitated in such a way as to achieve the following:

- Return disturbed areas to an acceptable state;
- Re-establish vegetation cover with suitable plant species so that remaining biodiversity features and prior land-use options are not compromised;
- Reduce the risk of soil erosion in order to achieve long-term stability of the landscape;
- Prevent alien plant invasion on site;
- Restore ecosystem function to areas that are to be rehabilitated; and
- Ensure that all areas are free-draining and non-polluting.

Responsible persons

Effective rehabilitation during the construction and operational phases of the project will be dependent on a number of project personnel. These are listed below.

The Developer

This refers to the project proponent/owner, Oya Energy (Pty) Ltd. They will be responsible for the following:

1. Overall accountability for rehabilitation, and setting and reviewing related targets related to this Plan;
2. Ensure that the requirements set out in this rehabilitation plan are adhered to and implemented;
3. Allocate the responsibilities assigned to the Environmental Control Officer (ECO) to an independent suitably qualified individual prior to the start of construction activities on site; and
4. Provide all principal contractors working on the project with a copy of this management plan as part of tender contract documentation to allow the contractors to cost for its requirements within their respective construction contracts.

The Project Manager

The project manager of the proposed development will be responsible for the overall implementation of the rehabilitation plan during the construction phase of the project. To

effectively implement the rehabilitation plan, the project manager must be aware of the findings, mitigation measures and conclusions of the Final BA report, the requirements of the EA, and this Rehabilitation Plan. The project manager must ensure that the contractors are aware of the specifications, legal constraints and company standards and procedures pertaining to activities taking place regarding the proposed power lines and other infrastructure. The project manager must also ensure that all commitments and conditions in the EMPr are communicated and adhered to by relevant employees and contractors involved in the proposed development, by making documents available and including the requirements into the induction programme for the proposed power line.

The Environmental Control Officer (ECO)

An ECO will be appointed to provide inputs during the construction phase of the proposed power line. These functions will be taken over by Oya Energy (Pty) Ltd during the operational phase. The ECO will be appointed by Oya Energy (Pty) Ltd and not the contractor, and will report directly to Oya Energy (Pty) Ltd. The ECO is responsible for monitoring and verifying the implementation of the management plan during the construction phases of the project. To effectively implement the management plan, the ECO must be aware of the findings, mitigation measures and conclusions of the Final BA Report, the EA, and this rehabilitation plan. The ECO has the following responsibilities:

1. Must fully understand the commitments in the EMPr and the EA for the proposed project.
2. Must familiarise him/herself and ensure compliance with the relevant legislation applicable to the project, as well as Oya Energy (Pty) Ltd, Health and Environment (SHE) Policy and procedures.
3. Must communicate the contents of the EMPr to staff members of the contractor / sub-contractors.
4. Monitor the implementation of the EMPr throughout the project, by means of site inspections, as well as reporting to Oya Energy (Pty) Ltd and the project team at progress meetings.
5. Undertake site inspections on a regular basis according to the frequency specified in the EMPr, to assess compliance with the EMPr and conditions in the EA, and to advise on appropriate action to rectify non-compliance.
6. Recommendations to Oya Energy (Pty) Ltd for the removal of personnel and/or equipment should they contravene the specifications of the EMPr.
7. Liaise with environmental statutory bodies, where this is deemed necessary in association with the project team and/or Oya Energy (Pty) Ltd personnel.
8. Compile monthly progress reports for submission to the project manager.
9. Advise the project management team on environmental issues and recommendations for the proposed power line construction activities.

The Contractor

The contractor, being any directly appointed company or individual undertaking the implementation of works, will be responsible for complying with the rehabilitation plan at all times during the construction phase. The contractor, and any sub-contractor/s, will be responsible for the implementation of the contractor specific EMPr, the SHE Plan and any other Oya Energy (Pty) Ltd Plans. The contractor and all sub-contractors will be responsible for:

1. Complying with the EMPr commitments and any other legislative requirements as applicable to the contractor's appointment for the proposed power line.
2. Drafting a method statement appropriate to the day-to-day activities under their direct control. This method statement for the activities to be undertaken by the contractor must abide by the EMPr and must be agreed upon by the project team representatives and the ECO.
3. Adhering to any instructions issued by the project manager, on advice of the Oya Energy (Pty) Ltd environmental specialist and/or ECO.
4. Submitting an environmental report at identified site meetings on any environmental incidents that have occurred within the period between site meetings, and reporting on any action to address any incidents previously identified by the contractor or the project team, the ECO or Oya Energy representatives.
5. Ensuring that all employees of the contractors receive appropriate training prior to the commencement of construction, taking cognisance of the EMPr and the conditions of the EA.

Proposed activities on site

This section provides an outline of the proposed activities on site in terms of the likely impacts expected from different project components. The purpose is to provide an indication of the type of rehabilitation activities that will be required.

Project components

The main infrastructure components to be constructed are as follows:

1. Wind turbines;
2. Access roads;
3. Construction area; and
4. Collector system.

Activities during pre-construction and construction phases

Various activities that may have an effect on the environment are expected to be undertaken during pre-construction and construction phases of the project, as follows:

1. Delineation of servitudes and/or positions for individual infrastructure components;
2. Establishment of contractor camps, site offices, change-rooms, workshops, vehicle parking, ablutions, material storage areas, waste storage areas, etc.;
3. Establishment of security measures for construction activities, including fencing and lighting for contractor's operational areas;
4. Transportation of equipment and machinery to the construction site locations;
5. Stripping and removal of surface vegetation at the sites of proposed infrastructure components;
6. Stripping and stockpiling of topsoil and subsoil to a stockpile for later use for rehabilitation and landscaping;
7. Grading and earthworks along the access road construction footprint;
8. Sourcing of construction material;
9. Construction and commissioning of the wind energy facility according to the agreed programme;
10. Development of construction environmental procedures;
11. Transportation of equipment, material and people;
12. Erosion control and pollution control;
13. Site rehabilitation following construction, of areas that have been disturbed and are not part of the ongoing operational phase of the proposed wind energy facility; and
14. Monitoring and maintenance of rehabilitated areas.

Current status of habitat on site

This section provides an outline of the existing status of the site with respect to natural vegetation. The purpose is to provide a context for the rehabilitation plan.

Ecosystem context

There are two regional vegetation types occurring in the general area, namely Koedoesberge-Moordenaars Karoo and Central Mountain Shale Renosterveld, which occur in the hills between the Great Escarpment close to Sutherland and the plains close to Laingsburg and Matjiesfontein. The vegetation on site is typical of this vegetation type that occurs on stony soils within these low mountain ranges. The vegetation is a low succulent scrub and dotted by scattered tall shrubs, patches of 'white' grass visible on plains, the most conspicuous dominants being dwarf shrubs of *Pteronia*, *Drosanthemum* and *Galenia.* Commonly occurring species on site include, in order of frequency of occurrence, *Ruschia intricata*, *Gorteria alienata*, *Pteronia glauca*, *Aizoon africanum*,

Figure 2: Typical vegetation on site

Eriocephalus ericoides, *Chrysocoma ciliata*, *Euryops lateriflorus*, *Leipoldtia schultzei*, *Euphorbia mauritanica*, and *Asparagus capensis*. The herbaceous layer contained a typical assemblage of species for this habitat, including, *Crassula deltoidea*, *Crassula subaphylla*, *Tylecodon reticulatus*, *Ehrharta calycina*, *Euphorbia rhombifolia*, *Tylecodon wallichii* and *Euphorbia multiceps*, and the smaller species such as, *Antimima hallii*, *Felicia filifolia*, *Cheiridopsis namaquensis* and *Pelargonium abrotanifolium.* Local species richness is not particularly high but there is quite strong species turnover from one site to another due to the high topographic and surface rockiness variation.

Ecosystem dynamics are driven by aridity, topographic variation and substrate conditions associated with this region. Rehabilitation methods that rely on agricultural techniques such as the application of fertilizer and the planting of cover crops are not appropriate. Seasonal rainfall characteristics can be a limiting factor (in the dry season) and can also affect the risk of soil erosion (during the wet season). The major implication is that active rehabilitation needs to take into account sparse, shallow, rocky soils and limited moisture availability.

Previously disturbed areas on site offer a glimpse into the possible species composition of recovered areas. A site adjacent to one of the cottages on site in an area that was possibly previously cleared had the following species: *Atriplex nummularia*, *Melianthus comosus*, *Pteronia* species, *Eriopcephalus ericoides*, *Ballota africana*, *Lycium cinereum*, *Searsia glauca*, *Bromus pectinatus*, *Diospyros austro-africanus*, *Ruschia intricata*, *Tetragonia microptera*, and *Aizoon africanum*. The last species is especially characteristic of and dominant in old lands in this general geographical region, indicating its suitability to colonise disturbed areas.

Possible problem areas

Some components of the landscape are more vulnerable to disturbance than others and are therefore more likely to become problematic areas with respect to rehabilitation. The most sensitive conditions are as follows:

- Steeply-sloping areas. There are numerous places where the slope inclination is moderate, sometimes steep. This introduces erosion risks and downslope effects on undisturbed areas.

Potential constraints to successful rehabilitation

This section provides an outline of key risks and constraints to successful rehabilitation. These include the following:

- Scale of clearing;
- Climate seasonality;
- Weeds;
- Seed availability;
- Soil management;
- Landform stability;
- Ecosystem connectivity; and
- Ecosystem resilience.

Scale of clearing

The scale of clearing will be very localized. The amount of rehabilitation that is required is relatively dispersed within this area and is a small area. Areas requiring rehabilitation will be adjacent to roads, as well as surrounding turbine bases and within crane pad areas. It is estimated that significantly more than 30 ha of rehabilitation will be required. The risks are therefore moderate to high especially due to the arid conditions on site.

Climate seasonality

The proposal area is in an arid area but where rainfall is relatively predictable and strongly seasonal. However, the amount of rainfall is a limiting factor. These are not expected to be significant constraints to successful rehabilitation. However, any seeding or planting that is required will have to take place from the beginning of the rainy season and not in the dry summer period.

Weeds

The project study area has low incidence of weeds on site and in neighbouring areas, although a number of invasive alien species are known to occur in the general geographical area, for example, *Prosopis glandulosa*. There are, therefore, various species from surrounding areas that could become established on site. The rehabilitated and disturbed areas are most at risk because they provide the best conditions for the establishment of weeds and invasive plants. The potential risks

are considered to be moderate, but controllable with the rigorous implementation of an Alien Invasive Plant Management Plan.

Seed availability

Due to the localised scale of the required rehabilitation works, it will probably not be necessary to undertake extensive re-seeding. If necessary, indigenous seed is commercially available for various grass species. It is common practice to use a seed mix when sowing in areas for re-vegetation. The main risks associated with this approach are that the seeds available are usually for combinations of species that are not necessarily present or dominant on site. The risks are, however, considered to be relatively low for successful rehabilitation of disturbed areas since a combination of methods can be employed to encourage growth of indigenous vegetation.

Soil management

Topsoil is arguably the single most important rehabilitation resource in the project area. Topsoil and subsoil that currently occurs in areas to be cleared must be recovered to be used in rehabilitation areas. Topsoil must be carefully managed and stockpiled to ensure that it does not become degraded. The success of this process is one of the biggest risks associated with successful rehabilitation of disturbed areas. However, rehabilitation programmes have been successfully undertaken through effective soils management.

Landform stability

The existing slope of the areas that will require rehabilitation varies from flat to gently inclining. Particular attention will have to be paid to maintaining surface stability during the early stages of rehabilitation. Minimizing surface water runoff from any small catchment areas that currently exist or that will be created from construction activities will be an important strategy, especially when these occur at elevated points in the landscape. Possible strategies that can be employed include the following:

- Contouring topsoil to match the slope of the surrounding landscape;
- Spreading a thin layer of cleared vegetation debris from cleared areas over re-contoured topsoil; and
- Rapid re-instatement of soil into holes and trenches dug for infrastructure components.

Rehabilitation implementation strategy

The rehabilitation process should form an integral part of site and construction activities. The ECO, who will be responsible for ensuring that the Rehabilitation Plan is implemented, must be appointed and on-site at project inception. This person should form an integral part of the project team.

The following descriptions, in the subsections below, outline the various stages and processes of the Rehabilitation Programme.

Identification and protection of environmentally sensitive areas

Sensitive sites and habitats must be identified prior to any construction activities taking place. No vegetation clearing, levelling, excavation or plant material removal is permitted without prior consent from the ECO. Areas highlighted as being environmentally sensitive from prior studies must be identified, and the necessary fencing and protection of these areas initiated. Areas of wetland and associated buffer zones should be disturbed to the minimum extent possible. The footprint of construction within these areas should be limited to only the minimum required and no neighbouring areas are to be disturbed.

Cleared plant material

Surface plant material that is cleared during construction activities can be stockpiled and/or bagged to be used as mulch during rehabilitation. Mulching is the covering of the soil with a layer of organic matter including leaves, twigs, bark or wood chips. The main purpose of mulching is to protect and cover the soil surface, as well as serve as a source of seed for re-vegetation purposes. The following principles should be adhered to:

- During local site clearing the standing vegetation should not be cleared and mixed with the soil, but should be cleared separately, either mechanically or by hand using a brush-cutter. The cleared vegetation should be stockpiled and used whole or shredded to protect the soil in disturbed areas and promote the return of indigenous species;
- Mulch is to be harvested from areas that are to be denuded of vegetation during construction activities. No harvesting should take place outside the area to be disturbed by construction activities;
- Brush-cut mulch should be stored for as short a period as possible; and
- Seed released from stockpiles should be collected for use in the rehabilitation process.

Seed collecting

The re-application of topsoil and cleared vegetation (as mulch) will be sufficient for rehabilitation at this site. However, the ECO can consider, as an option, to collect indigenous seed to sow. This measure is therefore not required, but is a possibility, if found necessary. If needed, indigenous seed can be collected from plants present on site, and should be used immediately, or stored appropriately, and used at the start of the following wet season. Seed can be broadcast onto the soil but should preferably be applied in conjunction with measures to improve seedling survival, such as scarification of the soil surface, or simultaneous application of mulch. The following principles apply:

- Indigenous seeds may be harvested for the purposes of re-vegetation in areas that are free of alien invasive plants, either at the site or prior to clearance of vegetation from suitable neighbouring sites;
- Seed may be harvested by hand and, if necessary, dried or treated appropriately;
- Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs, or from plant litter surrounding the shrubs, must be kept apart from individually harvested seed; and
- No alien or foreign species seed is to be used or brought onto the site.

Commercial seeding

In some areas the natural regeneration of the vegetation may be poor, and the application of seed to enhance vegetation recovery may be required. The use of commercial seed mix is at the discretion of the ECO. Mixed seed is available from commercial suppliers. A typical seed mix varies from place to place and may depend on availability and location.

As a principle, the mixture of seeds should include the following:

1. A mixture of annual and perennial plants;
2. Includes pioneer species;
3. Selected species must be able to grow in the area where they are being used;
4. Roots must have a binding effect on the soil; and
5. The final mixture must not cause an ecological imbalance in the area.

For the current site, any of the tabulated species can be used, depending on availability.

Soil, wetland and vegetation management

The following soil, wetland and vegetation management measures are proposed to aid in limiting impacts, as well as to assist with successful rehabilitation:

1. Soil must only be stripped from areas that are to be disturbed during construction or maintenance and not from any adjacent or other areas;
2. Erosion control measures must be included in the design of linear infrastructure;
3. Vehicles must be restricted to travelling only in designated roadways to limit the ecological footprint of the proposed development activities;
4. All disturbed areas must be rehabilitated using stockpiled soils, as required;
5. Ecologically sensitive areas must be rehabilitated where they have been damaged by construction activities;
6. The extent of all local construction sites must be demarcated, and no vegetation is to be removed outside of this zone;
7. If vegetation is to be cleared on site, erosion control measures must be kept in place to ensure that excessive scarring of the landscape is reduced;
8. Adequate storm water management must be incorporated into the design of the projectin order to prevent erosion;
9. Stripping and clearing of vegetation must ideally be planned to be done during the dry season;
10. Should any construction activities occur within a 1 in 100 year flood line or within 500 m of a watercourse, the relevant authorisation should be obtained according to the National Environmental Management Act (NEMA) 107 of 1998 and Section 21 c and i of the National Water Act 36 of 1998, respectively;
11. No structures are to be constructed within the riparian areas or within the active stream channel as far as possible. If at all possible, all support structures should be developed above the 1:100 year flood line. Or, if that is not possible, above the 1:50 year flood line.
12. Sensitive areas in the vicinity of construction works must be fenced for the duration of the construction phase and designated a 'no-go' area;

General considerations

- Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible. Rehabilitation of disturbed areas should therefore be carried out concurrently with construction, as far as possible. Disturbed footprint areas must be kept to a minimum;
- Once re-vegetated, areas should be protected to prevent trampling and erosion;
- No construction equipment, vehicles or unauthorized persons should be allowed onto areas that have been re-vegetated; and
- Any runnels, erosion channels or wash-aways developing after re-vegetation should be backfilled and consolidated to restore them back to a proper condition.

Construction process for tower structures and other disturbed areas

1. Topsoil and subsoil removed from foundation excavations must be stockpiled separately;
2. All excavated soil suitable for backfill must be returned to the excavation by backfilling with the subsoil first, and the topsoil last;

3. Material removed from the excavation that is not suitable or not required for backfill may be spread evenly over the disturbed area. However, spreading of subsoil is not permitted;
4. The local topography must be returned to as close to its original state as possible. If possible, sites should not be levelled;
5. If necessary, erosion control features must be constructed or any erosion control measures implemented using appropriate materials, including any remaining soil stockpiles;
6. The area to be backfilled must be done in such a way that water does not accumulate;
7. Previously cleared plant material can be used as a surface mulch to protect the soil surface;
8. Where necessary, re-vegetation can take place using seed, rescued plant material, or mulching. Where the affected area is less than 1 m across, passive re-vegetation can be employed, where natural ecological processes are relied upon to promote vegetation growth, but it is preferable to actively restore vegetation cover, as this reduces the risk of erosion; and
9. Compacted ground must be rehabilitated by ripping to a minimum depth of 600 mm.
10. Rock piles should be deployed in a heterogenous way to mimic habitat variability on site.

Rehabilitation programme

The following table has been prepared as a guideline to the various activities required. The table provides general information and is to be read in conjunction with the Rehabilitation Plan detailed in the sections above.

Preconstruction actions

Action	Responsibility	*Frequency*
Identify and protect sensitive areas	ECO	Once-off
Comprehensive photographic record of areas to be cleared	ECO	Once-off

Construction phase actions

Action	Responsibility	*Frequency*
Vegetation clearing, stockpiling of plant material & topsoil	Contractor	Ongoing
Seed collecting, if required	Contractor	Ongoing
Landscaping	Contractor	Ongoing
Fence off rehabilitation areas, if necessary	Contractor	Ongoing
Implementation of rehabilitation measures (terracing, fascine work, mulching, etc.)	Contractor	Ongoing
Soil levelling, seeding into rehabilitation areas, etc. to establish new vegetation.	Contractor	Ongoing
Photographic record of rehabilitation actions	ECO	Once-off

Post-construction phase actions

Action	Responsibility	*Frequency*
Monitor site for erosion, alien plants, vegetation growth	ECO / Rehabilitation Specialist	3-monthly and ad

		hoc for one year
Remediation in areas where rehabilitation is progressing poorly. If necessary, sow grass mix into bare patches.	Contractor	Ad hoc

Monitoring programme

In order to monitor the impact of rehabilitation activities, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide an assessment of the success of the rehabilitation activities.

The objective of monitoring is to ensure that the agreed rehabilitation process is successful, and that the prescribed rehabilitation objectives are met. There is therefore a need to monitor the progress of the physical aspects of rehabilitation during the construction, operational and closure phases, and to ensure that the desired final land use is successfully established. Maintenance of rehabilitated sites is often the difference between the ultimate success or failure of rehabilitation – monitoring of rehabilitation will determine whether rehabilitation objectives and requirements are being achieved, and that there are no residual impacts.

During the construction phase, the ECO will be responsible for monitoring and inspecting contractor's written records to illustrate compliance with the EMPr. The aim of compliance monitoring is to verify that the responsible parties are adhering to the procedures, management conditions and specifications contained in the EMPr, and the conditions set out in the EA. Monitoring by the ECO will also include regular monitoring of:

1. Control of alien vegetation associated with the infrastructure; and
2. Rehabilitation of construction sites after construction.

Note: Monitoring requirements of the Alien Invasive Management Programme are also applicable but are not repeated here.

Pre-construction and construction phase monitoring

The following monitoring is required during the construction phase of the project:

Monitoring action	*Indicator*	*Timeframe*
Photographs of area prior to construction	Baseline condition / pre-construction state	Pre-construction

Operational phase monitoring

The following monitoring is optional during the operational phase of the project:

Monitoring action	*Indicator*	*Timeframe*
Document rehabilitation measures implemented, and success achieved in problem areas	Decline in vulnerable bare areas over time	Annually

Concluding remarks

The information in this document is intended to provide various options that can be adapted for specific situations on the ground. The exact approach adopted for rehabilitation is dependent on local conditions and situations, and is not meant to adhere strictly to a formula. The experience of the ECO and the construction crew are important for ensuring that a successful rehabilitation programme is implemented.

References / further reading

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