Botanical Assessment for the proposed development of a Doringrivier Solar Energy Facility 3 on Remainder of Farm Doorn River 330, Theunissen , Free State Province

Botanical Surveys & Tours

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Report compiled for: EnviroAfrica CC

Client: Keren Energy

September 2022; January 2023

National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by EnviroAfrica CC to provide specialist botanical consulting services for the assessment of the area for the proposed development of a solar farm on Remainder of Farm Doorn River 330, Theunissen, Free State Province.

Details of Specialist

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 40 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 600 specialist botanical / ecological studies.
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Curriculum Vitae – Appendix 1

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the study was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Declaration of independence:

I David Jury McDonald, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

17 September 2022; 31 January 2023

Date:

CONTENTS

1. Background and Brief

Bergwind Botanical Surveys & Tours CC was appointed by EnviroAfrica CC on behalf of Keren Renewable Energy Pty Ltd (the 'Applicant') to undertake a botanical assessment to determine the botanical sensitivity and suitability of the area proposed for development of a solar facility on Remainder of Farm Doorn River 330, Theunissen, Free State Province. The solar facility would be connected to the Eskom Theseus Substation that is near the site of the proposed solar facility.

The study is conducted in terms of the National Environmental Management Act (NEMA) (No.7 of 1998) as amended and the 2014 Environmental Regulations. The protocols pertaining to terrestrial ecological specialist assessments are applied (GN 320 of 2020).

2. Terms of Reference

- Take cognizance of, and comply with, the substantive content requirements outlined within Appendix 6 of GN R982, as amended (i.e., GN 326), which outlines the legal minimum requirements for specialist studies in terms of the 2014 NEMA EIA Regulations, as amended;
- Adhere to the protocols applicable to specialist for environmental impact assessments (Government Gazette, 2020).
- Investigate the area proposed for the solar farm and determine its botanical sensitivity and possible constraints that would prevent solar farm development.
- Described the local and regional context of the vegetation communities and plant species within the affected areas.
- The ecosystem status and conservation value of the vegetation communities, including the whether the potentially affected areas comprise critically endangered or endangered ecosystem(s) listed in terms of Section 52 of the NEMBA;
- Record any rare or endangered species encountered or likely to be or have been present.
- The presence of and proximity of the proposed site to protected area(s) identified in terms of NEMPAA and proximity to a Biosphere Reserve (where relevant) (within, at least, a 20km radius of the site).

3. Project Area

3.1 Locality and Extent

Remainder of Farm Doorn River 330, Theunissen, lies approximately 10 km southwest of the town Virginia, in the Free State Province (Figure 1). The property is 208 ha in extent. Importantly, this farm is near the Eskom Theseus Substation which is a suitable connection point to the national grid for any solar PV plant that may be built in the area.

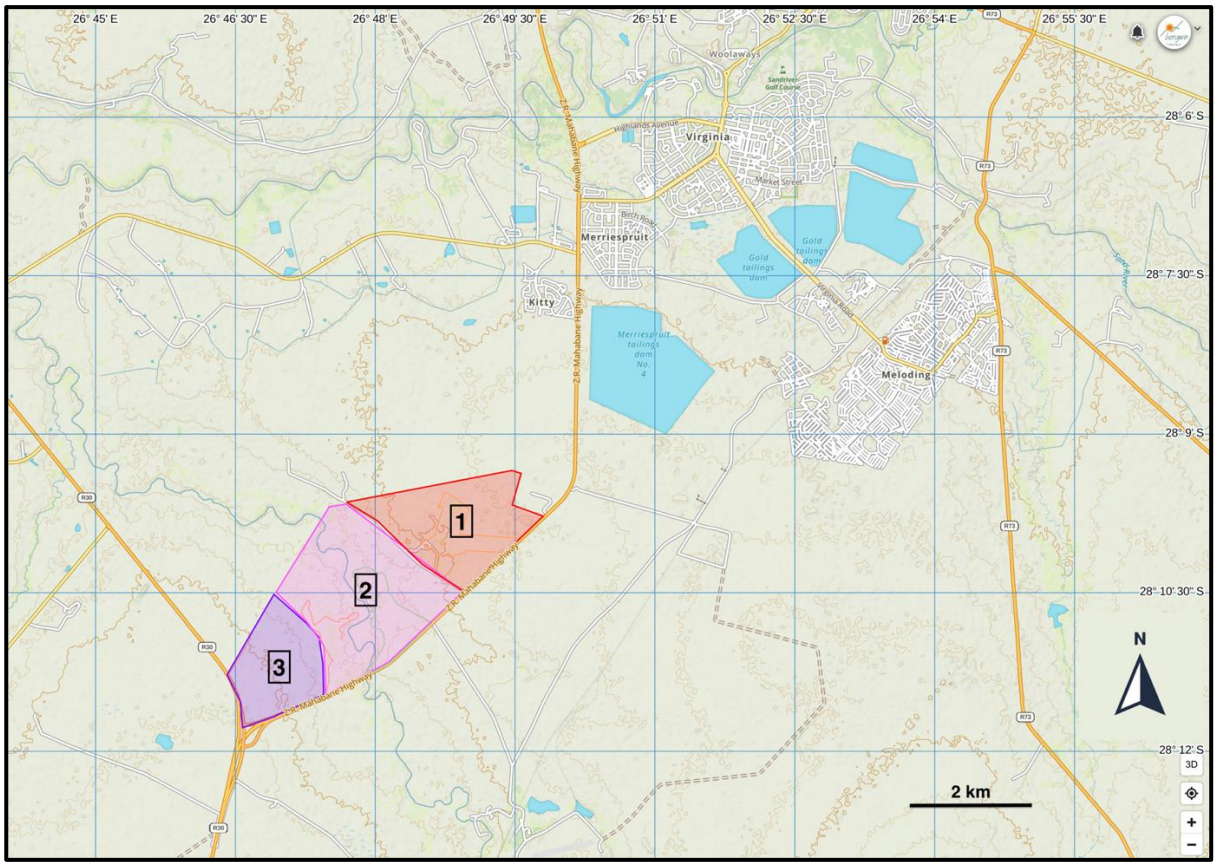


Figure 1. Topographical map of the general location of Remainder of Farm Doorn River 330, Theunissen (shown as 3 and shaded mauve on the map) where the proposed Doringrivier Solar 3 would be constructed. (Map source: GAIA GPS).

3.2 Topography, Geology and Soils

The topography of Remainder of Doorn River 330 (Doringrivier Solar 3) is relatively flat with very little relief. The terrain slopes gently down in a north-easterly direction towards the Doring River.

The underlying geology of Portion 1 of Farm Doorn River 330 consists of sediments of the Adelaide Subgroup, of the Beaufort Group which in turn is part of the Karoo Supergroup. The Adelaide Subgroup was laid down in the Late Permian Period and consists of mud-rock and sandstone. The Adelaide Subgroup sediments were in turn later intruded by Karoo Dolerite during the Jurassic Period, forming extensive dolerite sills, resulting in ridges and koppies. There are no dolerite koppies near Remainder of Farm Doorn River 330 (Figure 3).

The red sandy soils found are the result of aeolian and colluvial sand overlying the sedimentary rocks of the Karoo Supergroup (Mucina *et al.* 2006). At Doorn River 330, Theunissen, these sandy soils overlie sediments the Adelaide Subgroup at the upper end of the soil catena. These red sandy soils cover entire area of Remainder Farm Doringrivier 330. At lower elevations in the landscape, lower down in the soil catena (outside Remainder Farm Doorn River 330), the red sand has been removed by erosion to expose lighter-coloured soils in the riparian zone of the Doring River. These soils are more clay-rich, highly erodible, duplex soils, that have been exposed at lower elevations near the river. Among other factors, the exposure could have been caused by historical overgrazing by cattle. This has resulted in severe erosion in some areas, where the topsoil has been lost, and the exposed, highly erodible subsoil is lost quickly to water erosion (Bell & Maud, 1994; Hensley *et al*., 2006; Paige-Green, 2008). However, such erosion was no noted on Remainder Farm Doorn River 330.

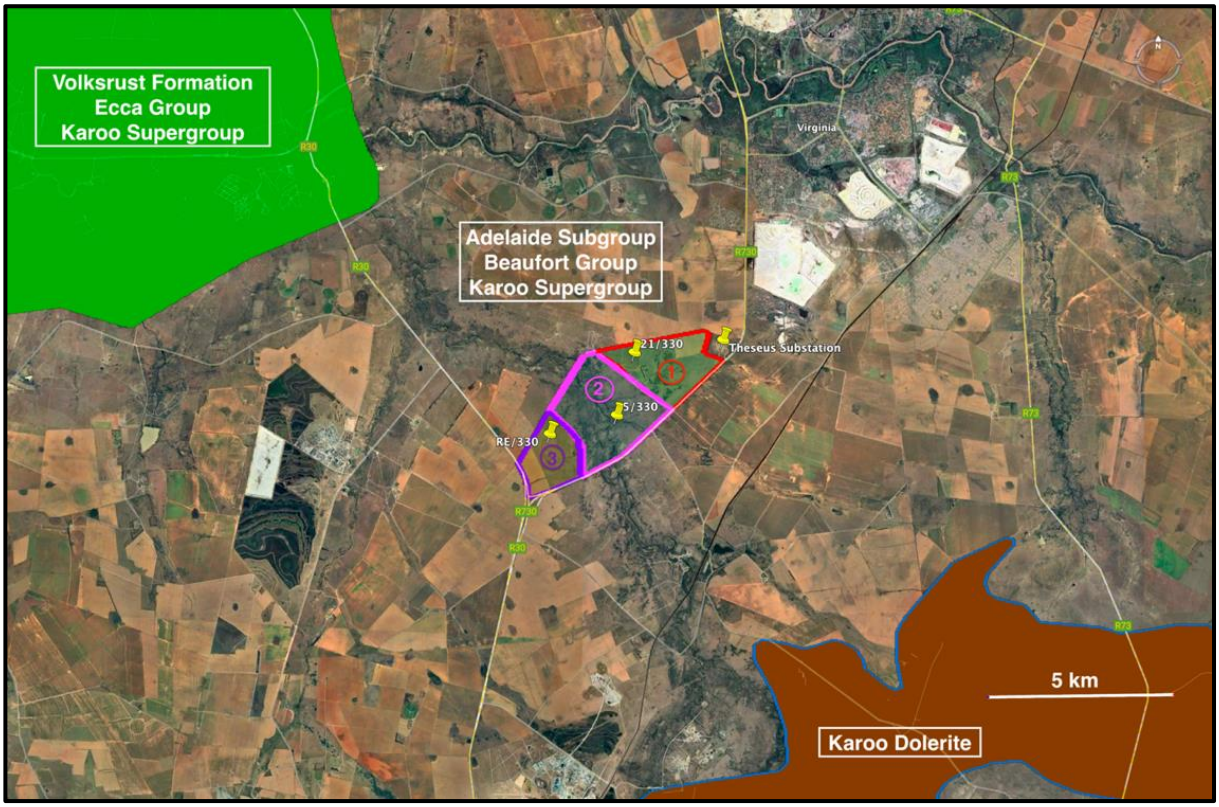


Figure 3. The parent farm Doorn River 330, Theunissen, and hence the three portions proposed for solar energy facilities is underlain by sedimentary rocks of the Adelaide Subgroup.

3.3 Climate

Farm Doorn River 330, Theunissen, is in the summer rainfall region and the climate is classified as warm-temperate. Overall mean annual precipitation (MAP) is 495--530 mm. Temperatures are high in summer and low in winter with severe frosts on average for 40 days of the year. The climate diagram (Figure 4) for Vaal-Vet Sandy Grassland shows the complete lack of rainfall in winter with rain occurring mainly from November to March. The climate modelled for Virginia, the nearest main centre (Figure 5), indicates a small amount of rain in the winter and agrees broadly with the climate diagrams for the two vegetation types

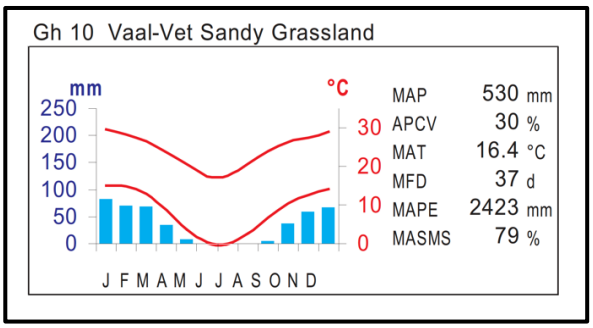


Figure 4. Climate diagrams for Vaal-Vet Sandy Grassland the vegetation type in the study area (Mucina *et al.* 2006 in Mucina & Rutherford, 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress.

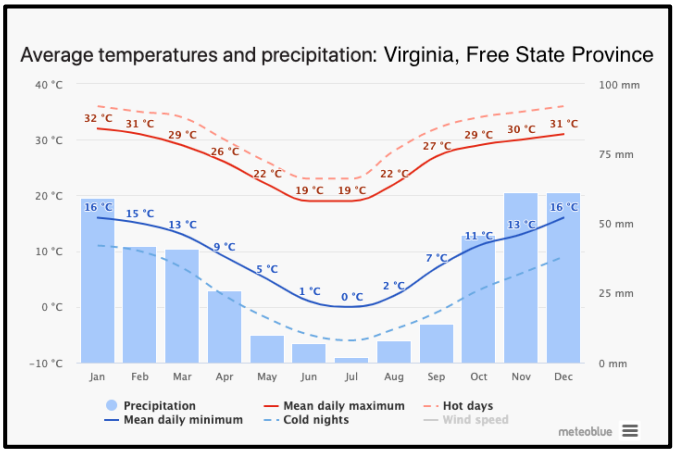


Figure 5. Climate chart for Virginia, Free State Province, modelled by meteoblue. The rainfall pattern is strongly biased towards summer rainfall (October to March) with the winters being cold

4. Methods

4.1 Desk-top analysis and reporting

Prior to carrying out fieldwork at Doorn River 330 in January 2022, the site was investigated at a desktop level using Google Earth Pro ™ satellite imagery. The natural vegetation that would occur at the farm was determined using the National Vegetation Map (SANBI, 2018) (referred to as VEGMAP). This map was overlaid on Google Earth imagery to enable vegetation mapping. No assumptions were made.

The National Web-based Environmental Screening Tool (https://screening.environment.gov.za/screeningtool) was applied to the study area to determine the sensitivity of the habitat and as a basis for checking the condition and sensitivity status during fieldwork.

4.2 Field Sampling

The vegetation was in the peak summer growth phase at the time of the site visit, with most grasses in flower, and many trees likewise. Some herbaceous plants were not in flower, notably the autumn-flowering geophytes. This was thus the ideal time for the investigation since the vegetation was lush from the summer rains. The season of the survey was therefore **not a limitation**.

The study area was by accessed by vehicle and on foot for approximately two hours. The method used was a ‘rapid-assessment technique’ in which site observations and numerous photographs were taken at waypoints distributed along the survey route. The collected records form the basis for this report. The survey track and waypoints as recorded are shown in Figure 6, as part of the survey of all three portions of Farm Doorn River 330 earmarked for solar energy facilities.

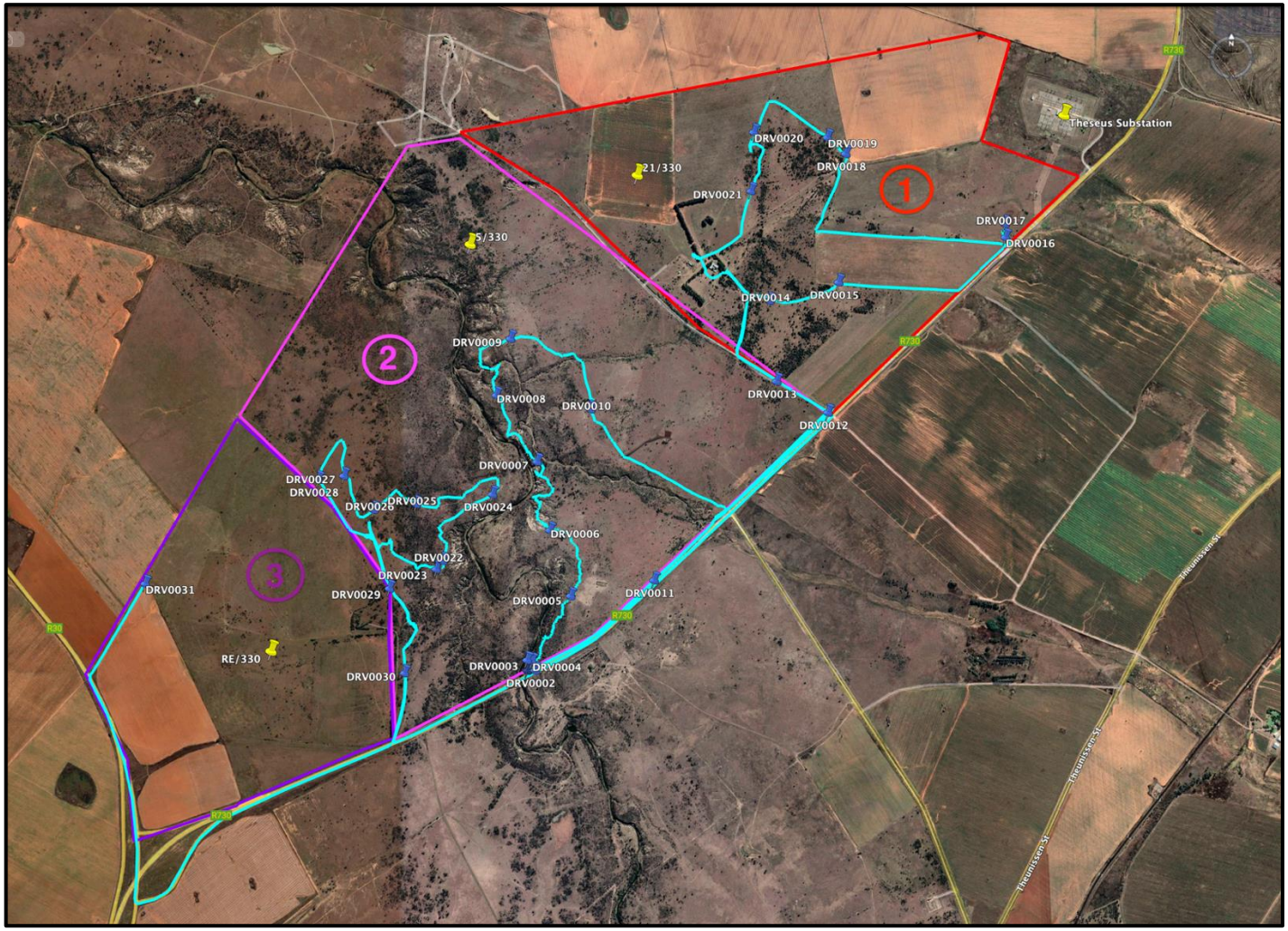


Figure 6. The three areas proposed for solar facility development, Doringrivier Solar 1 (red boundary), Doringrivier Solar 2 (pink boundary) and Doringrivier Solar 3 (purple boundary). The light blue line represents the survey track, and the sample waypoints are indicated by blue pins with (DRV#). The Eskom Theseus Substation is indicated at the upper right side of the image.

5. Disturbance regime

Remainder of Doorn River 330 has been actively farmed for some time with mixed agriculture, of crops and beef cattle (Figure 8). The natural vegetation has been transformed by ploughing and planting of maize and sunflower in some areas whereas in other areas ploughed lands have gone fallow and are now grazed by beef cattle.

Comparison of the aerial satellite images (Google Earth Pro ™), Figures 8—10, shows that the vegetation is in different phases of cultivation and lying fallow. In 2003 (Figure 8), most of Remainder of Doorn River 330 was cultivated; in May 2020 (Figure 9) approximately one quarter of the land was cultivated with the rest lying fallow. This condition persisted until February 2022 (Figure 10; image taken shortly before the field work for this study). In addition, since the land has lain fallow, it has been encroached by *Vachellia karoo* (soetdoring, sweet-thorn) (formerly *Acacia karoo*), a species that is an opportunistic colonizer. *Vachellia karoo* is a widespread species and in some instances is a good indicator of disturbance or absence of fire (Dingaan, 2008).

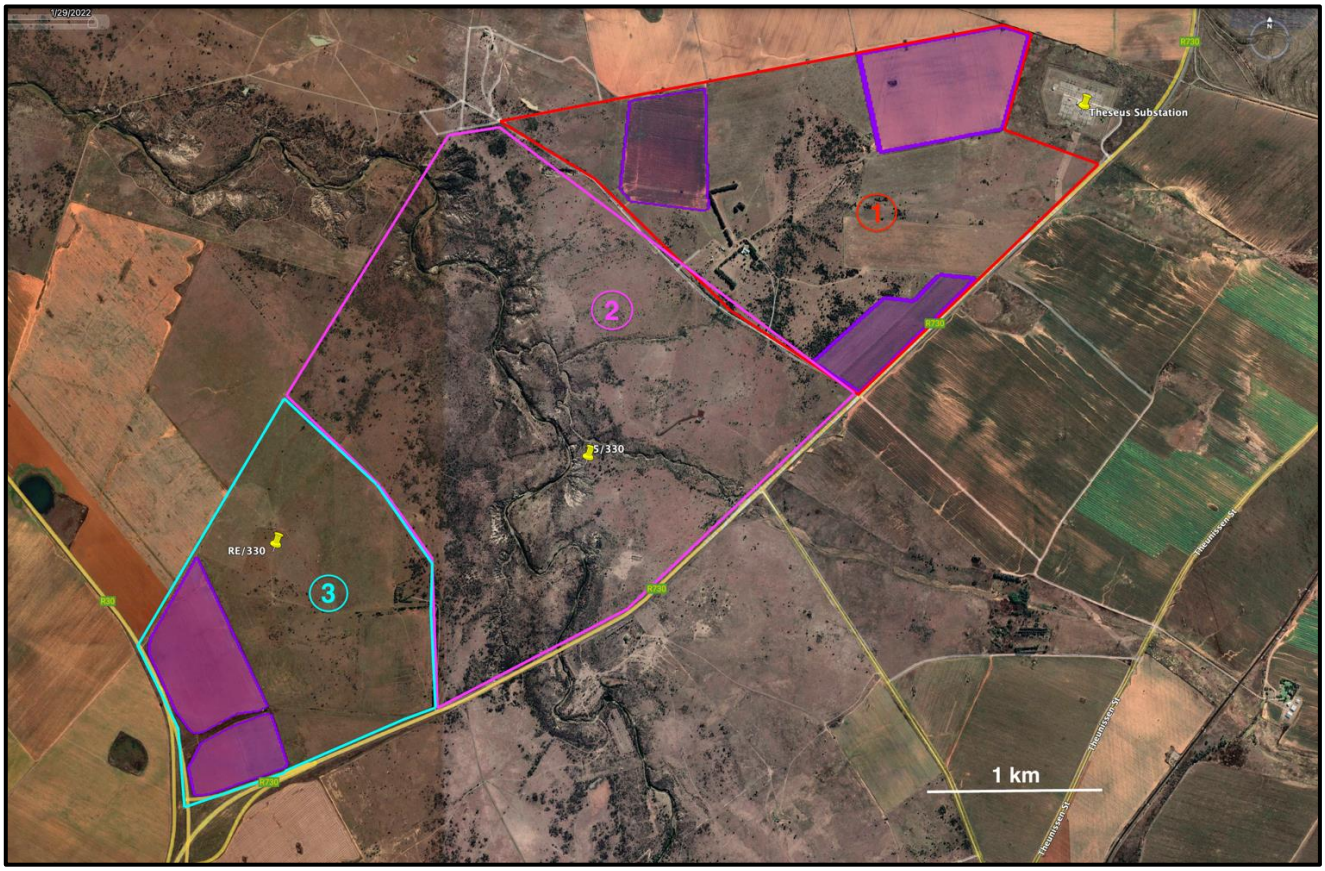


Figure 7. Google Earth Pro ™ aerial image with the areas earmarked for Doringrivier Solar 1, 2 & 3, indicating the areas, shaded in purple, that have been transformed by cultivation.

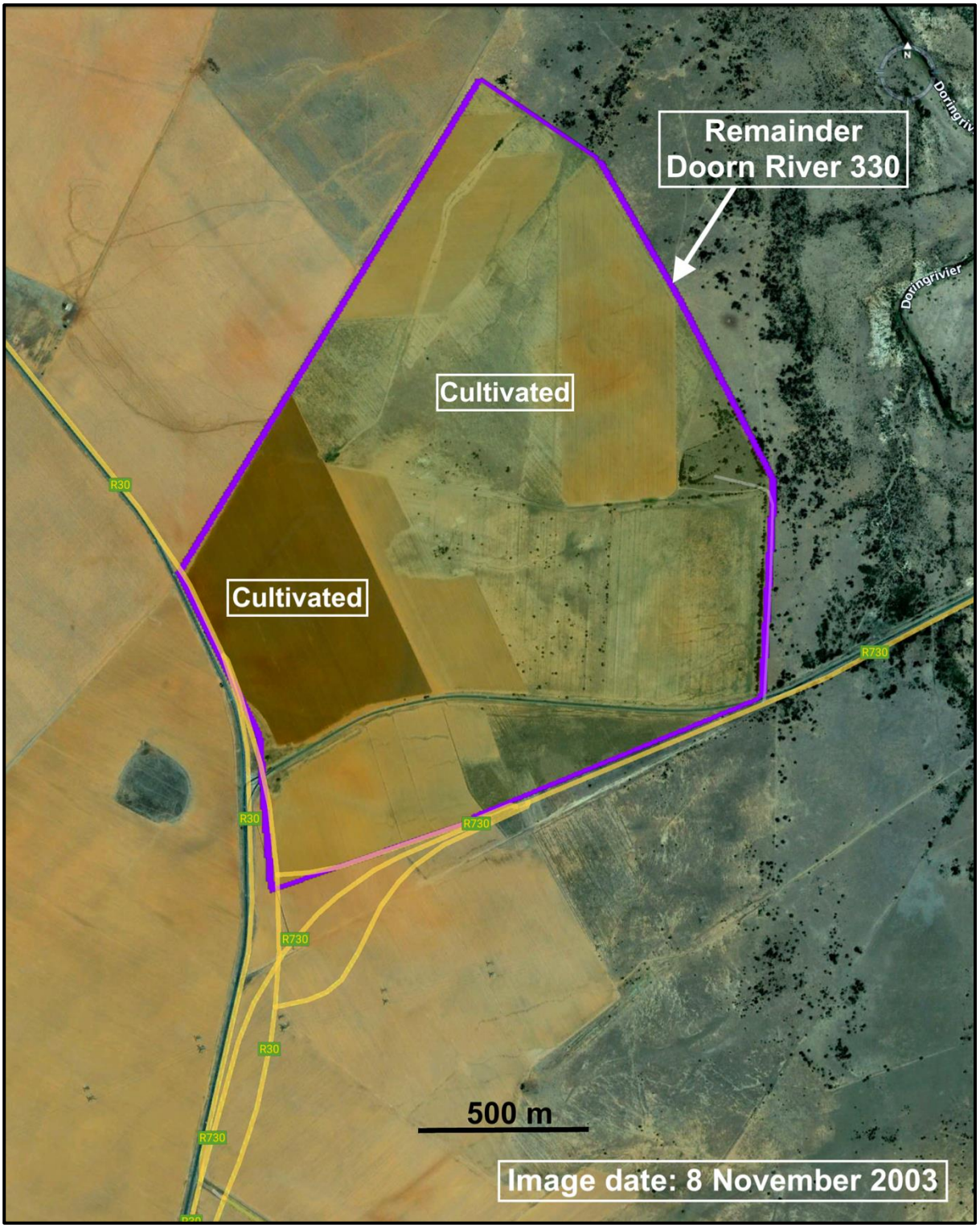


Figure 8. Remainder Doorn River 330 is outlined in purple on a satellite aerial image from November 2003, indicating that almost the entire area was subjected to cultivation at that time.

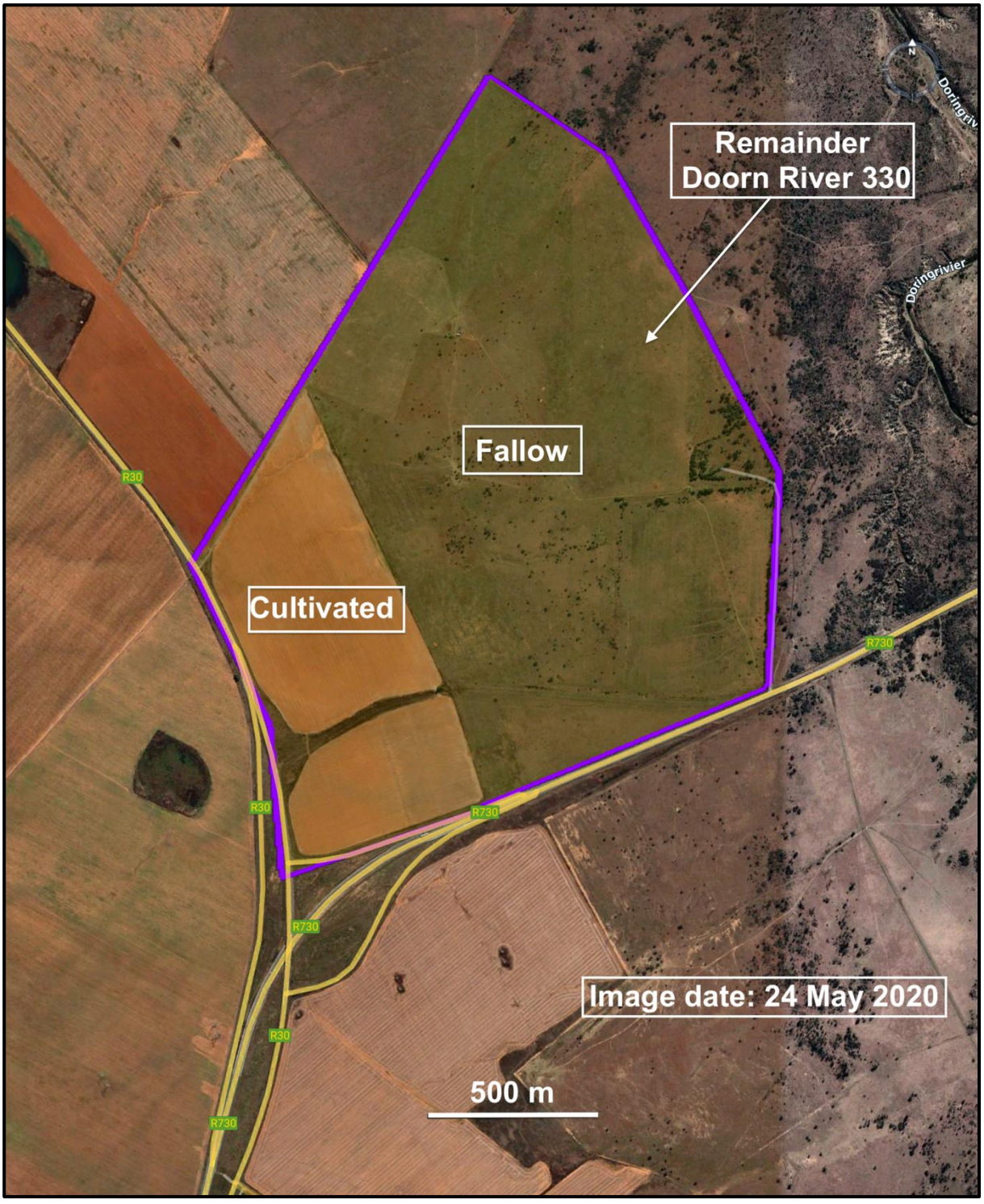


Figure 9. The effects of historical and recent cultivation are seen in this satellite image of Remainder Doorn River 330, outlined in purple. Approximately 25 percent of the land portion was under cultivation in May 2020 and the rest was fallow.

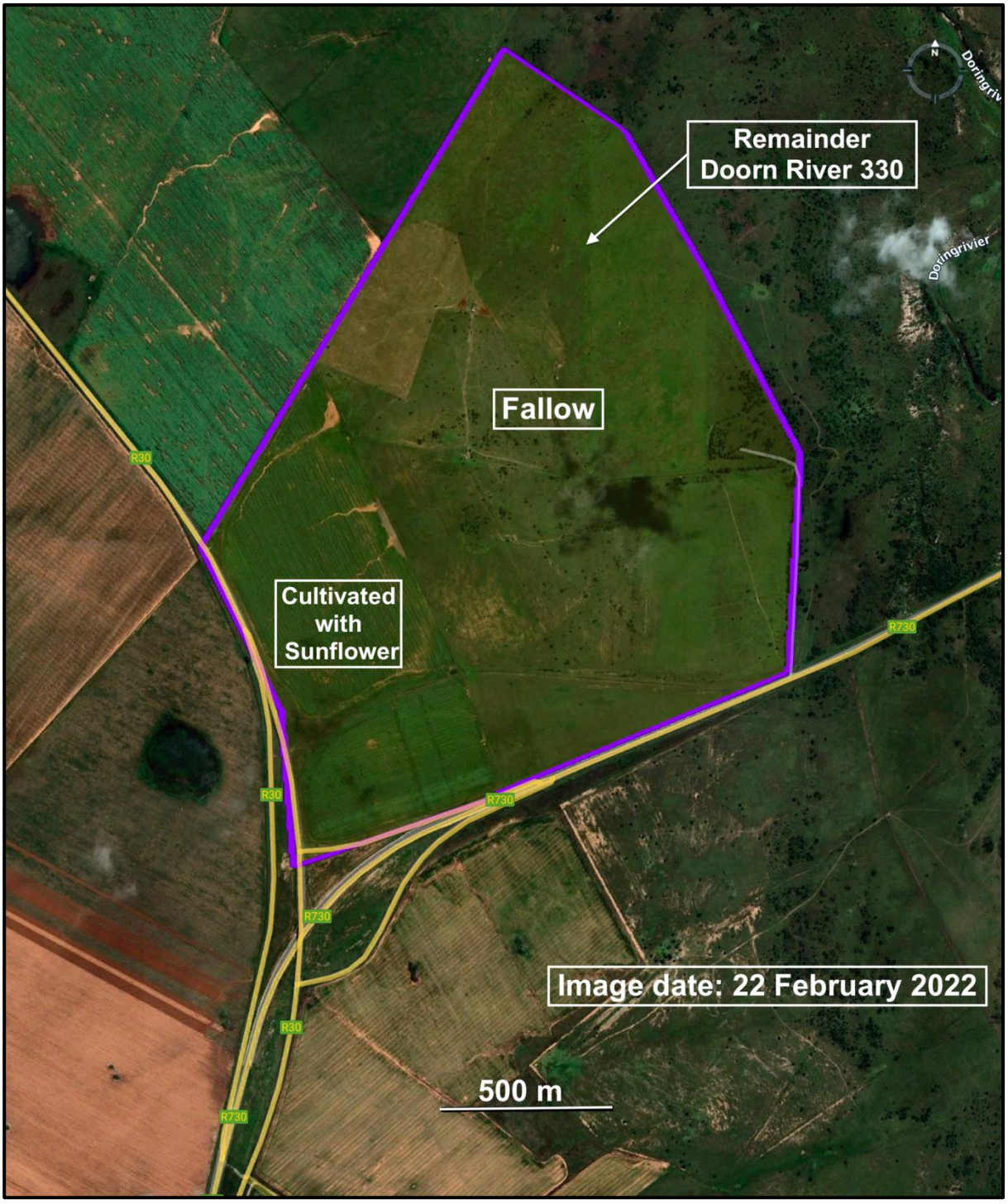


Figure 10. Google Earth Pro ™ image of Remainder Doorn River 330 from February 2020, showing cultivation with sunflower and the historically cultivated areas lying fallow.

6. Botanical evaluation of the study area

6.1 General description

The vegetation of Remainder of Farm Doorn River 330 falls within the Grassland Biome and is classified as the Vaal-Vet Sandy Grassland (SANBI, 2018) (Figure 11). This was confirmed during the field-survey.

Vaal-Vet Sandy Grassland, as the name indicates, is a low shrubland-grassland formation, where the dominant grasses are C4 grasses. These are grasses adapted to warm-temperate to sub-tropical conditions.

Species listed for Vaal-Vet Sandy Grassland by Mucina *et al.* (2006) include the following (Highveld Alluvial Grassland has many of the same plant species):

Trees: *Celtis africana, Cussonia paniculata, Pittosporum viridiflorum, Scolopia zeyheri, Searsia lancea, Ziziphus mucronata*.

Tall shrubs: *Buddleja saligna, Diospyros lycioides subsp. lycioides, Euclea crispa subsp. ovata, Grewia occidentalis, Gymnosporia buxifolia, Gymnosporia polyacantha, Olea europaea subsp. africana, Searsia burchellii, Searsia erosa, Tarchonanthus camphoratus.*

Low shrubs: *Anthospermum rigidum subsp. pumilum*, *Asparagus laricinus*, *Asparagus cooperi*, *Berkheya annectens*, *Chrysocoma ciliata*, *Clutia pulchella*, *Euryops empetrifolius*, *Felicia filifolia subsp. filifolia*, *Felicia muricata*, *Helichrysum dregeanum*, *Nenax microphylla, Osyris lanceolata*, *Pentzia globosa*, *Rosenia humilis*, *Selago saxatilis*, *Solanum tomentosum var. coccineum.*

Graminoids: *Aristida adscencionis, Aristida congesta, Aristida diffusa, Cymbopogon pospischilii, Cynodon dactylon, Cynodon incompletus, Digitaria argyrograpta, Elionurus muticus, Enneapogon scoparius, Eragrostis chloromelas, Eragrostis lehmanniana, Eragrostis micrantha, Eragrostis obtusa, Eragrostis plana, Eragrostis superba, Eragrostis trichophora, Eustachys paspaloides, Heteropogon contortus, Panicum stapfianum, Setaria lindenbergiana, Setaria sphacelata, Sporobolus fimbriatus, Themeda triandra, Tragus berteronianus, Tragus koelerioides, Tragus racemosus, Triraphis andropogonoides.*

Herbs: *Berkheya onopordifolia* var. *onopordifolia, Hermannia coccocarpa*, *Indigofera alternans, Mohria caffrorum*, *Pupalia lappacea, Salvia repens.*

Geophytic herbs: *Oxalis corniculata, Oxalis depressa*

Succulent herbs: *Crassula lanceolata*

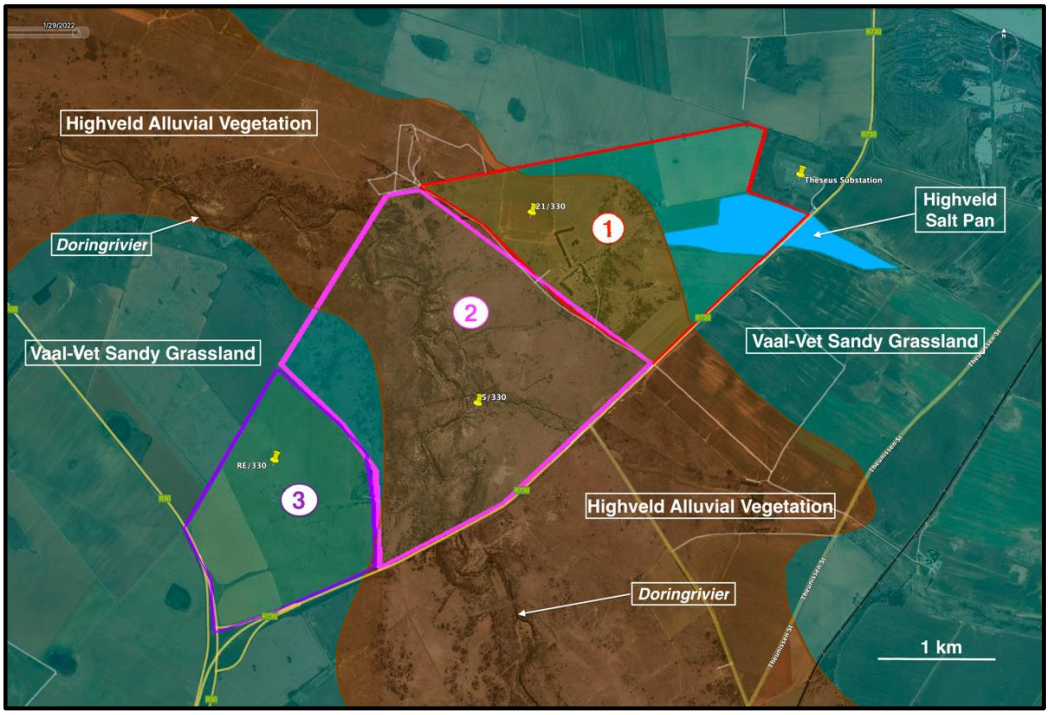


Figure 11. Extract from the Vegetation Map of South Africa, Lesotho & Swaziland (Mucina *et al.* 2005; SANBI, 2018) (VEGMAP) overlaid on a Google Earth pro ™ image, indicating that part of Remainder of Doorn River 330 (indicated as 3, with purple boundary) is mapped as Vaal-Vet Sandy Grassland.

6.2 The Vegetation of Remainder of Doorn River 330 as recorded in the field.

Approximately 25 percent of the land portion was under sunflowers and maize at the time of the survey (Figure 12). This is a summer annual crop and cattle would have been allowed to graze in the stubble once the crop had been harvested. The other 75 percent of the land portion was not cultivated in January 2022 and was vegetated with secondary grassland. This grassland consisted of grasses typical of disturbed veld and was dominated by grass species such as *Setaria sphacelata, Eragrostis lehmanniana* and *Digitaria eriantha* (Smuts Finger Grass). The dominance of *D. eriantha* suggests that it may have been sown in areas that were previously cultivated, to improve the quality of the grazing, as has been done in parts of Portion 21 of Doorn River 330. *Themeda triandra* was present but not common.

Shrubs and small trees were scattered and consisted of *Vachellia karoo* (as noted above to be encroaching), *Searsia* sp. and *Ziziphus mucronata*. *Asparagus laricinus* was present but not common. The currently uncultivated secondary grassland has low sensitivity.

Figure 12. Sunflowers cultivated in the southwestern part of Remainder Doorn River 330, January 2022

Figure 13. Secondary grassland that has re-established in the areas of Remainder Doorn River 330 under cultivation approximately 20 years ago. View westwards from the boundary with Portion 5 of Doorn River 330.

Figure 14. Secondary grassland that has re-established in the areas of Remainder Doorn River 330 under cultivation approximately 20 years ago, now being grazed by cattle. View eastwards from the sunflower fields.

7. Conservation Status and Vegetation Sensitivity

7.1 National Web-based Environmental Screening Tool

The National Web-based Environmental Screening Tool was applied to Remainder of Doorn River 330, where the Doringrivier Solar 3 is proposed to be built. The result from the screening tool for the plant species sensitivity theme (Figure 15) is that the sensitivity is **LOW**. From observations made in the field, there is agreement with this rating.

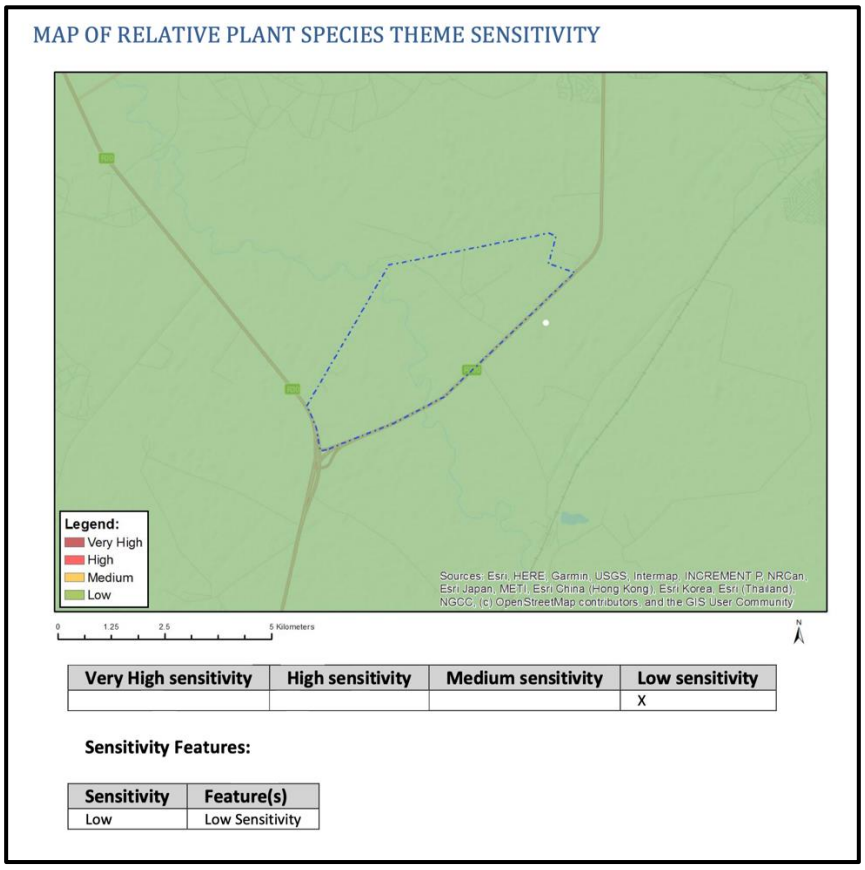
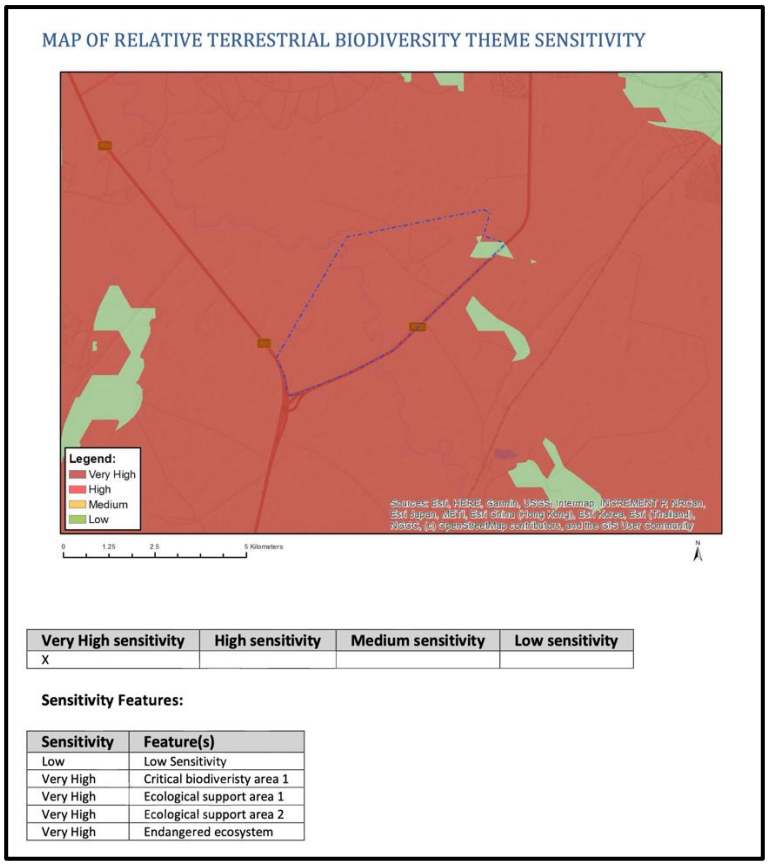


Figure 15. The map for relative plant species theme sensitivity produced by the National Web-based Environmental Screening Tool, indicating that Remainder of Doorn River 330 (within the blue outlined polygon) has **Low Sensitivity**.

Results were also obtained from the screening tool for the terrestrial biodiversity sensitivity for Remainder of Doorn River 330. Figure 16 indicates that the screening tool rates the land portion as having **VERY HIGH** terrestrial biodiversity sensitivity with only the far northeast corner rated as **LOW**. From observations made at Remainder of Doorn River 330, this appears to be an overrated assessment in the 'VERY HIGH' area and an underrated A more realistic ranking would be **MEDIUM** sensitivity for the entire land

portion, and **LOW** sensitivity for Remainder Doorn River 330 that is located in the southwest part of the blue-dotted polygon in Figure 16.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Critical biodiveristy area 1
Very High	Ecological support area 1
Very High	Ecological support area 2
Very High	Endangered ecosystem

Figure 16. The map output from the National Web-based Environmental Screening Tool for the Relative Terrestrial Biodiversity Theme Sensitivity where the blue outlined polygon contains Remainder of Doorn River 330. Terrestrial Biodiversity is indicated as being **Very High.**

7.2 Threat Status

According to the National List of Threatened Terrestrial Ecosystems (Government Gazette, 2011), Vaal-Vet Sandy Grassland is an **Endangered A1** ecosystem, where the A1 criterion denotes irreversible loss of natural habitat.

7.3 Red List Ecosystems (RLE)

The National List of Threatened Terrestrial Ecosystems (2011) is somewhat out of date and is now superseded to a large extent by the determination of 'Red List Ecosystems'. These ecosystems have been mapped (SANBI, 2021) and for Remainder Farm Doorn River 330, only small areas remain of Endangered habitat (see area 3 in Figure 17). The other parts of Remainder Doorn River are transformed and have very low conservation value (Figure 17).

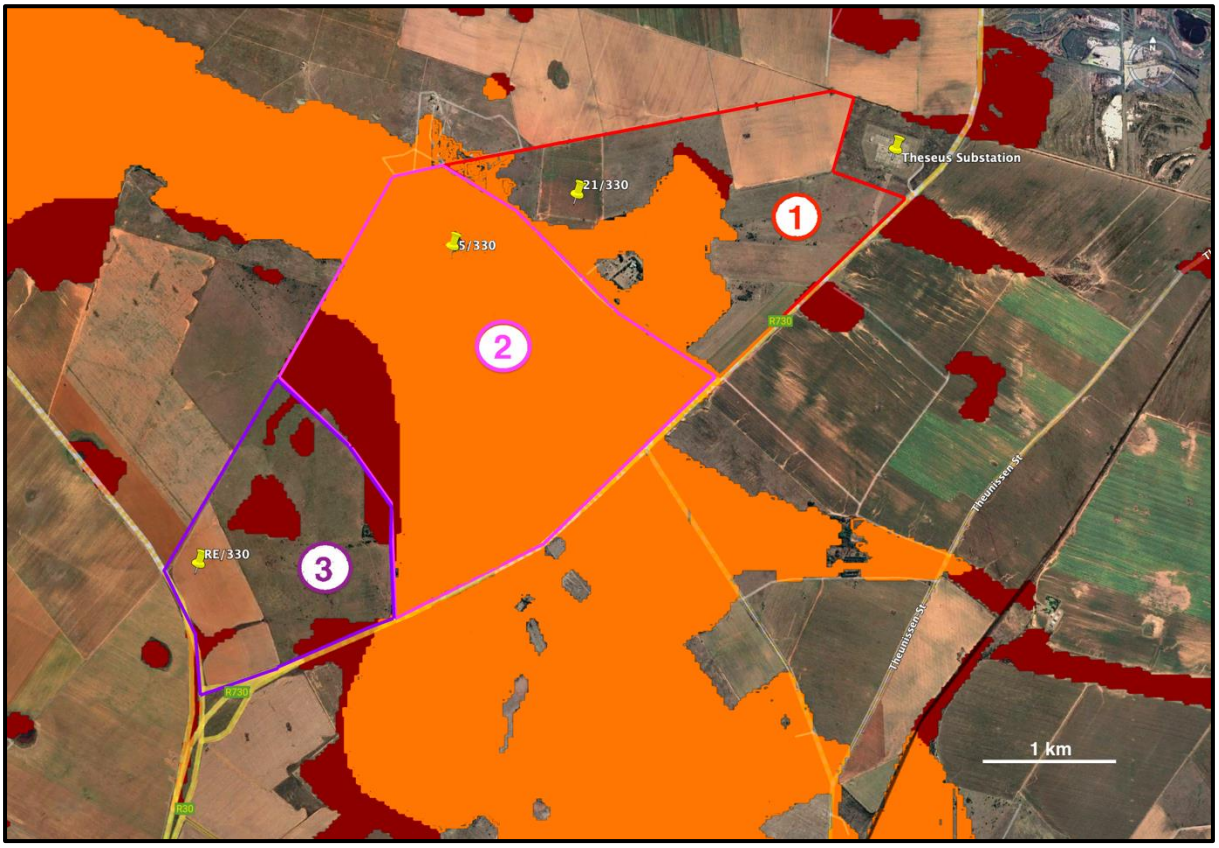


Figure 17. The RLE map overlaid on an Google Earth Pro ™ image for the Farm Doorn River 330, shows that in Remainder of Doorn River 330 (area with purple boundary marked 3) the terrain is mostly transformed, with small, fragmented areas of endangered habitat (dark red shading). The rest of the land parcel is transformed (no shading).

7.3 Critical Biodiversity Areas

The critical biodiversity areas (CBA) map for the Remainder of Doorn River 330 study area from the Department of Economic Development and Environmental Affairs, Free State Province, was overlaid on a Google Earth Pro™ image and examined to compare what was observed in the field with the aerial image and overlaid CBA map (Figure 18). Very small critical biodiversity areas are mapped on Remainder of Doorn River 330 (area 3 with pink boundary on the map) along the boundaries. The greater part of the land parcel is mapped as ecological support areas, ESA2.

The proposed SPV development area is not close to any protected area(s) identified in terms of NEMPAA and/or within 20 km proximity to a Biosphere Reserve.

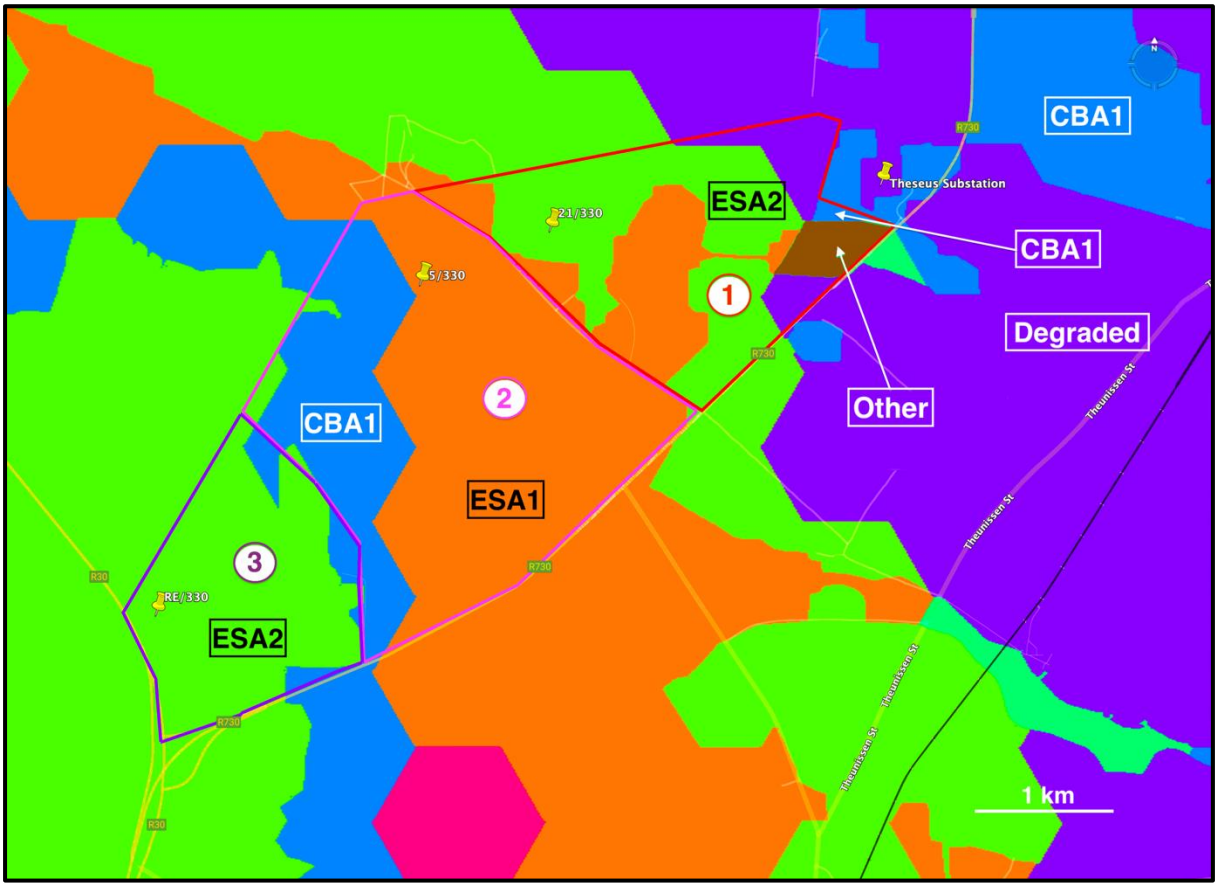


Figure 18. The Critical Biodiversity Map for Farm Doorn River 330, with focus on Remainder of Doorn River 330 (marked with 3 and a purple boundary). Most of the site consists of ESA2 (green) areas, with some small areas mapped as CBA1.

7.4 Sensitivity Mapping based on field observations

From the field-survey, a map has been compiled that represents the sensitivity status as determined from 'on-the-ground' observations (Figure 19). This map indicates areas of **High Sensitivity** where no solar photovoltaic SPV) installations should be built, **Medium Sensitivity** areas that are buildable with mitigation and **Low Sensitivity** areas that include cultivated land where SPVs could be built without compromise of sensitive plants communities on the site. The sensitivity classification (Figure 19) is in broad agreement the Critical Biodiversity Classification (Figure 18). The whole of Remainder Doorn River 330, Theunissen, has **Low** sensitivity.

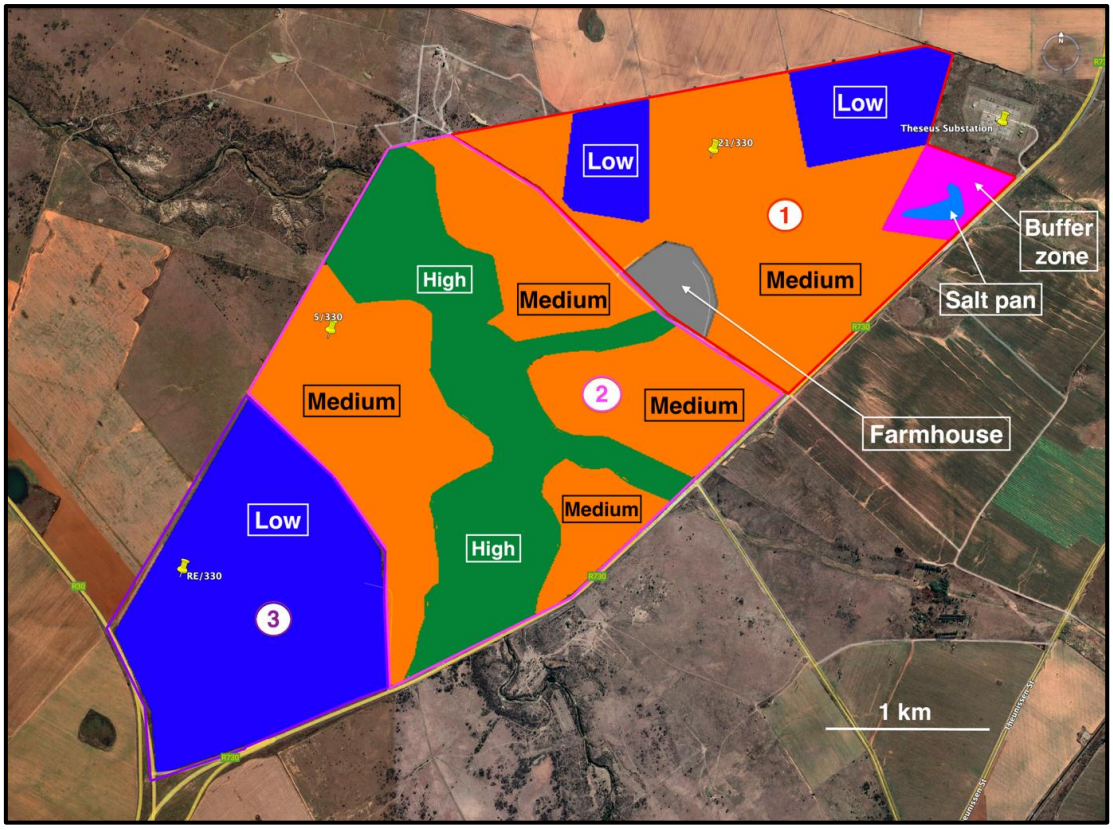


Figure 19. The sensitivity map for Remainder of Doorn River 330, Theunissen marked as "3" with a purple boundary. The **Medium** sensitivity areas are shaded orange, the **Low** sensitivity areas are shaded blue, and the salt pan which is a high sensitivity area is shaded blue with a pink buffer zone.

8. Plant Species of Conservation Concern

No plant species of conservation concern were recorded on Remainder of Doorn River 330.

9. The proposed Doringrivier Solar PV layout

The sensitivity map (Figure 19) was presented to the proponents of the Doringrivier Solar 3 SPV installation and the botanical sensitivity of Remainder of Doorn River 330, Theunissen, was taken into account when determining the SPV layout. There is very little botanically sensitive vegetation, there being no primary Vaal-Vet Sandy Grassland left. The entire area has been cultivated at some time or another and the areas that are now fallow are secondary grassland. The proposed Doringrivier Solar 3 (grey shaded area with cross-hatching in Figure 20) (Alternative 1) will be located in an area of secondary grassland. The area to the southwest that is cultivated with sunflowers

(Figures 10 & 12), will not be included in the solar PV construction area, unless Alternative 2 were to be built.

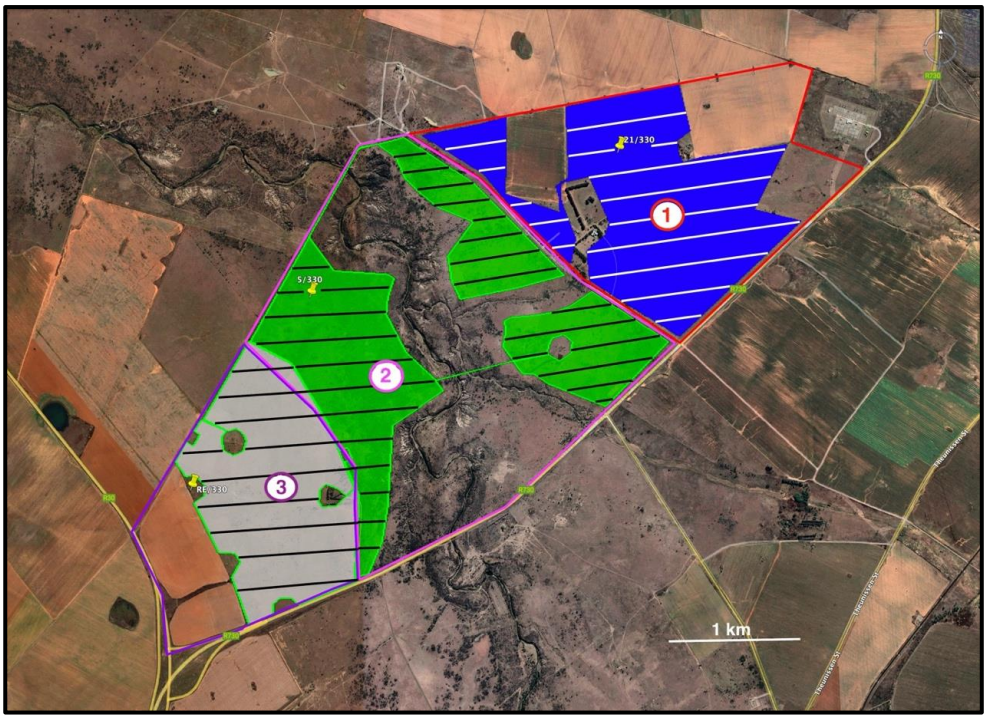


Figure 20. The proposed layout for Doringrivier Solar 3 (dark parallel lines on grey background) with the area marked as “3”.

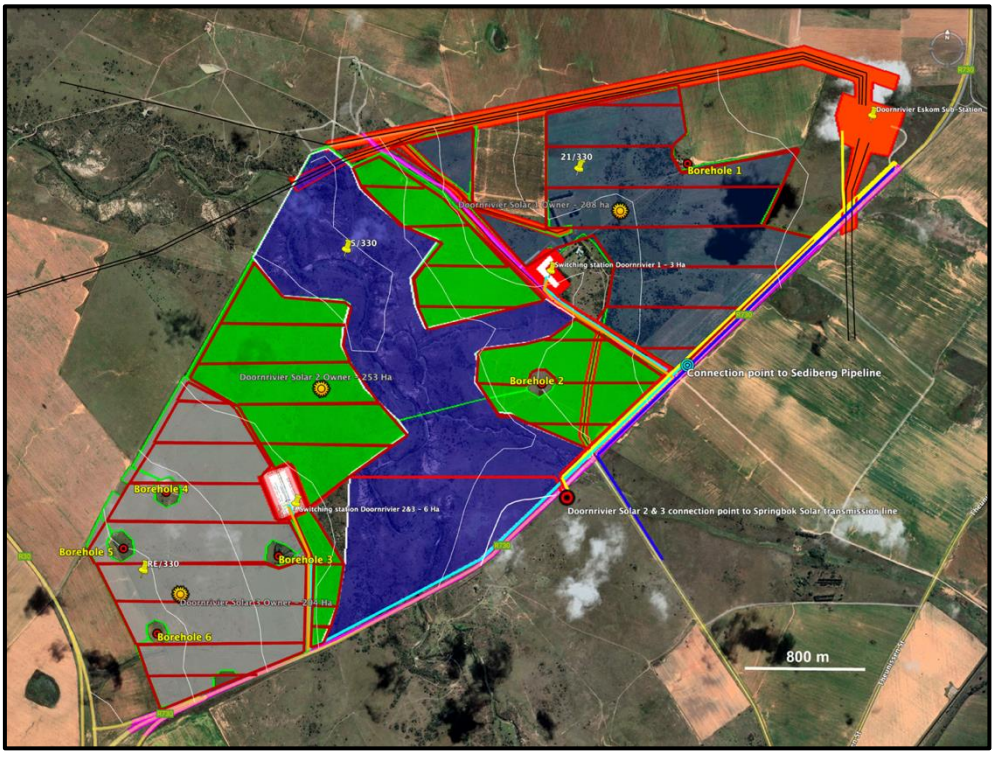


Figure 21. The preferred layout of Doringrivier Solar 1, 2 and 3, as prepared by the engineering team.

10. Impact Assessment

The No Go alternative, the Preferred Alternative (Alternative 1) i.e. construction and operation of the Doornrivier Solar 3 facility (with layout as given in Figures 20 & 21) and Alternative 2, that would be the development of the entire cadastral unit, Remainder of Doorn River 330, Theunissen, are assessed.

10.1 The No Go Alternative

In the case of the No-Go Alternative, the Doringrivier Solar 3 facility would not be built and there would be very little change to the *status quo*. The farming operation would continue as it is at present. The No Go alternative is assessed in Tables 1 & 2.

10.2 Direct Impacts of Alternatives 1 & 2 – Doringrivier Solar 3

Only the loss of Vaal-Vet Sandy Grassland is assessed, since it is the only vegetation type that originally occurred in the target area for Doringrivier Solar 3.

The direct impact of the Doringrivier Solar 3 Alternative 1 (Preferred Alternative) on natural vegetation on Remainder of Doorn River 330 would be **Low negative** prior to mitigation, and with mitigation **Low Negative,** during the construction phase (Table 1). During the operational phase the impact of Alternative 1would be **Very Low Negative** both prior to and after any mitigation (which is deemed unnecessary) (Table 2).

For Alternative 2 the direct impact would be Very Low Negative for both the construction and operational phases (Table 3).

Table 1. Impact: The loss of Vaal-Vet Sandy Grassland on Remainder of Doorn River 330 during the **construction phase** of Doringrivier Solar 3.

CRITERIA	'NO GO' ALTERNATIVE	Alternative 1 Doringrivier Solar 3 Remainder of Doorn River 330		Alternative 2 The entire area of Remainder of Doorn River 330	
Nature of direct impact (local scale)	Loss of Vaal-Vet Sandy Grassland				
		WITHOUT MITIGATION	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Extent	Local	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term	Long-term
Intensity	Very Low	Low	Low	Long-term	Long-term
Probability of occurrence	Probable	Definite	Definite	Definite	Definite
Confidence	High	High	High	High	High
Significance	Very Low Negative	Low Negative	Low Negative	Low Negative	Low Negative
Nature of cumulative impact	Loss of Vaal-Vet Sandy Grassland				
Cumulative impact prior to mitigation	N/A	Low Negative		Low Negative	
Degree to which impact can be reversed	N/A	Medium		Low	
Degree to which impact may cause irreplaceable loss of resources	N/A	Low		Low	
Degree to which impact can be mitigated	N/A	Low		Low	
Proposed mitigation	N/A	None		None	
Cumulative impact post mitigation	N/A	Low Negative		Low Negative	
Significance of cumulative impact (broad scale) after mitigation	N/A	Low Negative		Low Negative	

Table 2. Impact: The loss of Vaal-Vet Sandy Grassland on Remainder of Doorn River 330 during the **operational phase** of Doringrivier Solar 3.

CRITERIA	'NO GO' ALTERNATIVE	Alternative 1 Doringrivier Solar 3 Remainder of Doorn River 330		Alternative 2 The entire area of Remainder of Doorn River 330	
Nature of direct impact (local scale)	Loss of Vaal-Vet Sandy Grassland				
		WITHOUT MITIGATION	**WITH MITIGATION**	**WITHOUT MITIGATION**	**WITH MITIGATION**
Extent	Local	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term	Long-term
Intensity	Low	Very Low	Very Low	Very Low	Very Low
Probability of occurrence	Probable	Definite	Definite	Definite	Definite
Confidence	High	High	High	High	High
Significance	Low Negative	Very Low Negative	Very Low Negative	Very Low Negative	Very Low Negative
Nature of cumulative impact	Loss of Vaal-Vet Sandy Grassland				
Cumulative impact prior to mitigation	N/A	Very Low Negative		Very Low Negative	
Degree to which impact can be reversed	N/A	Very Low		Very Low	
Degree to which impact may cause irreplaceable loss of resources	N/A	Very Low		Very Low	
Degree to which impact can be mitigated	N/A	Not required		Not required	
Proposed mitigation	N/A	N/A		Restoration of laydown and other disturbed areas not used for the solar PV development	
Cumulative impact post mitigation	N/A	Very Low Negative		Very Low Negative	
Significance of cumulative impact (broad scale) after mitigation	N/A	Very Low Negative		Very Low Negative	

10.3 Mitigation in the Construction and Operational Phases

Since the area where the Doringrivier Solar 3 would be constructed has previously been cultivated, there is a low probability of there being any geophytes that could be translocated. There is thus no mitigation that should be applied in the construction phase.

In the operational phase, where there are areas that were used in the construction phase as laydown areas and that will not be used later, they should be rehabilitated. This can be achieved by sowing a suitable mix of grasses onto the disturbed areas.

10.4 Cumulative Impacts

To determine cumulative impacts on the vegetation due to other renewable energy projects within 30 km of Doorn River 330, the respective projects (Table 3) were plotted on Google Earth (Figure 22). The vegetation types were overlaid and determined as in Table 3 and then the Red Listed Ecosystems – Remnants (SANBI 2021) [RLE] were also superimposed on the project areas using Google Earth. The results of that visual inspection area given in the RLE Status (Remnants) column of Table 3.

Vaal-Vet Sandy Grassland is the most threatened vegetation type in most of the areas examined. However, the addition of the Doringrivier Solar 3 to the cumulative impacts would result in minimal further loss of endangered Vaal-Vet Sandy Grassland because there is very little of this vegetation that is undisturbed on Remainder of Farm Doorn River 330, Theunissen. No mitigation would be possible or required to offset these cumulative impacts.

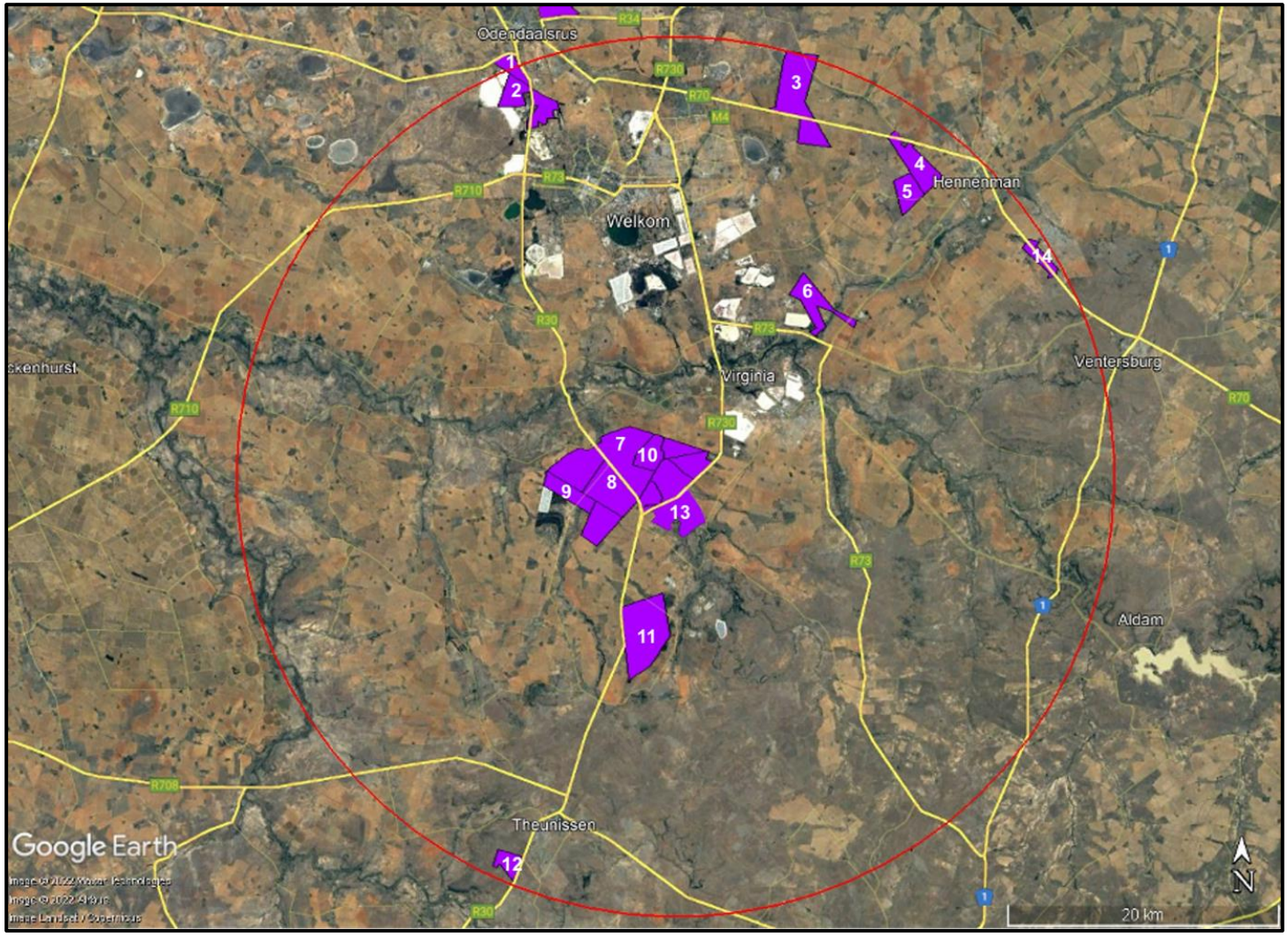


Figure 22. Solar PV projects within a 30 km radius (red circle) from Doorn River and the proposed Doringrivier 1, 2 & 3 Solar PV projects.

Table 3. List of solar PV applications within 30km of Doringrivier Solar 3. The remnant status was determined by inspection of the RLE Remnants (SANBI, 2021) using Google Earth, as they pertain to the project areas.

	Project name	Generating Capacity (MW)	Application date (year)	Application Status	Vegetation Types	RLE Status (Remnants)
1	Harmony Nyala solar energy facility	10	2015	Approved	Western Free State Clay Grassland	Least Concern (LC)
2	Harmony Eland solar energy facility	10	2015	Approved	Western Free State Clay Grassland	LC
3	Thabong Solar Farm	75	2013	In process	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	LC with two small areas of Endangered (EN) (Vaal-Vet Sandy Grassland)
4	Vogel's Rand Solar	10	2012	In process	Vaal-Vet Sandy Grassland	Small area of EN (Vaal-Vet Sandy Grassland)
5	Everest solar energy facility	75	2013	Lapsed	Vaal-Vet Sandy Grassland	Small area of EN (Vaal-Vet Sandy Grassland)
6	Onverwag and Vaalkranz	75	2013	Approved	Vaal-Vet Sandy Grassland	Very small area of EN (Vaal-Vet Sandy Grassland)
7	Selexos Solar	20	2012	Approved	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	Very small area of EN (Vaal-Vet Sandy Grassland)
8	Oryx solar energy facility	75	2013	In process	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	LC

9	Beatrix Gold Mine Co-Generation Facility	4	2012	Approved	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	Very small area of EN (Vaal-Vet Sandy Grassland)
10	Kalkoenkrans Solar PV Plant	-	2012	Lapsed	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	Very small area of EN (Vaal-Vet Sandy Grassland)
11	Selexos Solar – Farm Leeubult	19.9	2012	In process	Vaal-Vet Sandy Grassland	Very small area of EN (Vaal-Vet Sandy Grassland)
12	Sonvanger PV solar energy facility	-	2018	In process	Central Free State Grassland	No remnants
13	Springbok PV Plant	150		In process	Highveld Alluvial Vegetation Vaal-Vet Sandy Grassland	LC
14	Hennenman	5	2014	Approved	Central Free State Grassland	LC

11. Discussion and Recommendations

The botanical survey of Remainder of Doorn River 330, Theunissen, was aimed at determining (i) the vegetation type(s) and condition; (ii) the veracity of the existing CBA map; (ii) the sensitivity of any vegetation and (iv) areas that could be considered for the construction of a PV facility.

As described, a single vegetation type, Vaal-Vet Sandy Grassland (Endangered), was originally found on the property. The Vaal-Vet Sandy Grassland has mostly either been completely lost to cultivation or converted to secondary grassland. Since this vegetation type threatened over its extent due to agriculture it may be suggested that the direct and cumulative impacts would be **Medium** to **High.** However, as correctly expressed in the CBA map (Figure 18) mainly an ESA2 and small areas of CBA1 would be impacted by the proposed infrastructure. Therefore, the impact is rated rather as **Low negative** in the construction phase and **Very Low negative** in the operational phase for Alternative 1 and this would similarly apply to Alternative 2 as well.

If or when, at some time, the solar facility is decommissioned, the infrastructure should be removed and the grassland allowed to re-establish. That would happen through a natural process but may need some intervention with by application of a grass seed mix to foster more rapid restoration.

12. Conclusions

The general conclusion is that the proposed Doringrivier Solar 3 SP is acceptable since it will not have a strongly negative impact through the loss of Vaal-Vet Sandy Grassland. Rehabilitation of disturbed areas not used later will ensure that **Low Negative** impacts can be maintained and the acceptability of the proposed infrastructure is raised.

The low level of sensitivity of the receiving environment from a botanical perspective, and its extent elsewhere in the Free State Province, indicates that the areas selected for Doringrivier Solar 3 are suited to the purpose and it is supported.

13. References

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Paige-Green, P. 2008. Dispersive and erodible soils – fundamental differences. Proceedings of: Problem soils in South Africa Conference, Midrand, Gauteng, South Africa, pp. 7.

South African National Biodiversity Institute (SANBI) 2018, Vegetation Map of South Africa, Lesotho, and Swaziland [vector geospatial dataset] 2012. Available from the Biodiversity GIS website http://bgis.sanbi.org/SpatialDataset/Detail/18.

South African National Biodiversity Institute (SANBI). 2021 Red List of Ecosystems (RLE) for terrestrial realm for South Africa - remnants [Vector] 2021. Available from the Biodiversity GIS website, downloaded on 30 August 2022.

Report submitted: 17 September 2022; amended 31 January 2023.

Appendix 1: Minimum Content Requirements for Botanical and Terrestrial Biodiversity Specialist Reports as per Protocol for the Specialist Assessment of Environmental Impacts on Terrestrial Biodiversity (GN 320 of 20 March 2020)

Protocol ref	**Botanical and Terrestrial Biodiversity Specialist Assessment Report Content**	**Section / Page**
3.1.1.	contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Cover & Page 2
3.1.2.	a signed statement of independence by the specialist;	Pages 3 & 4
3.1.3.	a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Page 10
3.1.4.	a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Page 10
3.1.5.	a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Page 10
3.1.6.	a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	N/A
3.1.7.	additional environmental impacts expected from the proposed development;	N/A
3.1.8.	any direct, indirect and cumulative impacts of the proposed development;	Pages 25--31
3.1.9.	the degree to which impacts and risks can be mitigated;	Page 26 & 27
3.1.10.	the degree to which the impacts and risks can be reversed;	Page 26 & 27
3.1.11.	the degree to which the impacts and risks can cause loss of irreplaceable resources;	Pages 26 & 27
3.1.12.	proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	N/A
3.1.13.	a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	N/A
3.1.14.	a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Page 32
3.1.15.	any conditions to which this statement is subjected.	N/A

Appendix 2: Curriculum Vitae

Dr David Jury McDonald Pr.Sci.Nat.

Name of Company: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

Work and Home Address: 14 A Thomson Road, Claremont, 7708

Tel: (021) 671-4056 **Mobile:** 082-876-4051 **Fax:** 086-517-3806

E-mail: dave@bergwind.co.za

Website: www.bergwind.co.za

Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide

Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Seventeen years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality: South African (ID No. 560807 5018 080)
Languages: English (home language) – speak, read and write
Afrikaans – speak, read and write

Membership in Professional Societies:

- South Africa Association of Botanists
- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications:

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute).
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.
- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications;

involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.

- Further tasks involved the day-to-day management of a large non-profit environmental organisation.
- **Independent botanical consultant** (2005 – to present) over 600 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo, and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained
and major subjects passed:

B.Sc. (1977), University of Natal, Pietermaritzburg
Botany III
Entomology II (Third year course)

B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
Botany (Ecology /Physiology)

M.Sc. - (Botany), University of Cape Town, 1983.
Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.

PhD (Botany), University of Cape Town, 1995.
Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.

Certificate of Tourism: Guiding (Culture: Local)
Level: 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record:

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**
August 2000 - 2005 : Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa
January 1981 – July 2000 : Research Scientist (Vegetation Ecology) at National Botanical Institute
January 1979—Dec 1980 : National Military Service

Further information is available on my company website: www.bergwind.co.za