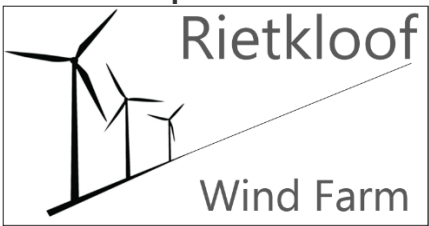



VISUAL IMPACT ASSESSMENT

Rietkloof Wind Energy Facility, Western Cape, South Africa

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MARCH 2016

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LIST OF ACRONYMS AND GLOSSARY

RK WEF	Rietkloof Wind Energy Facility
DEM	Digital Elevation Model
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
masl	Metres above sea level
MW	Megawatt
PV	Photo Voltaic
VIA	Visual Impact Assessment
WEF	Wind Energy Facility

EXECUTIVE SUMMARY

Rietkloof Wind Farm (Pty) Ltd proposes to develop a Wind Energy Facility (WEF) in the Western Cape Province of South Africa. The WEF falls within the Laingsburg Local Municipality and within the Central Karoo District Municipality.

The proposed Rietkloof WEF falls across eleven (11) farm portions, which total 27,202ha in extent. The site is planned to host up to 70 wind turbines with an output between 1.5MW and 4MW each, each with a foundation of 25m in diameter and 4m in depth. Additional infrastructure will include:

- Construction Phase:
 - Temporary laydown areas;
 - A construction camp; and
 - Concrete batching plant.
- Operations Phase:
 - Hard-standing area for each turbine (70m x 50m);
 - Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations);
 - Underground 33kV cabling between turbines buried along access roads, where feasible. These will also connect to the on-site substation;
 - Internal access roads up to 12m wide, including structures for storm-water control;
 - Up to 4 x 120m tall wind measuring lattice masts to collect data on wind conditions;
 - 132kV overhead distribution lines will be required to connect the WEF from the onsite 33/132kV substation to the Eskom 400kV Komsberg substation.

A site visit to assess the character of the region and ground-truth features identified from aerial imagery was undertaken from 15 to 18 February 2016. The following land use activities were recorded on site and within 20km of the proposed WEF boundary:

- Sheep farming and other agricultural activities; and
- Tourist accommodation.

Four farms offering accommodation for tourists were discovered within 20km of the wind farm boundary. The closest was the Keurkloof Guest Farm, owned by Steve Swanepoel. It is located to the south of the wind farm and 9.6km from the nearest wind turbine (Wind Turbine 64). The second farm offering tourist accommodation was the Saaiplaas Guest House, located to the north-east of the wind farm and 13km from the nearest turbine (Wind Turbine 34). The third guest farm is called "Gatsrivier" and is located to the north-west of the wind farm, 18km from the nearest wind turbine (Wind Turbine 20). The fourth guest farm is the "Blue Berry Hill" guest farm, located to the south-west of the wind farm, 18.6km from the nearest turbine (Wind Turbine 6).

The site and its surroundings are not highly developed. The site is remote and the sense of place

is typically Karoo. A large 765kV Eskom transmission line, and a 400kV Eskom transmission line are the only features which currently detract from the otherwise high scenic quality of the area.

Within twenty kilometres of the WEF boundary, seventy-nine (79) buildings were identified. These were identified using aerial imagery and were ground-truthed during the site visit. Twenty-eight (28) of these were found to be the homesteads of surrounding farmers. The visual impact of the WEF on these homesteads is dependent on the number of turbines visible and their proximity to the turbines. Not all of these homesteads are necessarily sensitive to the proposed wind energy facility, as this depends on their perception of wind turbines: they may have a neutral or positive opinion towards them. Therefore, we consider tourist facilities and parties that have stated that they are opposed to the wind energy facility to be particularly sensitive. Two interested and affected parties (I&APs) have objected to the WEF. The first objector is Mr Warren Petterson whose farm “Zeekoegat” is located to the south of the proposed WEF site. The homestead on the farm is 10.1km from the nearest turbine (Wind Turbine 6). The mountain hut that he is refurbishing is 14.5km from the nearest turbine (Wind Turbine 6). The second objector is Mr Steve Swanepoel whose cottage on the farm “Keurkloof” is located 9.6km from the nearest wind turbine (Wind Turbine 64).

The following buildings are within 10km of the wind farm. The number of turbines potentially visible are shown on the right-hand side column.

Ref ¹	Type	Name	Owner	Y ³	X ³	Turbines Visible (distance in km to nearest turbine) ^{4, 5}
Within 5km of WEF border						
51	Homestead	Polmietfontein		6330470	443040	46-50 (10.7)
34	Homestead			6333010	449244	41-45 (6.6)
16	Uncategorised ²	Aanstoot		6351610	462707	41-45 (5.5)
40	Uncategorised			6337390	468141	16-20 (13)
1	Homestead	Aurora	Gielie Hanekom	6349410	461339	16-20 (2.7)
50	Homestead	Geelhoek		6329970	443495	11-15 (10.8)
33	Uncategorised			6333490	454484	1-5 (5.6)
23	Uncategorised		Luipaardskloof	6340750	443335	1-5 (5)
35	Homestead			6332810	439634	0 (11.8)
52	Homestead	Zeekoegat	W&S Petterson	6329330	447026	0 (10.2)
14	Homestead	Swartland	T.J. Caldo	6358090	458174	0 (9.6)
15	Substation	Komsberg		6356090	462164	0 (8.9)
18	Homestead	Bona Esperance	P.J. Conradie	6357820	456285	0 (8.9)
25	Uncategorised		Luipaardskloof	6339940	440526	0 (8.4)
26	Uncategorised		Luipaardskloof	6340090	440492	0 (8.4)
27	Uncategorised		Luipaardskloof	6340810	441002	0 (7.6)
24	Uncategorised		Luipaardskloof	6339540	440740	0 (6.9)
Within 5 to 10km of WEF border						
57	Uncategorised			6325730	444389	61-65 (14.2)
45	Homestead	Roggekraal	J.O. Fourie	6336590	472657	51-55 (18.3)
55	Uncategorised			6330460	459609	46-50 (10.4)
53	Shed	Zeekoegat		6326840	448815	36-40 (12.7)
48	Homestead	Keurkloof		6329490	451615	11-15 (9.7)
56	Homestead	Patatsrivier		6334530	433541	1-5 (17.7)
20	Homestead	Saaiplaas	F.D. Conradie	6360060	464865	1-5 (13.9)
47	Homestead			6326740	458131	1-5 (13.3)
21	Guest accommodation	Saaiplaas Guest House		6359790	464181	1-5 (13)

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22	Uncategorised			6347620	467446	1-5 (9.1)
36	Homestead	Patatsrivier		6334800	433644	0 (17.5)
46	Homestead	Boelhouer	C.M. Francois	6326760	461796	0 (14.9)
49	Uncategorised			6326840	441771	0 (14.4)
17	Uncategorised	Haasvlei		6348010	436268	0 (13.6)
28	Uncategorised			6339910	436431	0 (13.2)
32	Uncategorised			6344930	469961	0 (12.3)

1. See Appendix A - buildings identified are shown on a map showing the viewshed of the WEF.
2. "Uncategorised" means the building was not accessible due to restricted access.
3. Projection: UTM34S.
4. The distance between the visual receptor and the nearest turbine may be greater than 10km because of the distance between the border of the wind farm area and the turbines located within it. Visual receptors are included in this list due to the fact that they are within 10km of the border of the WEF.
5. See Table 6.5 for a list of specific turbines visible from specific buildings.

The following protected areas were identified within 50km of the WEF boundary:

- Anysberg Nature Reserve, Provincial Nature Reserve, 22km south of the WEF boundary;
- Touw Local Authority Nature Reserve, Local Nature Reserve, 41km south-west of the WEF boundary.
- Klein Swartberg Mountain Catchment Area, 47km south-east of the WEF boundary.

Visitors to these nature reserves will not have any views of the Rietkloof Wind Energy Facility due to their distance from the project. There will be no visual impact on these nature reserves.

The following alternatives¹ were considered:

- Access road alternatives:
 - Access road alternative 1, footprint = 4.8ha, viewshed = 1,156ha
 - Access road alternative 2, footprint = 0.69ha, viewshed = 1,349ha
 - Access road alternative 3, footprint = 1.5ha, viewshed = 1,299ha
- Construction camp alternatives:
 - Camp alternative 1, footprint = 10.4ha, viewshed = 1,975ha;
 - Camp alternative 2, footprint = 7.8ha, viewshed = 1,988ha;
 - Camp alternative 3, footprint = 7.8ha, viewshed = 1,011ha;
 - Camp alternative 4, footprint = 11.9ha, viewshed = 211ha;
 - Camp alternative 6, footprint = 10.5ha, viewshed = 2,286ha;
 - Camp alternative 7, footprint = 9ha, viewshed = 1,569ha;
 - Camp alternative 8, footprint = 9ha, viewshed = 1,143ha;
 - Camp alternative 9, footprint = 9ha, viewshed = 1,971ha;
 - Camp alternative 10, footprint = 20.7ha, viewshed = 2,512ha;
 - Camp alternative 11, footprint = 20.9ha, viewshed = 1,297ha;
 - Camp alternative 12, footprint = 123.3ha, viewshed = 963ha;
 - Camp alternative 13, footprint = 396.3ha, viewshed = 1,684ha;
 - Camp alternative 14, footprint = 30ha, viewshed = 1,952ha.
- Substation alternatives (all footprints = 2.25ha except G7 3 which is 2.34ha)
 - Substation 1 also referred to as TNEI 1, viewshed = 1,790ha;
 - Substation 2 also referred to as TNEI 2, viewshed = 741ha;

¹ Viewshed calculated based on the terrain within 5km of the road options.

- Substation 3 also referred to as TNEI 3, viewshed = 2,100ha;
- Substation 4 also referred to as G7 1, viewshed = 2,198ha;
- Substation 5 also referred to as G7 2, viewshed = 853ha;
- Substation 6 also referred to as G7 3, viewshed = 928ha;
- Substation 7 also referred to as G7 4, viewshed = 1,276ha.

All of the alternatives considered are acceptable but the following alternatives are preferred from a visual impact perspective, due to the fact that they have the smallest viewsheds:

- Access road alternative 2 (does not have the smallest viewshed, but has the smallest footprint);
- Construction camp alternative 4;
- Substation alternative 5 (G7 2).

The wind energy facilities listed below are within 30km of the Rietkloof WEF and are seeking environmental authorisation or have received environmental authorisation.

- Konstabel Solar Project;
- Roggeveld Wind Project;
- Perdekraal Wind Project;
- Witberg Wind Project;
- Sutherland Wind and Solar Project;
- Hidden Valley Wind Project;
- PV Solar Project, south of Sutherland;
- Suurplaat Wind Project;
- Gunstfontein Wind Project;
- Komsberg Substation; and
- Brandvalley Wind Project.

Although it makes sense from a business and engineering perspective to concentrate facilities in this way, there is no escaping the fact that the development of multiple wind energy facilities, at this scale, will change the character of this remote area significantly. However, it should also be noted that the area is located within a Renewable Energy Development Zone - "Komsberg Wind" - as identified in the Strategic Environmental Assessment undertaken by the Council for Scientific and Industrial Research (CSIR) and the Department of Environmental Affairs. The planning instruments therefore support the concentration of renewable energy development within this area.

Summary of visual impacts identified:

CONSTRUCTION PHASE IMPACTS		
Visual impact of construction activity		
	Without mitigation	MOD -
	With mitigation	MOD -
Construction camp alternatives 1 to 14 (excluding 5)		
	Without mitigation	LOW -
	With mitigation	LOW -
OPERATION PHASE IMPACTS		
Impact of the layout on sensitive visual receptors		
	Without mitigation	HIGH -
	With mitigation	HIGH -
Access road, including alternatives 1, 2 and 3		
	Without mitigation	MOD -
	With mitigation	MOD -
On-site substation alternatives		
	Without mitigation	MOD -
	With mitigation	MOD -

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Shadow flicker		
No impact anticipated based in current layout.		
DECOMMISSIONING PHASE IMPACTS		
	Without mitigation	MOD -
	With mitigation	MOD -
CUMULATIVE IMPACTS		
Visual impact of facility construction and operation		
	Without mitigation	HIGH -
	With mitigation	HIGH -
NO-GO IMPACTS		
The Karoo's sense of place and its value to residents and visitors		
	Without mitigation	HIGH +
	With mitigation	N/A

- The impact of the wind farm on its own, and when considered cumulatively with other wind farms in the region, will have a high negative visual impact for the following reasons:
 - The screening effect of vegetation in this arid environment is non-existent;
 - The construction of infrastructure of this type in this region will contract strongly with the sense of place of the region.

1 INTRODUCTION

Coastal and Environmental Services (CES) has been appointed by Rietkloof Wind Farm (Pty) Ltd, as independent environmental assessment practitioners to undertake an Environmental Impact Assessment (EIA) of a proposed wind farm in the Western Cape Province. The project is known as "Rietkloof Wind Farm".

One of the required specialist studies as identified in the Final Scoping Report is that of a Visual Impact Assessment (VIA) of the proposed development.

This report is based on guidelines for visual assessment specialist studies as defined by Oberholzer (2005).

1.1 Objective

The Department of Environmental Affairs and Development Planning (DEA&DP) have issued South Africa's only guidelines for visual impact assessments, which have been followed in the preparation of this report. According to the DEA&DP guidelines (Oberholzer 2005), the following specific concepts should be considered during visual input into the EIA process:

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
- The consideration of both the natural and the cultural landscape, and their inter-relatedness.
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as aesthetic value or sense of place.
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.
- The need to determine the value of visual/aesthetic resources through public involvement.

2 BACKGROUND

2.1 Location and site description of the proposed development

Rietkloof Wind Farm (Pty) Ltd proposes to develop a WEF in the Western Cape Province of South Africa. The WEF falls within the Laingsburg Local Municipality and within the Central Karoo District Municipality.

The closest town within the Western Cape Province is Matjiesfontein, situated 30km south of the project area. Laingsburg is a further 30km east of Matjiesfontein, along the N1 national road.

The project area can be accessed via the R354 that connects to the N1 between Matjiesfontein and Laingsburg. The R354 is the main arterial road providing access to the project area, where there are a number of existing local, untarred roads providing access within the project area.

The proposed Rietkloof WEF falls across eleven (11) farm portions, provided in Table 2-1 below. These land portions, collectively referred to as the project area for the Rietkloof WEF, are currently used for animal husbandry, game farming and agriculture including grazing of sheep.

Table 2.1: Farm portions on which the proposed development is located.

Description of affected farm portions			
Farm Name and Number	21 digit SG Code	Municipality/ Province	Size (ha)
Portion 1 of Barendskraal 76	C04300000000007600001	Laingsburg LM / Central Karoo DM / Western Cape	2,828.6
The Remainder of Fortuin 74	C04300000000007400000	Laingsburg LM / Central Karoo DM / Western Cape	2,454.98
Portion 3 Fortuin 74	C04300000000007400003	Laingsburg LM / Central Karoo DM / Western Cape	1,868.4
Portion 1 of Hartjieskraal 77	C04300000000007700001	Laingsburg LM / Central Karoo DM / Western Cape	2,241.6
The Remainder of Hartjieskraal 77	C04300000000007700000	Laingsburg LM / Central Karoo DM / Western Cape	2,241.63
The Remainder of Nuwerus 284	C043000000000028400000	Laingsburg LM / Central Karoo DM / Western Cape	2,521.1
Portion 1 of Rietkloof Annexe 88	C04300000000008800001	Laingsburg LM / Central Karoo DM / Western Cape	1,428.1
The Remainder of Snyders Kloof 80	C04300000000008000000	Laingsburg LM / Central Karoo DM / Western Cape	1,683.5
Portion 1 of Snyders Kloof 80	C04300000000008000001	Laingsburg LM / Central Karoo DM / Western Cape	1,623.6
Vogelstruisfontein 81	C04300000000008100000	Laingsburg LM / Central Karoo DM / Western Cape	4,040.7
Remainder of Wilgehout Fontein 87	C04300000000008700000	Laingsburg LM / Central Karoo DM / Western Cape	4,269.4
Total hectares			27,201.58

The location of the farm portions is provided in Figure 2.1 below.

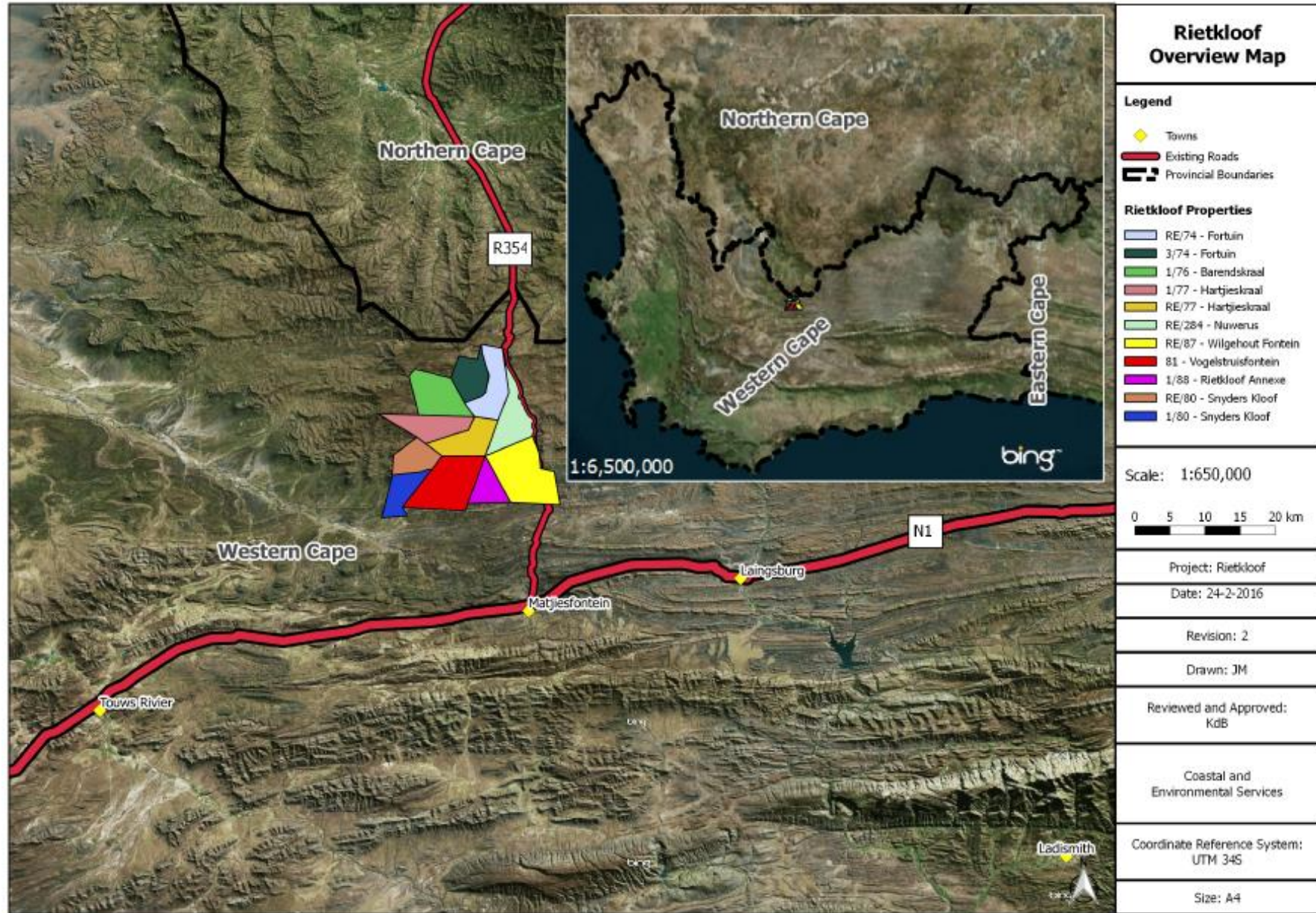


Figure 2.1: Location of the proposed Rietkloof Wind Energy Facility.

2.2 Detailed description of the Rietkloof WEF

Rietkloof WEF will have an energy generation capacity (at point of grid feed-in) of up to 140 megawatts (MW), and will include the following:

- Up to 70 potential wind turbine positions (between 1.5MW and 4MW in capacity each), each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 120m, and the rotor diameter up to 140m.
- Permanent compacted hard-standing laydown areas for each wind turbine (70mx50m, total 24.5ha) will be required during construction and for on-going maintenance purposes.
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations) would be required to increase the voltage to 33kV.
- Underground 33kV cabling between turbines buried along access roads, where feasible.
- Internal access roads up to 12m wide, including structures for storm-water control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.
- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s). A number of potential electrical 33kV powerlines will be required in order to connect wind turbines to the preferred onsite substation. The layout of the 33kV powerlines will be informed by sensitive features identified. The facility will consist of both above and below ground 33kV electrical infrastructure depending on what will require the shortest distance and result in the least amount of impacts to the environment.
- A number of potential 33/132kV onsite substation location(s) will be assessed. The footprint of these 33/132kV substation(s) will need to be assessed in both this EIA and the Basic Assessment² process for electrical infrastructure as the applicant will remain in control of the low voltage components of the 33/132kV substation (including isolators, control room, cabling, transformers etc.) (assessed in this EIA), whereas the high voltage components of this substation (assessed in BA) will likely be ceded to Eskom. The total footprint of this onsite substation will be approximately 200m x 200m. The exact coordinates of the low voltage components footprint (to be assessed in this EIA) and high voltage components footprint (to be assessed in the basic assessment process) will be provided in the EIA phase.
- Up to 4 x 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
- Temporary infrastructure including a large construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Borrow pits and quarries for locally sourcing aggregates required for construction (~4.5ha), in addition to onsite turbine excavations where required. All materials excavated will eventually be used on the compacting of the roads and hard-standing areas and no material will be sold to any third parties. The number and size of the borrow pits depends on suitability of the subsurface soils and the requirement for granular material for access road construction and other earthworks. Alternative borrow pit locations will be assessed in a separate BA process.
- Fencing will be limited around the construction camp and the entire facility would not necessarily need to be fenced off. The height of fences around the construction camp are anticipated to be up to 4m.
- Temporary infrastructure to obtain water from available local sources/ new or existing boreholes. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the DWS will be applied for separately to this EIA process.

It is important to note that the number of turbines and grid connection options detailed above will be subject to an iterative process based on the findings of the specialist reports and technical feasibility. A conceptual layout is provided in Figure 2.2. It is important to note that this layout is

² The Basic Assessment process is being undertaken by CES.

preliminary and will be informed by the EIA Phase.

2.3 Grid Connection Infrastructure

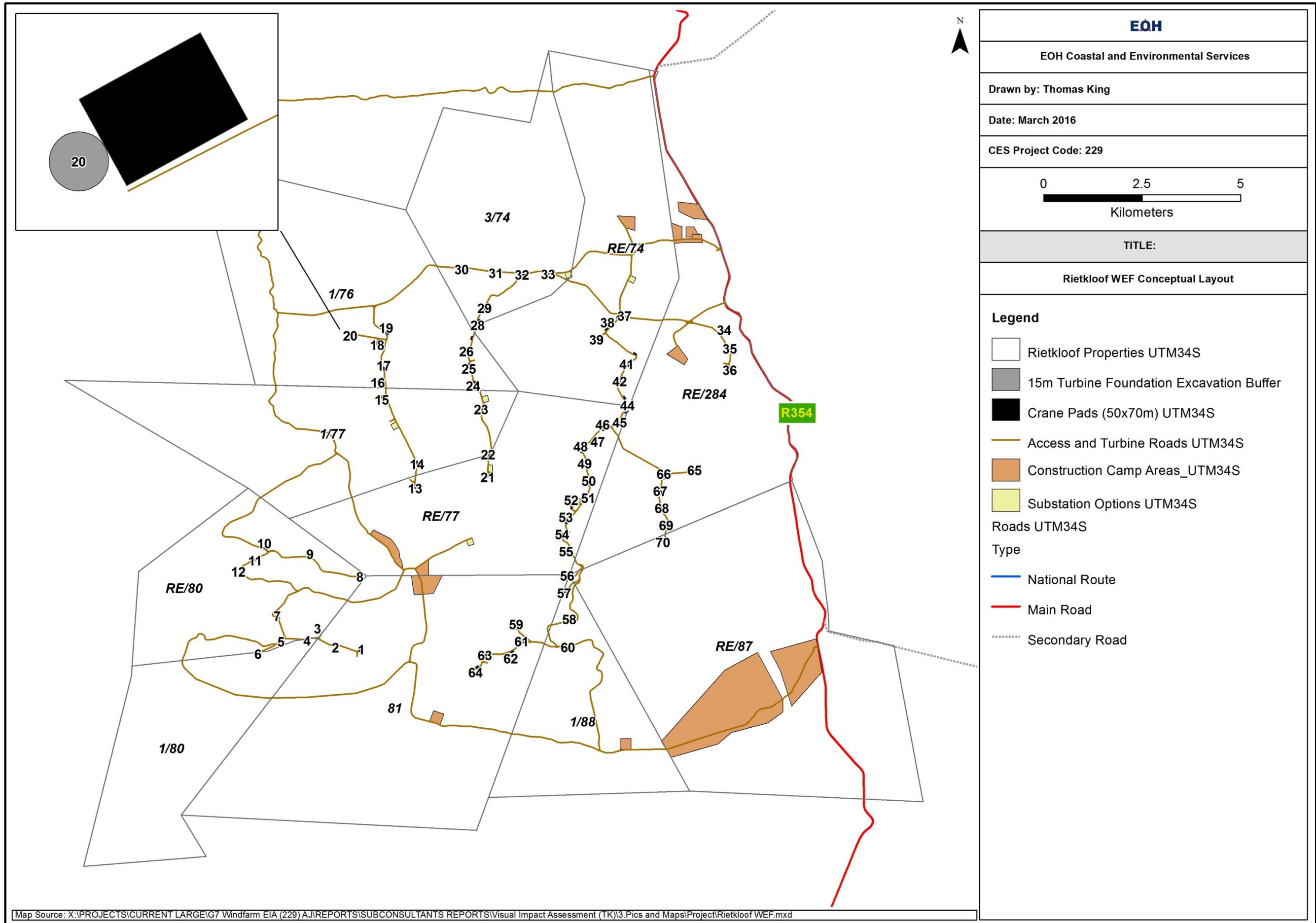
The following infrastructure will likely be ceded to Eskom at a later stage and will therefore be assessed in a separate Basic Assessment process:

- A number of potential electrical 33/132kV substation locations onsite would be assessed depending on the electrical design. The onsite substation would have a footprint of 200m x 200m each that would also house site offices, storage areas, ablution facilities and the maintenance building. The high voltage components of these substation locations will be assessed in this Basic Assessment process whereas the low voltage components will be assessed in the EIA process as it will remain under control of the applicant and will unlikely be ceded to Eskom.
- 132kV overhead distribution lines will be required to connect the WEF from the onsite 33/132kV substation to the Eskom 400kV Komsberg substation.
- Extension of the existing 400kV Komsberg substation with several electrical components to be defined by Eskom (e.g. additional feeder bay, transformer bay) on the existing substation property.

2.4 Potentially Shared infrastructure

Depending on Eskom's requirements it might be feasible for both Brandvalley and Rietkloof to connect to a shared onsite 33/132kV substation, which could then be connected via an off-site overhead 132kV power line to Komsberg Substation. The latter could then be shared by both facilities. This would be assessed as a potential connection alternative in a separate Basic Assessment process.

Access roads, laydown areas, borrow pit locations and buildings and other infrastructure will also be shared as far as feasibly possible.



Map Source: X:\PROJECTS\CURRENT LARGE\G7 Windfarm EIA (229) \AJ\REPORTS\SUBCONSULTANTS REPORTS\Visual Impact Assessment (TK)\3.Pics and Maps\Project\Rietkloof WEF.mxd

Figure 2.2: Conceptual layout of the Rietkloof Wind Farm

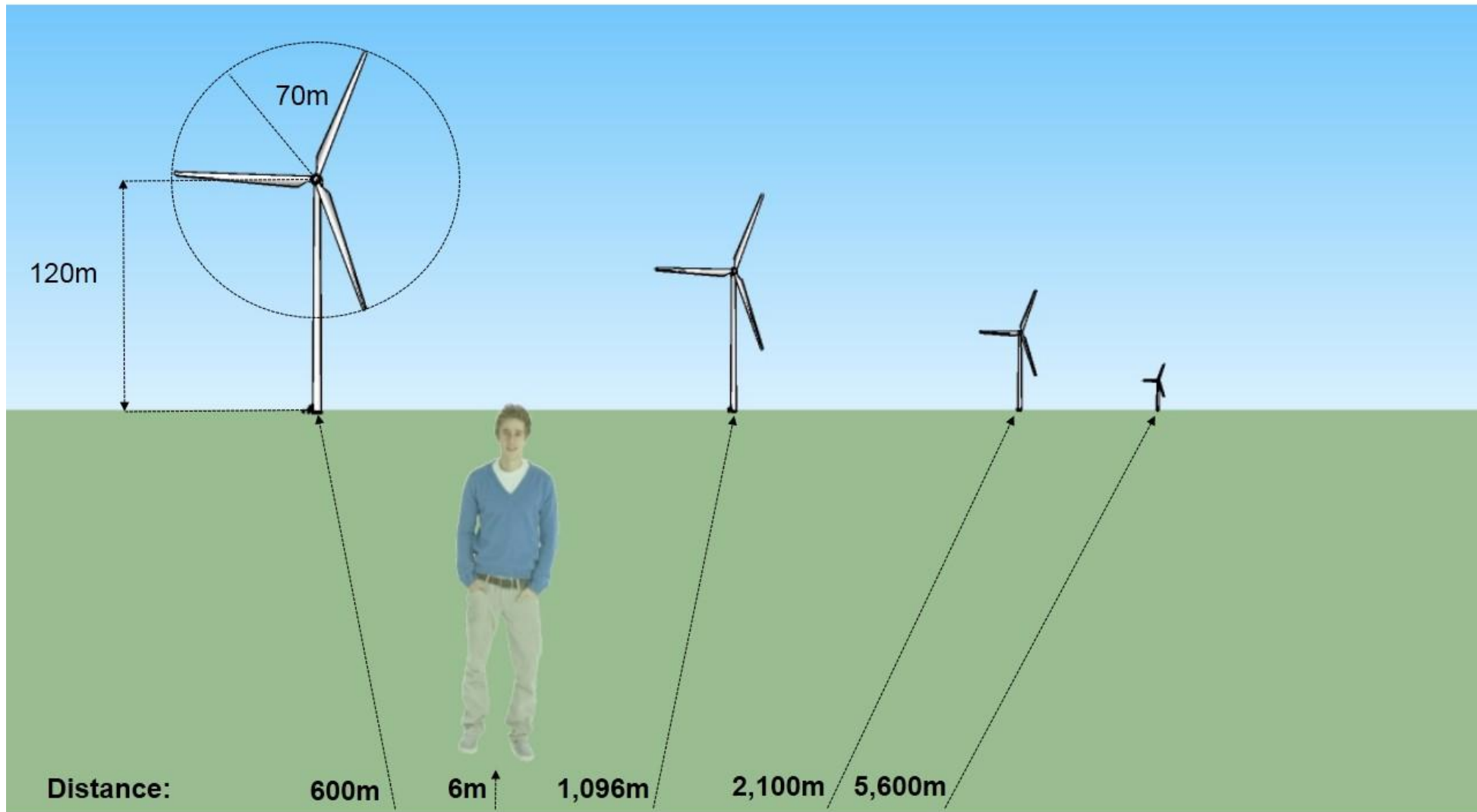


Figure 2.3: Conceptual view of a 120m high turbine, with 140m rotor diameter.

3 APPROACH TO STUDY

3.1 Terms of Reference

The overall aim of a Visual Impact Assessment (VIA) is to determine the current landscape quality (scenic views, visual sensitivity) and the visual impact of the proposed development. The terms of reference of the VIA will include the following tasks:

- Undertake a desktop survey using 1:50 000 survey maps, 1:10 000 orthophotos, any digital colour aerial photography and any other high resolution images.
- Conduct a site reconnaissance visit and photographic survey of the proposed project site. The focus of this survey should be on natural and cultural features, protected areas, coastal views and landscape, view sites, and scenic routes.
- Conduct a desk top mapping exercise and develop a Digital Elevation Model to establish visual sensitivity:-
 - Describe and rate the scenic character and sense of place of the area and site.
 - Establish extent of visibility by mapping the view-sheds and zones of visual influence.
 - Establish visual exposure to viewpoints.
 - Establish the inherent visual sensitivity and visual absorption capacity of the site by mapping slope grades, landforms, vegetation, special features and land use and overlaying all relevant map layers to assimilate a visual sensitivity map.
- Review relevant legislation, policies, guidelines and standards.
- Preparation of a Visual Baseline/Sensitivity report which shall include, *inter alia*:
 - Assessing visual sensitivity criteria such as extent of visibility, the sites inherent sensitivity, visual sensitivity of the receptors, visual absorption capacity of the area and visual intrusion on the character of the area.
 - Prepare photomontages of the proposed development.
 - Assess the proposed project against the visual impact criteria (visibility, visual exposure, sensitivity of site and receptor, visual absorption capacity and visual intrusion) for the site.
 - Assess impacts based on a synthesis of criteria for each site (criteria = nature of impact, extent, duration, intensity, probability and significance).
 - Establish mitigation measures/recommendations with regards to minimizing visual impacts.

3.2 Methodology

3.2.1 Site visit

A site visit was undertaken from Monday 15 February to Thursday 18 February 2016. The purpose of the site visit was as follows:

- To obtain a sense of the character and “sense of place” of the region;
- To take photos from selected viewpoints, this included particularly sensitive receptors and viewpoints that had a clear view of the project area;
- To determine the nature of the buildings identified from aerial imagery prior to the site visit;
- To take note of the existence of other infrastructure, tourist areas, nature reserves, heritage features, etc.

3.2.2 Data sources: project specific data

Rietkloof Wind Farm provided spatial data showing the layout of planned infrastructure. Rietkloof Wind Farm also provided an estimate of the height of the specific infrastructure components. These heights are used to calculate the viewshed of the infrastructure. The following heights have been used in the calculation of viewsheds:

- Turbine hub height = 120m;
- Rotor diameter = 140m (this means that a rotor tip height of 190m was used to calculate viewsheds);
- Construction camp options = 10m;
- Substation options = 10m.

An observer in the surrounding landscape was assumed to be 2m tall.

3.2.3 Data sources: the surrounding area

Data on the surrounding area were collected during a site visit. The consultant visiting the site identified and recorded the geographic location of:

- Dwellings within a fixed distance of the development edge;
- Roads and railways;
- Potentially sensitive visual receptors such as:
 - Wildlife reserves;
 - Tourist areas;
 - Landmarks;
 - Or any other area deemed to be important in the particular environment and that could be expected to be sensitive to the proposed development.

Data on the surrounding areas was also digitised from the most recent aerial imagery available. Typically, dwellings are digitised in this manner.

Data was also downloaded from online, or supplied by other consultants. All data was checked for accuracy.

3.2.4 Data sources: elevation data

The calculation of viewsheds is based on the use of Digital Elevation Models (DEMs) downloaded from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). These raster images have a resolution of 30 metres, which means that each pixel of the raster covers an area of 30 m x 30 m (900 m²), and is assigned a single height value.

When more detailed data is available, such as short-interval contours or a DEM for the specific areas, these are used.

3.3 Legislative context

A Scoping and Environmental Impact Assessment is being undertaken in accordance with Government Notice Regulation 982 published on 4 December 2014.

This visual impact assessment has been undertaken in accordance with the Department of Environmental Affairs and Development Planning's Guideline: "Guideline for involving visual and aesthetic specialists in EIA processes" (Oberholzer, 2005).

Spatial Development Frameworks (SDFs) are considered and discussed in the Environmental Impact Assessment Reports.

3.3.1 Seasonal changes

In terms of Appendix 6 of the 2014 EIA Regulations, a specialist report must contain information on "the date and season of the site investigation and the relevance of the season to the outcome of the assessment". The site visit was undertaken in summer. The season in which the site visit was undertaken does not have any considerable effect on the significance of the impacts identified, the

mitigation measures, or the conclusions of the assessment since the vegetation cover does not vary significantly over the seasons.

3.4 Assumptions and limitations

The calculation of viewsheds does not take into account the screening effect of vegetation or buildings.

3.5 Author's Details

3.5.1 Mr Thomas King, author

Thomas holds a BSc degree with specialisation in Zoology from the University of Pretoria and an Honours degree in Biodiversity and Conservation from Rhodes University. As part of his Honours degree, Thomas was trained in Geographical Information Systems (GIS) in addition to the required biological sciences courses. With CES, he has been primarily in charge of all GIS related work, including database and software management. He has been the lead author of four Visual Impact Assessments. He has assisted in the compilation of numerous others. He is fully competent with the use of ArcGIS 10 including ArcMap, ArcCatalog, and ArcScene. He is also familiar with the use of supporting GIS software such as Oruxmaps, Quantum GIS, DNR Garmin, SketchUp, to name a few.

3.5.2 Mr Henry Holland, reviewer

Henry Holland has been applying his Geographic Information Systems knowledge and experience to visual impact assessments since 1997, and has conducted a number of assessments for wind farm developments in the Eastern Cape. These include wind farms near Jeffreys Bay, St Francis Bay, Grahamstown, Coega and Cookhouse. He has extensive practical knowledge in spatial analysis, landscape analysis and environmental modelling, and has been involved in many environmental management projects as GIS coordinator and analyst since 1992.

4 BASELINE DESCRIPTION

4.1 Land use activities

The following land use activities were recorded on site and within 20km of the proposed WEF boundary:

- Sheep farming and other agricultural activities; and
- Tourist accommodation.

The site and its surroundings are used for low-intensity sheep farming, mostly the black-headed Dorper breed. Four farms offering accommodation for tourists were also discovered within 20km of the wind farm boundary. The closest was the Keurkloof Guest Farm, owned by Steve Swanepoel. It is located to the south of the wind farm and 9.6km from the nearest wind turbine (Wind Turbine 64). The second farm offering tourist accommodation was the Saaiplaas Guest House, located to the north-east of the wind farm and 13km from the nearest turbine (Wind Turbine 34). However this guest house is located on a farm that will host the Karusa Wind Farm, so it is assumed that the landowner is not opposed to the presence of wind turbines. The third guest farm is called "Gatsrivier" and is located to the north-west of the wind farm, 18km from the nearest wind turbine (Wind Turbine 20). The fourth guest farm is the "Blue Berry Hill" guest farm, located to the south-west of the wind farm, 18.6km from the nearest turbine (Wind Turbine 6).

4.2 Built environment

The site and its surroundings are not highly developed. Most of the homesteads are not connected to the Eskom grid and rely on solar energy and gas. Most farms have a Telkom line. The site lies on the western side of the R354 which connects Matjiesfontein and Sutherland. The broader area is accessible via good quality gravel roads. A large 765kV Eskom transmission line, and a 400kV Eskom transmission line cross the site from west to east. These lines are in stark contrast to the otherwise empty and unmodified nature of the landscape. High voltage transmission lines like these can reduce the potential for scenic views over a large region due to their height and length.

4.3 Topography

The study area considered (the site and the area within 20km of the site boundary) varies in height between 721 metres above sea level (masl) and 1328 masl. The study area has a typically Karoo-like topography: vast open valleys separated by steep-sided hills. Dry river beds trace along the valley floors.

4.4 Vegetation

The vegetation of the area is better described in the Ecological Report for this project. From a visual impact assessment perspective, the most important features of the vegetation of the area are its height and density. There are virtually no naturally occurring plants taller than 0.5m throughout the viewshed area. Trees have been planted around most of the homesteads. Sometimes weeping willows (*Salix babylonica*) have established themselves adjacent to a river bed, but these are rare.

4.5 Identified sensitive receptors

Within twenty kilometres of the WEF boundary, seventy-nine (79) buildings were identified. These were identified using aerial imagery and were ground-truthed during the site visit. Twenty-eight (28) of these were found to be the homesteads of surrounding farmers. The visual impact of the WEF on these homesteads is dependent on the number of turbines visible and their proximity to the turbines (i.e. their visual exposure to the development). The visual impact on these homesteads is discussed in the impacts chapter 6. Not all of these homesteads are necessarily sensitive to the proposed wind energy facility, as this depends on their perception of wind turbines: they may have

a neutral or positive opinion towards them. Therefore, we consider tourist facilities and interested and affected parties (I&APs) that have stated that they are opposed to the wind energy facility to be particularly sensitive. In terms of tourist facilities, the Gatsrivier, Saaiplaas and Blue Berry Hill guest farms have been identified as sensitive. During the scoping phase, two objections to the wind energy facility were received from nearby land owners. The first objector is Mr Warren Petterson whose farm “Zeekoegat” is located to the south of the proposed WEF site. The homestead on the farm is 10.1km from the nearest turbine (Wind Turbine 6). The mountain hut that he is refurbishing is 14.5km from the nearest turbine (Wind Turbine 6). The second objector is Mr Steve Swanepoel whose cottage on the farm “Keurkloof” is located 9.6km from the nearest wind turbine (Wind Turbine 64).

The following protected areas were identified within 50km of the WEF boundary:

- Anysberg Nature Reserve, Provincial Nature Reserve, 22km south of the WEF boundary;
- Touw Local Authority Nature Reserve, Local Nature Reserve, 41km south-west of the WEF boundary.
- Klein Swartberg Mountain Catchment Area, 47km south-east of the WEF boundary.

4.6 Viewshed of the layout comprising 70 turbines

Of the 70 turbine layout, at least the tip of one turbine blade (at 190m) will be visible from an area of 126,533ha. This is the turbine layout’s viewshed. The total area assessed includes a buffer of 20km around the border of the properties upon which the wind farm is proposed. 174,670ha within the 20km border of the wind farm will not be able to see a single turbine. In the table that follows, the number of turbines visible (first column) and the size of the area affected (second column) is presented.

Table 4.1: The turbine layout’s viewshed

Number of Turbines Visible	Area (ha)
66-70	13 072
61-65	6 080
56-60	5 752
51-55	5 923
46-50	6 450
41-45	6 427
36-40	6 469
31-35	6 853
26-30	7 202
21-25	8 548
16-20	10 596
11-15	10 472
6-10	11 804
1-5	20 885
0	174 670
TOTAL	301 203

The operation of these large, industrial structures will change the character of the site and its surroundings.



Plate 4.1: Dorper sheep are farmed in the project area.



Plate 4.2: The R356 which links the R354 with Ceres.



Plate 4.3: The project area is characterised by open spaces and low levels of development



Plate 4.4: Entrance to the Gatsrivier Guest Farm



Plate 4.5: The vegetation of the area is very sparse

The coordinates of the points at which the pictures appearing as plates 4.6 to 4.12 below were taken are provided in the table below.

Table 4.2: Coordinates of picture points

Plate	X ¹	Y
Plate 4.6 - Roggekraal	472278	6336670
Plate 4.7 - Keurkloof	453367	6329160
Plate 4.8 - Zeekoegat (entrance)	450886	6331160
Plate 4.9 - Zeekoegat (hill)	451182	6330490
Plate 4.10 - Zeekoegat (road)	448926	6330350
Plate 4.11 - Mountain hut	447297	6324830
Plate 4.12 - Bruwelsfontein	426826	6338690

1. UTM34S

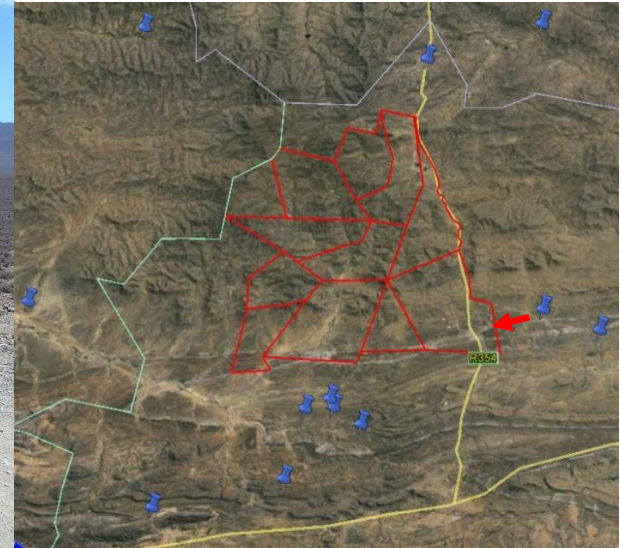


Plate 4.6: View from the ridge close to Roggekraal Farm. Distance to wind farm = 3.75km

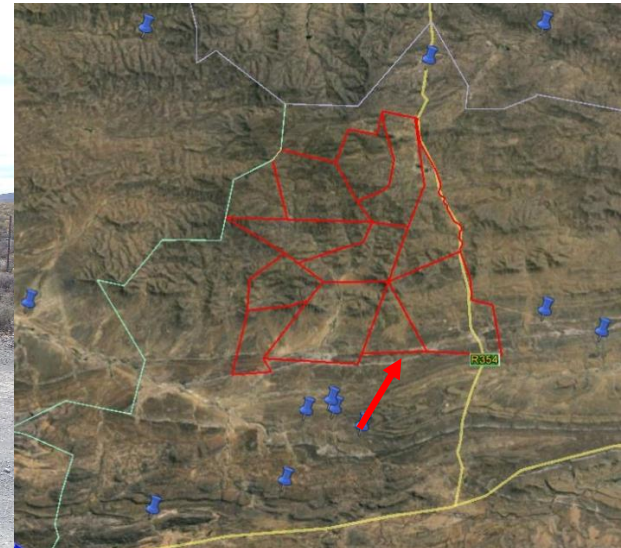


Plate 4.7: View from the entrance to Keurkloof Farm. Distance to wind farm = 7.6km

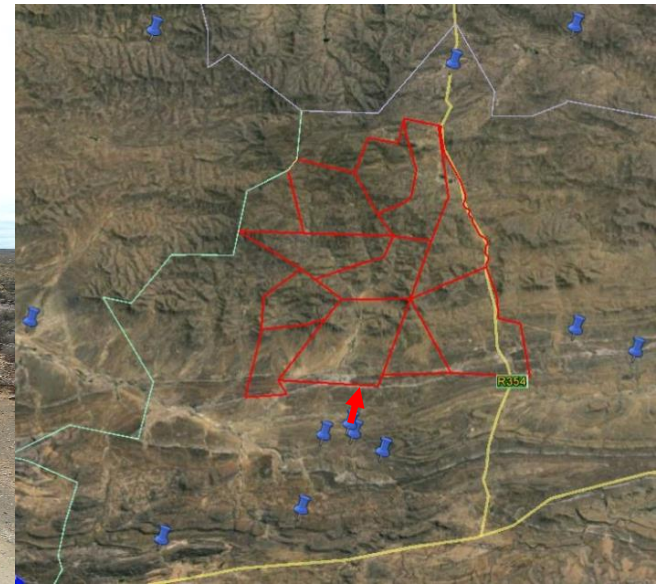


Plate 4.8: View from the entrance of Zeekoegat Farm. Distance to wind farm = 3.8km

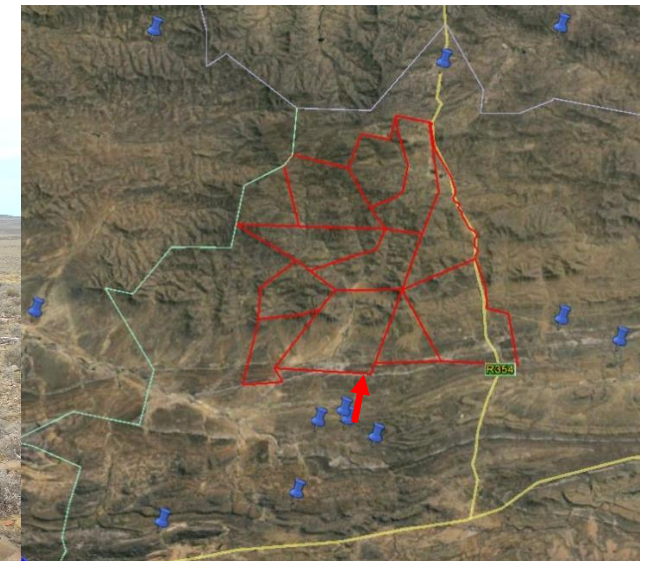


Plate 4.9: View from a hill on Zeekoegat Farm. Distance to wind farm = 4.6km



Plate 4.10: View on the way to Zeekoegat Homestead. Distance to wind farm = 4.6km



Plate 4.11: View from the mountain hut on Zeekoegat Farm. Distance to wind farm = 10km



Plate 4.12: View from Bruwelsfontein Farm. Distance to wind farm = 17.5km

5 DESCRIPTION OF ALTERNATIVES

A detailed description of the process involved in selecting the preferred alternative, and other alternatives considered, is provided in the Environmental Impact Assessment Report (EIAR) for this project. For the purposes of this Visual Impact Assessment, the following alternatives have been assessed.

5.1 Fundamental alternatives

5.1.1 Location alternative

One project location alternative namely Rietkloof Wind Farm.

5.1.2 Access road location alternatives

Three access road alternatives namely access road alternative 1, access road alternative 2, and access road alternative 3. Internal roads will form part of all three access road alternatives.

5.1.3 Construction camp alternatives

Fourteen construction camp alternatives.

5.1.4 On-site substation location alternatives

Seven onsite substation location alternatives.

5.1.5 Technology alternatives

One technology alternative namely, a Wind Energy Facility.

5.2 Incremental alternatives

5.2.1 Turbine layout alternatives

One turbine layout of 70 positions has been assessed.

5.3 No-go alternative

The no-go alternative is considered in the assessment of impacts chapter.

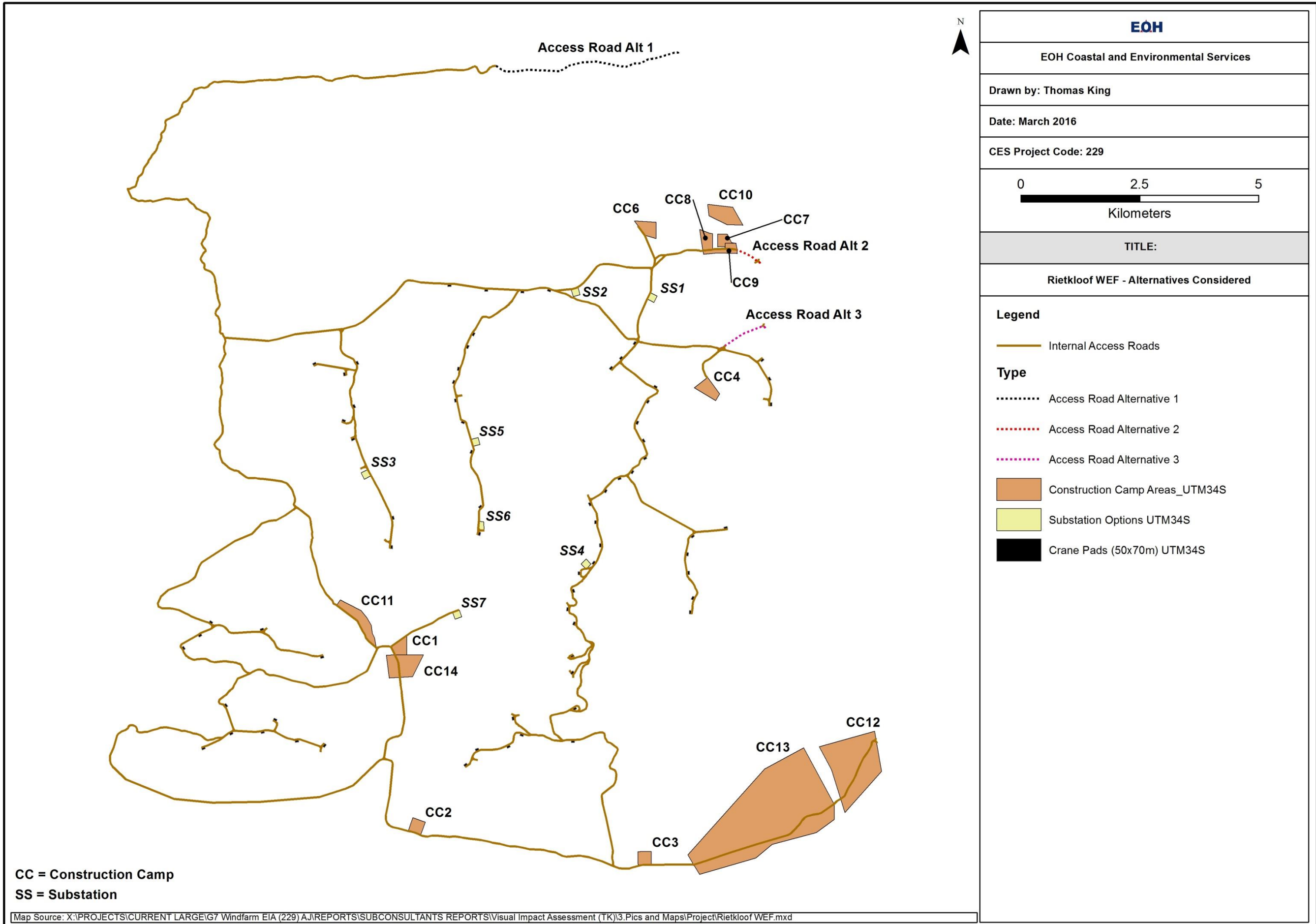


Figure 5.1: Alternative designs considered and assessed

6 IMPACT ASSESSMENT

6.1 Design phase impacts

Activities associated with the design and pre-construction phase pertain mostly to background studies, surveys and data collection. The visual impact in this phase is considered insignificant.

6.2 Construction phase impacts

The visual impacts during the construction phase of a wind farm are considered less significant than the impacts during the operations phase, due to the fact that:

- The construction phase has a much shorter duration than the operations phase,
- The size of the viewshed is much smaller, due to the fact that the construction equipment is much shorter than the erected wind turbines.

However, the construction of a wind farm of the size proposed will still require a large extent of construction activity, which will be a strong contrast to the current activity levels in the area. Therefore, some level of impact significance is expected and has been assessed.

6.2.1 Construction Phase Impact 1: Visual impact of construction activity

Cause and comment

There are various activities which will take place during the construction phase which will have impacts on sensitive visual receptors:

- Large areas of vegetation will need to be cleared to make way for digging of the turbine foundations, hardstand areas, substation footprints, access roads, laydown areas, workshops and storage yards.
- Construction of wind turbines will potentially draw attention if they are exposed above the skyline.
- There will be a large increase in the movement of vehicles in the area: large trucks delivering supplies and construction material; graders, excavators and bulldozers; light vehicle movement around site; large trucks hauling rubble and construction waste, etc.
- Soil stockpiles and heaps of vegetation debris.
- Dust emissions from construction activity.

Mitigation measures

The following mitigation measures are proposed:

- The construction contractor should clearly demarcate construction areas so as to minimise site disturbance.
- Treat roads to reduce dust emissions.
- The site should be kept neat and tidy. Littering should be fined and the ECO should organise rubbish clean-ups on a regular basis.

Significance statement

The duration of the construction phase impacts will be “*Short Term*”. The extent is “*Regional*” as construction activity will be visible beyond the immediate environs of the site. The severity of the impact is expected to be “*Moderate*” should mitigation measures not be employed. If they are, the impact is expected to be “*Slight*”. The likelihood of surrounding farmers having their views impacted by construction activity is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Regional	Moderate	Definite	MOD -
With Mitigation	Short term	Regional	Slight	Definite	MOD -

6.2.2 Construction Phase Impact 2: Construction camp alternatives 1 to 14 (excluding 5)

Cause and comment

The footprint of the construction camp alternatives is largely similar, but the viewshed differs quite significantly based on their location in the landscape.

Camp alternative	Footprint (ha)	Viewshed area (ha)*	Visual receptors
1	10.4	1,975	0
2	7.8	1,988	0
3	7.8	1,011	0
4	11.9	211	0
5	No longer considered a feasible alternative by the applicant based on a request by the landowner.		
6	10.5	2,286.2	0
7	9	1,569	0
8	9	1,143	0
9	9	1,971	1
10	20.7	2,512	0
11	20.9	1,297	0
12	123.3	963	0
13	396.3	1,684	0
14	30	1,952	0

*Viewshed calculated based on the terrain within 5km of the construction camp alternatives

Mitigation and management

Construction camp alternative 4 has the smallest viewshed, and should be the preferred option.

Significance Statement

The duration of the impact will be “*Short term*”. The extent is “*Localised*”. The severity of the impact is expected to be “*Slight*”. The likelihood of surrounding farmers having their views impacted is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Localised	Slight	Definite	LOW -
With Mitigation	Short term	Localised	Slight	Definite	LOW -

6.3 Operation phase impacts

6.3.1 Operations Phase Impact 1: Impact of wind turbines on sensitive visual receptors

Cause and comment

The buildings listed in the table below are located within 5km of the border of the wind energy facility. The number of turbines potentially visible are listed in the column on the right-hand side.

Table 6.1: Buildings within 5km of the border of RK WEF and number of turbines visible

Ref	Type	Name	Owner	Y ¹	X	Turbines Visible (distance in km to nearest turbine)
51	Homestead	Polmietfontein		6330470	443040	46-50 (10.7) ³
34	Homestead			6333010	449244	41-45 (6.6)
16	Uncategorised ²	Aanstoot		6351610	462707	41-45 (5.5)
40	Uncategorised			6337390	468141	16-20 (13)
1	Homestead	Aurora	Gielie Hanekom	6349410	461339	16-20 (2.7)
50	Homestead	Geelhoek		6329970	443495	11-15 (10.8)
33	Uncategorised			6333490	454484	1-5 (5.6)
23	Uncategorised		Luipaardskloof	6340750	443335	1-5 (5)
35	Homestead			6332810	439634	0 (11.8)
52	Homestead	Zeekoegat	W&S Petterson	6329330	447026	0 (10.2)
14	Homestead	Swartland	T.J. Caldo	6358090	458174	0 (9.6)
15	Substation	Komsberg		6356090	462164	0 (8.9)
18	Homestead	Bona Esperance	P.J. Conradie	6357820	456285	0 (8.9)
25	Uncategorised		Luipaardskloof	6339940	440526	0 (8.4)
26	Uncategorised		Luipaardskloof	6340090	440492	0 (8.4)
27	Uncategorised		Luipaardskloof	6340810	441002	0 (7.6)
24	Uncategorised		Luipaardskloof	6339540	440740	0 (6.9)

1) Projection: UTM34S

2) Buildings that are labelled "Uncategorised" were not accessible due to locked gates or forbidden access.

3) The distance between the visual receptor and the nearest turbine may be greater than 5km because of the distance between the border of the wind farm area and the turbines located within it. Visual receptors are included in this list due to the fact that they are within 5km of the border of the WEF.

The homesteads of a number of farmers within 5km of the wind farm will be able to see wind turbines:

- Polmietfontein;
- Aanstoot;
- Aurora;
- Geelhoek;
- Luipaardskloof.

Wind turbines will dominate views from these distances and visual receptors will be highly exposed to the development.

Table 6.2: Buildings within 5 to 10 km of the RK WEF and number of turbines visible

Ref	Type	Name	Owner	Y	X	Turbines Visible (distance in km to nearest turbine)
57	Uncategorised			6325730	444389	61-65 (14.2)
45	Homestead	Roggekraal	J.O. Fourie	6336590	472657	51-55 (18.3)
55	Uncategorised			6330460	459609	46-50 (10.4)
53	Shed	Zeekoegat		6326840	448815	36-40 (12.7)
48	Homestead	Keurkloof		6329490	451615	11-15 (9.7)
56	Homestead	Patatsrivier		6334530	433541	1-5 (17.7)
20	Homestead	Saaiplaas	F.D. Conradie	6360060	464865	1-5 (13.9)
47	Homestead			6326740	458131	1-5 (13.3)
21	Guest accommodation	Saaiplaas Guest House		6359790	464181	1-5 (13)
22	Uncategorised			6347620	467446	1-5 (9.1)
36	Homestead	Patatsrivier		6334800	433644	0 (17.5)
46	Homestead	Boelhouer	C.M. Francois	6326760	461796	0 (14.9)
49	Uncategorised			6326840	441771	0 (14.4)
17	Uncategorised	Haasvlei		6348010	436268	0 (13.6)
28	Uncategorised			6339910	436431	0 (13.2)
32	Uncategorised			6344930	469961	0 (12.3)

Two particularly sensitive receptors have been identified within 5 to 10km of the wind farm:

- The Keurkloof Guest House;
- The Saaiplaas Guest House.

At these distances the wind turbines will not be dominant in views but they will be clearly recognisable by visual receptors (their visual exposure to the wind turbines will be moderate).

Table 6.3: Buildings within 10 to 15 km of the RK WEF and number of turbines visible

Ref	Type	Name	Owner	Y	X	Turbines Visible (distance in km to nearest turbine)
66	Guest accommodation	Blue Berry Hill Guest Farm		6323410	438227	46-50 (18.6)
70	Uncategorised			6328720	430772	1-5 (20)
61	Trainstation / Village	Matjiesfontein		6323020	461027	1-5 (14.4)
60	Homestead	Baviaans	Christo and Toy Mathee	6326110	475953	0 (24.1)
59	Derelict			6333360	479290	0 (23.1)
67	Homestead	Blue Berry Hill		6322210	437213	0 (20.2)
58	Uncategorised			6340180	478616	0 (20.1)
68	Trainstation	Tweedside		6320860	441106	0 (19.7)
19	Homestead	Ekkraal	K. Steenkamp	6368290	456549	0 (19.3)
13	Uncategorised			6367940	450066	0 (19)
31	Homestead	Brandenburg	A.J. Du Plessis	6353100	431946	0 (19)
5	Guest accommodation	Gatsrivier		6360250	436216	0 (18.9)
12	Uncategorised			6367770	449680	0 (18.9)
2	Uncategorised			6366240	445744	0 (18.5)
69	Homestead			6322270	440871	0 (18.4)
4	Guest accommodation	Gatsrivier		6360070	437350	0 (17.9)
29	Uncategorised	Haasvlei		6345530	430488	0 (17.4)

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63	Homestead	Pietermeintjies fontein	CJ Freysen	6322070	450062	0 (17.3)
10	Uncategorised			6363470	444005	0 (16.9)
64	Uncategorised	Jagerskraal		6323440	445193	0 (16.2)
9	Uncategorised			6363280	445269	0 (16.1)
11	Uncategorised			6365000	449975	0 (16.1)
62	Homestead			6323000	454452	0 (16)
65	Uncategorised	Jagerskraal		6323620	445112	0 (15.9)
39	Homestead	Smitskraal		6358230	470231	0 (15)
44	Uncategorised			6344400	474314	0 (14.8)

Two particularly sensitive receptors have been identified within 10 to 15km of the wind farm:

- The Gatsrivier Guest Farm.
- The Blue Berry Hill Guest Farm;

The wind turbines will be recognisable to these visual receptors and their visual exposure to the development will be moderate. It should be noted that none of the accommodation units on Gatsrivier will be able to see any turbines.

Table 6.4: Buildings within 15 to 20 km of RK WEF and number of turbines visible

Ref	Type	Name	Owner	Y	X	Turbines Visible (distance in km to nearest turbine)
76	Uncategorised			6325840	428645	61-65 (23.4)
78	Uncategorised			6332900	424177	41-45 (24.5)
79	Uncategorised			6322980	431906	31-35 (22.9)
37	Uncategorised			6345960	424626	6-10 (23.2)
54	Homestead	Bruwelsfontein		6337260	426272	6-10 (21.7)
38	Homestead	Kareerivier		6353700	425810	1-5 (25.1)
30	Derelict	Brandenburg	A.J. Du Plessis	6354080	427312	1-5 (23.7)
71	Homestead	Liebenhof		6327810	481709	0 (27.5)
72	Uncategorised			6317420	471136	0 (27)
74	Uncategorised			6317290	435839	0 (25.1)
73	Uncategorised			6314640	450202	0 (24.6)
75	Uncategorised			6320320	433507	0 (23.8)
41	Homestead	De Hoop		6369740	467409	0 (23.5)
77	Uncategorised			6327590	427518	0 (23.4)
8	Guest accommodation	Gatsrivier		6360590	432869	0 (21.7)
42	Homestead			6365730	471127	0 (21.4)
3	Uncategorised			6366990	443506	0 (20.2)
7	Guest accommodation	Gatsrivier		6360370	434779	0 (20)
6	Guest accommodation	Gatsrivier		6360390	434684	0 (20)
43	Derelict			6363390	469775	0 (18.8)

There are no structures similar in size and type to the proposed wind turbines in existing views and the turbines are likely to change these views to a considerable extent. The sense of place of the region is remote rural in many parts of the study area and wind turbines will, for some visual receptors, alter the remoteness of the region. Visual intrusion of the proposed development is therefore rated as high (although it should be noted that this will not be the case for all visual receptors in the region since the aesthetic appeal of wind turbines differ significantly among viewers). It should also be noted that wind turbines have to be fitted with red lights that flash intermittently. These will be highly visible at night, especially at this particular site due to the almost total absence of other non-natural light emitters.

Table 6.5: Turbine / visibility matrix for buildings within 10km of Rietkloof WEF

	Building Reference Number																												A					
	1	14	15	16	17	18	20	21	22	23	24	25	26	27	28	32	33	34	35	36	40	45	46	47	48	49	50	51		52	53	55	56	57
Wind Turbine Generator (0 = not visible; 1 = visible)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	1	7
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	1	7
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	1	7
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	1	1	0	1	0	0	1	7
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	0	0	1	6
	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	0	1	1	7
	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	5
	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	1	5
	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	0	1	5
	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	5
	11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	1	0	1	7
	12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	6
	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	3
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	2
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	4
	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	3
	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	3
	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	2
	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	4
	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	5
	24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	1	0	0	1	6	
	25	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	1	0	0	1	6	
	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	3	
	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	3	
	28	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	1	6	
	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	4
	30	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	5
	31	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	7
	32	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	9	
	33	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	6	
	34	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	5
	35	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	5
	36	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	
	37	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	4	
	38	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	
	39	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1	7	
	40	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	7
	41	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	8
	42	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	1	0	1	9
	43	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	8
	44	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	7
	45	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	6
	46	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	6

Visual Impact Assessment

47	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	6
48	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	6
49	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	5
50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	5
51	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	5
52	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
53	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	5
54	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
55	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
56	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	0	1	0	1	8
57	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
58	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
59	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	1	0	1	7
60	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	6
61	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	1	0	1	7
62	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	1	0	1	7
63	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	1	0	1	7
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	1	1	0	1	7
65	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	5
66	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	1	0	1	7
67	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	5
68	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	1	0	1	6
69	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	5
70	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	1	0	1	7
B	19	0	0	41	0	0	3	1	15	2	0	0	0	0	0	0	1	44	0	0	20	54	0	1	40	0	12	46	0	37	50	1	65	

Column "A" = total number of buildings affected by a particular turbine

Row "B" = total number of turbines visible from a particular building

Mitigation and management

Other than avoiding the site completely there are no mitigation measures that will reduce the visual intrusion of the wind turbines due to their size/height and visibility, and the lack of screening opportunities in the landscape.

Significance Statement

The duration of the impact will be “*Permanent*”. The extent is “*Study Area*”. The severity of the impact is expected to be “*Severe*”. The likelihood of surrounding farmers having their views impacted is “*Definite*”. The turbine’s presence will change the character of this remote area.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Study area	Severe	Definite	HIGH -
With Mitigation	Permanent	Study area	Severe	Definite	HIGH -

6.3.2 Operations Phase Impact 2: Access road, including alternatives 1, 2 and 3

Cause and comment

Details of the access road alternatives is presented in the table below.

Road alternative	Length (m)	Width (m)	Footprint (ha)	Viewshed area (ha)*	Visual receptors
1	4,029	Up to 12m	4.8	1,156	0
2	575	Up to 12m	0.69	1,349	1
3	1,218	Up to 12m	1.5	1,299	2

*Viewshed calculated based on the terrain within 5km of the road options

The access roads (excluding the alternatives considered above) will have a total length of 133,324m. Based on a width of 12m, these will have a footprint of 160ha. This road network will be visible from an area of 35,791.5ha, limited to within 5km of the road network. A part of this road network will be visible to the following receptors:

- Gielie Hanekom at his farm “Aurora”;
- An uncategorised building on the farm “Aanstoot”.

Mitigation and management

Although Access Road Alternative 2 does not have the smallest viewshed or the smallest number of visual receptors, it should be the preferred alternative due to it having the smallest footprint.

Significance Statement

The duration of the impact associated with both access road alternatives will be “*Permanent*”. The extent is “*Localised*”. The severity of the impact is expected to be “*Slight*”. The likelihood of surrounding farmers having their views impacted is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without	Permanent	Localised	Slight	Definite	MOD -

Visual Impact Assessment

Mitigation					
With Mitigation	Permanent	Localised	Slight	Definite	MOD -

6.3.3 Operations Phase Impact 3: On-site substation alternatives

Cause and comment

The substation options all have an almost identical footprint. Their viewsheds differ based on their location in the landscape.

Substation alternative	Footprint (ha)	Viewshed area (ha)	Visual receptors
Substation alternative 1 (TNEI 1)	2.25	1,790	0
Substation alternative 2 (TNEI 2)	2.25	741	1
Substation alternative 3 (TNEI 3)	2.25	2,100	0
Substation alternative 4 (G7 1)	2.25	2,198	0
Substation alternative 5 (G7 2)	2.25	853	0
Substation alternative 6 (G7 3)	2.34	928	0
Substation alternative 7 (G7 4)	2.25	1,276	0

*Viewshed calculated based on the terrain within 5km of the substation alternatives

Mitigation and management

Although substation alternative 2 (TNEI 2) has the smallest viewshed, it is the only option that will be visible at the homestead of Mr Gielie Hanekom at Aurora. We therefore suggest that substation alternative 5 (G7-2) be selected as the preferred alternative, since it has the smallest viewshed and will not be visible from any homesteads or buildings located outside of the project area.

Significance Statement

The duration of the impact will be “*Permanent*”. The extent is “*Localised*”. The severity of the impact is expected to be “*Slight*”. The likelihood of surrounding farmers having their views impacted is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Localised	Slight	Definite	MOD -
With Mitigation	Permanent	Localised	Slight	Definite	MOD -

6.3.4 Operations Phase Impact 4: Shadow Flicker

Cause and comment

Shadow flicker results from the shade cast by a wind turbine and its rotating blades. The shade cast by the blades “flicker” from the point of view of a stationary observer as the blades rotate.

We have not performed detailed modelling of the shadow flicker effect, but have assessed this impact based on the rule of thumb that shadow flicker is potentially a problem if a turbine is located within 800 metres of an occupied building i.e. if a turbine is within 800m of an occupied building, the particular building and turbine and the topography of the area between them should be assessed to determine whether shadow flicker may be a problem. This can be analysed using basic trigonometry.

We assessed the potential for shadow flicker to impact buildings located within the project area i.e. buildings on the farms hosting the wind turbines. We found that none of the turbines was within 800m of a wind turbine, as indicated in the figure below.

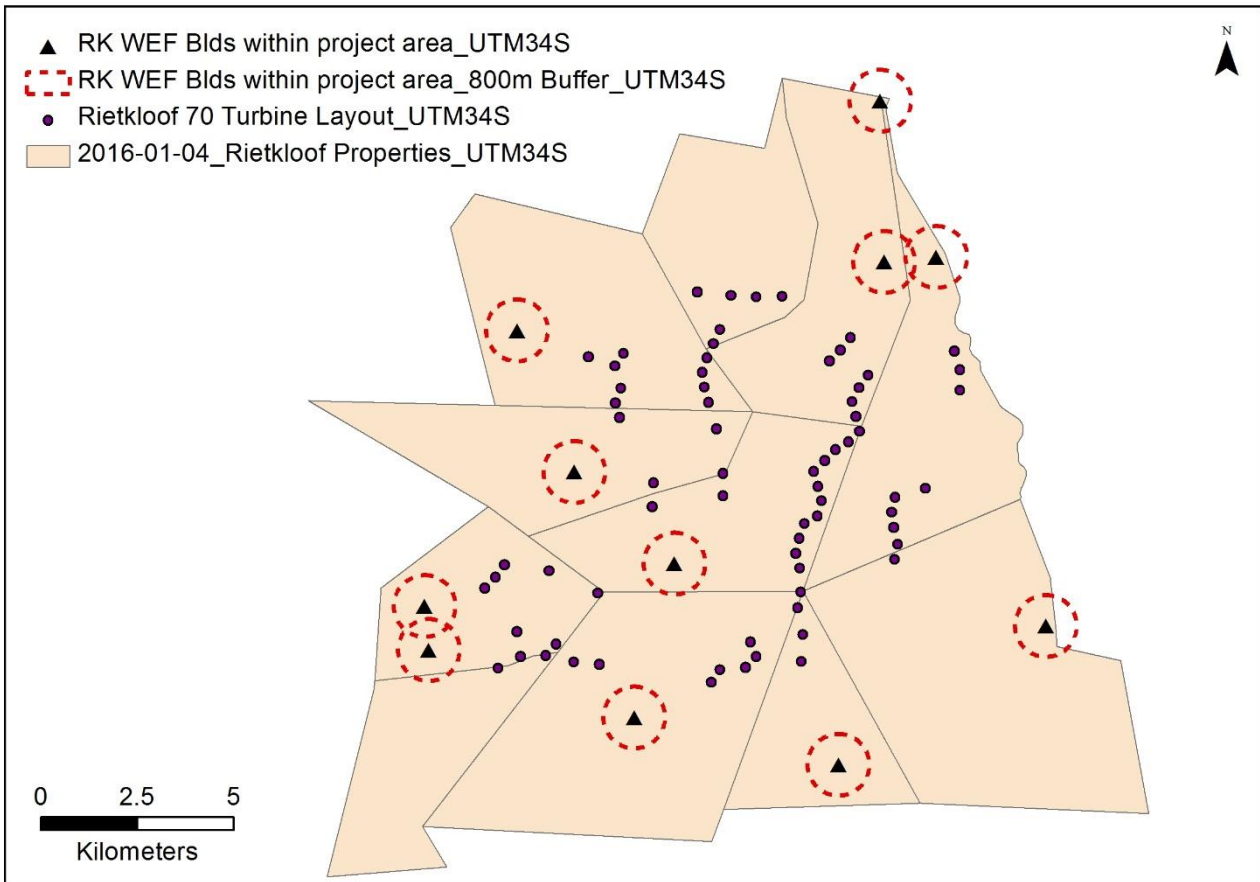


Figure 6.1: Shadow flicker

Mitigation and management

We recommend that if the turbine layout is adjusted and it is found that an occupied building is located within 800m of a wind turbine, then the potential for shadow flicker should be assessed. A building should not be affected for more than 30 hours per year, or for longer than 30 minutes in a day (Parsons Brinckerhoff, 2011).

Significance Statement

There is **NO IMPACT** anticipated as a result of shadow flicker based on the layout assessed.

6.4 Decommissioning phase impacts

6.4.1 Decommissioning Phase Impact 1: Visual impact of decommissioning activity

Cause and comment

Wind farms are typically designed for a 25 year life. After 25 years, the proposed Rietkloof Wind Farm may either be refurbished (re-powered) or decommissioned. If it is decommissioned, the impacts during the decommissioning phase will be very similar to those identified in the construction phase. The mitigation measures applicable to the construction phase will be applicable during the decommissioning phase as well.

Significance statement

The duration of the decommissioning phase impact will be “*Short Term*”. The extent is “*Regional*” as activity will be visible beyond the immediate environs of the site. The severity of the impact is expected to be “*Moderate*” should mitigation measures not be employed. If they are, the impact is expected to be “*Slight*”. The likelihood of surrounding farmers having their views impacted by is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Regional	Moderate	Definite	MOD -
With Mitigation	Short term	Regional	Slight	Definite	MOD -

6.5 Cumulative Impacts

6.5.1 Cumulative Impact 1: Visual impact of facility construction and operation

Cause and comment

According to the South African Renewable Energy EIA Application Database, dated 21 December 2015 (Dataset Title: REEA_OR_2015_Q4.shp) the applications listed in Table 6.5 have applied for or have received environmental authorisation.

There are other wind energy developments and electrical infrastructure proposed and existing in close proximity to the Rietkloof WEF. These facilities are in various stages of development ranging from application phase to authorisation (environmental authorisation and preferred bidder).

The following projects are located within a 30km buffer around Rietkloof WEF:

- Konstabel Solar Project;
- Roggeveld Wind Project;
- Perdekraal Wind Project;
- Witberg Wind Project;
- Sutherland Wind and Solar Project;
- Hidden Valley Wind Project;
- PV Solar Project, south of Sutherland;
- Suurplaat Wind Project;
- Gunstfontein Wind Project;
- Komsberg Substation; and
- Brandvalley Wind Project.

Furthermore, there are high voltage transmission lines (one 786kV and two 400kV power lines) running immediately north of the project area, running between the Komsberg station and the Kappa substation.

The recently built 765kV line runs from the Gamma substation near Victoria West past the Kappa substation near Touwsriver (southwest of the project site) to connect to the Omega substation near Koeberg. This is part of Eskom’s grid strengthening project for power transmission and distribution in South Africa.

The Komsberg capacitor station located southeast of the project site has two 400 kV lines running through its capacitor banks from the Droerivier substation to the Bacchus and Muldersvlei

substations, respectively, via the Kappa substation.

The approved renewable energy projects located in the vicinity are intended to be connected to the Komsberg station where new substation infrastructure will be built.

Although it makes sense from a business and engineering perspective to concentrate facilities in this way, there is no escaping the fact that the development of multiple wind energy facilities, at this scale, will change the character of this remote area significantly. However, it should also be noted that the area is located within a Renewable Energy Development Zone - “Komsberg Wind” - as identified in the Strategic Environmental Assessment undertaken by the Council for Scientific and Industrial Research (CSIR) and the Department of Environmental Affairs.

Mitigation and management

There are no feasible mitigation measures to reduce the cumulative visual impact of the wind farms. If each wind farm implements the mitigation measures suggested in their individual Visual Impact Assessments and Environmental Management Programmes, this will serve to reduce the cumulative impact.

Significance Statement

The duration of the impact will be “*Permanent*”. The extent is “*Regional*”. The severity of the impact is expected to be “*Moderate*”. The likelihood of the impact occurring is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Regional	Moderate	Definite	HIGH -
With Mitigation	Permanent	Regional	Moderate	Definite	HIGH -

Table 6.6: Renewable energy applications within 50km of Rietkloof WEF according to the South African Renewable Energy EIA Application Database, dated 21 December 2015

Key:

Approved and status known	Approved but status not known	EIA being undertaken	Lapsed / withdrawn
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DEA_REF	EIA_P ROCE S	PROJ_TITTL	APP_RECEIV	APPLICANT	TECHNOLOGY	MEGA WATT	PROJ_STA TU
12/12/20/1782	S&EIA	Proposed development of renewable Energy facility at the Sutherland site, Western and Northern Cape province	2010/10/14	Mainstream Renewable Power Sutherland	Onshore Wind	811	Approved
12/12/20/1783 /1	S&EIA	Proposed development of a renewable Energy facility at Perdekraal, Western Cape - Split 1	2012/12/01	South Africa Mainstream Renewable Power Perdekraal West Pty Ltd	Onshore Wind	150	Approved
12/12/20/1783 /2	S&EIA	Proposed development of a renewable Energy facility at Perdekraal, Western Cape - Split 2	2012/12/01	South Africa Mainstream Renewable Power Perdekraal West Pty Ltd	Onshore Wind	150	Approved
12/12/20/1783 /2/AM1	Amend ment	Proposed development of a renewable Energy facility at Perdekraal, Western Cape - Split 1	2014/10/03	South Africa Mainstream Renewable Power Perdekraal West Pty Ltd	Onshore Wind	0	Approved
12/12/20/1787	S&EIA	Proposed renewable energy facility at Konstabel	2010/01/29	South Africa Mainstream Renewable Power Development	Onshore Wind and Solar PV	170	Approved
12/12/20/1966	S&EIA	Proposed establishment of the Witberg Bay wind energy facility, Laingsburg Local Municipality, Central Karoo District, Western cape	2013/11/07	Witberg Wind Power Pty Ltd	Onshore Wind	140	Approved
12/12/20/1988	EIA	Proposed Construction Of The 140Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local Municipality Of The Western Cape Province	2014/12/05	Roggeveld Wind Power (Pty) Ltd	Onshore Wind	140	Approved
12/12/20/2228	S&EIA	Proposed wind energy facility near Komsberg, Western Cape	2011/03/18	Inca Komsberg Wind Pty Ltd	Onshore Wind	300	Withdrawn/ Lapsed
12/12/20/2370	S&EIA	Proposed Hidden Valley wind energy facility , Northern cape	2013/01/01	ACED Renewables Hidden Valley, Northern Cape Province	Onshore Wind	650	Approved
12/12/20/2370 /1	S&EIA	Proposed Hidden Valley wind energy facility , Northern cape	2013/01/01	ACED Renewables Hidden Valley, Northern Cape Province	Onshore Wind	150	Approved
12/12/20/2370 /2	S&EIA	Proposed Hidden Valley wind energy facility , Northern cape	2013/01/01	ACED Renewables Hidden Valley, Northern Cape Province	Onshore Wind	150	Approved
12/12/20/2370 /3	S&EIA	Proposed Hidden Valley wind energy facility , Northern cape	2013/01/01	ACED Renewables Hidden Valley, Northern Cape Province	Onshore Wind	150	Approved
14/12/16/3/3/2 /395	S&EIA	Proposed 280 MW Gunstfontien Wind energy Facility, Northern Cape Province	2014/11/06	Networx Eolos Renewables (Pty) Ltd	Onshore Wind	280	Approved

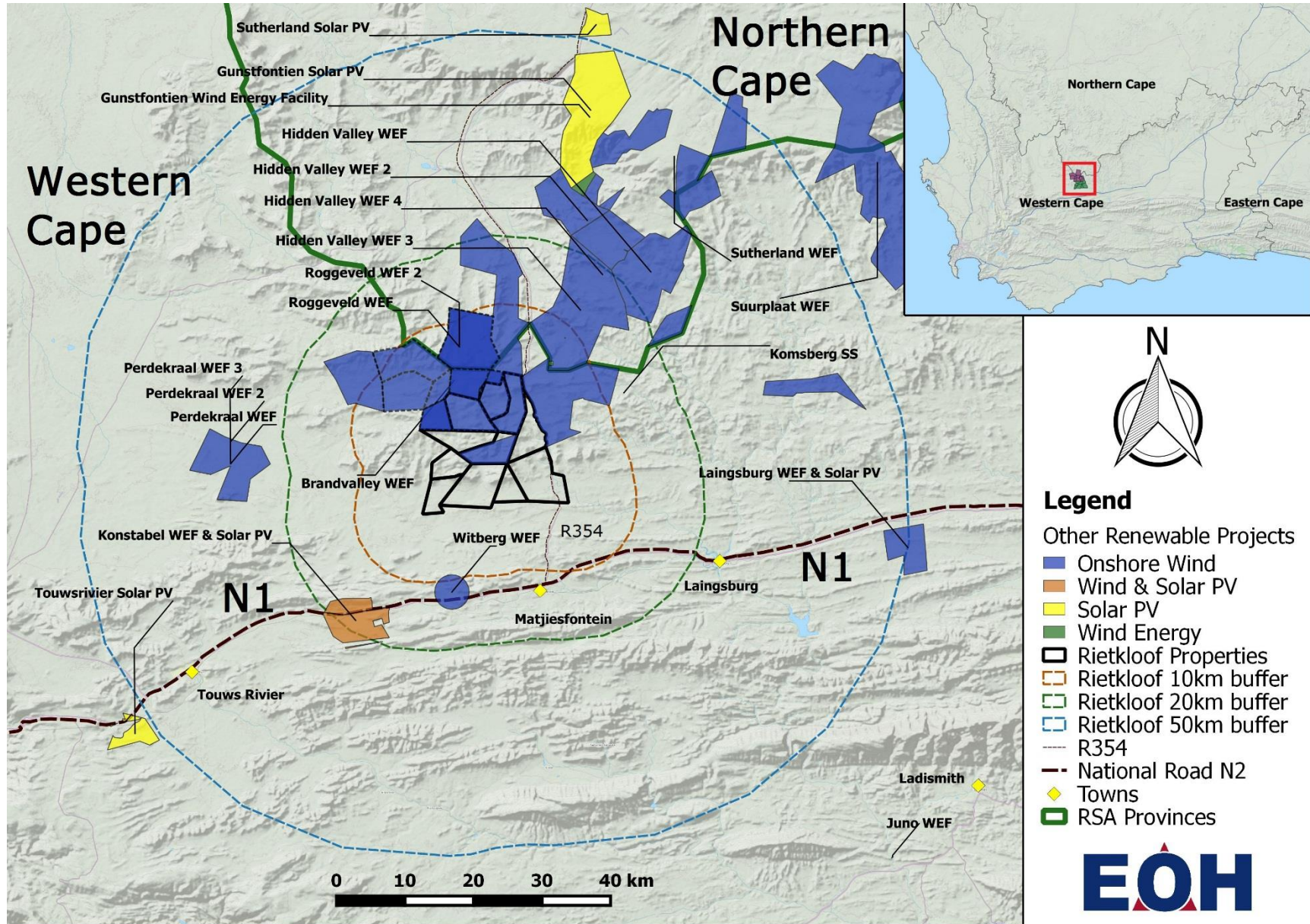


Figure 6.2: Other WEF proposals within 30km of the Rietkloof WEF

6.6 No-Go Impacts

6.6.1 No-Go Impact 1: The Karoo’s sense of place and its value to residents and visitors

Cause and comment

The low rainfall of the region has created the Karoo. It has defined the settlement patterns and the land use. The sense of place of the Karoo, including this region, is of vast open skies, long and straight roads, very few people, hot days and cold nights, creaky wind mills drawing what little water they can from underground aquifers, kranzts, isolated farms, imposing hills forming the horizon. It is not an industrial area. The people who live in the Karoo treasure this unique area, and derive pleasure from the tranquillity and peace it provides. It is also this sense of place that attracts visitors to the Karoo.

Mitigation and management

Not applicable.

Significance Statement

The duration of the impact is “*Permanent*”. The extent is “*Regional*”. The severity of the impact is expected to be “*Moderate*”. The likelihood of the impact occurring is “*Definite*”.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Regional	Moderate	Definite	HIGH +
With Mitigation	N/A	N/A	N/A	N/A	N/A

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Conditions that should be included in the EMPr

7.1.1 Construction Phase

- The construction contractor should clearly demarcate construction areas so as to minimise site disturbance.
- Treat roads to reduce dust emissions.
- The site should be kept neat and tidy. Littering should be fined and the ECO should organise rubbish clean-ups on a regular basis.
- Construction camp alternative 4 should be the preferred alternative, due to it having the smallest viewshed.

7.1.2 Operations Phase

- Access road alternative 2 should be the preferred access road alternative due to it having the smallest footprint.
- Substation alternative 5 (G7-2) should be the preferred alternative, due to it having the smallest viewshed.
- If the turbine layout is revised and it is found that a turbine is planned to be situated within 800m of an occupied building, a shadow flicker assessment should be undertaken to determine whether the building will be impacted.

8 CONCLUSIONS

8.1.1 Summary of impacts

Construction Phase Impacts:

- Impact 1: Visual impact of construction activity

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Study area	Moderate	Definite	MOD -
With Mitigation	Short term	Study area	Slight	Definite	MOD -

- Impact 2: Construction camp alternatives 1 to 14 (excluding 5)

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Localised	Slight	Definite	LOW -
With Mitigation	Short term	Localised	Slight	Definite	LOW -

Operations Phase Impacts:

- Impact 1: Impact of the layout on sensitive visual receptors

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Study area	Severe	Definite	HIGH -
With Mitigation	Permanent	Study area	Severe	Definite	HIGH -

- Impact 2: Access road, including alternatives 1, 2 and 3

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Localised	Slight	Definite	MOD -
With Mitigation	Permanent	Localised	Slight	Definite	MOD -

- Impact 3: On-site substation alternatives

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Localised	Slight	Definite	MOD -

Visual Impact Assessment

With Mitigation	Permanent	Localised	Slight	Definite	MOD -
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- Impact 4: Shadow flicker impact

No impact anticipated based on turbine layout assessed.

Decommissioning Phase Impacts:

- Impact 1: Visual impact of decommissioning activity

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Short term	Study area	Moderate	Definite	MOD -
With Mitigation	Short term	Study area	Slight	Definite	MOD -

Cumulative Impacts:

- Impact 1: Visual impact of facility construction and operation

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Regional	Moderate	Definite	HIGH -
With Mitigation	Permanent	Regional	Moderate	Definite	HIGH -

No-Go Impacts:

- Impact 1: The Karoo's sense of place and its value to residents and visitors

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Without Mitigation	Permanent	Regional	Moderate	Definite	HIGH +
With Mitigation	N/A	N/A	N/A	N/A	N/A

8.1.2 Concluding points

- The project area is typically Karoo. The sense of place is one of remoteness, low levels of development, peace and tranquillity.
- Sensitive receptors within 20km of the wind farm include 4 guest cottages and the homesteads of numerous farmers. The guest cottages are the following:
 - Gatsrivier Guest Farm:
 - 5 guest cottages located between 17 and 22 km from the nearest turbine;
 - No turbines will be visible at any of the cottages based on the 70 turbine layout assessed.
 - Saaiplaas Guest House:
 - Located 13 km from the nearest turbine;
 - Between 1 and 5 turbines visible.

- Keurkloof Guest House:
 - Located 9.7 km from the nearest wind turbine;
 - Between 11 and 15 turbines visible.
- Blue Berry Hill Guest Farm:
 - Located 18.6km from the nearest wind turbine;
 - Between 46 and 50 turbines visible.
- The following protected areas were identified within 50km of the WEF boundary:
 - Anysberg Nature Reserve, Provincial Nature Reserve, 22km south of the WEF boundary;
 - Touw Local Authority Nature Reserve, Local Nature Reserve, 41km south-west of the WEF boundary.
 - Klein Swartberg Mountain Catchment Area, 47km south-east of the WEF boundary.
- The site is located within a renewable energy development zone - "Komsberg Wind" - as identified by the CSIR and the Department of Environmental Affairs in their strategic environmental assessment.
- The impact of the wind farm on its own, and when considered cumulatively with other wind farms in the region, will have a high negative visual impact for the following reasons:
 - The screening effect of vegetation in this arid environment is non-existent;
 - The construction of infrastructure of this type in this region will contrast strongly with the sense of place of the region (in other words the visual intrusion of these structures on sensitive visual receptors will be high since they are not congruent with the surrounding landscape).
- Of the alternatives presented, the following are preferred due to the fact that they have the smallest viewshed:
 - Access road alternative 2;
 - Construction camp alternative 4;
 - Substation alternative 5 (G7-2).

9 SUBSEQUENT LAYOUT CHANGES

9.1 Introduction

The purpose of this chapter is to discuss changes introduced to the original 70-turbine layout assessed and how these might affect the conclusions reached.

9.2 Changes to layout

The following changes have been made to the layout assessed:

1. Turbines 56 and 57 have been taken out of the layout;
2. The following changes have been made to the access roads:
 - a. Leaving the South Eastern ridge in a western direction starting from Turbine 59 to connect to the main valley access road;
 - b. Leaving the western ridge of the northern part of the wind farm starting from Turbine 13 to connect to the main valley access road;
 - c. The access road between turbines 55 and 58 is no longer considered.

These changes are displayed in the images below.

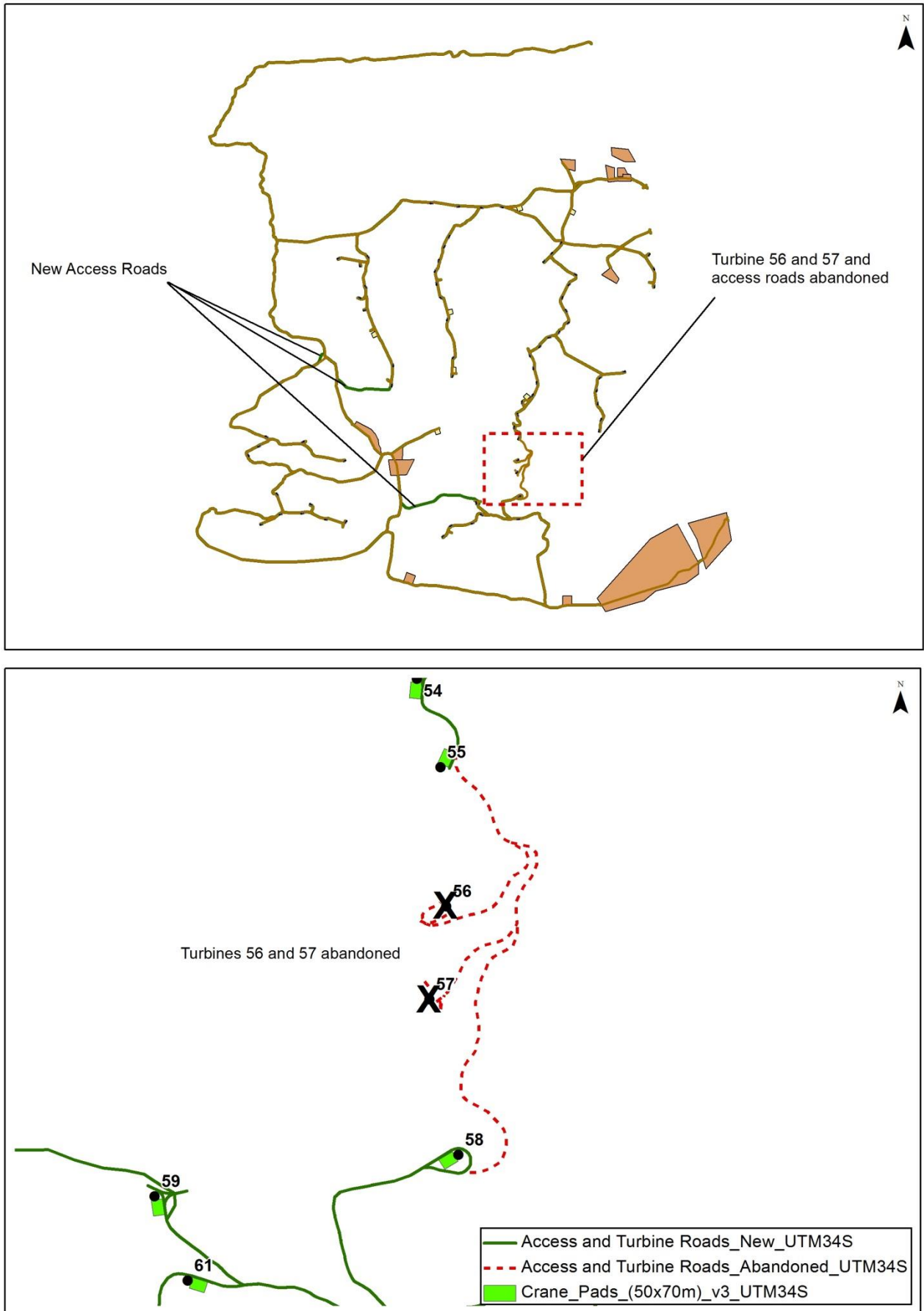


Figure 9.1: Changes to the Rietkloof WEF layout

9.3 Impact on conclusions and recommendations

9.3.1 Access roads

The key differences in the old and new access road layouts are provided in the table below.

Table 9.1: Old versus new access road layout

	Access Road (old)	Access Road (new)
Length ¹	133,324m	133,783m
Footprint	160ha	160.5ha
Viewshed area	35,791.5ha	34,649ha

1. Excludes length of access road alternatives.

The length of access roads has increased by 459m, and the footprint by 0.5ha. The viewshed area has decreased slightly.

9.3.2 Turbine layout

Turbines 56 and 57 have been abandoned. Turbines 56 and 57 were visible from 8 and 6 sensitive receptors³ respectively.

9.3.3 Conclusions

The changes to the layout are minor and do not change the broad conclusions of the report and mitigation measures suggested.

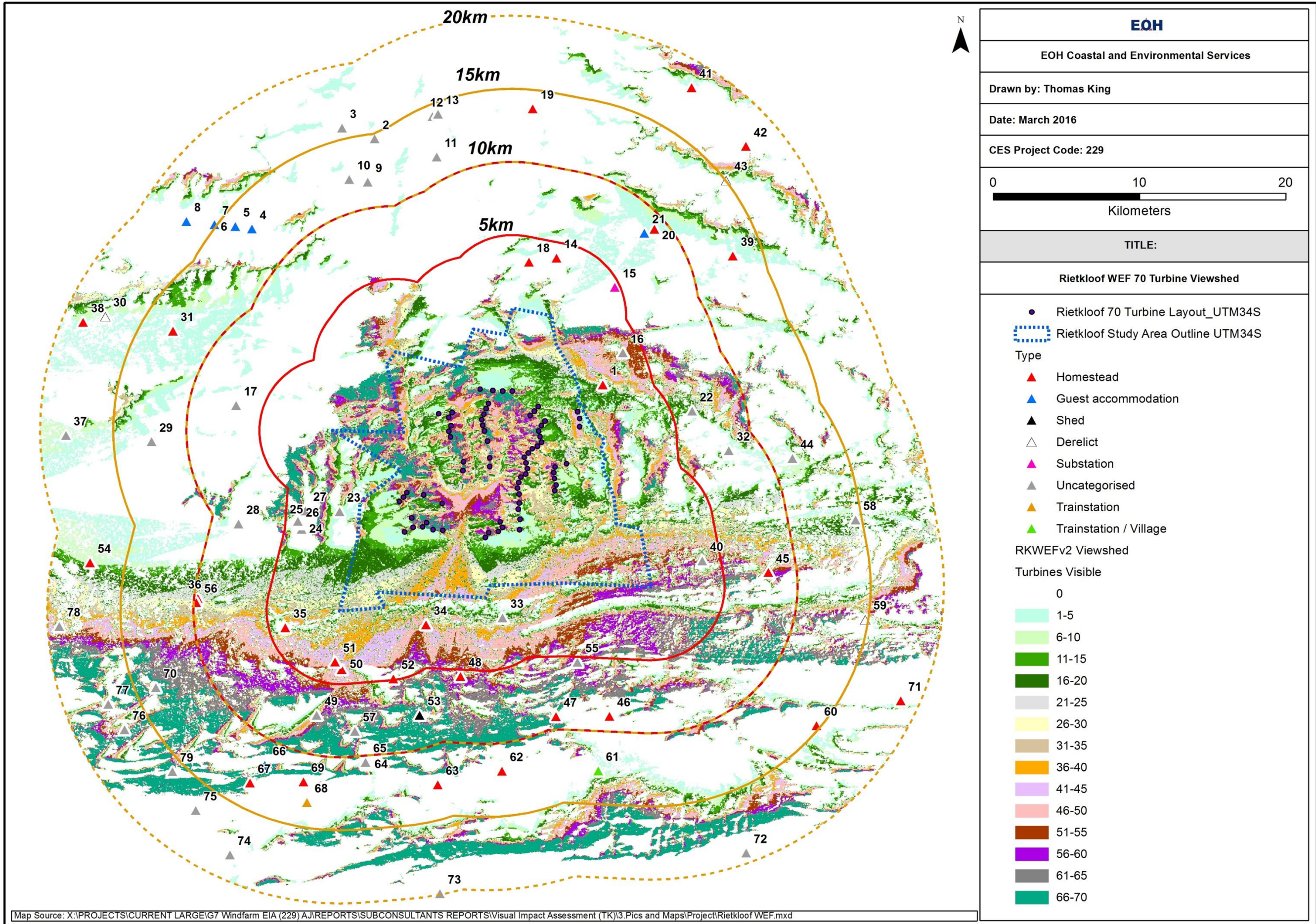
³ Note that only sensitive receptors (buildings) within 10km of the WEF border were assessed to determine which specific turbines are visible to them.

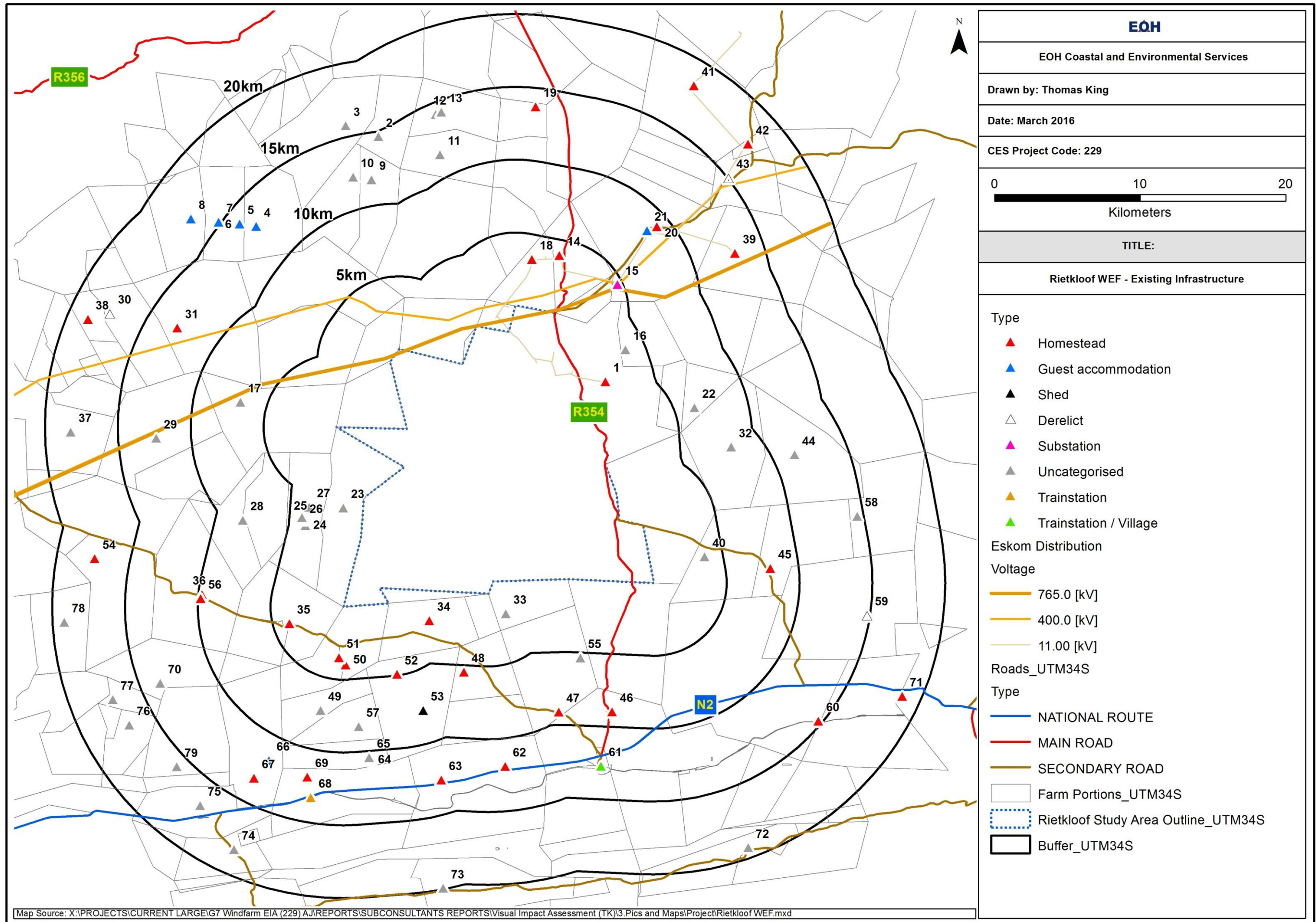
REFERENCES

Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

Parsons Brinckerhoff, 2011. *Update of UK Shadow Flicker Evidence Base - Final Report*, London, England: Department of Energy and Climate Change.

APPENDIX A - VIEWSHED MAP





APPENDIX B - CURRICULUM VITAE

THOMAS KING

QUALIFICATIONS

- BSc Honours Biodiversity and Conservation (Rhodes University)
- BSc Zoology (University of Pretoria)

PROFESSIONAL REGISTRATION AND DEVELOPMENT

Registrations

- South African Council for Natural Scientific Professions (Professional Natural Scientist)

Training

- CES short course: Conducting Environmental Impact Assessments – Completed and passed March 2011
- CFA Level II Candidate - June 2016

PROFESSIONAL EXPERIENCE

January 2006 – December 2006: Field assistant (Remote Exploration Services)

January 2011 – April 2011: GIS technician (Conservation Support Services)

April 2011 – Present: Environmental consultant (EOH Coastal & Environmental Services)

SELECTED CONSULTING EXPERIENCE

Environmental consulting experience as a project manager, report writing and GIS manager for various development types. Specific experience includes the following:

Forestry

- Lurio Green Resources Forestry Environmental and Social Impact Assessment.
- Niassa Plantation Environmental and Social Impact Assessment.
- Equatorial Palm Oil Liberia Environmental, Social and Health Impact Assessment.
- Ugandan Palm Oil Environmental and Social Impact Assessment.

Renewable energy

- EIA for Richards Bay Wind Energy Project, EAB Astrum Energy
- EIA for Hluhluwe Wind Energy Project, Kimocode (Pty) Ltd
- EIA for Plan 8 Wind Energy Project, Infinite Plan 8
- EIA for St Lucia Wind Farm, St Lucia Wind Farms (Pty) Ltd
- EIA for Coega Wind Farm, InnoWind (Pty) Ltd
- EIA for Brakkefontein Wind Farm, Terra Power Solutions

Agriculture and waste management

- Basic environmental assessment for the development of a chicken rearing facility in the Paterson district of the Eastern Cape, Eco Pullets (Pty) Ltd.

Mining

- Pre-feasibility risk assessment for the development of a heavy minerals mine on the West Coast of South Africa, Zirco Resources (Pty) Ltd.
- Environmental Control Officer for the Kenmare Heavy Mineral Mine, Nampula Province, Mozambique.
- Baobab Iron Ore Mine, Tete Province Mozambique.
- Alphamin Bisie Tin Project, Nord Kivu, Democratic Republic of the Congo.
- Syrah Resources Graphite Project, Cabo Delgado, Mozambique.
- Zirco Heavy Minerals Mine, Northern Cape, South Africa.

SPECIALIST ASSESSMENTS

Visual Impact Assessments:

- Syrah Resources Graphite Mine, Cabo Delgado, Mozambique. Completed: August, 2013.
- Zirco Roode-Heuwel Mine in the Northern Cape of South Africa. Completed: March, 2014.
- Baobab Iron Ore Mine, Tete, Mozambique. Completed: April 2014.
- Triton Minerals Nicanda Hills Graphite Project. Completed August 2015.

Traffic Impact Assessments:

- Trans-Caledon Tunnel Authority (TCTA) Mooi-Mnegi transfer scheme. Completed June 2012.
- Syrah Resources Graphite Mine, Cabo Delgado, Mozambique. Completed: August, 2013.
- Baobab Iron Ore Mine, Tete, Mozambique. Completed: April 2014
- Triton Minerals Nicanda Hills Graphite Project. Completed August 2015.
- Alphamin Bisie Tin Mining Project, Nord Kivu, DRC. Completed September 2015.

RESEARCH & TEACHING EXPERIENCE

I have completed a study on the rate at which Sub-tropical Thicket (an Eastern Cape vegetation type) recovers after heavy grazing by ostriches. This study was done as part of my honours degree at Rhodes University.

CURRICULUM VITAE – HENRY HOLLAND

Profession: GIS Consultant
 Date of Birth: 26 December 1968

BIOGRAPHICAL SKETCH

Henry has been doing GIS related work since 1992 when he started his M.Sc. in Geology. Since finishing Masters he worked in Angola establishing a GIS department for a diamond exploration company, after which he worked on a freelance basis for eight years doing GIS related work and computer programming. In 2005 established the Mapthis Trust which provides geospatial services for a range of environmental and geology companies and projects. Henry has been involved in Visual Impact Assessments (VIAs) since 1997.

TERTIARY EDUCATION

1996 M. Sc. Geology/GIS Rhodes University
 1986 B.Sc. Hons UOFS

KEY EXPERIENCE

The table below presents an abridged list of Henry’s project experience relevant to this proposal:

Completion Date	Project description	Role	Client
2015	Scatec Kenhardt PV EIA, Northern Cape – VIA report	Author	CSIR
2015	Vredenburg Landfill Extension BA, Western Cape – Visual Impact Report	Author	Jeffares & Green (Pty) Ltd
2015	Umgeni Lovu and Tongaat Desalination Plants EIAs, KwaZulu-Natal	Author	CSIR
2015	Inyanda-Roodeplaat WEF, Uitenhage, EC	Author	SRK
2015	OTGC Oil Storage Terminal BA – Visual Impact, Durban, KZN	Author	CSIR
2014	Mainstream Dealesville Solar Plants VIA, Freestate Province	Author	CSIR
2014	Mulilo Solar Plants VIA, Northern Cape	Author	CSIR
2014	Frontier SRMOP EIA, Saldanha, WC	Author	CSIR
2013	Ishwati Emoyeni Wind Energy Facility VIA, Western Cape	Author	CSIR
2013	Venter Fert Composting and Fertiliser Plant	Author	Public Process Consultants
2013	Kipeto Power Line, Kenya	Author	Kipeto Energy Ltd.
2012	Ngqura Manganese Export Facility VIA, Coega, Eastern Cape	Author	CSIR
2012	Toliara Sands Mining Project VIA, Toliara, Madagascar	Author	CES
2012	Mkuze Biofuel Power Plant VIA, Mkuze, KwaZulu-Natal	Author	CSIR
2012	Vleesbaai WEF VIA, Western Cape	Author	CSIR
2012	Saldanha Desalination Plant VIA, Saldanha Bay, Western Cape	Author	CSIR
2012	Mossel Bay WEF, Western Cape	Author	CES
2012	Keimoes Solar Energy Facility, NC	Author	CSIR
2012	Douglas Solar Energy Facility, NC	Author	CSIR
2012	Richards Bay WEF VIA, KZN	Author	CES
2012	Hluhluwe WEF VIA, KZN	Author	CES
2012	Plan8 Grahamstown Wind Farm VIA, Eastern Cape	Author	CES
2012	Kipeto Wind Farm VIA, Kenya	Author	Galetech Energy Developments Ltd.
2011	Coega IDZ Zone 12 Wind Farm	Author	CSIR
2011	Haverfontein Wind Farm, Mpumalanga	Author	CES

Visual Impact Assessment

Completion Date	Project description	Role	Client
2011	Middleton Wind Farm, Cookhouse	Author	CES
2011	Broadlands PV Plant, Humansdorp	Author	CSIR
2011	Ubuntu Wind Farm, Jeffrey's Bay	Author	CSIR
2011	Lushington Park Wind Farm, East London	Author	CES
2011	Chaba Wind Farm, Komga	Author	CES
2010	Thomas River Wind Farm and PV Park VIA, Stutterheim	Author	CES
2010	Eskom Power Line VIA, Kouga	Author	CES
2010	Laguna Bay Resort VIA	Author	CES
2010	Kouga Wind Farm VIA	Author	Arcus GIBB
2010	Electrawinds Coega Wind Farm VIA	Author	CSIR
2010	Innowind Coega Wind Farm VIA	Author	CES
2010	Jeffrey's Bay Wind Farm VIA, Jeffrey's Bay	Author	CSIR
2010	Cookhouse Wind Farm VIA, Cookhouse	Author	CES
2009	Waainek Wind Farm VIA, Grahamstown	Author	CES
2009	Coega Wind Turbine BA (Visual Input)	Author	CSIR
2009	Sierra Leone Ethanol Plant VIA	Author	CSIR
2009	NamWater Desalination Plant VIA, Swakopmund, Namibia	Author	CSIR
2009	Nooitgedagt/Coega Water Supply VIA, Motherwell	Author	SRK
2009	CDM Brewery VIA, Nampula, Mozambique	Author	CES
2009	TankaTara Preliminary Visibility Analysis, Addo	Author	CES
2008	Kouga Wind Energy Project VIA, Jeffreys Bay	Author	CSIR
2008	Aston Bay VIA	Author	CES
2008	NPA Boundary Wall VIA, Port Elizabeth	Author	CSIR
2008	Eliitheni Coal Mining VIA, Indwe	Author	Savannah Environmental (PTY) Ltd.
2008	Coegakamma Chicken Broiler Housing VIA	Author	Public Process Consultants
2008	Amanzi Country Lifestyle Estate VIA, Uitenhage	Author	Public Process Consultants
2008	Coegakammaskloof Chicken Broiler Housing VIA	Author	Public Process Consultants
2008	Ngqura Manganese Terminal Pre-Feasibility VIA	Specialist Input	CSIR
2007	Visual Impact Assessment for Stuyterville Bulk Water Supply, Baviaanskloof	Author	Anton Bok and Associates
2007	Eliitheni Coal Mining Scoping VIA	Author	Savannah Environmental (PTY) Ltd.

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me, and that I am available to work on this project.



Date: 11/01/16

[Signature of staff member and authorized representative of the firm]

Day/Month/Year

Full name of staff member: Henry Holland

APPENDIX C - SPECIALIST DECLARATION



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

File Reference Number:	(For official use only)
NEAS Reference Number:	
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

- (1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and
- (2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

EIA FOR THE PROPOSED RIETKLOOF WIND ENERGY FACILITY

Specialist:	Thomas King		
Contact person:	Thomas King		
Postal address:	PO Box 934, Grahamstown		
Postal code:	6140	Cell:	
Telephone:	046 622 2364	Fax:	046 622 6564
E-mail:	t.king@cesnet.co.za		
Professional affiliation(s) (if any)	SACNASP		

Project Consultant:	Coastal and Environmental Services		
Contact person:	Ms Belinda Huddy		
Postal address:	Suite 408, 4th Floor, 76 Regent Road, Sea Point, Cape Town		
Postal code:	8005	Cell:	
Telephone:	021 045 0900	Fax:	
E-mail:	b.huddy@cesnet.co.za		

4.2 The specialist appointed in terms of the Regulations

I Thomas King, declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

EOT Coastal and Environmental Services

Name of company (if applicable):

10 March 2016

Date:

APPENDIX D - CONTENTS OF A SPECIALIST REPORT (GNR 982)

Section		NEMA 2014 Regulations - Appendix 6 Requirement	Section	Check
1	1	A specialist report prepared in terms of these Regulations must contain—		
	(a)	details of-		
		(i) the specialist who prepared the report; and	3.5	✓
		(ii) the expertise of that specialist to compile a specialist report;	Appendix B	✓
	(b)	a declaration that the person is independent in a form as may be specified by the competent authority;	Appendix C	✓
	(c)	an indication of the scope of, and the purpose for which, the report was prepared;	3.1	✓
	(d)	a description of the methodology adopted in preparing the report or carrying out the specialised process;	3.2	✓
	(e)	a description of any assumptions made and any uncertainties or gaps in knowledge;	3.4	✓
	(f)	a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;	6.3	✓
	(g)	recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;	7	✓
	(h)	a description of any consultation process that was undertaken during the course of carrying out the specialist report;	N/A	<input checked="" type="checkbox"/>
	(i)	a summary and copies of any comments that were received during any consultation process; and	N/A	<input checked="" type="checkbox"/>
	(j)	any other information requested by the competent authority.	N/A	<input checked="" type="checkbox"/>
	2	Where a proposed development and the geographical area within which it is located has been subjected to a pre-assessment using a spatial development tool, and the output of the pre-assessment in the form of a site specific development protocol has been adopted in the prescribed manner, the content of a specialist report may be determined by the adopted site specific development protocol applicable to the specific proposed development in the specific geographical area it is proposed in.	N/A	<input checked="" type="checkbox"/>

Notes:

- Point H: The EAP undertakes a public participation process in terms of the NEMA EIA regulations. The Issues and Response Trail was provided to the author who reviewed it, and the issues raised therein were considered in this study. The author was shown around the farm of Mr Warren Petterson by his farm manager.
- Point I: Comments on the EIA and the specialist studies are submitted to the EAP, who captures these in an Issues and Response Trail. The original copies are also provided in the EIA documents.
- Point J: No additional information has been requested by the competent authority.
- Point 2: The site is within a renewable energy development zone - Komsberg Wind - as identified in the Strategic Environmental Assessment undertaken by the CSIR and DEA.

APPENDIX E - PHOTOMONTAGES



Viewpoint name: Viewpoint 03 - Ridge just after Roggekraal

X-coordinate: 467752 (UTM34S)

Y-coordinate: 6338294 (UTM34S)

Orientation: Facing west



Viewpoint name:	Viewpoint 03 - Ridge just after Roggekraal
X-coordinate:	467752 (UTM34S)
Y-coordinate:	6338294 (UTM34S)
Orientation:	Facing west
Distance to nearest turbine:	10.5km



Viewpoint name: Viewpoint 15 - Hill on Zeekoegat
X-coordinate: 451182 (UTM34S)
Y-coordinate: 6330489 (UTM34S)
Orientation: Facing north



Viewpoint name: Viewpoint 15 - Hill on Zeekoegat
X-coordinate: 451182 (UTM34S)
Y-coordinate: 6330489 (UTM34S)
Orientation: Facing north
Distance to nearest turbine: 8.8km

Consideration of other viewpoints on Zeekoegat

The position of three viewpoints was provided to the author. These were viewpoint (VP) 09 (Entrance to Zeekoegat / View 1 as described by Warren Petterson), VP 13 (Ridge on Zeekoegat / View 2 as described by Warren Petterson), and VP 14 (Lodge on Zeekoegat / View 3 as described by Warren Petterson). Of the available options, it was decided that viewpoint 15 would be used to create a photomontage. This is because VP 15 had a clear and unobstructed view of the landscape upon which the proposed turbines will be situated, was situated on an elevated portion of the local topography; and was situated close enough to the proposed turbines to allow the modelled wind turbines to show up relatively clearly on the output. Therefore, the view from this viewpoint gives the best indication of what the view will be from all points on the farm.



Viewpoint name: Viewpoint 16 - Keurkloof Cottage
X-coordinate: 451617 (UTM34S)
Y-coordinate: 6329496 (UTM34S)
Orientation: Facing north



Viewpoint name: Viewpoint 16 - Keurkloof Cottage
X-coordinate: 451617 (UTM34S)
Y-coordinate: 6329496 (UTM34S)
Orientation: Facing north
Distance to nearest turbine: 9.6km