Proposed Highlands Wind Energy Facilities and Grid Connections

Eastern Cape Province

for WKN Windcurrent South Africa (Pty) Ltd

Visual Impact Assessment

August 2018

Prepared for
Arcus Consultancy Services

Prepared by
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in association with
Bernard Oberholzer, Landscape Architect

NEMA requirements for Specialist Reports		
	Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended	**Section**
1 (1)(a)	(i) the specialist who prepared the report; and	Page 4
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 5
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA)	an indication of the quality and age of the base data used for the specialist report;	Section 3
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 12 and 13
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 2
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 12 and 13
(g)	an identification of any areas to be avoided, including buffers;	Section 9
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Map 7
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Section 15
(k)	any mitigation measures for inclusion in the EMPr;	Sections 12 and 13
(l)	any conditions for inclusion in the environmental authorisation;	Sections 14 and 15
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 14
(n)	a reasoned opinion-	Sections 12, 13 and 15
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Refer to EAP
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to EAP
(q)	any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

Visual Specialists

The Visual Impact Assessment (VIA) was prepared by the following:

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Expertise

Quinton Lawson has a Bachelor of Architecture Degree (Natal) and has more than 10 years' experience in visual assessments, specializing in 3D modeling and visual simulations. He has previously lectured on visual simulation techniques in the Master of Landscape Architecture Programme at UCT.

Bernard Oberholzer has a Bachelor of Architecture (UCT) and Master of Landscape Architecture (U. of Pennsylvania), and has more than 20 years' experience in undertaking visual impact assessments. He has presented papers on *Visual and Aesthetic Assessment Techniques*, and is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared for the Dept. of Environmental Affairs and Development Planning, Provincial Government of the Western Cape, 2005.

The authors have been involved in visual assessments for a wide range of residential, industrial and renewable energy projects. They prepared the 'Landscape Assessment' report for the *National Wind and Solar PV Strategic Environmental Assessment*, in association with the CSIR, for the Department of Environmental Affairs in 2014.

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Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number: NEAS Reference Number:	12/12/20/ or 12/9/11/L
	DEA/EIA

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

Proposed Highlands Wind Energy Facilities, Eastern Cape: Visual Assessment

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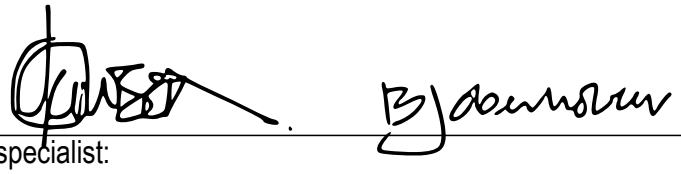
The specialists appointed in terms of the Regulations_

We, Quinton Lawson and Bernard Oberholzer, declare that --

General declaration:

We act as the independent specialists in this application;
We 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;
We declare that there are no circumstances that may compromise our objectivity in performing such work;
We 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;
We will comply with the Act, Regulations and all other applicable legislation;
We have no, and will not engage in, conflicting interests in the undertaking of the activity;
We undertake to disclose to the applicant and the competent authority all material information in our 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 us for submission to the competent authority;
all the particulars furnished by us in this form are true and correct; and
We realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



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Name of company (if applicable):

23 August 2018
Date:

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List of Abbreviations

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
NEMA	National Environmental Management Act
O&M	Operations and Maintenance
PE	Protected Environment
REDZ	Renewable Energy Development Zone
SAHRA	South African Heritage Resources Agency
SANBI	South African National Botanical Institute
SEA	Strategic Environmental Assessment
SRTM	Shuttle Radar Topography Mission
VIA	Visual Impact Assessment
WEF	Wind Energy Facility

Definitions

Definitions	
Cultural landscapes	Human-modified landscapes, particularly those of aesthetic, historical or archaeological significance.
Cumulative impacts	The combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities.
Receptors	Viewers who would be affected by a proposed development, the viewers usually being residents, commuters, visitors or tourists.
Sense of place	The unique or special qualities found in a particular location, including the combined natural, cultural, aesthetic, symbolic and spiritual qualities.
View corridor	A linear geographic zone, usually along movement routes such as trails, roads and railways, visible to users of the routes.
Viewshed	A geographic zone encompassing a view catchment area, usually defined by ridgelines, similar to a watershed.
View shadow	A zone within the view catchment area that is visually obscured from the proposed development by the topography, trees or structures.
Visual buffer	A geographic zone of varying distance, indicating visual sensitivity or visual constraints for proposed development or activities.

1 Purpose and Scope of the Study

The visual assessment of the proposed Highlands Wind Energy Facilities forms part of the Basic Assessment Report being prepared by Arcus Consultancy Services. The proposed project consists of six applications, being 3 wind farm phases and 3 grid applications generating up to 150MW of electricity.

The project is located on the R63 between Somerset East and Pearston in the Eastern Cape, within the Cookhouse Renewable Energy Development Zone (REDZ), indicated on Map 1. The land parcels comprising the development area of interest amount to approximately 9000 hectares, but only a small portion (approximately 2%) of this would be developed. (Arcus June 2018).

A first phase Visual Screening Study was carried out for the project area in 2017 which, along with fieldwork, and a number of other specialist studies has been used to inform the layouts of the proposed wind farms.

The Visual Screening Study was a desktop study of the proposed wind farm site in its general context, including potential scenic resources, landscape features and possible sensitive receptors. These, along with preliminary visual buffers were used to determine the visual sensitivity of the study area and the potential for wind farm development.

The current Visual Impact Assessment (VIA), together with fieldwork, involves a more detailed assessment, including viewshed mapping and visual simulations, to determine potential visual impacts as well as possible mitigations to minimise visual impacts.

2 Visual Assessment Methodology

The methodology involves a number of standard procedures including those in the Guideline for Involving Visual and Aesthetic Specialists (Oberholzer, B. 2015). The methodology includes the following steps:

Site Analysis

This involves the identification of existing scenic resources and sensitive receptors in and around the study area. The context of the proposed development within its surroundings, the intactness of the landscape and the prevailing sense of place are further considerations. These are captured through a photographic survey of the site and surrounds. Inputs from the heritage and social specialist studies were useful at this stage.

Determining the Zone of Visual Influence

This includes mapping of viewsheds and view corridors in relation to the proposed wind farms, as well as important viewpoints, in order to assess the zone of visual influence of the proposed project. Some areas may be in a view shadow from which the proposed wind farms would not be visible. Distance radii from the proposed wind farms give an idea of the levels of their visibility to surrounding receptors.

Identifying Visual Issues

Visual issues are identified during the public participation process, which is being carried out by others. Visual issues may also be identified by the visual, social or heritage specialists. The significance and proposed mitigation of the visual issues are addressed as part of the visual assessment.

Reviewing the Legal Framework

The legal, policy and planning framework may have implications for visual aspects of the proposed development. The heritage legislation tends to be pertinent in relation to natural and cultural landscapes, while Strategic Environmental Assessments (SEAs) for renewable energy provide a guideline at the regional scale.

Assessing Potential Visual Impacts

An assessment is made of the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project. The rating of visual significance is based on the methodology provided by the Environmental Assessment Practitioner (EAP), in this case Arcus Consulting, to ensure consistency across the various specialist studies. The assessment includes cumulative visual impacts of the combined wind farms in relation to other existing and approved wind farm projects, powerlines and other infrastructure in the area.

Formulating Mitigation Measures

Possible mitigation measures are identified to avoid or minimise negative visual impacts of the proposed wind farms. The intention is that these would be included in the project design, the Environmental Management programme (EMPr) and the authorisation conditions.

3 Sources of Information

The main sources of information for the visual assessment included the following:

- Project description of the proposed WEF provided by Arcus (May 2018).
- Council for Geoscience : 1:1000000 Geological Map of South Africa : Spatial Dataset 2011
- Chief Directorate : National Geospatial Information 1:50000 Topographic series
- Shuttle Radar Topography Mission (SRTM) 1 arcSEC 30m DEM Data 2014
- Google Earth satellite imagery, 2018.
- Google Maps and Open Street Map (OSM) Data 2018
- DEA : Renewable Energy EIA Application Database (REEA) Official Release 2018 Q1
- DEA : South Africa Protected Areas Database (SAPAD) Official Release 2018 Q1
- DEA : South Africa Conservation Areas Database (SACAD) Official Release 2018 Q1
- SANBI : National Freshwater Ecosystem Priority Areas (NFEPA) River and Wetland Datasets 2017
- SAHRA : National Heritage Sites Inventory Database 2017
- ESKOM : Electricity Grid Infrastructure (EGI) Dataset 2018

Other sources of information are listed in the references.

4 Site Investigation

A visit to the Highlands project site and surroundings, including a photographic survey, was carried out on 22 February 2018. The route taken on the field trip is indicated on Map 3. The season was not a consideration, nor had any effect on carrying out a visual assessment. Panoramic photographs were taken from major routes and from potential sensitive receptors.

5 Assumptions and Uncertainties

The actual turbine model has still to be finalised, but maximum sizes have been provided by the Applicant, which were used in the visual assessment. Some assumptions had to be made regarding the nature of the proposed substation and operation and management buildings (O&M buildings), as well as lighting and fencing relating to the proposed wind farms, as architectural details of these will only become available at a later stage.

6 Regulatory and Planning Framework

The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA (Act No. 107 of 1998), and NEMA EIA Regulations (2014) apply as the proposed wind farms are a listed activity. The need for a visual assessment as part of the Basic Assessment has been identified.

The National Heritage Resources Act (NHRA) (Act No. 25 of 1999), provides legislative protection for natural, cultural and scenic resources as part of the National Estate. This report deals with visual considerations, while archaeological, paleontological and historical sites are covered in the heritage specialist studies (see references).

As the site falls within the gazetted Cookhouse REDZ, a streamlined Basic Assessment process is being followed. Within the REDZ a 'Landscape Assessment' (Lawson, Q. and Oberholzer, B. 2014) was carried out as part of the SEA for the 8 REDZs around the country. Areas of varying visual sensitivity were identified within each REDZ based on desktop mapping at a broad regional scale. The Landscape Assessment therefore provides a framework, but requires more detailed mapping at the local site scale.

7 Description of the Project

The 3 Highlands Wind Farms consist of an overall total of 49 turbines, according to the latest layout based on information from Arcus (May 2018). The actual turbine model has not been finalised, but is planned to have a maximum generating capacity of up to 5 MW. These would have a maximum rotor diameter of 150m and a maximum tip height of 200m. (See Figure 1).

There are six components to the Proposed Development, representing three development phases, as indicated on Maps 8, 9 and 10.

Highlands North WEF: Phase 1, consisting of up to 17 turbines;
Electrical Grid Connection and Associated Infrastructure for Highlands North WEF Phase 1;

Highlands Central WEF: Phase 2, consisting of up to 14 turbines;
Electrical Grid Connection and Associated Infrastructure for Highlands Central WEF Phase 2;

Highlands South WEF: Phase 3, consisting of up to 18 turbines; and
Electrical Grid Connection and Associated Infrastructure for Highlands South WEF Phase 3.

Each of the grid connections listed above will have 2 proposed route alternatives with a 31m servitude. A 300m corridor for each powerline is being assessed.

The supporting infrastructure within the site includes roads, underground and overhead medium voltage (MV) power lines (33 kV or lower) and a substation, as well as operations and maintenance buildings (O&M buildings) housing offices, workshops and storage facilities.

Although 3 substation sites are being assessed, only 2 substations would be constructed. It is fairly common for the O&M buildings to be located adjacent to the substation, along with parking, fencing and security lighting. (See Figure 2 for a 3D model of a notional substation).

A full list of proposed facilities is given in Table 1 below.

Table 1: Description of Proposed Wind Farms and Grid Connection

Facility	Extent/Footprint	Height	Comments
Affected land parcels: **Development area of interest:** **Actual footprint:**	Approx. 11 180 ha Approx. 9 000 ha Approx. 180 ha	n/a	
WEF North Phase 1 **WEF Central Phase 2** **WEF South Phase 3**	17 turbines 14 turbines 18 turbines	Hub ht. max. 135m Rotor diam. max. 150m Tip ht. max. 200m	Colour: off-white / grey - TBC
Grid North Phase 1 **Grid Central Phase 2** **Grid South Phase 3**	Max. length 5 km Max. length 8 km Max. length 20 km	Max. 30m " "	66 and 132 kV lines. 31m servitudes. Preferred 300m corridor containing both servitudes.
Turbine pads	100 x 50m crane pad and laydown area per turbine	n/a	Foundation 20 to 25m diameter.
Permanent hardstand for maintenance	100 x 30m per turbine	n/a	
Internal access roads	Internal road linking turbine locations.	n/a	6m width, and wider in places to accommodate abnormal trucks.
Electrical substation	110 x 100m x 2 substations	Single storey building	
Operations and maintenance structures	50 x 100m demarcated area.	Single storey buildings	Located adjacent to substation. Workshop/office buildings, maintenance and storage.
Security fencing	Around substation and O&M building.	Approx. 3m	
Security Lighting **Navigation lights**	To be confirmed To be confirmed.	To be confirmed At hub height.	At substation and O&M building. Flashing red light on selected turbines (to CAA requirements).
Grid Connection:			
North WEF powerline **Central WEF powerline** **South WEF powerline**	Max. 5 km length Max. 8 km length Max. 20 km length	Approx. 30m	66 or 132 kV powerlines 31m servitudes
Construction Phase:			
Lay down area, construction camp	Main laydown area and construction yard 1 ha each.	Single storey structures	Temporary site camp, laydown areas incl. prefab buildings, access road, site offices.
On-site concrete batching plant	To be confirmed.	n/a	Temporary plant.
Borrow pits	To be confirmed.	n/a	Possibly from existing sources.

Consideration of Alternatives:

The wind farm layouts being assessed are the preferred alternatives, as previous alternatives were screened out of the project scope in the Screening Phase, during which visual constraints (including scenic resources and sensitive receptors), were taken into account.

Some micro-siting of the proposed infrastructure may be required as the project progresses, and will result in a final preferred layout that minimises potential negative impacts.

Alternative locations for substations and routes for grid connections, within each phase are indicated on Maps 11, 12 and 13.

8 Description of the Study Area

A description of the landscape and scenic features, as well as potential receptors of the study area, is given in Table 2 below, on Maps 2, 5 and 6, and Figures 1 to 6.

Table 2: Characteristics of the Study Area

Location	The WKN Highlands site is located in the Eastern Cape, about 20 km west of Somerset East on the R63 Route to Pearston. The site lies at the eastern end of the Camdeboo Region, and at the foot of the Bruintjieshoogte Mountain, which forms part of the Great Escarpment. The site lies within the gazetted Cookhouse REDZ, one of several renewable energy development zones in the country.
Geology and landforms	The geology has a primary influence on landforms, and the character of the landscape, or 'sense of place'. The geology of the Highlands site consists of mudstones and sandstones of the Adelaide Formation, Beaufort Group, which forms part of the extensive Karoo Supergroup. The dolerite dykes and sills, which intruded the area, (shown in pink on Map 2), are responsible for many of the peaks and ridges in the general area. The Highlands site is a gently undulating upland area at about 1100m elevation. The region to the north of the R63 Route becomes much more mountainous, where the *Groot Bruintjieshoogte* range overlooks the site, with a short pass on the R63. The western part of the site, including the scarp with its steeper slopes, has been incised by the *Voëlrivier* and its tributaries, and the eastern part by the *Brakrivier* and its tributaries.
Vegetation cover and land use	The rugged west-facing escarpment consists of Camdeboo Escarpment Thicket, a 2 to 3m succulent thicket, with *Portulacaria afra* (spekboom) dominant, as well as aloe species. The eastern part of the site consists of Bedford Dry Grassland, an open dry grassland interspersed with *Acacia karoo* woodland, especially in the drainage lines. (Mucina and Rutherford, 2006). Copses of exotic shade trees (pine, wattle, palms) have historically been planted around the farmsteads. Invasive prickly pear and sisal plants are also common. The study area has a pleasing rural character with green pastures grazed by cattle and sheep (including mohair producers), interspersed by crops and woodland along the alluvial stream courses. There are numerous farmsteads, both on the site and in the immediate surroundings. These range from about 2.5 to 7.5 km apart.
Scenic features and receptors	The low escarpment, which runs along the western side of the site is the main scenic feature of the study area. The skyline of the escarpment edge is considered to be particularly visually sensitive. Any turbines located on the scarp edge would tend to be seen in silhouette against the sky. The remaining upland, covered mainly in grassland, tends to be visually exposed, and wind turbines would be potentially visible over long distances. A parcel of land on the western border of the site forms part of the Mountain Zebra-Camdeboo Protected Environment (PE), managed by a PE Landowners Association. The PE parcel is on a south-west facing slope of the scarp face, and is therefore orientated away from the proposed wind farms. The parcel is not known to have any tourism facilities that could be affected by the proposed wind farms.

	There are a number of game farms and tourist facilities in the general area, such as East Cape Safaris at Kaalplaas (Viewpoint 9), Kamala Game Reserve - also indicated as Kampala Game Reserve on maps (near Viewpoint 1), Vaalklip Game Farm (Viewpoint 7) and Side by Side Safaris. Other receptors are travellers on the R63 Route, which runs across the northern portion of the site, and includes the Bruintjieshoogte Pass, with roadside view sites. Besides its scenic value, the Pass is historically significant as an important route from the Cape Colony into the Eastern Cape (Orton, J. 2018), the Pass largely following the same route as the old wagon road used by the early settlers. The exposed road cuts on the Bruintjieshoogte Pass also have great geological interest, described in more detail in the Palaeontological Specialist Study (Almond, J.E. 2018).

Interbedded geological formations on the exposed road cut of the Bruintjieshoogte Pass

District road in the undulating plain east of the site

The low escarpment forming the western portion of the site, seen from the Bruintjieshoogte Pass

Gently undulating plain east of the site with agriculture in the alluvial valleys, and Bruintjieshoogte Mountains behind

9 Visual Constraints and Sensitivity Mapping

Criteria normally used for determining visual sensitivity, along with the reasoning for these, are listed in Table 3 below. The criteria are divided into inherent scenic resources of the study area, and potential sensitive receptors.

Guidelines have been prepared in the past for wind energy farms in general, as indicated in Table 4, and these were merely used as a starting point. The buffers have been adapted to reflect local scale mapping, as well as actual viewsheds and site conditions.

Scenic resources and sensitive receptors within the study area have been categorised into no-go, highly sensitive, moderately sensitive and low visual sensitivity areas, as indicated in Table 5. The visual constraints for the proposed wind farms are indicated on Maps 4, 5 and 6, and the visual sensitivity levels on Map 7.

The visual sensitivity mapping helped to guide the testing of various scenarios for the layout of wind turbines during the screening phase, the current proposed layout largely avoiding visually sensitive areas, (see Map 7).

Table 3: Criteria for Determining Visual Sensitivity

Scenic Resource	**Contributing Factors**
Topographic features	Landscape features in the area contribute to scenic and natural heritage value. These include features that provide visual interest or contrast in the landscape such as ridges, scarp edges, steep slopes and geological features. Intact wilderness or rural landscapes tend to have increased scenic value.
Water Features	Water bodies, such as rivers and dams, generally have aesthetic, scenic, recreational and amenity value. Sensitivity generally relates to their national, regional or local significance.
Cultural landscapes	Cultural landscapes, often along fertile river valleys, tend to have rural scenic value and historical or cultural significance. These need to be correlated with the Heritage Assessment.
Sensitive Receptors	**(includes residents, commuters, visitors and tourists)**
Protected Areas	These include nature reserves and protected environments, which have wilderness and scenic attributes in addition to their biological conservation role, serving as important visitor / tourist destinations. Visual significance is increased by their protection status.
Game reserves / resorts	Private nature reserves, game farms, recreation resorts and tourist accommodation are important for the local economy, and tend to be sensitive to loss or degradation of scenic quality.
Human settlements	Towns, villages and farmsteads, particularly residential and resort areas, tend to be sensitive to visual intrusions, including an effect on property values and tourism. It is assumed that farmsteads within the development site would not be visually sensitive.
Scenic routes and arterial roads	Scenic and arterial routes tend to have historical, recreational and tourism importance, and are therefore visually sensitive. The R63 is the major arterial route in the study area.
Heritage sites	These form part of the heritage study, but could have visual implications.

Table 4: Recommended Visual Buffers for Wind Turbines

(Note: These are seen as a general guide based on previous strategic studies for wind energy facilities and would need to be adapted to the local conditions of the Highlands site. See also Table 5.)

Landscape features/criteria	**PGWC Guidelines (2006)[1]**	**Visual Guidelines (2014)[2]**	**Comments**
Project area boundary	-	-	Usually 1 to 1.5 times height of the proposed turbines.
Prominent topographic features	500m	500m	Peaks, ridgelines and scarp edges.
Steep slopes	>1:4	>1:4 and >1:10	Generally avoid slopes >1:10
Perennial rivers, large dams, wetland features	500m	Perennial rivers: 250 - 500m.	Buffers also subject to specialist freshwater assessment.
Minor streams (green corridors have visual landscape value).	-	-	Min. 50m. subject to freshwater assessment.
Provincial / arterial roads	500m	1 km	The R63 Route is the main arterial in the area.
Scenic routes and passes	2.5 km	1 to 3 km	Bruintjieshoogte Pass has scenic and historical value.
Nature reserves / protected areas	2 km	3 to 5 km (subject to viewshed)	Mountain Zebra – Camdeboo P.E. has no facilities - could be less.
Private nature reserves/ game farms/ guest farms/ resorts (tourism value)	500m	2 to 5 km (subject to viewshed)	e.g. Kamala Private Game Reserve, East Cape Safaris Game Farm, Side by Side Safaris and Vaalklip Game Farm.
Farmsteads	400m (noise)	500m	General literature recommends 500m to 2 km.[3]
Towns / settlements	800m	2 to 4 km	Somerset East is approx. 20 away and Pearston approx. 27km away.
Cultural landscapes / heritage sites	500m	500m (subject to viewshed).	Refer to Heritage Specialist Study.

[1] Provincial Government of the Western Cape / CNdV Africa, May 2006. Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape.

[2] Lawson Q. and Oberholzer B. 2014. National Wind and Solar SEA Specialist Report: Landscape Assessment. CSIR Report for Dept. Environmental Affairs.

[3] Based on a survey of the international literature carried out in 2014, as part of the SEA for Wind and Solar PV (Lawson and Oberholzer). A buffer of 500m from residential buildings is considered a preferred minimum, but setbacks vary up to 2km and more in parts of Europe, Australia, Canada, Scotland and the USA. A setback of 10x the total turbine height is often given as a guideline. The buffers relate to safety, noise, flicker and visual effects, some of which has been based on medical research.

Table 5: Visual Sensitivity Mapping Categories for Highlands Wind Farms

(Note: The Buffers relate to wind turbines. These should be seen as recommended minimum buffers. Optimum buffers may be greater. See also Table 4.)

Scenic Resources	No-go areas	High visual sensitivity	Moderate visual sensitivity	Low visual sensitivity
Topographic features	Landscapes of national scenic value.	Landscapes of regional scenic value.	Landscapes of local scenic value	-
Steep slopes	Slopes >1:5 Peaks 0 - 500m	Slopes 1:5 to 1:10	-	-
Water features	Features of national scenic value 0 - 500m	Features of regional scenic value 0 - 250m	Features of local scenic value 0 - 100m	-
Cultural landscapes [1]	Cultural landscapes of national significance	Cultural landscapes of regional significance	Cultural landscapes local significance	-
Protected Landscapes / Sensitive Receptors				
Protected Environment	0 - 500m	-	500m - 2 km	-
Private reserves / game farms	0 - 500m	500m - 1 km	1 km - 2 km	-
Farmsteads inside the site	0 - 250m	250 - 500m	500m - 1 km	-
Farmsteads outside the site	0 - 500m	500m - 1 km	1 - 2 km	-
Scenic route	0 - 500m	500m - 1 km	1 - 2 km	-
Arterial route R63	0 - 250m	250 – 500m	500m – 1 km	-
District roads	0 - 250m	250 – 500m	-	-

[1] Cultural landscapes and features to be determined by the heritage specialist.

10 Key Visual Issues

The potential visual issues identified by the specialists during the screening phase of the Basic Assessment process include the following:

- Potential scarring in the landscape caused by earthworks for access roads and assembly platforms, particularly on steeper slopes;
- Dust and noise during construction from heavy machinery and truck traffic.
- Potential visual effect of wind turbines on the rural landscape and on surrounding farmsteads and game farms / reserves;
- Potential shadow flicker caused by wind turbines to nearby receptors (early morning and late afternoon).
- Potential visual clutter of on-site substation/s, operations and maintenance structures (O&M structures) and connecting powerlines.
- Potential visual intrusion caused by navigation lighting from turbines and security lighting at substations and O&M structures at night.

Additional issues may be added during the public participation process.

11 Visual Assessment Criteria

The visual assessment of the proposed WEF is based on a number of quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance, including the following considerations:

11.1 Visibility

Distance radii are indicated on Maps 8, 9 and 10 to illustrate visibility of the proposed wind turbines. Degrees of visibility are listed below, but may be subject to foreground topography and the number of turbines that are visible. (See also Figure 1).

High visibility:	Prominent feature within the observer's viewframe 0-2.5km
Mod-high visibility:	Relatively prominent within observer's viewframe 2.5-5km
Moderate visibility:	Only prominent with clear visibility as part of the wider landscape 5-10km
Marginal visibility:	Seen in very clear visibility as a minor element in the landscape 10-20km

A range of significant viewpoints were identified, together with their relative distances and anticipated visibility for the Highlands wind farms in Table 6 below. (See Map 3)

Degrees of visibility of the proposed powerline grid connection, indicated below, would be different for the grid pylons as these are significantly smaller than the wind turbines. (Maps 11, 12 and 13).

High visibility:	Prominent feature within the observer's viewframe 0-500m
Mod-high visibility:	Relatively prominent within observer's viewframe 500m-1km
Moderate visibility:	Only prominent with clear visibility as part of the wider landscape 1-2km
Marginal visibility:	Seen in very clear visibility as a minor element in the landscape 2-4km+

Except for a short section of the R63 Route, all the viewpoints are more than 2 km from the proposed powerlines and therefore the visibility would be marginal.

11.2 Visual Exposure

Visual exposure of the proposed wind farms is determined by the viewshed indicated on Maps 14, 15 and 16, being the geographic area within which the project would be visible. The turbines would be located on a visually exposed upland. Some areas to the north and west would be in a view shadow, and therefore not affected by the wind farms. A combined viewshed for all 3 of the proposed wind farms is indicated on Map 17.

11.3 Landscape Integrity

Visual quality tends to be enhanced by scenic or rural intactness of the landscape, as well as absence of other visual intrusions. The proposed wind farms would partly alter the character of the landscape, although farming could continue.

11.4 Visual Sensitivity

The low escarpment along the western edge is a scenic feature, particularly when seen from the R63 and *Bruintjieshoogte* Pass. Sensitive features and receptors are indicated on Maps 4, 5 and 6, and overall visual sensitivity is indicated on Map 7.

Cultural landscapes, such as the farmsteads in the surroundings, generally form part of a separate heritage study, but are important in that they may be visually sensitive.

11.5 Visual Absorption Capacity (VAC)

This is the potential of the landscape to screen the wind farms from view. The upland site is gently undulating, and therefore visually exposed, i.e. has low visual absorption capacity. The area to the north of the R63 is partly screened by the *Bruintjieshoogte* range.

Table 6: Distances and Visibility from Viewpoints: Wind Farms (see Map 3)

View-point	Location	Coordinates	Distance to WEF	Visibility of WEF
VP1	Goedehoop (Kamala Private Game Reserve)	32.706490S 25.445065E	5.3km	Moderate-high visibility.
VP2	Opposite Lekkerwater on R63	32.700113S 25.412498E	2.3km	High visibility.
VP3	Viewsite on Bruintjieshoogte Pass	32.681138S 25.340371E	1.9km	High visibility.
VP3a	Crest of Bruintjieshoogte Pass	32.687757S 25.351308E	857m	High visibility.
VP4	Allemansfontein Farm	32.667288S 25.265467E	7.7km	Moderate visibility.
VP4a	Toekoms farm	32.696542S 25.270453E	5.4km	Partly in view shadow, facing west away from proposed wind farms.
VP5	Boschfontein Farm	32.714650S 25.265360E	5.1km	Moderate-high visibility.
VP5a	Woodcliffe farm	32.743777S 25.234579E	8.2km	Derelict farmstead, surrounded by trees and facing south away from proposed wind farms.
VP6	Intersection with Pearston District Road	32.750674S 25.209773E	10.7km	Marginal visibility.
VP6a	Blaaukrantz farm	32.775372S 25.213988E	11.5km	Partly in view shadow, surrounded by trees, facing south away from proposed wind farms.
VP7	Vaalklip Farm Gate (game farm)	32.786705S 25.232462E	10.5km	Partly in view shadow.
VP8	District road near Coetzenburg and Wentworth farms	32.750093S 25.510084E	Road: 12.1km Farms: ±10km	Marginal visibility.
VP9	District road near Kaalplaas (East Cape Safaris Game Farm)	32.818506S 25.458107E	Road: 7.1km Farm: 4.7km	Moderate-high visibility.
VP10	District road near Uitkomst farm	32.838857S 25.430732E	Road: 5.6km Farm: 4.5km	Moderate-high visibility.

The overall visual impact intensity is assessed in Tables 7 and 8 below, using the criteria described above.

Table 7: Visual Impact Intensity (severity): Wind Farms

Visual Criteria	Comments	North WEF	Central WEF	South WEF
Visibility of turbines (distance)	Visible from R63, farmsteads, game farms.	High	Medium	Medium
Visibility of lights at night	Navigation lights on turbines, security lighting at substation/s, O&M buildings.	Medium	Medium	Medium
Visual exposure (viewshed)	Exposed upland, partly screened by landforms mainly to the north and west.	Medium	Medium	Medium
Landscape integrity (rural intactness)	Rural cattle farming character.	Medium	Medium	Medium
Landscape sensitivity (features, receptors)	Escarpment, R63 / *Bruinjieshoogte* Pass, Protected Environment.	High	Medium	Medium
Visual absorption capacity	Visually exposed upland plateau, with some screening by topography.	Med-High	Med-High	Med-High
Overall impact intensity	Summary	**Med-high**	**Medium**	**Medium**

Table 8: Visual Impact Intensity (severity): Powerline Grid

Visual Criteria	Comments	North Grid	Central Grid	South Grid
Visibility of powerline (distance from viewpoints)	Visible from R63, farmsteads, game farms.	Low	Low	Low
Visibility of access roads	Mainly gravel access roads.	Low	Low	Low
Visual exposure	Exposed upland, partly screened by landforms.	Med-low	Med-low	Medium
Landscape integrity (rural intactness)	Rural cattle farming character.	Medium	Medium	Medium
Landscape sensitivity (features, receptors)	Ridgelines, R63, Protected Environment.	Med-low	Med-low	Med-low
Visual absorption capacity	Visually exposed upland plateau, with some screening by topography.	Medium	Medium	Medium
Overall impact intensity	Summary	**Med-low**	**Med-low**	**Med-low**

12 Visual Impact Assessment: Proposed Wind Farms

Each of the 3 Highlands Wind Farms and each of the 3 grid connections are assessed separately in the following tables using the methodology provided by Arcus (2018). The significance ranking of visual impacts was based on Hacking. The construction phase would be similar for all 3 wind farms.

Status (positive or negative type impact):

The status, or nature of the visual impact, is considered to be **negative**, given the height of the wind turbines and the scale of the proposed wind farm, in relation to the landscape character of the area.

Extent (spatial scale):

The zone of visual influence would not exceed about 20km, and the visual receptors would be restricted to users of the R63 and local farmsteads. The assigned value would therefore be local **(medium)** for wind turbines and site **(low)** for the powerline and related infrastructure.

Duration (temporal scale):

The predicted life-span of the proposed wind farms and powerline is expected to be more than 15 years, and therefore the assigned numerical value is **long term (high).** Construction phase would be **short-term (low)**.

Intensity (severity or degree of alteration):

Based on the potential visual impacts outlined in Section 11 above it is expected that the intensity of the impacts would be **medium to medium-high** for the proposed wind farms, and **low- medium** for the powerline and related infrastructure. (See Tables 7 and 8).

Consequence:

Consequence is calculated as a combination of intensity + extent + duration in conjunction with status. Consequence during the construction period would be lower because it is short term.

Probability (likelihood):

The likelihood of the potential wind farm visual impacts occurring is **high** without and **medium** with mitigation, given the scale of the proposed wind farm and the exposed nature of the terrain, and less certainty about the effect of the mitigations.

Significance:

Significance is determined by combining consequence with probability, firstly without mitigation and then with mitigation measures in place. The level of significance is calculated automatically in the visual assessment tables below.

Confidence:

The confidence rating for the visual impact findings is **high** based on the field work, viewshed mapping and photomontages, as well as experience with similar visual effects of wind farms elsewhere. Confidence with mitigation may tend to be less predictable.

Reversibility:

The potential visual impacts are reversible over the long term if the wind farm is decommissioned and the site rehabilitated, the assigned rating for reversibility of visual impacts on the affected environment therefore being **high**.

Table 9: Wind farms – Construction Phase

Impact Phase: Construction

Potential impact description:

- Potential visual effect of construction activities, including cranes, construction traffic, dust and noise affecting the rural sense of place.
- The construction activities would be highly visible (within 2,5km) for a section of the R63, the *Bruintjieshoogte* Pass and Lekkerwater farmstead.
- The construction activities would be moderately visible (within 10km) of about 10 farmsteads in the area.
- The construction activities would be mainly local in scale but could extend further along the arterial routes in terms of heavy-duty trucks.
- The activities would be of short term duration.

	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	Low	Negative	High	Moderate	High
With Mitigation	Medium	Low	Low	Negative	Medium	Moderate	Medium

Can the impact be reversed?	YES. Through site rehabilitation.
Will impact cause irreplaceable loss of resources?	NO. Areas disturbed by construction activities can be rehabilitated.
Can impact be avoided, managed or mitigated?	YES, some mitigation has already been achieved through careful siting of wind turbines in response to specialist studies. Further mitigation can be achieved through careful siting and visual screening of related infrastructure. Visual mitigation is possible through careful siting of the construction camp and stockpiles, as well as visual screening.

Mitigation measures:

1. Substation and O&M buildings to be located in visually unobtrusive positions, or alternatively screened with earth berms and planting.
2. Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape, away from arterial or district roads, or alternatively screening measures utilized.
3. Clear demarcation of construction camps, limited in size to only that which is essential.
4. Employment of dust suppression and litter control measures. Formulation and adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO).
5. Areas disturbed during construction to be rehabilitated to original state.

Table 10: Highlands North WEF – Operation Phase

Impact Phase: Operation							
Potential impact description: • Potential visual intrusion of wind turbines, assembly pads, access roads, substation, and operations/maintenance buildings on the rural landscape. • Navigation lights on the turbines and security lighting at the substation at night. • Highly visible (within 2,5km) for a section of the R63, the *Bruintjieshoogte* Pass and Lekkerwater farmstead. • Moderately visible (within 10km) of about 10 farmsteads in the surrounding area. • The wind farm would be local in scale, beyond the site. Navigation lights visible over longer distances. • The visual intrusion of the wind farm would be of long term duration, but is reversible.							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	High	Moderate	High
With Mitigation	Medium	Medium	Medium	Negative	Medium	Moderate	High
Can the impact be reversed?			YES, but only over the long term through decommissioning.				
Will impact cause irreplaceable loss of resources?			NO, scenic resources would be restored after decommissioning in the long term.				
Can impact be avoided, managed or mitigated?			YES, some mitigation has already been achieved through careful siting of wind turbines in response to specialist studies. Lighting and signage can be managed.				
Mitigation measures: 1. Positioning of turbines has already been mitigated through iterative layouts based on specialist studies. 2. Navigation lights to be to Civil Aviation Authority requirements. 3. Lighting at substations and O&M buildings to be minimised through use of reflectors, low-level bollard lights and movement sensors so that lights only come on when required. 4. Signage to be minimised as far as practical, and billboard type signs avoided.							

Table 11: Highlands North WEF – Decommissioning Phase

Impact Phase: Decommissioning							
Potential impact description: Potential visual intrusion of remaining structures, platform earthworks and access roads on the rural landscape.							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	High	Moderate	High
With Mitigation	Low	Low	Low	Neutral	Medium	Low	Medium
Can the impact be reversed?			YES, through removal of structures and rehabilitation of the site.				
Will impact cause irreplaceable loss of resources?			NO, the landscape would be restored after rehabilitation.				
Can impact be avoided, managed or mitigated?			YES, through removal of structures and rehabilitation of the site.				
Mitigation measures: 1. Turbines and above-ground structures to be demolished or recycled for new uses. 2. Access roads no longer required to be ripped and regraded. 3. Exposed or disturbed areas revegetated for grazing pasture or natural vegetation to blend with surroundings.							

Table 12: Highlands Central WEF – Operation Phase

Impact Phase: Operation

Potential impact description:

- Potential visual intrusion of wind turbines, assembly pads, access roads, substation, and operations/maintenance buildings on the rural landscape.
- Navigation lights on the turbines and security lighting at the substation would be visible at night.
- Highly visible (within 2,5km) from the protected area to the west, and moderate to highly visible (within 5km) for a section of the R63, the *Bruintjieshoogte* Pass and 3 farmsteads.
- Moderately visible (within 10km) of another 5 farmsteads in the area.
- The wind farm would be local in scale, beyond the site. Navigation lights visible over longer distances.
- The visual intrusion of the wind farm would be of long term duration, but is reversible.

	Intensity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	Medium	Negative	High	Moderate	High
With Mitigation	Medium	Medium	Medium	Negative	Medium	Moderate	Medium

Can the impact be reversed?	YES, but only over the long term through decommissioning.
Will impact cause irreplaceable loss of resources?	NO, scenic resources would be restored after decommissioning in the long term.
Can impact be avoided, managed or mitigated?	YES, some mitigation achieved through careful siting of wind turbines in response to specialist studies. Lighting and signage can be managed.

Mitigation measures:

1. Positioning of turbines has already been mitigated through iterative layouts based on specialist studies.
2. Navigation lights to be to Civil Aviation Authority requirements.
3. Lighting at substations and O&M buildings to be minimised through use of reflectors, low-level bollard lights and movement sensors so that lights only come on when required.
4. Signage to be minimised as far as practical, and billboard type signs avoided.

Table 13: Highlands Central WEF – Decommissioning Phase

Impact Phase: Decommissioning

Potential impact description:

Potential visual intrusion of remaining structures, platform earthworks and access roads on the rural landscape.

	Intensity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	Medium	Negative	High	Moderate	High
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium

Can the impact be reversed?	YES, through removal of structures and rehabilitation of the site.
Will impact cause irreplaceable loss of resources?	NO, the landscape would be restored after rehabilitation.
Can impact be avoided, managed or mitigated?	YES, through removal of structures and rehabilitation of the site.

Mitigation measures:

1. Turbines and above-ground structures to be demolished or recycled for new uses.
2. Access roads no longer required to be ripped and regraded.
3. Exposed or disturbed areas revegetated to grazing pasture or natural vegetation to blend with surroundings.

Table 14: Highlands South WEF – Operation Phase

Impact Phase: Operation

Potential impact description:

- Potential visual intrusion of wind turbines, assembly pads, access roads, substation, and operations/maintenance buildings on the rural landscape.
- Navigation lights on the turbines and security lighting at the substation would be visible at night.
- The construction activities would be moderate to highly visible (within 5km) from 4 farmsteads, and only moderately visible (within 10km) for a section of the R63, the *Bruintjieshoogte* Pass and 1 farmstead.
- The wind farm would be local in scale, beyond the site. Navigation lights visible over longer distances.
- The visual intrusion of the wind farm would be of long term duration, but is reversible.

	Intensity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Low	High	Negative	High	Moderate	High
With Mitigation	Medium	Low	High	Negative	Medium	Moderate	Medium

Can the impact be reversed?	YES, but only over the long term through decommissioning.
Will impact cause irreplaceable loss of resources?	NO, scenic resources would be restored after decommissioning in the long term.
Can impact be avoided, managed or mitigated?	YES, some mitigation achieved through careful siting of wind turbines in response to specialist studies. Lighting and signage can be managed.

Mitigation measures:

1. Positioning of turbines has already been mitigated through iterative layouts based on specialist studies.
2. Navigation lights to be to Civil Aviation Authority requirements.
3. Lighting at substations and O&M buildings to be minimised through use of reflectors, low-level bollard lights and movement sensors so that lights only come on when required.
4. Signage to be minimised as far as practical, and billboard type signs avoided.

Table 15: South WEF – Decommissioning Phase

Impact Phase: Decommissioning

Potential impact description:

Potential visual intrusion of remaining structures, platform earthworks and access roads on the rural landscape.

	Intensity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Low	High	Negative	High	Moderate	High
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium

Can the impact be reversed?	YES, through removal of structures and rehabilitation of the site.
Will impact cause irreplaceable loss of resources?	NO, the landscape would be restored after rehabilitation.
Can impact be avoided, managed or mitigated?	YES, through removal of structures and rehabilitation of the site.

Mitigation measures:

1. Turbines and above-ground structures to be demolished or recycled for new uses.
2. Access roads no longer required to be ripped and regraded.
3. Exposed or disturbed areas revegetated to grazing pasture or natural vegetation to blend with surroundings.

13 Visual Impact Assessment: Proposed Grid Connections

The 3 Highlands grid connection phases all terminate near the R63 Route. All 3 phases, including alternatives, are similar in nature, and are therefore included in the same tables for the construction, operation and decommissioning phases.

Although the South grid connection (Phase 3) is longer than the North and Central grids, the zones of visibility, indicated on Maps 11, 12 and 13 are confined to the wind farm site and the visual significance would therefore be similar to that of the North and Central grids.

The preferred route of the two provided is the eastern route (see Maps 12 and 13), and the western one on Map 11, being the shortest route, and because it is located in a lower lying area and therefore less visible on the skyline.

13.1 Highlands North, Central and South Grid Connections

Table 16: Powerline Grid – Construction Phase

Impact Phase: Construction							
Potential impact description: • Potential visual effect of construction activities, including cranes, construction traffic, dust and noise affecting the rural sense of place. • The construction activities would be highly visible (within 500m) for a short section of the R63. • The construction activities would be at the site scale. • The construction activities would be of short term duration.							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	Low	Negative	Low	Low	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?			YES. Through site rehabilitation.				
Will impact cause irreplaceable loss of resources?			NO. Areas disturbed by construction activities can be rehabilitated.				
Can impact be avoided, managed or mitigated?			YES. Some visual mitigation is possible through careful siting and screening of the construction camps and stockpiles, and rehabilitation of disturbed areas.				
Mitigation measures: 1. Location of the powerline off ridgelines and crests where possible to minimize skyline effects. 2. Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape, away from arterial or district roads, or alternatively screening measures utilized. 3. Clear demarcation of construction camps, limited in size to only that which is essential. 4. Employment of dust suppression and litter control measures. Formulation and adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO). 5. Existing roads used where possible for access / maintenance roads. 6. Areas disturbed during construction to be rehabilitated to original state.							

Table 17: Powerline Grid – Operation Phase

Impact Phase: Operation							
Potential impact description: • Potential visual intrusion of powerline pylons on the rural landscape. • The powerlines would be highly visible (within 500m) for a short section of the R63. • The powerlines would be at the site scale. • The visual intrusion of the powerlines would be of long term duration.							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	High	Negative	High	Moderate	High
With Mitigation	Medium	Low	High	Negative	High	Moderate	High
Can the impact be reversed?			YES, but only over the long term through decommissioning.				
Will impact cause irreplaceable loss of resources?			NO, scenic resources would be restored after decommissioning in the long term.				
Can impact be avoided, managed or mitigated?			No, there is little or no potential for mitigation, except for micro-siting of pylons.				
Mitigation measures: 1. Ridgelines and crests to be avoided in micro-siting of pylons. 2. Monopoles to be used in preference to Lattice pylons where possible.							

Table 18: Powerline Grid – Decommissioning Phase

Impact Phase: Decommissioning							
Potential impact description: Potential visual intrusion of pylons and access roads on the rural landscape.							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	High	Negative	High	Moderate	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	Medium
Can the impact be reversed?			YES, through removal of pylons and rehabilitation of the site.				
Will impact cause irreplaceable loss of resources?			NO, the landscape/scenic resources could be restored after rehabilitation in the long term.				
Can impact be avoided, managed or mitigated?			YES, through removal of pylons and rehabilitation of the site.				
Mitigation measures: 1. Pylons to be dismantled and removed from the site on decommissioning. 2. Access roads that are no longer required to be ripped and regraded. 3. Exposed or disturbed areas revegetated to grazing pasture or natural vegetation to blend with surroundings.							

Visual Assessment of a No-go Alternative

In the no-go alternative, there would be no wind farms or additional powerlines and therefore no additional visual intrusion on the rural landscape and on surrounding farmsteads. At the same time no renewable energy would be produced at the site for export to the national grid.

The potential visual impact significance of the no-go scenario would be neutral as there would be no further visual impacts.

Visual Assessment of Cumulative Visual Impacts

The development of the proposed wind farms and grid connections, when seen together with the existing wind farms and power lines in the vicinity, would result in cumulative visual impacts resulting in further change to the largely rural character to the area.

Besides the proposed Highlands wind farms and powerline grid connections, there are existing Eskom powerlines parallel with the R63 Route, an approved solar PV farm near Pearston and a proposed Middleton wind farm south of Cookhouse on the N10 National Route, both within 35 kilometres of the Highlands site, as indicated on Map 1.

The Environmental Impact Report (EIR) for the Solar PV Farm near Pearston indicated that the visual impact would be moderate both before and after mitigation, (CEN, 2012). No specialist visual assessment was included in the EIR and no negative cumulative impacts were identified.

Except for the brief Scoping Report, no further information could be found on the proposed Middleton Wind Energy Facility, including specialist visual studies.

The fact that the proposed Highlands wind farms fall within the gazetted Cookhouse REDZ means that it would form part of a renewable energy node.

Given that the renewable energy projects mentioned above are not within viewing distance of each other and that they form part of REDZ, the cumulative visual impact significance is considered to be **low** in the local context.

14 Environmental Management Programme

Visual input into the Environmental Management Programme (EMPr) is discussed below. This should be included in the authorization for the project.

14.1 Construction Phase Monitoring:

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including siting of the construction camp and stockpiles, dust suppression and litter control measures, as well as rehabilitation of borrow pits and haul roads, with monthly reporting to an environmental management team.

Responsibility: ECO / Contractor.

Timeframe: Preparation of EMPr during the planning phase. Monitoring during the contract phase.

14.2 Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of rehabilitated areas, control of signage, lighting and wastes on the site, with interim inspections by the ECO.

Responsibility: Operating company.

Timeframe: During the operational life of the project.

14.3 Decommissioning Phase Monitoring:

Ensure that procedures for the removal of turbines, structures and internal powerlines during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority.

It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and the vegetation or grazing cover reinstated.

The revegetation measures are not described here as they would fall under the auspices of the vegetation/biodiversity specialist.

Responsibility: Operating company / qualified rehabilitation ecologist or horticulturist.

Timeframe: During the decommissioning contract phase, as well as a prescribed maintenance period thereafter (usually one year).

15 Findings and Recommendations

Wind Farm Assessment:

The potential visual impact significance of the proposed Highlands wind farms during construction would be **Moderate**. The North wind farm could be **Moderate** during the operation phase, but being in close proximity to the R63 Route and *Bruintjieshoogte* Pass and a number of farmsteads in the area it would be higher than the Central and South wind farms, i.e. **Moderate-high**. If it is found at a later stage that not all the wind turbines are required, consideration could be given to removing turbine numbers 1 to 5 in the layout. This would help to reduce the visual significance but is not necessarily an essential mitigation.

The visual impact of the proposed Central and South wind farms would be **Moderate**, being further away from sensitive receptors. The significance for all 3 wind farms after mitigation would remain the same as mitigation has already been implemented through siting of the wind turbines in response to the specialist studies. The visual impacts are summarized in Table 19 below.

The layout of the proposed turbines in all 3 wind farms succeeds in avoiding practically all the major visual constraints for the study area, occupying the least sensitive parts of the site, as indicated on Map 7.

The fact that the proposed wind farms could potentially be dismantled during the decommissioning phase in the long term, and the site restored to more or less its original state, is a positive consideration.

Table 19: Visual Impact Significance: Wind Farms

	Without Mitigation	With Mitigation
Construction Phase: all WEFs	Moderate	Moderate
Operation Phase: North WEF	Moderate*	Moderate*
Operation Phase: Central WEF	Moderate	Moderate
Operation Phase: South WEF	Moderate	Moderate
Decommissioning Phase: North WEF	Moderate	Low
Decommissioning Phase: Central WEF	Moderate	Low
Decommissioning Phase: South WEF	Moderate	Low

* Could potentially be higher than moderate in the case of the North WEF, i.e. 'moderate-high'. (See also Table 7).

Cumulative Assessment:

When assessed together with the proposed Pearston Solar PV farm and the Middleton wind energy farm, some 35 km away, the proposed Highlands wind farms would result in little or no cumulative visual impact, distance being a mitigating factor to the point where the renewable energy facilities would not be within viewing distance of each other. In addition, the proposed Highlands wind farms form part of the Cookhouse REDZ. The cumulative visual impact significance is therefore considered to be **Low**.

Powerline Grid Assessment:

The potential visual impact significance of related powerline grid connections for the 3 wind farms, would be **Moderate** before and after mitigation. The zone of visual influence for these would be largely confined to the wind farm site and a short section of the R63, where the powerlines connect with an existing Eskom powerline. Given the smaller scale of the pylons, in comparison to the wind turbines, and therefore the smaller zone of visual influence, the significance rating could be lower than 'Moderate'. The potential visual impacts for the 3 grid connections, including the alternatives, are summarized in Table 20 below.

Of the two alternatives provided, the eastern route on Maps 12 and 13 are preferred from a visual perspective, being in a lower lying area and therefore less visible.

Table 20: Visual Impact Significance: Powerlines

	Without Mitigation	With Mitigation
Construction Phase: all powerlines	Low	Low
Operation Phase: all powerlines	Moderate*	Moderate*
Decommissioning Phase: all powerlines	Moderate*	Low

* Could potentially be lower than moderate, i.e. 'moderate-low'. (See also Table 8).

Conclusion:

It is the opinion of the Visual Specialists that the preferred Highlands wind farm layouts do not present a potential fatal flaw in visual terms. Mitigations have been implemented through various iterations and refinements to the layout taking the specialist studies into account. Additional visual mitigations have been recommended that should form part of the conditions for environmental authorisation.

Several micro-siting adjustments were made to the position of the turbines, substations and access roads during August 2018 (the Final Mitigated Layout), but these did not affect the overall visual impact significance ratings, and may have resulted in minor improvements in some cases.

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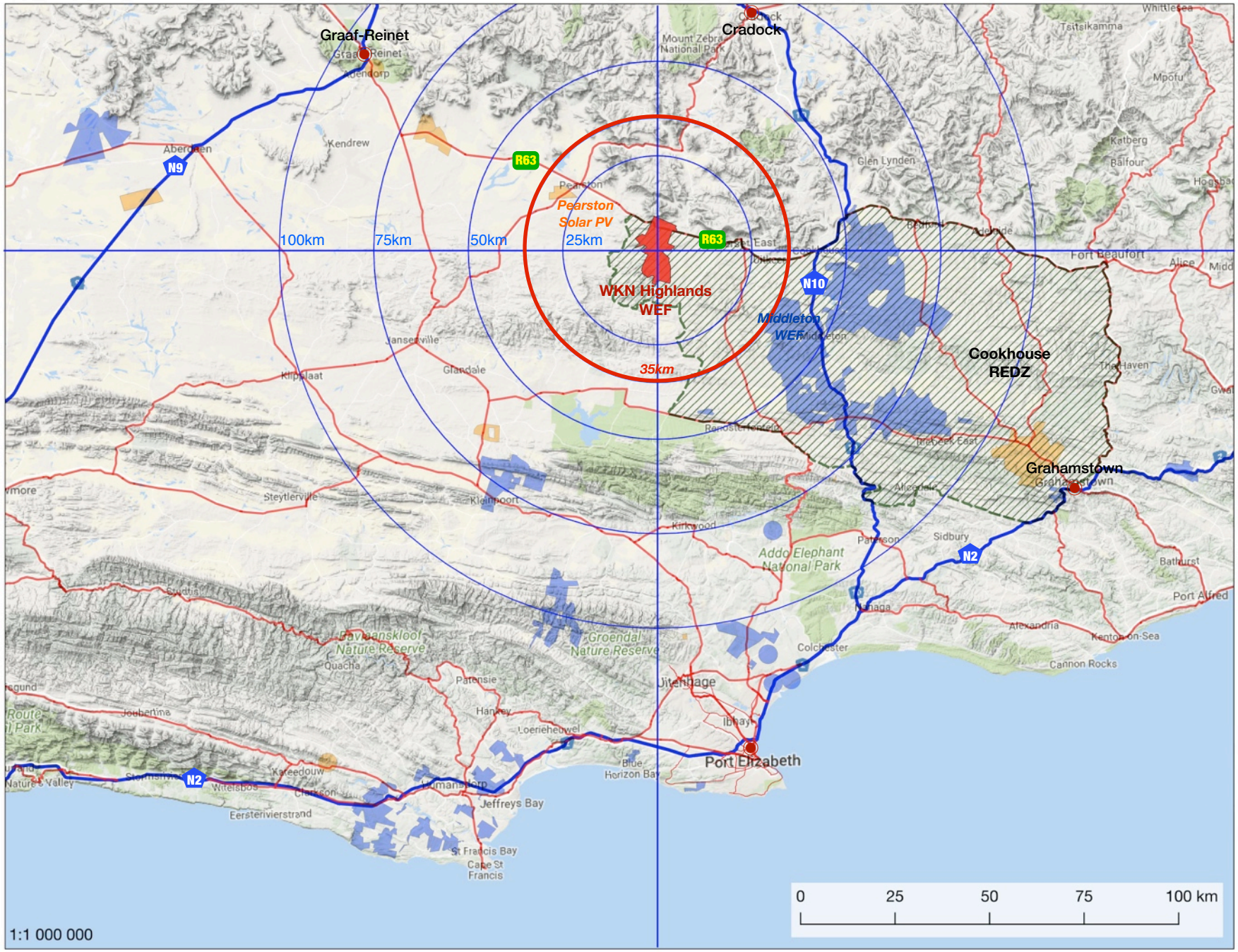
Renewable Energy Projects, Q1 2018

Onshore Wind Energy Facilities

Solar PV and CPV Facilities

Cookhouse REDZ

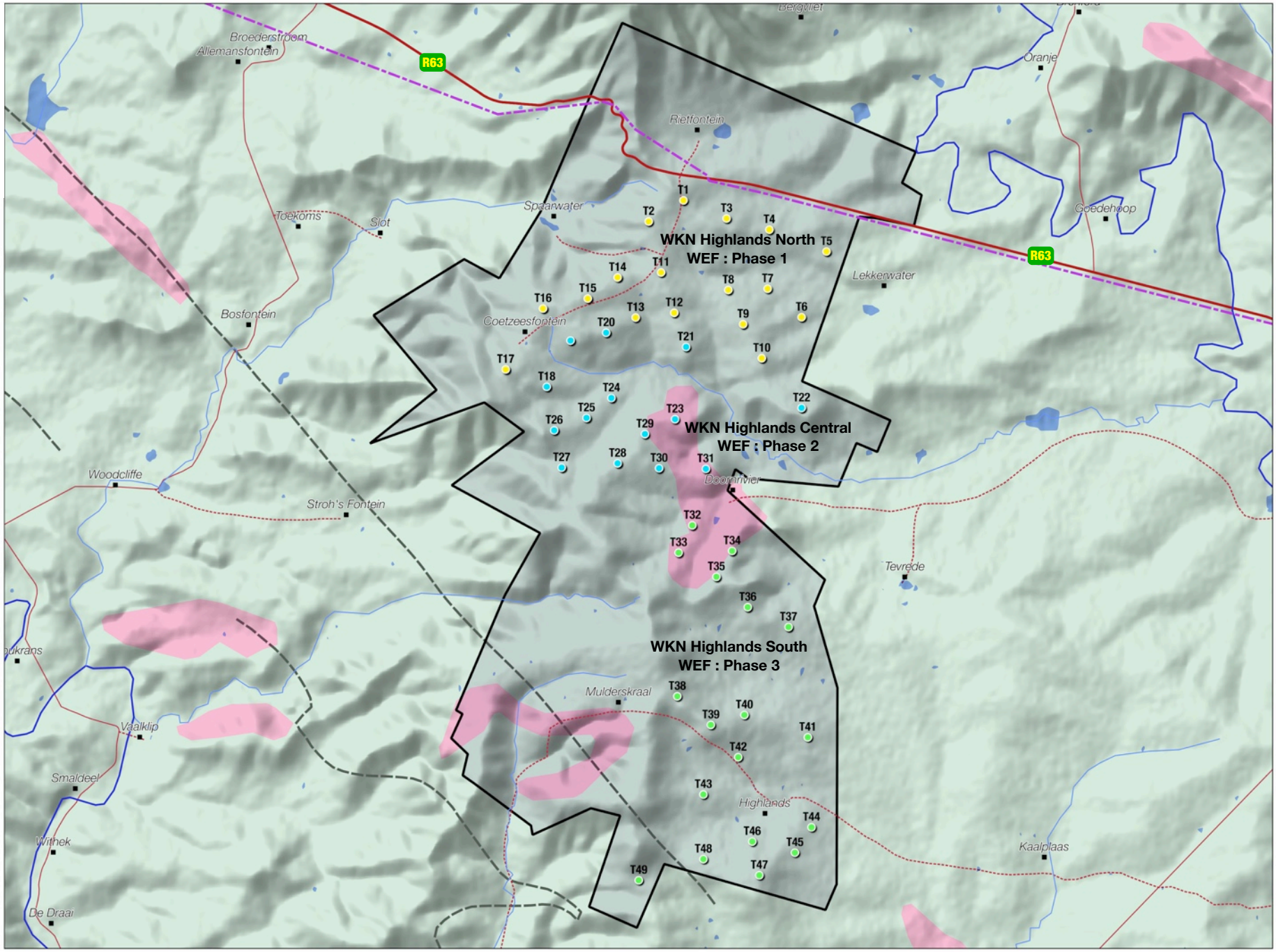


Base Map Source : Google Maps 2018, DEA GIS : REEA_OR_2018_Q1

Map 1 • Locality indicating Cumulative Renewable Energy Projects

Geology Legend :

- Adelaide Formation, Beaufort Group
- Karoo Dolerite
- Dolerite Dykes

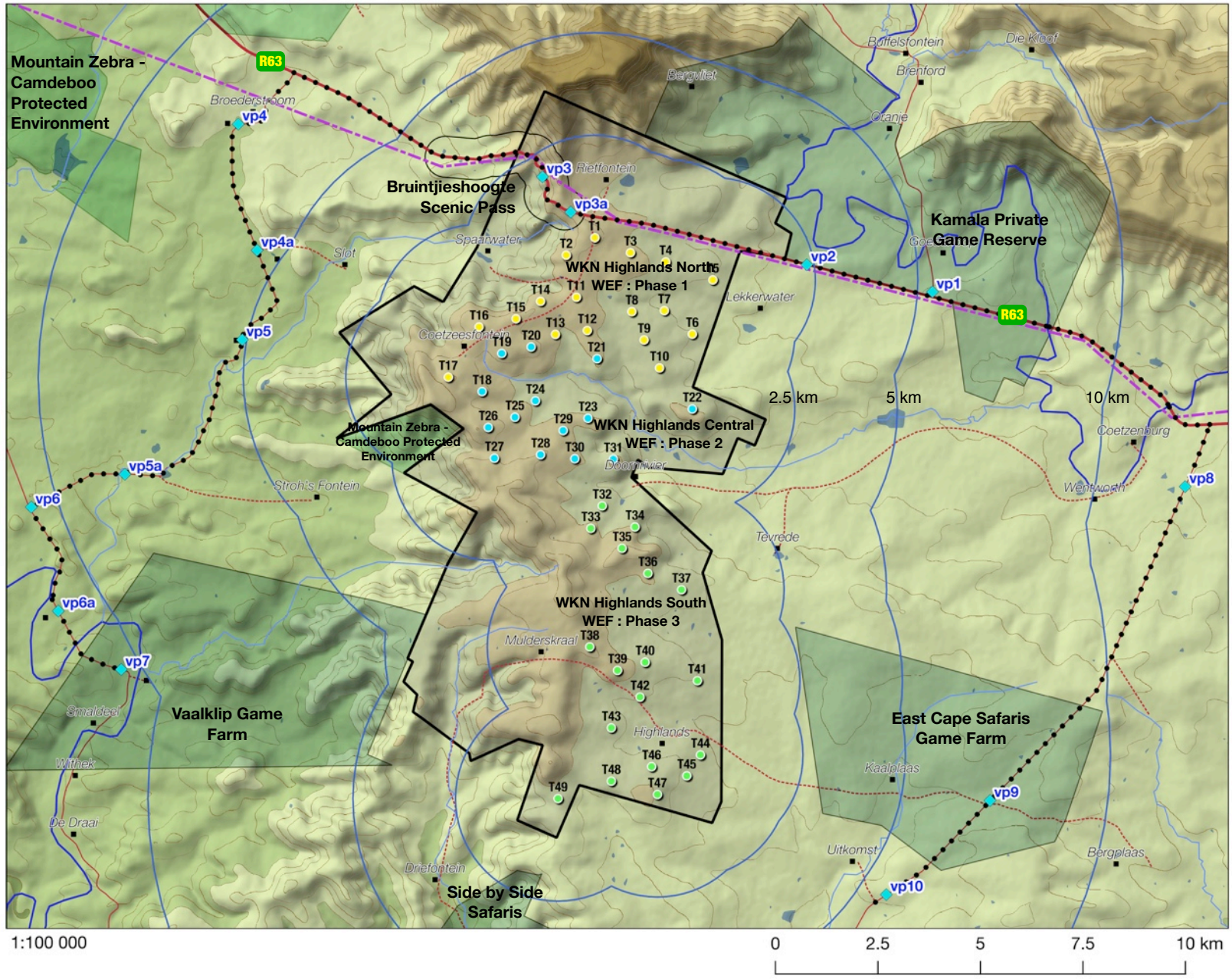


Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Council for Geosciences, Various Sources

Map 2 • Geology

Physiography :

- 500 - 750m
- 750 - 1000m
- 1000 - 1250m
- 1250 - 1500m
- 1500 - 1750m



Legend :

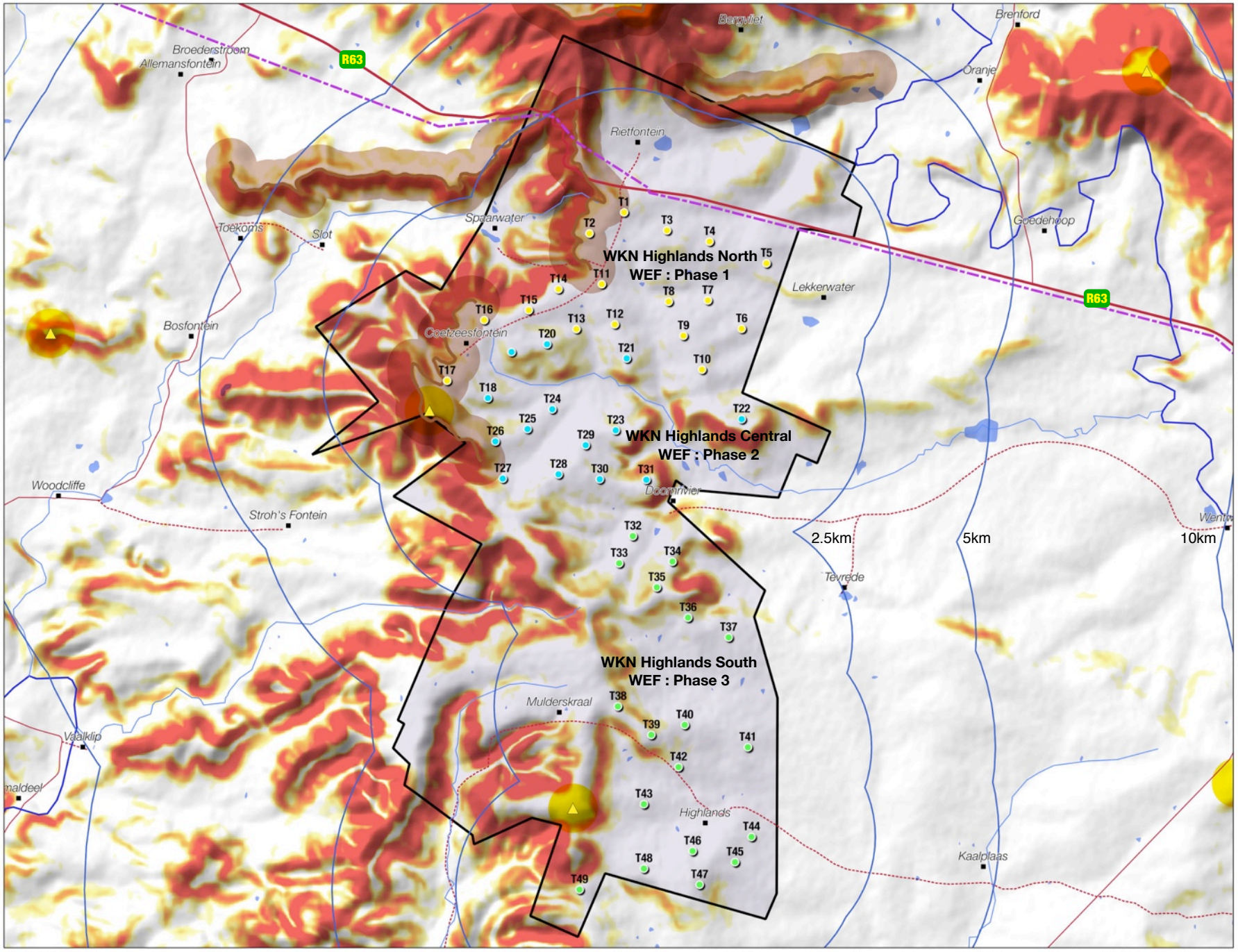
- Field Track Route
- vp6 Fieldwork Viewpoints
- T21 Wind Turbine locations
- 5 km Distance Radii

Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 3 • Physiography with 50m contours, Fieldwork and Viewpoints

Legend :

- Steep Slopes
- Topographic Features, Ridgelines
- Peaks
- Farmsteads

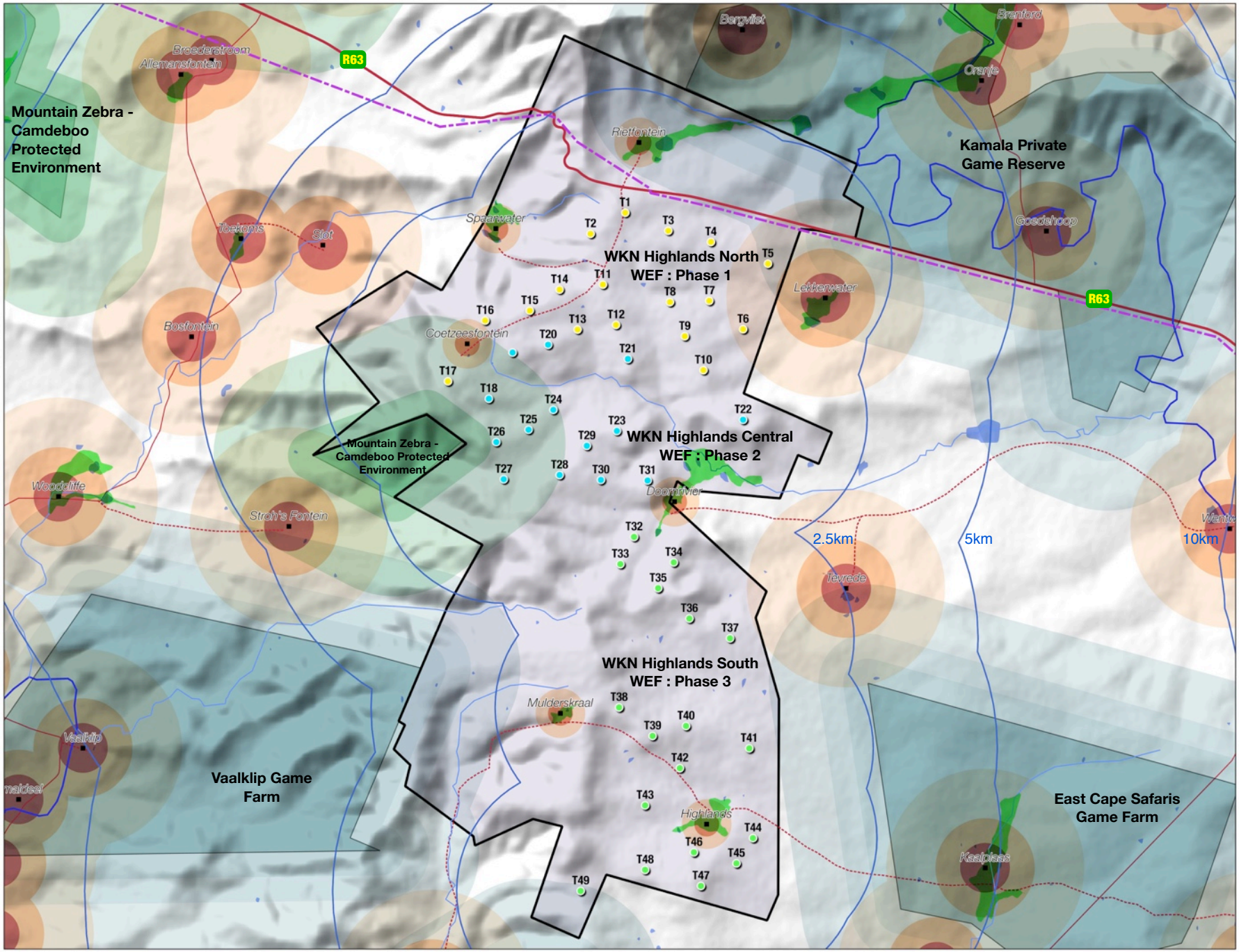


Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 4 • Steep Slopes, Topographic Features, Peaks

Legend :

- SAPAD Protected Environments
- Private Nature Reserves, Game Farms
- Farmsteads with Buffers
- Cultural Landscapes



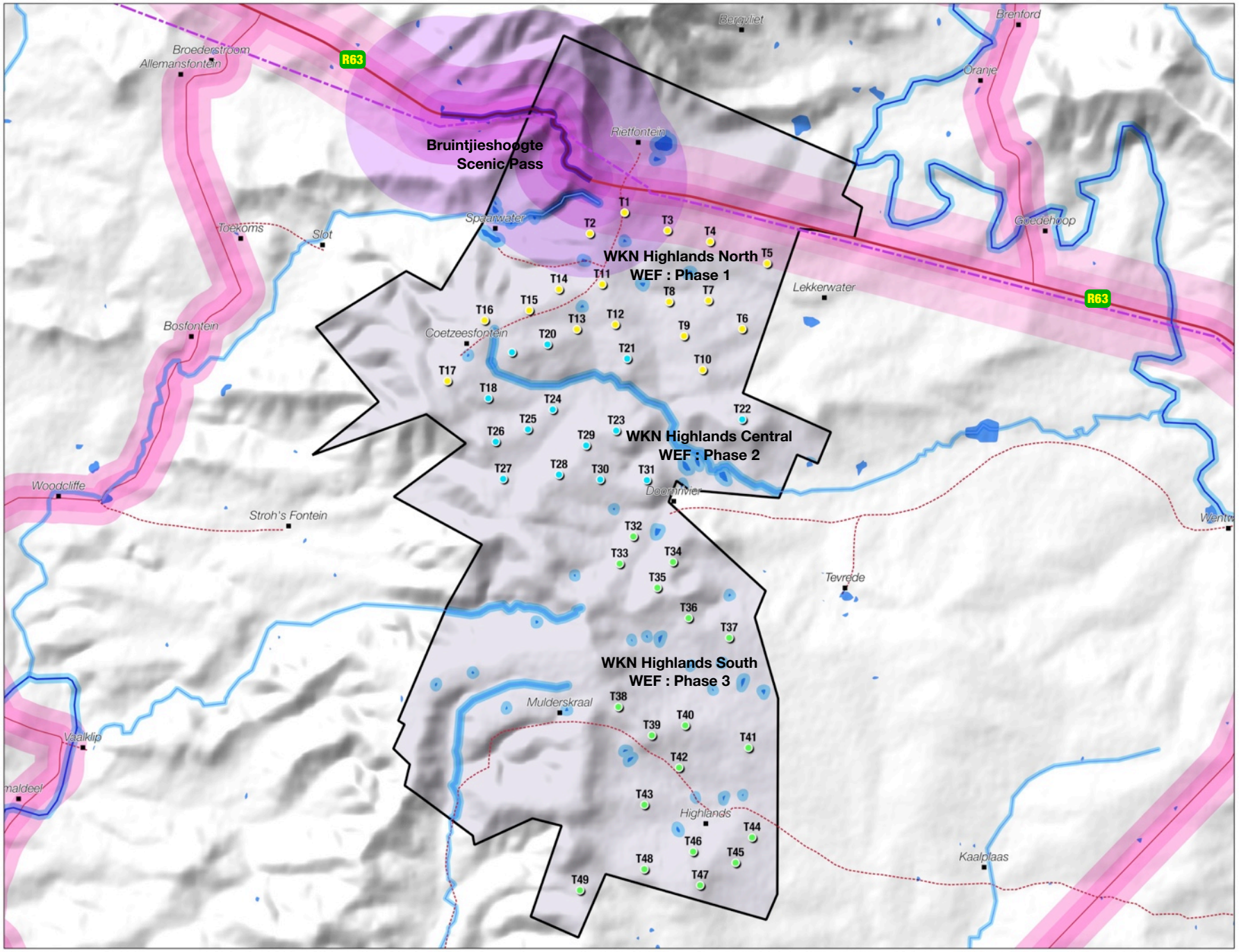
1:75 000 0 2.5 5 7.5 10 km

Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 5 • Protected Environments, Cultural Landscapes, Farmsteads with buffers

Legend :

- Arterial Route R63 and buffers
- Bruintjieshoogte Scenic Route and buffers
- District Road and buffers
- Rivers, Wetlands with buffers
- Existing ESKOM Transmission Line



1:75 000

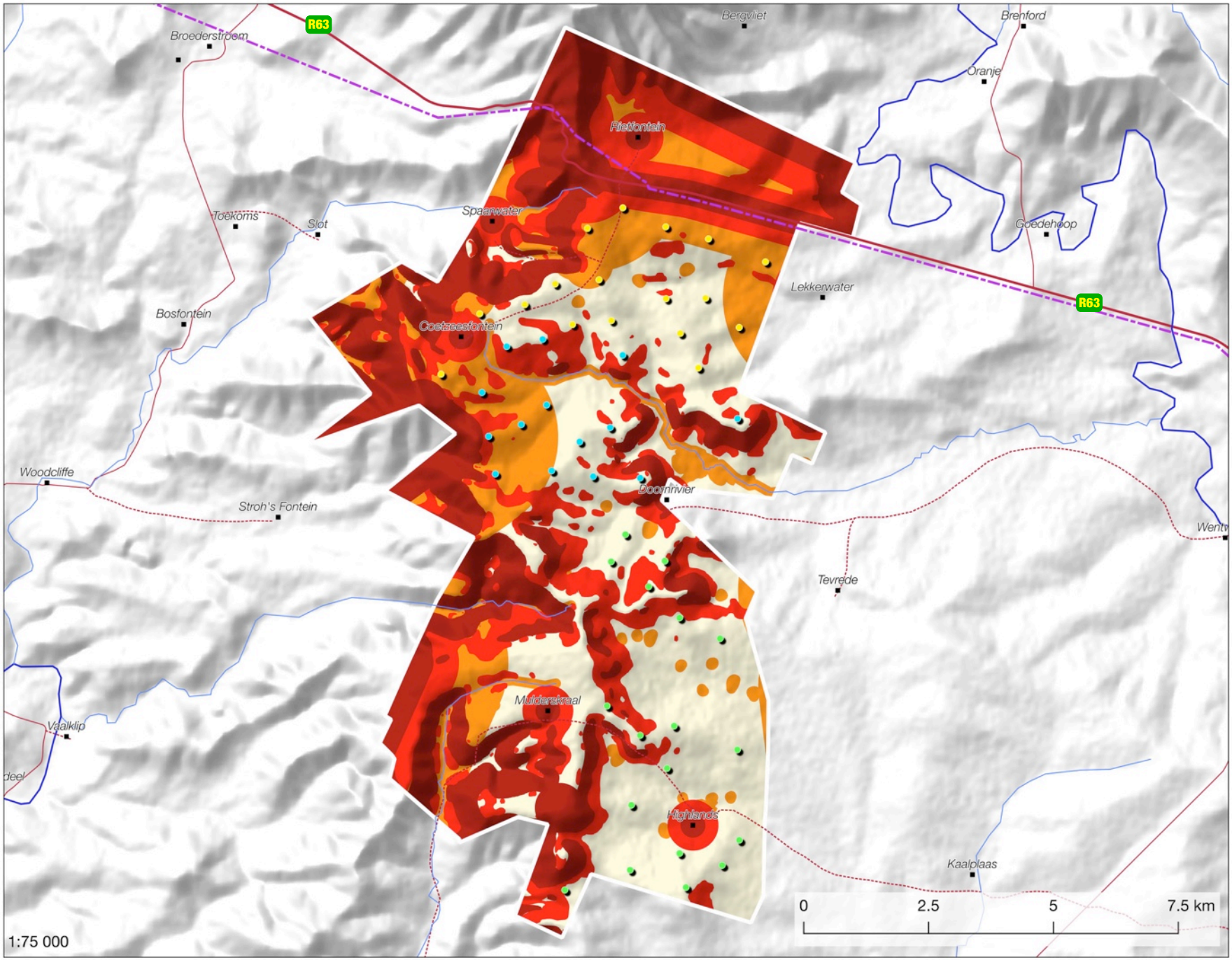
0 2.5 5 7.5 10 km

Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 6 • Scenic and Arterial Routes, Rivers and Wetlands with buffers

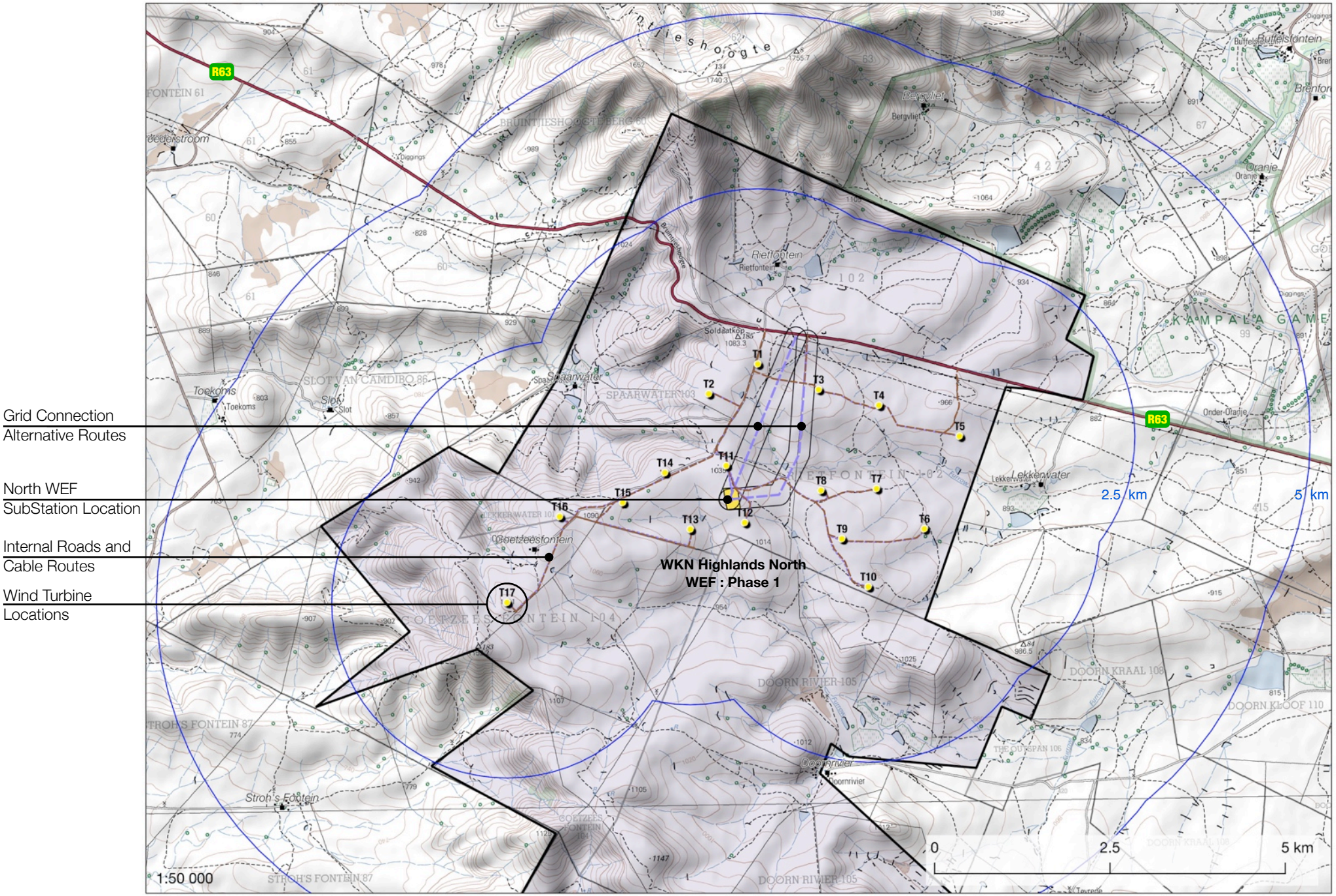
Visual Sensitivity Legend :

- Very High
- High
- Medium
- Low



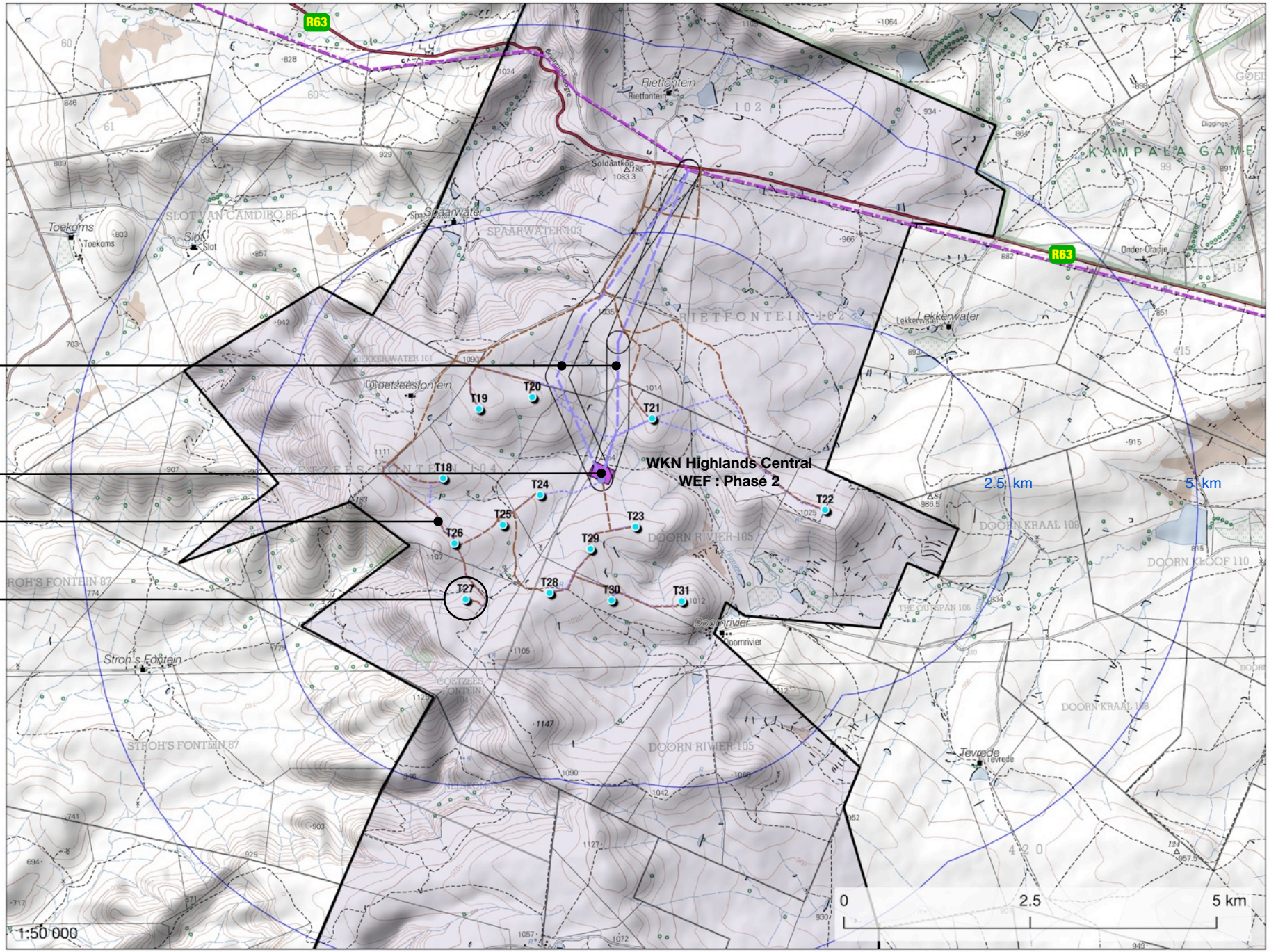
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 7 • Highlands Visual Sensitivity



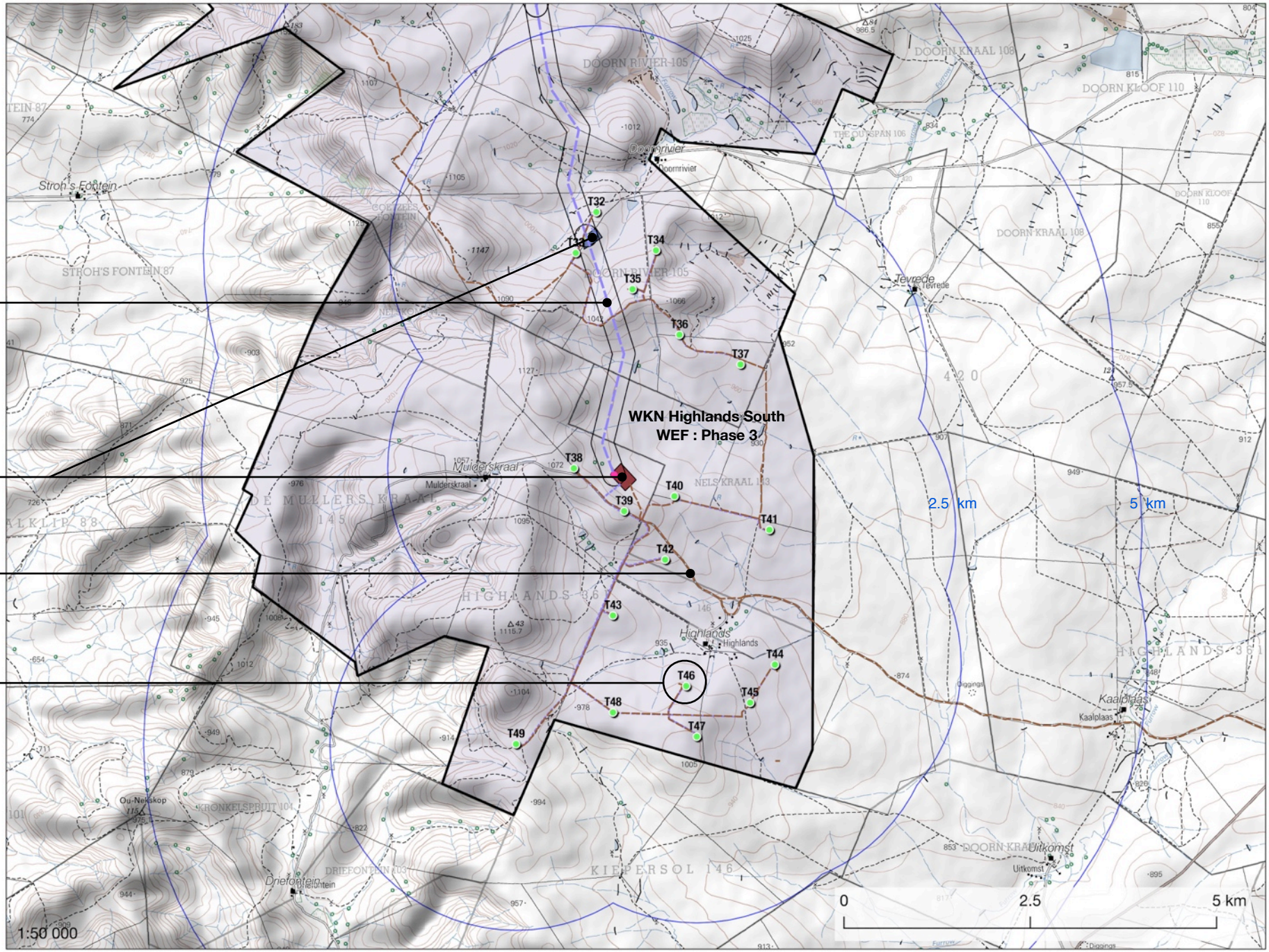
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 8 • WKN North WEF Layout



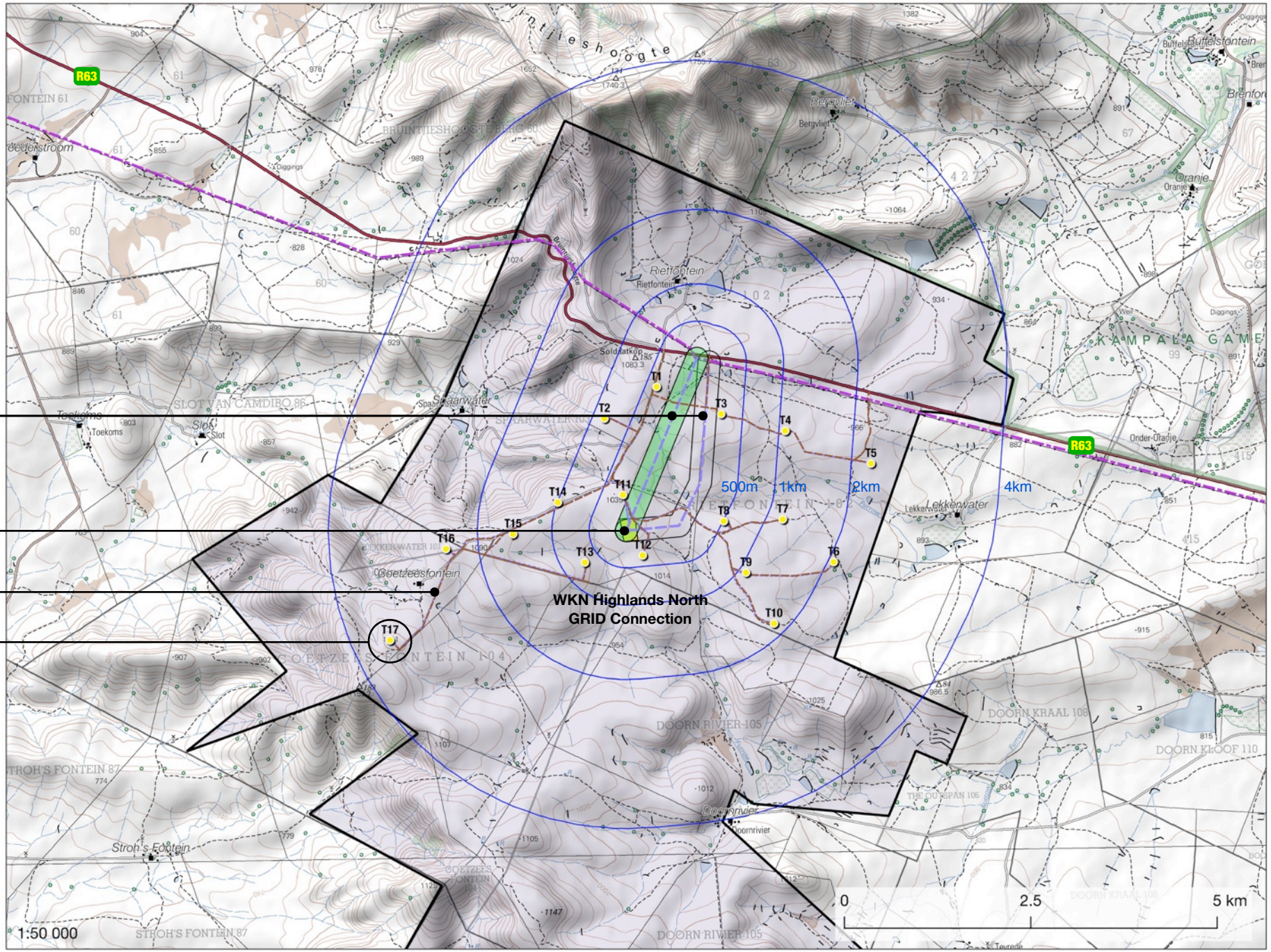
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 9 • WKN Central WEF Layout



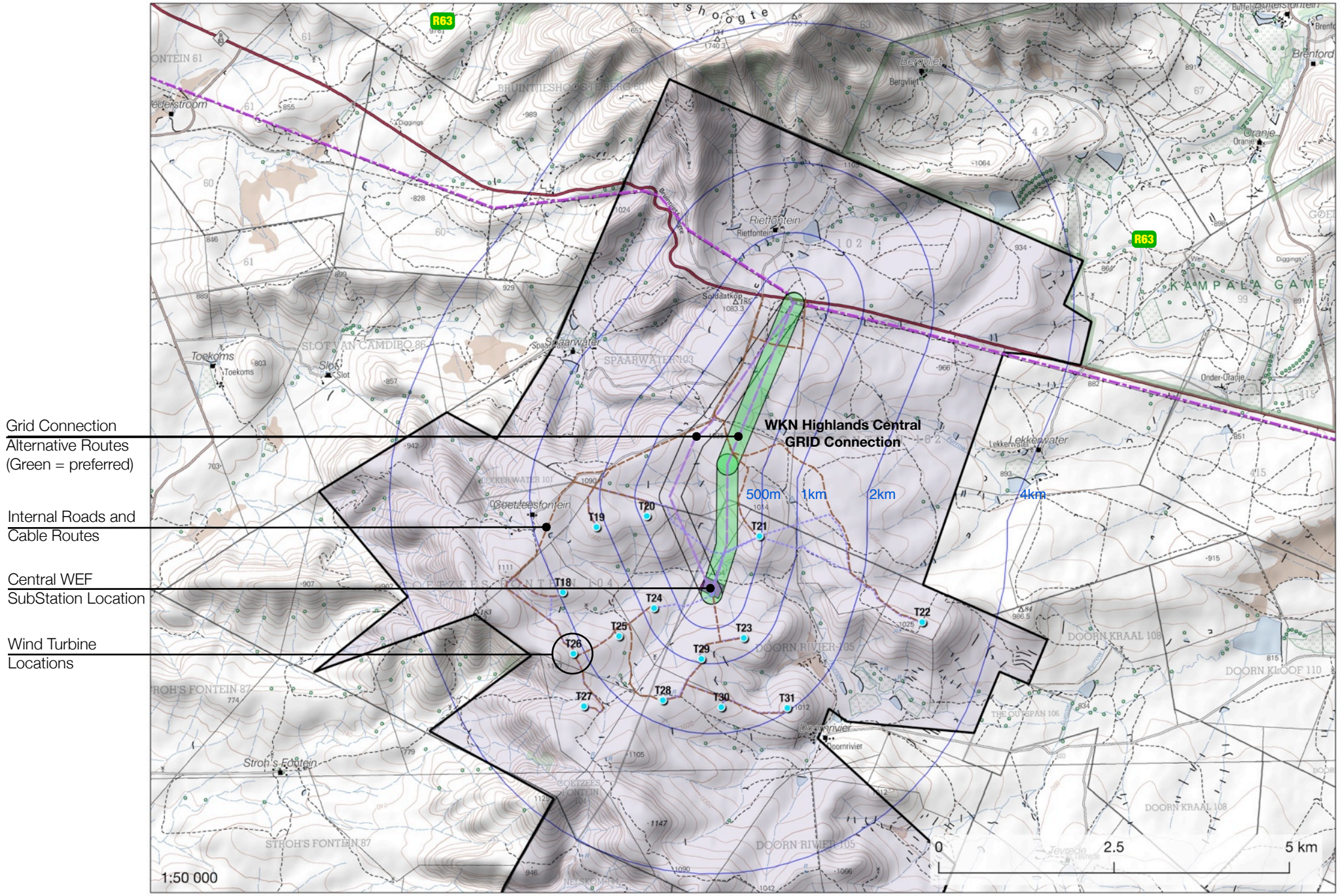
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 10 • WKN South WEF Layout



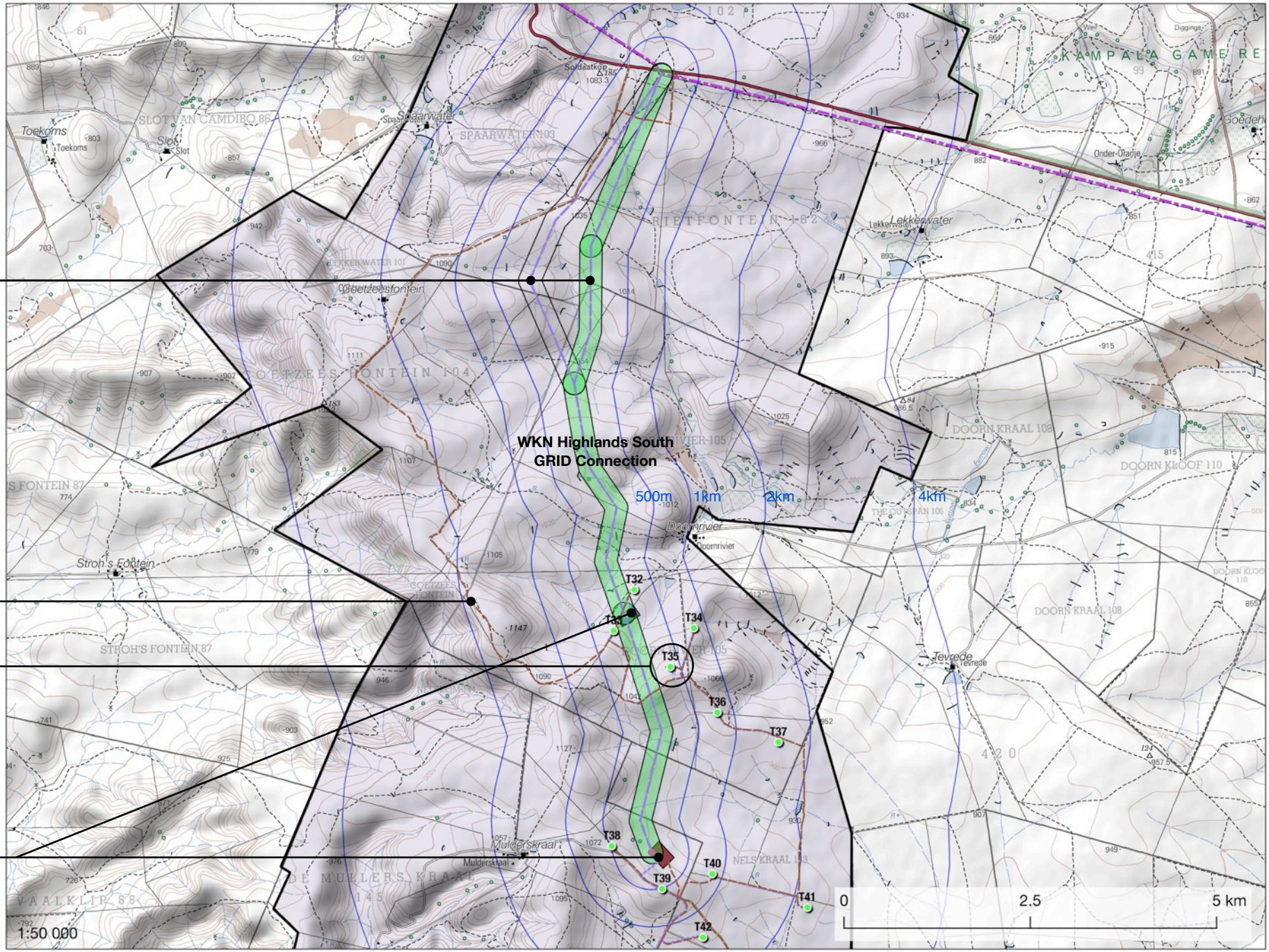
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 11 • North WEF GRID Connection Layout



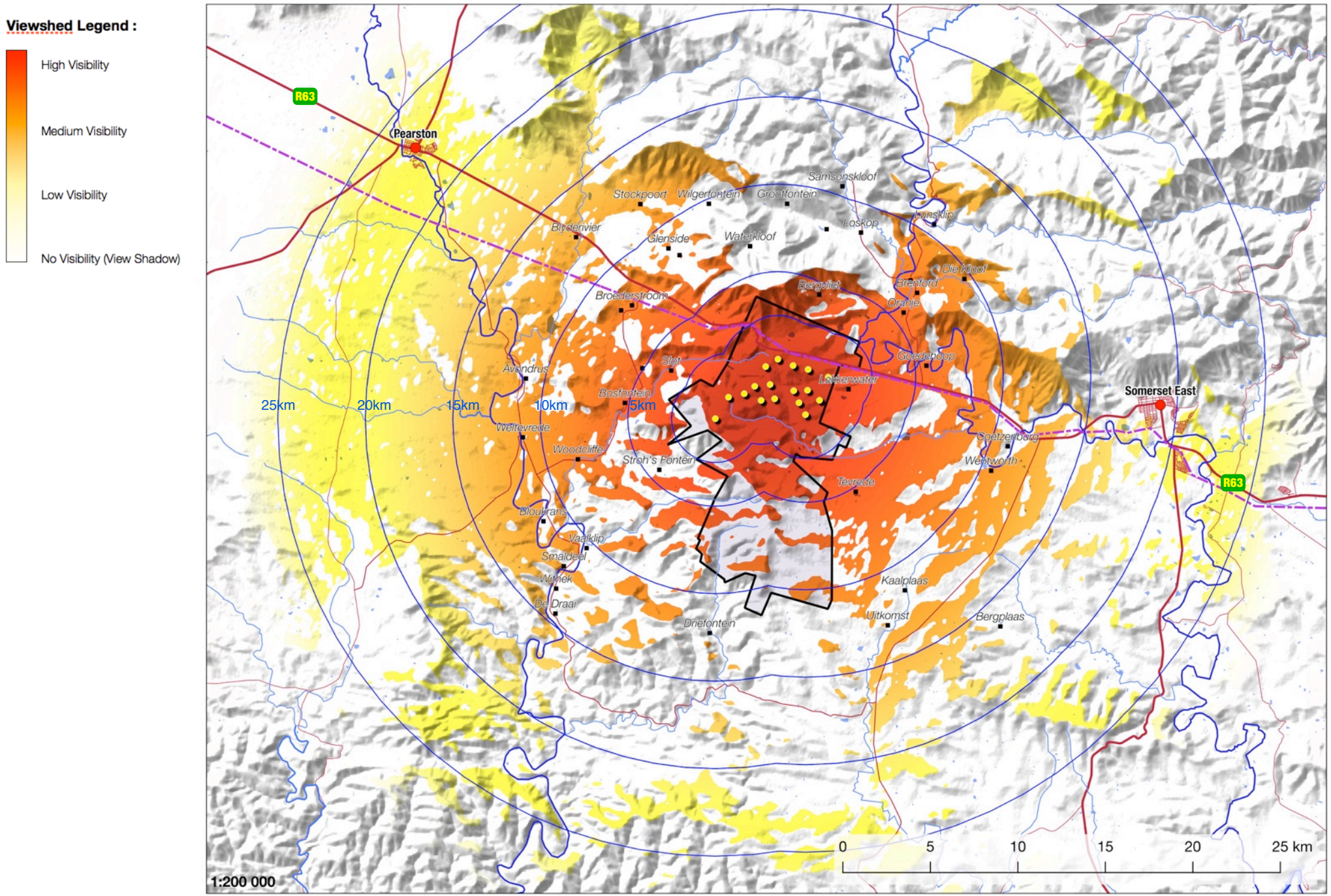
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 12 • Central WEF GRID Connection Layout



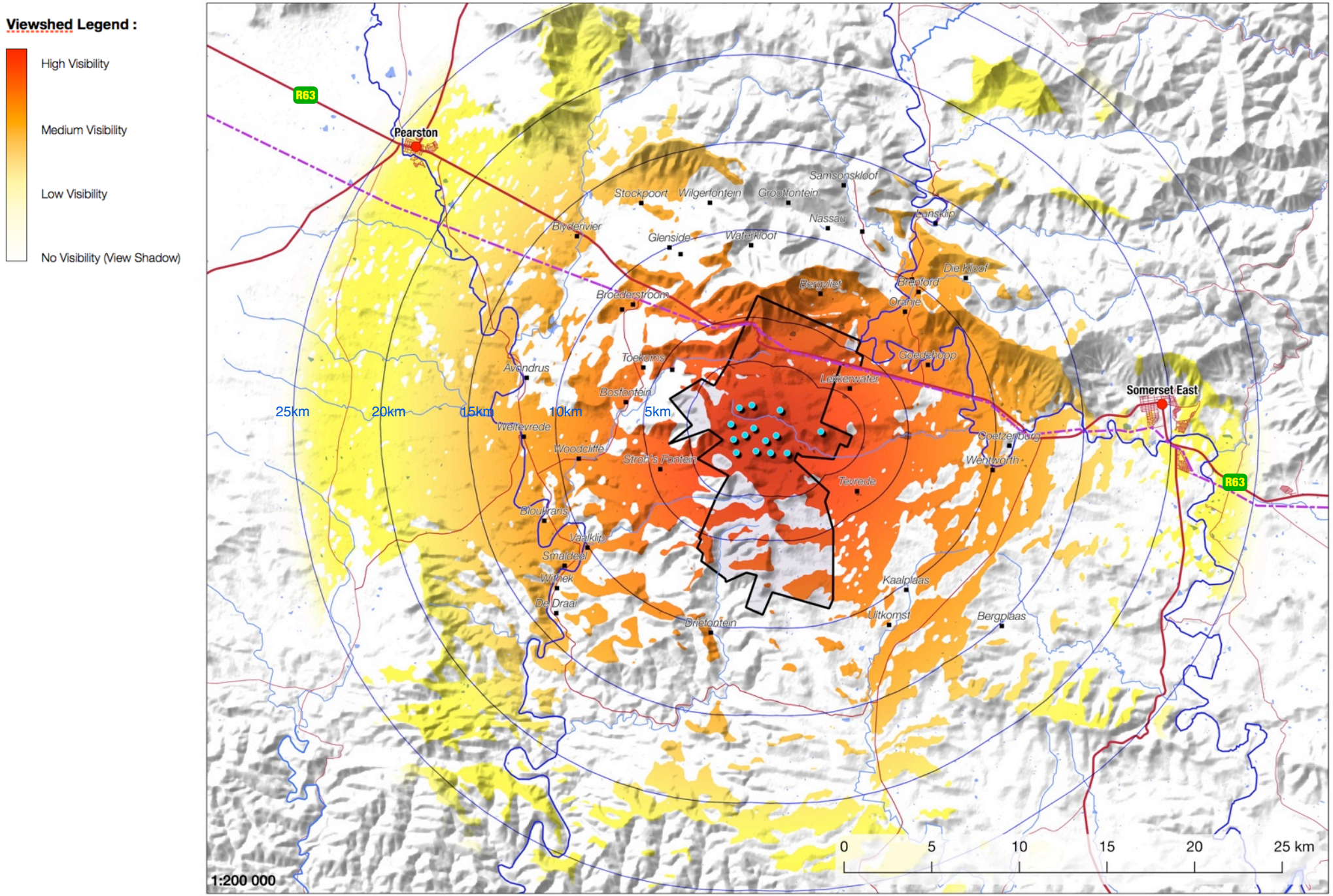
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources, NGI 1:50 000 Topographic Series : 3225 CB Bruintjieshoogte, CD The Ridges

Map 13 • South WEF Grid Connection Layout



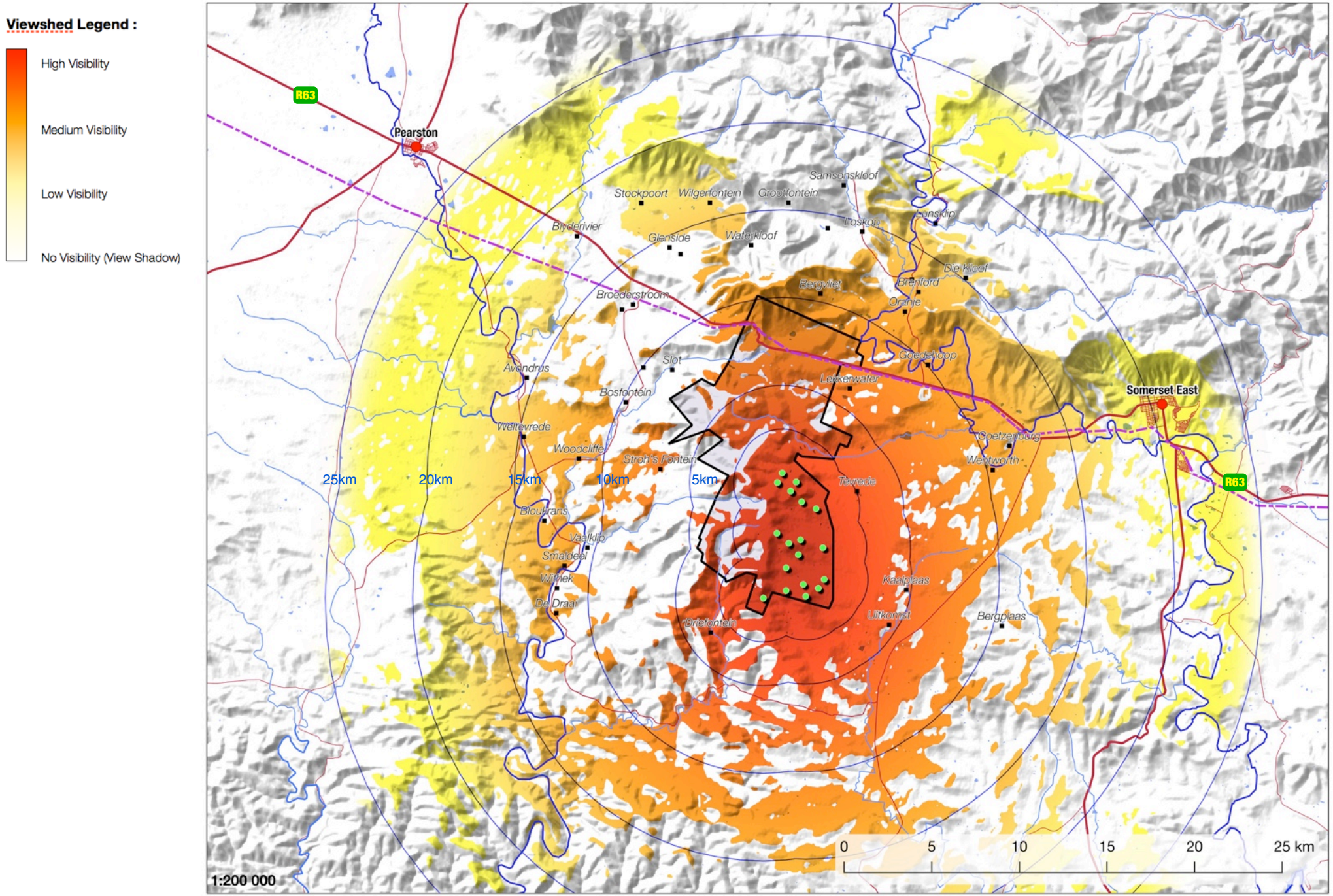
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 14 • Viewshed North WEF



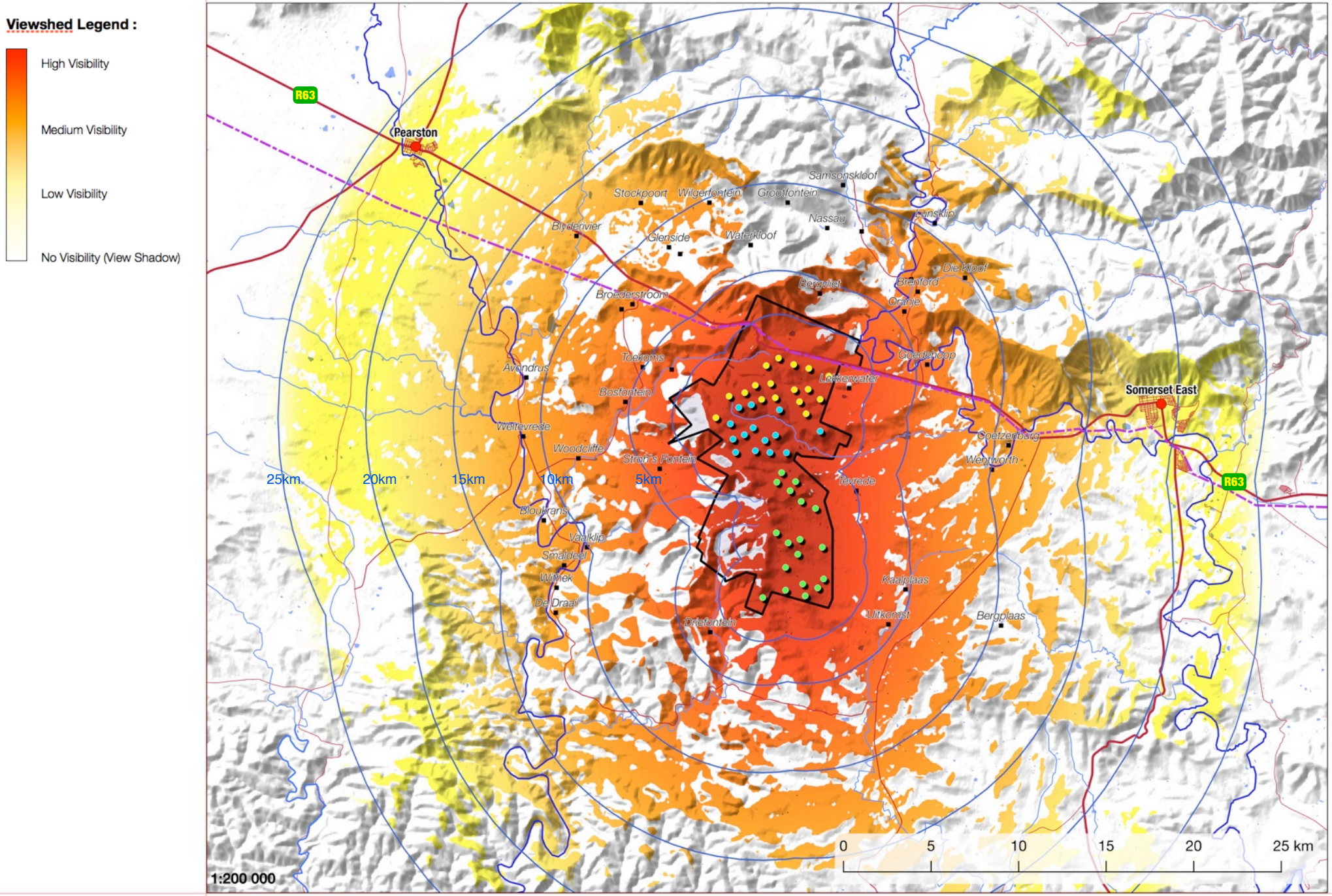
Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 15 • Viewshed Central WEF



Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 16 • Viewshed South WEF



Base Map Source : SRTM 1arcSEC DEM 2014, GIS Data ; Various Sources

Map 17 • Viewshed Combined North, Central, South WEFs

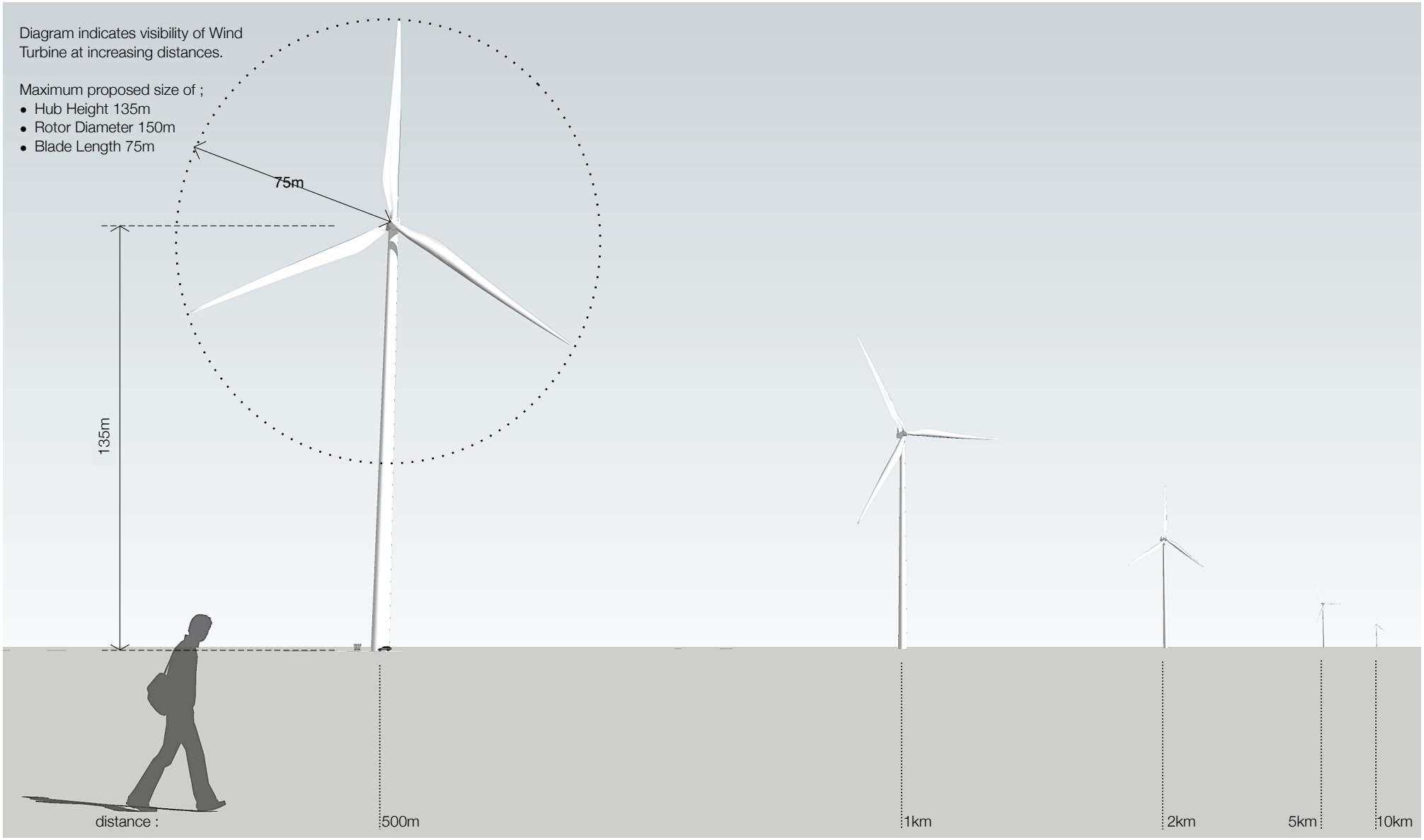


Figure 1 : WKN Highlands WEF : 3D Models : Wind Turbine Distances

3D Models : qarc 2018

Diagram indicates a notional 3D view of a
Substation and adjacent Switching Station

Assumed size of ;

- 150 x 150m footprint
- Internal gantry heights of 10 - 12m
- Buildings normal 3.5 - 5m heights
- Monopole transmission pylons 15m high

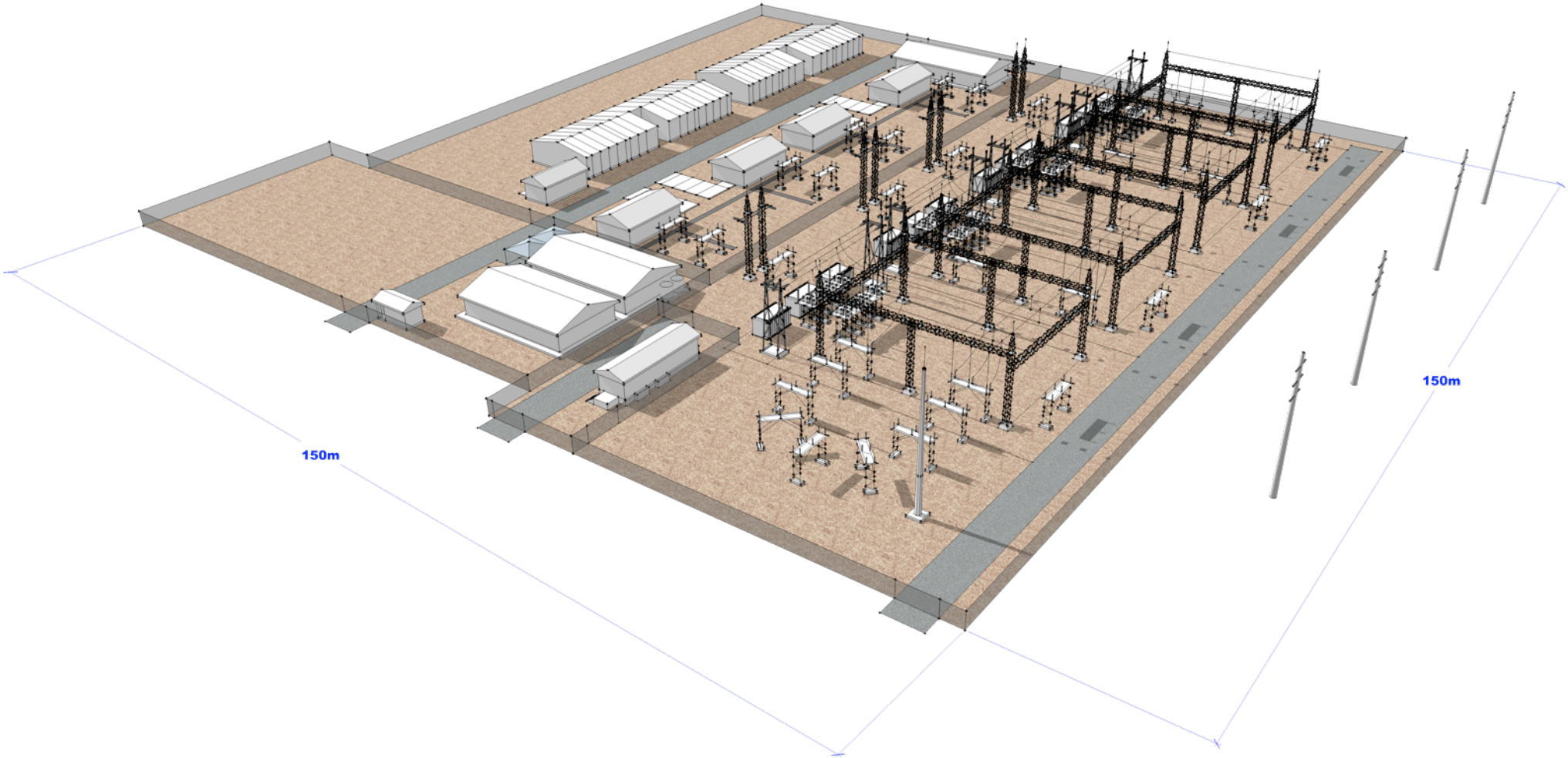
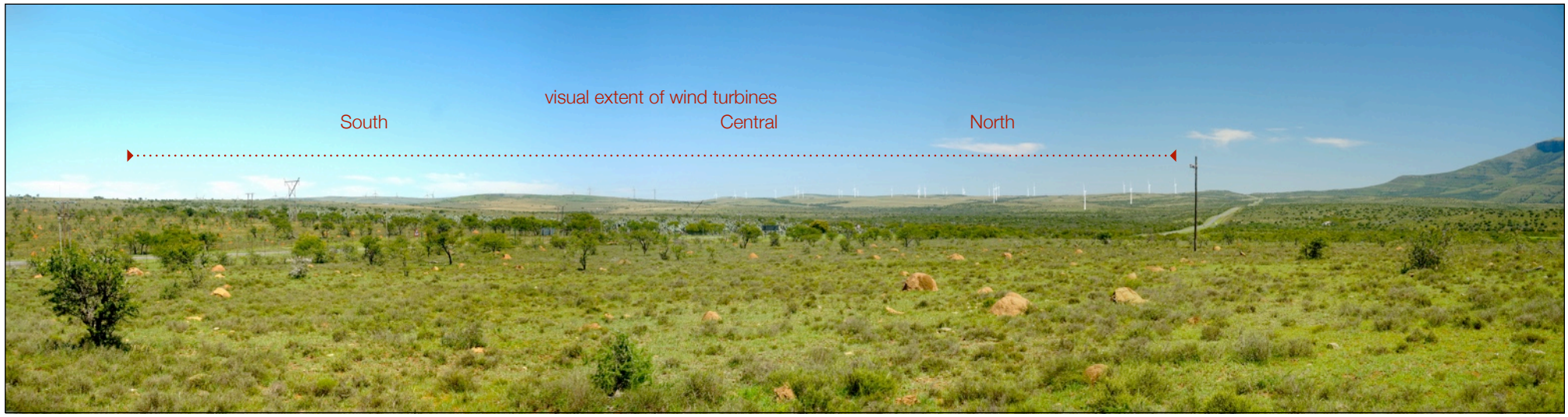
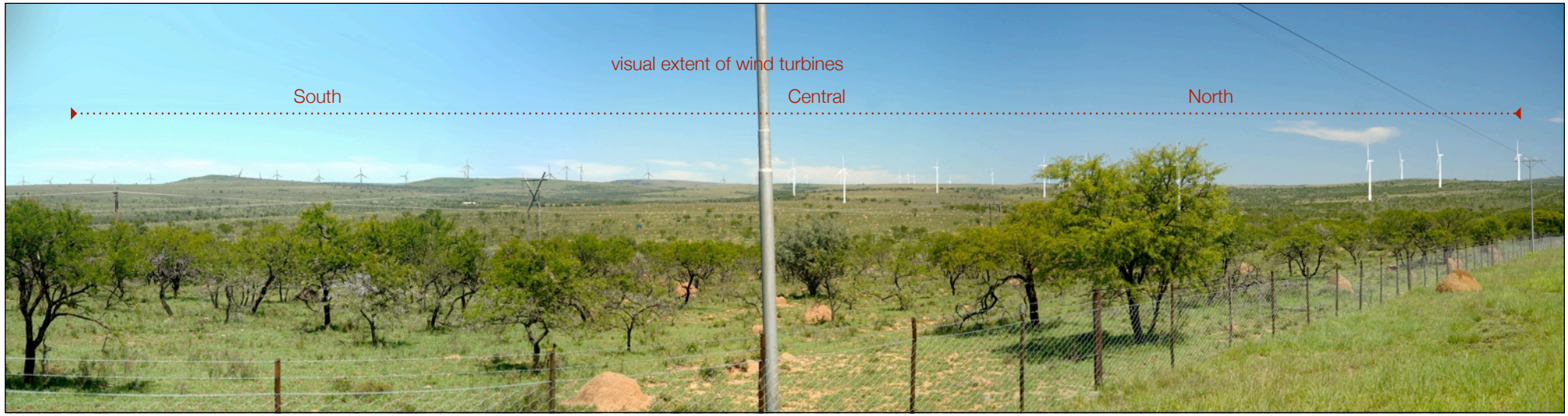


Figure 2 : WKN Highlands WEF : 3D Models : Notional SubStation



Viewpoint 1 : Moderately to highly visible on skyline from Goedehoop Road (Kampala Game Reserve). Transmission lines visible in middle distance. 32.706490 S 25.445065 E distance 5.3km



Viewpoint 2 : Highly visible on skyline from the R63 opposite Lekkerwater. Existing transmission lines visible in foreground. 32.700113 S 25.412498 E distance 2.3km

Figure 3 : WKN Highlands WEF : Viewpoint Photomontages

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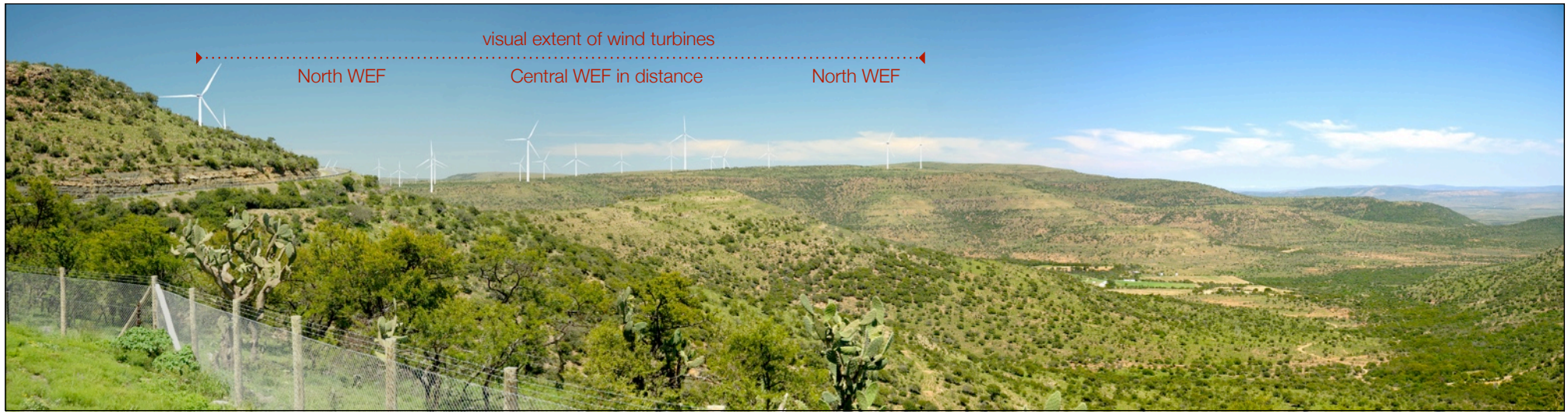
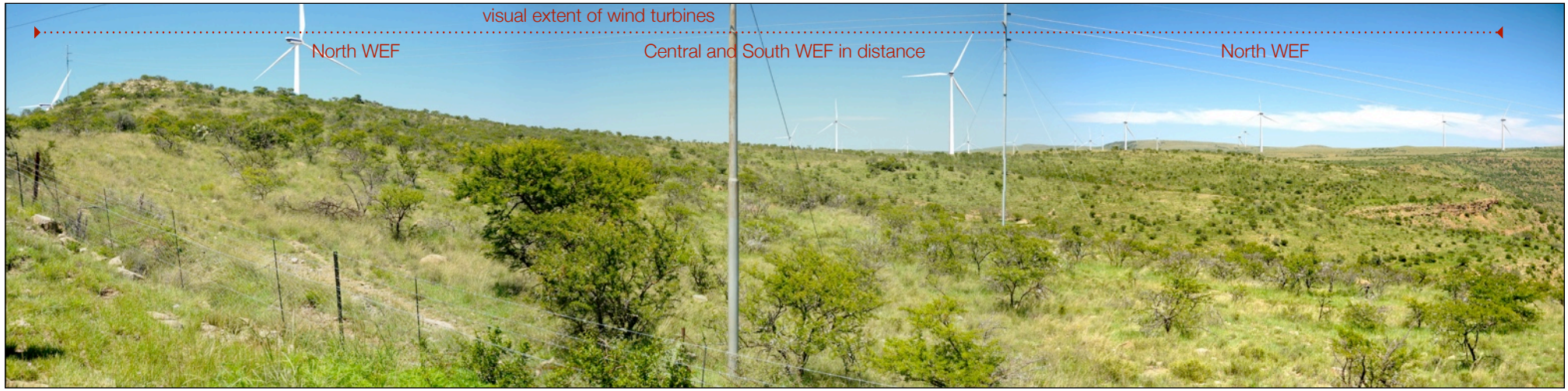


Viewpoint 3 : Highly visible in close proximity from the picnic stop on the scenic Bruintjieshoogte Pass.

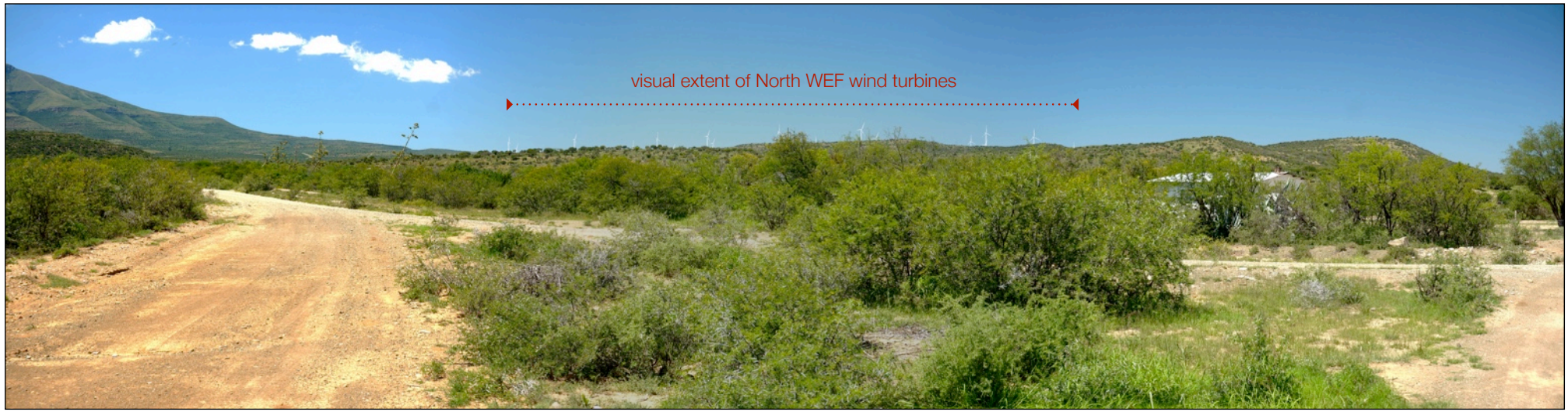
32.681138 S 25.340371 E distance 1.9km



Viewpoint 3a : Highly visible in close proximity from the crest of the scenic Bruintjieshoogte Pass.

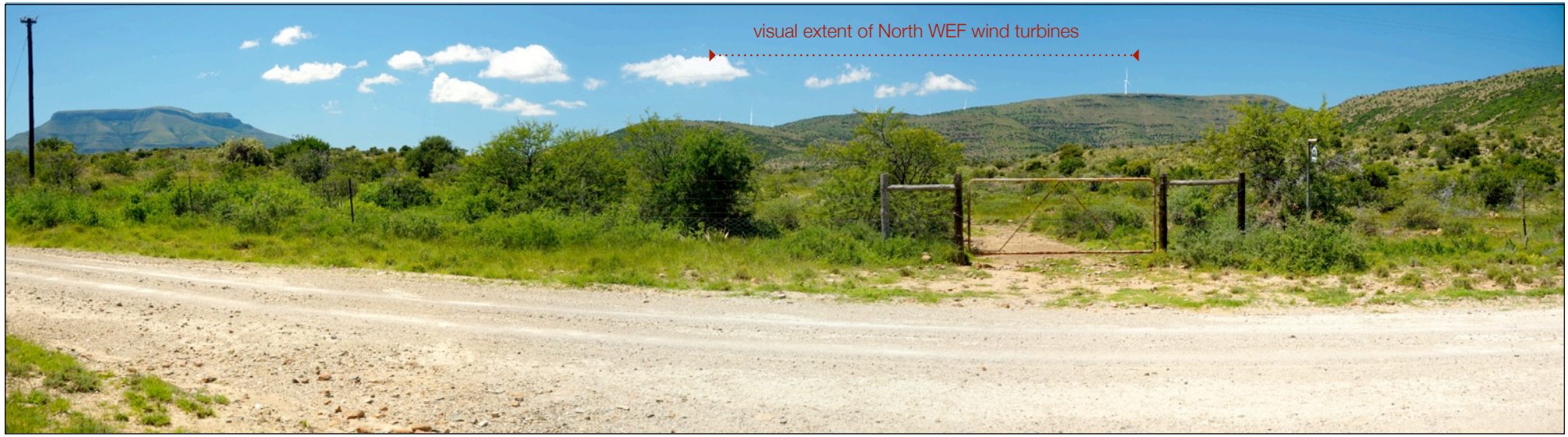
32.687757 S 25.351308 E distance 857m

Figure 4 : WKN Highlands WEF : Viewpoint Photomontages



Viewpoint 4 : Moderately visible on skyline ridges from District Road at Allemansfontein Farm

32.667288 S 25.265467 E distance 7.7km



Viewpoint 5 : Moderately visible on skyline from District Road at Boschfontein Farm

32.714650 S 25.265360 E distance 5.1km

Figure 5 : WKN Highlands WEF : Viewpoint Photomontages

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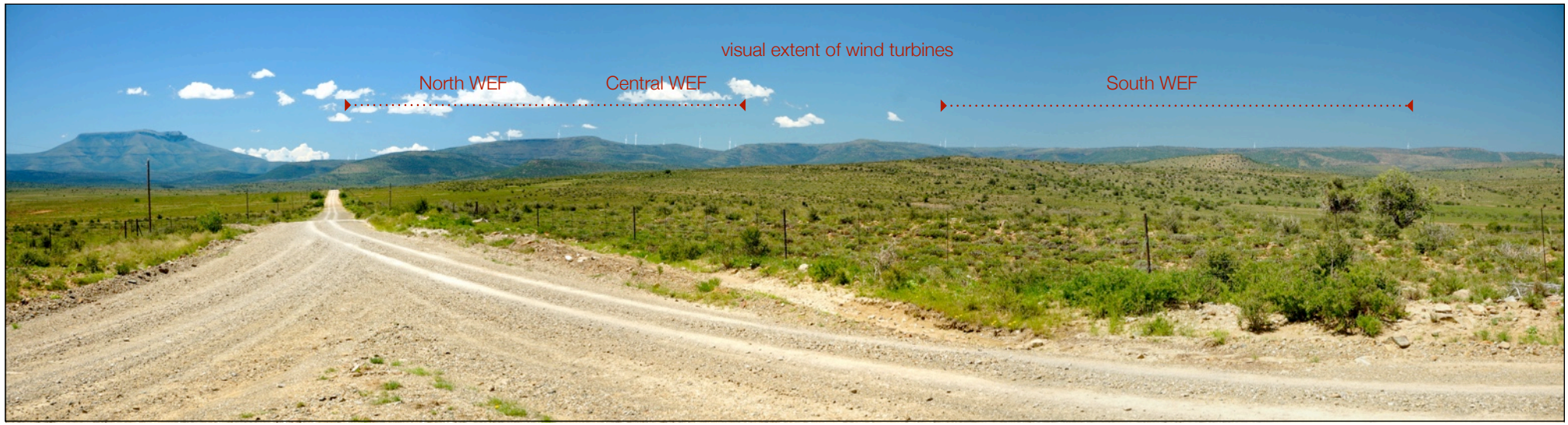
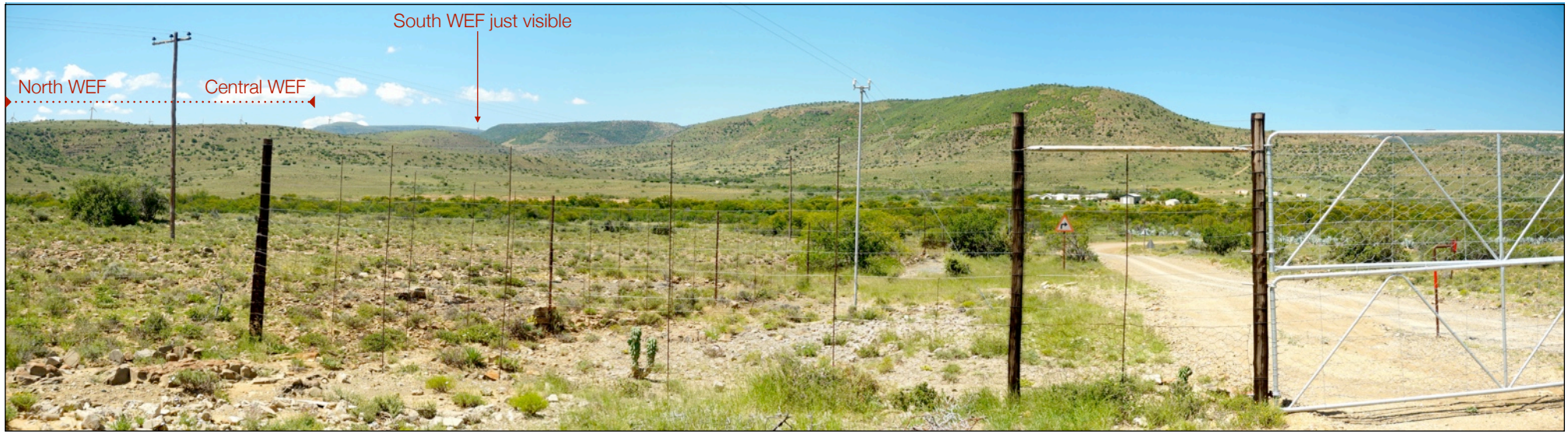


Viewpoint 6 : Marginally visible on skyline from the intersection with Pearston District Road

32.750674 S 25.209773 E distance 10.7km



Viewpoint 7 : Marginally visible from the District Road at Vaalklip Farm Gate

32.786705 S 25.232462 E distance 10.5km

Figure 6 : WKN Highlands WEF : Viewpoint Photomontages

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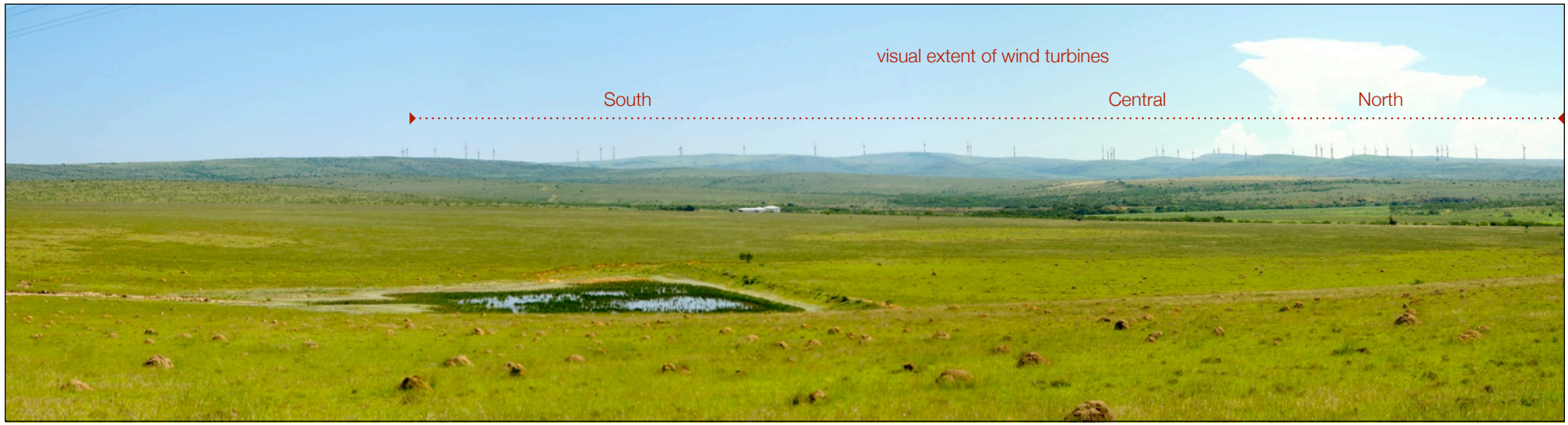
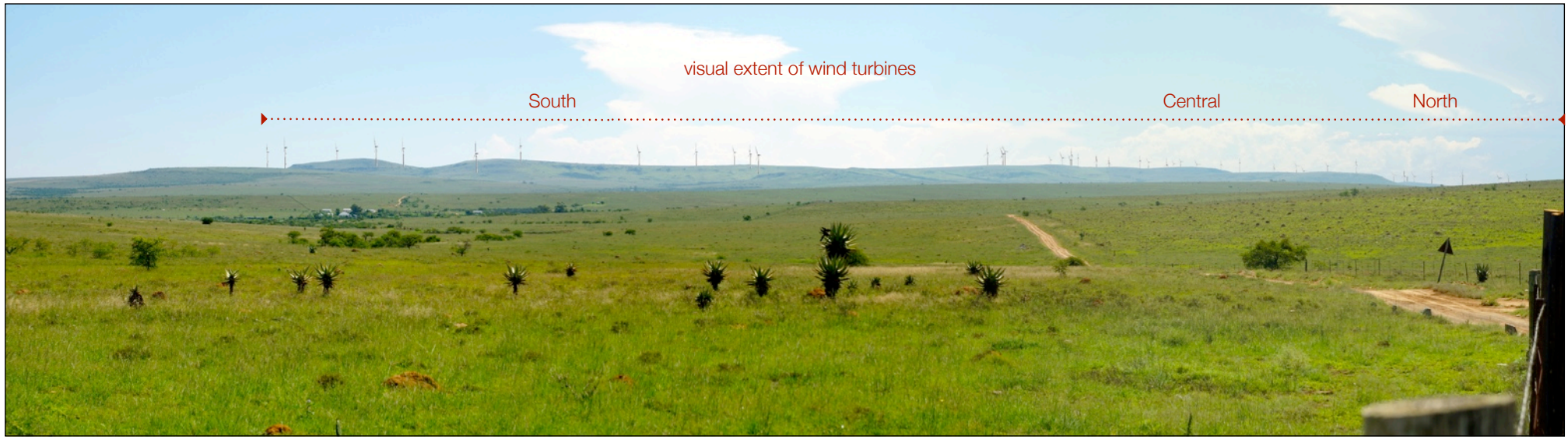


Viewpoint 8 : Marginally visible on skyline from the District Road near Coetzenberg and Wentworth Farms

32.750093 S 25.510084 E distance 12.1km



Viewpoint 9 : Moderately visible from District Road near Kaalplaas (East Cape Safaris)

32.818506 S 25.458107 E distance 7.1km

Figure 7 : WKN Highlands WEF : Viewpoint Photomontages

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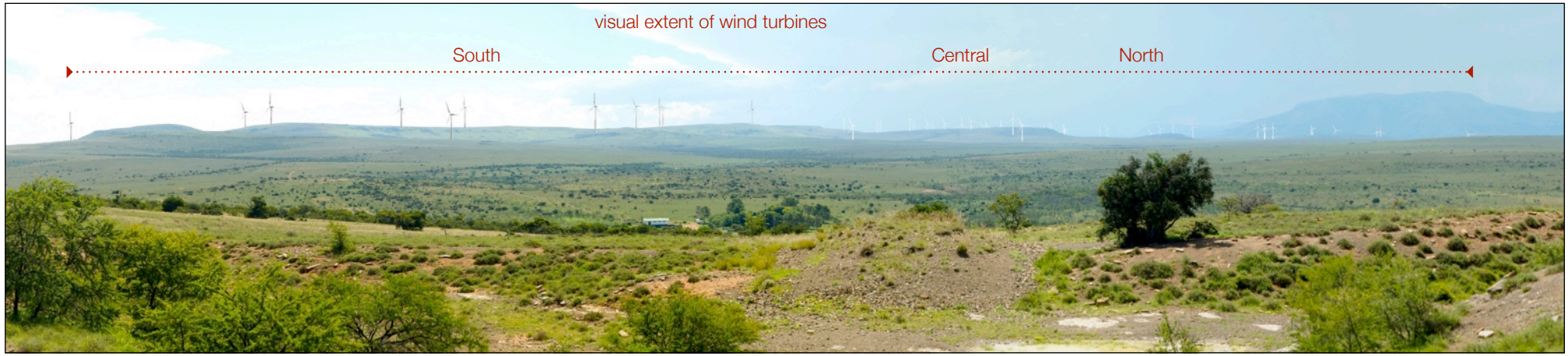

Viewpoint 10 : Moderately visible from District Road near Uitkomst Farm

32.838857 S 25.430732 E distance 5.6km

Figure 8 : WKN Highlands WEF : Viewpoint Photomontages

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