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VOLUME II

SPECIALIST STUDY REPORTS

This volume is a shared volume for the following Environmental Assessment Reports:

- **THE PROPOSED KOMSBERG EAST GRID CONNECTION (POWER LINE AND SWITCHING STATION), WESTERN AND NORTHERN CAPE PROVINCES**
  (DEA REFERENCE NUMBER: TO BE RECEIVED ON SUBMISSION TO DEA)
  DRAFT BASIC ASSESSMENT REPORT
- **THE PROPOSED KOMSBERG EAST WIND ENERGY FACILITY, WESTERN CAPE PROVINCE**
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- **THE PROPOSED KOMSBERG WEST GRID CONNECTION (POWER LINE AND SWITCHING STATION), WESTERN AND NORTHERN CAPE PROVINCES**
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  DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Specialist Study Reports:

Specialist Impact Assessment Report	Specialist
Visual Impact Assessment	Bernie Oberholzer and Quinton Lawson Bernard Oberholzer Landscape Architects and MLB Architects
Aquatic Impact Assessment Report	Dr. Brian Colloty Scherman Colloty and Associates Environmental and Aquatic Management Consulting
Social Impact Assessment	Tony Barbour Tony Barbour Environmental Consultant and Researcher
Fauna and Flora Impact Assessment Report	Simon Todd Simon Todd Consulting
Avifaunal Impact Assessment Report, including Specialist Study Review	Andrew Pearson and Anja Terörde Arcus Consulting
Bat Impact Assessment Report, including Specialist Study Review	Jonathan Aronson Arcus Consulting
Noise Impact Assessment Report and Addendum	Morné de Jager Enviro Acoustic Research
Heritage, Archaeology and Palaeontology Impact Assessment Report	Tim Hart and John Almond ACO & Associates
Transport and Traffic Assessment	Hermanus Steyn Aurecon

Komsberg Wind Energy Facility, Western and Northern Cape

for

Komsberg Wind Farms (Pty) Ltd

Visual Impact Assessment

December 2015
Updated March 2016

Prepared for

Arcus Consulting Services

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EXECUTIVE SUMMARY

Komsberg East and Komsberg West wind energy facilities (WEF) consisting of up to 55 wind turbines each, are proposed in the Moordenaars Karoo, the nearest towns being Sutherland and Laingsburg. The site is located on the border between the Western and Northern Cape Provinces in a semi-arid agricultural area. The Roggeveld wind energy facility and others are proposed to the west. The proposed development falls within the Komsberg Focus Area for wind energy development in the Strategic Environmental Assessment process by the CSIR for the Department of Environmental Affairs.

The mountainous area is located at the foot of the Komsberg escarpment and includes a few low peaks ranging from about 1100 to 1500m in altitude. Farmsteads are far apart, mostly located near seasonal watercourses. The Komsberg Pass and Komsberg Wilderness Nature Reserve lie some 7km to the north-west of the proposed Komsberg West WEF. The area is generally known for its wide open spaces, serenity, quiet and starry skies at night, the rural landscape being relatively intact and free of visual intrusions, although there are a number of powerlines in the general area.

Each of the WEF areas would have a substation with a 132kV transmission line linking to the existing main Komsberg Substation. Access roads would need to be provided for the construction and maintenance of the wind energy facilities.

Scenic landscape features have been mapped, along with selected viewpoints and view corridors. These have in turn been combined with viewsheds and distance radii to establish the visibility and visual exposure of the area in relation to the WEFs. The proposed facilities have then been overlaid on a composite visual informants map to determine potential visual impacts, as well as areas in need of possible mitigation and/or refinement of the site layout plan.

Given the scale and siting of the proposed WEF, as well as the height of the wind turbines, a significant transformation of the study area can be expected, and this resulted in a <u>medium-high</u> potential visual impact significance for both areas before mitigation, and <u>medium</u> after mitigation during the operation phase.

The construction phase of the two WEF projects, being short-term, would have <u>medium-high</u> visual impact significance, reduced to <u>medium</u> after mitigation.

The conclusion of the Visual Assessment Report is that the visual impacts relating to the two WEF sites could be mitigated to some extent by making adjustments to the positions of the wind turbines, as well as the substations and operations / maintenance buildings in the layout plans, using the mitigations in Tables 5c and 6c, and the recommended buffers in Table 2 as a guide. These adjustments in the micro-siting would form part of the normal iterative EIA process.

The 132kV grid connection powerlines for both Komsberg East and West would have a visual impact significance of <u>medium</u>, which could be marginally reduced by means of careful alignment to avoid skyline ridges, and using the mitigations in Tables 7c and 8c as a guide.

Contents

1 Visual Specialists

The Visual Impact Assessment (VIA) was prepared by Bernard Oberholzer, Landscape Architect, and by Quinton Lawson, Architect, (see Attachment A for expertise, and Attachment B for the Specialist Declaration).

2 Purpose and Scope of the VIA

A Visual Baseline Study, together with other specialist studies, was previously prepared in August 2015, and formed part of the Environmental Scoping Report. The Baseline Study was intended to inform the layout of the proposed Komsberg wind energy facility (WEF).

The current VIA includes a detailed description of the project and the receiving environment, identifies possible visual impacts and risks associated with the project, establishes criteria and ratings for visual impacts and provides recommended mitigations to minimise potential visual impacts.

The 'Guideline for Involving Visual and Aesthetic Specialists' (Oberholzer, June 2005), issued by the Provincial Government of the Western Cape, was used as a guide.

3 Site Investigation

A visit to the proposed Komsberg project site and surroundings was carried out on 25 June 2015, being mid-winter. The season was not a major consideration for carrying out a visual assessment.

4 VIA Methodology

The visual assessment method includes the following:

- Mapping of the study area location and its landscape context;
- Mapping of the projected viewsheds and distance radii of the proposed WEF to determine the possible zone of visual influence;
- Identification of important viewpoints and view corridors, and a photographic survey from selected viewpoints, taking into account possible sensitive receptors;
- Identification of landscape characteristics, including topographical and geological features, vegetation cover, land use, cultural landscapes, protected areas and farmsteads;
- Identification and mapping of visual / landscape constraints, including buffers, for the proposed WEF.
- Assessment of possible visual impacts or risks associated with the project, with the help of photographic montages to simulate the proposed wind energy facilities.
- Formulation of possible mitigations and recommendations to minimise potential adverse visual impacts.

5 Description of the Proposed WEF Project

In general the proposed WEF consists of two facilities, one known as 'Komsberg East' and the other as 'Komsberg West', each having some 55 wind turbines. The final capacity of the two facilities will only be determined at the implementation stage. Each of the facilities would require a substation and powerline grid connection. Proposed layouts have been provided for each of the 2 sites. A detailed list of facilities and related infrastructure is given in Table 1 below, and layouts of the facilities are indicated in Figures 3 to 5. Two layouts have been provided, the first being the preferred layout and the second with additional possible turbine positions.

Table 1: Description of Energy Facilities at Komsberg East and West Sites

Facility	**Extent/Footprint**	**Height**	**Comments**
Total site area Komsberg East WEF area Komsberg West WEF area	26 715 ha 15 741 ha 10 974 ha	n/a n/a	Leased areas. Development areas may be smaller. (Possibly less than 2% of the overall land area).
No. of wind turbines: Komsberg East WEF Komsberg West WEF	2 to 5MW turbines approx. 55 turbines approx. 55 turbines	Hub ht. up to 120m max. Rotor diam. up to 140m max. (depending on final selection of turbine type)	Each to have 275MW (depending on future authorised capacity) Colour: off-white / grey
Electrical turbine trans-former.	Located inside the turbine tower or adjacent to tower.	n/a	
Turbine pad. Hardstanding crane area.	Up to 30 x 30m Approx. 50 x 30m	n/a n/a	Concrete and steel pad. Compacted gravel hardstanding.
Internal access tracks: Komsberg East WEF Komsberg West WEF	 37.37 km 44.08 km	 n/a	Up to 20m wide during construction incl. road reserve. 6-8m wide during operation. Gravel surface.
Electrical substation for each East and West facilities. 33/132kV.	100 x 150m substation 100 x150m switching station	Single storey buildings Gantries approx. 10m	Earth-colour building / roof finish. Cables placed underground where possible.
Transmission lines: Komsberg East WEF Komsberg West WEF	1km wide corridor. 55km 35km	 18-30m	Standard Eskom monopole or lattice for 132kV powerline. Connects to existing Eskom Komsberg main transmission substation.
Wind measuring masts at each area.	6 x 80m met masts remain on site post construction.		Mast type: Lattice with stayed cables. (3 per project).
Operations and main-tenance buildings (O&M building) for each area.	50 x 30m (for each area)	Single storey	Earth-colour plastered and painted masonry buildings or steel portal frame structures. No reflective finishes.
Fuel storage			Unknown
Security fencing	n/a	2-3m	Around substation and O&M buildings.
Security Lighting Navigation lights	n/a For selected turbine nacelles as per CAA	 At hub height.	At substation and O&M buildings. Flashing red light on selected tur-bines only (to CAA requirements).
Construction Phase:			
Lay down area, temporary construction camp and batching plant for each area.	150 x 100m (for each area)	 Single storey structures	Temporary gravel hard standing and prefab structures. No on-site construction accommodation.
Borrow pits	Not established	n/a	From development site and/or im-ported from the district.

6 Description of the Study Area

Relevant landscape features of the receiving environment include the following:

Location (Fig. 1)

The proposed WEF is located at the foot of the Komsberge on the border of the Northern and Western Cape Provinces in the Moordenaars Karoo. The project site is accessed via the R354 tarred road between Matjiesfontein and Sutherland to the west of the project area, and local district gravel roads. The nearest towns are Sutherland, about 40km to the north, and Laingsburg, about 50km to the south of the proposed wind energy site.

Geology

The geology of the area is characterised by the mudstones and sandstones of the Beaufort Group belonging to the Karoo Sequence, (Geological Survey, 1984, 1:1 000 000 Map). The erosion of the alternating formations has resulted in the undulating ridges and valleys, which are scenically characteristic of the study area. The more resistant sandstones tend to form the ridges, which are more prominent and therefore visually sensitive.

Physical Landscape

The topography is a reflection of the geology of the area. The elevation ranges from about 800m in the valleys to a high point of 1450m, the higher areas being more exposed to wind. Steeper slopes are encountered in the eastern portion, which could be both a physical and visual constraint in places. The landscape is dissected by a number of seasonal rivers and tributaries, such as the Komsberg River, Koringplaas River and Dwars River, with scattered farmsteads being typically located in the more fertile valleys. The Komsberg range forms an escarpment to the north of the site, with a series of ridges running southward into the study area. The various topographic features are indicated on Fig. 2.

Vegetation

The vegetation is a reflection of the substrate and rainfall. The higher elevations of the study area have mountain shale Renosterveld shrubland, while the lower lying areas of the Moordenaars Karoo to the south have a low succulent scrub, (Mucina and Rutherford, 2006). Exotic trees, including gums, poplars and willows are found around the farmsteads. The exotics often form copses and shelterbelts providing some visual screening for the farmsteads.

Land Use

The relatively low rainfall and sparse vegetation limit the agricultural potential to mainly extensive grazing, including Marino sheep for wool. Crops are confined to the alluvial valleys where irrigation is available. The farms tend to be large in area in order to be viable for sheep farming, with farmsteads being on average 10km apart. A series of Eskom power lines run along the southern edge of the study area.

The Komsberg Wilderness Nature Reserve, a private reserve, is located near the Komsberg Pass, about 5km northwest of the proposed wind energy facility. There are no large settle-ments, and except for gravel roads and farm dams, there is little infrastructure within the study area.

Existing powerlines and substation to the south of the site

Undulating landscape and low Karoo scrub in the south

Tree copses and stone kraals around farmsteads

Komsberg Pass in mountainous terrain to the north

7 Visual Sensitivity

The Moordenaars Karoo, like the Great Karoo, is characterised by its wide open spaces, quiet serenity and starry skies. Most of the area is uninhabited and conveys a strong sense of place characterised by its remoteness and natural landscape qualities.

The landscape to the north is more mountainous, where the Komsberge form the escarpment, and is therefore more scenic in terms of topography.

The skyline ridges tend to be visually sensitive, particularly where wind turbines and other structures, such as substations will be seen in silhouette against the sky.

The stream valleys are a valuable scenic resource in the semi-arid countryside. The limited alluvial valleys provide opportunities for cultivation and are therefore a scarce resource.

The visual integrity and scenic value of the Komsberg Pass and Komsberg Wilderness Nature Reserve (private), need to be taken into account in the siting of the proposed wind turbines in the landscape.

8 Site opportunities and Constraints

The landscape to the south is more undulating and lower lying, and already includes a powerline corridor, as well as substations. This southern area is therefore potentially less visually sensitive.

The broken topography, with numerous ridges and valleys, has reasonably good visual absorption capacity, which could potentially help to screen any proposed wind turbines from surrounding settlements. Ridgelines, knolls and peaks are however visually exposed and therefore considered sensitive scenic resources.

Sensitive receptors include a number of farmsteads, although several of these would be included in the project area.

9 Visual Issues

An 'Issues Trail' (Table 1.1) in the Draft Scoping Report has been prepared by Arcus (Oct. 2015). A number of visual issues raised are summarised below:

- An existing servitude road providing access to the proposed development would run adjacent to a homestead on the farms De Fontuin and Koornplaats, which could have visual, noise and dust issues during construction.
- The particular sense of place and silence referred to in Section 7 above, could be adversely affected by the proposed development, and possibly compromise the experience enjoyed by residents and visitors to the area. However, some of the farms form part of the project.
- The South African Astronomy Observatory near Sutherland is concerned about lighting at night and dust generated during construction, which could affect the quality of the night sky and have a negative effect on optical astronomy. However, the Observatory is above the escarpment some 35km away and outside the viewshed.

10 Visual Informants Map (see Fig. 12)

A Visual Informants Map is included, indicating the main scenic resources, along with recommended buffers where applicable, (see also Table 4 below). The buffers generally conform to those developed in the National Wind and Solar PV Strategic Environmental Assessment compiled by the authors with the CSIR in 2014 (still in process). The proposed wind turbines have been overlaid on the Visual Informants Map to help determine possible visual impacts.

The Visual Informants Map includes the following:

- *Steep slopes* with gradients steeper than 1:5 tend to have high visual sensitivity.
- *Topographic features,* being mainly ridges and koppies. The skylines of these are visually sensitive requiring careful siting of facilities. Prominent peaks should be avoided.
- *Seasonal rivers* and associated buffers are scenic resources and therefore visually sensitive.

- *Cultural landscapes* and associated buffers consist of historically farmed areas along river courses or near springs, which have rural and cultural value.
- *District Roads* and associated buffers are sensitive visual corridors used by local residents and visitors. The Komsberg Pass is a scenic corridor.
- *'Komsberg Wilderness Nature Reserve'* is a private nature reserve with biological and scenic value.
- *Farmsteads* inside the project area would have a noise buffer, and those outside the project area a suggested 2km visual buffer.

11 Assumptions and Uncertainties

It was assumed that for this assessment the facilities listed in Table 1 represent the maximum extent of the proposed development. The position of the wind turbines and related infrastructure will be finalised as part of this EIA process.

12 Policy and Legislative Context

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). The proposed wind energy facility is a listed activity requiring a scoping study and EIA.

The National Heritage Resources Act (NHRA) (Act No. 25 of 1999): The NHRA and associated provincial regulations provide legislative protection for natural, cultural and scenic resources, as well as for archaeological and paleontological sites within the study area. This report deals with visual considerations, including natural and scenic resources. Archaeological, paleontological and historical sites are covered by the relevant heritage specialists.

Setbacks for wind turbines are indicated in the table below based on the Provincial Government of the Western Cape (PGWC) guidelines (2006), and on more recent guidelines developed by the Authors with the CSIR (2014). (The buffers are nominal and subject to site-specific micro-siting and viewsheds).

Table 2: Setbacks for Wind Turbines (see also Fig. 12)

Landscape features/criteria	**PGWC 2006 Guidelines**	**Recommended Guidelines (2014)**
Project area boundary	-	270m (subject to turbine specification).
Ephemeral streams/ tributaries	-	250m (not considered of visual significance)
Perennial rivers, wetland features	500m	500m (the layout generally complies with this)
Major ridgelines, peaks and scarps	500m	(As per visual informants map, where the buffer has been applied to peaks).
Local district gravel roads	500m	500m (the layout generally complies with this)
Scenic passes and poorts	review if scenic	1 to 3km (can be less if outside the viewshed).
R354 arterial route	review if scenic	1 to 3km (can be less if outside the viewshed).
Farmsteads (inside the project site)	400m (noise)	800m*
Farmsteads (outside the project site)	400m (noise)	2 to 4km (can be less if outside the viewshed).
Private nature reserves/ game farms/ guest farms/ resorts	500m	2 to 5km (can be less if outside the viewshed).
South African Large Telescope (SALT) near Sutherland	-	25km (can be less if outside the viewshed).

*The general literature recommends 500m to 2km buffer between wind turbines and residential buildings.

13 Need and Desirability

The need for renewable energy in the short term and long term is generally accepted, and the Department of Environmental Affairs, together with the CSIR, has been preparing a Strategic Environmental Assessment (SEA) to facilitate the efficient rollout of wind and solar PV in South Africa, (study in process).

As part of the above-mentioned SEA a number of focus areas have been identified for wind energy. One of these is the Komsberg Focus Area, within which the proposed Komsberg Wind Facility site is located. The proposed facility is therefore located in a suitable place geographically, although visually sensitive areas mapped as part of the SEA need to be taken into consideration. The proposed site is furthermore located in a fairly remote and sparsely populated area. However, local site conditions and sensitive receptors need to be taken into account, which is the purpose of the current VIA.

14 Cumulative Visual Impacts

The proposed Komsberg wind facility would result in additional industrial type components in the local landscape setting. Existing Eskom powerlines are located to the south of the proposed site, and another large wind facility is planned about 20km away in the Klein Roggeveld Mountains to the west. The cumulative visual impacts are assessed in Section 18 below.

15 Alternatives

Besides the Komsberg sites, four other sites were originally investigated in the Western Cape, Eastern Cape, Northern Cape and Kwazulu-Natal, these having been discounted at the site selection process owing to technical and environmental considerations.

Two areas (Komsberg East and Komsberg West) are currently proposed for the Komsberg wind facility. A preferred layout (by the Developer) within these areas is assessed in Section 18 below. Alternative positions for wind turbines have also been provided by the Developer, to be considered as part of the iterative EIA process.

16 Potential Visual Impacts

*Table 3: Potential Visual Impacts**

Source	**Pathway**	**Receptor**
Potentially large number of proposed wind turbines (55 in each area).	The potential visual intrusion of the wind turbines on the skyline and on scenic resources.	Residents of surrounding farms, 'Komsberg Wilderness Nature Reserve', and visitors/tourists to the area.
Proposed related infrastructure, incl. access roads, (particularly up steep slopes), substations and powerlines.	Visual effect of infrastructure on the rural landscape of the Karoo. Roads on steep slopes would require cut / fill embankments.	As above, both within the viewsheds of the WEF and the connecting grid powerlines.
Potential flicker effect of rotors in the early morning and evening when the sun is near the horizon.	Potential visual disturbance caused by the flicker-effect.	Residents, visitors and road users close to the turbines. The area is however sparsely populated with few roads.
Potential effect of red navigation lights on top of the wind turbines at night.	Potential visual intrusion of the red lights on the Karoo night sky. PAL lighting could be used, which is only activated when planes are in the area.	Residents and visitors within the viewshed of the WEF up to about 30km. Only for a brief time when the lights are activated.
Potential effect of construction activities of the proposed WEF.	Potential intrusion of heavy construction vehicles, cranes, stockpiling of materials, construction camps, and borrow pits, including dust and noise.	Residents, visitors and road users in proximity to the overall project area.

* 'Visual' in its broadest meaning includes visual, scenic, aesthetic and amenity values represented by the natural and the built environment, which can in totality be described as the area's 'sense of place'.

17 Visual Assessment Criteria

The visual assessment is based on a number of quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance. The criteria are listed below:

Visibility

Visibility is largely determined by distance between the energy facilities and the viewer. Distance radii are used to quantify visibility of the proposed facilities, (assuming 100-120m high turbines). Degrees of visibility are listed below, but may be subject to foreground topography and trees and the number of turbines that are visible.

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

Potential visibility of the Komsberg WEF from selected viewpoints is given in Table 4 below, and in the photographic montages, (Figures 15 to 21).

Visual Exposure (Figures 6, 7 and 8)

Visual exposure is determined by the viewshed, being the geographic area within which the project would be visible, the boundary tending to follow ridgelines and high points in the landscape. Some areas within the viewshed fall within a view shadow, and would therefore not be affected by the proposed wind energy facilities.

Viewsheds have been prepared for Komsberg East and Komsberg West WEF, and for the grid connections (Figures 9 and 10). The viewshed to the north is restricted to some extent by the Komsberg escarpment, and to the east and west by mountain ridges.

Alternative sites for wind turbines included in the latest layout would change the viewshed slightly, but not significantly.

Visual Absorption Capacity

This is the potential of the landscape to screen the project. The study area has numerous ridges and koppies, with visually enclose valleys, which would help to screen the project. On the other hand, ridgelines and steep upper slopes tend to be visually exposed.

Visual Sensitivity

Visual sensitivity is determined by topographic features, steep slopes, rivers, scenic routes, cultural landscapes and nature reserves. These, together with the setbacks indicated in Table 2, have been indicated on the Visual Informants Map, (Fig. 12).

Landscape Integrity

Visual quality is enhanced by the scenic or rural quality and intactness of the landscape, as well as by the lack of other visual intrusions. The area to the south has a number of existing powerlines and substations, while the Komsberg escarpment area to the north is more scenically pristine.

Cultural Landscapes

Cultural landscapes are enhanced by the presence of heritage sites, historical farmsteads, gravesites and cultivated lands. These tend to occur along the river courses within the study area.

Table 4: Viewpoints and Potential Visibility

View point	Fig. No.	Location	Coordinates	Distance	Visibility
VP1	15	Gravel district road east of Meintjiesplaas	32.8394S, 20.8040E	4.65km	West site moderate-highly visible on the skyline. East site not visible.
VP2	15	Gravel district road near Kareedoornkraal	32.8426S, 20.8395E	4.55km	West site moderately visible on the skyline, but partly obscured by foreground ridge. East site not visible.
VP3	16	Gravel district road at Blounek	32.8209S' 20.9525E	10.73km	East site marginally visible on skyline. Partially obscured by topography. West site not visible.
VP4	16	Gravel district road at Banksdrif	32.8106S, 20.9595E	9.43km	East site marginally visible on skyline. Partially obscured by topography. West site not visible.
VP5	17	De Fontein farmstead	32.7857S, 20.9818E	6.14km	East site moderate-highly visible on skyline. Partially obscured by topography. West site not visible.
VP6	17	Gravel district road at Rondawel	32.7559S, 20.9314E	6.18km (E) 4.90km (W)	East site moderate-highly visible on skyline. West site moderately visible, mainly obscured by ridges.
VP7	18	Gravel district road at Perdebos	32.7162S, 20.8834E	9.74km (E) 1.52km (W)	West site highly visible on skyline ridge, but partly obscured by ridgeline. East site marginally visible.
VP8	-	Gravel district road at 1km radius	32.7005S, 20.8522E	1.24km	West site highly visible on skyline, but partly obscured by ridgeline. East site not visible.
VP9	18	Gravel district road at 2km radius	32.7021S, 20.8367E	2.40km	West site highly visible on skyline, but partly obscured by ridgeline. East site not visible.
VP10	19	Gravel district road at Welgemoed	32.7086S, 20.7800E	4.33km	West site moderate-highly visible on skyline, but partly obscured by ridgeline. East site not visible.
VP11	19	Gravel district road at top of Komsberg Pass	32.6785S, 20.7577E	8.22km	West site marginally visible, but partly obscured by ridgeline. East site not visible. Less visible against mountain backdrop.
VP12	20	Gravel district road at entrance to 'Komsberg Wilderness Nature Reserve' (private nature reserve).	32.6944S, 20.7790E	5.61km	West site moderately visible on skyline, but partly obscured by ridgeline. East site not visible.
VP13	20	Gravel district road near De Kom farmstead	32.7366S, 20.7274E	7.31km	West site moderately visible on skyline, but partly obscured by ridgeline. East site not visible.
VP14	21	Access road to De Plaat farmstead	32.8068S, 20.7192E	9.18km	West site marginally visible on skyline, but partly obscured by ridgeline. East site not visible.

18 Visual Impact Assessment

Table 5a below is based on criteria generally used by the authors for visual assessments, and the remaining tables are based on standard assessment templates provided by Arcus.

18.1 Komsberg EAST Wind Energy Facility:

Table 5a: Intensity of Potential Visual Impacts

Criteria	**Comments**	**Komsberg East wind turbines**	**Komsberg East infrastructure**
Visibility of facilities Distance from selected viewpoints (Table 3)	Large number of turbines. Remoteness and viewing distance are mitigating factors in some cases. Powerlines visible from sensitive receptors. Construction activities are an aggravating factor.	High (4)	Medium (3)
Visual exposure Zone of visual influence or view catchment	Most visual exposure is to the south and west, but less to the north and east because of surrounding ridges.	High (4)	Medium (3)
Visual sensitivity Effect on landscape features and scenic resources	Includes topographic features, skyline ridges, steep slopes, road corridors and farmsteads. General remoteness is a mitigating factor.	High (4)	High (4)
Landscape integrity Effect on rural/ natural character of the area	Largely intact natural / rural landscape would be affected by industrial type wind energy development.	Very high (5)	Medium (3)
Visual absorption capacity (VAC)	Surrounding ridges provide some visual enclosure / absorption, but vegetation is low / sparse.	Medium (3)	Medium (3)
Overall visual impact intensity	Combination of the characteristics above.	**High (20)**	**High (16)**

Rating values: Very low (1), Low (2), Medium (3), High (4), and Very high (5).
Overall values: Very low (1-5), Low (6-10), Medium (11-15), High (15-20), Very high (21+)

Table 5b: Visual Impact Rating before Mitigation

Criteria	**Description**	**Rating**
A. *Extent* *– the area over which the impact will be experienced*		
Local	Confined to study area (approx. 30km radius)	**L**
B. *Intensity* *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
High	Visual or scenic characteristics of the area are severely altered	**H**
C. *Duration* *– the timeframe over which the impact will be experienced and its reversibility*		
Medium-term	Approx. 20 years. (Impact could be reversed at decommissioning stage)	**M**
Consequence	A x B x C	**Med-high**
Probability	Likelihood of the impact occurring (>90%) Highly likely.	**Definite**
Significance	Med-high consequence + Definite	**Med-high**
Status	Negative or positive	**-ve**
Confidence	Based on photomontages and similar projects	**High**

Table 5c: Visual Impact Significance without and with Mitigation

Possible Impact or Risk for Komsberg East:							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Construction Phase							
Without Mitigation	local	short term	High	-ve	**Med-high**	probable	high
With Mitigation	local	short term	High	-ve	**Medium**	possible	medium
Operation Phase							
Without Mitigation	local	med term	High	-ve	**Med-high**	definite	high
With Mitigation	local	med term	High	-ve	**Medium**	possible	medium
Closure Phase (Decommissioning)							
Without Mitigation	local	long term	low	neutral	**Low**	probable	high
With Mitigation	local	long term	low	neutral	**Low**	probable	high
Can the impact be reversed?		YES, at decommissioning phase, assuming rehabilitation of the landscape.					
Will impact cause irreplaceable loss of visual / scenic resources?		YES, during the construction and operational phases, during the life of the project, but could be largely reinstated after the decommissioning phase.					
Can impact be avoided, managed or mitigated?		The scale of wind turbines makes these difficult to visually mitigate. Minor mitigation is possible through micro-siting.					
Mitigation measures		Avoid locating wind turbines and related structures on prominent elevations, especially peaks (marked with yellow triangles on Fig. 12), which are important markers in the landscape and therefore visually sensitive. Avoid slopes steeper than 1:5 gradient, where possible, being highly sensitive. Slopes steeper than 1:10 require special measures in the siting of roads and structures to avoid visually unsightly cut and fill embankments, and possible erosion. Certain access roads on steep slopes in the current layout need to be reviewed and micro-sited during the implementation phase to avoid visual scarring of mountain slopes. Avoid cultural landscapes or valuable cultivated land, particularly because of the scarcity of the latter. Although generally acceptable, the position of certain wind turbines in the current layout could be improved through micro-siting, in particular turbine numbers KE1, KE2, KE18, KE25 and KE45 in order to avoid visually sensitive steep slopes or scarp edges. Ensure setbacks for wind turbines as indicated in Table 2. Locate substations in unobtrusive, low-lying areas, away from roads and habitations, and screened by the topography if possible. Avoid ridgelines. Screen substation structures with earth berms and tree-planting if possible. Use down-reflectors for all lighting at substations to avoid light pollution. Preferably locate the substation and O&M buildings on the proposed southern site, rather than the alternative northern site, which has a visually more sensitive ridgeline. Locate the proposed structures further away from the scarp edge (i.e. to the west). Consolidate operations/ maintenance buildings and parking areas in unobtrusive areas to avoid the sprawl of buildings in the open landscape. Locate access roads in sympathy with the grain of the landscape and the contours, and avoid drainage courses. Keep roads as narrow as possible to minimise cut and fill on steeper slopes. Avoid slopes steeper than 1:10.					
Can any residual risk be monitored / managed?		Not easily because of the height of the wind turbines and technical considerations of siting. Micro-siting and landscape rehabilitation would help to manage residual risks to some extent.					
Will this impact contribute to any cumulative impacts?		YES, the wind facility would result in additional industrial type development in the local landscape setting. Other large wind facilities are planned to the west. The potential cumulative visual impact of the wind farms together could be **high**.					

18.2 Komsberg WEST Wind Energy Facility:

Table 6a: Intensity of Potential Visual Impacts

Criteria	**Comments**	**Komsberg West wind turbines**	**Komsberg West infrastructure**
Visibility of facilities Distance from selected viewpoints (Table 3)	Large number of turbines. Viewing distance is a mitigating factor in some cases. Powerlines visible from sensitive receptors. Construction activities are an aggravating factor.	High (4)	Medium (3)
Visual exposure Zone of visual influence or view catchment	Most visual exposure is to the south and west, but less to the north and east because of surrounding ridges.	High (4)	Medium (3)
Visual sensitivity Effect on landscape features and scenic resources	Includes topographic features, skyline ridges, steep slopes, road corridors and farmsteads. General remoteness is a mitigating factor.	High (4)	High (4)
Landscape integrity Effect on rural/ natural character of the area	Largely intact natural / rural landscape would be affected by industrial type wind energy development.	Very high (5)	Medium (3)
Visual absorption capacity (VAC)	Surrounding ridges provide some visual enclosure / absorption, but vegetation is low / sparse.	Medium (3)	Medium (3)
Overall visual impact intensity	Combination of the characteristics above.	**High (20)**	**High (16)**

Rating values: Very low (1), Low (2), Medium (3), High (4), and Very high (5).
Overall values: Very low (1-5), Low (6-10), Medium (11-15), High (15-20), Very high (21+)

Table 6b: Visual Impact Rating before Mitigation

Criteria	**Description**	**Rating**
A. ***Extent***– *the area over which the impact will be experienced*		
Local	Confined to study area (approx. 30km radius)	**L**
B. ***Intensity***– *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
High	Visual or scenic characteristics of the area are severely altered	**H**
C. ***Duration***– *the timeframe over which the impact will be experienced and its reversibility*		
Medium-term	Approx. 20 years. (Impact could be reversed at decommissioning stage)	**M**
Consequence	A x B x C	**Med-high**
Probability	Likelihood of the impact occurring (>90%) Highly likely.	**Definite**
Significance	High consequence + Definite	**Med-high**
Status	Negative or positive	**-ve**
Confidence	Based on photomontages and similar projects	**High**

Table 6c: Visual Impact Significance without and with Mitigation

<u>Possible</u> Impact or Risk for Komsberg West:							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Construction Phase							
Without Mitigation	local	short term	High	-ve	**Med-high**	probable	high
With Mitigation	local	short term	High	-ve	**Medium**	possible	medium
Operation Phase							
Without Mitigation	local	long term	High	-ve	**Med-high**	probable	high
With Mitigation	local	long term	High	-ve	**Medium**	possible	medium
Closure Phase (Decommissioning)							
Without Mitigation	local	long term	low	neutral	**Low**	probable	high
With Mitigation	local	long term	low	neutral	**Low**	probable	high
Can the impact be reversed?	YES, at decommissioning phase, assuming rehabilitation of the landscape.						
Will impact cause irreplaceable loss of visual / scenic resources?	YES, during the construction and operational phases, during the life of the project, but could be largely reinstated after the decommissioning phase.						
Can impact be avoided, managed or mitigated?	The scale of wind turbines makes these difficult to visually mitigate. Minor mitigation is possible through micro-siting.						
Mitigation measures	Avoid locating wind turbines and related structures on prominent elevations, especially peaks (marked with yellow triangles on Fig. 12), which are important markers in the landscape and therefore visually sensitive. Avoid slopes steeper than 1:5 gradient, where possible, being highly sensitive. Slopes steeper than 1:10 require special measures in the siting of roads and structures to avoid visually unsightly cut and fill embankments, and possible erosion. Certain access roads on steep slopes in the current layout need to be reviewed and micro-sited during the implementation phase, to avoid visual scarring of mountain slopes. Avoid cultural landscapes or valuable cultivated land, particularly because of the scarcity of the latter. Although generally acceptable, the position of certain wind turbines in the current layout could be improved through micro-siting, in particular turbine numbers KW12, KW31 and KW50, in order to avoid visually sensitive steep slopes or scarp edges. Ensure setbacks for wind turbines as indicated in Table 2. Locate substations in unobtrusive, low-lying areas, away from roads and habitations, and screened by the topography if possible. Avoid ridgelines. Screen substation structures with earth berms and tree-planting if possible. Use down reflectors for all lighting at substations to avoid light pollution. Preferably locate the substation and O&M buildings on the proposed western site, being on the same alignment with the connecting transmission line, rather than the alternative eastern site. Consolidate operations/ maintenance buildings and parking areas in unobtrusive areas to avoid the sprawl of buildings in the open landscape. Locate access roads in sympathy with the grain of the landscape and the contours, and avoid drainage courses. Keep roads as narrow as possible to minimise cut and fill on steeper slopes. Avoid slopes steeper than 1:10.						
Can any residual risk be monitored / managed?	Not easily because of the height of the wind turbines and technical considerations of siting. Micro-siting and landscape rehabilitation would help to manage residual risks to some extent.						
Will this impact contribute to any cumulative impacts?	YES, the wind facility would result in additional industrial type development in the local landscape setting. Other large wind facilities are planned to the west. The potential cumulative visual impact of the wind farms together could be **high**.						

18.3 Komsberg EAST Grid Connection:

Table 7a: Intensity of Potential Visual Impacts

Criteria	**Comments**	**Komsberg East grid connection**
Visibility of facilities Distance from selected viewpoints (Table 3)	Long distance of powerline (55km). Viewing distance is a mitigating factor in most cases. Powerlines visible from some sensitive receptors.	Medium (3)
Visual exposure Zone of visual influence or view catchment	Limited visual exposure because of relatively low height of pylons.	Low (2)
Visual sensitivity Effect on landscape features and scenic resources	Includes topographic features, skyline ridges, steep slopes, road corridors and farmsteads. General remoteness is a mitigating factor.	Medium (3)
Landscape integrity Effect on rural/ natural character of the area	Largely intact natural / rural landscape would be affected by powerlines, but partly follows route of existing powerlines.	High (4)
Visual absorption capacity (VAC)	Surrounding ridges provide some visual enclosure / absorption, but vegetation is low / sparse.	Medium (3)
Overall visual impact intensity	Combination of the characteristics above.	**Medium (15)**

Rating values: Very low (1), Low (2), Medium (3), High (4), and Very high (5).
Overall values: Very low (1-5), Low (6-10), Medium (11-15), High (15-20), Very high (21+)

Table 7b: Visual Impact Rating without Mitigation

Criteria	**Description**	**Rating**
A. *Extent* – *the area over which the impact will be experienced*		
Local	Confined to study area (approx. 5km radius)	**L**
B. ***Intensity*** – *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Medium	Visual or scenic characteristics of the area are moderately altered.	**M**
C. ***Duration*** – *the timeframe over which the impact will be experienced and its reversibility*		
Long-term	More than 15 years. (Impact could be reversed at decommissioning stage)	**H**
Consequence	A x B x C	**Medium**
Probability	Likelihood of the impact occurring (>90%) Highly likely.	**Definite**
Significance	Medium consequence + Definite	**Medium**
Status	Negative or positive	**-ve**
Confidence	Based on photomontages and similar projects	**High**

Table 7c: Visual Impact Significance without and with Mitigation

<u>Possible</u> Impact or Risk for Komsberg East Grid Connection:							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Construction Phase							
Without Mitigation	local	short term	Medium	-ve	**Medium-low**	probable	high
With Mitigation	local	short term	Medium	-ve	**Medium-low**	possible	medium
Operation Phase							
Without Mitigation	local	long term	Medium	-ve	**Medium**	probable	high
With Mitigation	local	long term	Medium	-ve	**Medium**	possible	medium
Closure Phase (Decommissioning)							
Without Mitigation	local	long term	Low	neutral	**Low**	probable	high
With Mitigation	local	long term	Low	neutral	**Low**	probable	high
Can the impact be reversed?	YES, at decommissioning phase, assuming rehabilitation of the landscape.						
Will impact cause irreplaceable loss of visual / scenic resources?	YES, during the construction and operational phases, during the life of the project, but could be largely reinstated after the decommissioning phase.						
Can impact be avoided, managed or mitigated?	The pylons are difficult to visually mitigate but are not very tall. Minor mitigation is possible through micro-siting.						
Mitigation measures	Avoid visually sensitive skylines, such as peaks, scarp edges, ridges and other prominent elevations, as well as drainage courses, in the siting of powerlines. Preferably locate the proposed powerline along the southern route alternative, which crosses fewer visually sensitive ridgelines than the northern route alternative. Avoid slopes steeper than 1:5 gradient, where possible, these being highly sensitive. Ensure setbacks for pylons, similar but smaller than those for wind turbines as indicated in Table 2. Locate internal connecting powerlines below ground, where possible, particularly on visually exposed ridges (in areas of shallow bedrock, powerlines could be covered with overburden). Locate powerline trenches ideally on the same alignment as access roads to minimise disturbance. Rehabilitate disturbed areas with indigenous vegetation after construction.						
Can any residual risk be monitored / managed?	Yes, through micro-siting and the EMPr.						
Will this impact contribute to any cumulative impacts?	YES, the powerline would result in additional visual clutter in the local landscape setting, partly following existing powerlines. Other powerlines run about 10km south of the project area. The potential cumulative visual impact could be **medium-high.**						

18.4 Komsberg WEST Grid Connection:

Table 8a: Intensity of Potential Visual Impacts

Criteria	**Comments**	**Komsberg West grid connection**
Visibility of facilities Distance from selected viewpoints (Table 3)	Long distance of powerline (55km). Viewing distance is a mitigating factor in most cases. Powerlines visible from some sensitive receptors.	Medium (3)
Visual exposure Zone of visual influence or view catchment	Limited visual exposure because of relatively low height of pylons.	Low (2)
Visual sensitivity Effect on landscape features and scenic resources	Includes topographic features, skyline ridges, steep slopes, road corridors and farmsteads. General remoteness is a mitigating factor.	Medium (3)
Landscape integrity Effect on rural/ natural character of the area	Largely intact natural / rural landscape would be affected by powerlines.	Medium (3)
Visual absorption capacity (VAC)	Surrounding ridges provide some visual enclosure / absorption, but vegetation is low / sparse.	Medium (3)
Overall visual impact intensity	Combination of the characteristics above.	**Medium (14)**

Rating values: Very low (1), Low (2), Medium (3), High (4), and Very high (5).
Overall values: Very low (1-5), Low (6-10), Medium (11-15), High (15-20), Very high (21+)

Table 8b: Visual Impact Rating without Mitigation

Criteria	**Description**	**Rating**
A. *Extent* *– the area over which the impact will be experienced*		
Local	Confined to study area (approx. 5km radius)	**L**
B. ***Intensity*** *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Medium	Visual or scenic characteristics of the area are moderately altered.	**M**
C. ***Duration*** *– the timeframe over which the impact will be experienced and its reversibility*		
Long-term	More than 15 years. (Impact could be reversed at decommissioning stage)	**H**
Consequence	A x B x C	**Medium**
Probability	Likelihood of the impact occurring (>90%) Highly likely.	**Definite**
Significance	Medium consequence + Definite	**Medium**
Status	Negative or positive	**-ve**
Confidence	Based on photomontages and similar projects	**High**

Table 8c: Visual Impact Significance without and with Mitigation

<table>
<tr><td colspan="8"><u>Possible</u> Impact or Risk for Komsberg West Grid Connection:</td></tr>
<tr><td></td><td>Extent</td><td>Duration</td><td>Intensity</td><td>Status</td><td>Significance</td><td>Probability</td><td>Confidence</td></tr>
<tr><td colspan="8">Construction Phase</td></tr>
<tr><td>Without Mitigation</td><td>local</td><td>short term</td><td>Medium</td><td>-ve</td><td>Medium-low</td><td>probable</td><td>high</td></tr>
<tr><td>With Mitigation</td><td>local</td><td>short term</td><td>Medium</td><td>-ve</td><td>Medium-low</td><td>possible</td><td>medium</td></tr>
<tr><td colspan="8">Operation Phase</td></tr>
<tr><td>Without Mitigation</td><td>local</td><td>long term</td><td>Medium</td><td>-ve</td><td>Medium</td><td>probable</td><td>high</td></tr>
<tr><td>With Mitigation</td><td>local</td><td>long term</td><td>Medium</td><td>-ve</td><td>Medium</td><td>possible</td><td>medium</td></tr>
<tr><td colspan="8">Closure Phase (Decommissioning)</td></tr>
<tr><td>Without Mitigation</td><td>local</td><td>long term</td><td>Low</td><td>neutral</td><td>Low</td><td>probable</td><td>high</td></tr>
<tr><td>With Mitigation</td><td>local</td><td>long term</td><td>Low</td><td>neutral</td><td>Low</td><td>probable</td><td>high</td></tr>
<tr><td colspan="2">Can the impact be reversed?</td><td colspan="6">YES, at decommissioning phase, assuming rehabilitation of the landscape.</td></tr>
<tr><td colspan="2">Will impact cause irreplaceable loss of visual / scenic resources?</td><td colspan="6">YES, during the construction and operational phases, during the life of the project, but could be largely reinstated after the decommissioning phase.</td></tr>
<tr><td colspan="2">Can impact be avoided, managed or mitigated?</td><td colspan="6">The pylons are difficult to visually mitigate but are not very tall. Minor mitigation is possible through micro-siting.</td></tr>
<tr><td colspan="2">Mitigation measures</td><td colspan="6">Avoid visually sensitive skylines, such as peaks, scarp edges, ridges and other prominent elevations, as well as drainage courses, in the siting of powerlines.

Preferably locate the proposed powerline along the northern route alternative, which connects with the Komsberg East WEF, rather than the southern branch route alternative.

Avoid slopes steeper than 1:5 gradient, where possible, these being highly sensitive.

Apply setbacks for pylons, similar but smaller than those for wind turbines as indicated in Table 2.

Locate internal connecting powerlines below ground, where possible, particularly on visually exposed ridges. (in areas of shallow bedrock, powerlines could be covered with overburden).

Locate powerline trenches ideally on the same alignment as access roads to minimise disturbance.

Rehabilitate disturbed areas with indigenous vegetation after construction.</td></tr>
<tr><td colspan="2">Can any residual risk be monitored / managed?</td><td colspan="6">Yes, through micro-siting and the EMPr.</td></tr>
<tr><td colspan="2">Will this impact contribute to any cumulative impacts?</td><td colspan="6">YES, the powerline would result in additional visual clutter in the local landscape setting, mainly following existing powerlines. Other existing powerlines run about 5km south of the project area. The potential cumulative visual impact could be medium-high.</td></tr>
</table>

19 Findings and Recommendations

Komsberg East WEF:

Using the assessment methodology above, it was determined that the visual impact significance of the Komsberg East WEF would be medium-high before mitigation, given the large number of wind turbines (up to 55 turbines), the large size of turbines, and the nature of the receiving environment, as well as receptors in the area.

The need for 20m wide roads during construction in mountainous terrain, and the location of the substation and other operations / maintenance buildings on ridgelines in certain parts of the site were a further concern.

The potential visual impacts have been partly mitigated by relocating some of the turbines, in consultation with the specialists. In some cases only micro-siting is required.

Buffers around topographic features, settlements and roads as recommended in Table 2 have generally been followed, as indicated in the layout. The (southern) option for the substation and operations / maintenance buildings should be used in preference to the alternative (northern) option. Where these mitigations have been implemented, as indicated in the final layout, (Figure 22), the visual impact significance would be reduced to medium.

The construction phase of the WEF and associated infrastructure would be short-term (<2 years) and would therefore have a lower visual significance rating.

Komsberg West WEF:

The visual impact significance for Komsberg West WEF would be similar to that of Komsberg East, being medium-high before mitigation.

The potential visual impacts have been partly mitigated by using the same mitigation measures as for Komsberg East, in consultation with the specialists.

Similarly, buffers around topographic features, settlements and roads are recommended as indicated in Table 2 and must be followed as per the layout. The (western) option of the substation and operations / maintenance buildings should be used in preference to the alternatives. Where these mitigations have been implemented, as indicated in the final layout (Figure 23), the visual impact significance would be reduced to medium.

Komsberg East Grid Connection:

The proposed grid connection powerline between the WEF and the existing main Komsberg substation is planned to consist of monopoles or lattice structures with a maximum height of 30m, the route being approximately 55km in length. This could potentially have a medium visual impact significance.

Minor adjustments to the route alignment, avoiding peaks and other prominent topographic features, as indicated in the mitigations, could help to reduce the visual significance. The preferred (southern) option for the switching station and line should be used as opposed to the northern alternative, as mentioned above.

The construction phase of the grid connection would be short-term (<2 years) and would therefore have a potentially lower visual significance rating.

Komsberg West Grid Connection:

The proposed grid connection powerline between the WEF and the existing main Komsberg substation would be similar to that of the Komsberg East connection, the route being shorter in length (35km). This could potentially have a medium visual impact significance.

Similar adjustments to the route alignment, avoiding peaks and other prominent topographic features, could help to reduce the visual significance. The preferred (western) option for the switching station and line should be used as opposed to the eastern alternative, as mentioned above.

The construction phase of the grid connection would be short-term (<2 years) and would therefore have a potentially lower visual significance rating.

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Attachment A

Visual Specialists

The visual baseline study was prepared by the following:

Bernard Oberholzer, Landscape Architect, and Principal at BOLA
PO Box 471, Stanford, Western Cape, 7210
Email: Bernard.bola@gmail.com

Quinton Lawson, Architect, and Partner at MLB Architects.
2 Gordon Street, Gardens, Cape Town 8001.
Email: quinton@mlbarch.co.za

Expertise

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 and Development Planning, Provincial Government of the Western Cape, 2005.

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.

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.

Attachment B

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:	12/12/20/ or 12/9/11/L
Date Received:	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

Komsberg Wind Energy Facility, Western and Northern Cape

Specialist:	Bernard Oberholzer		
Contact person:	Bernard Oberholzer		
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Professional affiliation	SACLAP		

Specialist:	Quinton Lawson		
Contact person:	Quinton Lawson		
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Telephone:	021 462 0170	Fax:	021 462 0179
E-mail:	quinton@mlbarch.co.za		
Professional affiliation	SACAP		

4.2 The specialist appointed in terms of the Regulations_

We, Bernard Oberholzer and Quinton Lawson, declare that -- General declaration:

We act as the independent specialist 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 not, 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 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
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.

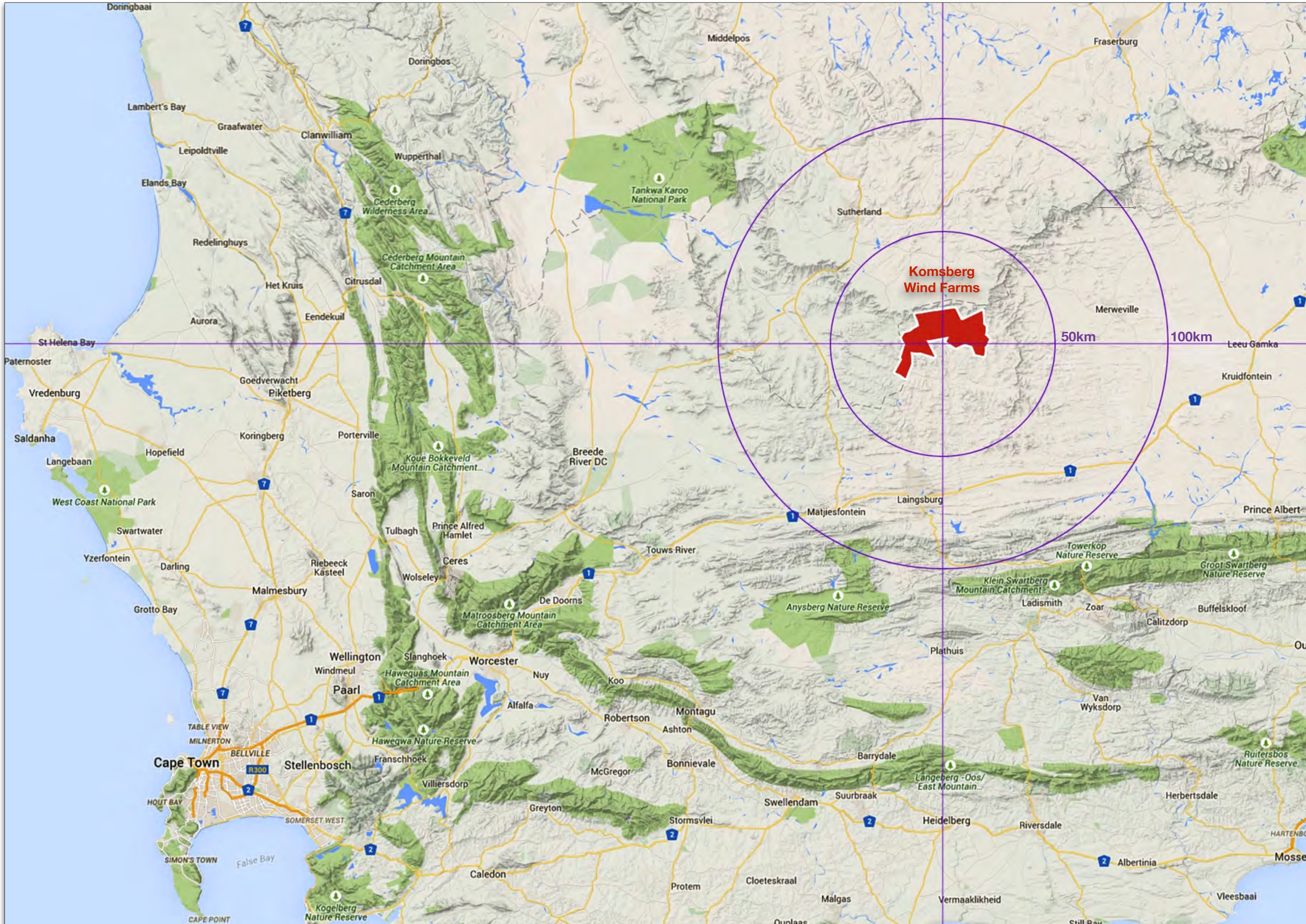
Signatures of the specialists:

BOLA and MLB Architects

Name of company (if applicable):

22 March 2016

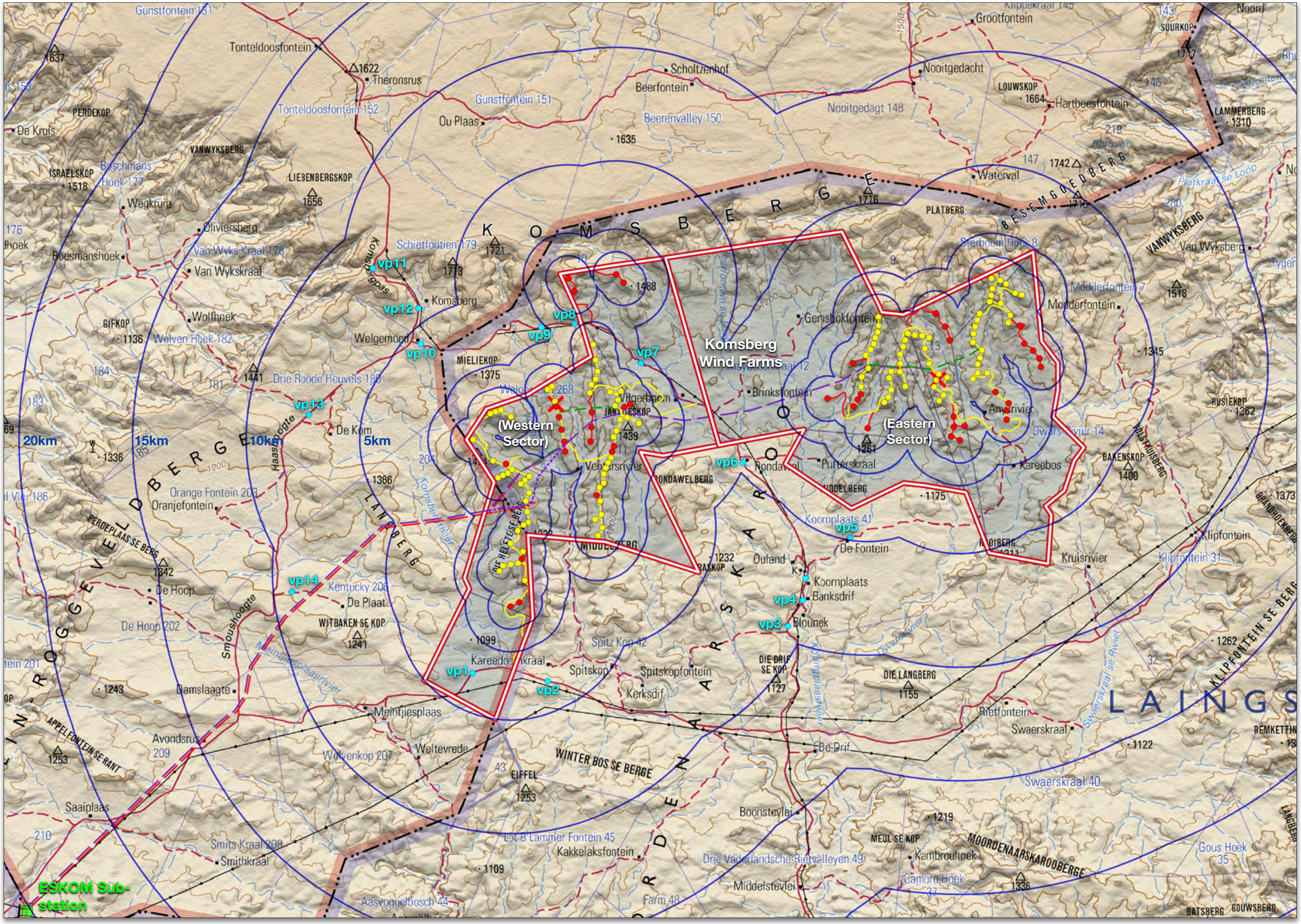
Date:



Base Map Source : Google Maps 2015

0 50km 100km

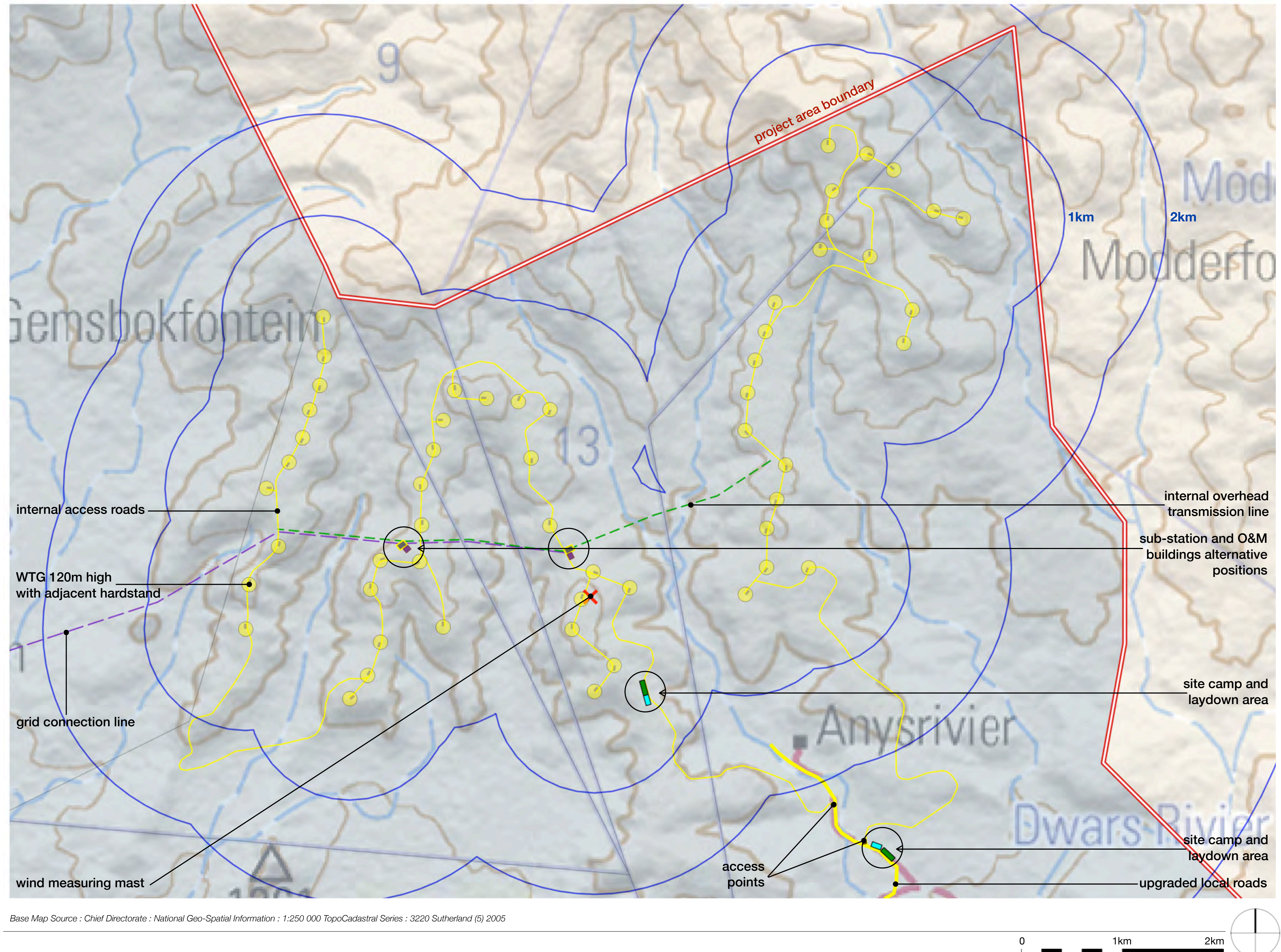
Figure 1 • Locality Map



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

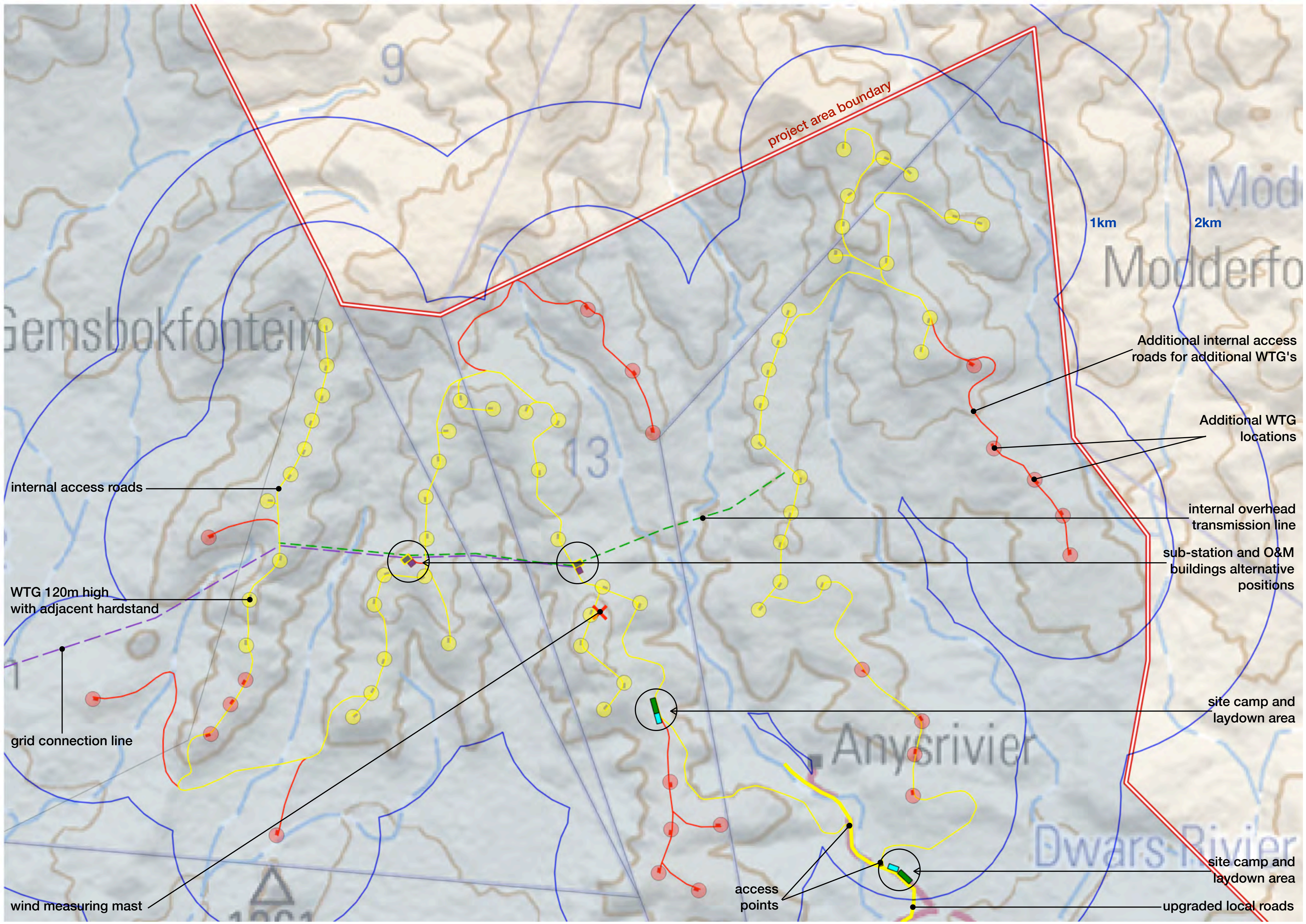
0 5km 10km

Figure 2 • Local Context : Viewpoints and Distance Radii



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005

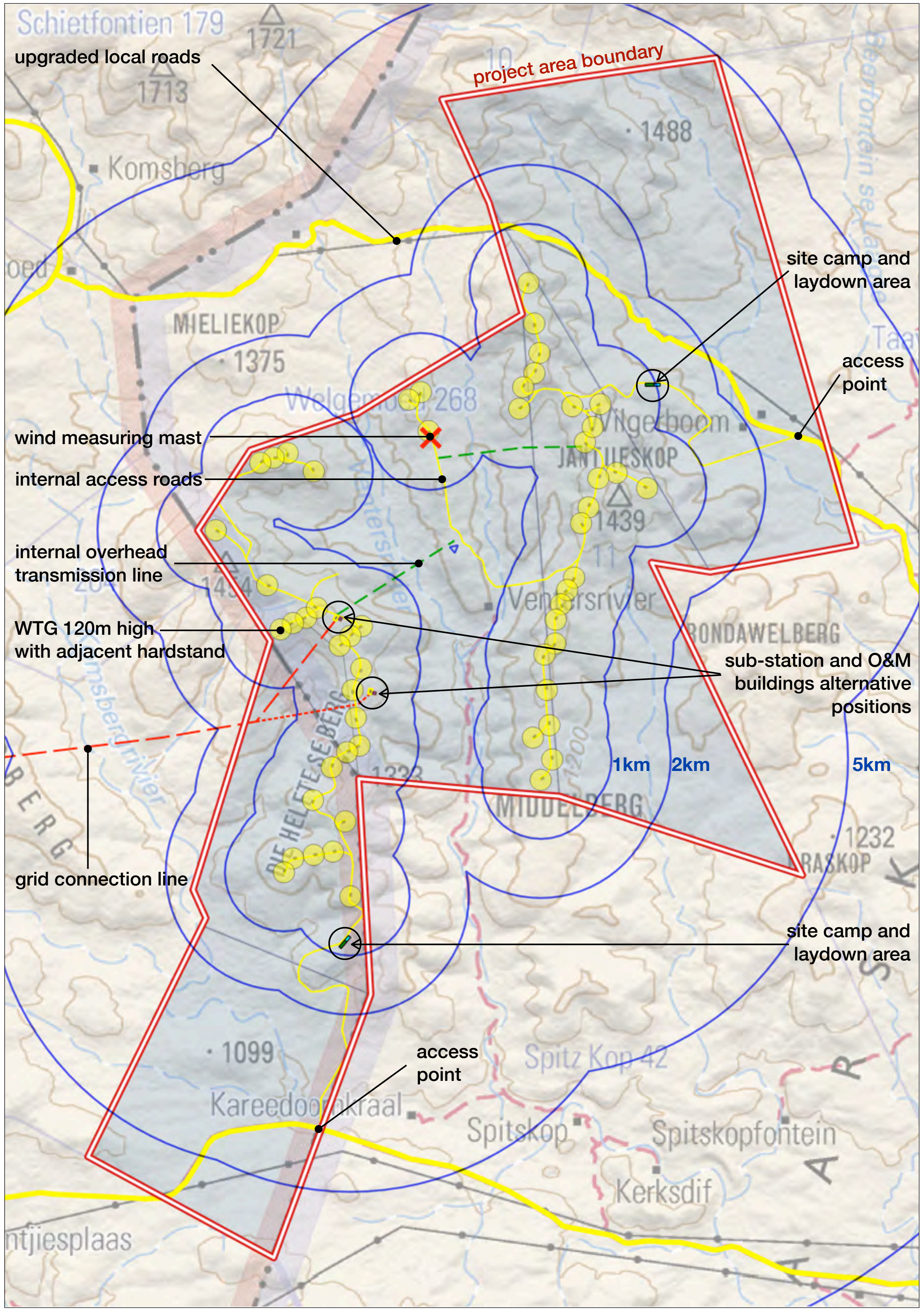
Figure 3 • Komsberg East WEF Layout

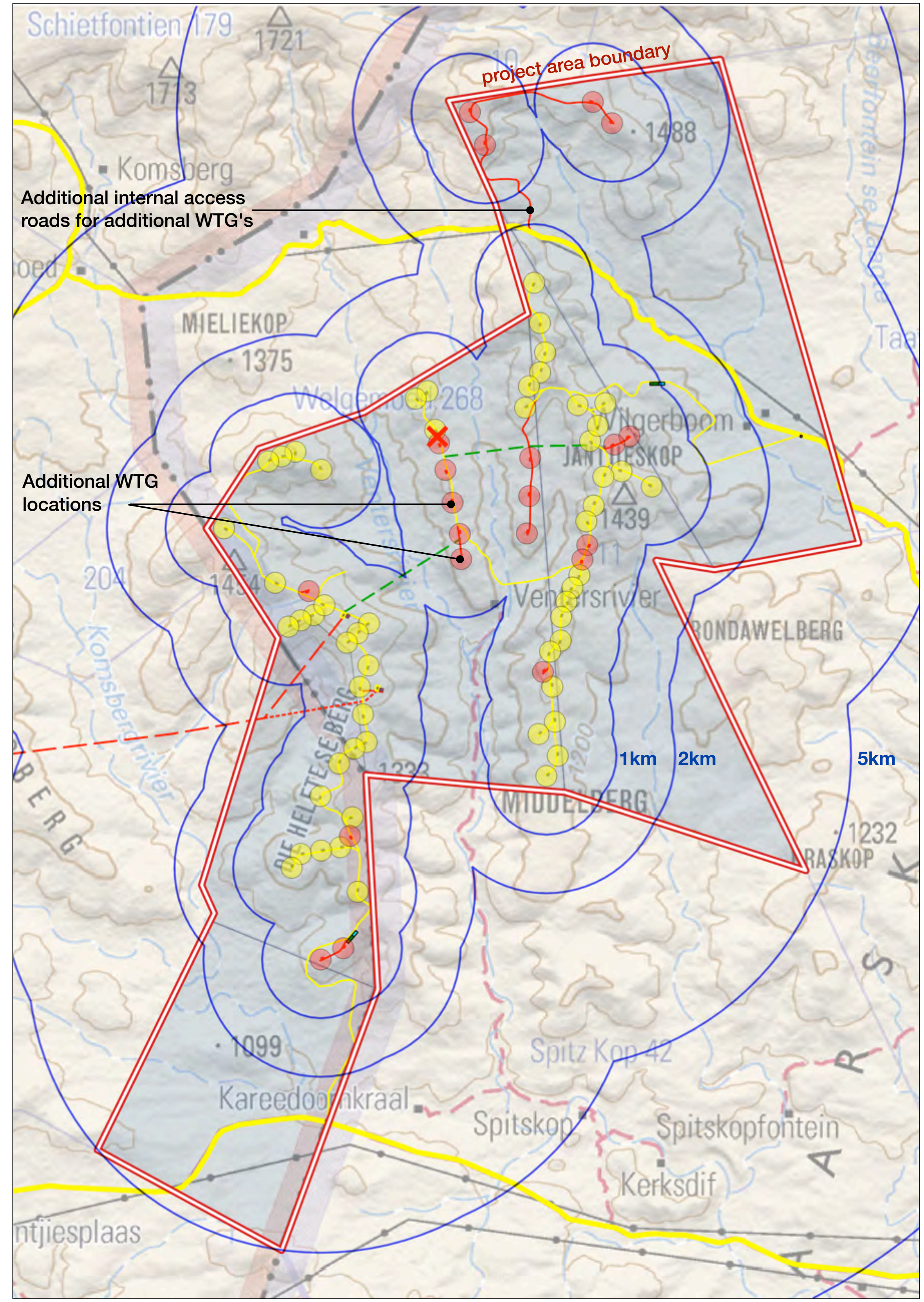


Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005

0 1km 2km

Figure 4 • Komsberg East WEF Layout • Optional additional WTG Sites





Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

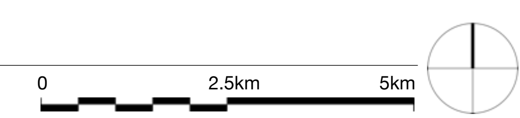
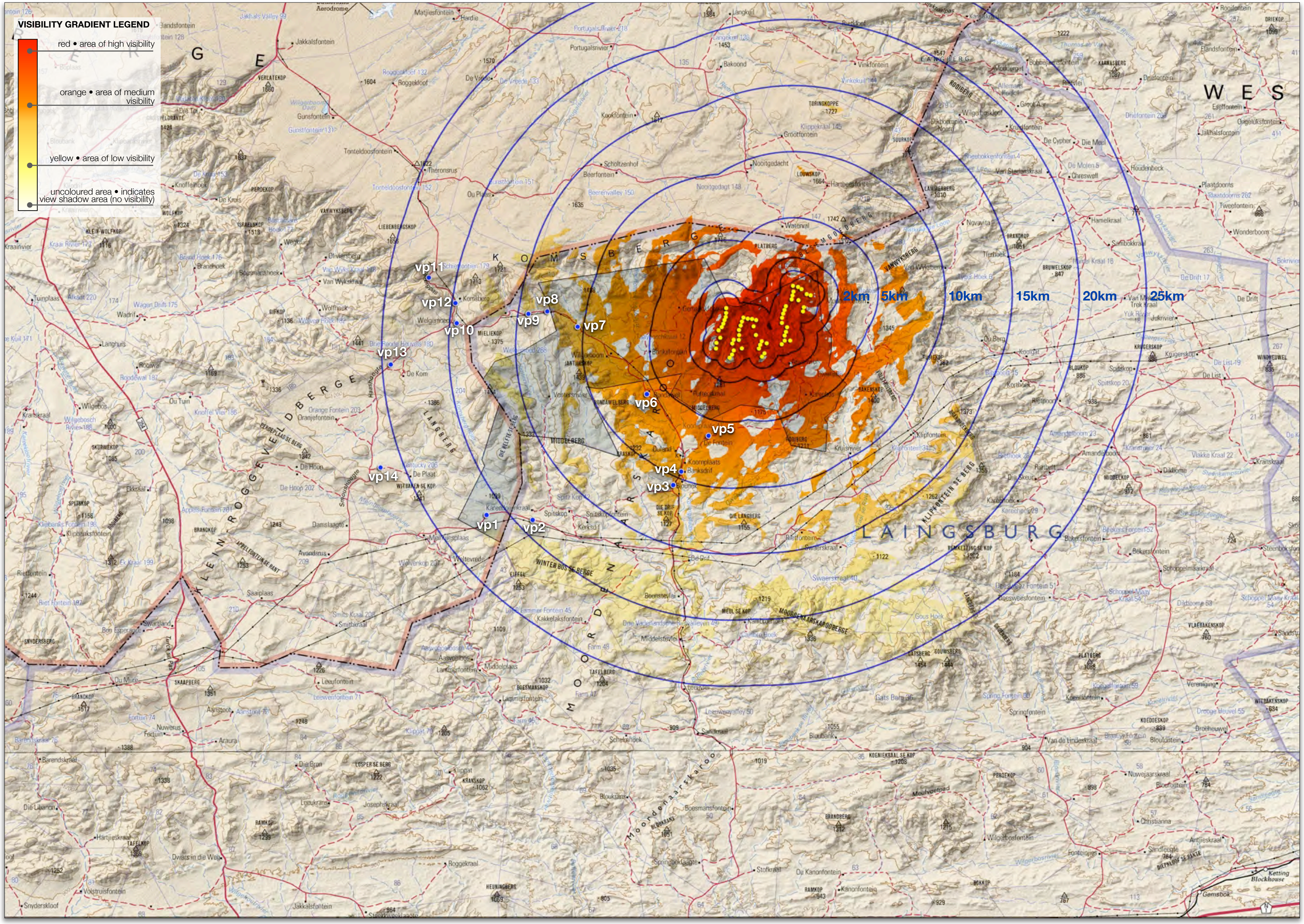
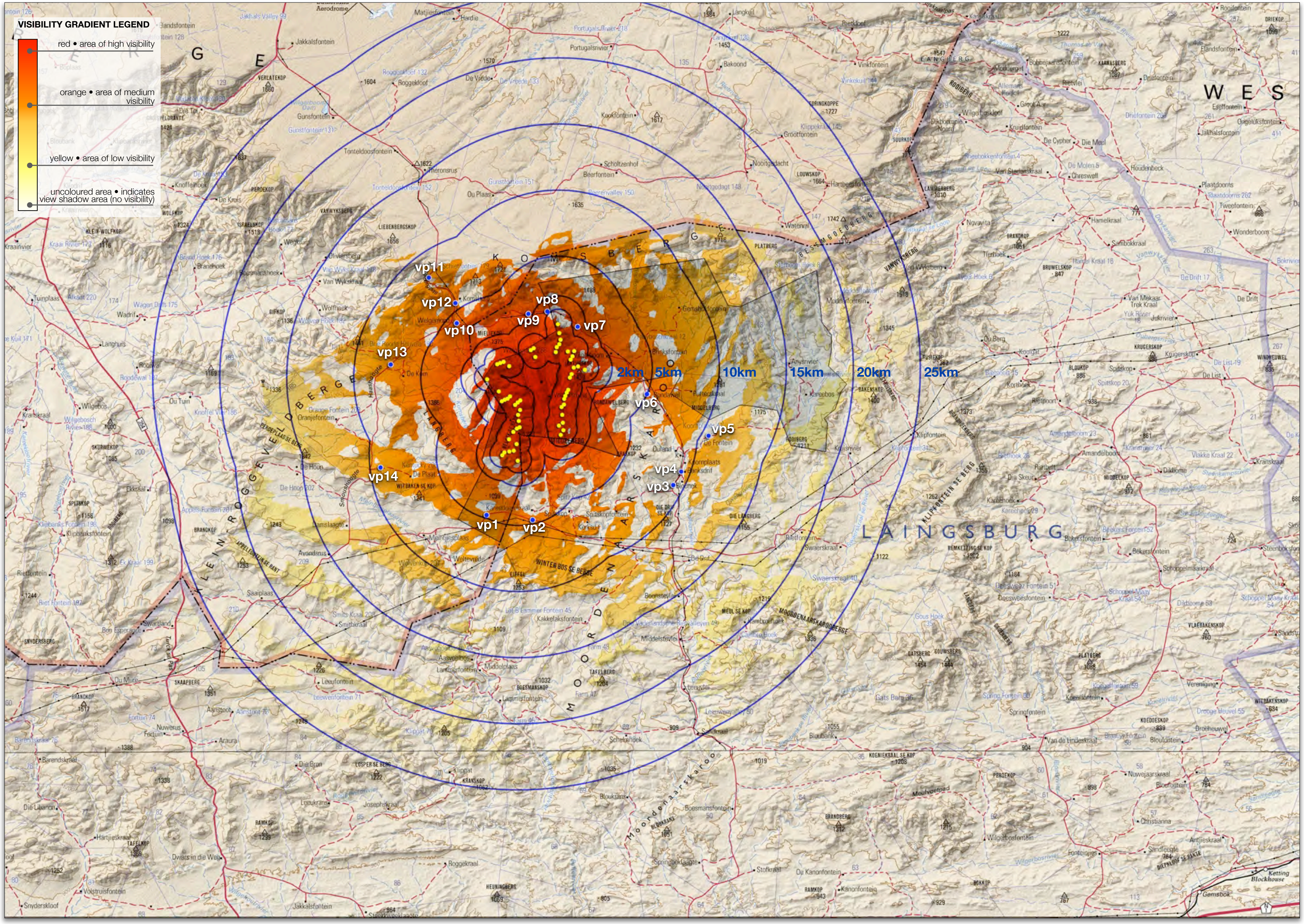


Figure 5 • Komsberg West WEF Layout • Optional additional WTG Sites



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

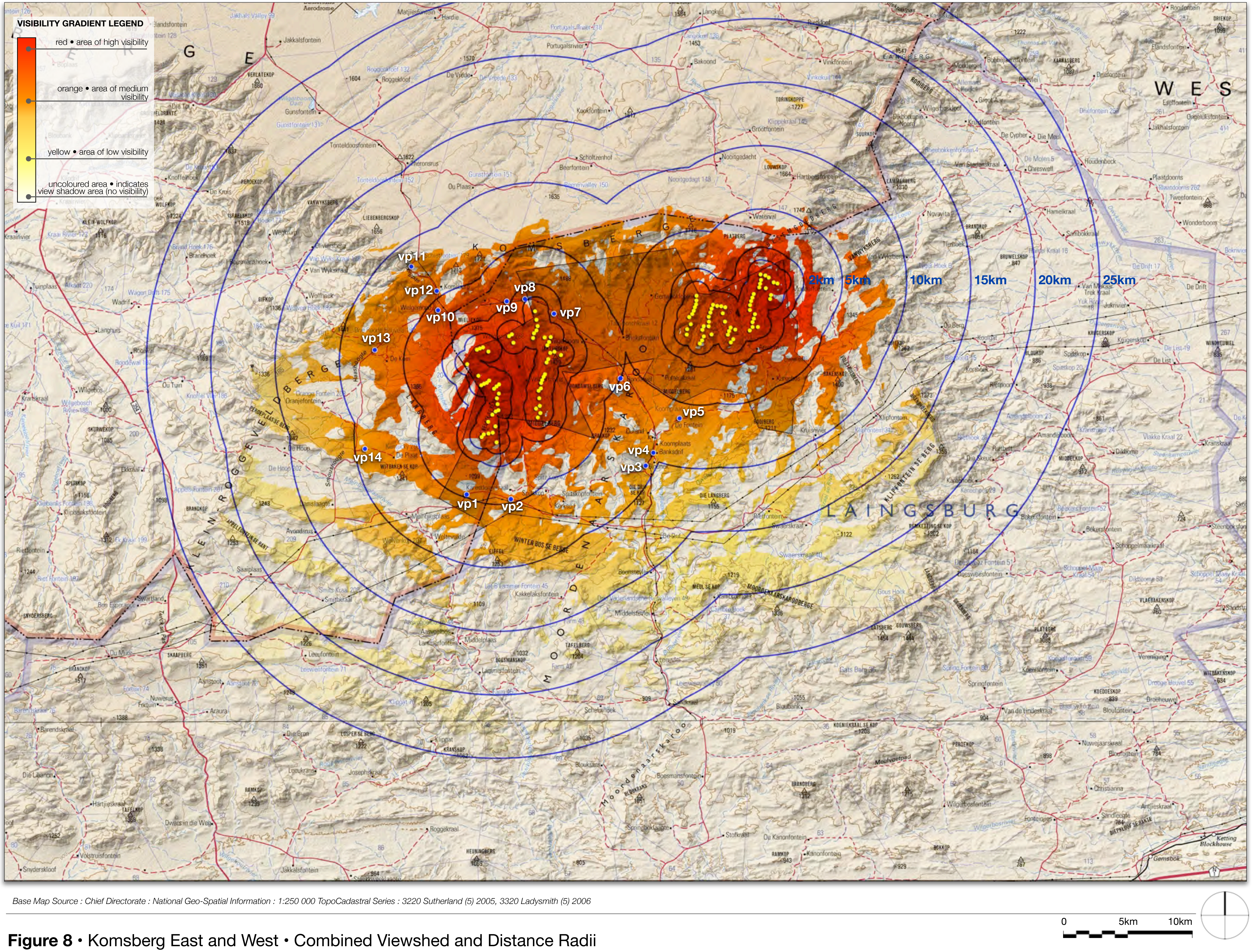
Figure 6 • Komsberg East : Viewshed and Distance Radii



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

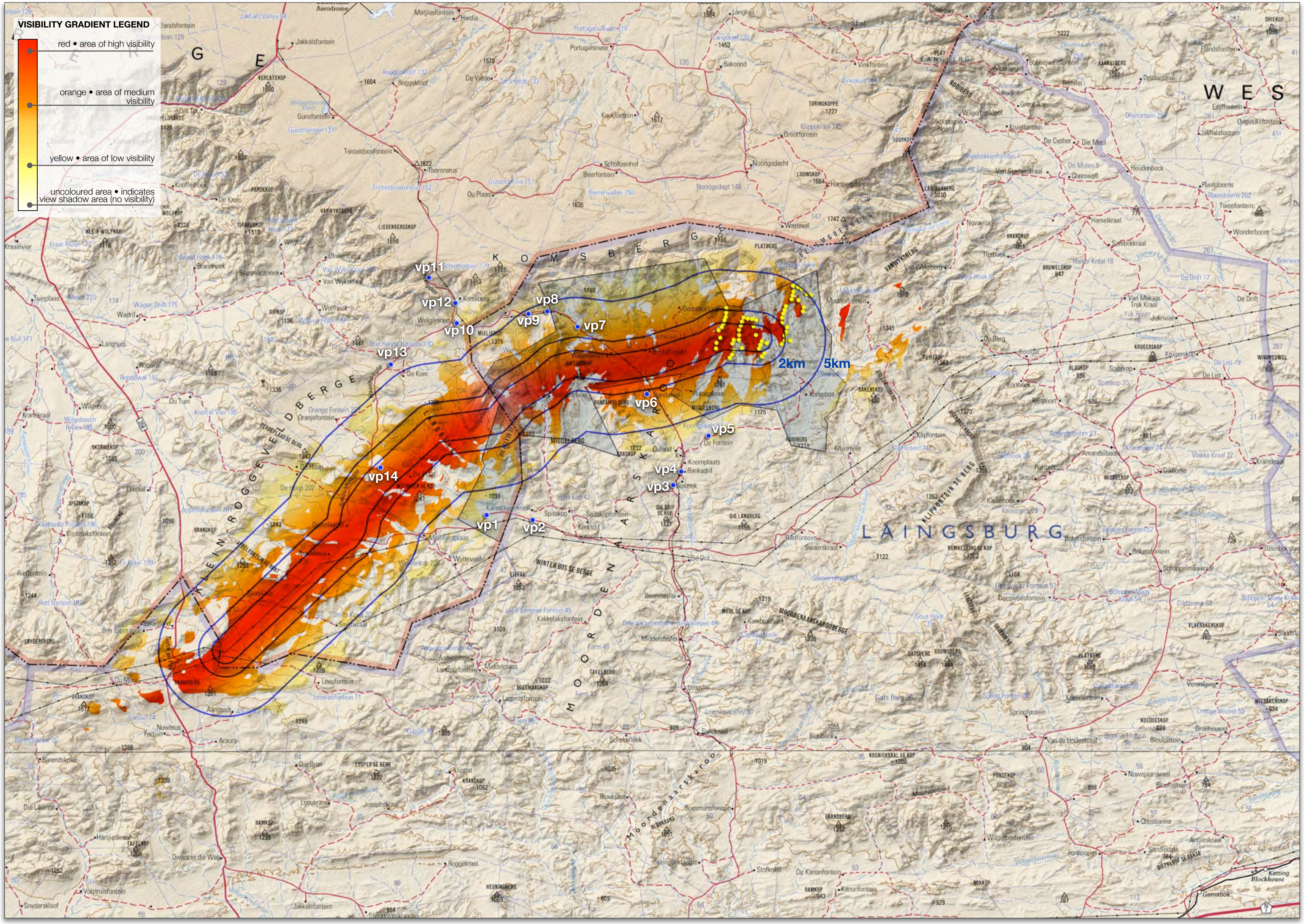
0 5km 10km

Figure 7 • Komsberg West : Viewshed and Distance Radii



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

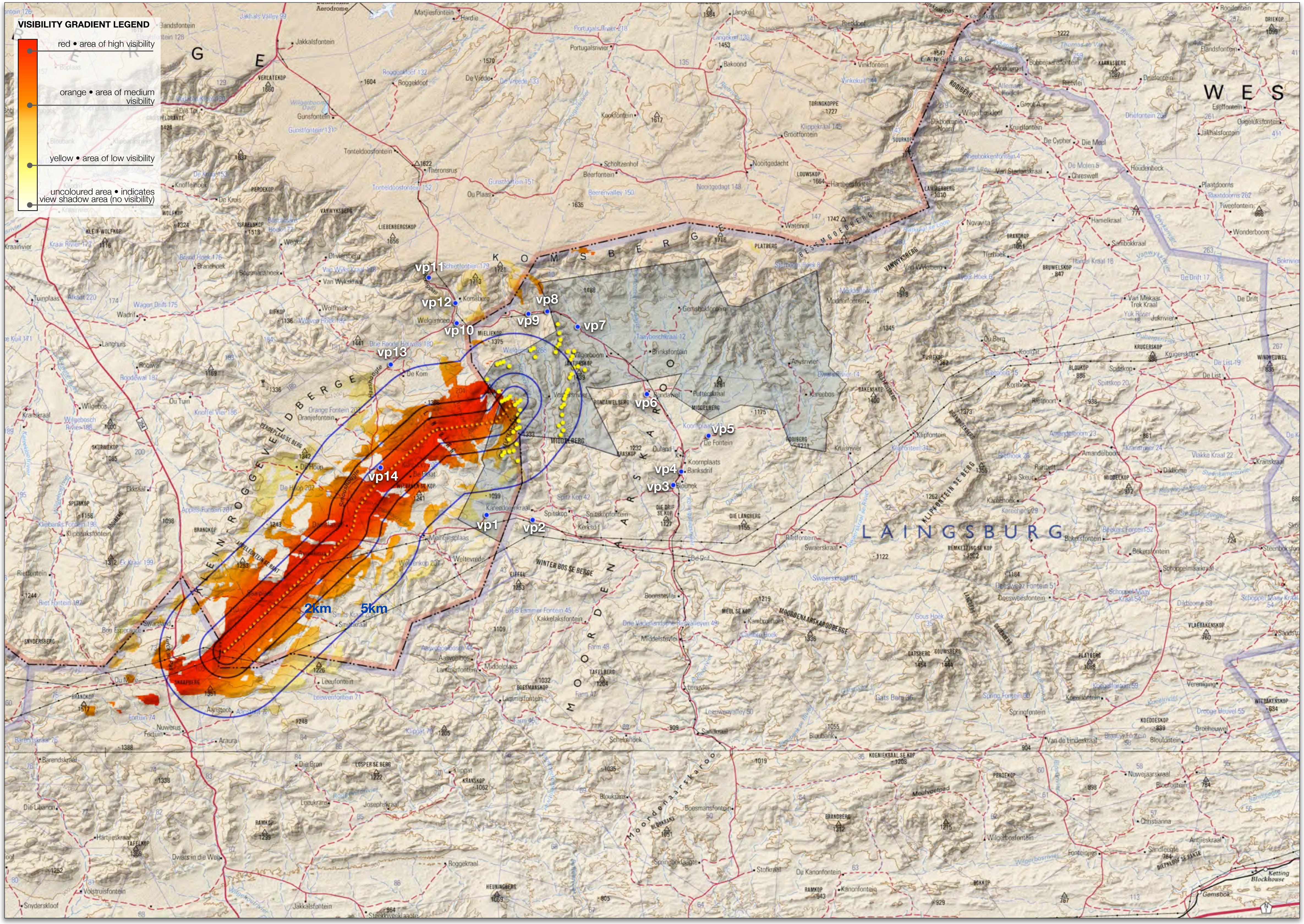
Figure 8 • Komsberg East and West • Combined Viewshed and Distance Radii



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

0 5km 10km

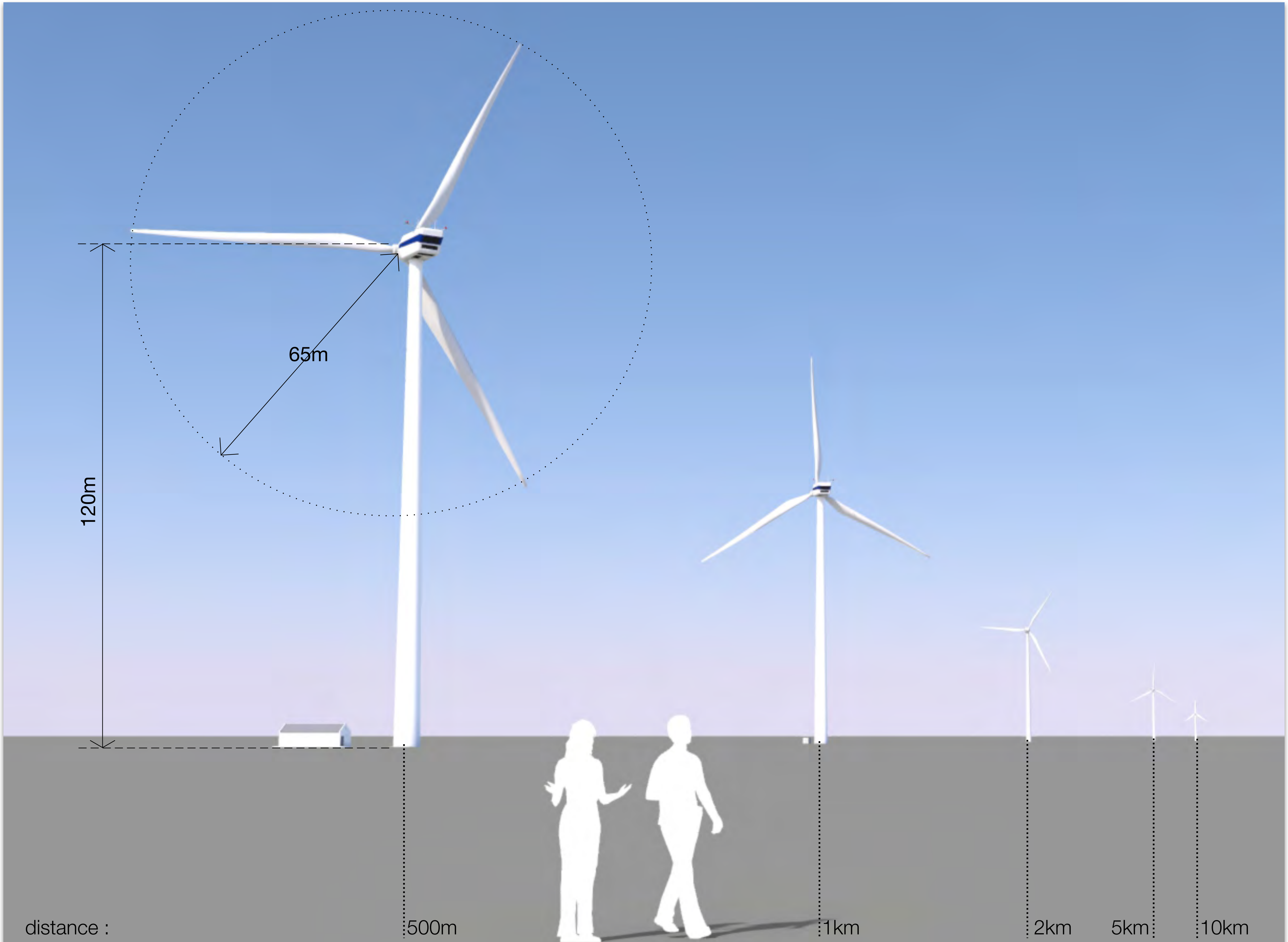
Figure 9 • Komsberg East Grid Connection : Viewshed and Distance Radii



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005, 3320 Ladysmith (5) 2006

0 5km 10km

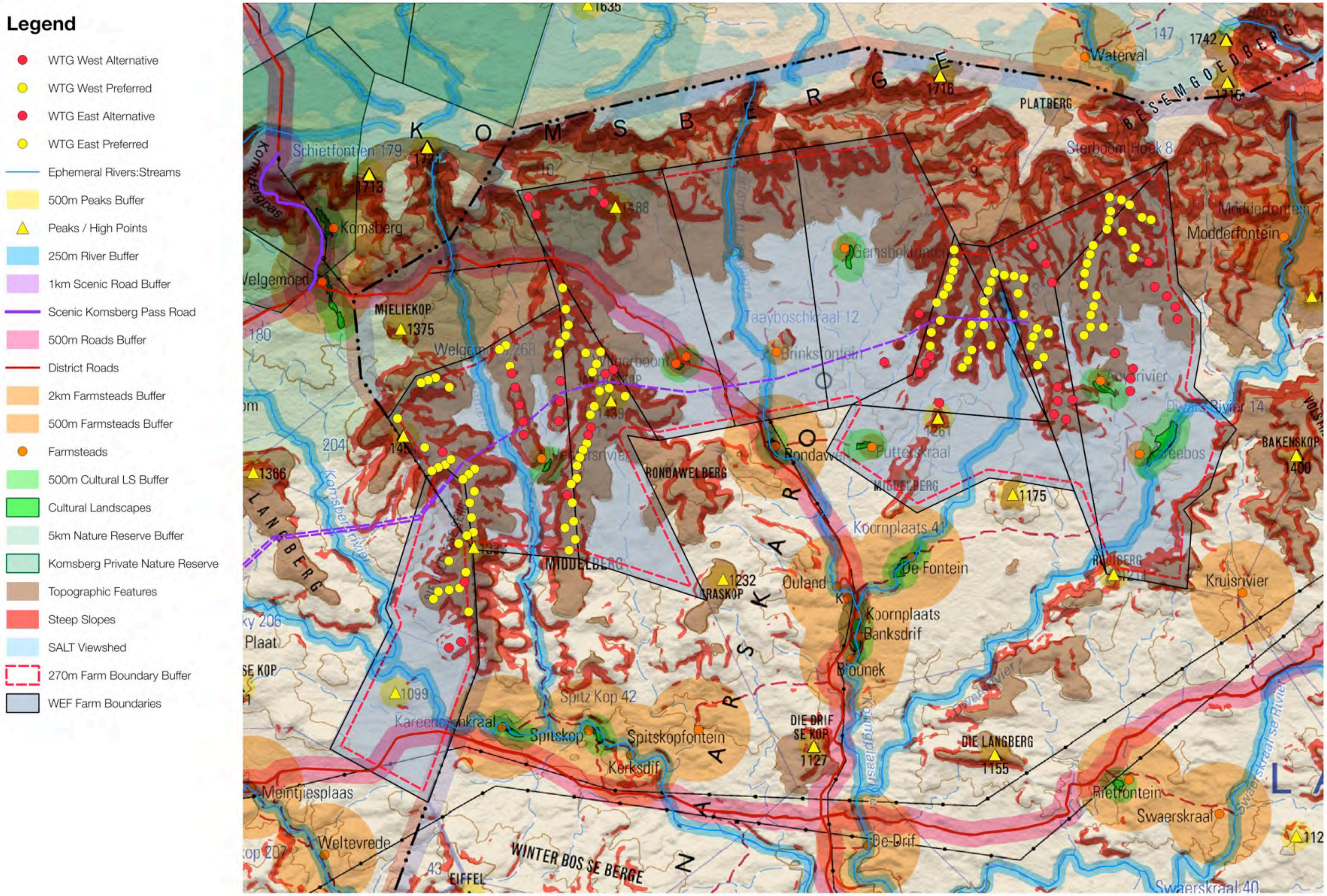
Figure 10 • Komsberg West Grid Connection : Viewshed and Distance Radii



3D Model and projection by mlb/BOLA 2015

no scale

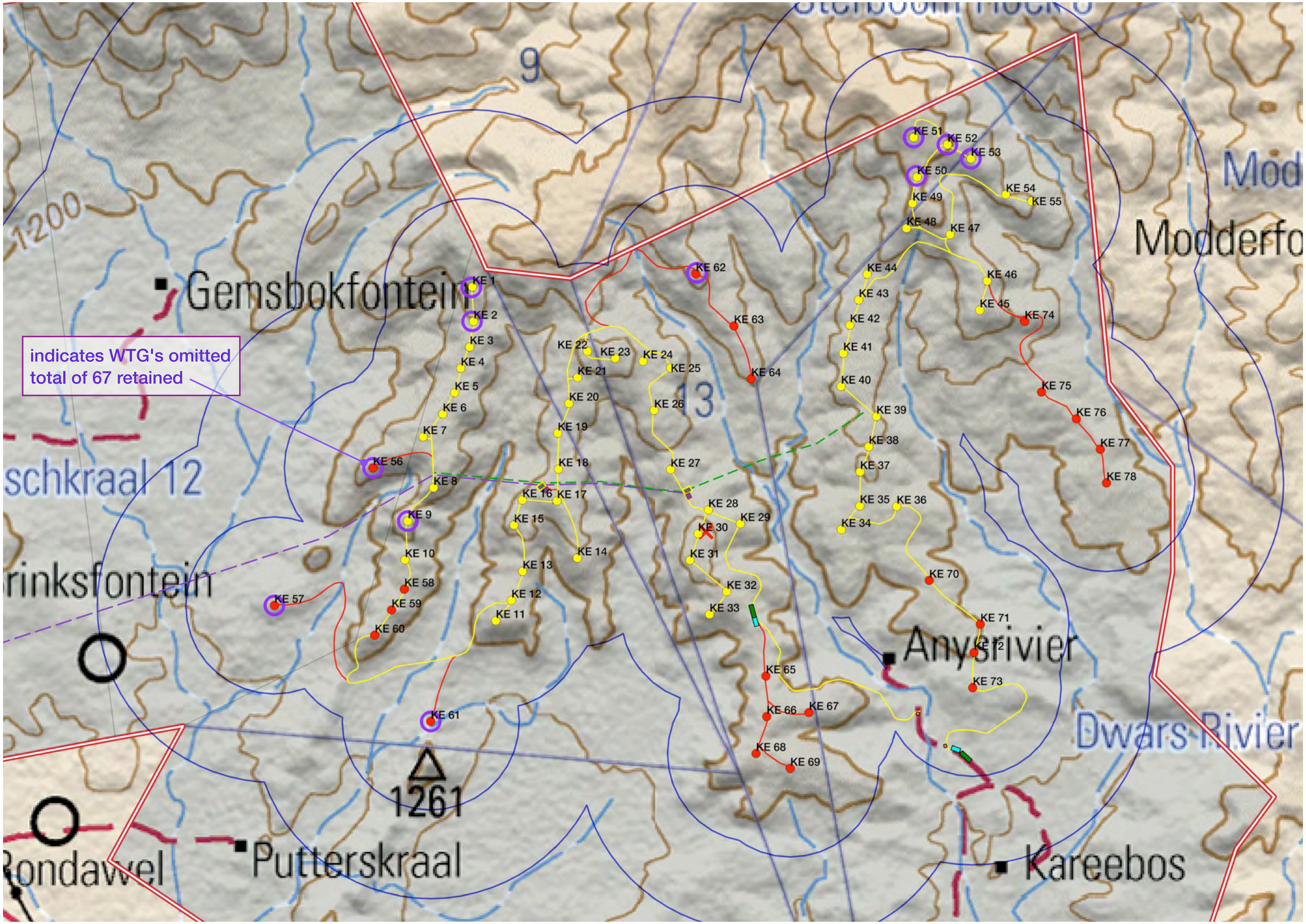
Figure 11 • Indicative Visibility of Wind Turbines at increasing distances



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005

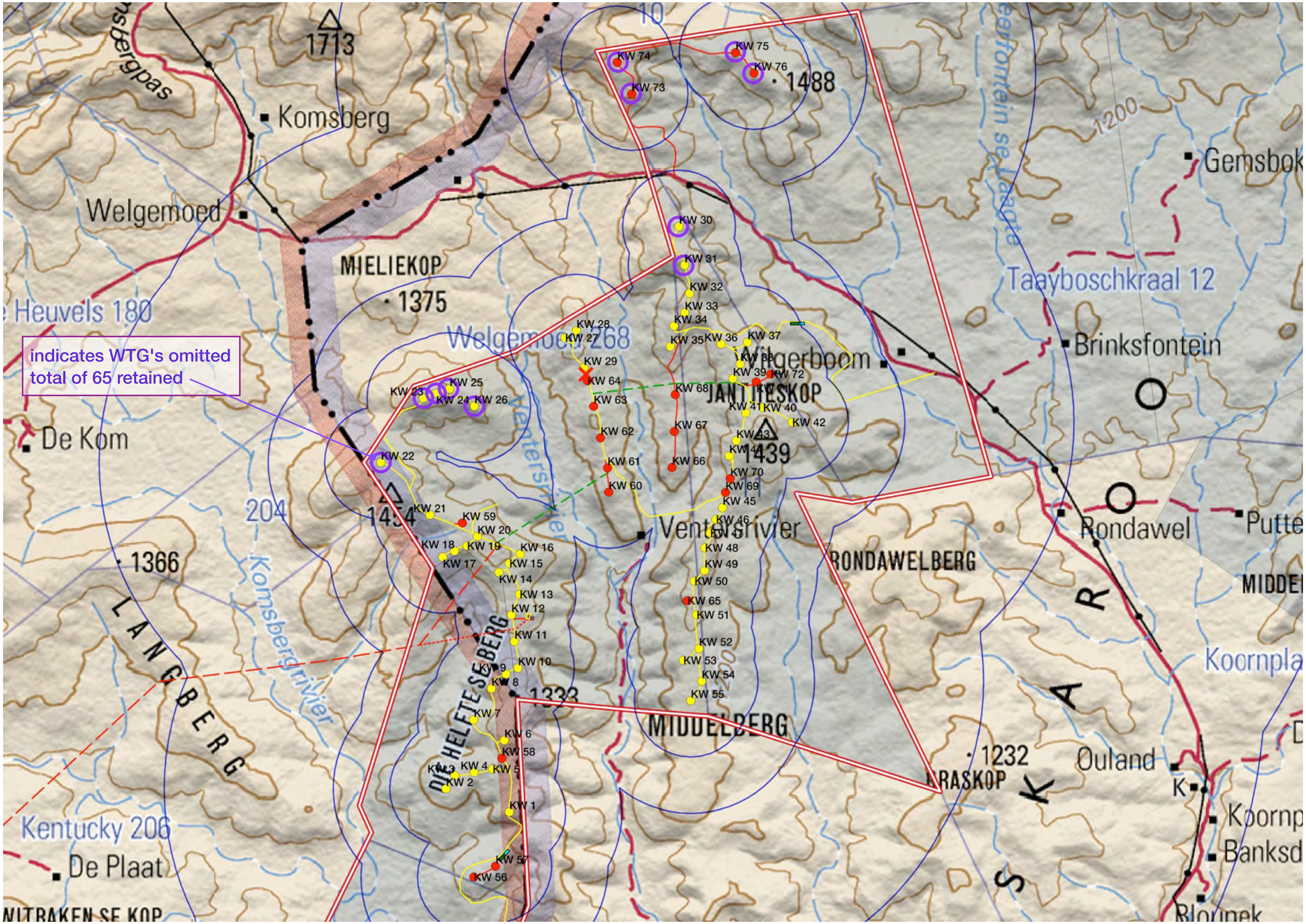
0 5km 10km

Figure 12 • Visual Informants with Komsberg East and West WEF Layouts



Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005

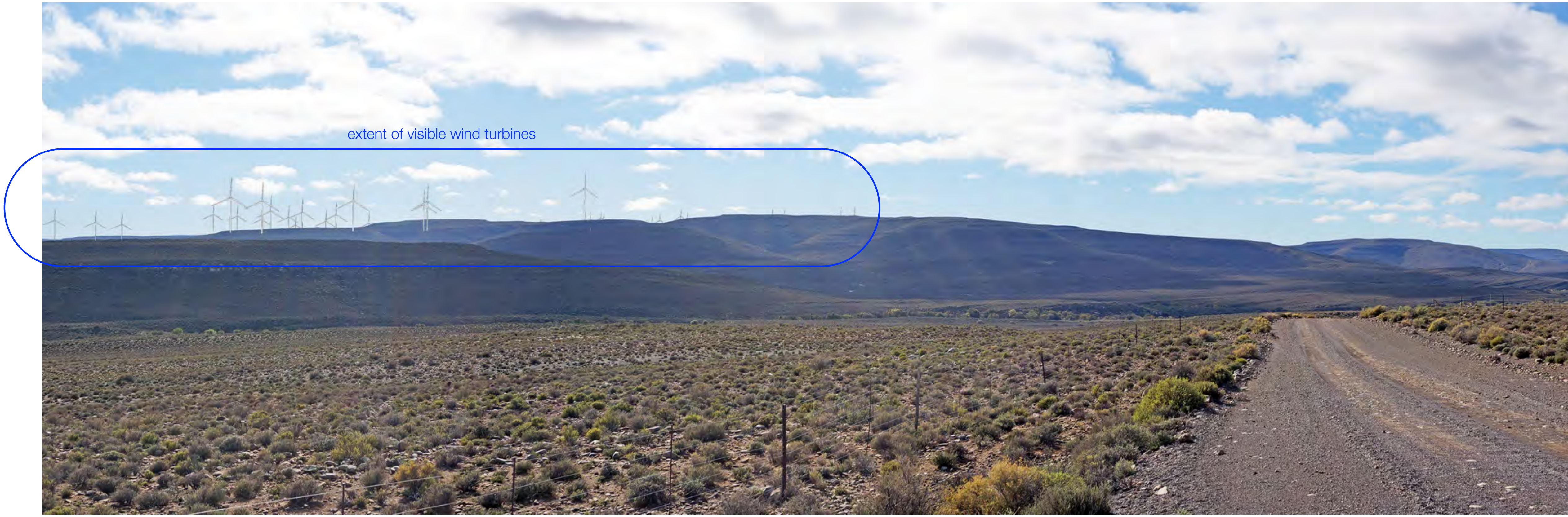
Figure 13 • Komsberg East Proposed WEF Amended Layout



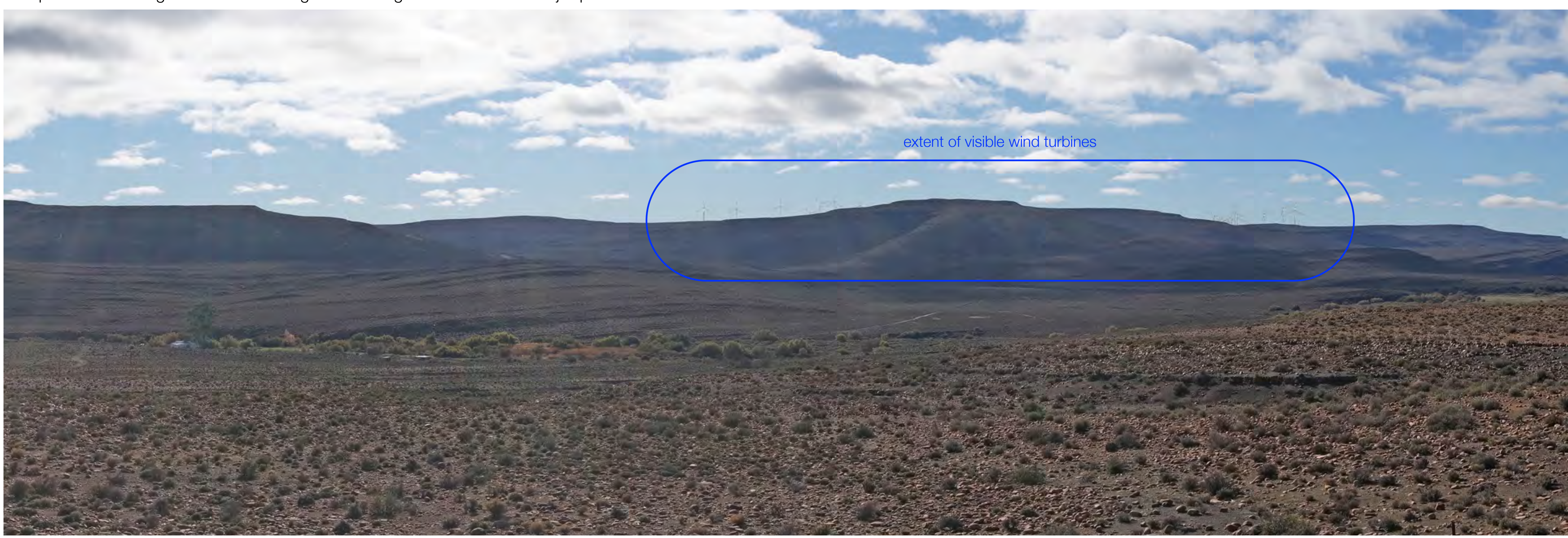
Base Map Source : Chief Directorate : National Geo-Spatial Information : 1:250 000 TopoCadastral Series : 3220 Sutherland (5) 2005

0 2.5km 5km

Figure 14 • Komsberg West Proposed WEF Amended Layout



viewpoint 1 • Looking towards Komsberg West from gravel road near Meintjiesplaas : distance 4.6km



viewpoint 2 • Looking towards Komsberg West from gravel road near Kareedoornkraal : distance 4.5km

photographs : bola/mlb 2015

Figure 15 • Photomontages : Viewpoints 1 and 2

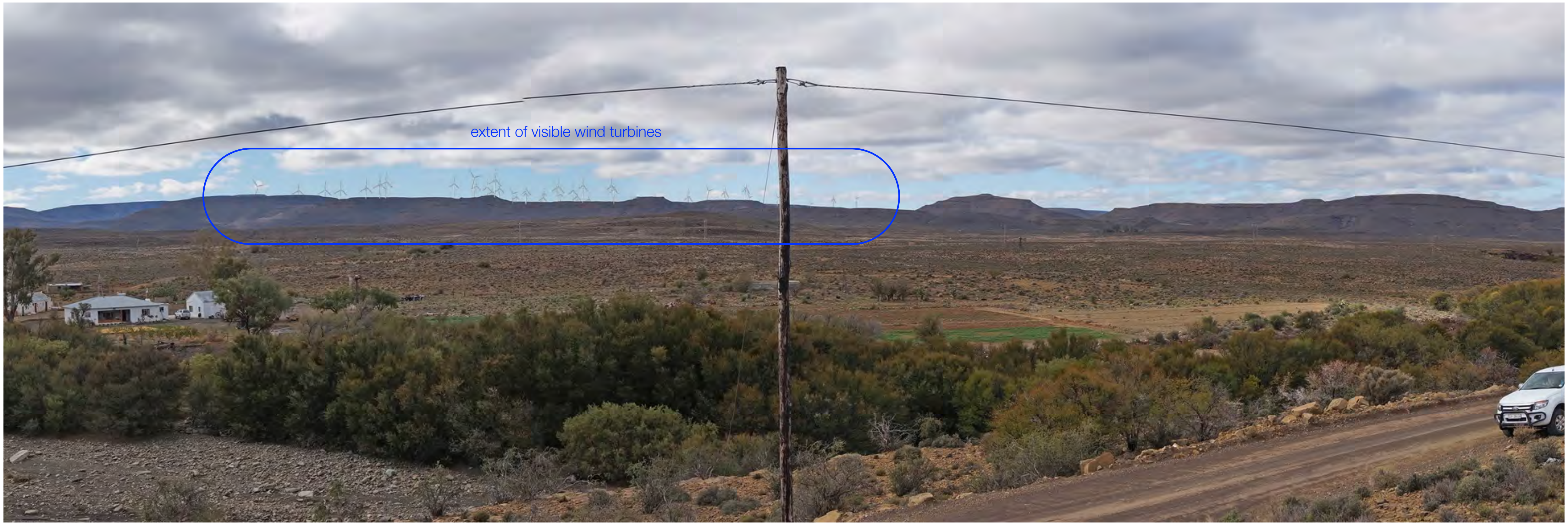
viewpoint 3 • Looking towards Komsberg East from gravel road opposite Blounek : distance 10.7km

viewpoint 4 • Looking towards Komsberg East from gravel road near Banksdrif : distance 9.4km

photographs : bola/mlb 2015

Figure 16 • Photomontages : Viewpoints 3 and 4

viewpoint 5 • Looking towards Komsberg East from farm werf De Fontein : distance 6.1km



viewpoint 6 • Looking towards Komsberg East from gravel road near Rondawel : distance 6.2km

photographs : bola/mlb 2015

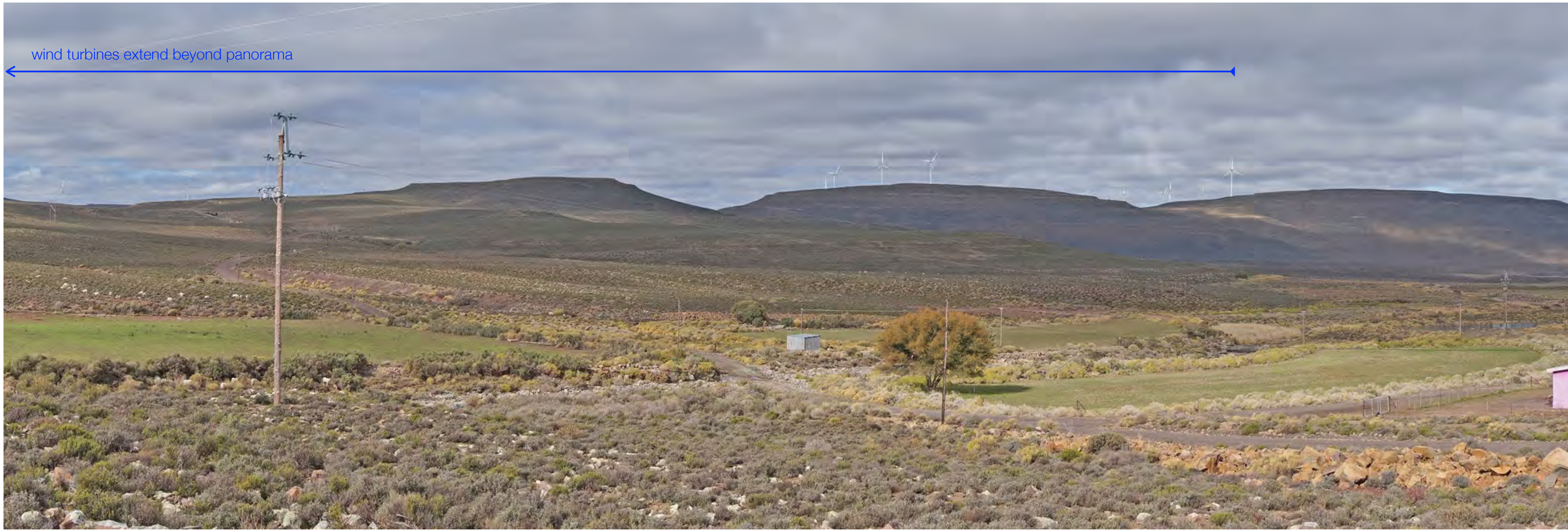
Figure 17 • Photomontages : Viewpoints 5 and 6

viewpoint 7 • Looking towards Komsberg West from gravel road at Perdebos : distance 1.5km

viewpoint 9 • Looking towards Komsberg West from gravel road at 2.4km distance

photographs : bola/mlb 2015

Figure 18 • Photomontages : Viewpoints 7 and 9



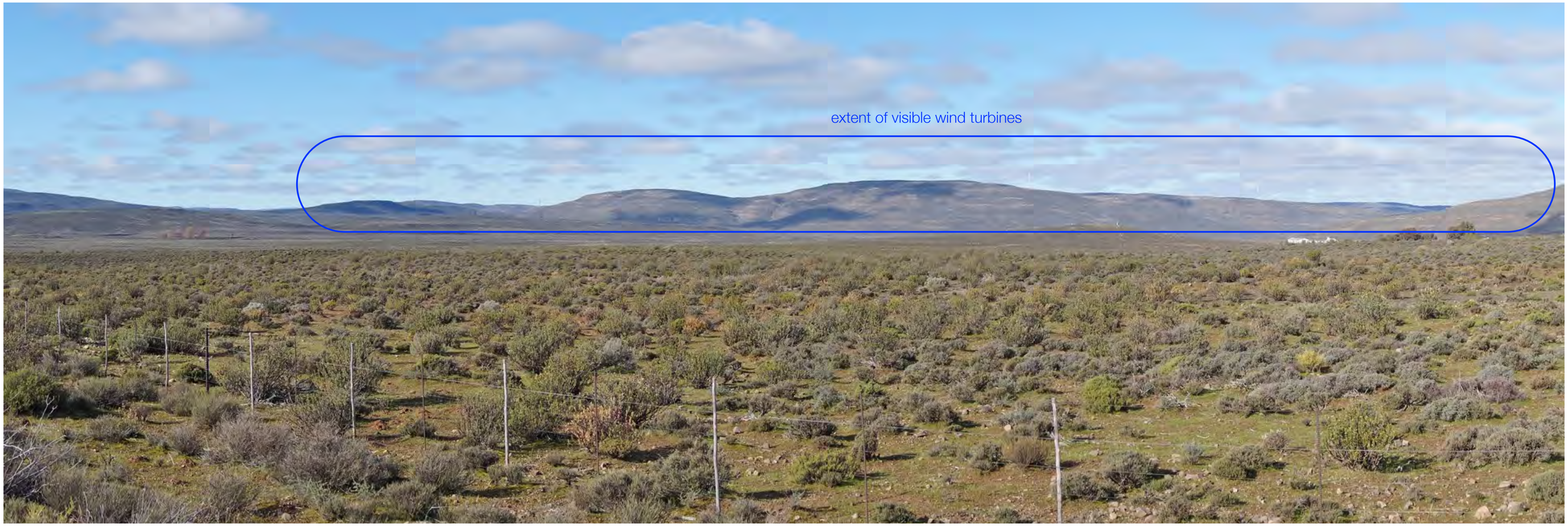
viewpoint 10 • Looking towards Komsberg West from Welgemoed Farm : distance 4.3km

viewpoint 11 • Looking towards Komsberg West from Komsberg Pass : distance 8.2km

photographs : bola/mlb 2015

Figure 19 • Photomontages : Viewpoints 10 and 11

viewpoint 12 • Looking towards Komsberg West from entrance to Komsberg Nature Reserve : distance 5.6km



viewpoint 13 • Looking towards Komsberg West from gravel road near De Kom Farm : distance 7.3km

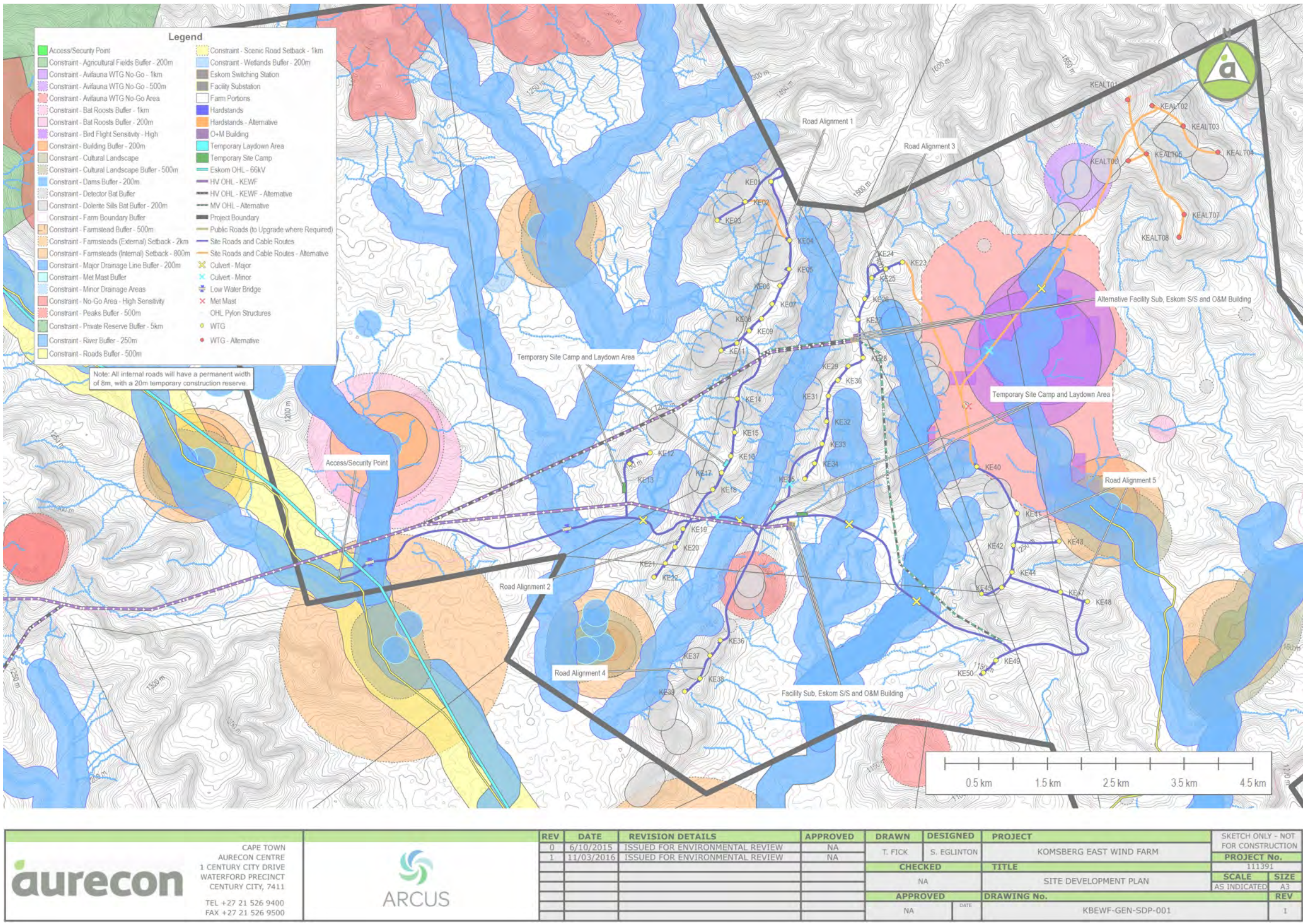
photographs : bola/mlb 2015

Figure 20 • Photomontages : Viewpoints 12 and 13

viewpoint 14 • Looking towards Komsberg West from access road to De Plaat Farm : distance 9.2km

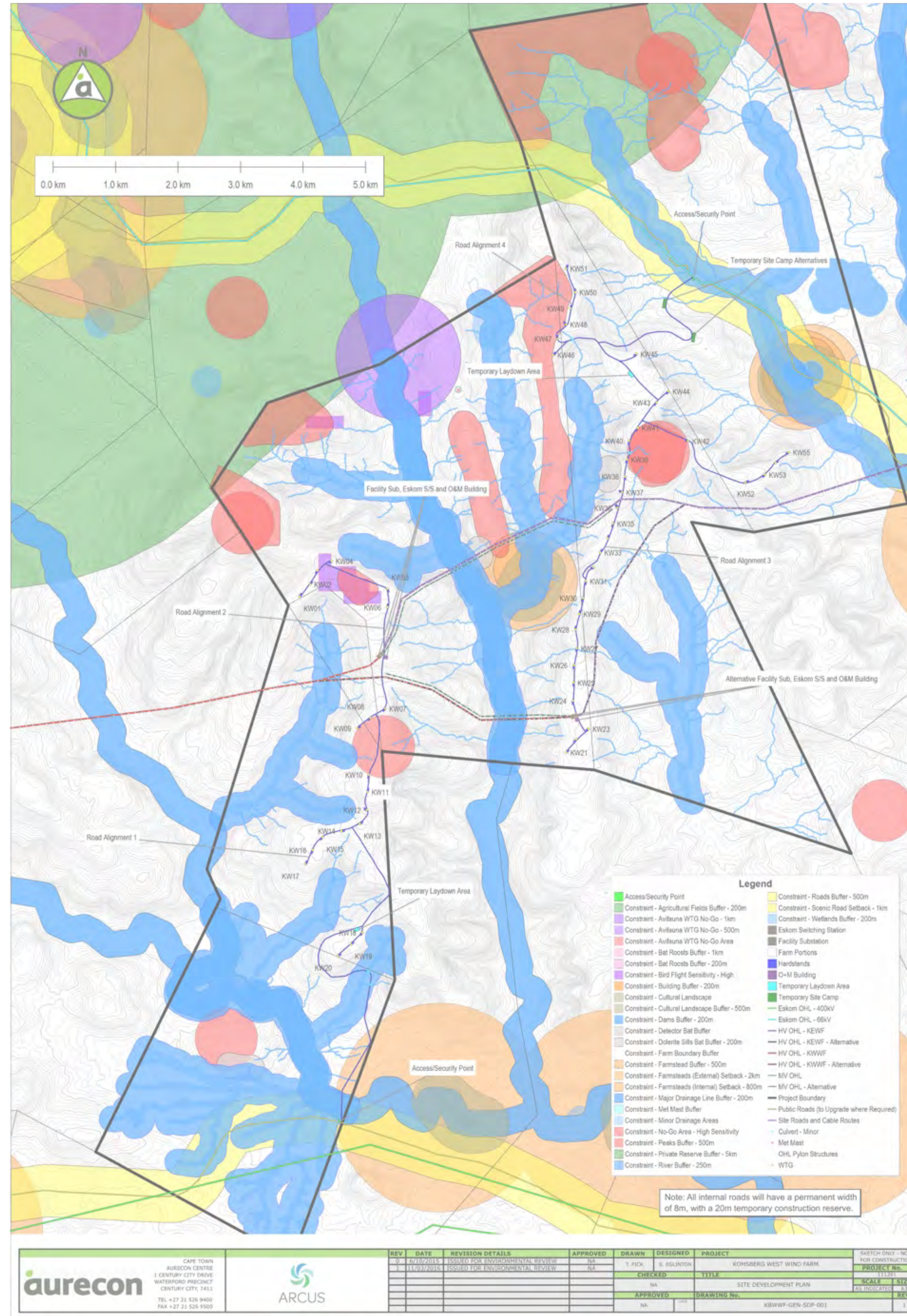
photographs : bola/mlb 2015

Figure 21 • Photomontage : Viewpoint 14



Source : Aurecon 2016 / Arcus

Figure 22 • Komsberg East SDP Revised Layout by Aurecon



Source : Aurecon 2016 / Arcus

Figure 23 • Komsberg West SDP Revised Layout by Aurecon

Aquatic Impact Assessment:

Komsberg Wind Energy Facility,

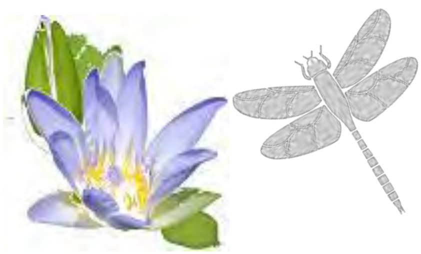
Northern Cape Province

Prepared for:

Arcus Consulting
Office 211 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

Prepared by:

Scherman Colloty & Associates
1 Rossini Road
PORT ELIZABETH, 6070



April 2016

SPECIALIST STATEMENT DETAIL

This statement has been prepared with the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant other National and / or Provincial Policies related to biodiversity assessments in mind.

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Certified EAP / Member SAEIES & SASAqS

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present. Please refer to the attached CV for additional detail and project related experience.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs

Signed:…  ……………… Date:…4 April 2016…………

1 - Introduction

Scherman Colloty & Associates (SC&A) was appointed by Arcus Consulting to conduct an aquatic impact assessment for the proposed Komsberg Wind Energy Facility between Laingsburg and Sutherland on the Western and Northern Cape boundary (Figure1). This included delineating any natural waterbodies remaining on the properties in question, as well as the potential consequences of the layout on the surrounding water courses. This was based on information collected during site visits in late August 2012, July 2014 and June 2015, which coincides with winter rainfall within the region while adhering to the assessment criteria contained in the DWAF 2005 / 2007 delineation manuals and the National Wetland Classification System found in the Appendix 1.

This report thus provides the relevant delineations and Present Ecological State status assessment of the observed waterbodies together with an analysis of the potential impact of the proposed facilities on the aquatic environment.

1.1 Scope

It is our understanding that the proposed project, has triggered the preparation of environmental impact assessments and potential applications under the National Water Act (Act 36 of 1998), where required. The potential impacts on the surrounding water bodies therefore need evaluation, with specific attention drawn to the likelihood of any changes to the regional hydrology and how this could impact on these systems. SC&A understands the study area well and has worked on a number of projects within the region and therefore possess a high level of information.

The following potential issue will be assessed:

- Potential loss of riverine and wetland habitat (road and services crossings)
- Increase in stormwater runoff and the potential to increase the amount of erosion in the catchment
- The possible impact of supplying the water requirements for construction and operation phases of the development, should a natural resource be considered as the supply source

All aspects of the SC&A study could then form part of the Water Use Licence process should this become a requirement

1.2 Terms of reference and methods

SC&A endeavours to provide a report which would include the following aspects related to potential wetlands and rivers for the site:

EIA Phase

- Maps depicting demarcated waterbodies delineated to a scale of 1:10 000 after a site visit has been conducted.
- The determination of the desktop ecological state of any aquatic systems, estimating their biodiversity, conservation and ecosystem function importance with regard ecosystem services.
- Recommend buffer zones and No-go areas around any delineated wetland areas based on the relevant legislation, e.g. Conservation Plan guidelines or best practice.
- Assess the potential impacts, based on the supplied methodology
- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated aquatic areas.
- Provide the relevant aspects with regard compiling the Environmental Management / Monitoring Plans.
- Supply the client with geo-referenced GIS shape files of the aquatic areas.
- Provide one draft report for comment, with a maximum of two rounds of comments addressed for the respective assessment phases as required.

The following checklist as per the NEMA specialist assessment requirements was also provided by Arcus Consulting:

NEMA Regulations Appendix 6: Specialist Reports

CONTENT ITEM	COMMENT	COMPLETED
1. (1) A specialist report prepared in terms of these Regulations must contain- (a)details of- (i) the specialist who prepared the report; and (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;	Use the form Arcus has provided	✓
(c) An indication of the scope of, and the purpose for which, the report was prepared;		✓
(d) The date and season of the site investigation and the relevance of the season to the outcome of the assessment;		✓
(e) A description of the methodology adopted in preparing the report or carrying out the specialised process;		✓
(f) The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;		✓
(g) An identification of any areas to be avoided, including buffers;	NOTE	✓
(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;	NOTE	✓
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;		✓
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;		✓
(k) Any mitigation measures for inclusion in the EMPr or closure plan;		✓
(I) Any conditions for inclusion in the environmental authorisation;		✓
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation;		✓
(n) a reasoned opinion - (i) as to whether the proposed activity or portions thereof should be authorised; and (ii) if the opinion is that the proposed activity or portion thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	NOTE	✓

(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;		Please refer to EIA Comments and Response documents
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and		Please refer to EIA Comments and Response documents
(q) any other information requested by the competent authority.		✓ - Department of Water and Sanitation

NEMA REGULATIONS APPENDIX 3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

	CONTENT ITEM	COMMENT	COMPLETED
1	Describe any policies or legislation relevant to your field that the applicant will need to comply with.		✓
2	Comment on need/desirability of the proposal in terms your field and in terms of the proposal's location.		✓
3	Determine the-- (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and (ii) degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated;	Through the life of the activity FOR EACH ALTERNATIVE and for CUMULATIVE IMPACTS. Refer to EIA assessment table structure below.	✓
4	Determine what the most ideal location within the site for the activity is in terms of your field.		✓
5	Identify suitable measures to avoid, manage or mitigate identified impacts.	Split this into ALL PHASES of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (v) operation activities. (iv) decommissioning/closure & rehabilitation of the environment after construction and where applicable post closure.	✓
6	Identify residual risks that need to be managed and monitored.	Refer to table structure below. .	✓

7	Include a concluding statement indicating a preferred alternative in terms of your field.		✓

2 - Project description

The proposed wind energy facilities will result in possible water course crossings on portions of the following farms (a comprehensive list is provided in Appendix 2 with regard the proposed transmission line corridors):

Komsberg West

- Taaiboschkraal 12 Portion 2
- Welgemoed 268 Portion 3
- Vlakkloof 11 and
- Schalkwykskraal 204 Portion 2

Komsberg East

- Taaiboschkraal 12 Portion 4
- Boschmankloof 9 Portion 3,
- Anysriviersplaat 13 and
- Dwarsrivier 14

A detailed description of the project is provided in the main EIA document, and the following summary is provided related to the water resources within the study area:

Description of Construction Phase

It is estimated that construction will take approximately 18 - 24 months subject to the final design of the WEF, weather and ground conditions, excluding time for testing and commissioning. The construction process will consist of the following principal activities:

- Site survey and preparation;
- Construction of site entrance, access tracks and passing places;
- Enabling works to sections of the public roads to the WEF sites (if required) to facilitate turbine delivery;
- Construction of the contractors' compound;
- Construction of crane pads;
- Construction of turbine foundations;
- Construction of substation building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines;
- Erection of electricity distribution line;
- Testing and commissioning of the wind turbines; and
- Rehabilitation.

It is possible for certain operations to be carried out concurrently, although predominantly in the order mentioned above. This would minimise the overall length of the construction programme. Construction would be phased such that the civil engineering works would be continuing in some parts of the site, whilst wind turbines are being erected elsewhere.

Site rehabilitation will be programmed and carried out in order to allow the rehabilitation of disturbed areas as early as possible and in a progressive manner.

Based on experience from other WEF developments the construction phase is likely to create approximately 300 to 400 employment opportunities. Of this total, approximately 25% will be available to skilled personnel (engineers, technicians, management and supervisory), 15% to semi-skilled personnel (drivers, equipment operators) and 60% to low skilled personnel (construction labourers, security staff).

The number and nature of employment opportunities will be refined as the development process progresses.

During the construction phase, water will be supplied from a number of boreholes on different land portions of the proposed project sites as listed above. Early estimations are that 25 000kl will be needed per annum during construction. Water for construction purposes (e.g. mass earthworks and roads) will be transferred from the source to the point of use on the site via tanker. All storage of water will be below WULA authorisation limits, i.e. 10 000m^3.

Description of Operational Phase

The proposed development would be designed to have an operational life of up to 25 years. The current REIPPPP set out by the Department of Energy (DoE) grants a Power Producer Agreement (PPA) for 20 years. During operation of the development, the large majority of the WEF sites will continue with agricultural use as it is currently. The only development related activities on-site will be routine servicing and unscheduled maintenance, as detailed in the following sections.

Based on experience from other WEF developments, the operational phase is likely to create approximately 35 permanent employment opportunities. Of this total, approximately 70% (24) will be low and medium-skilled and 30% (11) will be high skilled positions. The number and nature of employment opportunities will be refined as the development process progresses.

Anticipated water usage for the operations stage is estimated to be in the range of 300m^3 annum at most will be used for equipment cleaning, basic civil maintenance and for domestic water purposes e.g. sanitation, washing and drinking.

It is anticipated that only domestic waste water (sewage) will be generated during the construction and operation phases. All waste water would be stored in conservancy tanks (less than 5 000 m^3) and transported to a licensed wastewater treatment works (e.g. Laingsburg) as and when the tanks are full.

Routine Servicing

Wind turbine operations would be overseen by suitably qualified local contractors who visit the site regularly to carry out maintenance. The following turbine maintenance would be carried out along with any other maintenance required by the manufacturer's specifications:

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes; and
- Blade inspections.

Routine scheduled servicing would likely take place twice per year with a main service likely to occur at twelve-month intervals. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. In addition, oil sampling and testing from the main gear. Other visits to the site would take place approximately once per week to ensure that the turbines are operating at their maximum efficiency.

Site tracks will be maintained in good order. Safe access will be maintained all year round.

The turbines are monitored 24 hours a day in real-time via a supervisory control and data acquisition (SCADA) system.

Unscheduled Maintenance

Unscheduled maintenance associated with unforeseen events would be dealt with on an individual basis. In the unlikely event of a main component failure, cranes may be mobilised to site to carry out repairs and/or replacement works.

3 – Study area description

The proposed development occurs within the following catchments within the Nama Karoo Ecoregion located within the Gouritz Water Management Area (Figure 2)

J11A – Komsberg / Venter rivers catchment

J11B – Bierfontein se Laagte / Koringplaas / Swaerkraal se /Dwars rivers catchment.

The proposed grid connections (transmission lines for both projects will extend into the of the Meintjiesplaas/Rooival J11D catchments to the west prior to joining the Komsberg MTS (Figure 2).

These catchments are characterised by several perennial water courses and drainage lines associated with these mainstem systems listed above. With the larger systems containing alluvial riverbeds / washes.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site have been assigned a condition score of AB (Nel *et al.* 2011), indicating that they largely intact of biological significance. This is largely due to this catchments falling with the headwaters of the Buffels River that flows towards Laingsburg, and forming part of an upstream Fish Freshwater Ecosystem Priority Area (Fish FEPA).

The only exception being the Komsberg River in the western portion of the development area was rated by Nel *et al.* 2011 as C (Moderately Modified). The proposed transmission lines within the J11D catchment will cross the observed rivers within reaches that were classed as C (Moderately Modified) but it is anticipated that all towers will span these systems including their respective riparian zones or the 1:100 year floodline whichever is greater.

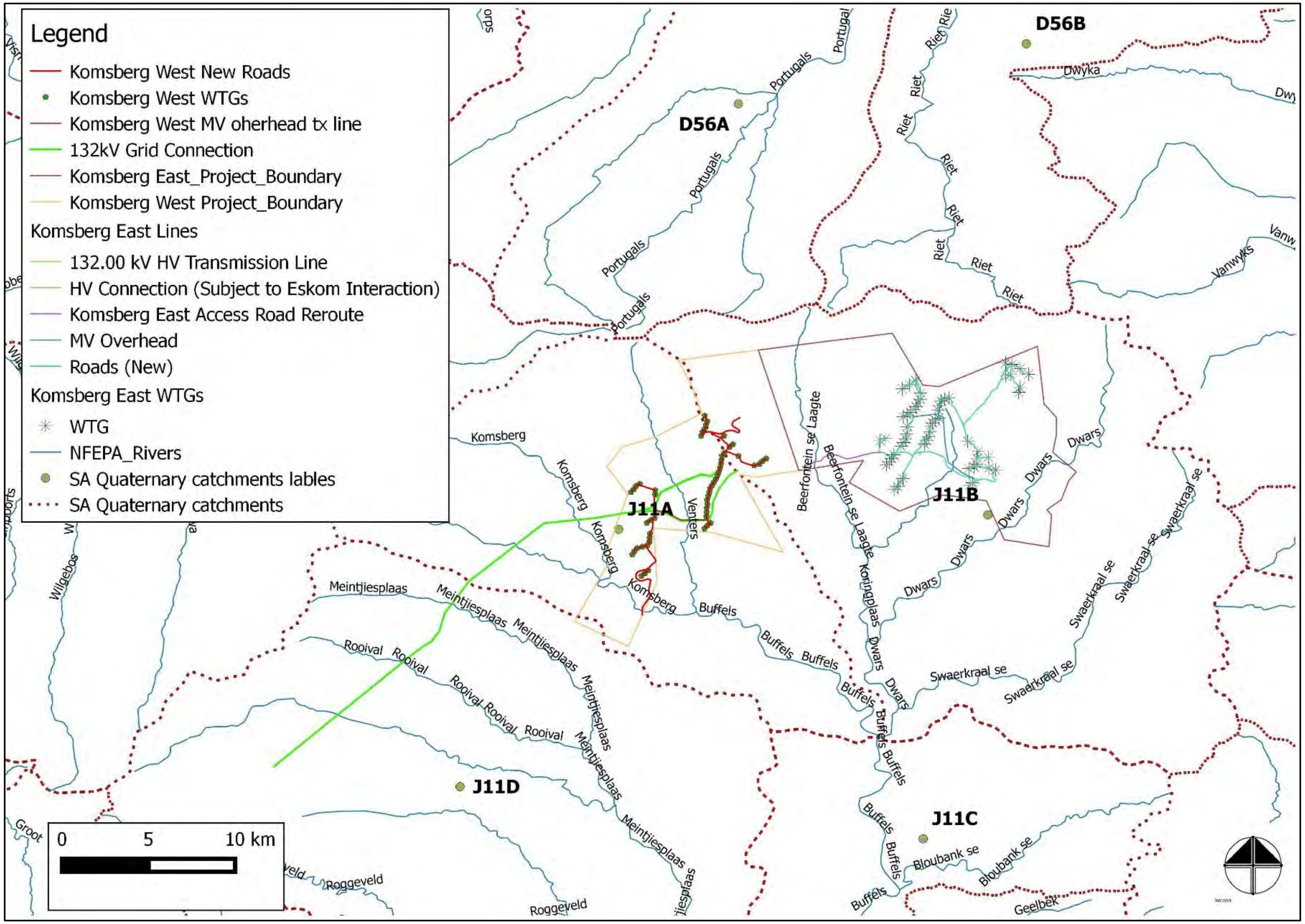


Figure 1: Project locality map indicating various quaternary catchments and mainstream rivers within the region (NFEPA & DWS)

4 – Waterbody delineation & classification

The water body delineation and classification was conducted using the standards and guidelines produced by the DWA (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (SANBI, 2009). These methods are contained in the attached Appendix 1, which also includes wetland definitions, wetland conservation importance and Present Ecological State (PES) assessment methods used in this report. Reference is also included with regard relevant legislation related to the protection of waterbodies and the minimum requirements in terms of prescribed buffers.

For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -
  - (a) a river or spring;
  - (b) a natural channel in which water flows regularly or intermittently;
  - (c) a wetland, lake or dam into which, or from which, water flows; and
  - (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, several natural wetlands could occur within the study area. The remaining waterbodies are artificial or man-made systems as shown in Figure 2a & b. However, no natural wetlands were observed within the study area as the potential wetlands observed were either farm dams / borrow-pits (Plate 1) or agricultural fields (Plate 2) misidentified by the National Wetland Inventory (Ver 4) as wetland areas.

Figure 3a & b indicates significant watercourses observed within the site (Plate 3). Any activities within these areas or the 32m buffer (or the 1:100 floodline, whichever is the greatest) will require a Water Use license (possible General Authorisation). It is estimated based on the present layout that 37 new water course crossings (including 4 related to the alternative layout) will be required for the Komsberg West Project, while 55 new crossings will be required form the Komsberg East projects (inclusive of 14 with the alternative layout options. The co-ordinates for each of the respective crossings is provided in Appendix 3.

It could not be determined from the present information, which of the existing road section will require upgrades along the public roads but this will likely be required in parts.

However, it has been assumed that all of the proposed transmission lines for both projects will adequately span any water courses, thus no direct impacts on these ephemeral systems are anticipated.

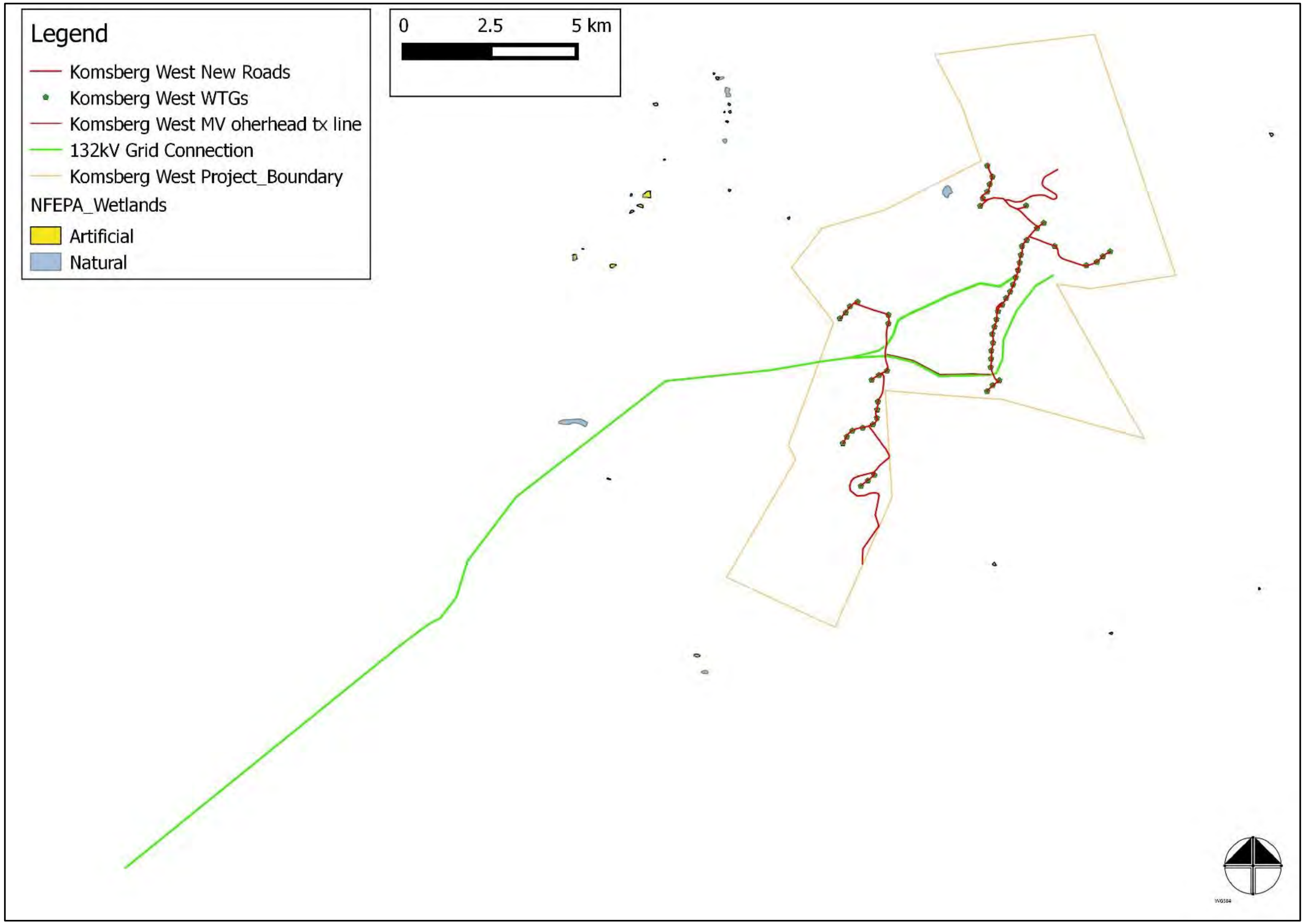


Figure 2a: Potential wetlands according to the National Wetland Inventory (SANBI, 2015 ver. 4) in relation to the proposed Komsberg West layout (but none located within the site confirmed).

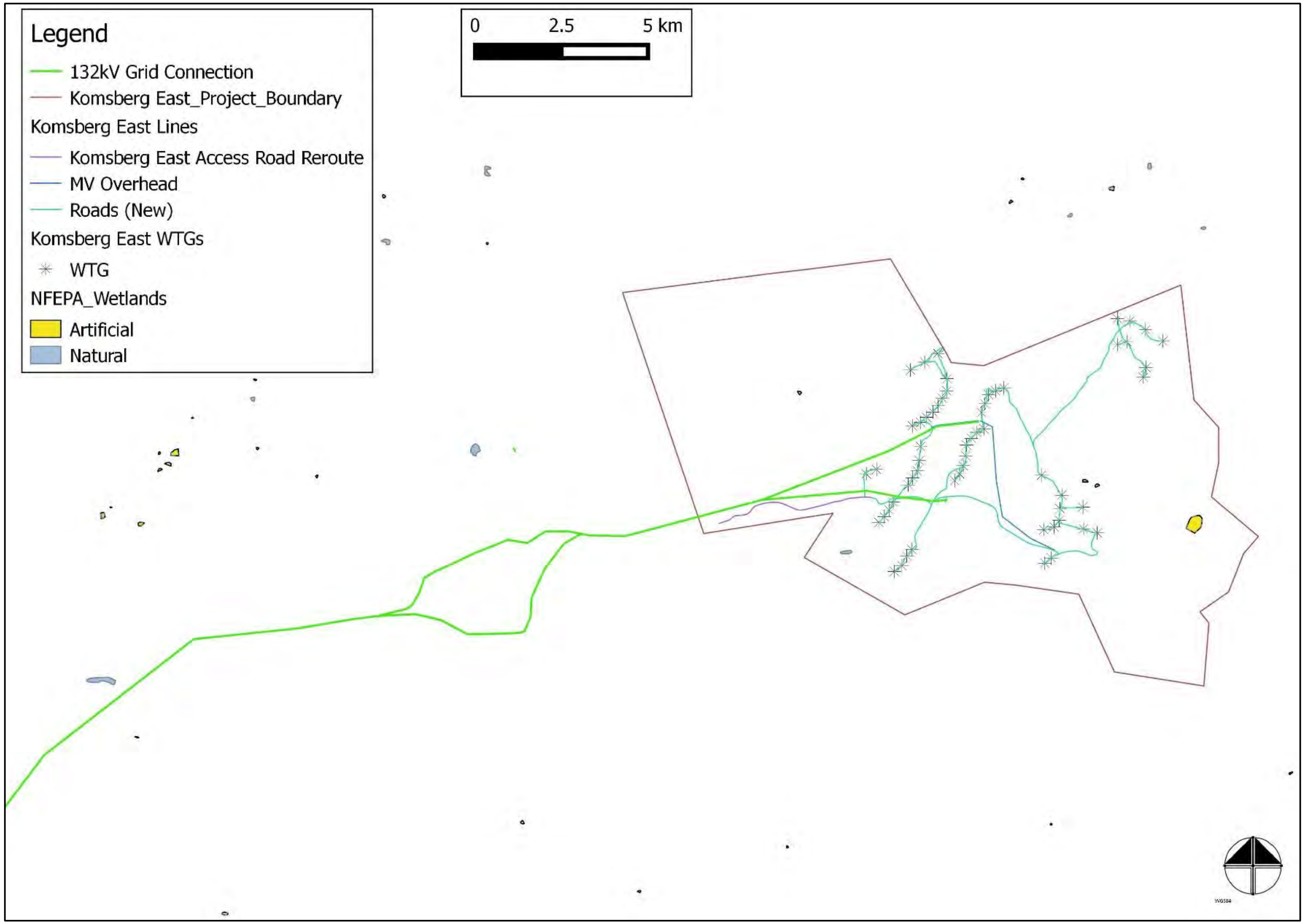


Figure 2a: Potential wetlands according to the National Wetland Inventory (SANBI, 2015 ver. 4) in relation to the proposed Komsberg East layout (but none located within the site confirmed).

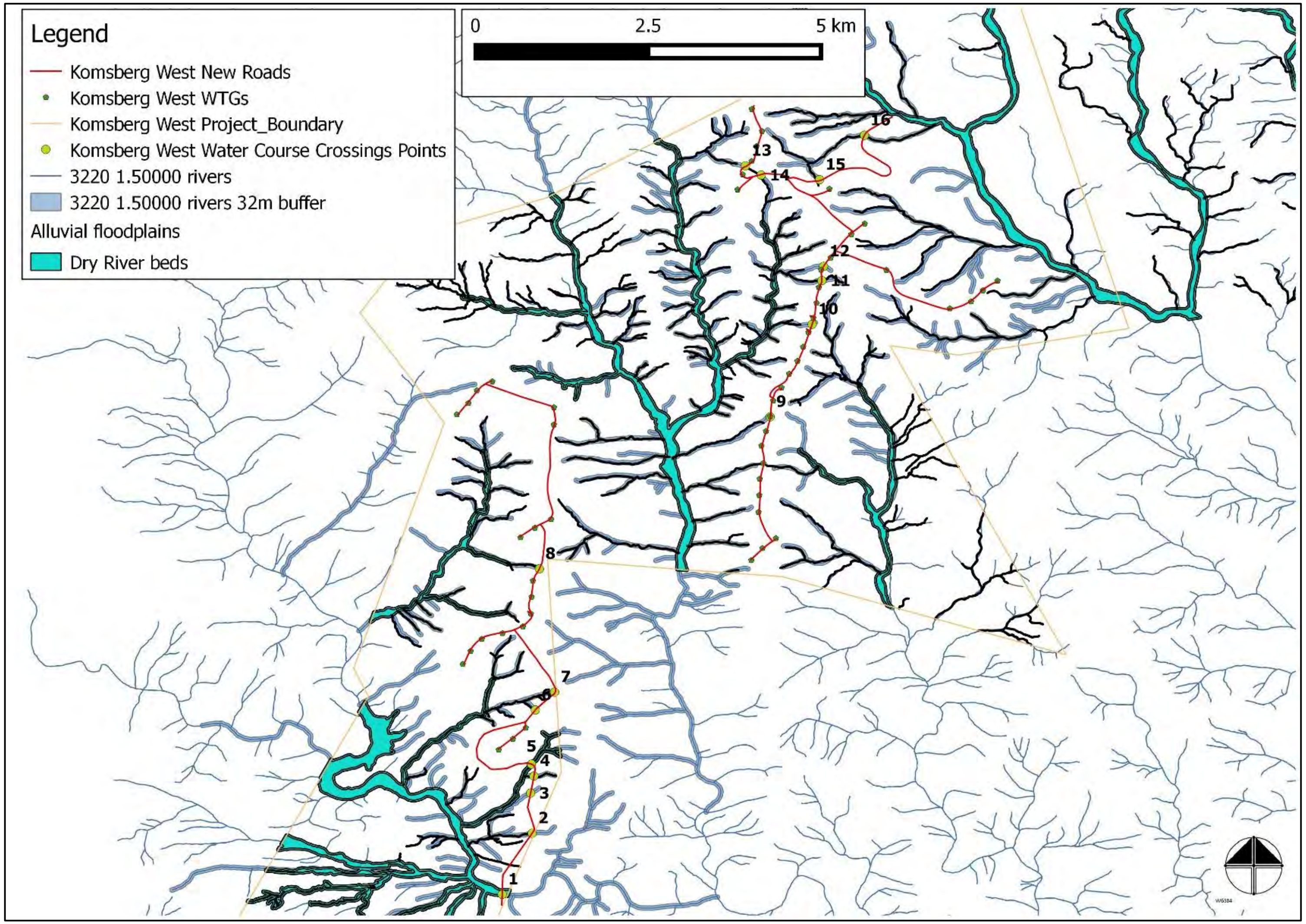


Figure 3a: The various activities in relation to the water courses (incl 32m buffer) associated with the Komsberg Wind Farm West road layout (red lines). Also indicated are the positions of the 16 new water course crossings.

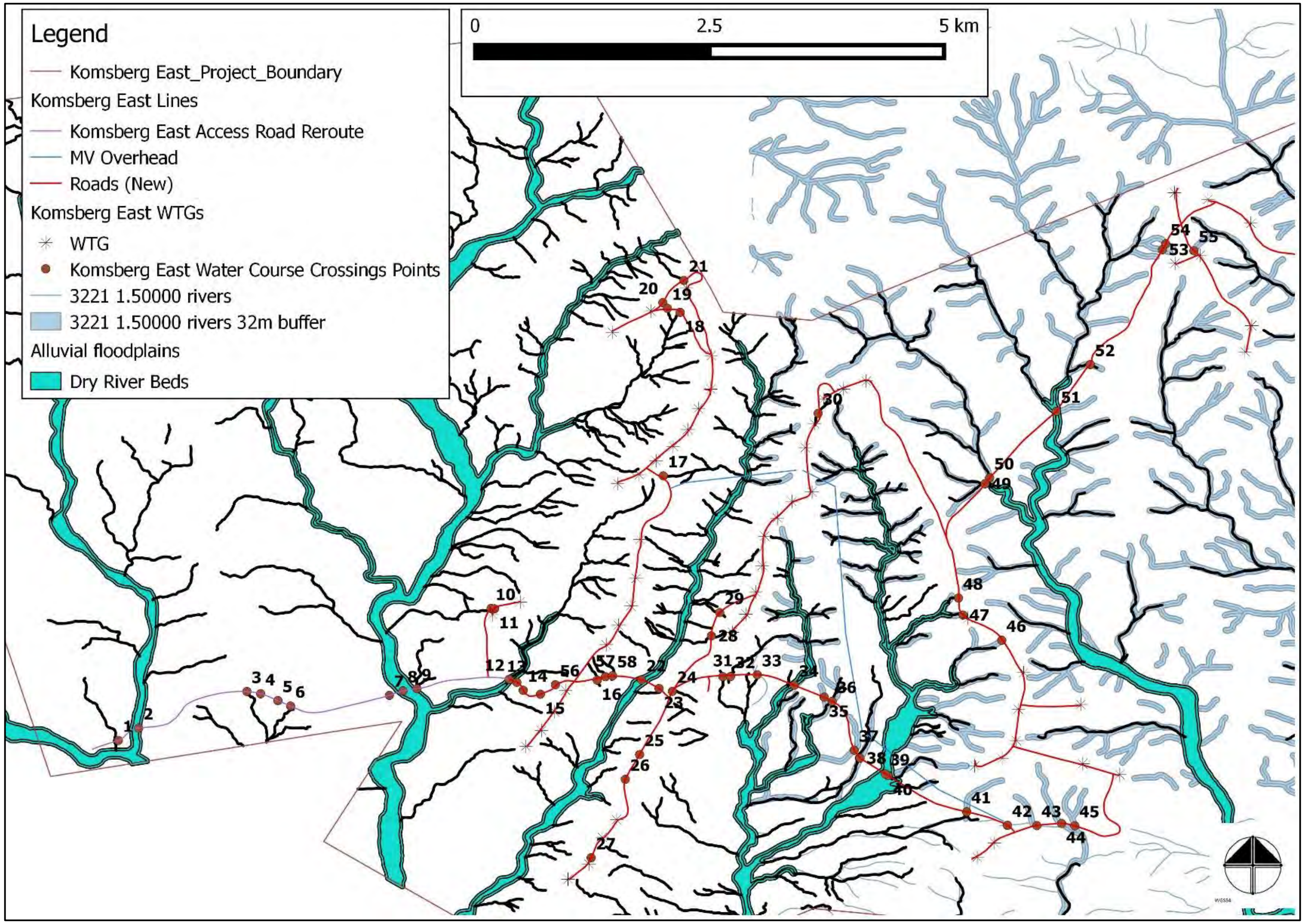


Figure 3a: The various activities in relation to the water courses (incl of 32m buffer) for the Komsberg Wind Farm East road layout (light and dark green lines). Also indicated are the positions of the 55 new water course crossings.

5 - Present Ecological State and conservation importance

The Present Ecological State (PES) of the Rivers

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centered on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed or then overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where A = Natural or Close to Natural & B = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
7980	A	High	Moderate
7820	A	High	Moderate
7821	A	High	High
7923	B	High	High
7772	B	High	Moderate
7863	A	High	High
7782	B	High	High
7901	A	High	High

It is thus evident that the study area systems are largely functional and or have limited impacts as a result of current land use practices. This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout shown in Figure 3a & b. In other words, the systems observed are largely natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

6 - Recommended buffers

Presently there are no prescribed aquatic buffers other than those proposed in the Northern Cape, thus the, recommendations by Desmet and Berliner (2007) will be applied as these are becoming more widely accepted (Table 1). These are shown below, to make the engineers and contractors aware of these buffers during the planning phase, i.e. construction, associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas i.e. 32m for this development.

Table 1: Recommended buffers for rivers, with those applicable to the project highlighted in blue

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	▪ 50	▪ These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers i.e. rivers mapped at this scale by DWS	▪ 100	▪ These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 scale streams, i.e. all systems that appear on the topo-cadastral maps	▪ 32	▪ Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Plate 1: Small borrow pit area associated with past road works that was identified as a natural wetland by NFEPA (Nel *et al*. 2011) and was classified as an artificial or man-made dam in this study

Plate 2: A view of an agricultural fields that were shown as natural wetland by NFEPA (Nel *et al*. 2011) and thus not a waterbody.

Plate 3: A typical water course observed within the study area, consisting of a dry riverbed and narrow riparian zone, with no obligate / facultative plant species

7 – Potential impacts and risk assessment

During the impact assessment study a number of potential key issues / impacts were identified and these were assessed based on the methodology supplied Arcus Consulting.

The following impacts were not assessed as the factors were not present within the study area aquatic ecosystems:

Loss of aquatic species of special concern, and

Wetland loss as no natural wetlands were observed in close proximity to any of the proposed infrastructure (i.e. within 500m of the proposed layouts).

The following direct and indirect impacts were assessed with regard the riparian areas and water courses:

Impact 1: Loss of riparian systems and water courses

Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function

Impact 3: Increase in sedimentation and erosion

Impact 4: Potential impact on localised surface water quality

The impacts were assessed as follows:

i. Komsberg EAST Wind Energy Facility

<table>
<tr><td colspan="8">Nature: Impact 1 - Loss of riparian systems and water courses during the construction phase

The physical removal of the narrow strips of riparian zones and disturbance of any alluvial watercourses by 58 road crossings, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact.</td></tr>
<tr><td colspan="3">▪ Reversibility</td><td colspan="2">▪ High</td><td colspan="3">▪ High</td></tr>
<tr><td colspan="3">▪ Irreplaceable loss of resources</td><td colspan="2">▪ No</td><td colspan="3">▪ No</td></tr>
<tr><td colspan="3">▪ Can impacts be mitigated</td><td colspan="2">▪ Yes</td><td colspan="3"></td></tr>
<tr><td colspan="8">▪ Mitigation:
• Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint).
• A number of the transmission line towers to the grid are located within some of the watercourses and these should be placed outside of these areas (incl 32m buffer)
• No vehicles to refuel or be maintained within drainage lines/ riparian vegetation.
• During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
• Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.</td></tr>
<tr><td colspan="8">▪ Cumulative impacts:
The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 6-9 other renewable projects. However the annual rainfall figures are low and this impact is not anticipated and only a small percentage of the proposed projects reach the construction phase.</td></tr>
<tr><td colspan="8">▪ Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.</td></tr>
<tr><th></th><th>Extent</th><th>Duration</th><th>Intensity</th><th>Status</th><th>Significance</th><th>Probability</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>Local (L)</td><td>Medium Term (M)</td><td>L-</td><td>Negative</td><td>Medium (-)</td><td>High</td><td>High</td></tr>
<tr><td>With Mitigation</td><td>Local (L)</td><td>Short term (L)</td><td>L-</td><td>Negative</td><td>Low (-)</td><td>High</td><td>High</td></tr>
</table>

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or the 58 new road crossings on riparian form and function during the operational phase		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.		
▪ **Cumulative impacts:** Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout. This is also coupled to the fact that surrounding developments would impact on a different catchment in the neighbouring water management area, coupled to the low average rainfall figures.		
▪ **Residual impacts:** Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Short Term (L)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

Nature: Impact 3 - Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.		
▪ **Cumulative impacts:** Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		
▪ **Residual impacts:** During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium- term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

Nature: Impact 4 – Impact on localized surface water quality mainly during the construction phase. During both preconstruction, construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.		
	Without mitigation	**With mitigation**
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	
Mitigation: » Strict use and management of all hazardous materials used on site. » Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.). » Containment of all contaminated water by means of careful run-off management on the development site. » Strict control over the behaviour of construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. » Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.		
Cumulative impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		
Residual impacts: Residual impacts will be negligible after appropriate mitigation.		

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

ii. Komsberg WEST Wind Energy Facility

Nature: Impact 1 - Loss of riparian systems and water courses during the construction phase The physical removal of the narrow strips of riparian zones and disturbance of any alluvial watercourses by 16 (road crossings, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact.		
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	

▪ **Mitigation:**

- Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint).
- A number of the transmission line towers to the grid are located within some of the watercourses and these should be placed outside of these areas (incl 32m buffer)
- No vehicles to refuel or be maintained within drainage lines/ riparian vegetation.
- During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
- Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.

▪ **Cumulative impacts:**

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 6-9 other renewable projects. However the annual rainfall figures are low and this impact is not anticipated and only a small percentage of the proposed projects reach the construction phase.

▪ **Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or the 16new road crossings on riparian form and function during the operational phase

	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	

▪ **Mitigation:**

Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.

▪ **Cumulative impacts:**

Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout. This is also coupled to the fact that surrounding developments would impact on a different catchments in the neighbouring water management area, coupled to the low average rainfall figures.

▪ **Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

Nature: Impact 3 - Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase

	Without mitigation	With mitigation
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.

Cumulative impacts:

Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Residual impacts:

During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

Nature: Impact 4 – Impact on localized surface water quality mainly during the construction phase

During both preconstruction, construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.

	Without mitigation	With mitigation
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:

» Strict use and management of all hazardous materials used on site.

» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).

» Containment of all contaminated water by means of careful run-off management on the development site.

» Strict control over the behaviour of construction workers.

» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

Cumulative impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	High	High

iii. Komsberg EAST Grid Connection

It is anticipated the no impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer as presently a few of these are located within these areas.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

iv. Komsberg WEST Grid Connection

It is anticipated the no impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer as presently a few of these are located within these areas.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

8 – Conclusion and recommendations

The proposed layouts for the facilities and proposed transmission lines would seem to have limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses with the exception of a number of water course crossings. Use of any existing roads will support this. Thus based on the findings of this study no objection to the authorisation of any of the proposed activities for both facilities inclusive of the alternatives is made.

No aquatic protected or species of special concern (flora) were observed during the site visit. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW.

There will be upgrades required in part to the public road approaching the sites from the west and these findings also apply there, but it is understood that these current crossings may be upgrade by increasing the current size of the culverts and provide additional erosion protection, thus a possible net benefit to the local systems. The actual requirements and designs will be finalized in the detail design phase. It is therefore recommended that these positions are assessed in the EMP walk down phase to provide detailed mitigations to the engineers as and when required. However as stated the overall impacts are envisaged low, i.e. not wetlands or sensitive habitats will be crossed by the upgrades.

Figure 3a & b further indicates the affected water courses and those that would trigger the need for a Water Use License application (a potential GA) in terms of Section 21 c and i of the National Water Act, should any construction take place within these areas.

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10 – Appendix 1: Wetland assessment methods

Survey methods

The assessment was initiated with a survey of the pertinent literature, past reports and the various conservation plans that exist for the study region. Maps and Geographical Information Systems (GIS) were then employed to ascertain, which portions of the proposed development, could have the greatest impact on the wetlands and associated habitats.

A one day site visit was then conducted to ground-truth the above findings, thus allowing critical comment of the development when assessing the possible impacts and delineating the wetland areas.

Wetland and riparian areas were then assessed on the following basis:

Vegetation type – verification of type and its state or condition based, supported by species identification using Germishuizen and Meyer (2003), Vegmap (Mucina and Rutherford, 2006 as amended) and the South African Biodiversity Information Facility (SABIF) database.

Plant species were further categorised as follows:

Terrestrial: species are not directly related to any surface or groundwater base-flows and persist solely on rainfall

Facultative: species usually found in wetlands (inclusive of riparian systems) (67 – 99% of occurrences), but occasionally found in terrestrial systems (non wetland) (DWAF, 2005)

Obligate: species that are only found within wetlands (>99% of occurrences) (DWAF, 2005)

Assessment of the wetland type based on the NWCS method discussed below and the required buffers

Mitigation or recommendations required

National Wetland classification System (NWCS 2010)

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

The South African National Biodiversity Institute (SANBI) in collaboration with a number of specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS 2010). This system comprises a hierarchical classification process of defining a wetland based on the principles of the Hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (SANBI 2009).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in wetland classification as the HGM approach has been adopted throughout the water resources management realm with regard the determination of the Present Ecological State (PES) and

Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All of these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water Affairs. The Ecological Reserve of a wetland or river is used by DWA to assess the water resource allocations when assessing water use license applications (WULA).

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This **is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

Wetland definition

Although the National Wetland Classification System (SANBI, 2009) is used to classify wetland types it is still necessary to understand the definition of a wetland. Wetland definitions as with classification systems have changed over the years. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as **"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"** (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised seaward boundary of the shallow photic zone (Lombard *et al*., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (SANBI, 2009):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the later as a water course (SANBI, 2009). The DWA is however reconsidering this position with regard the management of estuaries due to the ecological needs of these systems with regard to water allocation. Table 1 provides a comparison of the various wetlands included within the main sources of wetland definition used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the National Water Act, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (SANBI, 2009).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils

The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the National Water Act (Act No. 36 of 1998), and ecosystems are included in DWAF's (2005) delineation manual.

Ecosystem	**NWCS "wetland"**	**National Water Act wetland**	**DWAF (2005) delineation manual**
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often describes as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian[2] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

Wetland importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

Improve water quality;

Impede flow and reduce the occurrence of floods;

Reeds and sedges used in construction and traditional crafts;

Bulbs and tubers, a source of food and natural medicine;

Store water and maintain base flow of rivers;

Trap sediments; and

---

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods would be considered riparian wetlands, opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

Reduce the number of water borne diseases.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 2 summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 2: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al.*, 2008.

<table>
<tr><td rowspan="15">Ecosystem services supplied by wetlands</td><td rowspan="9">Indirect benefits</td><td rowspan="8">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">Stream flow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancement benefits</td><td>Sediment trapping</td></tr>
<tr><td>Phosphate assimilation</td></tr>
<tr><td>Nitrate assimilation</td></tr>
<tr><td>Toxicant assimilation</td></tr>
<tr><td>Erosion control</td></tr>
<tr><td colspan="2">Carbon storage</td></tr>
<tr><td colspan="3">Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits</td><td colspan="3">Provision of water for human use</td></tr>
<tr><td colspan="3">Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">Provision of cultivated foods</td></tr>
<tr><td colspan="3">Cultural significance</td></tr>
<tr><td colspan="3">Tourism and recreation</td></tr>
<tr><td colspan="3">Education and research</td></tr>
</table>

Relevant wetland legislation and policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from the destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance (No. 19 of 1974)
- National Forest Act (No. 84 of 1998)
- National Heritage Resources Act (No. 25 of 1999)

Apart from NEMA, the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) will also apply to this project. The CARA has categorised a large number of invasive plants together with associated obligations of the land owner. A number of Category 1 & 2 plants were found at all of the sites investigated, thus the contractors must take extreme care further spread of these plants doesn't occur. This should be done through proper stockpile management (topsoil) and suitable rehabilitation of disturbed areas after construction.

An amendment of the National Environmental Management was promulgated late December 2011, namely the Biodiversity Act or NEM:BA (Act No 10 of 2004), which lists 225 threatened ecosystems based on vegetation type (Vegmap, 2006 as amended). Should a vegetation type or ecosystem be listed, actions in terms of NEM:BA are triggered.

Provincial legislation and policy

Various provincial guidelines on buffers have been issued within the province. These are stated below so that the engineers and contractors are aware of these buffers during the planning phase. Associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas.

Until national guidelines for riverine and wetland buffers are established, the guidelines set out in the Eastern Cape Biodiversity Conservation Plan documentation should be applied (Berliner & Desmet, 2007). Table 3 recommends buffers for rivers.

Table 3: Recommended buffers for rivers, with the applicable buffer related to this study shaded in grey

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by agricultural practices. These larger buffers are particularly important to lower the amount of crop-spray reaching the river.
All remaining 1:50 000 streams	32	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Currently there is no accepted priority ranking system for wetlands. Until such a system is developed, it is recommended that a **50m buffer be set for all wetlands**.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the sites are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas – CSIR 2011 draft. This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

National Wetland Classification System method

During this study due to the nature of the wetlands and watercourses observed, it was decided that the newly accepted National Wetlands Classification System (NWCS) be adopted. This classification approach has integrated aspects of the HGM approached used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (SANBI, 2009) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (SANBI, 2009).

The classification system used in this study is thus based on SANBI (2009) and is summarised below:

The NWCS has a six tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 4). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular systems has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale. This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

Landform – shape and localised setting of wetland

Hydrological characteristics – nature of water movement into, through and out of the wetland

Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for the inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses of six descriptors to characterise the wetland types on the basis of biophysical features. As with Level 5, these are non hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, thus are nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 5 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

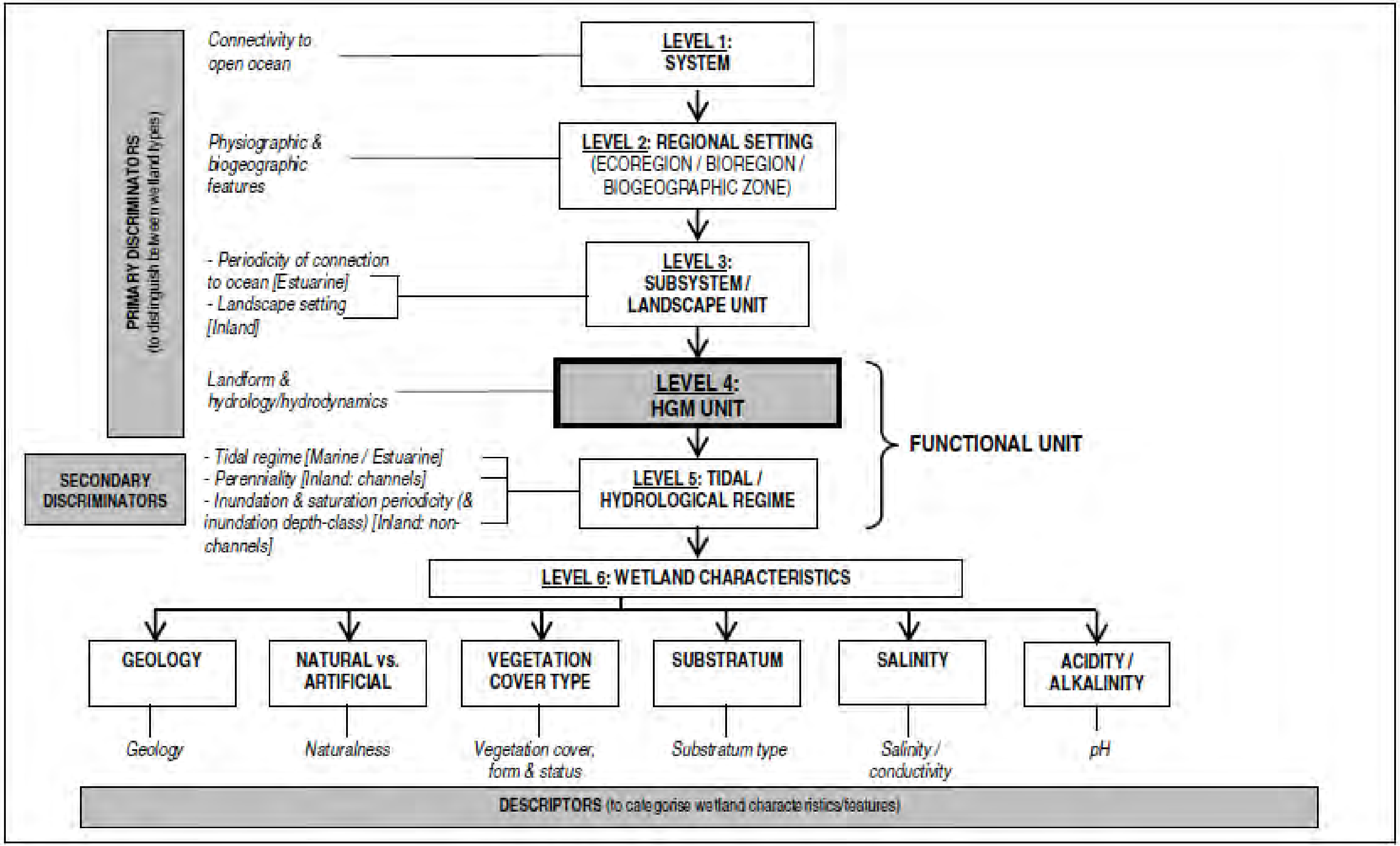

Figure 4: Basic structure of the National Wetland Classification System, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From SANBI, 2009).

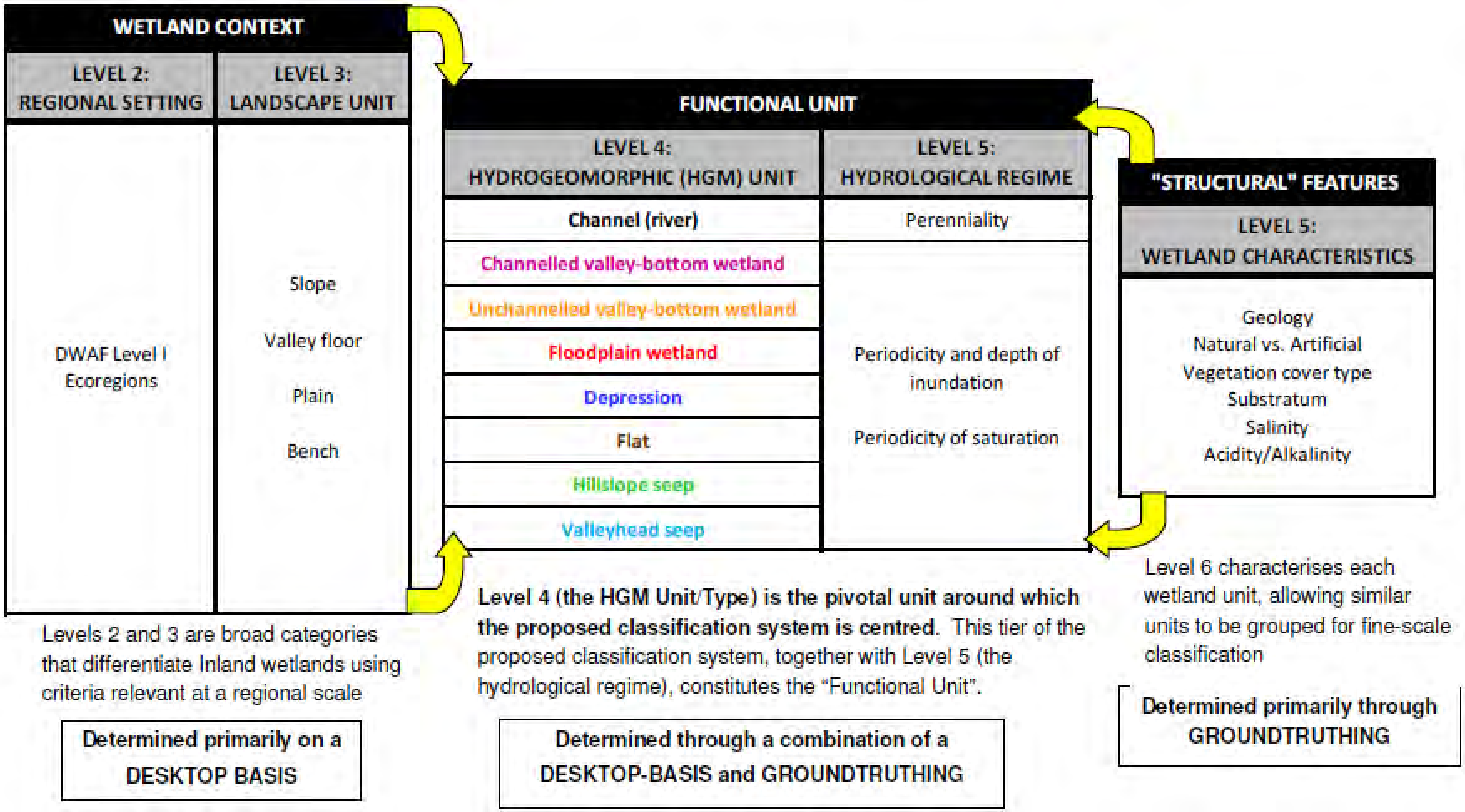

Figure 5 Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from SANBI, 2009).

Wetland condition and conservation importance assessment

To assess the Present Ecological State (PES) or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 4), and provide a score of the Present Ecological State of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind, and is not always suitable for impact assessments. This coupled to degraded state of the wetlands in the study area, a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 4: Description of A – F ecological categories based on Kleynhans *et al*., (2005).

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary ***driving processes*** behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human landuse activities on the wetland surface itself and how these may have ***modified*** the condition of the wetland. The integration of the scores from these 4 modules provides an overall Present Ecological State (PES) score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a rapid site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWAF’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness
- Species of conservation concern
- Habitat fragmentation with regard ecological corridors
- Ecosystem service (social and ecological)

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of conservation concern was observed (HIGH). Any systems that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Wetlands which receive a LOW conservation importance rating could be included into stormwater management features, but should not be developed so as to retain the function of any ecological corridors.

11 - Appendix 2 – List of affected farms

PROPERTIES AFFECTED BY THE PROPOSED KOMSBERG WEST GRID CONNECTION						
	Property Name	**Erf number**	**Portion**	**SG number**	**Size (hectares)**	**Owner details**
1	Welgemoed	268	2	C04300000000026800004	192,45 ha	A De V Le Roux Familietrust
2	Kentucky	206		C07200000000020600000	7032,7672 ha	Eldri Van Zyl Trust
3	Rheebokke Fontein	209	1	C07200000000020900001	299,8933	Ockert Gerbrandt Conradie
4	Rheebokke Fontein	209	2	C07200000000020900002	1651,6268	Ockert Gerbrandt Conradie
5	Rheebokke Fontein	209	3	C07200000000020900003	952,6560	Wolwekop Trust
6	Standvastigheid	210	RE	C07200000000021000000	4716,7192	Standvastigheid Family Trust

PROPERTIES AFFECTED BY THE PROPOSED KOMSBERG EAST GRID CONNECTION						
	Property Name	**Erf number**	**Portion**	**SG number**	**Size (hectares)**	**Owner details**
1	Taayboschkraal	12	4	C04300000000001200004	2 782,9282ha	Standvastigheid Familie Trust
2	Taayboschkraal	12	3	C04300000000001200003	2919,1296ha	Myburgh FamilieTrust
3	Taayboschkraal	12	1	C04300000000001200001	811,5327ha	PJD Stofberg
4	Boschmans Kloof	9	3	C04300000000000900003	255,3623ha	PJD Stofberg
5	Anys Riviers Plaat	13	0	C04300000000001300000	1548,5599ha	HLN Muller
6	Vlakkloof	11	0	C04300000000001100000	2098, 8603 ha	A De V Le Roux Familietrust
7	Welgemoed	268	2	C04300000000026800004	192,45 ha	A De V Le Roux Familietrust
8	Taayboschkraal	12	2	C04300000000001200002	3489, 8240 ha	Myburgh FamilieTrust
9	Kentucky	206		C07200000000020600000	7032,7672 ha	Eldri Van Zyl Trust
10	Rheebokke Fontein	209	1	C07200000000020900001	299,8933	Ockert Gerbrandt Conradie
11	Rheebokke Fontein	209	2	C07200000000020900002	1651,6268	Ockert Gerbrandt Conradie
12	Rheebokke Fontein	209	3	C072000000000209000023	952,6560	Wolwekop Trust
13	Standvastigheid	210	RE	C07200000000021000000	4716,7192	Standvastigheid Family Trust

12 - Appendix 3: Preliminary water course crossings for the respective projects,

Komsberg East WEF		
Crossing #	South DD.ddd WGS4	East DD.ddd WGS4
1	-32.74486201346314829	20.92786070882382532
2	-32.74346299050132814	20.93017118787553343
3	-32.73929638905844541	20.94249405560821842
4	-32.73955268905260141	20.94405614340004718
5	-32.7403337623422459	20.94602063322766838
6	-32.74095998207910441	20.94746712701109459
7	-32.73973140513025015	20.95871259575250178
8	-32.73922316409354494	20.96025382384572211
9	-32.73897853755869392	20.96184963316847671
10	-32.7298528755238749	20.97028053531077063
11	-32.72988573551444347	20.9706748551975295
12	-32.73790877795067189	20.97234022061582692
13	-32.73825268978989556	20.97320797629549105
14	-32.73915619690251333	20.97393913955140121
15	-32.73961015223927262	20.97589919434725658
16	-32.73801124525867579	20.98236367990934781
17	-32.71477013985532523	20.98989794967705436
18	-32.69617138519650013	20.99180382912972576
19	-32.69571134532861834	20.9903579895449397
20	-32.69505414551734646	20.98983222969592788
21	-32.6925321412416281	20.99223922400469888
22	-32.73797982989078292	20.98740962594773052
23	-32.73896275843395642	20.98940062555156061
24	-32.73928233096657436	20.99091710086626605
25	-32.74647619939025134	20.98718707147966711
26	-32.74928859092302957	20.98555971843890333
27	-32.75821041389301769	20.98167455550618854
28	-32.73296716540921381	20.99536079242041353
29	-32.73032865748030673	20.99630345689608646
30	-32.70765595189837427	21.00751090461897874
31	-32.73760783329681345	20.99666710773309219
32	-32.73760783329681345	20.9975214674877364
33	-32.73739117835622636	21.00057546428429944
34	-32.73859046645752358	21.00478892069944337
35	-32.73994725163954911	21.00820667340384063
36	-32.74042941978049726	21.00910555743977071
37	-32.74597627644065057	21.01161395805097243
38	-32.74687712325161471	21.01227419728618884
39	-32.7486665767757188	21.01515894327841139
40	-32.74886306239240241	21.015475694223678
41	-32.752984394530678	21.02441348015529243

42	-32.75452610201079295	21.02905015286029666
43	-32.75455585442609419	21.03239941796117662
44	-32.75430804357015546	21.0352080171003486
45	-32.75457078802978828	21.03672301927158372
46	-32.73346747448583471	21.02840985861723055
47	-32.73060113987173736	21.02400157428984429
48	-32.72866991586359831	21.02348086003273764
49	-32.71566514045521501	21.02649805221776802
50	-32.71499810154493559	21.02702456374142059
51	-32.70742085023728407	21.03461985911799559
52	-32.7021017037658055	21.0384831870879303
53	-32.68903383272036933	21.04669204219581502
54	-32.68836794082841379	21.04706784223422389
55	-32.68915944118631245	21.0502833069343005
56	-32.73853459619202511	20.9775998845787619
57	-32.73762117594820609	20.98329788705209253
58	-32.73751243544299427	20.98410256679069263

Komsberg West WEF		
Crossing #	**South DD.ddd WGS4**	**East DD.ddd WGS4**
1	-32.83640664962517519	20.82331501546524066
2	-32.82696776972003505	20.82794336225807541
3	-32.82075252735864268	20.82771021543777579
4	-32.81813147330349523	20.82822355197502517
5	-32.81628807979399909	20.82783249798244896
6	-32.80791674821441717	20.82844231631871068
7	-32.80515154389961907	20.83141421519031766
8	-32.78611132719251486	20.82906019193054092
9	-32.76261428611545767	20.86473424562148082
10	-32.74831714352893641	20.87122059098697591
11	-32.74156411158499935	20.87271909223447963
12	-32.73937319510220334	20.87298536271252658
13	-32.72382306725550905	20.86092248671614158
14	-32.72525247684500727	20.8633541260178248
15	-32.72597539663740207	20.87235776343216287
16	-32.71911240539113663	20.87929937369010247

SOCIAL IMPACT ASSESSMENT
FOR
KOMSBERG EAST AND WEST WIND ENERGY FACILITY AND GRID CONNECTIONS
WESTERN CAPE AND NORTHERN CAPE PROVINCE

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Prepared for

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EXECUTIVE SUMMARY

INTRODUCTION AND LOCATION

Arcus Consulting (Pty) Ltd (hereafter referred to as Arcus) was appointed as the lead consultant to manage the Environmental Impact Assessment (EIA) process for the proposed Komsberg 550 MW Wind Energy Facility (WEF). The facility will consist of the Komsberg East and West sites. Each site will have a generation capacity of up to 275 MW. The study area is located ~ 45 km north of the town of Laingsburg in the Laingsburg Local Municipal (LLM) area in the Western Cape Province. A small section of the site falls within the Northern Cape Province, within the Karoo Hoogland Local Municipality (KHLM), which forms part of the Namakwa District Municipality. The town of Sutherland is located ~ 50 km to the north west of the site.

Tony Barbour was appointed by Arcus Consulting to undertake a specialist Social Impact Assessment (SIA) as part of the EIA process. This report contains the findings of the SIA undertaken as part of the EIA process.

PROJECT DESCRIPTION

The proposed Komsberg WEF consists of the Komsberg East and West component. Each component will consist of 55 wind turbines between 2MW and 5MW in capacity with a rotor diameter of up to 140m and a hub height of up to 120m. The Komsberg East and West WEFs will each have a contracted capacity of up to 280 MW.

Based on the information from other WEF projects the construction of Komsberg East and West WEFs is expected to extend over a period of ~ 4 years assuming that the construction of each component follows on from each other. The capital expenditure for each of the 280 MW Komsberg East and West WEFs will be at least of R 5 billion (2015 Rand value). The total capital expenditure would therefore be in the region of R 10 billion.

APPROACH TO THE STUDY

The approach to the SIA study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice. The key activities in the SIA process embodied in the guidelines include:

- Collection and review of baseline socio-economic data;
- Review of relevant planning and policy frameworks for the area;
- Site specific information collected during the site visit to the area and interviews with key stakeholders;
- Review of information from similar projects; and
- Identification of social issues associated with the proposed project.

SUMMARY OF KEY FINDINGS

Policy Review

For the purposes of the meeting the objectives of the SIA the following national, provincial and local level policy and planning documents were reviewed, namely:

National

- National Energy Act (2008);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- White Paper on Renewable Energy (November 2003);
- Integrated Resource Plan (IRP) for South Africa (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012);
- Astronomy Geographic Advantage (AGA) Act (Act 21 of 2007).

Provincial and local

- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014;
- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);
- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2010);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006); and
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002).
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Laingsburg Local Municipality Integrated Development Plan (2012-2017).
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

As indicated above, small section of the site is located in the Karoo Hoogland Municipality (KHLM) within the Northern Cape Province. The following provincial level policy and planning documents were reviewed:

- Karoo Hoogland Local Municipality Integrated Development Plan (2012-2017).
- Northern Cape Provincial Growth and Development Strategy (2004-2014);
- Northern Cape Climate Change Response Strategy;
- Northern Cape Spatial Development Framework;

The findings of the review indicated that renewable energy is strongly supported at a national and local level. At a national level the White Paper on Energy Policy (1998) notes:

- Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future; and,
- The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

The IRP 2010 also allocates 43% of energy generation in South Africa to renewables, while the New Growth Path Framework and the National Infrastructure Plan both support the development of the renewable energy sector.

The development of and investment in renewable energy is also supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all make reference to renewable energy. At a provincial level the development of renewable energy is supported by the White Paper on Sustainable Energy for the Western Cape, Climate Change Strategy and Action Plan for the Western Cape, Western Cape Growth and Development Strategy, Northern Cape Provincial Growth and Development Strategy and the Northern Cape Provincial Spatial Development Framework,

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that the development of renewable energy is supported at a national and provincial level. The area has also been identified as an area where renewable energy should be concentrated. It is therefore the opinion of the authors that the establishment of the proposed WEFs is supported by the relevant policies and planning documents.

However, the provincial and local policy and planning documents also make reference to the importance of tourism and the region's natural resources. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed facility, does not materially impact on the region's natural resources and the tourism potential of the Province.

Construction Phase

The key social issues associated with the construction phase include:

Potential positive impacts

- Creation of employment and business opportunities, and the opportunity for skills development and on-site training;
- Benefits associated with providing technical advice on wind energy to local farmers and municipalities;
- Improved cell phone reception.

The construction phase for a single 280 MW WEF is expected to extend over a period of 18-24 months and create approximately ~ 400 employment opportunities. It is anticipated that approximately 55% (220) of the employment opportunities will be available to low skilled workers (construction labourers, security staff etc.), 30% (120) to semi-skilled workers (drivers, equipment operators etc.) and 15% (60) for skilled personnel (engineers, land surveyors, project managers etc.). The construction of the Komsberg East and West WEFs (550 MW) will not create an additional 400 new employment opportunities. Assuming that the construction of

Komsberg East and West WEFs follow on from each other it is highly likely that the majority of the original 400 workers will be employed for the construction of the first 280 MWs will be employed for the construction of the second 280 MWs. For the purposes of the assessment is it assumed that 80% (320) of the original 400 workers working on the construction of the first 280 MW WEF will be employed for the construction of the second 280 MW WEF. The total number of employment opportunities created by Komsberg East and West WEFs will therefore be ~ 480.

Members from the local community in the area may be in a position to qualify for the majority of the low skilled and semi-skilled employment opportunities. The levels of unemployment in Laingsburg, Sutherland and the LLM are high. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from Laingsburg, Sutherland and the LLM. The creation of potential employment opportunities, even temporary employment, will therefore represent a significant, if localised, social benefit. While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited the construction of three wind energy projects in the area which is planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Komsberg WEFs. It is estimated that these projects will employ 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy.

The total wage bill for the 18-24 month construction phase of a single 240 MW WEF will be in the region of R 100 million (2015 Rand value). The total wage bill for the construction of 550 MWs (Komsberg East and West) would therefore be ~ R 200 million (2015 Rand value). A percentage of the wage bill will be spent in the local economy and will create significant opportunities for local businesses in Laingsburg, Sutherland and the LLM. Given the high unemployment and low income levels in Laingsburg, Sutherland and the LLM even a small percentage of the monthly salary bill spend would represent a significant opportunity. This benefit will extend over a period of ~ 4 years assuming that the construction of the Komsberg East and West WEFs follow on from each other.

The capital expenditure associated with the construction of a 280 MW WEF will be in the region of R 5 billion (2015 Rand value). The total combined capital expenditure for the Komsberg East and West WEFs will therefore be ~ R 10 billion (2015 Rand value). A percentage of the capital expenditure associated with the construction phase has the potential to benefit local companies. However, the opportunities for local companies in Laingsburg, Sutherland and the LLM will be limited. In this regard the benefits are likely to accrue to building contractors and suppliers based in towns based further afield, such as Worcester, Paarl and Cape Town.

The sector of the local Laingsburg and Sutherland economy that will benefit from the proposed development is the local service industry. This is also confirmed by the experience with the other renewable projects. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the meeting the needs of 400 construction workers who will need to be accommodated, transported to site and fed (3 meals a day) over a period of 4 years (Komsberg East and West). Experience for other renewable energy projects located near small towns, such as Pofadder in the Northern Cape Province, is that local residents and businesses have benefitted significantly from meeting the needs of construction workers. However, the presence of construction workers also has the potential to impact negatively on local family and social networks.

However, based on the findings of the site visit there may not be not sufficient accommodation in Laingsburg and Sutherland and surrounds to accommodate all the construction workers. The issue of accommodation therefore represents a potential challenge and will need to addressed in consultation with the LLM, community representatives and local farmers from the area should the project proceed.

The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors which would support local economic development in the LLM.

Potential negative impacts

- Impacts associated with the presence of construction workers on site and in the area;
- Influx of job seekers to the area;
- Increased safety risk to farmers, risk of stock theft and damage to farm infrastructure associated with presence of construction workers on the site;
- Increased risk of veld fires;
- Impact of heavy vehicles, including damage to roads, safety and dust;
- Potential loss of productive farmland associated with construction-related activities.

The findings of the SIA indicate that the significance rating for all of the potential negative impacts with mitigation is **Low Negative**. All of the potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. However, in order to effectively mitigate the impact of construction workers on the local community of Laingsburg and Sutherland will require a commitment to employing local community members. In the absence of such a commitment the impact of construction workers on the local community of Laingsburg and Sutherland was assessed to be **Medium Negative**.

Table 1 summarises the significance of the impacts associated with the construction phase.

Table 1: Summary of social impacts during construction phase

Impact	Significance No Mitigation	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Medium (Positive)	High (Positive)
Benefits associated with providing technical advice to local farmers and municipalities	N/A	Low (Positive)
Improved cell-phone coverage	N/A	Low (Positive)
Presence of construction workers and potential impacts on family structures and social networks	Medium (Negative for community as a whole)	Low (Negative for community as a whole)
Influx of job seekers	Low (Negative)	Low (Negative)
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Medium (Negative)	Low (Negative)
Increased risk of veld fires	Medium (Negative)	Low (Negative)
Impact of heavy vehicles and construction activities	Medium (Negative)	Low (Negative)
Loss of farmland	Low (Negative)	Low (Negative)

Operational phase

The key social issues affecting the operational phase include:

Potential positive impacts

- Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
- Benefits associated with the establishment of a Community Trust and other Economic Development commitments and programmes associated with the bidding requirements set out by the Department of Energy;
- The establishment of infrastructure to generate renewable energy.

The total number of permanent employment opportunities associated with the Komsberg East and West WEFs would be ~ 60. Of this total ~ 40 are low skilled workers, 15 semi-skilled and 5 skilled. The annual wage bill for the operational phase will be ~ R 6 million (2015 Rand value). The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. Given the location of the proposed facility the majority of permanent staff is likely to reside in Laingsburg and Sutherland which will benefit the local economy.

The establishment of a Community Trust and other economic development commitments and initiatives also creates an opportunity to support local economic development in the area. Community Trusts provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. The revenue from the proposed WEFs can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development;
- Support for SMME's.

The long term duration of the revenue stream associated with a WEF linked Community Trust also enables local municipalities and communities to undertake long term planning for the area. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created the current lack of generation capacity in South Africa and climate change and lack of generation capacity in South Africa, represents a positive social benefit for society as a whole.

Potential negative impacts

- The visual impacts and associated impact on sense of place;
- Potential impact on tourism.

The visual impacts on landscape character associated with large renewable energy facilities, such as WEFs, are highlighted in the research undertaken by Warren and Birnie (2009). In the South African context, many South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape. The impact of large, WEFs on the landscape is therefore a key issue in wind farm development in South Africa, specifically given South African's strong attachment to the land and the growing number of renewable energy applications. Based on the findings of the SIA the significance of the visual impact associated with the Komsberg WEFs with mitigation was rated **Medium Negative.** Table 2 summarises the significance of the impacts associated with the operational phase.

Table 2: Summary of social impacts during operational phase

Impact	Significance No Mitigation	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Low (Positive)	Medium (Positive)
Establishment of Community Trust	Medium (Positive)	High (Positive)
Promotion of renewable energy projects	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	High (Negative)	Medium (Negative)
Impact on tourism	Low	Low

Cumulative Impacts

Twelve (12) renewable energy projects, including 10 WEFs, are located in the study area. The potential for cumulative impacts associated with combined visibility (whether two or more wind facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. The significance with mitigation is rated a **Medium Negative**. However, this should be viewed within the context of the area being identified as a Renewable Energy Development Zone by the CSIR under the DEAs SEA process. The area has therefore been identified as an area where renewable energy should be concentrated.

In addition, due to the proximity of the different sites the various WEFs could be viewed as a single large WEF as opposed to a number of separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impacts associated with combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). This therefore reduces the potential cumulative impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the areas sense of place in to one area as opposed to impacting on a number of more spread out areas.

In addition to the potential negative impacts, the establishment of the proposed WEFs and other renewable energy projects in the area also has the potential to create a number of socio-economic opportunities for the LLM and KHLM, which, in turn, will result in a positive social benefit. The positive cumulative impacts include the creation of employment, skills development and training opportunities, creation of downstream business opportunities. This benefit is rated as **High Positive** with enhancement.

Power lines

Based on the findings of the SIA the social impacts associated with the transmission lines for the Komsberg East and West WEFs can be mitigated with careful route selection. The significance with careful route selection would be **Low Negative**.

Potential health impacts

The potential health impacts typically associated with WEFs include, noise, shadow flicker and electromagnetic radiation. As indicated above, the findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation and in fact will have positive health benefits (WHO, 2004). Based on these findings it is assumed that the significance of the potential health risks posed by the proposed Komsberg East and West WEFs is of **Low Negative** significance.

No-Development Option

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a High negative social cost. The no-development option also represents a lost opportunity in terms of the employment and business opportunities (construction and operational phase) associated with the proposed Komsberg East and West WEFs, and the benefits associated with the establishment of a Community Trust. This also represents a negative social cost. The significance of this cost is rated as **Medium Negative**.

However, at a provincial and national level, it should be noted that the proposed WEFs are not unique. In this regard, a significant number of renewable energy developments, including WEFs, are currently proposed in the Western Cape and South Africa. Foregoing the development of the proposed Komsberg East and West WEFs would therefore not necessarily compromise the development of renewable energy facilities in the Western Cape and or South Africa. However, the socio-economic benefits the local communities in Laingsburg, Sutherland and the LLM would be forgone.

Decommissioning phase

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the WEFs decommissioning phase is likely to involve the disassembly and possible replacement of the existing components with more modern technology. This is likely to take place in the 20-25 years post commissioning. The decommissioning phase is therefore also likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

Given the relatively small number of people associated with the operational phase for Komsberg East and West WEFs (~ 60), the potential social impacts linked to the decommissioning of the facility will need to be managed through the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be **Low Negative.**

CONCLUSIONS AND RECOMMENDATIONS

The findings of the SIA indicate that the development of the proposed Komsberg East and West WEFs will create employment and business opportunities for the local economy, specifically during the construction phase. However, for the community of Laingsburg and Sutherland to benefit from these opportunities will require a commitment to employ local community members and implement an effective training and skills development programme where required. The establishment of a Community Trust will also benefit the local community. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change and a lack of generation capacity in South Africa, represents a positive social benefit for society as a whole.

The potential visual impacts associated with the proposed Komsberg East and West WEFs can be effectively addressed with careful siting of selected wind turbines. In addition, the recommendations contained in the VIA should be implemented.

It is therefore recommended that the Komsberg East and West WEFs be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the SIA and VIA Report.

IMPACT STATEMENT

The findings of the SIA undertaken for the proposed Komsberg East and West WEFs indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the area. It is therefore recommended that the Komsberg East and West WEFs be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the SIA report and other key specialist studies.

ACRONYMS

CKDM	Central Karoo District Municipality
DEA&DP	Department of Environmental Affairs and Development Planning (Western Cape)
DEA	Department of Environmental Affairs (National)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
HD	Historically Disadvantaged
IDP	Integrated Development Plan
IPP	Independent Power Producer
KHLM	Karoo-Hoogland Local Municipality
kV	Kilovolts
LED	Local Economic Development
LLM	Laingsburg Local Municipality
LM	Local Municipality
MF	Management Forum
MW	Megawatt
NCP	Northern Cape Province
NDM	Namakwa District Municipality
PSDF	Provincial Spatial Development Framework
REF	Renewable Energy Facility
SAAO	South African Astronomical Observatory
SALT	South African Large Telescope (Pty) Ltd
SDF	Spatial Development Framework
SIA	Social Impact Assessment
WCP	Western Cape Province
WEF	Wind Energy Facility

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SECTION 1: INTRODUCTION

1.1 INTRODUCTION

Arcus Consulting (Pty) Ltd (hereafter referred to as Arcus) was appointed as the lead consultant to manage the Environmental Impact Assessment (EIA) process for the proposed Komsberg 550 MW Wind Energy Facility (WEF). The facility will consist of the Komsberg East and West sites. Each site will have a generation capacity of up to 275 MW. The study area is located ~ 45 km north of the town of Laingsburg in the Laingsburg Local Municipal (LLM) area in the Western Cape Province. A small section of the site falls within the Northern Cape Province, within the Karoo Hoogland Local Municipality (KHLM), which forms part of the Namakwa District Municipality. The town of Sutherland is located ~ 50 km to the north west of the site.

Tony Barbour was appointed by Arcus Consulting to undertake a specialist Social Impact Assessment (SIA) as part of the EIA process. This report contains the findings of the SIA undertaken as part of the EIA process.

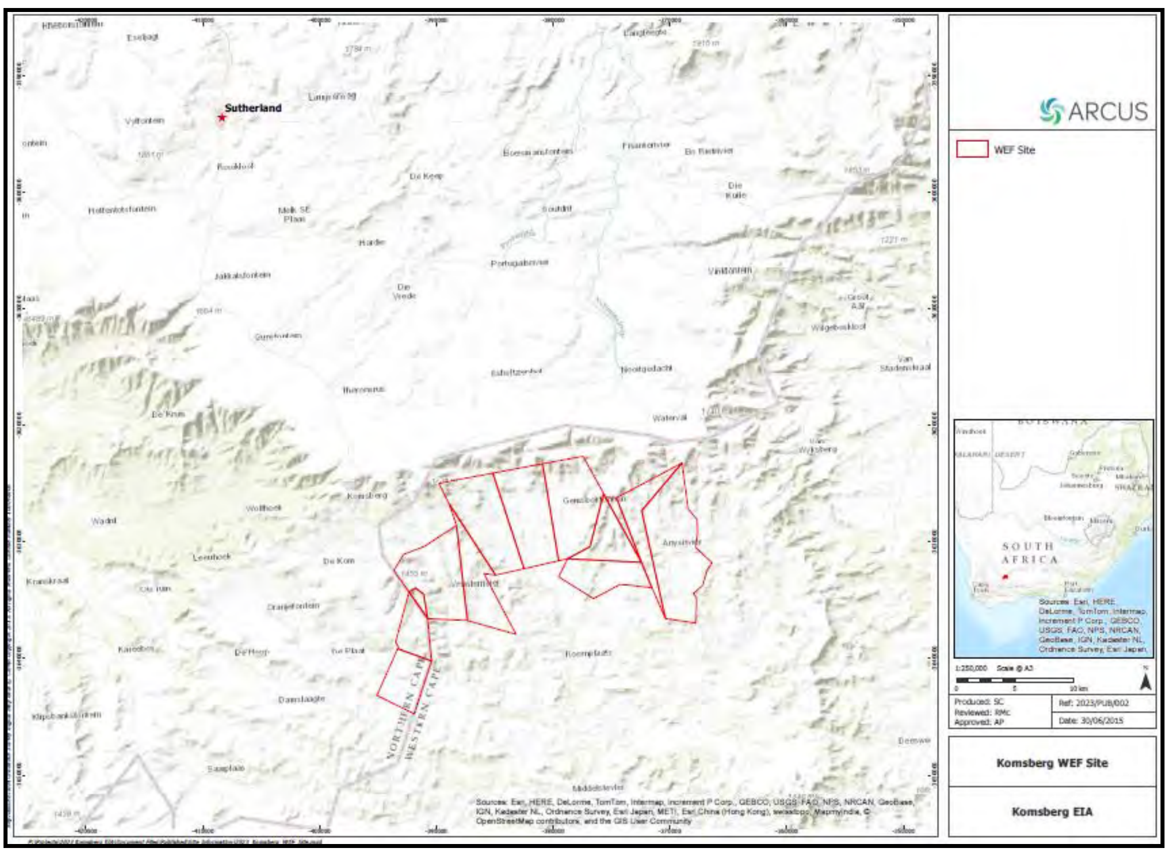

Figure 1.1: Location of Komsberg Wind Energy Facility

1.2 TERMS OF REFERENCE

The terms of reference for the SIA require:

- A description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility;
- A description and assessment of the potential social issues associated with the proposed facility;
- Identification of enhancement and mitigation aimed at maximising opportunities and avoiding and or reducing negative impacts.

1.3 PROJECT DESCRIPTION

A wind energy facility (WEF) consists of multiple wind turbines which are used to capture the kinetic energy of the wind and generate electricity. This captured kinetic energy is used to drive a generator located within the wind turbine and the energy is subsequently converted into electrical energy. A typical wind turbine consists of four primary components (Figure 1.2).

- The **foundation unit** upon which the turbine is anchored to the ground;
- The **tower** which will have a hub height of 120 m. The tower is a hollow structure allowing access to the nacelle. The height of the tower is a key factor in determining the amount of electricity a turbine can generate. The tower houses the transformer which converts the electricity to the correct voltage for transmission into the grid. The transformer can also be placed in a small housing outside the tower depending on the design;
- The **nacelle** (generator/turbine housing). The nacelle houses the gearbox and generator as well as a wind sensor to identify wind direction. The nacelle turns automatically ensuring the blades always face into the wind to maximise the amount of electricity generated;
- The **rotor** which is comprised of three rotor blades with a diameter of 140 m. The rotor blades use the latest advances in aeronautical engineering materials science to maximise efficiency. The greater the number of turns of the rotor the more electricity is produced.

The amount of energy a turbine can harness is dependent on the wind velocity and the length of the rotor blades. Wind turbines typically start generating power at wind speeds of between 10 - 15 km/hour, with speeds between 35 - 60 km/hour required for full power operation. In a situation where wind speeds are excessive (beyond 90km/hour), the turbine automatically shuts down to prevent damage. A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a WEF can be monitored and controlled remotely, with a mobile team used for maintenance, when required.

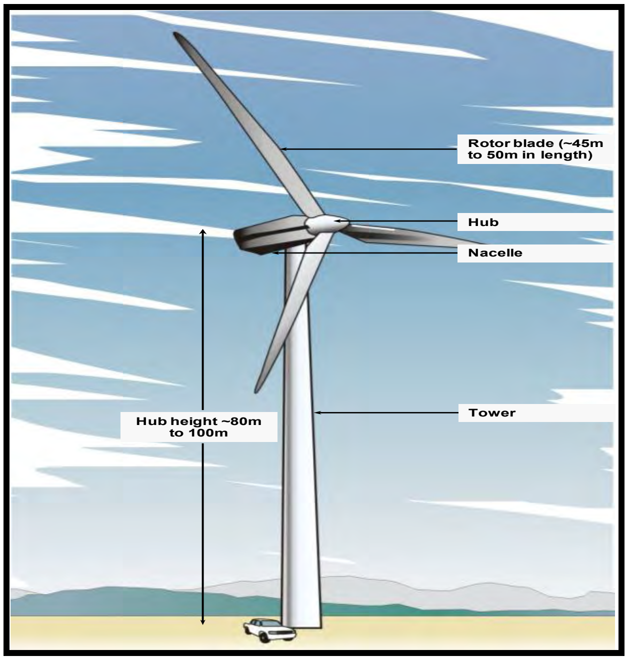

Figure 1.2: Typical example of wind turbine structure and components

The Komsberg West WEF is located on the following properties:

Table 1.1: Komsberg West WEF properties

Property Name	Erf number	Portion	Size (ha)
Komsberg West			
De Plaat	205	1	1517,3105HA
Schalkwykskraal	204	2	1067.4261HA
VlakKloof	11	0	2098.8603HA
Welgemoed	268	1	2841,82 HA
Welgemoed	268	2	192,45 HA
Taayboschkraal	12	2	3489.8240H

The Komsberg East WEF is located on the following properties:

Table 1.2: Komsberg East WEF properties

Property Name	Erf number	Portion	Size (ha)
Komsberg East			

Taayboschkraal	12	3	2919.1296H
Taayboschkraal	12	4	2 782,9282 HA
Anys Riviers Plaat	13	0	1548,5599HA
Dwars River	14	RE	5024.1806H
Taayboschkraal	12	1	811.5327H
Koornplaats	41	2	1695.4694H
Boschmans Kloof	9	3	255.3623H

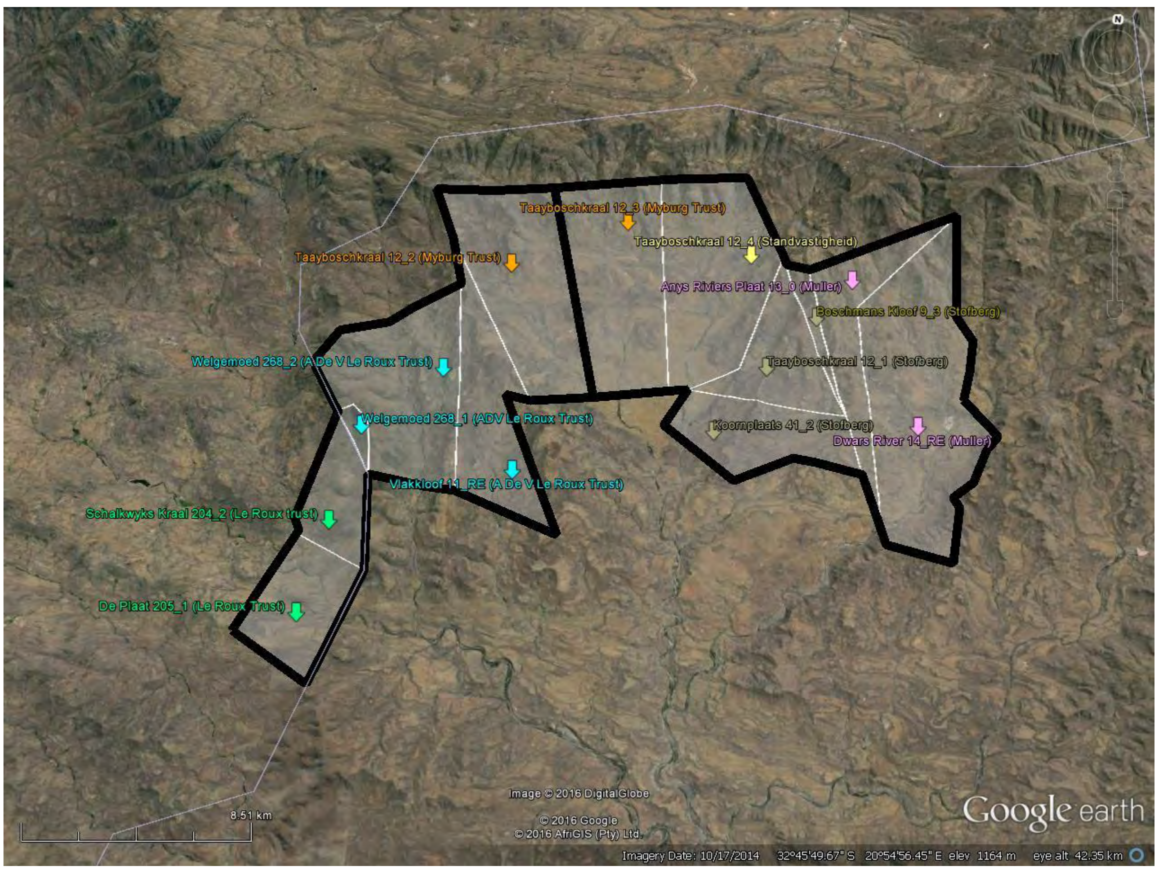

Figure 1.3: Location of properties associated with Komsberg East and West sites

The typical infrastructure associated with the establishment of the proposed Komsberg East and West WEFs includes:

- 55 wind turbines between 2MW and 5MW in capacity with a rotor diameter of up to 140m and a hub height of up to 120m will be established on each site (Komsberg East and West)
- The Komsberg East and West sites will each generate ~ 280 MW;

- Foundations and hardstands associated with the wind turbines.
- Up to 8m wide internal access road to each turbine, the substation complex and the ancillary infrastructure, including underground cabling adjacent the roads. Road length will be up to 50km in total.
- Medium voltage cabling between turbines and the substation, to be laid underground where practical.
- Overhead medium voltage cables between turbine strings or rows.
- 100 x150m on-site substation complex to facilitate stepping up the voltage from medium to high voltage (up to 400kV) to enable the connection of the wind farm to the national grid.
- A 35km (Komsberg West) and 55km (Komsberg East) high voltage power line from the onsite substation to the National Grid at the Eskom Komsberg Main Transmission Substation;
- A 30 x 50m operations and services workshop area / office building for control, maintenance and storage; and
- Temporary infrastructure including a site camp, laydown areas and a batching plant totalling 150 x100m in extent.

1.4 OVERVIEW OF SITE AND ASSOCIATED LAND USES

The greater Komsberg WEF site is located almost equidistant (~40km) from the towns of Sutherland in the Northern Cape Province (NCP) and Laingsburg in the Western Cape Province (WCP). The bulk of the WEF site, as well as the majority of proposed turbines, is located in the WCP. Off-site properties affected by the proposed overhead 132 kV transmission (Tx) lines are all located in the NCP. Laingsburg and Sutherland are the only significant towns in the vicinity of the site. The small village of Matjiesfontein is located ~50km to the south-west of the site. Primary access to the majority of the site is from the south (Laingsburg side, N1). A network of public and private gravel roads traverses the study area (Figure 1.2 and Photograph 1.1). On Gemsbokfontein, Putterskraal and Anysrivier, the access roads terminate on the relevant farms. Due to the steep, rocky terrain, most parts of the study area are currently physically inaccessible by vehicle. In short, most of the properties are relatively isolated.

The greater Komsberg site is largely located in the region known as the Moordenaarskaroo (north of Laingsburg). The westernmost site portion and properties located to the west affected by the proposed Tx line are located in the Klein Roggeveld and transition zone with the Moordenaarskaroo. The Klein Roggeveld has a transitional to predominantly winter-rainfall regime. The veld has significant fynbos (e.g. renosterbos) and some succulent elements. The Moordenaarskaroo has a transitional to predominantly summer-rainfall regime. Karoo bossiesveld is the dominant veld type. The Moorenaarskaroo is typically cooler and wetter in summer than the Klein Roggeveld and Tankwa Karoo located to the west. Veld palatability to small stock increases from the Klein Roggeveld (fynbos) to the Moordenaarskaroo (bossiesveld).

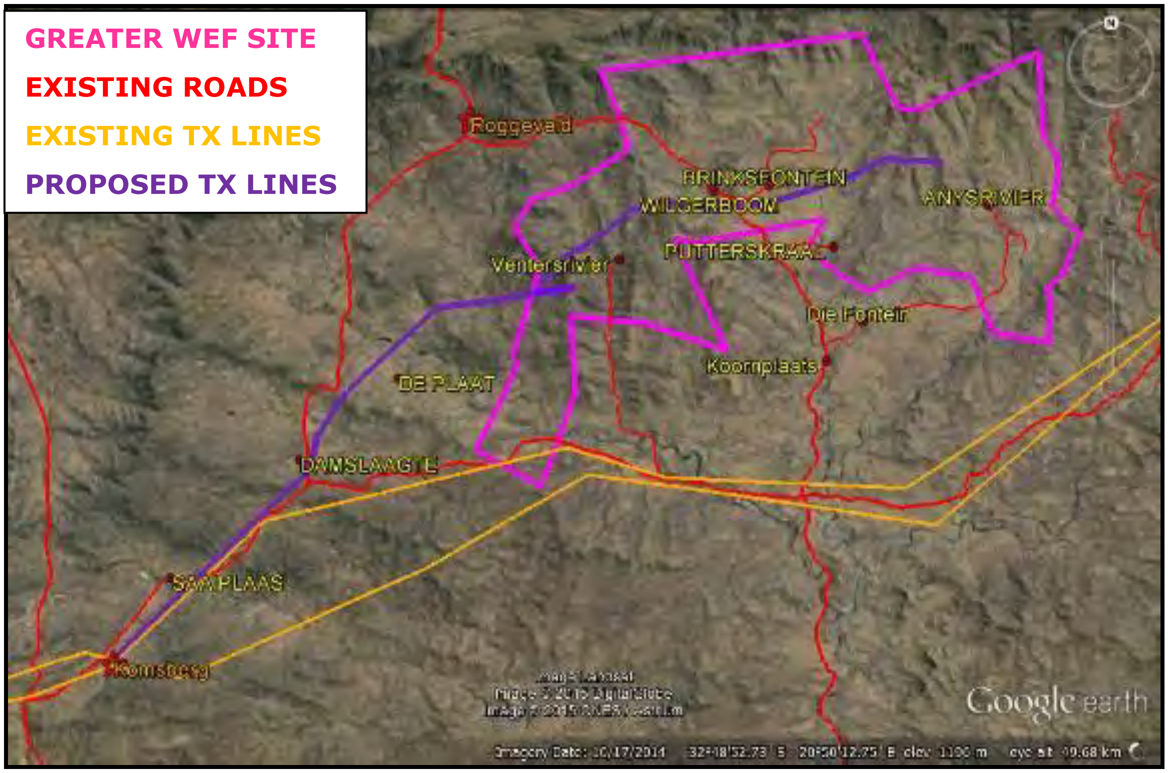

Figure 1.3: Local farm roads in the study area

Photograph 1.1: Komsberg gravel road and existing 400 kV line on Damslaagte

Both the Moordenaarskaroo and the Klein Roggeveld are located in broken, hilly terrain associated with the transition to the Great Escarpment south of Sutherland (Photograph 1.2). The study area is classified as arid and vegetation cover is essentially comprised of karroid scrub, dwarf shrubs, and isolated patches of grass. Trees are limited to the banks of ephemeral rivers and streams.

The settlement pattern is very sparse and essentially linked to good sources of surface water (e.g. fountains or streams). This is largely related to the aridity of the area and the low natural productivity of the veld. Extensive commercial small stock farming (sheep and, to a lesser extent, goats) is the dominant land use in the broad region. Properties are large, and operations typically consist of a number of farms (owned or rented), typically spread out over a number of micro-climatic regions (Tankwa Karoo, Klein Roggeveld, Moordenaarskaroo) to ensure year round access to grazing resources and manage lambing and other events. Most operations are in excess of 5000 ha. Ownership is relatively stable, with properties in the ownership of the same family for a number of decades, up to 4 generations. Few – if any - properties are not actively farmed (i.e. no vacant land).

Only a few key farms are permanently inhabited. Labourers (1-5 households per inhabited farm) typically reside on these farms, near the main farmstead, and are deployed to other properties on an as-needed basis (Photograph 1.3). As a result, most of the properties in the broader area are not permanently inhabited. For instance, of the WEF properties, only three farmsteads are inhabited, while an additional two owners live on farms in the broader region.

Photograph 1.2: Ridge located in the northern portion of Welgemoed (le Roux)

Photograph 1.3: Labourer's cottages on Wilgerboom along the Koornplaats-Komsberg gravel road.

Most study area farmers consider themselves part of the Laingsburg farming community. Routine grocery shopping is done in Laingsburg, while most farmers also visit Worcester monthly or so for major shopping and accessing higher order services.

Stock farming is supplemented by small-scale irrigated fodder cropping (mainly for own use) on most farms, and additional commercial vegetable seed cropping on a few. Mainly onion seed is produced[1]. Due to the limitations of terrain, soils and available irrigation water, seed cropping areas are limited in scale (few hectares per farm).

Natural game, including kudu, vaal-ribbok and steenbok occur on study area farms. A few farms have also been stocked with small numbers of small game – springbuck, blesbuck – for private hunting. Game farming is not currently established on any of the site properties. No tourism facilities – accommodation, walking trails, etc – are currently associated with the site properties, but the owners of Brinksfontein are in the process of converting the farm house to a guest farm facility. As discussed in Section 3 below, tourism development in the surrounding area is also very limited.

Eskom's large Komsberg substation is located ~20 km to the south-west of the site (Photograph 1.4). Two Tx line corridors (400kV and 760 kV) are currently associated with the Komsberg substation. One corridor traverses the south-westernmost portion

[1] Laingsburg is a major vegetable seed producing area. The hot, dry climate is conducive to the suppression of many parasites (e.g. mildew), and promotes quick, even drying of seed. Limited access to water means large distances between geographically isolated cropping areas, ideal for ensuring no cross-pollination with other cultivars takes place.

of the broader WEF site (namely Schalkwykskraal 204/2). The smaller Roggeveld substation is located ~5km north-west of the site. Only 66 kV lines are associated with the Roggeveld substation. In addition, a number of Telkom line are located along some roads in the study area. Apart from roads and the mentioned Eskom and Telkom line infrastructure, no other service industrial infrastructure is located in the study area.

Photograph 1.4: Eskom Komsberg substation located adjacent to Saaiplaas farm

More detailed overviews of the properties and land uses associated with each of the two WEF components and proposed associated Tx line alignments are provided below.

1.4.1 Komsberg West WEF

Properties effectively belonging to two owners would be affected by the Komsberg West WEF (Table 1.3).

Table 1.3: List of farms and farm owners Komsberg West WEF

PROPERTY	FARM NAME	OWNER	EFFECTIVE OWNER
De Plaat 205/1;	De Plaat	Le Roux Family Trust	Mr. Andries le Roux
Schalkwykskraal 204/2;	Kareedoringbos, Ventersrivier	Le Roux Family Trust	Mr. Andries le Roux
Vlakkloof 11/0;	Vlakkloof	A de V Le Roux Family Trust	Mr. Andries le Roux
Welgemoed 268/1	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Welgemoed 268/2	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Taayboschkraal 12/2	Wilgerboom	Myburgh Family Trust	Mr. Billie Myburgh

The relevant properties belonging to Mr le Roux are used as seasonal grazing only. Main operations are based on Fortuin, located ~30 km to the south-west of the WEF site. No inhabited farmsteads are located on the WEF properties. Labour is deployed from Fortuin. No cropping currently takes place on the property, but the owner has identified a few hectares adjacent to the Venters River as a potential onion seed/ alfalfa cropping area (le Roux, pers. comm). Schalkwykskraal 204/2 is currently traversed by a 400 kV Eskom Tx line over a distance of ~3 km.

The bulk of turbines as well as the on-site substation proposed for the Komsberg West WEF would be located on Mr Le Roux's properties (Photograph 1.5). A number of new on-site roads would be required. In addition, the le Roux properties would be affected by the proposed Tx alignment for both Komsberg East (all 5 properties) and West (4) WEFs.

Photograph 1.5: Koppies on which turbines are proposed located in the north-western portion of Welgemoed Farm

Mr Billie Myburgh and his wife live on Wilgerboom. A number of farm buildings and labourer's houses are located on Wilgerboom. Small orchards and limited irrigated fodder cropping activities are associated with the farmstead (Photograph 1.6). Two labourer families work and live on the farm. Mr Myburgh's son Alwyn farms and lives on Rondawel, located ~4 km south-east of Wilgerboom (Myburgh, pers. comm). Only 4 turbines are proposed on Wilgerboom (all 4 Alternative 2), ~6 km north of the farmstead. The proposed new Tx line (East WEF connection) would be located <1km south of Wilgerboom farmstead. A number of new on-site roads are proposed on the Myburgh property.

Photograph 1.6: Entrance to Wilgerboom off the Koornplaats-Komsberg gravel road

1.4.2 Komsberg East WEF

Properties effectively belonging to four owners would be affected by the Komsberg East WEF (Table 1.4). Mr. Billie Myburgh is the only owner who would also be affected by the West WEF. However, no turbines are proposed on his property (Brinksfontein) within the East WEF.

Table 1.4: List of farms and farm owners Komsberg East WEF

PROPERTY	FARM NAME	OWNER	EFFECTIVE OWNER
Taayboschkraal 12/3	Brinksfontein	Myburgh Family Trust	Mr. Billie Myburgh
Taayboschkraal 12/4	Gemsbokfontein	Standvastigheid Family Trust	Mr. Francois Conradie
Taayboschkraal 12/1	(Putterskraal)	PJD Stofberg	Mr. Pieter Stofberg
Koornplaats 41/2	Putterskraal	PJD Stofberg	Mr. Pieter Stofberg
Boschmanskloof 9/3[2]	(Anysrivier)	HLN Muller	Mr. Hennie Muller
Anys Rivier Plaat 13/0	(Anysrivier)	HLN Muller	Mr. Hennie Muller
Dwars Rivier 14/ RE	Anysrivier	HLN Muller	Mr. Hennie Muller

Brinksfontein forms part of larger stock farming operations based on adjacent Wilgerboom. A farmstead is located on Brinksfontein (Photograph 1.7). The house is not currently inhabited. The owners are in the process of renovating the house, with the purpose of establishing a wilderness-based guest farm facility (Myburgh, pers. comm). No turbines are proposed on Brinksfontein. The East WEF grid connection Tx line would pass <1 km to the south of Brinksfontein. A new road access road is proposed on Brinksfontein.

[2] According to information provided by Arcus, the property belongs to Mr Pieter Stofberg. However, according to Mr. Hennie Muller, the property belongs to him.

Photograph 1.7: Farmstead on Brinksfontein viewed from access road to Gemsbokfontein

Gemsbokfontein forms part of farming operations based on Saaiplaas farm (adjacent to Eskom Komsberg substation near the R354). Gemsbokfontein is used for seasonal grazing. A farm house and labourer's cottages are located on Gemsbokfontein, but these appear to be uninhabited at present (Photograph 1.8).

Seven turbines are proposed on Gemsbokfontein, namely on high ground >3 km to the south-east of the farmstead (Photograph 1.9). In addition, the East WEF Tx line would be located ~3 km to the south of the farmstead.

Photograph 1.8: Farmstead on Gemsbokfontein viewed from the access road

Photograph 1.9: Ridge on which turbines are proposed, located ~3 km to the south-west of the Gemsbokfontein farmstead

Putterskraal belongs to Mr Pieter Stofberg, whose main operations are based in Rawsonville. A farm manager and three labourer households currently reside on Koornplaats 41/2 ('Putterskraal'). The properties are used for extensive grazing by sheep and goats (Photograph 1.10). Fodder crops are cultivated for own use near the Putterskraal farmstead. A number of turbines are proposed on Taayboschkraal 12/1 and Koornplaats 41/2.

Photograph 1.10: Putterskraal farmstead and kraals

Photograph 1.11: View from Putterskraal yard towards ridges proposed for turbines ~3 km north-east of the farmstead

The owner of Anysrivier, Mr. Hennie Muller, and his son, Mr. Hein Muller, both reside on Anysrivier. In addition, four labourer households work and reside on Anysrivier (Photograph 1.12). The properties are used for extensive grazing by sheep and goats. Fodder cropping areas and small fruit and olive orchards are associated with the farmstead. Another small fodder cropping area is located to the south of the farmstead (Muller, Hennie, pers. comm).

Approximately a third of Komsberg East WEF turbines are proposed on the Muller properties (Photograph 1.13).

Photograph 1.12: Anysrivier farmstead and labourers cottages viewed from the north

Photograph 1.13: View to north-west of Anysrivier farmstead

1.4.3 Komsberg West grid connection

The proposed Komsberg West Tx corridor would be ~30 km in length. It would traverse properties belonging to five owners, two of whom also have properties forming part of the WEF sites (Table 1.5). The relevant properties of the remaining 3 owners however form part of the proposed Great Karoo and Karusa WEFs. The West Tx connection traverses an area in which many inhabited farms serving as operational bases for larger farming operations, are located.

Table 1.5: Farms and farm owners affected by transmission lines for Komsberg West grid connection

PROPERTY	FARM NAME	OWNER	EFFECTIVE OWNER
Welgemoed 268/1	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Welgemoed 268/2	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Kentucky 206	De Plaat	Mr. Eldri van Zyl	Mr. Eldri van Zyl
Rheebokkefontein 209/1	Damslaagte	Mr. Ockert Conradie	Mr. Ockert Conradie
Rheebokkefontein 209/2	(Damslaagte)	Mr. Ockert Conradie	Mr. Ockert Conradie
Rheebokkefontein 209/3	(Saaiplaas)	Standvastigheid Family Trust	Mr. Francois Conradie
Standvastigheid 210	Saaiplaas	Standvastigheid Family Trust	Mr. Francois Conradie

From east to west, the initial ~3km of line would be located across four of Mr Andries le Roux's properties. The proposed alignment is near-parallel to the existing Eskom 400 kV line located ~7.5 km to the south. As indicated, the properties are currently used for seasonal grazing only and are not inhabited.

Approximately 13 km of the proposed alignment would traverse Kentucky 206 (De Plaat). The property belongs to Mr. Eldri van Zyl. The proposed line would be located <1.5km north of the De Plaat farmstead. The farmstead is inhabited by the owner and his wife (Photograph 1.14). Four farm labourer households also reside on the property. The property is used for extensive grazing. A dam and a small fodder cropping area are located near the proposed alignment, but are not affected by it. No Tx lines are currently located on the property. Kentucky 206 forms part of the approved Great Karoo WEF. The Tx corridor proposed for the Komsberg WEFs appears to closely follow that of the Great Karoo WEF (van Zyl, pers. comm).

Photograph 1.14: De Plaat farmstead viewed from the farm access road off the Komsberg gravel road

Only the extreme western corner of De Hoop farm would be affected, over a distance of <500m. The line would be located ~5.5 km south-east of the De Hoop farmstead. De Hoop belongs to Mr Erasmus van Zyl. Mr. van Zyl, his family and a number of labourers' families live on De Hoop. De Hoop forms part of a multi-farm livestock-based operation. No Tx lines are currently located on De Hoop. De Hoop forms part of the Karusa WEF.

Damslaagte would be affected over a distance of ~5km. Damslaagte is permanently inhabited by the owner, Mr Ockert Conradie (Photograph 1.15). Three labourer households live and work on Damslaagte. Damslaagte forms part of a multi-farm sheep farming operation. Fodder crops for own use are cultivated on Damslaagte. The proposed Tx alignment roughly follows that of the Komsberg gravel road across Damslaagte. The new Tx line would be located ~600m to the east of the Damslaagte farmstead. A 400 kV line is currently located across Damslaagte, approximately 2.5 km south of the farmstead. Damslaagte forms part of the Karusa WEF.

The final ~9km towards the Eskom Komsberg substation would be located across Saaiplaas. Saaiplaas belongs to Mr Francois Conradie. Saaiplaas is the basis of a multi-farm sheep-based operation, which also includes Gemsbokfontein. Fodder is grown on Saaiplaas for own use. Mr Conradie and his family live on Saaiplaas. Five labourer households also live on Saaiplaas (Photograph 1.16). A farm house on Saaiplaas has been converted into a guest facility. Komsberg substation is located adjacent to Saaiplaas. Two Tx corridors currently traverse Saaiplaas. The proposed new Tx line would be aligned parallel to, and directly adjacent to one of the existing Tx line corridors. The new line would be located ~900m from the Saaiplaas farmstead. As indicated, Gemsbokfontein forms part of the Komsberg East WEF. Saaiplaas forms part of the Karusa WEF.

Photograph 1.15: Damslaagte farm yard viewed from the Komsberg gravel road

Photograph 1.16: Labourers houses on Saaiplaas. The proposed Tx line would be located ~900 m to the east

1.4.4 Komsberg East grid connection

The Komsberg East grid connection is approximately 50km in length. The westernmost ~30km is identical to the West connection. The remaining eastern ~20 km is proposed entirely across the WEF site, thus affecting no additional land owners (Table 1.6). The bulk of the ~20 km alignment is proposed on high ground in relatively inaccessible terrain. The alignment would cross one public gravel road. No existing Tx lines are located in the area.

Table 1.6: Farms and farm owners affected by transmission lines FOR Komsberg East grid connection

PROPERTY	FARM NAME	OWNER	EFFECTIVE OWNER
Anys Rivier Plaat 13/0	(Anysrivier)	HLN Muller	Mr. Hennie Muller
Boschmanskloof 9/3[3]	(Anysrivier)	HLN Muller	Mr. Hennie Muller
Taayboschkraal 12/1	(Putterskraal)	PJD Stofberg	Mr. Pieter Stofberg
Taayboschkraal 12/3	Brinksfontein	Myburgh Family Trust	Mr. Billie Myburgh
Taayboschkraal 12/2	Wilgerboom	Myburgh Family Trust	Mr. Billie Myburgh
Taayboschkraal 12/4	Gemsbokfontein	Standvastigheid Family Trust	Mr. Francois Conradie
Vlakkloof 11/0;	Vlakkloof	A de V Le Roux Family Trust	Mr. Andries le Roux
De Plaat 205/1;	De Plaat	Le Roux Family Trust	Mr. Andries le Roux
Schalkwykskraal 204/2;	Kareedoringbos, Ventersrivier	Le Roux Family Trust	Mr. Andries le Roux
Welgemoed 268/1	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Welgemoed 268/2	Welgemoed	A de V Le Roux Family Trust	Mr. Andries le Roux
Kentucky 206	De Plaat	Mr. Eldri van Zyl	Mr. Eldri van Zyl
De Hoop 202	De Hoop	Mr. Erasmus van Zyl	Mr. Erasmus van Zyl
Rheebokkefontein 209/1	Damslaagte	Mr. Ockert Conradie	Mr. Ockert Conradie
Rheebokkefontein 209/2	(Damslaagte)	Mr. Ockert Conradie	Mr. Ockert Conradie
Rheebokkefontein 209/3	(Saaiplaas)	Standvastigheid Family Trust	Mr. Francois Conradie
Standvastigheid 210	Saaiplaas	Standvastigheid Family Trust	Mr. Francois Conradie

The easternmost ~1 km of the alignment would be located across Anysrivier. The line would be located on high ground >3km to the north of the Anysrivier farmstead, across broken terrain.

[3] See preceding footnote.

Approximately 2.5 km would be located across Putterskraal. The line would affect higher ground in the northern portion of Putterskraal, ~4.5 km north of the farmstead.

Approximately 3.5 km would be located across Gemsbokfontein. The line would be located partially on high ground, and partially on the large plain ("vlak") south of Gemsbokfontein and Brinksfontein. The line would be located roughly equidistant (~3 km) from the Gemsbokfontein (to the north) and Putterskraal (to the south) farmsteads.

Approximately 6.5km would be located across Mr. Billie Myburgh's properties Brinksfontein and Wilgerboom. The line would be located <1 km from both farmsteads. In addition, the line would traverse the Koornplaats-Komsberg gravel road which serves as access road to both (Photograph 1.17). The line would cross the road at what the owners consider the entrance to both farms (Muller, pers. comm).

Photograph 1.17: Approximate location of proposed Tx line crossing of the Koornplaats-Komsberg gravel road south of Wilgerboom farmstead

The remaining portion of alignment up to the proposed West Tx alignment is located across Vlakkloof. As indicated, Vlakkloof and adjacent le Roux properties are not inhabited, and only used for seasonal grazing. As indicated, the alignment of the westernmost ~30km is identical to that of the West Tx connection.

1.5 ASSUMPTIONS AND LIMITATIONS

1.5.1 Assumptions

Strategic importance of the project and no-go option

It is assumed that the strategic importance of promoting renewable energy, including wind energy, is supported by the national and provincial energy policies.

Technical suitability

It is assumed that the proposed development site represents a technically suitable site for the establishment of a wind energy facility.

Fit with planning and policy requirements

Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported.

1.5.2 Limitations

Demographic data

Demographic data is presented at municipal level, as no ward-level information could be obtained. It is however assumed that conditions within the relevant municipalities are comparable across wards.

1.6 APPROACH TO STUDY

The approach to the Social Impact Assessment (SIA) study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice and have also been endorsed by DEA. The key activities in the SIA process embodied in the guidelines include:

- Describing and obtaining an understanding of the proposed intervention (type, scale, location), the communities likely to be affected and determining the need and scope of the SIA;
- Collecting baseline data on the current social environment and historical social trends;
- Identifying and collecting data on the Social Impact Assessment variables and social change processes related to the proposed intervention. This requires consultation with affected individuals and communities;
- Assessing and documenting the significance of social impacts associated with the proposed intervention;
- Identifying alternatives and mitigation measures.

In this regard the study involved:

- Review of demographic data from Census 2011 and other available sources;
- Review of relevant planning and policy frameworks for the area;
- Site specific information collected during the site visit to the area and interviews with interested and affected parties;
- Review of information from similar studies, including the EIAs undertaken for the Suurplaat WEF and the Hidden Valley WEF, both near Sutherland;
- Literature review of social issues associated with wind energy facilities.

The identification of potential social issues associated with proposed wind energy facility is based on observations during the project site visit, review of relevant documentation, experience with similar projects and the area. Annexe A contains a list of the secondary information reviewed and interviews conducted. Annexe B summarises the assessment methodology used to assign significance ratings to the assessment process.

1.6.1 Definition of social impacts

Social impacts can be defined as "The consequences to human populations of any public or private actions (these include policies, programmes, plans and/or projects) that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally live and cope as members of society. These impacts are felt at various levels, including individual level, family or household level, community, organisation or society level. Some social impacts are felt by the body as a physical reality, while other social impacts are perceptual or emotional" (Vanclay, 2002).

When considering social impacts it is important to recognise that social change is a natural and on-going process (Burdge, 1995). However, it is also important to recognise and understand that policies, plans, programmes and/or projects implemented by government departments and/or private institutions have the potential to influence and alter both the ***rate*** and ***direction*** of social change. Many social impacts are not in themselves "impacts" but change process that may lead to social impacts (Vanclay, 2002). For example the influx of temporary construction workers is in itself not a social impact. However, their presence can result in range of social impacts, such as increase in antisocial behaviour. The approach adopted by Vanclay stresses the importance of understanding the processes that can result in social impacts. It is therefore critical for social assessment specialists to think through the complex causal mechanisms that produce social impacts. By following impact pathways, or causal chains, and specifically, by thinking about interactions that are likely to be caused, the full range of impacts can be identified (Vanclay, 2002).

An SIA should therefore enable the authorities, project proponents, individuals, communities and organisations to understand and be in a position to identify and anticipate the potential social consequences of the implementation of a proposed policy, programme, plan or project. The SIA process should alert communities and individuals to the proposed project and possible social impacts, while at the same time allowing them to assess the implications and identify potential alternatives. The assessment process should also alert proponents and planners to the likelihood and nature of social impacts and enable them to anticipate and predict these impacts in advance so that the findings and recommendations of the assessment are incorporated into and inform the planning and decision-making process.

However, the issue of social impacts is complicated by the way in which different people from different cultural, ethic, religious, gender, and educational backgrounds etc view the world. This is referred to as the "social construct of reality". The social construct of reality informs people's worldview and the way in which they react to changes.

1.6.2 Timing of social impacts

Social impacts vary in both time and space. In terms of timing, all projects and policies go through a series of phases, usually starting with initial planning, followed by implementation (construction), operation and finally closure (decommissioning). The activities, and hence the type and duration of the social impacts associated with each of these phases are likely to differ.

1.7 SPECIALIST DETAILS

Tony Barbour, the lead author of this report is an independent specialist with 25 years' experience in the field of environmental management. In terms of SIA experience Tony Barbour has undertaken in the region of 130 SIAs and is the author of the Guidelines for Social Impact Assessments for EIA's adopted by the Department of Environmental Affairs and Development Planning (DEA&DP) in the Western Cape in 2007.

Schalk van der Merwe, the co-author of this report, has an MPhil in Environmental Management from the University of Cape Town and has worked closely with Tony Barbour on a number of SIAs over the last ten years.

1.8 DECLARATION OF INDEPENDENCE

This confirms that Tony Barbour and Schalk van der Merwe, the specialist consultants responsible for undertaking the study and preparing the Draft SIA Report, are independent and do not have any vested or financial interests in the proposed Komsberg WEF being either approved or rejected.

1.9 REPORT STRUCTURE

The report is divided into six sections, namely:

- Section 1: Introduction;
- Section 2: Policy and planning context;
- Section 3: Overview of study area
- Section 4: Identification and assessment of key issues;
- Section 5: Key Findings and recommendations.

SECTION 2: POLICY AND PLANNING ENVIRONMENT

2.1 INTRODUCTION

Section 2 provides an overview of the significant policy and planning documents of relevance to the proposed WEF, namely:

- The policy and planning environment affecting the proposed wind energy facility;
- The local socio-economic environment.

The majority of the site is located in the Western Cape Province, within the Laingsburg Local Municipality, which forms part of the Central Karoo District Municipality. A small section of the site falls within the Northern Cape Province, within the Karoo Hoogland Local Municipality, which forms part of the Namakwa District Municipality.

The focus of the policy and planning review at a district and local level is on the section of the site that falls within the Western Cape Province. An overview of the Northern Cape Provincial planning and policy documents is however provided.

2.2 POLICY AND PLANNING ENVIRONMENT

Legislation and policy embody and reflect key societal norms, values and developmental goals. The legislative and policy context therefore plays an important role in identifying, assessing and evaluating the significance of potential social impacts associated with any given proposed development. An assessment of the "policy and planning fit[4]" of the proposed development therefore constitutes a key aspect of the Social Impact Assessment (SIA). In this regard, assessment of "planning fit" conforms to international best practice for conducting SIAs. Furthermore, it also constitutes a key reporting requirement in terms of the applicable Western Cape Department of Environmental Affairs and Development Planning's *Guidelines for Social Impact Assessment* (2007).

For the purposes of the meeting the objectives of the SIA the following national level policy and planning documents were reviewed, namely:

- National Energy Act (2008);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- White Paper on Renewable Energy (November 2003);
- Integrated Resource Plan (IRP) for South Africa (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012);

[4] Planning fit" can simply be described as the extent to which any relevant development satisfies the core criteria of appropriateness, need, and desirability, as defined or circumscribed by the relevant applicable legislation and policy documents at a given time.

- Astronomy Geographic Advantage (AGA) Act (Act 21 of 2007).

Based on a review of current Western Cape Province (WCP) policy the following provincial and local policy and planning documents were reviewed, namely:

- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014;
- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);
- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2010);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006); and
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002).
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Laingsburg Local Municipality Integrated Development Plan (2012-2017).
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

As indicated above, small section of the site is located in the Karoo Hoogland Municipality (KHLM) within the Northern Cape Province. The following provincial level policy and planning documents were reviewed:

- Northern Cape Provincial Growth and Development Strategy (2004-2014);
- Northern Cape Climate Change Response Strategy;
- Northern Cape Spatial Development Framework;

In addition, Section 2.6 provides a summary of some of the key health and disturbance issues associated with wind farms based on international experience. The findings of the review concentrate on three documents, namely the National Wind Farm Development Guidelines produced by the Environment Protection and Heritage Council (EPHC) of Australia (Draft, July, 2010), recent research on wind energy development in Scotland undertaken by Warren and Birnie in 2009 (Warren, Charles R. and Birnie, Richard V. (2009) 'Re-powering Scotland: Wind Farms and the 'Energy or Environment?' Debate', and a review of the potential health impacts associated with wind farms undertaken by the Australian Health and Medical Research Council (July, 2010).

2.3 NATIONAL POLICY ENVIRONMENT

2.1.1 National Energy Act (Act No 34 of 2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including wind:

"To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies…" (Preamble).

2.1.2 White Paper on the Energy Policy of the Republic of South Africa

Investment in renewable energy initiatives, such as the proposed WEF, is supported by the White Paper on Energy Policy for South Africa (December1998). In this regard the document notes:

"Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future".

The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and ***wind*** and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:

- Ensuring that economically feasible technologies and applications are implemented;
- Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and,
- Addressing constraints on the development of the renewable industry.

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive and many appropriate applications exist.

The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- Minimal environmental impacts in operation in comparison with traditional supply technologies; and
- Generally lower running costs, and high labour intensities.

Disadvantages include:

- Higher capital costs in some cases;
- Lower energy densities; and
- Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.

The IRP 2010 aims to allocate 43% of new energy generation facilities in South Africa to renewables.

2.1.3 White Paper on Renewable Energy

The White Paper on Renewable Energy (November, 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The White Paper notes that while South Africa is well endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol[5], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms of the accord South Africa committed itself to a reduction target of 34% compared to business as usual.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act).

Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is:

2.1.4 National Integrated Resource Plan for Electricity (2010-2030)

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures

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[5] The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia)

such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9,6 GW; 6,3 GW of coal; 11,4 GW of renewables; and 11,0 GW of other generation sources.

A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%). Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:

- The installation of renewables (solar PV, CSP and wind) were brought forward in order to accelerate a local industry;
- To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW was included in the IRP;
- The emission constraint of the RBS (2140 million tons of carbon dioxide per year after 2024) was maintained; and
- Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

Table 2.1 National Energy Development Commitments before the next IRP

	New build options							
	Coal (PF, FBC, imports, own build)	Nuclear	Import hydro	Gas – CCGT	Peak – OCGT	Wind	CSP	Solar PV
	MW	MW	MW	MW	MW	MW	MW	MW
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500[1]	0	0	0	0	400	0	300
2015	500[1]	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400[4]	100[4]	300[4]
2019	250	0	0	237[3]	0	400[4]	100[4]	300[4]
2020	250	0	0	237[3]	0	400	100	300
2021	250	0	0	237[3]	0	400	100	300
2022	250	0	1 143[2]	0	805	400	100	300
2023	250	1 600	1 183[2]	0	805	400	100	300
2024	250	1 600	283[2]	0	0	800	100	300
2025	250	1 600	0	0	805	1 600	100	1 000
2026	1 000	1 600	0	0	0	400	0	500
2027	250	0	0	0	0	1 600	0	500
2028	1 000	1 600	0	474	690	0	0	500
2029	250	1 600	0	237	805	0	0	1 000
2030	1 000	0	0	948	0	0	0	1 000
Total	6 250	9 600	2 609	2 370	3 910	8 400	1 000	8 400

Firm commitment necessary now

Final commitment in IRP 2012

1. Built, owned & operated by IPPs 2. Commitment necessary due to required high-voltage infrastructure, which has long lead time 3. Commitment necessary due to required gas infrastructure, which has long lead time 4. Possibly required grid upgrade has long lead time and thus makes commitment to power capacity necessary

Source: Integrated Resource Plan (IRP) for South Africa (2010)

Table 2.1 above indicates the new capacities of the Policy commitment. The dates shown in Table 2.1 indicate the latest that the capacity is required in order to avoid security of supply concerns. The document notes that projects could be concluded earlier than indicated.

It should, however, be noted that Table 2.1 does not reflect the actual amount capacities ultimately announced in the individual Rounds of the REIPPPP where wind had an allocation between 600 and 800MW per year and solar between 500 and 700MW. With Round 4 announcement in April 2015 the allocation for wind and solar was doubled in the so called Round 4b and even an expedited Round 4c with an additional 1800MW was introduced for bidding in October 2015. Furthermore the department announced that the current REIPPPP will be extended with an additional 6300MW for the upcoming years.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW. The key recommendations contained in the Policy-Adjusted IRP Final Report (March 2011) that have a bearing on the renewable energy sector include:

General

- The dark shaded projects in Table 2.1 need to be decided before the next IRP iteration, with the identified capacities thereafter assumed as "committed" projects;
- The light shaded options should be confirmed in the next IRP iteration; and
- All non-shaded options could be replaced during the next, and subsequent, IRP iterations if IRP assumptions change and thus impact on the quantitative model results.

Conclusions

The key conclusions that are relevant to the renewable energy sector include:

- An accelerated roll-out of renewable energy options should be allowed in order to derive the benefits of localisation in these technologies.

2.1.5 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

2.1.6 The New Growth Path Framework

Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South

Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: ***energy***, transport, communication, water and housing.

The New Growth Path also identifies five other priority areas as part of the programme to create jobs, through a series of partnerships between the State and the private sector. The Green Economy is one of the five priority areas, including expansions in construction and the production of technologies for solar, wind and biofuels. In this regard clean manufacturing and environmental services are projected to create 300 000 jobs over the next decade.

2.1.7 National Infrastructure Plan

The South African Government adopted a National Infrastructure Plan in 2012. The aim of the plan is to transform the economic landscape while simultaneously creating significant numbers of new jobs and strengthen the delivery of basic services. The plan also supports the integration of African economies. In terms of the plan Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, ***electricity plants***, hospitals, schools and dams will contribute to improved economic growth.

As part of the National Infrastructure Plan, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). The Committee identified and developed 18 strategic integrated projects (SIPS). The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions) and consist of:

- Five geographically-focussed SIPs;
- Three spatial SIPs;
- Three energy SIPs;
- Three social infrastructure SIPs;
- Two knowledge SIPs;
- One regional integration SIP;
- One water and sanitation SIP.

The three energy SIPS are SIP 8, 9 and 10.

SIP 8: Green energy in support of the South African economy
- Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010);
- Support bio-fuel production facilities.

SIP 9: Electricity generation to support socio-economic development
- Accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances;

- Monitor implementation of major projects such as new power stations: Medupi, Kusile and Ingula.

SIP 10: Electricity transmission and distribution for all

- Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development.
- Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity.

2.1.8 Astronomy Geographic Advantage Act (2007);

The main purpose of the Astronomy Geographic Advantage (AGA) Act (Act 21 of 2007) is to provide for the preservation and protection of such areas within South Africa that are uniquely suited for optical and radio astronomy.

Regulations promulgated in terms of AGA in 2009 require all developments in the Sutherland area that entail external night lighting, to be fully cut-off, with no light emitted in the upward direction. This is aimed at protecting the observational integrity of SALT (Southern African Large Telescope), the largest single telescope in the Southern Hemisphere, located approximately 20 km east of Sutherland.

The nearest proposed turbine location on the Komsberg WEF site with regard to SALT, would be located ~60 km to the south-east of SALT. This WEF site is located outside of the viewshed of SALT as well as below the escarpment.

2.4 PROVINCIAL POLICY AND PLANNING ENVIRONMENT

2.4.1 White Paper on Sustainable Energy for the Western Cape

The White Paper on Sustainable Energy (2010) compliments the Climate Change Strategy and Action Plan, specifically by *inter alia* setting targets for renewable energy generation. The White Paper is currently in Final Draft form. Once approved by Provincial cabinet, it will constitute the formal Western Cape's policy document on which the Western Cape Sustainable Energy Facilitation Bill will be based. The purpose of the White Paper and the envisaged Bill is to create an enabling policy environment in the Western Cape in order to promote and facilitate energy generation from renewable sources, as well as efficient energy use technologies and initiatives. This objective forms an integrated part of the Province's overarching energy policy objectives, namely:

- To ensure medium-term energy security, sufficient in order to support economic growth;
- To reduce energy poverty;
- To increase the efficient use of energy;
- To limit the greenhouse emissions footprint (associated with the use of fossil fuels);
- To decrease reliance on finite fossil fuel resources and associated unpredictable commodity markets.

The White Paper forms part of the Provincial Government of the Western Cape's (PGWC) strategy to aimed at removing a number of barriers (e.g. energy pricing, legal, institutional, low levels of investment confidence, insufficient knowledge) currently frustrating the province's energy goals by preventing the adoption and commercialization of clean energy (including electricity generation from renewable sources such as wind and solar) technologies and initiatives. The White Paper notes that, with regard to sources of renewable energy, wind and solar both represent commercially viable options in the province. The document proposes that special focus should be given to these renewables subsectors and specific associated technologies in particular in order to achieve critical mass of installation, and thus drive down establishment costs and ensure permanent employment opportunities.

The context, vision, identified goals and targets of the White Paper are briefly discussed below:

Context

The White Paper is rooted in an integrated set of high-level provincial policy documents, and in particular, the Western Cape Provincial Growth and Development Strategy (PGDS)[6] of 2007 and the Sustainable Development Implementation Plan (SDIP)[7]. These policy documents provide the overarching framework for the White Paper. Information contained in the internal Sustainable Energy Strategy (SES) document which was prepared in 2007, largely informed the drafting of the White Paper.

Vision

The vision underpinning the White Paper, the so-called "2014 Sustainable Energy Vision for the Western Cape" is the following:

The Western Cape has a secure supply of quality, reliable, clean and safe energy, which delivers social, economic and environmental benefits to the Province's citizens, while also addressing the climate change challenges facing the region and the eradication of energy poverty (White Paper, 15).

Goals

Six goals have been identified in order to realise to this vision. These goals are grouped under economic, environmental and social sustainability categories. These goals are listed below, and each briefly discussed:

- Goal 1: alleviate energy poverty (Social sustainability): This goal is aimed at addressing energy-related under-development amongst the province's poor.
- Goal 2: Improve the health of the nation (Social sustainability): The goal is aimed at reducing health and safety risks associated with the use of fuels such as coal, paraffin and wood, as well as the generation of electricity from fossil fuels. In this regard it is noted that use of renewable sources to generate electricity does not emit harmful substances such as smoke, or oxides of sulphur nitrogen into the atmosphere. The document notes that improving the health of the nation includes

[6] The main purpose of the PGDS is to provide a strategic framework for accelerated and shared economic growth in the Western Cape. The PGDS builds on the 12 iKapa strategies which were developed by the relevant PGWC line departments, including the Provincial Spatial Development Framework (PSDF), the Sustainable Development Implementation Plan (SDIP) and the Climate Change Response Strategy (CCRS).

[7] This plan includes programmes to encourage biodiversity, effective open-space management and the better management of settlements by ensuring the sustainability of services in respect of water, waste, energy and land. The SES and White Paper both effectively form part of SDIP.

improving the health of the individual through improved indoor climate as well as the outdoor climate.

- Goal 3: Reduce harmful emissions (Environmental sustainability): The White Paper notes that improved energy efficiency and increased use of renewable energy are cost effective methods to reduce Greenhouse Gas emissions, thereby combating Climate Change. Addressing Climate Change opens the door to utilizing additional finance mechanisms to reduce CO2 emissions.
- Goal 4: Reduce negative footprints in our environment (Environmental sustainability): The White Paper notes that the use of fossil fuels has a documented negative impact on the regional and local environment. The negative impact includes but is not limited to individual health, ground water pollution and air pollution. Any reduction in the use of fossil fuels through switching to clean(er) energy sources and more efficient energy uses is therefore desirable.
- Goal 5: Enhance energy security (Economic sustainability): The massive South African black-outs that started first in the Western Cape in early 2006 alerted the Province to its energy vulnerability. It is essential that the Western Cape increases its resilience against external energy supply disruptions and the massive price fluctuations caused by national or international decisions with regard to energy commodities (coal, oil):
- Goal 6: Improve economic competitiveness (Economic sustainability): It has been demonstrated internationally that one of the ways to improve economic competitiveness is by improving industrial and commercial energy efficiency. Support of industrial best practice energy management as a tool to stay competitive and improve the economy is important.

Targets

The PGWC agreed to targets for electricity from renewable sources and for energy efficiency to be achieved by 2014. The purpose of the White Paper is to quantify the relevant targets, and further to provide an incremental implementation plan until 2014. In this regard, four targets have been identified. Of these, two are of direct relevance to the proposed WEF:

- Target for electricity generated from renewable sources: *15% of the electricity consumed in the Western Cape will come from renewable energy sources in 2014, measured against the 2006 provincial electricity consumption* (White Paper, 21)

In this regard, the White Paper notes that in order to reach this target, it will be necessary for the PGWC to ensure that the environment to establish and generate renewable energy is such that a minimum of 15% of the electricity can be produced, and must be consumed, from renewable sources.

- Target for reducing carbon emissions: *The carbon emissions are reduced by 10% by 2014 measured against the 2000 emission levels* (p. 23).

In this regard, the White Paper notes that achieving this target largely depends on achieving the renewables target.

Applicability

The White Paper remains the most recent document in this regard. It was adopted by Provincial Cabinet in 2010. By 2011 DEA&DP had finalized a Draft Western Cape

Sustainable Energy Bill[8]. However, in MEC Bredell's Departmental Oversight Report to WC Parliament in November 2013, he indicated that further drafting of the Bill has been suspended, as the process had been overtaken by developments in national legislation[9].

2.4.2 Western Cape Climate Change Response Strategy

The Western Cape Climate Change Response Strategy (WCCCRS) was adopted in February 2014. It is an update of the 2008 Western Cape Climate Change Response Strategy and Action Plan. The key difference with the 2008 Strategy is a greater emphasis on mitigation, including strategically suitable renewable energy development.

The 2014 WCCCRS was updated in accordance with the National Climate Change Response Policy (2013). It is strongly aligned with the overarching provincial objectives contained in the Western Cape Draft Strategic Plan 2009-2014 (2010), and the WCP 'Green is Smart' Strategy (2013). In line with the National Climate Change Response Policy, the Strategy takes a two-pronged approach to addressing climate change:

- **Mitigation:** Contribute to national and global efforts to significantly reduce Green House Gas (GHG) emissions and build a sustainable low carbon economy, which simultaneously addresses the need for economic growth, job creation and improving socio-economic conditions;
- **Adaptation:** Reduce climate vulnerability and develop the adaptive capacity of the Western Cape's economy, its people, its ecosystems and its critical infrastructure in a manner that simultaneously addresses the province's socio-economic and environmental goals (WCCCRS, 2014: 21).

The Strategy will be executed through an implementation framework which will include an institutional framework for both internal and external stakeholders, with a strong emphasis on partnerships. The framework still has to be prepared. A monitoring and evaluation system is further envisaged in order to track the transition to a low carbon and climate resilient WCP. Policy aspects dealing with mitigation are of specific relevance to renewable energy generation.

Energy and emissions baseline

Based on comprehensive 2009 data for all WCP energy use sectors, the following key findings pertain to overall WCP energy use and emissions:

- Electricity is the key fuel used in the WCP, accounting for 25% of total consumption;
- Approximately 95% of base load electricity is generated from low-grade coal and the remainder by nuclear. The vast bulk of WCP electricity is generated in the north of the country;
- In terms of emissions by sector, electricity is responsible for 55% of total WCP emissions. According to the Strategy, this supports the case for a shift towards renewables and clean energy types;

[8] www.gov.za/department-environmental-affairs-and-development-planning-2011-budget-speech-delivered-western-cape.

[9] Parliament of the Province of the Western Cape - Announcements, Tablings and Committee Reports (2013) F*riday, 15 November 2013,* 202 No 69 – 2013, Fifth session, Fourth Parliament, Item B.1.b (x).

- Transport (55%) was the greatest energy user, followed by industry (33%). Although domestic consumption accounted for only 8%, it accounted for 18% of emissions, again underscoring the emission-intensive nature of electricity generation.

Mitigation potential
According to the Strategy, the main opportunities for mitigation include energy efficiency, demand-side management, and moving towards a less-emission intensive energy mix.

In the short to medium term, four areas with mitigation potential are identified, including promoting renewable energy in the form of both small-scale embedded generation as well as large scale renewable energy facilities. Together with other mitigation interventions, renewable energy generation is anticipated to result in the following socio-economic benefits:

- Reducing fuel costs to households and business;
- Improving the competitiveness of businesses;
- Job creation opportunities with the development of new economic sectors;
- Local business development;
- Improved air quality (with positive health impacts);
- Reducing the negative impact of large carbon footprints, particularly for export products; and
- Reducing stress on energy needs of the province and thereby increasing energy security (p. 27).

Renewable energy as strategic focus area
Initial implementation of the Strategy will focus on select focus areas aligned with the National Climate Change Response Policy Flagship Programmes and the Western Cape Green Economy Strategy Framework. These focus areas will be reviewed every five years – i.e. the next revision is due in 2019. Renewable area is identified as one of nine focus areas. The Strategy document notes that renewable energy is a key area of focus for the Western Cape, and forms a fundamental component of the drive towards the Western Cape becoming the green economy hub for Africa.

The role of provincial government is identified as 'supporting the development of the renewable energy industry through promoting the placement of renewable energy facilities in strategic areas of the Western Cape as well as through supporting renewable energy industries' (p.32).

The document further notes that waste-to-energy opportunities are being investigated in order to facilitate large-scale rollout. Current investigation includes understanding the most appropriate technologies for waste-to-energy projects as well as developing decision support tools for municipalities to implement waste-to-energy programmes (p. 32).

Priority areas identified for renewable energy development:
- Development of the Renewable Energy economy in the WCP, in terms of both the appropriate placement of renewable energy as well as manufacturing opportunities;
- Development of waste-to-energy opportunities for both municipal and private sector (commercial and industrial) waste systems;
- Development of opportunities around small-scale renewable energy embedded generation activities (32).

2.4.3 Provincial Strategic Plan 2014-2019 (2014)

The Western Cape Provincial Strategic Plan (WCPSP) was adopted by Cabinet in 2014. It builds upon the 2009-2014 Draft Provincial Strategic Plan ('Building an Open Opportunity Society for All') which formed the overarching strategic framework during the incumbent provincial government's first term in office. The WCPSP 2014-2019 sets out the overarching vision and priorities for its second term in office, i.e. until 2019.

The vision statement for the 2014-2019 Plan is 'a highly skilled, innovation-driven, resource-efficient, connected, high-opportunity society for all'. It is hoped that the systems, structures and budgets which were put in place during the first term would help facilitate implementation of the new Plan. At the same time, the current Plan reflects provincial government's (PGWC) shift from a 'silo-based' (single department) to a transversal (cross-cutting) approach to government. The five strategic goals identified for the 2014-2019 period are:

- Creating opportunities for growth and jobs;
- Improving education outcomes and opportunities for youth development;
- Increasing wellness and safety, and tackling social ills;
- Enabling a resilient, sustainable, quality and inclusive living environment; and
- Embedding good governance and integrated service delivery through partnerships and spatial alignment (WCPSP, 2014: p.8).

Five sets of performance indicators are identified to evaluate implementation of strategies aimed at meeting these goals. In addition, the Plan identifies a number of 'game changers' which would help tackling provincial development issues, and result in palpable 'real' change. It envisages that action plans would be prepared by 2015/2016 for each of these identified 'game changers'. The 'game changers' are clustered around three priority areas. Key aspects of the Plan pertaining to renewable energy are discussed below.

Strategic Goal 1: Energy security as 'game changer'

Economic growth/ job creation (Strategic Goal 1) is one of the 3 priority development areas. Achieving Energy security is identified as one of two 'game changers' for fostering this. In this regard, the Plan notes that inadequate electricity supplies over the next five years and beyond threaten to be a significant impediment to growth. A number of strategic priorities are identified to address the issue, including the development of a WCP green economy. The Plan notes that PGWC has prioritized the development of a green economy, with the further aim of establishing it as the green economy hub of Africa.

The Plan further notes that the WCP has already established itself as the national renewable energy hub. In that regard, it is home to developers which have developed more than 60% of the 64 successful projects in the first three rounds of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), as well as a wide array of firms that provide key support services for the industry (engineering and environmental consultancies, legal advisors, etc.). The WCP has also seen the majority of local manufacturing investments. Three of the 4 PV manufacturers that have been successful in supplying to the REIPPPP projects are located in Cape Town, whilst 2014 also saw major global players opening manufacturing facilities for inverters and wind turbine towers.

Future energy security priorities include scaling up renewable energy generation in the province, including embedded generation such as rooftop solar PV, and the importation of liquid natural gas as an alternative power source to support further rollout of renewable energy and low carbon fuel switching (WCPSP, 2014: p.21).

Strategic Goal 4: Reducing greenhouse emissions and improving air quality
The Plan notes that PGWC is committed to improving the resilience, sustainability, quality and inclusivity of the urban and rural settlements. The Plan further notes that while some resource conservation and management improvements have been made, the WCP resource base remains under severe pressure.

Water, energy, pollution and waste, transport and resource-use inefficiencies are leading to extensive environmental degradation, poor air quality, loss of biodiversity and agricultural resources, which result in a deterioration of social and economic conditions. These challenges are further exacerbated by population growth and climate change impacts. It is anticipated that climate change will worsen air quality, as its effects will slow air circulation around the world, resulting in an increase in the frequency and severity of disasters (e.g. fires, floods, and coastal erosion) (WCPSP, 2014: p. 35).

Strategic outcomes pursued under Goal 4 include the enhanced management and maintenance of the ecological and agricultural resource-base; sustainable and integrated urban and rural settlements; and an improved climate change response.

Four outcomes are prioritized, including reduced greenhouse gas emissions and improved air quality. In this regard, the Plan notes that, as air quality and climate change are integrally linked, activities such as reducing fossil fuel burning will address both these priorities (WCPSP, 2014: p. 36). The Plan does not discuss reduced fossil fuel burning or renewable energy in any further detail.

With regard to interventions to air quality management, the Plan refers to the Western Cape Air Quality Management Plan (WCAQMP). The WCAQMP (2010) and associated working groups focus on key interventions relating to governance and integrated management of air quality, climate change, town and regional planning and transport planning. The WCAQMP does not address renewable energy generation.

2.4.4 Western Cape Land Use Planning Act

In line with the Spatial Planning and Land Use Management Act, (Act 16 of 2013), the Western Cape Land Use Planning Act 2014 (LUPA) was adopted by PGWC in April 2014. Chapter III (which deals with spatial planning matters) sets out the minimum requirements for drafting a Provincial Spatial Development Framework (PSDF) for the WCP.

Of specific relevance, Section 4 requires a PSDF to (3) 'contain at least (*c*) provincial priorities, objectives and strategies, dealing in particular with (*iiii*) adaptation to climate change, mitigation of the impact of climate change, renewable energy production and energy conservation'. This requirement would apply to all future revisions of the PSDF. As such, it indicates PGWC's commitment to renewable energy production in order to respond to climate change.

2.4.5 Western Cape Provincial Spatial Development Framework

PSDFs are due for revision every five years. The 2014 Revision of the Western Cape PSDF replaces the 2009 PSDF. The 2014 PSDF was approved by MEC Bredell (Local Government, Environmental Affairs and Development Planning) in April 2014. In his Preface to the 2014 PSDF the MEC indicated that the 2014 PSDF carries the buy-in of all the Provincial departments to inform and guide their sector planning/spatial development strategies, and is therefore 'owned' by all Heads of Department (PSDF, p.2).

While it builds on and continues to incorporate the key principles and spatial policies of the 2009 PSDF, the new PSDF replaces the 2009 one as policy framework. A number of reasons necessitated this replacement. These include the fact that the 2009 PSDF was drafted in a climate of economic buoyancy before the global recession had hit home. The 2009 PSDF also had to be updated in line with new policy such as the One Cape 2040 vision, LUPA, and the National Development Plan (NDP), as well as the results of the 2011 Census. Finally, the 2014 PSDF reflects PGWC's new transversal (cutting across departments) approach to government, while providing greater clarity with regard to the planning responsibilities of the three spheres of government. (2014)

Overarching guiding principles
The new PSDF is based on a set of 5 guiding principles, namely:

- Spatial justice;
- Sustainability and resilience;
- Spatial efficiency;
- Accessibility, and
- Quality and Livability.

Under Sustainability and resilience, the PSDF notes that land development should be spatially compact, resource-frugal, compatible with cultural and scenic landscapes, and should not involve the conversion of high potential agricultural land or compromise ecosystems (p. 22). The 2004 Growth Potential Study was also revised in 2013 as part of the PSDF process[10].

Key spatial challenges are outlined in Chapter 2 of the PSDF. Energy security and climate change response are identified as key high-level future risk factors. The PSDF notes that the WCP is subject to global environmental risks such as climate change, depletion of material resources, anticipated changes to the global carbon regulatory environment, and food and water insecurity. The challenge would be to open up opportunities for inclusive economic growth, and decouple economic growth from resource consumptive activities (i.e. the development of a 'greener' economy, as outlined in the 2013 WCP Green is Smart strategy – see further below).

In this regard, the 2014 PSDF is in response to a number of associated escalating risks, including understanding the spatial implications of known risks (e.g. climate change and its economic impact and sea level rise, flooding and wind damage associated with extreme climatic events); and energy insecurity, high levels of

[10] eadp-westerncape.kznsshf.gov.za/sites/default/files/news/files/2013-10-15/2013-growth-potential-study-of-towns-report_0.pdf. The 2014 PSDF is informed by three additional studies, also available at the above link.

carbon emissions, and the economic impacts of the introduction of a carbon tax (p. 27).

The WCP Spatial agenda

The spatial agenda for the WCP is set out in Chapter 2.6. This agenda is anticipated to deliver on the objectives of greater inclusivity, growth and environmental resilience. The agenda may be summarized as three linked sub-agendas, all addressed in the PSDF:

- (1) Growing the WCP economy in partnership with the private sector, non-governmental and community based organisations;
- (2) Using infrastructure investment as primary lever to bring about the required urban and rural spatial transitions, including transitioning to sustainable technologies, as set out in the 2013 Western Cape Infrastructure Framework (WCIF), while also maintaining existing infrastructure;
- (3.) Improving oversight of the sustainable use of the Western Cape's spatial assets. This sub-agendum is of specific relevance to climate change response and renewable energy. Its key objective is safeguarding the biodiversity networks, ecosystem services, agricultural resources, soils and water, as well as the WCP's unique cultural, scenic and coastal resources on which the tourism economy depends. In addition, it seeks to understand the spatial implications of known risks (e.g. climate change) and to introduce risk mitigation and/or adaptation measures (p. 33).

Chapter 3.1 deals with the sustainable use of the WCP's assets. These are identified as Biodiversity and Ecosystem services; Water resources; Soils and Mineral resources; Resource consumption and disposal; and Landscape and scenic assets. Policies are outlined for each of these themed assets. The last two themed assets are of specific relevance with regard to renewable energy.

Resource consumption and disposal

Key challenges facing the WCP are identified as matters pertaining to waste disposal, air quality, energy, and climate change.

Energy

With regard to energy use, the PSDF notes that the Cape Metro (albeit the province's most efficient user) and West Coast regions are the WCP's main energy users. It further notes that the WCP's electricity is primarily drawn from the national grid, which is dominated by coal-based power stations, and that the WCP currently has a small emergent renewable energy sector in the form of wind and solar generation facilities located in its more rural, sparsely populated areas. The PSDF also reiterates PGWC's commitment to shifting the economy towards gas[11] as transitional fuel (see WCIP below) (p. 50-1). Most of the energy discussion in the PSDF is dominated by aspects pertaining to natural gas.

With regard to renewable energy, the following policy provisions are of relevance:

[11] The PSDF at present envisages mainly from offshore West Coast gas fields via a terminal at Saldanha. The PSDF refers to the potential exploitation of own shale reserves, but also to the environmental sensitivity involved.

- Policy R.4.6: *Pursue energy diversification and energy efficiency in order for the Western Cape to transition to a low carbon, sustainable energy future, and delink economic growth from energy use*;
- R.4.7: *Support emergent Independent Power Producers (IPPs) and sustainable energy producers (wind, solar, biomass and waste conversion initiatives) in suitable rural locations (as per recommendations of the Strategic Environmental Assessments for wind energy (DEA&DP) and renewable energy (DEA)*[12] (p.52).

Unlike the 2009 PSDF, the new PSDF does not provide any spatial provisions with regard to REF or transmission line infrastructure. Instead, such determination is envisaged in terms of the WCP WEF SEA, the DEA REF SEA, municipal SDFs, etc.

In this regard the two policy directives contained in the 2009 PSDF that had a direct relevance for WEFs are not contained in the 2014 revision, namely:

HR26 *(…) transmission lines (…) should be aligned along existing and proposed transport corridors rather than along point to point cross-country routes.* (Mandatory directive)

HR27 *Wind farms should be located where they will cause least visual impact, taking into consideration the viability of the project.* (Guiding directive)

Climate change

Water scarcity is identified as probably the key risk associated with climate change. Essentially the same primary response objectives outlined in the 2014 Western Cape Climate Change Response Strategy (WCCCRS – see 4. below) are identified in the PSDF. These are energy efficiency, demand management and renewable energy.

Policy provisions are made with regard to climate change adaptation and mitigation. Concerning renewable energy, the following is of relevance:

- R.4.16: *Encourage and support renewable energy generation at scale* (p.52).

Landscape and scenic assets

A specialist study was undertaken into the Province's cultural and scenic landscapes. This study[13] was one of the informants of the 2014 PSDF. It established that the WCP's cultural and scenic landscapes are significant assets underpinning the tourism economy, but that these resources are being incrementally eroded and fragmented. According to the study agriculture is being reduced to 'islands', visual cluttering of the landscape by non-agricultural development is prevalent, and rural authenticity, character and scenic value are being eroded. The mountain ranges belonging to the Cape Fold Belt together with the coastline are identified as the most significant in scenic terms, and noted to underpin the WCP's tourism economy.

A number of scenic landscapes of high significance are under threat, mainly from low density urban sprawl, and require strategies to ensure their long-term protection. These include landscapes under pressure for large scale infrastructural developments

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[12] See notes under Regional Methodology Review below.

[13] DEA&DP Winter and Oberholzer (2013). *Heritage and Scenic Resources: Inventory and Policy Framework for the Western Cape. - A Study prepared for the Western Cape Provincial Spatial Development Framework*. Draft 5. See footnote 1 above.

such as ***wind farms***, solar energy facilities, transmission lines and shale gas development in the Central Karoo (p. 54). With regard to renewable energy, the following policy provisions are of relevance:

- R.5.6: *Priority focus areas proposed for conservation or protection include -*

    - *Rural landscapes of scenic and cultural significance situated on major urban edges and under increasing development pressure, e.g. Cape Winelands;*
    - *Undeveloped coastal landscapes under major development pressure;*
    - *Landscapes under pressure for large scale infrastructural developments such as* ***wind farms****, solar energy facilities, transmission lines and fracking, e.g. Central Karoo; and*
    - *Vulnerable historic mountain passes and 'poorts'* (p.55).

Renewable energy within the Spatial Economy
Chapter 3.2 deals with opportunities in the WCP spatial economy, including with regard to regional infrastructure development. Essentially the same objectives are identified as in the WCIF, including the promotion of a renewable energy sector (p.61). General project-based (EIA and specialist assessment) provisions are made for evaluating the suitability of sites proposed for bulk infrastructure (Policy E.1) (p.63).

2.4.6 Western Cape Infrastructure Framework

The Western Cape Infrastructure Framework (WCIF)(2013) was developed by the WCP Provincial Department of Transport and Public Works in terms of the Provincial Government's mandate to coordinate provincial planning under Schedule 5A of the Constitution. The objective of the WCIF is to align the planning, delivery and management of infrastructure to the strategic agenda and vision for the Province, as outlined in the 2009-2014 Draft Provincial Strategic Plan. The One Cape 2040 and 2013 Green is Smart strategy were other key informants.

The document notes that given the status quo of infrastructure in the province, and the changing and uncertain world facing the Western Cape over the 2-3 decades a new approach to infrastructure is needed. Namely one that satisfies current needs and backlogs, maintains the existing infrastructure, and plans proactively for a desired future outcome. The 2040 vision requires a number of transitions to shift fundamentally the way in which infrastructure is provided and the type of infrastructure provided in WCP.

The WCIF addresses new infrastructure development under five major 'systems' (themes), and outlines priorities for each. Energy is one of the 'systems' identified. The document notes that a provincial demand increase of 3% per year is anticipated for the period 2012-2040. Key priorities are in matching energy generation/ sourcing with the demand needed for WCP economic growth. Additionally, the energy focus should be on lowering the provincial carbon footprint, with an emphasis on renewable and locally generated energy.

Energy infrastructure transition
Three key transitions are identified for the WCP Energy 'system' infrastructure, namely:

- Shifting transport patterns to reduce reliance on liquid fuels;

- Promoting natural gas as a transition fuel by introducing gas processing and transport infrastructure; and
- Promoting the development of renewable energy plants in the province and associated manufacturing capacity (p. 31).

2.4.7 Western Cape Green Economy Strategy Framework

The Western Cape Green Economy Strategy (2013) – 'Green is Smart' - is a framework for shifting the Western Cape economy from its current carbon intensive and resource-wasteful path within a context of high levels of poverty to one which is smarter, greener, more competitive and more equitable and inclusive. The Strategy is closely aligned with provincial development goals and the 2014 WCCCRS.

The Strategy's point of departure is that while the WCP faces significant challenges in terms of climate change and economic development. Two of the WCP's key economic sectors - both of national importance - agriculture and tourism, are vulnerable to climate change. At the same time, these challenges hold significant potential for opportunities linked to attracting investment, economic development, employment creation, and more resilient infrastructure and patterns of consumption. These opportunities are partly linked to the WCP's existing leadership in some fields of green technology, including knowledge services.

The core objective of the Strategy is to position the WCP as the lowest carbon footprint province in South Africa, and a leading green economy hub on the African continent.

Drivers, Enablers and Priorities

The Strategy framework is made up of 5 drivers of the green economy which are market focused and principally private sector driven, and supported by 5 enablers which are either public sector driven, or the product of a collaborative effort.

The five drivers are: smart mobility, smart living and working, smart ecosystems, smart agri-processing and smart enterprise. The relevant cross-cutting enablers are: finance, rules and regulations, knowledge management, capabilities, and infrastructure.

The framework also identifies priorities that would position the WCP as a pioneer and early adopter of green economic activity. These priorities have been identified in terms of the WCP being firstly, a front-runner or pioneer and secondly, an early adopter of innovations and technologies which already exist, but are not widely adopted in South Africa. Some priorities are considered game-changers, and are singled out as 'high level priorities for green growth'.

Three such 'high level priorities for green growth' are identified, two of which are of relevance here:

- Natural Gas and Renewables: Off-shore natural gas, potential gas baseload power plants and renewable energy IPP programme, together with a greenfield gas infrastructure, will be the game-changer for the Western Cape to be the lowest carbon province in South Africa, and achieve significant manufacturing investment;
- Green Jobs: A green growth path without job growth is unsustainable. There must be early pursuit of priorities with a high rate of job growth potential –

notably rehabilitation of natural assets, responsible tourism and the waste sector (p.8).

Renewable energy servicing hub

'Under the section dealing with drivers, renewable energy is discussed under 'Smart Enterprise'. The WCP's objective in terms of this driver is to establish the WCP as a globally recognized centre of green living, working, creativity, business and investment, and thereby attract investment, business and employment opportunities. Based on existing comparative advantages, three key opportunities are identified, one of which is of relevance here, namely to establish the WCP as Africa's new energy servicing hub.

In this regard, the Strategy document notes that WCP is well placed to be the most important research and servicing hub for the renewable and natural gas energy sectors in South Africa and on the African continent.

In support of this claim, it notes that the Darling Wind Energy Facility (WEF) was the first operational WEF in the country, and that a number of further WEFs and SEFs have been approved for the province under REIPPP. Estimated investment of REIPPP projects in the Western Cape in the first two rounds is just under R8 billion (wind and solar). WCP professional service firms play a leading advisory role in REIPPP projects across the country.

The WCP is further home to the country's first photovoltaic manufacturers, Tenesol/ SunPower and SolaireDirect. On the back of REIPP, AEG and jointly, Enertronica and Gefran have also established manufacturing facilities in the Cape, with growing interest from other companies. South Africa's first dedicated renewable training centre is being established in the Western Cape at the Cape Peninsula University of Technology (CPUT). The aim of the centre is to prepare a skilled labour pool for the new emerging renewable energies: wind, solar and bio. The first phase will combine theoretical and practical training for wind turbine service technicians and for solar farms. In the long run, the centre will also become a development and research facility for renewable energy.

The Strategy also notes that there are important initial opportunities in the construction of new energy infrastructure. However, the real long-term benefits lie in the servicing of operational infrastructure. In this regard, it is estimated that the annual servicing and maintenance costs of WEFs for instance amount to approximately 10% of the initial capital investment (p.36).

Public and market sector procurement are identified as some of the key enablers. The creation of a streamlined regulatory system – the reduction of 'red tape' – is identified as a key prerequisite for creating en enabling environment.

A leader in renewable energy research, manufacturing and servicing

Under the section dealing with enablers necessary to unlock development potential, renewable energy is discussed under "Smart Infrastructure". The Strategy document notes that existing infrastructure systems, particularly those relating to energy and transport, are carbon intensive, with high costs to the environment. Opportunities for the WCP are linked to tapping into infrastructural development funding by leveraging existing advantages.

With regard to the energy sector, the Strategy proposes that the WCP becomes an early adopter of natural gas processing and transport infrastructure, and become the hub of Concentrated Solar manufacture and servicing. Natural gas is identified as the key potential 'game changer' of the WCP economy, and at present the best way to transition the economy to a more fully-integrated renewables sector as major part of the WCP fuel mix in the long term. In this regard, the relative ease with which gas-fired stations could be activated make them an ideal supplement to less predictable wind and solar sources.

CSP manufacturing and servicing centre

Surprisingly, WEF and Solar PV manufacture and servicing receive no specific mention, while Concentrated Solar (CSP) does. The Strategy document justly notes that while the Northern Cape Province is the best suited for CSP facilities, the WCP has strong existing research capabilities in CSP at the University of Stellenbosch (US), and the WCP's existing manufacturing sector already has the capacity to manufacture many CSP components.

Potential opportunities of commercialisation of CSP technology for local (RSA, Africa) conditions based on US research could be substantial. This subsector is identified as an important area of collaboration between the two provinces to realise the potential benefits (p 41). The key action at this stage to initiate a WCP manufacturing and servicing centre is to lobby for support for a pilot of South African designed CSP technologies, adapted to SA conditions (p. 43).

2.4.8 One Cape 2040 Strategy

The One Cape 2040 (2012) vision was developed by the Western Cape Government, the City of Cape Town (CoCT) and the Western Cape Economic Development Partnership. It was adopted as policy by CoCT Council in 2012. It is aimed at stimulating a transition towards a more inclusive and resilient WCP economy. It seeks to set a common direction to guide planning and action and to promote a common commitment and accountability to sustained long-term progress.

The 2040 Strategy does not replace any existing statutory plans. Rather, it is intended as a basic reference point and guide for all stakeholders planning for long-term economic resilience and inclusive growth.

Six key transitions are identified which to define the necessary infrastructure-related shifts in the WCP. One of these 6 key transitions is an Ecological transition ('Green Cape') from an unsustainable, carbon-intensive resource use economy, to a sustainable, low carbon-footprint one. The development of renewable energy projects and natural gas are expected to significantly decrease the WCP's carbon footprint.

2.4.9 Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011)

Amendments to the Western Cape Land Use Ordinance (1985) (LUPO) were promulgated in 2011 in order to guide the development of commercial renewable energy generation facilities (REFs), mainly wind and solar[14]. The Zoning Scheme amendments are specifically intended to provide guidance with regard to land use compatibility, and applicable development restrictions and conditions, including provision for mandatory rehabilitation post construction and final decommissioning

[14] Province of the Western Cape (2011). *Provincial Gazette 6894, Friday 29 July 2011;* PN 189/2011 (pp. 1381-6).

("abandonment" in terms of the Provincial Notice[15]). The ambit of the Regulations include all REFs as well as associated ("appurtenant") infra/ structure(s) operated for commercial gain, irrespective of whether such feed into the electricity grid or not. The section below provides an overview of key points of relevance to the proposed WEF.

Zoning status

- In terms of zoning status, "renewable energy structures" are designated as a consent use in the zone Agriculture I.

Land use restrictions

- Restrictions with regard to height are mainly applicable to wind energy facilities (WEFs), but associated on-site buildings for all REFs are limited to a maximum of 8,5 m (ground to highest point of roof);
- Restrictions with regard to setback are only applicable to WEFs.

Establishment of a Rehabilitation Fund

- Prior to authorisation, the applicant ("owner") must make financial provision for the rehabilitation or management of negative environmental impacts, as well as of negative impacts associated with decommissioning or abandonment of the facility. Such provision should be in the form of a fund to be administrated by the Municipality, and should be to the satisfaction of the competent authority (i.e. Department of Energy).

Land clearing/ erosion management

- Land clearing should be limited to areas considered essential for the construction, operation and decommissioning of an REF;
- All land cleared during construction which does not form part of the REF structural footprint, must be rehabilitated in accordance with an approved rehabilitation plan;
- Soil erosion must be avoided at all costs, and any high risk areas should be rehabilitated.

Visual impact management

- Visual and environmental impacts must be taken into account, to the satisfaction of the competent authority;
- Associated structures (i.e. substations, storage facilities, control buildings, etc.) must be screened from view by indigenous vegetation, and/or located underground, or be joined and clustered to avoid adverse visual impacts. In addition, appurtenant structures must be architecturally compatible with the receiving environment;
- Lighting should be restricted to safety and operational purposes, must be appropriately screened from adjacent land units, and should also be in accordance with applicable Civil Aviation Authority requirements.

Operational management and maintenance

- REFs may not cause or give rise to any noise or pollution, deemed to be a nuisance in terms of applicable Environmental Impact Assessment (EIA) regulations or Municipal by-laws;

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[15] "A Renewable energy structure shall be considered *abandoned* when the structure fails to continuously operate for more than one year" (§ 4(3) (m)).

- The REF owner/ operator is responsible for maintaining the REF in a good condition, including with regard to painting, structural repairs, on-going rehabilitation measures (e.g. erosion), as well as the upkeep of safety and security measures.

Decommissioning management

- An REF which has reached the end of its lifespan or that has been abandoned must be removed. The owner (operator) is responsible for the removal of such structures in whole, no longer than 150 days after the date of discontinued operation, and the land must be rehabilitated to the condition it was in prior to construction of the facility;
- Decommissioning activities must include the removal of all REF structures, associated structures, as well as transmission lines; the disposal of solid and hazardous waste according to applicable waste disposal regulations; and the stabilisation and re-vegetation of the site. In order to minimise disruptive impacts on vegetation, soils, etc., the competent authority may grant approval not to remove any underground foundations or landscaping.

In conclusion, it should be noted that the relevant provisions are mandatory (compliance requirements), and would therefore have to be implemented by the proponent.

2.4.10 Western Cape Draft Strategic Plan 2009-2014

The 11 Strategic Objectives embodied in the Western Cape Draft Strategic Plan 2009-2014 (2010)("Building an Open Opportunity Society for All") embody the key overarching strategic objectives identified by Provincial Government for its term in office from 2009-2014. Although the Draft Plan has been replaced by the WCPSP 2014-2019, it remains of relevance. In this regard, the objectives identified and work groups established in terms of it were some of the key informants of the 2014 WCCCRS. The 2013 WCIP is also explicitly based on the Draft Plan. Of the 11 Outcomes, the following are broadly applicable to REF projects:

- 1. Creating opportunities for growth and jobs;
- 6. Developing integrated and sustainable human settlements;
- 7. Mainstreaming sustainability and optimising resource use and efficiency;
- 9. Reducing and alleviating poverty.

According to the plan to achieve the outcomes pertaining to "Mainstreaming sustainability and optimising resource use and efficiency", key measures include:

- The promotion of energy efficiency in households, commerce, industry and all provincial offices, hospitals and schools; a green building programme and a green low-cost housing programme to increase the chances of the poor against climate change impacts.
- Development of a wind energy sector and energy production from alternative sources as well as net metering supported by a small-scale feed-in tariff to encourage small-scale renewable energy production.

Proposed socio-economic interventions are underpinned by the Administration's beliefs that "economic growth constitutes the foundation of all successful development; that growth is driven primarily by private sector business operating in a market environment; and that the role of the state is (a) to create and maintain an enabling environment for business and (b) to provide demand-led, private sector-driven support for growth sectors, industries and businesses” (WC Department of the Premier; 2010: 8).

2.4.11 Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology

The document developed in 2006 remains the most recent DEA&DP publication with regard to the locational/ siting aspects of WEFs. The document focuses specifically on the siting of wind energy facilities. Some of the key findings and recommendations that have a potential bearing on the study are briefly summarized below. However, it should be noted that the document does not have Guideline or Policy status.

Cumulative Impact Issues
The experience in Europe is that the very high cumulative impact of wind farms has resulted due to a policy of permitting small (wind) energy schemes in relatively close proximity to each other (only 2.5 km in Denmark). As a result the document recommends that:

- Large installations should be located extremely far apart (30 – 50km), and;
- Smaller installations should be encouraged in urban / brownfield areas.

Recommended Disturbed Landscape Focus
In addition to proposing that smaller facilities should be focused in urban/ brownfield areas, the proposed methodology further recommends focusing on existing disturbed rural landscapes, and in particular, those rural landscapes that have already been “vertically compromised” by the location, for example, of transmission lines, railway lines, and all phone towers.

Protecting Rural Landscape Values (put after "Urban Emphasis)
The document notes that in Europe in the past, a great degree of emphasis was given to quantifying views from residential locations. This policy emphasis has effectively led to commercial-scale renewable energy developments having been pushed into more "remote" rural locations. The study notes that in the South African context this policy would effectively "penalizing" rural areas, and compromising wilderness and touristic visual values. As indicated above the area has been impacted upon by existing power and railway lines.

Site Specific Aesthetic Considerations
The document lists the following site-specific recommendations for turbines:

- Stick to linear, non-organic layouts;
- Placement in straight rows is preferred;
- Maintain consistency in height;
- Consistency of type across an entire facility is recommended.

In terms of REF spatial policy development the following initiatives also have a bearing on the proposed WEF:

- DEA/ CSIR are currently undertaking a Strategic Environmental Assessment (SEA) aimed at identifying strategic geographical areas best suited for the effective and efficient roll-out of large scale wind and solar PV energy projects, referred to as Renewable Energy Development Zones (REDZs). Through a process of positive and negative mapping as well as wide stakeholder consultation, eight focus areas have been identified as potentially being of national strategic importance for wind and solar PV development. In 2013 the DEA/ CSIR embarked on a national road show to meet with regional stakeholders, but it does not seem as if an SEA document, available for public review, has been prepared to date[16].

- According to DEA&DP's website, a WCP SEA for the placement of WEFs is currently being undertaken. The project, headed by Paul Hardcastle, is listed as 'under development', and no documents are available yet. The project context is unclear, but it is likely linked to the national REF SEA[17].

2.4.12 Guideline for the Development on Mountains, Hills and Ridges in the Western Cape (2002)

The aim of the Guideline is to provide a decision-making framework with regard to developments which include listed activities in terms of National Environmental Management Act Regulations, and which are proposed in an environment which is characterised by mountains, hills and ridges.

The Guideline notes that mountains, hills and ridges are subject to a range of development pressures. A guiding framework is therefore needed to control development in these areas. Key reasons listed are:

- Provide catchment areas for valuable water resources;
- Often characterized by unique and sensitive ecosystems;
- Have aesthetic / scenic value; and
- Provide "wilderness" experience opportunities.

The Guideline defines a mountain, hill or ridge as "*a physical feature that is elevated above the surrounding landscape*".

The Guideline is divided into 2 sections. The second deals with key decision-making criteria which need to be taken into account when adjudicating the suitability of developments in such areas. Key criteria which are of specific relevance to the proposed WEF include:

- Development on the crest of a mountain, hill or ridge should be strongly discouraged;
- Preserve landform features through ensuring that the siting of facilities is related to environmental resilience and visual screening capabilities of the landscape;
- Adopt the precautionary principle to decision making;
- The criteria used to assess developments in these areas include, amongst others, density of the development, aesthetics, location, value in terms of "sense of place", character of adjacent land use, character of the general area, and cumulative impacts which may arise from other existing and planned developments in the area.

The proposed WEF site is located in a landscape characterised by rolling hills in an agricultural setting. However, it should be noted that the Guidelines were developed in 2002 and do not take into account the locational requirements of WEFs. This issue will be discussed in more detail in the SIA.

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[16] See: http://www.csir.co.za/nationalwindsolarsea/background.html (accessed 18-04-15).
[17] eadp.westerncape.gov.za/wc-sustainable-energy-projects-db/wc-strategic-environmental-assessment-placement-wind-energy (accessed 18-04-15).

2.4.13 Northern Cape Province Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) identifies poverty reduction as the most significant challenge facing the government and its partners. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

- Agriculture and Agro-processing;
- Fishing and Mariculture;
- Mining and mineral processing;
- Transport;
- Manufacturing;
- Tourism.

However, the NCPGDS also notes that economic development in these sectors also requires:

- Creating opportunities for lifelong learning
- Improving the skills of the labour force to increase productivity
- Increasing accessibility to knowledge and information

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

- Developing requisite levels of human and social capital
- Improving the efficiency and effectiveness of governance and other development institutions
- Enhancing infrastructure for economic growth and social development

Of specific relevance to the SIA the NCPGDS make reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of energy sources such as wind and solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape Province.

In this regard care will need to be taken to ensure that the proposed WPP and other renewable energy facilities do not negatively impact on the regions natural environment. In this regard the NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed wind energy facility, does not affect the tourism potential of the province.

2.4.14 Northern Cape Provincial Spatial Development Framework

Northern Cape Provincial Spatial Development Framework (NCSDF) (2012) lists a number of sectoral strategies and plans are to be read and treated as key components of the PSDF. Of these there are a number that are relevant to the proposed WPP. These include:

- Sectoral Strategy 1: Provincial Growth and Development Strategy of the Provincial Government.
- Sectoral Strategy 2: Comprehensive Growth and Development Programme of the Department of Agriculture, Land Reform and Rural Development.
- Sectoral Strategy 5: Local Economic Development (LED) Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 11: Small Micro Medium Enterprises (SMME) Development Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 12: Tourism Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 19: Provincial renewable energy strategy (to be facilitated by the Department of Economic Development and Tourism).

Under Section B 14.4, Energy Sector, the NCSDF (2012), notes the total area of high radiation in South Africa amounts to approximately 194 000 km^2 of which the majority falls within the Northern Cape. It is estimated that, if the electricity production per km^2 of mirror surface in a solar thermal power station were 30.2 MW and only 1% of the area of high radiation were available for solar power generation, then generation potential would equate to approximately 64 GW. A mere 1.25% of the area of high radiation could thus meet projected South African electricity demand in 2025 (80 GW) (NCPSDF, 2012). However the SDF does indicate that this would require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres. The SDF also notes that the implementation of large concentrating solar power (CSP) plants has been proposed as one of the main contributors to greenhouse gas emission reductions in South Africa. In this regard various solar parks and CSP plants have been proposed in the province with Upington being the hub of such developments (NCPSDF, 2012).

Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

- Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.

- Enhance the efficiency of Eskom's power station at the Vanderkloof power station.
- In order to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape, construct a 400 kV transmission power line from Ferrum Substation (near Kathu/Sishen) to Garona Substation (near Groblershoop). There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
- Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government as well as the private sector.
- Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003). This target relates to the delivery of 10 000 GWh of energy from renewable energy sources (mainly biomass, wind, solar, and small-scale hydro) by 2013.

Section C8.3.3, Energy Policy, sets out the policy guidelines for the development of the energy sector, with specific reference to the renewable energy sector.

- The construction of telecommunication infrastructure must be strictly regulated in terms of the spatial plans and guidelines put forward in the PSDF. They must be carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible.
- EIAs undertaken for such construction must assess the impacts of such activities against the directives listed in (a) above.
- Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020.
- The following key policy principles for renewable energy apply:
  - Full cost accounting: Pricing policies will be based on an assessment of the full economic, social and environmental costs and benefits of energy production and utilisation.
  - Equity: There should be equitable access to basic services to meet human needs and ensure human well-being. Each generation has a duty to avoid impairing the ability of future generations to ensure their own well-being.
  - Global and international cooperation and responsibilities: Government recognises its shared responsibility for global and regional issues and act with due regard to the principles contained in relevant policies and applicable regional and international agreements.
  - Allocation of functions: Government will allocate functions within the framework of the Constitution to competent institutions and spheres of government that can most effectively achieve the objectives of the energy policy.
  - The implementation of sustainable renewable energy is to be promoted through appropriate financial and fiscal instruments.
  - An effective legislative system to promote the implementation of renewable energy is to be developed, implemented, and continuously improved.
  - Public awareness of the benefits and opportunities of renewable energy must be promoted.

- The development of renewable energy systems is to be harnessed as a mechanism for economic development throughout the province in accordance with the Sustainable Development Initiative (SDI) approach (refer to Toolkit D10) or any comparable approach.
- Renewable energy must, first, and foremost, be used to address the needs of the province before being exported.

2.4.15 Northern Cape Climate Change Response Strategy

The key aspects of the PCCRS Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key Sectors to ensure proactive long term responses to the frequency and intensity of extreme weather events such as flooding and wild fire, with heightened requirements for effective disaster management".

Key points from MEC Lucas' address include the NCPG's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the NCP's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is indented as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The MEC also indicated that the NCP was involved in the processing a number of WPP and SEF EIA applications.

2.4.16 Northern Cape Province Provincial Growth and Development Strategy

The Provincial Growth and Development Strategy (PGDS) notes that the most significant challenge that the government and its' partners in growth and development are confronted with is the reduction of poverty. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The PGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

- Agriculture and Agro-processing;
- Fishing and Mariculture;
- Mining and mineral processing;
- Transport;
- Manufacturing;
- Tourism.

However, the PGDS also notes that economic development in these sectors also requires:

- Creating opportunities for lifelong learning;
- Improving the skills of the labour force to increase productivity;
- Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

- Developing requisite levels of human and social capital;
- Improving the efficiency and effectiveness of governance and other development institutions;
- Enhancing infrastructure for economic growth and social development.

Of specific relevance to the SIA the NCPGDS make reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of energy sources such as wind and solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed WPP therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the NCP.

In this regard care will need to be taken to ensure that the proposed WPP and other renewable energy facilities do not negatively impact on the regions natural environment. In this regard the NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed WEFs, do not materially affect the tourism potential of the province. The potential impact on heritage sites may also have social implications. This issue will be assessed during the Assessment Phase.

2.5 DISTRICT AND LOCAL POLICY AND PLANNING ENVIRONMENT

2.5.1 Central Karoo District Municipality Integrated Development Plan

The Vision of the CKDM is "Working together in development and growth". The Mission statement linked to the vision is "*Central Karoo place a high priority upon ensuring that future growth improves the quality of life in the region. It is the desire to be financial sustainable, maintain the rural character and create healthy communities by facilitating economic growth, improving infrastructure and the green energy opportunities, providing and supporting alternative modes of delivery (shared* *services), improve marketing, branding and communication with all stakeholders, provide excellent disaster and risk management services, and maintaining housing choices for a range of income levels".*

The IDP identifies 8 Strategic Objectives which are aligned with the national key performance areas and the core functions of the municipality. The objective relevant to the proposed project is to pursue economic growth opportunities that will create descent work. The IDP goes onto note that the CKDM place a high priority upon ensuring that future growth improves the quality of life in the region. In this regard the DM seeks to be financial sustainable, maintain the rural character and create healthy communities by facilitating economic growth, improving infrastructure and the *green energy* opportunities, providing and supporting alternative modes of delivery (shared services), improve marketing, branding and communication with all stakeholders, provide excellent disaster and risk management services, and maintaining housing choices for a range of income levels.

The Strategic Objectives that are relevant to the proposed WEF include:

- Strategic Objective 5: To establish an inclusive tourism industry through sustainable development and marketing which is public sector led, private sector driven and community based. Tourism (as indicated below) has been identified as a key growth sector. Care therefore needs to be taken to ensure that projects, such as the proposed WEF, do not impact negatively on the areas current and future tourism potential;
- Strategic Objective 6: To ensure a united integrated development path in a safe and sustainable environment. Under Strategic Objective 6: To ensure a united integrated development path in a safe and sustainable environment, the key strategic priority listed in the IDP is Green Energy;
- Strategic Objective 7: To pursue economic growth opportunities that will create descent work. The following activities listed under Strategic Objective 7 are relevant to the proposed WEF:
  - To increase SMME activities
  - The promote integrated youth, elderly, disabled and gender development
  - Facilitate the establishment and functioning of the Economic Development Agency (EDA)

Table 5.2 in Section 5.5, Strategy Alignment, provides a summary of the strategies for the district and local municipalities. The strategies that are of relevance to the proposed WEF are listed in Table 2.1 below:

Table 2.1: List of IDP strategies

Strategy	Laingsburg	Prince Albert	Beaufort West	Central Karoo District
Economic Development	Create an environment conducive for economic development	To stimulate, strengthen and improve the economy for sustainable growth.	Agricultural business to improve the job creation potential Creation of employment to reduce unemployment to acceptable levels To reduce poverty and to promote the empowerment of women, HIV/ AIDS sufferers involved in economic and household responsibilities	To pursue economic growth opportunities that will create descent work.
Standard of living	Improve the standards of living of all people in Laingsburg Improve the social environment with community beneficiation, empowerment and ownership Developing a safe, clean, healthy and sustainable environment for communities	To improve the general standards of living	To create a crime free, safe and healthy environment	To ensure a united integrated development path in a safe and sustainable environment To promote a safe and healthy environment and social viability of residents through the delivery of a responsible environmental health service. To effectively plan to minimise the impact of disasters on the community, visitors, infrastructure and environment
Skills development	To create an institution with skilled employees to provide a professional service to its clientele guided by municipal values	To commit to continuous improvement of human skills and resources to delivery effective services	Empowerment of personnel, management and council members for effective service delivery	
Tourism			Business initiatives and the optimising of tourism (South African and foreign)	To establish an inclusive tourism industry through sustainable development and marketing which is public sector led, private sector driven and community based.

A Strength, Weakness, Opportunities and Threats (SWOT) analysis was undertaken as part of the IDP process. Of relevance to the proposed project the Green Energy and Regional Local Economic Development were identified as key opportunities. However, tourism was also identified as a key opportunity. One of the key challenges is the transformation of the tourism industry and the increased involvement of HDIs.

The IDP also refers to the Central Karoo Growth and Development Strategy 2007-2022, which was developed following a conference held on 9 March 2007. As part of the strategy the Central Karoo Economic Development Agency [CKEDA] was established in September 2010. Some of the projects the EDA is involved include Hydroponics, Karoo Tourism Strategy and Regional LED Forum

2.5.2 Central Karoo Spatial Development Framework

The Central Karoo SDF indicates desired land-use patterns, addresses spatial reconstruction and provides guidance in respect of the location and nature of future development. The SDF adopts the vision and mission of the IDP and expresses it in a spatial sense. In terms of the SDF the Central Karoo is divided into five functional areas, namely:

- Rural areas;
- Rural settlements (Merweville, Matjiesfontein, Prince Albert Road and Klaarstroom);
- Institutional settlements (Nelspoort);
- Local towns (Leeu Gamka and Murraysburg);
- Main local towns Beaufort West, (Laingsburg and Prince Albert).

The SDF notes that care should be given the role played by the agricultural sector. In this regard:

- Agricultural areas have been affected by urban development and have placed pressure on agricultural resources;
- Care should be taken to maintain the rural character of non-urban areas;
- The formation of small rural towns should be avoided;
- Areas should provide for the development of alternative agricultural use, to make a positive contribution to sustainable economic growth. This includes tourism-orientated developments, packing and processing developments, housing for farm labourers and provisions for small-scale farming and intensive agriculture.

2.5.3 Laingsburg Local Municipality Integrated Development Plan

The Vision for the LLM as stated in the LLM IDP (2012-2017) is to make the Laingsburg Municipality a desirable place to live, invest and visit, where all people may enjoy a sustainable quality of life by the year 2017.

The Mission statement is "To create a people centred and economically viable municipality where all have equal access to i) basic social services, ii) educational and skills enhancement programmes, iii) entrepreneurial and job opportunities as well as, enjoy a clean, sustainable environment embedded in safety and security, which is governed by a participative, professional, transparent and accountable administration".

Key challenges facing the LLM include:

- Lack of employment opportunities;
- Low skills levels;
- Insufficient self-employment within the town;
- Lack of investment.

While crime rates are generally low, there are high levels of domestic violence in Laingsburg. This is linked to the high levels of unemployment, combined with alcohol and drug abuse. The majority of women in the town are unemployed which results in a high dependence on working male partners. In addition, prostitution is rampant amongst young girls. This is linked to the role of truckers and the limited employment opportunities for young girls in the area.

The potential opportunities listed in the IDP that are potentially relevant to the proposed development include:

SMME sector
The IDP notes that the SMME's sector in Laingsburg and particularly the informal sector can contribute significantly to the economy of Laingsburg, specifically on the diversification of Agricultural products. The proposed development has the potential to create opportunities for the local SMME sector.

Tourism sector
The tourism hospitality industry is identified as one the key sectors in terms of opportunities. Matjiesfontein Village and the associated hotel attracts about 10 000 visitors per year. However, the majority are one day or overnight visitors. The challenge is to attract them to stay longer and also visit other areas in the LLM. The IDP notes that this would require the development of the skills in the hospitality industry. The location of Laingsburg on the N1 also creates potential for attracting tourists to the town and the surrounding area.

Agriculture sector
The agriculture sector is the most prominent sector in the local economy. However in terms of employment, the agricultural potential, lie more on Agri-processing and Agri-businesses. Most of the agricultural products are sold in their raw form hence, there is potential for value adding locally. This would also create opportunities for SMMEs. The low skill levels do however represent a constraint.

The IDP lists a number of strategies. The following strategies are relevant to the proposed development:

Cross cutting strategies
The objective is to create a stable social environment conducive to empowerment, social development and community care by investing in human capital through skills development

Economic development
The objective is to create opportunities to increase household income. The strategies identified include:

- Investing in human capital through skills development strategies;
- Promotion of SMME's;

- Resource mobilisation and investment through the support of private public partnerships.

Social development
The objective is to ensure a stable social environment and reduce poverty by 80%. The strategies include:

- Promotion of functional literacy through ABET;
- Moral regeneration strategy and sports development.

Environmental and spatial development
The objective is the improvement / maintenance of environmental status of the Municipal area and eradication of the spatial legacy. The key relevant strategy is the development of alternative sources of energy

2.5.4 Laingsburg Local Municipality Local Economic Development Plan

The Local Economic Strategy document (MCA, 2006) notes that despite locational advantages, economic development remains a significant challenge for Laingsburg Municipality. In this regard a large portion of economic activity, especially in the transport sector has been redirected to Cape Town and George, as a result of technological advances in communication and road transport.

The potential comparative advantages for the LLM include:

Agricultural sector: Agriculture remains the dominant economic activity in Laingsburg, consisting mainly of extensive sheep farming.

Transport: Laingsburg is located on the N1 and therefore benefits from passing traffic. In peak season ~ 14 000 vehicles pass through the town per day, dropping to ~ 7000 during the experiences the passage of approximately 7000 vehicles per day during the rest of the year.

Primarily urban population: Laingsburg's population is mostly urban at almost 90% (Central Karoo Economic Regeneration Study, SETPLAN). This is largely the result of an agricultural economy which is not labour intensive. The LED report notes that this urban population holds great potential as human capital if it can be equipped to become a productive resource for the economy. However, low education and skills levels remain a challenge.

Existing infrastructure and water provision: Laingsburg and other towns in the Central Karoo are fortunate to have good infrastructure in terms of roads, sanitation, electricity and water-supply. The majority of residents are formally housed in Laingsburg. Furthermore, Laingsburg is the only municipality in the Central Karoo without a foreseeable problem in terms of water provision.

There are also a number of challenges facing future economic development of Laingsburg. These include:

Single dominant economic sector: Agriculture is the most dominant sector in Laingsburg Municipality, both in terms of economic contribution as well as employment.

Lack of employment opportunities, skills shortages, and low self-employment: There a shortage of employment opportunities in the town, especially for young people. Low skills levels contribute to the problem and the high unemployment levels.

Poverty and substance abuse: The high levels of poverty are linked to very high levels of alcohol and drug abuse amongst impoverished residents.

Spatial and racial segregation: The spatial form of Laingsburg is similar to most South African towns. It reflects the typical characteristics and legacy of Apartheid planning, which separated historically privileged groups from marginalised groups through the location and expansion of township development on the outskirts of the town.

The LED strategy identifies four strategic goals to address the economic challenges, namely:

- Sustainable Economic Growth;
- Job creation;
- Human Resource Development;
- Poverty and Substance Abuse Reduction.

2.6 INTERNATIONAL EXPERIENCE WITH WIND FARMS

2.6.1 Introduction

This section summarises some of the key social issues associated with wind farms based on international experience. The findings of the review concentrate on three documents.

The first is the National Wind Farm Development Guidelines produced by the Environment Protection and Heritage Council (EPHC) of Australia (Draft, July, 2010). The guidelines highlight the potential social and biophysical impacts associated with WEFs. Given the similarities between South Africa and Australia, such as large, unobstructed landscapes and climates, these guidelines are regarded as relevant to the South Africa situation.

The second relates to recent research on wind energy development in Scotland undertaken by Warren and Birnie in 2009 (Warren, Charles R. and Birnie, Richard V.(2009) 'Re-powering Scotland: Wind Farms and the 'Energy or Environment?' Debate'). The Scottish experience is also regarded as relevant to the South Africa context for a number of reasons. Firstly, installed wind power capacity has expanded rapidly in Scotland over the past decade. Before 1995 no wind farms existed. By late 2008, there were 59 operational onshore wind farms, 65 consented to or under construction and a further 103 in the planning process (BWEA, 2008). South Africa faces a similar situation, with a rush of applicants seeking approval for WEFs. Secondly, the impact on the landscape, specifically the Scottish Highlands, was one of the key concerns raised in Scotland. The impact on undeveloped, natural landscapes is also likely to become an issue of growing concern in South Africa. The key points raised in the article by Warren and Birnie that are relevant to South Africa are summarized below.

The third document is a review of the potential health impacts associated with wind farms undertaken by the Australian Health and Medical Research Council (July, 2010).

It should be noted that the section is not specific to the site but merely a review of international literature.

2.6.2 National Wind Farm Development Guidelines (Australia)

The Environment Protection and Heritage Council (EPHC) of Australia developed a set of guidelines for the establishment of Wind Farms (National Wind Farm Development Guidelines, DRAFT - July 2010). The section below summarizes the key social issues listed in the guidelines.

Wind Turbine Noise

The guidelines note that excessive noise may cause annoyance, disturbance of activities such as watching TV, or sleep disturbance when received at a noise-sensitive location such as a dwelling. At higher levels, environmental noise has been linked to long-term health issues such as raised blood pressure and cardiovascular disease.

With regard to WEFs, the noise produced by wind turbines is associated with their internal operation and the movement of the turbine blades through the air. The noise levels associated with a WEF are dependent on a number of factors, including, the number of turbines operating, wind speed and direction. Noise levels diminish with distance from the wind farm. The guidelines also note that a unique characteristic of wind turbines is that while noise emission increase with increasing wind speed, this is also often, but not always, accompanied by an increase in the background noise environment. The background noise is associated with wind blowing past or through objects, such as trees or buildings. As a result, the background noise near a dwelling may be high enough to 'mask' the sound of the turbines.

Concerns have also been raised regarding the potential health impacts associated with low frequency noise (rumbling, thumping) and infrasound (noise below the normal frequency range of human hearing) from wind farms. The guidelines indicate that low frequency noise and infrasound levels generated by wind farms are normally at levels that are well below the uppermost levels required to cause any health effects. This issue is addressed in the review undertaken by the Australian Health and Medical Research Council (July, 2010).

***Noise monitoring*[16]**

With regards to monitoring, the guidelines recommend that the operational phase of the wind farm should include unattended post-construction noise monitoring for a sufficient period of time to demonstrate compliance with the noise criteria under expected worst-case conditions.

The Guidelines also recommend that a procedure should be developed, prior to construction activities commencing, to handle any complaints of construction noise. Similar procedures should concurrently be developed for implementation during operations and decommissioning stages. Complainants should be requested to keep a diary or sound log where they can note times of day and associated weather conditions when wind farm noise emission are found to be a problem. The sound log can also include a description of the type of sound heard. This information can then be used to help try and identify meteorological conditions, particularly wind speed and direction, where the wind farm noise emission is most problematic.

Landscape Impacts
The guidelines note that due to the size and layout of wind turbine towers, the construction of WEFs will impact upon the landscape and its significance. Therefore, the significance of landscape values, and the extent of the impact, should be assessed. In this regard the impact of a wind farm on a landscape is not necessarily just visual – other 'values' can also be affected. Community values and perceptions of landscape may include associations, memories, knowledge and experiences or other cultural or natural values (National Wind Farm Development Guidelines, DRAFT - July 2010). Therefore, the assessment should consider the impact on landscape values in addition to considering the visual impacts.

The guidelines also note that landscapes change over time, both naturally and through human intervention. In addition, landscape values, being subjective, change not only with time, but also from person to person. As a result there are a wide variety of opinions of what is valued and what is not. The perceptions by which we value landscapes are influenced by a range of factors such as visual, cultural, spiritual, environmental, and based on memories or different aesthetics (National Wind Farm Development Guidelines, DRAFT - July 2010).

Shadow flicker
Shadow flicker is produced by wind turbine blades blocking the sun for short periods of time (less than 1 second) as the blades rotate causing a strobing effect. Since wind turbines are tall structures, shadow flicker can be observed at considerable distances but usually only occurs for brief times at any given location. The most common effect of shadow flicker is annoyance.

The likelihood of shadow flicker affecting people is dependent on the alignment of the wind turbine and the sun, and their distance from the wind turbine. The main risk associated with shadow flicker is the potential to disturb residents in the immediate vicinity. The Guidelines note that the investigations undertaken when developing the Guidelines indicated that the potential risk for epileptic seizures and distraction of drivers is negligible to people living, visiting or driving near a wind farm.

Mitigation measures
Where shadow flicker is an issue the following mitigation measures can be implemented.

- Plant screening vegetation between their property and the turbine(s);
- Install heavy blinds or shutters on affected windows.

The Guidelines also recommend that the issue of shadow flicker should be addressed in the design and layout of the wind farm.

Electromagnetic Interference (EMI)
Wind turbines can produce electromagnetic interference (EMI), in two ways. Firstly in the form of an electric and magnetic (electromagnetic) field that may interfere with radio communications services, and secondly, due to the obstruction of radio communications services by the physical structure of the wind turbines. Microwave, television, radar and radio transmissions are all examples of radio communication signals that may be impacted by the development of a wind farm.

Blade glint
Blade glint can be produced when the sun's light is reflected from the surface of wind turbine blades. Blade glint has potential to annoy people.

Cumulative impacts
The Guidelines note that the cumulative impact of multiple wind farm facilities in a region is likely to become an increasingly important issue for wind farm developments in Australia. This is also likely to be the case in South Africa. The assessment of cumulative impacts is also required for additional phases of existing or approved wind farms. The Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts of wind farms on landscapes, including:

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Cumulative impacts may be visual and aesthetic, but they can also occur in relation to non-visual values about landscape. Non-visual values include sounds/noise, associations, memories, knowledge and experiences or other cultural or natural values. As an example, the Guidelines indicate that locating four wind farms in a valley previously best known for its historic wineries might change the balance of perception about the valley's associational character, irrespective of whether all four wind farms were sited in a single view shed (National Wind Farm Development Guidelines, DRAFT - July 2010).

The Guidelines also note that the rapid expansion of wind energy sector also has the potential for consultation "fatigue", specifically in areas where more than one WEF is proposed. An abundance of community meetings, information sessions or materials about various developments, may result in community members tiring of attending local events or engaging in local discussions or activities.

Mitigation
The Guidelines indicate that mitigation measures for wind farms are limited and therefore **general location** and **site selection** is of utmost importance.

2.6.3 Experience from Scotland and Europe

The information summarized below is based on research on wind farms undertaken by Warren, Charles R. and Birnie, Richard V published in the Scottish Geographical Journal in 2009.

Institutional capacity and strategic guidance

The research found that the rapid establishment of numerous large wind farms in Scotland has proved highly controversial. From around 2002, the potential negative impacts of wind farm developments have been the highest profile environmental issue in Scotland, generating extensive media coverage.

The experience in Scotland indicated that the speed of the wind power 'gold rush' took everyone by surprise – politicians, planners, scientists, land managers, conservationists and the public alike. As a result a severe burden was placed in officials and related planning and development control procedures. In addition, officials and planners had very few specific criteria for assessing proposals, notably because of the lack of overall strategic locational guidance. Basic data on most aspects of wind farm development, including environmental impacts, is limited and short term. As a result the debates regarding wind farms often degenerated into exchanges of claims and counter-claims that were typically long on assertion and short on evidence.

The potential for a similar situation to develop in South Africa is high. In addition, the lack of a National set of Guidelines for Wind Farms and spatial information on sensitive landscapes is a concern.

Landscape Impacts

In the Scottish case, the primary argument employed to oppose wind farms related to the impact on valued landscapes. As in the South African case, the visual impacts are exacerbated by the fact that the locations with the greatest wind resources are often precisely those exposed upland areas which are most valued for their scenic qualities, and which are often ecologically sensitive. The establishment of wind farms together with the associated service roads and infrastructure, transforms landscapes which are perceived to be natural into 'landscapes of power' (Pasqualetti et al., 2002, p. 3).

Impacts on Tourism

In addition to the loss of amenity for those who live and work nearby, the concern was that wind farms would damage the Scottish tourist industry. The paper notes that Scotland's image as a country of magnificent, varied, unspoilt scenery is a major reason why tourists come here. The concern raised is that wind farms will cause tourists to stay away by tarnishing that image. The same argument could be applied to South Africa. However, the paper notes that, "so far, however, there is no clear evidence to support this assertion". In this regard far more visitors appeared to associate wind farms with clean energy than with landscape damage, suggesting that they could help to promote Scotland's reputation as an environmentally friendly country as long as they are sensitively sited (NFO System Three, 2002). In addition, some tourists may choose to avoid areas with wind farms, but on current (albeit limited) evidence, wind farms seem unlikely to have more than small, localised impacts on tourism. However, the paper notes that this could change as more are built.

The key lesson for South Africa is this regard is that wind farms should be located in areas that minimize the potential impact on landscapes and as such also reduce the potential impact on tourism. This highlights the need for spatial information on sensitive landscapes.

Noise impacts

The study found that early wind turbines were criticized for being noisy, and this reputation has stuck. However, the research found that modern designs are remarkably quiet, allowing normal conversation underneath a working turbine. The paper notes that at a distance of 350 m, wind farms generate a noise level of 35−45 decibels (dB) (cf. a busy office: 60 dB; a quiet bedroom: 35 dB), and this is often difficult to detect above normal background sounds such as the noise of the wind (SDC, 2005). Research by Krohn and Damborg (1999) indicated that turbine noise affected very few people, however, for those few the impact can be significant.

Explaining Public Perceptions of Wind Farms

Research found that the media coverage in Scotland relating to wind farms gives the impression that the majority of the public are strongly opposed to this form of renewable energy. However, every survey of public attitudes, from the earliest days of wind power onwards, has found just the opposite. Both in the UK and across Europe, large majorities (often around 80%) support renewable energy generally and wind power specifically (Krohn & Damborg, 1999; Devine-Wright, 2005a; SDC, 2005; Wolsink, 2007b). The research therefore found that the strong, consistent support is at odds with the widespread local opposition.

The research also found temporal and spatial patterns in attitudes. In this regard, attitudes to wind farms often followed a U-shaped progression over a period of time (Gipe, 1995; Wolsink, 2007a). The initial positive support of the concept (when no nearby schemes are planned) became more critical when a local wind farm was proposed. This opposition then shifted towards more positive attitudes once locals had experienced the wind farm in operation. In this regard several studies found that the strongest support for wind farms is amongst those who have personal experience of them (Fullilove, 2005) and/or those living closest to them (Braunholtz, 2003; Elliott, 2003; SEI, 2003). Some of the opposition arose from exaggerated perceptions of the likely negative impacts, fears which are often not realised (Elliott, 1994; Braunholtz, 2003).

However, the research found that over and above all these interacting influences, two factors are of particular importance in determining whether people support or oppose specific wind farm proposals. One is their perception and evaluation of the landscape impact and the other is whether they and their community have a personal stake in the development. Both of these factors are relevant to the South African situation.

The Influence of Landscape Perceptions on Attitudes

The paper notes that one of the few established empirical facts in the wind farm debate is that aesthetic perceptions, both positive and negative, are the strongest single influence on public attitudes (Pasqualetti et al., 2002; Warren et al., 2005; Wolsink, 2007b; Aitken et al., 2008). In addition, across Europe, the strength of anti-wind farm groups is strongly related to national attitudes to landscape protection; opposition is greatest in countries where landscapes are traditionally valued highly (Toke et al., 2008). In Scotland, the primary motivation of most opposition groups is the strong belief that wind farms despoil landscapes, whereas advocates of wind power typically perceive wind turbines as benign or positive features. The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and diametrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries.

The paper identifies two other factors that are important in shaping people's perceptions of wind farms' landscape impacts. The first is the cumulative impact of increasing numbers of wind farms (Campbell, 2008). If people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. Whereas in Scotland the landscape effects of wind farms are often described in negative terms, in places such as Denmark wind turbines have become an integral part of the cultural landscape. Despite the widely varying perceptions, one of the few areas of consensus in the Scottish debate is that landscape issues are central, and that if wind farms are to be built, sensitive siting in the landscape is critical.

The impact on landscapes is also likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of wind farm applications.

The Influence of Ownership on Attitudes

The research found that the second influential factor related to the issue of ownership. Experience across Europe indicated that wind power became more socially acceptable when local communities were directly involved in, and benefited from the developments. In Denmark, Germany, the Netherlands and Sweden, where wind farms have typically been funded and controlled by local cooperatives, there has long been widespread support for wind power (Redlinger et al., 2002; Meyer, 2007; Szarka, 2007). However, in Britain where the favored development approach has been the private developer/public subsidy model, many proposals have faced stiff local opposition.

These findings have potentially important implications for the future development of the wind energy sector in South Africa and the support from locally affected communities.

In conclusion the paper notes that despite being very acrimonious, the wind farm debate has helped to reintroduce energy issues to the arena of public debate. This is a significant positive benefit. For many years, most people have used electricity with little or no regard for the environmental costs of energy production. The high profile debates over wind farms and the potential impact on the Scottish Highlands have highlighted the fact that societies energy needs do have environmental implications.

2.6.4 Health impacts of wind farms

This section summarizes the key findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010.

Effects of Noise from Wind Turbines on Human Health

The health and well-being effects of noise in general on people can be classified into three broad categories:

- Subjective effects including annoyance, nuisance and dissatisfaction;
- Interference with activities such as speech, sleep and learning; and
- Physiological effects such as anxiety, tinnitus or hearing loss (Rogers, Manwell & Wright, 2006).

The findings of the literature review indicate that the measurement of health effects attributable to wind turbines is regarded as very complex. However, in summary the findings of the literature review indicated that:

- Sound from wind turbines does not pose a risk of hearing loss or any other adverse health effects in humans. Sub audible, low frequency sounds and infrasound from wind turbines do not present a risk to human health (Colby, et al 2009).
- 'There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects' (Berglund & Lindvall 1995).
- Infrasound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour (DTI, 2006);
- There is no peer-reviewed scientific evidence indicating that wind turbines have an adverse impact on human health (CanWEA, 2009).
- Wind energy is associated with fewer health effects than other forms of traditional energy generation and in fact will have positive health benefits (WHO, 2004).

The overall conclusion of the review based on current evidence is that wind turbines do not pose a threat to health if planning guidelines are followed.

Effects of Shadow Flicker and Blade Glint on Human Health
The findings of the review found that the evidence on shadow flicker does not support a health concern (Chatham-Kent Public Health Unit, 2008) as the chance of conventional horizontal axis wind turbines causing an epileptic seizure for an individual experiencing shadow flicker is less than 1 in 10 million (EPHC, 2009). As with noise, the main impact associated with shadow flicker from wind turbines is annoyance.

With regard to blade glint, manufacturers of all major wind turbine blades coat their blades with a low reflectivity treatment, which prevents reflective glint from the surface of the blade. According to the Environment Protection and Heritage Council (EPHC) the risk of blade glint from modern wind turbines is considered to be very low (EPHC, 2009).

Effects of Electromagnetic Radiation and Interference from Wind Turbines on Human Health
Review found that Electromagnetic Fields (EMF) emanate from any wire carrying electricity and Australians are routinely exposed to these fields in their everyday lives. The same would apply to South Africans. In this regard the electromagnetic field produced by the generation and export of electricity from wind farms does not pose a threat to public health (Windrush Energy 2004). The closeness of the electrical cables between wind turbine generators to each other, and shielding with metal armour effectively eliminate any EMF (AusWEA, nd. b).

SECTION 3: OVERVIEW OF STUDY AREA

3.1 INTRODUCTION

Section 3 provides an overview of the study area with regard to:

- The administrative context;
- The demographic and socio-economic context.

The majority of the site is located in the Western Cape Province, within the Laingsburg Local Municipality, which forms part of the Central Karoo District Municipality. A small section of the site falls within the Northern Cape Province, within the Karoo Hoogland Local Municipality, which forms part of the Namakwa District Municipality.

The focus of Section 3 is on section of the site that falls within the Western Cape Province. An overview of the Northern Cape Provincial planning and policy documents is however provided.

3.2 ADMINISTRATIVE CONTEXT

As indicated above, the majority of the site is located in the Western Cape Province, within the Laingsburg Local Municipality (LLM), which forms part of the Central Karoo District Municipality (CKDM). A small section of the site falls within the Northern Cape Province, within the Karoo Hoogland Local Municipality (KHLM), which forms part of the Namakwa District Municipality (NDM). The LLM is one of three local municipalities that make up the CKDM in the Western Cape Province (Figure 3.1). The town of Laingsburg is the administrative seat of the LLM. Beaufort West is the administrative seat of the CKDM.

The KHLM is one of six local municipalities that make up the Namakwa District Municipality (NDM) (Figure 3.2). The town of Sutherland is the administrative seat of the KHLM.

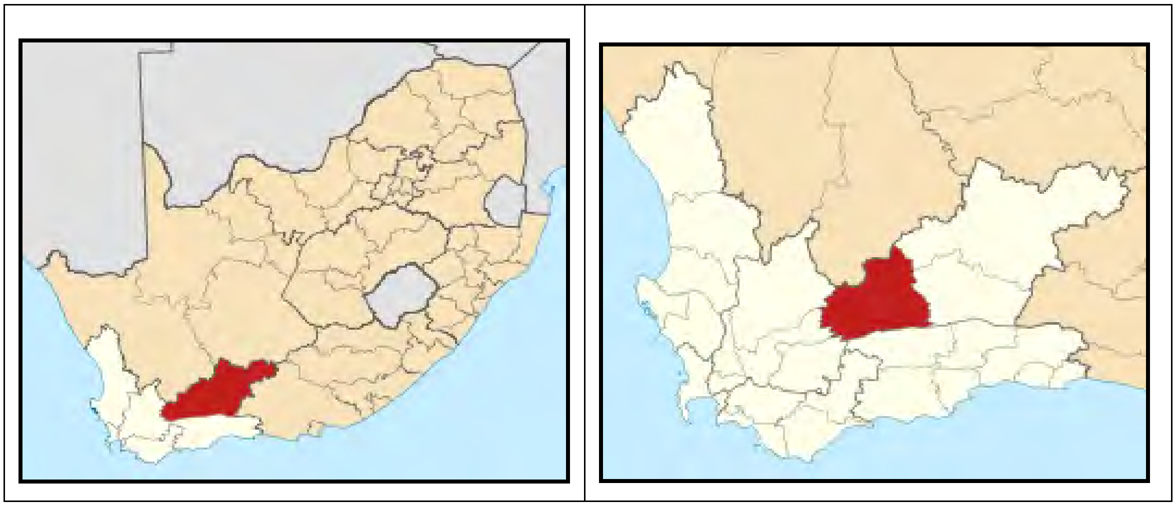


Figure 3.1: Location of Central Karoo District Municipality (left) and Laingsburg Local Municipality (right) within the Western Cape Province (white) ***(Source: Wikipedia)***

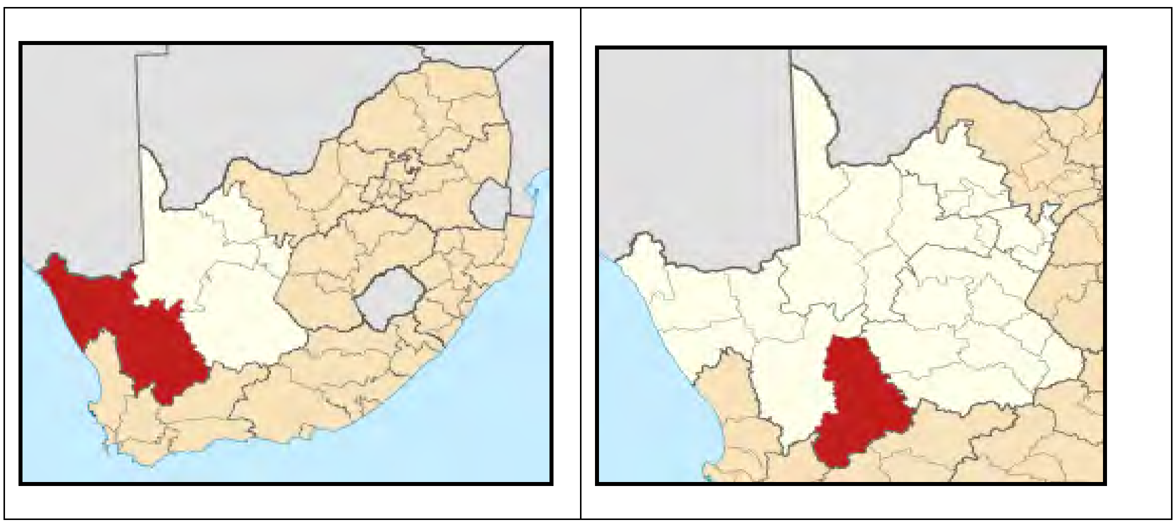


Figure 3.2: Location of Namakwa District Municipality (left) and Karoo Hoogland Local Municipality (right) within the Northern Cape Province (white) ***(Source: Wikipedia)***

3.1 STUDY AREA TOWNS

3.3.1 Sutherland

Sutherland was established in 1857 on the farm De List in order to provide the Roggeveld region with a church site. The town is located on the south-western edge of the Great Escarpment, and is renowned as one of the coldest places in South Africa. Sub-zero winter temperatures are common in winter, and the Roggeveld Mountains to the north of town are often covered in snow.

The town is modest in size. The historic (white) part of town is centered on the Dutch Reformed Church building. Streets are laid out in a grid pattern, are generously proportioned, and characteristically lined with mature Aleppo pines and cypresses. Spatially, the town remains largely segregated. Erven in this part of town are generous in size, and many are planted with orchards. The Coloured areas of Kerkgronde, Skema and Hopland are located on the east side of the main town. A substantial number of traditional cut-stone dwellings survive in town, as do a number of historic braakdakhuise (thatched stone houses) in various states of disrepair in Kerkgronde.

Retail and services are essentially concentrated along the two tarred roads in town, namely the tarred main road, Piet Retief Street (an extension of the R354) and Sarel Cilliers Street (an extension of the R356). Retail establishments include a number of superettes, butcheries, an agricultural co-op/ hardware store, and at least 5 liquor stores. A post office and one bank (Standard) are located in Piet Retief Street.

Two primary schools and one secondary school are located in the town. A hospital is also located in Sutherland. However, the services provided by the hospital are limited. The nearest fully operational hospital is in Calvinia, approximately 160 km north of Sutherland. The town has no resident doctors or dentists, and no pharmacy is located in town.

Unlike Laingsburg, Sutherland is relatively isolated and does not benefit from high volumes of passing traffic. This spatial isolation has direct negative consequences with regard to maintaining economically viable operations not linked to primary agriculture, as well as attracting investment capital into the Municipality. As a result residents of Sutherland typically travel to Worcester or even Cape Town on a monthly basis to do their shopping etc. The town is not serviced by any public transport, and people without cars typically hire someone from the local community to provide transport for trips out of town.

The town itself has seen only some modest growth as lifestyle resettlement destination over the past decade. Of significant importance in this regard was the establishment of the town as tourist / astronomical destination since the commissioning of the South African Large Telescope (SALT) in 2005. The establishment of the town as tourism destination has resulted in modest growth in available retail facilities. This has been further stimulated by the presence of a resident population and visiting researchers at the SAAO/ SALT facility.

A further consequence has been a steep increase in property prices since 2005, and the scarcity of available rental stock. The increase in property prices has made it even more difficult for historically disadvantaged members of the community to acquire property in the traditionally white part of town. The existing scarcity of available rental stock is likely to have potential implications in terms of the town’s ability to accommodate personnel associated with the construction phase. In addition, competition for available rental stock is also likely to impact on visiting researchers at the SAAO/ SALT facility.

3.3.2 Laingsburg

The town of Laingsburg is located on the N1 and essentially represents the gateway to the Great Karoo. The town was established in 1881 along the banks of the ephemeral Buffelsrivier, mainly to provide a stop-over for travelers to the Kimberley diamond fields. The town’s Victorian origins are still visible in a number of late-Victorian style houses located along the main road and some of the side roads. The town serves as regional agricultural service centre for its hinterland, but service and retail opportunities associated with the N1 also play an important role in the town's economy.

The N1 provides a direct road link to Cape Town and the more densely populated Boland to the south-west, and Beaufort West, the Orange Free State and Gauteng to the north-west. While relatively large distances separate the municipality from other large urban areas, the N1 nevertheless ensures that the town is not isolated. While many benefits are associated with this situation, it has at the same time increased the town's vulnerability to infectious diseases such as TB and HIV, and more recently, to the influx of hard drugs such as tik. "Highway relationships" and prostitution linked to the movement of truckers along the N1 constitute a significant risk with regard to the transmission of STDs and of unwanted pregnancies.

Laingsburg's location in proximity to the real or imagined economic opportunities associated with people movement along the N1 has been specifically significant. This situation of urban concentration (and rural depopulation) has gained significant momentum over the past decade or so as a result of significant labor shedding by the agricultural sector in the wake of implementation of the Extension of Security of Tenure Act (ESTA) legislation. The movement of the land has been further compounded by an increasing shift away from traditional stock farming to less labor-intensive game farming. Approximately 80% of the LM's population lives in Laingsburg. The lack of local employment opportunities has resulted in significant concentration of poverty in the town, mainly amongst the Coloured population group. The main settlements in the LLM are Laingsburg and Matjiesfontein.

3.3 CENTRAL KAROO DISTRICT MUNICIPALITY

3.3.1 Introduction

The Central Karoo District Municipality (CKDM) is the largest DM in the Western Cape Province covering an area of 38 853 km², which constitutes ~ 30% of the total area of the Province. However, with a population of 71 011 the CKDM is the least populated DM in the Province. The distances between settlements within the district therefore tend to be large. The district comprises of three Local Municipalities:

- Beaufort West Municipality;
- Prince Albert Municipality;
- Laingsburg Municipality.

Beaufort West is the most populated of the local municipalities with a population size of 49 586, followed by Prince Albert (13 136) and Laingsburg (8 289)(Census 2011). The main language spoken in the district is Afrikaans followed by IsiXhosa.

3.3.2 Economic overview

The CKDM IDP (2012-2017) indicates that economic development remains a developmental challenge for the DM. This is due to the low population density, distance from large markets and the arid climate. In addition there are high levels of unemployment and poverty and a lack of skilled persons.

In 2008 the CKDM economic growth rate was 6 % compared to the Province's annual growth rate of 4.3% (CKDM IDP 2012-2017). However, the due to global recession the growth rate in 2009 was 0.2 %, while the Province's economy contracted by 1.2

%. The decline in the growth from 2008 to 2009 was due to the impact of the 2008/09 global recession (Figure 3.3).

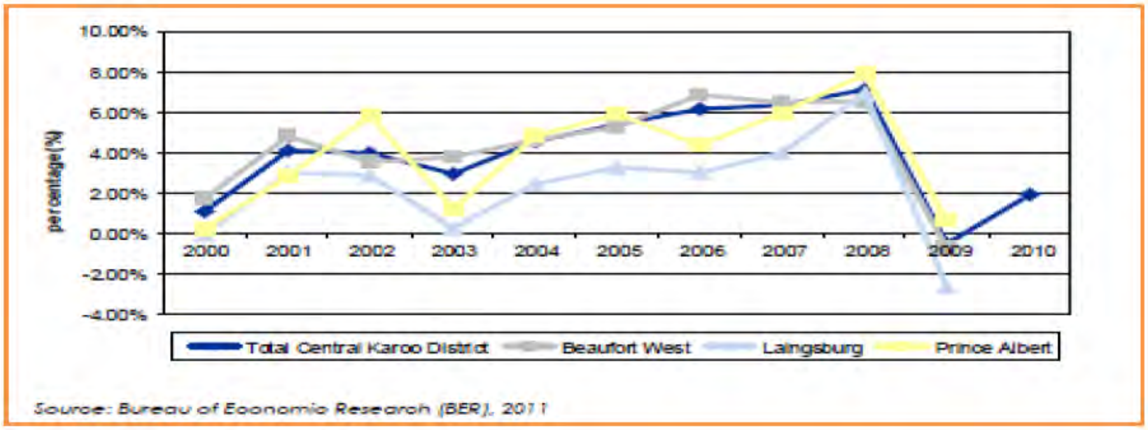


Figure 3.3: CKDM GDP-R Growth, 1999 to 2009

The contribution of the different economic sectors to the local economy has changed over the last 10 years. The 2009 figures compared to the 1999 figures indicate that the most significant changes were in the finance, insurance, real estate and business services sector and manufacturing sector. These sectors increased by 8.9 % and 4.4 % respectively, while the agriculture and transport, storage and communication sectors decreased by 7.0 % 3.8 % respectively.

In the Beaufort West LM mining and quarrying displayed a growth rate of 26.9 % while manufacturing recorded a growth rate of 10.12 %. In the Prince Albert LM the construction (15.2 %) and finance, insurance, real estate and business (14.4 %) sectors all displayed strong growth. In the Laingsburg LM construction (11.8 %) and manufacturing (9.7 %) recorded strong growth.

In terms of employment the most important economic sector is the Community, social and personal services sector (16.9 %), followed by Agriculture; hunting; forestry and fishing (15.7 %) and Wholesale and retail trade (14.0 %). The Agriculture sector also plays a key role in the other District Municipalities in the Western Cape, accounting for 27.9% and 24.2% the jobs in the West Coast and Cape Winelands respectively.

3.3.3 Employment

The Community survey of 2007 found that the Central Karoo had the lowest percentage of the Western Cape's labour force (0.8 %). At the same time the DM also had the highest unemployment rate (30.8%). Based on the 2011 Census figures the unemployment rate in the CKDM was 23.1% compared to 21.6% for the Western Cape Province. Within the DM the unemployment rates for the LLM, Prince Albert and Laingsberg LM were 25.5, 17.9 and 19.4 % respectively in 2011 (Census 2011).

As indicated above, the majority of employment in the Central Karoo is within the agriculture sector. However, the agriculture sector is dependent on exports to the Europe. Due the financial crisis in 2008 exports to Europe have declined significantly, which in turn has resulted in job losses in the agriculture sector.

Although unemployment impacts across gender, race, age and other social divides its effects within certain groups are more pronounced. Some of the differential impacts of unemployment can be found within the breakdown of gender, population group and age.

In terms of unemployment by population group, the unemployment rate for Black Africans (45.0 %) was greater than any other population group. The figure for Coloureds was 33.4 % while for Whites is was only 2.6 %. Disparities are also found within different age groups, with younger age groups experiencing higher levels of unemployment and representing significantly higher shares of the unemployed in comparison with their share of the labour force. The unemployment rate for those in younger age groups is significantly higher than the older age groups. The differences in unemployment rates between age groups may in part be accounted for in the higher education, skill and experience levels of relatively older workers – these characteristics make work-seekers more attractive to prospective employers and improve their chances of finding employment (CKDM IDP 2012-2017).

In terms of gender, males make up 52.9% of the CKDMs labour force. Although males represent more than half of the labour force, they represent only 41.3 % of the district's total unemployed population. The high representation of females within the unemployed translates into a significantly higher unemployment rate for females (38.3 %) compared with males (24.0 %) CKDM IDP 2012-2017).

CKDM has third lowest proportion of skilled labour force (38.6 %) and the second highest of low skilled (26.6 %) people in the Western Cape. The low skill levels in the CKDM places a strain on the region's economy and poses a challenge to the areas future development (CKDM IDP, 2012-2017). The IDP notes that a large proportion of occupations in the DM are classified as either skilled (39 %) or high skilled (21 %). The concentration of employment opportunities in the skilled sector therefore means that there are relatively few opportunities available to those with low skill levels. The current proportion of low skilled occupations available in the District is 27 % (CKDM IDP 2012-2017). This mismatch in terms of skills levels and employment opportunities highlights the need for individuals to up-skill in order to improve their chances of finding employment within the district CKDM IDP 2012-2017).

3.3.4 Household income

The CKDM IDP (2012-2017) indicates that the 32% of households in 2009 earned income between R0 and R42 000, 41.8% earned between R42 000 and R132 000, 23.1% between R132 000 and R600 000 and 3.1% earn above R600 000. The IDP notes that the figures indicated that there has been a shift in earning power in the number of people earning at the lower end of the scale while the people in the middle to upper ends of the scale has increased significantly.

3.3.5 Human development index[18]

The Human Development Index (HDI) for the CKDM increased from 0.57 in 2001 to 0.60 in 2010. While the HDI within the CKDM has improved over the past decade the

[18] The Human Development Index (HDI) is a composite, relative index that attempts to quantify the extent of human development of a community and is based on measures of life expectancy, literacy and income. The HDI therefore provides a measure of people's ability to live a long and healthy life, to communicate, to participate in the life of the community and to have sufficient resources to obtain a decent living. In terms of measurement the maximum level is 1, which indicates a high level of human development, and a minimum value of 0.

CKDM has the lowest HDI of all the Districts, followed by the West Coast and Cape Winelands DM. Within the CKDM the Prince Albert Municipality has the lowest HDI followed by Laingsburg Municipality. The low HDI poses a major challenge for the district in terms of creating employment opportunities to improve the standard of living in the area.

3.3.6 Poverty rate[19] and indigent households

Research undertaken by Global Insight indicates that the number of people living in poverty in the CKDM in 2010 was approximately 20 200 people. In this regard the CKDM had the highest number of people living in poverty in the Western Cape (32.5%). Prince Albert has the highest proportion of poor people and it is rising compared to the rest of the district (Table 3.1).

Table 3.1: Western Cape Province- Poverty Rate, Percentage of People Living in Poverty, 2001 and 2010 per municipality

Municipality	2001 (%)	2010 (%)
City of Cape Town	23.9	19.7
West Coast District	32.0	30.4
Cape Winelands District	30.9	25.7
Overberg District	31.0	29.6
Eden District	31.6	21.7
Central Karoo District	38.7	32.5

Municipality	2001 (%)	2010 (%)
Laingsburg Municipality	37.6	36.1
Prince Albert Municipality	44.1	43.3
Beaufort West Municipality	37.5	29.1

According to the Western Cape Department of Local Government information the number of households in the Central Karoo District totalled 14 945 of which 5 903 (39.5 %) were classified as indigent (August 2011). From the Department's information, of the total number of households, 43.1 % received free basic access to water, 40.2 % to electricity, and 39.4 % to sanitation services. Within the CKDM the Beaufort West LM has the highest number of indigent households followed by the Prince Albert and Laingsburg LM (Table 3.2).

Table 3.2: Indigent Households within the Central Karoo Municipality

[19] The poverty rate represents the percentage of people living in households with an income less than the poverty income. The poverty income is defined as the minimum monthly income needed to sustain a household and varies according to household size, the larger the household the larger the income required to keep its members out of poverty. The poverty income used is based on the Bureau of Market Research's Minimum Living Level (BMR report no. 235 and later editions, Minimum and Supplemented Living Levels in the main and other selected urban areas of the RSA, August 1996). For example, the monthly income needed to keep a 1 person household out of poverty in 2010 is estimated to be R1 315, while for a two person household it is R1 626; a four person household requires an estimated income of R2 544 to stay out of poverty while a household with eight or more person requires an estimated R4 729.

Municipality	Households	Indigent Households
Laingsburg Municipality	1960	663
Beaufort West Municipality	10 135	4 351
Prince Albert Municipality	2 850	889

3.3.7 Gini coefficient[20]

The Gini coefficient for the DMs in the Western Cape Province are largely similar, and vary between 0.57 (City of Cape Town and 0.6 (West Coast DM). The Gini coefficient for the CKDM was 0.58 in 2019 (Table 3.3). Within the CKDM the Prince Albert Municipality had the highest Gini coefficient in 2010 (0.61) followed by the Laingsburg Municipality (0.59). The income inequality within the CKDM is exacerbated by the high unemployment rates and low income levels.

Table 3.3: Western Cape Province-Gini coefficient 2001 and 2010 per City/District /Municipality

Municipality	2001	2010
City of Cape Town	0.60	0.57
West Coast District	0.59	0.60
Cape Winelands District	0.60	0.59
Overberg District	0.58	0.58
Eden District	0.59	0.56
Central Karoo District	0.59	0.58

Municipality	2001	2010
Laingsburg Municipality	0.59	0.59
Prince Albert Municipality	0.61	0.61
Beaufort West Municipality	0.59	0.57

3.3.8 Main transport corridors

The N1 national road that bisects the Central Karoo is a key transport corridor for road-based freight transport, passenger services and private vehicles. This vital link bisects South Africa on a northeast-southwest axis, providing access to and between Limpopo Province, Gauteng, the Free State and the Western Cape. Within the Central Karoo District it links the towns of Beaufort West, Leeu-Gamka, Laingsburg and Matjiesfontein. This road is part of the SANRAL network.

Running parallel to the N1 through the Central Karoo is the long-distance main railway line connecting Cape Town to Johannesburg / Pretoria and the other main urban centres of South Africa.

[20] The Gini coefficient is a summary statistic of income inequality, which varies from 0, in the case of perfect equality where all households earn equal income, to 1 in the case where one household earns all the income and other households earn nothing. In practice the coefficient is likely to vary from approximately 0.25 to 0.70.

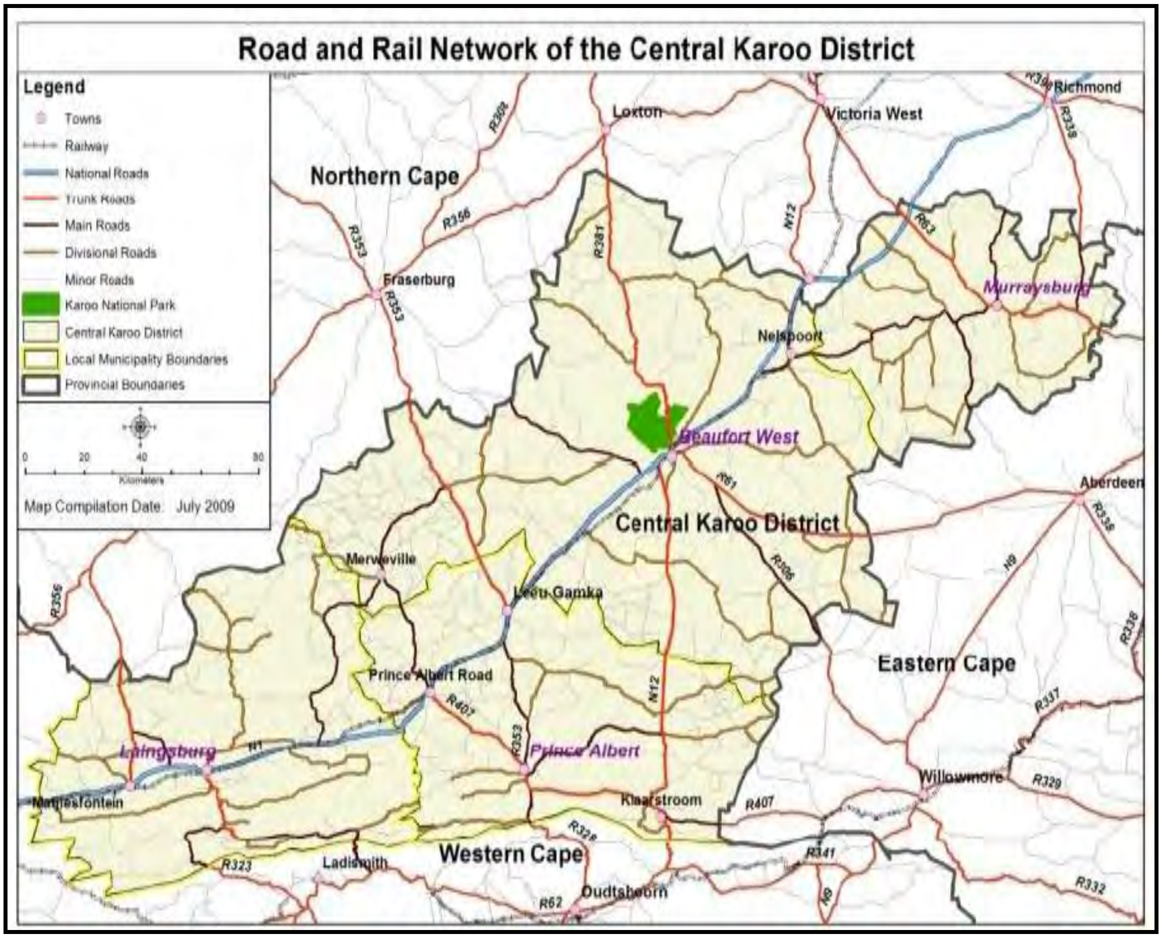


Figure 3.4: Transport links within the CKDM

3.4 CENTRAL KAROO AND LAINGSBURG MUNICIPALITY

3.4.1 Demographic information

As indicated in Table 3.4., the population of the CKDM increased by from 60 483 in 2001 to 71 011 in 2011, which represents an increase of ~ 17.4%. The population of the LLM increased from 6 680 in 2001 to 8 289 in 2011 (~ 19 %) over the same period. This represents an average annual increase of ~ 1.6 % and 2.16 % for the CKDM and LLM respectively. The increase in the population in both the CKDM and LLM was linked to an increase in the economically active 15-65 year age group. The increase in the economically active 15-65 age group in also reflected in the decrease in the dependency ratios in both the CKDM and LLM (see below). As expected, the number of households in both the CKDM and LLM increased between 2001 and 2011. The household size in the CKDM decreased marginally, from 3.8 to 3.6. The household size in the LLM stayed at 3.3 between 2001 and 20122.

Table 3.4: Overview of key demographic indicators for the CKDM and LLM

	CKDM		LLM	
ASPECT	**2001**	**2011**	**2001**	**2011**
Population	60 483	71 011	6 680	8 289
% Population <15 years	32.7	30.5	29.3	26.5
% Population 15-64	61.4	63.3	63.0	66.3
% Population 65+	6.0	6.2	7.7	7.2
Households	15 009	19 076	1 922	2 408
Household size (average)	3.8	3.6	3.3	3.3
Formal Dwellings %	95.7 %	97.0 %	96.6 %	96.6 %
Dependency ratio per 100 (15-64)	62.9	58.0	58.7	50.9
Unemployment rate (official) - % of economically active population	36.2 %	23.1 %	26.3 %	17.9 %
Youth unemployment rate (official) - % of economically active population 15-34	47.3 %	30.9 %	37.0 %	22.0 %
No schooling - % of population 20+	17.3 %	10.1 %	20.0 %	11.7 %
Higher Education - % of population 20+	6.1 %	7.1 %	5.9 %	8.7 %
Matric - % of population 20+	14.9 %	21.5 %	12.4 %	16.7 %

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

The majority of the population is in the LLM was Coloured (79 %), followed by Whites (13.3%) and Black Africans (7%) (Census, 2011). The dominant language within the Municipality is Afrikaans (~ 94%), followed by English (1.7%) and isiXhosa (~1.2%)(Census 2011).

The dependency ratio in both the CKDM and LLM decreased from 62.9 to 58.0 and 58.7 to 50.9 respectively. The age dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64. The increase represents a positive socio-economic improvement, and reflects a decreasing number of people dependent on the economically active 15-64 age group. This decrease is linked to the increase in the percentage of economically active people in both the CKDM and LLM. Despite the decrease the dependency ratios for the CKDM and LLM are higher than the provincial (45) dependency ratio.

In terms of percentage of formal dwellings, the number of formal dwellings in the CKDM increased significantly from 95.7 % in 2001 to 97.0 3% in 2011. The number of formal dwellings in the LLM remained constant at 96.6% for the same period. This represents a positive socio-economic advantage for the area. The high level of formal dwellings is also likely to reflect a low in-migration into the both the CKDM and LLM, which in turn is likely to be an indication of the limited economic opportunities in the area.

Employment

The official unemployment rate in both the CKDM and LLM also decreased for the ten year period between 2001 and 2011. In the CKDM the rate fell from 36.2 % to 23.1 %, a decrease of 13.1 %. In the LLM the unemployment rate decreased from 26.3 % to 17.9 %, a decrease of 8.4 %. Youth unemployment in both the CKDM and LLM also dropped over the same period. However, the youth unemployment rate in the both the CKDM (30.9 %) and LLM (22 %) remain high. This is likely to be due to the decline in the role of the agricultural sector and the subsequent loss of employment opportunities in this sector.

Household income

Based on the data from the 2011 Census, 5.3 % of the population of the LLM have no formal income, 2% earn between 1 and R 4 800, 2.9% earn between R 4 801 and R 9 600 per annum, 20.9% between R 9 601 and 19 600 per annum and 25.4% between R 19 600 and R 38 200 per annum (Census 2011). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household. Based on this measure 56.5% of the LLMs population live below the poverty line. The low-income levels reflect the limited formal employment opportunities in the LLM. This is due the LLMs reliance on the agricultural sector. The low income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low income levels also result in reduced spending in the local economy and less tax and rates revenue for the district and local municipality.

Education

The education levels in both the CKDM and LLM also improved, with the percentage of the population over 20 years of age with no schooling dropping in the CKDM decreasing from 17.3 1% to 10.1 %. For the LLM the decrease was from 20.0 % to 11.7 %. The percentage of the population over the age of 20 with matric also increased in both the CKDM and LLM, from 14.9 % to 21.5 % in the CKDM and 12.4 % to 16.7% in the LLM. The levels in both the CKDM and LLM are however lower than the national (28.4%) provincial (28.1%) averages.

The IDP (CKDM 2012-2017) also notes that the population in the CKDM have limited options when it comes to higher education and further education facilities. Only one institution in Beaufort West serves the District and people are compelled to further their studies outside of the District.

Table 3.5: Overview of key demographic indicators for the Karoo Hoogland and Laingsburg Municipalities

	KAROO HOOGLAND		LAINGSBURG	
ASPECT	**2001**	**2011**	**2001**	**2011**
Population	10 512	12 588	6 680	8 289
Households	2 942	3 843	1 922	2 408
Household size (average)	3.2	3	3.3	3.3
% Population <15 years	29.7	27.7	29.3	26.5
% Population 15-64	61.1	62.3	63	66.3
% Population 65+	9.1	10	7.7	7.2
Dependency ratio per 100 (15-64)	63.6	60.5	58.7	50.9
Unemployment rate (official) - % of economically active population	28.6	14.6	26.3	17.9
Youth unemployment rate (official) - % of economically active population 15-34	40.3	20	37	22
No schooling - % of population 20+	28	18.4	20	11.7
Higher Education - % of population 20+	8.1	8.7	5.9	8.7
Matric - % of population 20+	13.9	16.9	12.4	16.7

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

As indicated in Table 3.5, the age structure of both the KHLM and LLM has changed slightly since Census 2001. The youthful component of both LMs decreased in favor of the 15-65 age group. This is reflected by decreases in the dependency ratios of both LMs, but most strongly expressed in the Laingsburg LM's reduction from 58.7 to 50.9. The significant 65+ group in Karoo Hoogland (10%) is likely linked to Sutherland as a popular retirement destination. Formal unemployment and youthful unemployment levels in Karoo Hoogland decreased by nearly 50% since Census 2001, while the Laingsburg LM achieved significant but more modest reductions. Youthful unemployment remains high in both LMs.

Education levels have also improved in both LMs since Census 2001. Significant improvement has been made in reducing the portion of the population with no schooling, but figures are still high, especially for Karoo Hoogland (18.4%). 25.6% of the Karoo Hoogland population 20+ have a matric and/ or higher qualification, while the figure for Laingsburg is 25.4%.

3.4.2 Municipal services

As indicated in Table 3.6, the provision of and access to municipal services as measured in terms of flush toilets, weekly refuse removal, piped water and electricity, has, with the exception of waste removal in the LLM, increased in both the CKDM and LLM for the period 2001 to 2011. As indicated in Table 3.2 there have been significant improvements in the number of households with access to piped water inside their dwellings in the CKDM. However, the improvements in the LLM have not been as significant. It is also worth noting that despite the high percentage of formal dwellings in the LLM (96.6%) the level of services to these dwellings in terms of flush toilets, weekly refuse removal and piped water are all below 70%.

In addition, the service levels in the CKDM and LLM are lower than the 2011 provincial averages for the Western Cape Province. The provincial figures are flush toilets (85.9%), weekly refuse removal (89.9%), piped water (78.7%) and electricity (93.4%).

Table 3.6: Overview of access to basic services in the CKDM and LLM

	CKDM		LLM	
	2001	**2011**	**2001**	**2011**
% households with access to flush toilet	75.1	77.6	62.8	68.1
% households with weekly municipal refuse removal	78.1	78.7	63.1	59.5
% households with piped water inside dwelling	55.5	77.2	60.1	66.3
% households which uses electricity for lighting	83.9	89.4	73.7	79.4

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

Table 3.7: Overview of access to basic services in the Karoo Hoogland and Laingsburg Municipalities

Municipal Services	**KAROO HOOGLAND**		**LAINGSBURG**	
	2001	**2011**	**2001**	**2011**
Formal Dwellings %	94.5	96.9	96.6	96.6
% households with access to flush toilet	23	39.4	62.8	68.1
% households with weekly municipal refuse removal	59.5	62.7	63.1	59.5
% households with piped water inside dwelling	50.1	59.8	60.1	66.3
% households which uses electricity for lighting	66.7	64.9	73.7	79.4

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

Compared to other parts of the country, both KHLM and LLM enjoy high levels of formal housing provision. According to Census 2011, only 3.4% of both LM's populations do not have access to formal housing (Table 3.7).

Other service levels are less impressive, although both LMs have made improvements in terms of all (Karoo Hoogland) or most (Laingsburg) indicators. Access to waterborne sewage is particularly low in the Karoo Hoogland (<40%). More than 35% of Karoo Hoogland, and >20% of Laingsburg households do not have access to electricity for lighting.

3.4 LOCAL ECONOMY

3.4.1 Agricultural sector

Commercial stock farming forms the economic backbone of the Laingsburg/Sutherland region, and essentially consists of extensive small stock farming, typically sheep. Carcass, wool and multi-purpose breeds are stocked. The grass component is insufficient to support meaningful numbers of large stock. Goats are suited to the region, but are not generally favoured due to their very destructive browsing habit.

Operations in the Sutherland/ Laingsburg region are characterised by the seasonal movement of stock between pastures located in different farming areas. This transhumance pattern is centuries old, and is based on the utilisation of summer (Great Karoo, Moordenaarskaroo) and winter rainfall areas (Klein Roggeveld, Tankwa, Ceres Karoo) in turn in order to ensure continuous fresh pasture throughout the year, and to protect veld from overgrazing linked to inherently low carrying capacities as a result of arid conditions. Operations therefore typically consist of a number of farms, mostly ranging in size from 5000 ha to 10 000 ha in total, dispersed over a large area.

The Klein Roggeveld and Tankwa are milder in winter than the Roggeveld and great escarpment north of Sutherland, and thus better suited to lambing ewes. At the same time, these regions are very hot and dry in summer, making it preferable to move stock back to the Moordenaarskaroo or Roggeveld. As was indicated in Section 1.4, the majority of farms comprising the WEF serve only as winter grazing for main operations located in the Roggeveld, Klein Roggeveld or Moordenaarskaroo. The Tankwa farms on which the bulk of the WEF infrastructure is proposed is valued for its comparatively warm winters, higher winter rainfall than the surrounding areas, and the abundance of streams and small watercourses. At the same time, it becomes unbearably hot and dry in summer. Veld carrying capacities are low, around 6 ha to 1 sheep.

The employment opportunities associated with extensive stock farming are limited and in many instances only available seasonally (e.g. shearing). Virtually no beneficiation of primary produce (meat, wool, hides) currently takes place locally. As a result, the local primary agricultural sector supports only very limited local secondary employment and investment.

Most farming operations in the broad region produce fodder crops on a small scale, mainly for own use. The Laingsburg-Sutherland-Ceres area is a key producer of vegetable seed crops, namely onions, garlic, leeks and carrots. Olives, drying peaches, citrus and other crops are also grown on a small scale in the Laingsburg area. All cropping activities are irrigation-based. Cropping areas and potential cropping areas are therefore restricted in this region of low rainfall, ephemeral rivers and deep groundwater. With regard to the WEF study area, vegetable seed is produced on at least 3 site farms. In the case of Rietfontein and Klipbanksfontein (Conradie), workers are transported in during planting and harvesting for a few days at a time, with a skeleton staff supervising operations throughout the year.

Game farming is currently increasingly displacing stock farming in the Laingsburg area. Game farming is even less employment-intensive than stock farming, with the result that an already limited employment base is in danger of erosion. However, this trend is at present limited to virtually absent in the area south of Sutherland, including the WEF site and surrounds.

3.4.2 Tourism

Tourist flows into the study area municipalities are currently modest, and mainly associated with the town of Sutherland (observatory) and the small Victorian rail siding of Matjiesfontein along the N1 west of Laingsburg.

The construction and commissioning of the South African Large Telescope (SALT), the largest telescope in the Southern Hemisphere, is credited as the most important contributing factor to the growth of the tourism sector in Sutherland. Prior to the construction of SALT in 2005 the accommodation in the town was limited to a single guesthouse and one hotel. At present, the town has over 30 B&B/guest house facilities and one hotel (providing a total of approximately 300 beds), as well as a number of restaurants and coffee shops/ bistros. In addition, fourteen guest farms have become established around the town. An estimated 15 000 visitors visit the town annually. The majority of tourist are from the Western Cape and visit the town during the winter months when atmospheric conditions for viewing are optimal. Peak visitor numbers are over the June school holidays. Snow tourism is also becoming a major attraction. As major attractions are limited to a few winter months, accommodation facilities and restaurants battle with significant under-subscription during most of the year.

Matjiesfontein is a quaintly preserved/ restored scattering of Victorian houses and the Lord Milner Hotel around a rail siding. Thanks to its location near the N1, Matjiesfontein is arguably one of South Africa's best-known bastions of Victoriana and nostalgia tourism. Matjiesfontein is largely dedicated to residential and tourism uses. Its location along the N1, between Laingsburg and Touwsrivier, makes it ideal as a stop or stop-over for tourists. Travellers are less well catered for, as general shops and services (e.g. fuel station) are not represented.

Information provided by the Karoo Hoogland Tourism Bureau as well as the Laingsburg Tourism Bureau indicates that no significant tourism attractions or destinations are located in the WEF study area. Guest accommodation is available on two farms to the south of the WEF site, but mainly caters for contractors and consultants working in the area. In this regard, the WEF is located more or less in between two major accommodation destinations, namely Matjiesfontein and Sutherland (le Roux, pers. comm). No other tourism destinations or facilities are currently located in or around the WEF site.

SECTION 4: IDENTIFICATION OF KEY ISSUES

4.1 INTRODUCTION

Section 4 provides an assessment of the key social issues identified during the study. The identification of key issues was based on:

- Review of project related information;
- Interviews with key interested and affected parties;
- Experience/ familiarity of the authors with the area and local conditions;
- Experience with similar projects;

The assessment section is divided into the following sections:

- Assessment of compatibility with relevant policy and planning context ("planning fit";
- Assessment of social issues associated with the construction phase;
- Assessment of social issues associated with the operational phase;
- Assessment of social issues associated with the decommissioning phase.
- Assessment of the "no development" alternative;
- Assessment of cumulative impacts.

4.2 ASSESSMENT OF POLICY AND PLANNING FIT

As indicated in Section 1.6, legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents.

For the purposes of the meeting the objectives of the SIA the following national, provincial and local level policy and planning documents were reviewed, namely:

National

- National Energy Act (2008);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- White Paper on Renewable Energy (November 2003);
- Integrated Resource Plan (IRP) for South Africa (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012);
- Astronomy Geographic Advantage (AGA) Act (Act 21 of 2007).

Provincial and local

- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014;

- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);
- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2010);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006);
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002).
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Laingsburg Local Municipality Integrated Development Plan (2012-2017).
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

As indicated above, small section of the site is located in the Karoo Hoogland Municipality (KHLM) within the Northern Cape Province. The following provincial level policy and planning documents were reviewed:

- Karoo Hoogland Municipality Integrated Development Plan (2012-2017);
- Northern Cape Provincial Growth and Development Strategy (2004-2014);
- Northern Cape Climate Change Response Strategy;
- Northern Cape Spatial Development Framework;

The findings of the review indicated that renewable energy is strongly supported at a national and local level. At a national level the White Paper on Energy Policy (1998) notes:

- Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future; and,
- The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

The IRP 2010 also allocates 43% of energy generation in South Africa to renewables, while the New Growth Path Framework and the National Infrastructure Plan both support the development of the renewable energy sector.

The development of and investment in renewable energy is also supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all make reference to renewable energy. At a provincial level the development of renewable energy is supported by the Northern Cape Provincial Growth and Development Strategy, Northern Cape Provincial Spatial Development Framework, White Paper on Sustainable Energy for the Western Cape, Climate Change Strategy and Action Plan for the Western Cape and Western Cape Growth and Development Strategy.

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that the development of renewable energy is supported at a national and provincial level. The area has also been identified as an area where renewable energy should be concentrated. It is therefore the opinion of the authors that the establishment of the proposed WEF is supported by the relevant policies and planning documents.

However, the provincial and local policy and planning documents also make reference to the importance of tourism and the region's natural resources. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed facility, does not impact on the region's natural resources and the tourism potential of the Province.

4.3 CONSTRUCTION PHASE SOCIAL IMPACTS

The key social issues associated with the construction phase are the following:

Potential positive impacts
- Creation of employment and business opportunities, and opportunity for skills development and on-site training;
- Benefits associated with providing technical advice on wind energy to local farmers and municipalities;
- Improved cell phone reception.

Potential negative impacts
- Impacts associated with the presence of construction workers on local communities;
- Impacts related to the potential influx of job-seekers;
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site;
- Increased risk of grass fires associated with construction related activities;
- Noise, dust, waste and safety impacts of construction related activities and vehicles;
- Impact on productive farmland.

4.3.1 Creation of local employment, training, and business opportunities

Based on the information from other WEF projects the construction phase for a 280 MW WEF (Phase 1) is expected to extend over a period of 18-24 months and create approximately 400 employment opportunities during peak construction. Of this total approximately 55% (220) will be low skilled positions (construction labourers, security staff etc.), 30% (120) semi-skilled positions (drivers, equipment operators etc.) and 15% (60) skilled positions (engineers, land surveyors, project managers etc.). The work associated with the construction phase will be undertaken by contractors and will include the establishment of the WEF and the associated components, including, access roads, substation, services and power line.

The construction of the Komsberg West and East WEFs (550 MW) will not create an additional 400 new employment opportunities. Assuming that the construction of the East and West components are phased to follow on from each other, it is highly likely that the majority of the original 400 workers will be employed for both components. For the purposes of the assessment is it assumed that 80% (320) of the original 400 workers employed to construct the first 280 MW WEF will be employed in the construction of the second 280 MW WEF. The total number of employment opportunities created by the construction of the Komsberg East and West WEFs will therefore be ~ 480. For the purposes of the assessment it is assumed that 80% (64)

of the 80 new employment opportunities will be for low skilled workers, 15% (12) for semi-skilled workers and 5% (4) for skilled workers.

Members from the local community in the area may be in a position to qualify for the majority of the low skilled and semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local LLM and KHLM community. As indicated above, the levels of unemployment in the LLM and KHLM are relatively high. The level of unemployment in Laingsburg and Sutherland is also high and there are limited employment opportunities in the town and surrounding area. The creation of potential employment opportunities, even temporary employment, will therefore represent a significant, if localised, social benefit.

While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited the construction of three wind energy projects in the area which is planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Komsberg WEFs. It is estimated that these projects will be employing 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy. In addition, the implementation of a training and skills development programme prior to the commencement of construction would also increase the potential to employ local community members. The number of low skilled and semi-skilled positions taken up by members from the local community will be enhanced by the implementation of these enhancement measures by the proponent in consultation with the LLM and Department of Labour. However, if required, it is only practical for the proponent (or their contractors) to implement a training and skills development programme once the project has been formally finalised or reached Financial Close with the Department of Energy or appropriate government agency, but still aligned with construction.

The capital expenditure associated with the construction of a 280 MW WEF will be in the region of R 5 billion (2015 Rand value). The total combined capital expenditure for the Komsberg East and West WEFs will therefore be ~ R 10 billion (2015 Rand value). A percentage of the capital expenditure associated with the construction phase has the potential to benefit local companies. However, the opportunities for local companies in Laingsburg will be limited. In this regard the benefits are likely to accrue to building contractors and suppliers based in towns based further afield, such as Worcester, Paarl and Cape Town. Implementing the enhancement measures listed below can enhance these opportunities. However, the potential opportunities for local companies are likely to be limited due to the high import content associated with WEF projects.

The total wage bill for the 18-24 month construction phase of a single 280 MW WEF will be in the region of R 100 million (2015 Rand value). The total wage bill for the Komsberg East and West WEFs would therefore be ~ R 200 million (2015 Rand value). This is based on a monthly wage of R 8 000 for low-skilled workers, R 12 000 for semi-skilled workers and R 30 000 for skilled workers over a period of 20 months.[21] A percentage of the wage bill will be spent in the local economy and will create significant opportunities for local businesses in Laingsburg, Sutherland and

[21] These are assumptions made by the author and are not to be construed as commitments on the part of the proponent or the contractors that will built the facility. Wages will be determined based on legislated requirements and market norms.

Worcester. Given the high unemployment and low income levels in Laingsburg and Sutherland even a small percentage of the monthly salary bill spend in the town would represent a significant opportunity. Based on the authors experience with other renewable energy projects local spend by construction workers represents a significant benefit for local shops and businesses in the area. This benefit will extend over a period of ~ 4-6 years assuming that the construction of the Komsberg East and West WEFs follow on from each other.

The sector of the local economy that will also benefit from the proposed development is the local service industry. This is also confirmed by the experience with the other renewable projects. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the meeting the needs of 400 construction workers who will need to be accommodated, transported to site and fed (3 meals a day) over a period of 4 years (Komsberg East and West). Experience for other renewable energy projects located near small towns, such as Pofadder in the Northern Cape Province, is that local residents and businesses have benefitted significantly from meeting the needs of construction workers. Many homeowners in Poffadder benefitted from construction of the Abengoa Solar Energy Project by turning their homes into B&Bs, adding extra rooms, providing catering and laundry services etc. The proposed the Komsberg East and West WEF project therefore has the potential to create an opportunity for investment in Laingsburg and Sutherland. However, as indicated in Section 4.3.2 below, the presence of construction workers also has the potential to impact negatively on local family and social networks.

The hospitality industry in the area will also likely to benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other renewable energy projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

However, based on the findings of the site visit there is not sufficient accommodation in Laingsburg and Sutherland and surrounds to accommodate the ~ 300 workers associated with the construction phase. However, the intention is to source the majority of labour from the local area which will reduce the need for accommodation. . The local farmers in the area have also indicated that they do not support the establishment of a construction camp on the site although this will not be needed. The issue of accommodation represents a potential challenge and will need to addressed in consultation with the LLM, community representatives and local farmers from the area should the project proceed.

The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors which would support local economic development in the LLM.

Table 4.1: Impact assessment of employment and business creation opportunities during the construction phase (Komsberg East and West WEF)

Nature: Creation of employment and business opportunities during the construction phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Positive	Medium	M	High
With Mitigation/ Enhancement	H	L	H	Positive	High	H	High

Assessment of No Go option

There is no impact, as the current status quo will be maintained. The potential employment and economic benefits associated with the construction of the proposed WEFs would however be forgone. The potential opportunity costs in terms of local capital expenditure, employment, skills development and opportunities for local business are therefore regarded as a negative. Potential opportunity costs would be greatest with regards to local employment provision and opportunities for the local service sector.

Recommended enhancement measures

The following enhancement measures are also recommended in order to enhance local employment and business opportunities associated with the construction phase:

- The need to implement an accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions should be assessed by the proponent. Such a programme is needed should be initiated prior to the initiation of the construction phase but only once the project has been formally finalised or Financially Closed with the Department of Energy or appropriate government agency. The aim of the potential programme should be to maximise employment opportunities for members of the local community. In this regard the programme could be aimed at community members from Laingsburg and Sutherland. If required, the programme should be developed in consultation with the Department of Labour and the LLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;
- The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;
- Before the construction phase commences the proponent should meet with representatives from the LLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase;
- The local authorities and relevant community representatives should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project;
- Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Where feasible, efforts should be made to employ local contactors

that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;

- The contractor should liaise with the LLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
- Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.
- The LLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.

Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

4.3.2 Technical advice for local farmers and municipalities

The establishment of a WEF in the area creates an opportunity for the technical staff involved in the project to provide local farmers and the LLM with advice regarding the installation of wind energy technology to supplement their current and future energy needs. Experience from other renewable energy projects indicate that farmers would appreciate assistance in this regard in the form of expert opinion as to what type of small scale wind technologies could be installed to meet their needs and how best to install small-scale wind energy installations on their farms. This could be achieved via a workshop / discussion with the local farmers in the area. Local municipalities would also benefit from the knowledge of technical staff involved in the establishment of the project.

Table 4.2: Assessment of benefit of technical advice for local farmers and municipalities

Nature: Potential benefit for local farmers and municipalities associated with providing advice on installation of small-scale wind energy technology to supplement their energy needs							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	N/A	N/A	N/A	N/A	Neutral	N/A	N/A
With Mitigation/ Enhancement	M	M	L	Positive	Low	H	Medium

Assessment of No Go option

There is no impact as the current status quo would be maintained. The potential positive benefit for local farmers and the municipality in terms of potential future energy savings would however be lost.

Recommended enhancement measures

- The proponent in consultation with the contractor should hold a workshop/s with local farmers and representatives from the LLM to discuss options for installing small-scale wind energy facilities and the technology and costs involved.

4.3.3 Improved cell phone reception in the area

The cell phone reception in parts of the study area is poor. The farmers in the area indicated that any improvement in the cell phone reception would represent a significant benefit for the local famers in the area. The benefits would be linked to improving security on the farms in the area and also enabling local farmers to contact doctors etc. in the event of emergencies. In this regard the local farmers enquired if it would be possible for the proponent to establishment a booster tower as part of the construction of the proposed WEFs. The establishment of a booster tower would also enable the contractors on site to manage the construction phase more effectively.

Table 4.3: Assessment of benefit of improving cell phone reception in the area

Nature: Potential benefit for local farmers in terms of improving security on the farms in the area and also enabling local farmers to contact doctors etc. in the event of emergencies.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	N/A	N/A	N/A	N/A	Neutral	N/A	N/A
With Mitigation/ Enhancement	M	M	L	Positive	Low	H	Medium

Assessment of No Go option

There is no impact as the current status quo would be maintained. The potential positive benefit for local farmers would however be lost.

Recommended mitigation measures

The proponent in consultation with the contractor should investigate option of establishing a cell phone booster mast on the site.

4.3.4 Impact of construction workers on local communities

The presence of low and semi-skilled construction workers poses a potential risk to family structures and social networks in the town of Laingsburg and Sutherland depending on where they are accommodated. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use;
- An increase in crime levels;
- The loss of girlfriends and/or wives to construction workers;
- An increase in teenage and unwanted pregnancies;
- An increase in prostitution;
- An increase in sexually transmitted diseases (STDs), including HIV.

As indicated above, while the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited the construction of three wind energy projects in the area which is planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Komsberg WEFs. It is estimated that these projects will be employing 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy. The majority of the low skilled (220) and semi-skilled (120) work opportunities associated with the construction phase are therefore likely to be taken up by local community members from the area. This will reduce the potential risked posed by outsiders to family structures and social networks in the town of Laingsburg and Sutherland depending on where they are accommodated. This is a positive in that the local members of the community interviewed indicated that the likelihood of these risks developing was high with the advent of many outsiders due to the current high unemployment and low income levels in the town.

The use of local residents from Laingsburg and Sutherland to fill the low skilled job categories will also reduce the need to provide accommodation for construction workers in Laingsburg and Sutherland. As indicated above, there is limited accommodation available in both of these small towns. If necessary, the implementation of an accredited training and skills development programme prior to the initiation of the construction phase would therefore not only maximse employment opportunities for local residents but also reduce risks posed by construction workers to the local community. The programme would also assist the contractor to address the issue of providing accommodation for construction workers. The skilled workers (60) are likely to be accommodated in local guest houses in the town and on local farms.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. The experience with the Abengoa solar energy project in the Northern Cape Province has demonstrated that this risk is real. The presence of construction workers associated with the Abengoa project resulted in an increase in the spread of STD, increase in un-planned pregnancies, increase in drugs, alcohol abuse and anti-social behavior. The Abengoa projects have left a tangible legacy of HIV and single mothers.

In terms of potential threat to the families of local farm workers in the vicinity of the site, the risk is likely to be low. This is due to the low number of permanent workers residing on local farms in the area. The potential risk is therefore likely to be limited. The risk can also be effectively mitigated by ensuring that the movement of construction workers on and off the site is carefully controlled and managed. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

Table 4.3: Assessment of impact of the presence of construction workers in the area on local communities

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No Go option

There is no impact as the current status quo would be maintained. The potential positive impacts on the local economy associated with the additional spending by construction workers in the local economy will also be lost.

Recommended mitigation measures

- If necessary, the proponent should consider the implementation of an accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions prior to the initiation of the construction phase but only once the project has been formally finalised or Financially Closed with the Department of Energy or appropriate government agency. The aim of the programme should be to maximise employment opportunities for members of the local community. In this regard the programme could be aimed at community members from Laingsburg and Sutherland. The programme could be developed in consultation with the Department of Labour and the LLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the current low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;
- The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;
- The proponent should establish a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the LLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers;
- The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation;
- The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site;
- The contractors should make the necessary arrangements to transport workers from other local towns in the area, such as Worcester and Paarl, home over weekends. This will reduce the risk posed to local family structures and social networks in Laingsburg and Sutherland;
- No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

4.3.5 Influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the manner in which they conduct themselves can impact on the local community.

Experience from other projects has also shown that the families of job seekers may also accompany individual job seekers or follow them at a later date. In many cases the families of the job seekers that become "economically stranded" and the construction workers that decided to stay in the area, subsequently moved to the area. The influx of job seekers to the area and their families can also place pressure on the existing services in the area, specifically low income housing. In addition to the pressure on local services the influx of construction workers and job seekers can also result in competition for scarce employment opportunities. Further secondary impacts included increase in crime levels, especially property crime, as a result of the increased number of unemployed people. These impacts can result in increased tensions and conflicts between local residents and job seekers from outside the area.

These issues are similar to the concerns associated with the presence of construction workers and are discussed in Section 4.4.2. However, in some instances the potential impact on the community may be greater given that they are unlikely to have accommodation and may decide to stay on in the area. In addition, they will not have a reliable source of income. The risk of crime associated with the influx of job seekers it therefore likely to be greater. However, the findings of the SIA indicate that potential for economically motivated in-migration and subsequent labour stranding in Laingsburg and Sutherland is likely to be low. This is due to the towns small size and location and the limited economic opportunities that the town has to offer. The risks associated with job seekers moving to the area staying on in Laingsburg and Sutherland are therefore likely to be low and are likely to be limited the construction phase.

Table 4.4: Assessment of impact of job seekers on local communities associated with the construction phase

Nature: Potential impacts on family structures, social networks and community services associated with the influx of job seekers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	L	Negative	Low	M	Medium
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	Medium

Assessment of No Go option

There is no impact as the current status quo would be maintained. The potential positive impacts on the local economy associated with the additional spending by construction workers in the local economy will also be lost.

Recommended mitigation measures

It is not possible to prevent job seekers from coming to the area in search of a job. However, as indicated above, the potential influx of job seekers to the area as a result of the proposed WEF is likely to be low. In addition:

- The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities;

- The proponent should implement a policy that no employment will be available at the gate and or in Laingsburg and Sutherland (except for local residents).

4.3.6 Risk to safety, livestock and farm infrastructure

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famer's and farm workers in the vicinity of the site threat. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged or stock theft linked either directly or indirectly to the presence of farm workers on the site. All of the local farmers in the area interviewed indicated this was a key issue in that the presence of construction workers on the site increased the exposure of their farming operations and livestock to the outside world, which, in turn, increased the potential risk of stock theft and crime. The local farmers also indicated that this was also likely to be an issue during the construction phase, albeit to a reduced extent. The local farmers did, however, indicate that the potential risks (safety, livestock and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on the site workers during the construction phase.

The affected and adjacent properties are primarily used for stock farming. The properties are extensive. Some properties (5 le Roux properties, Gemsbokfontein) are not permanently inhabited. Most of the farms are relatively inaccessible. Only Mr Myburgh's properties (Wilgerboom and Brinksfontein) are traversed by a public road at present. Gemsbokfontein, Putterskraal and Anysrivier are at the terminus of farm roads. Due to the isolation the study area is considered very safe at present. Based on the comments from the local farmers interviewed, stock theft is not regarded as major problem and farm gates, houses and stores are typically left unlocked.

The concern is that the WEF would introduce a large number of workers ('feet and eyes') into a hitherto isolated and relatively safe area, with very limited people presence. This could expose owners to potentially significant losses in the form of organised stock theft. The potential to mask the activities of local thieves was also noted.

Table 4.5: Assessment of risk to safety, livestock and damage to farm infrastructure

Nature: Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No-Go option

There is no impact as it maintains the current status quo.

Recommended mitigation measures

- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences;

- The contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties;
- The proponent should establish a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site;
- The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below);
- The Environmental Management Programme (EMP) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
- The contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- The contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;
- The housing of construction workers on the site should be strictly limited to security personnel.

4.3.7 Increased risk of grass fires

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could in turn pose a threat to livestock, crops, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The issue of fire risks was raised by a number the local farmers in the area. In this regard they pointed out that grazing is the main productive resource in the study area. For some operations it provides crucial seasonal grazing. As generally the case in arid areas, the study area veld is very vulnerable to disturbance, and takes decades to recover. The local farmers also indicated that grass fires resulted in change in the composition of the veld, favouring the establishment of less palatable grazing. Given the very slow rate of succession, grass fires may therefore significantly diminish the grazing resource for a period of decades.

However, the local farmers did indicate that measures should be implemented to reduce the potential risk of fires developing. This included the provision of fire-fighting equipment on the site during the construction phase. They also indicated that the potential risk of grass fires was heightened by the windy conditions in the area, specifically during the dry, summer months from May to October.

Table 4.6: Assessment of impact of increased risk of grass fires

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences;
- Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
- The contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;
- The contractor should provide adequate fire fighting equipment on-site;
- The contractor should provide fire-fighting training to selected construction staff;
- No construction staff, with the exception of security staff, to be accommodated on site over night;
- As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

4.3.8 Impacts associated with construction vehicles

The movement of heavy construction vehicles during the construction phase has the potential to damage local farm roads and create dust and safety impacts for other road users in the area and also impact on farming activities. The project components are likely to be transported to the site from Cape Town via the N1. The N1 provides the key link between the Western Cape and Gauteng and is an important commercial and tourist route. The transport of components of the WEF to the site therefore has the potential to impact on other road users travelling along the N1. Measures will need to be taken to ensure that the potential impact on motorist using the N1 is minimised. The recommended mitigation measures are listed below.

At a local, site specific level, the potential impacts associated with construction related traffic was identified as a key by a number if affected landowners. In terms of the Komsberg West WEF the owner of Wilgerboom has indicated that the proposed new on-site road off the public gravel road (Koornplaats-Komsberg) is located <500m from the Wilgerboom farmstead would not be acceptable. According to information provided by Arcus the road would service the eastern portion of the le Roux properties. The owners of Wilgerboom have indicated that they would not be happy with a road across this portion of their farm. Construction and operational phase concerns with regard to safety and security were cited. The owner has indicated that he would need to consult with the developer in this regard (Myburgh, pers. comm).

As far as the Komsberg East WEF was concerned the issue of access was raised as a key issue by the owner of De Fonteine Farm adjacent to Anysrivier. De Fonteine and Anysrivier share a sole access road off the Laingsburg-Komsberg gravel road. From information provided by Arcus, it would appear that essentially all construction traffic associated with the East WEF would make use of this road, before accessing a proposed new internal road on Anysrivier, which would also provide access to Putterskraal and Gemsbokfontein. De Fonteine was bought three decades ago by three partners from a Stellenbosch engineering firm. The farm was acquired specifically for the semi-desolate, Karoo-wilderness aspect, as a private retreat for the partners, their families and friends. The property supports limited farming, mainly a few sheep. The partners live in Stellenbosch but visit the farm at least one weekend a month throughout the year. A farm house is located on De Fonteine, and is used when the farm is visited. One labourer household permanently lives and works on the property. Substantial work has gone into rehabilitating infrastructure on the farm. A large orchard has been established adjacent to the farmstead (Biesenbach, pers. comm). At present, the road to Anysrivier passes between the De Fonteine farmstead and a low kopje to the west of the road (Photograph 4.1 and 4.2 below). The following key issues were raised by the owners of De Fonteine:

- The current road alignment would be physically incapable of handling the abnormal loads required. The road would need to be widened or re-aligned to the west. The potential for widening is very limited. Both options are likely to significantly disturb the current sense of place;
- A significant amount of abnormal and other traffic would be generated by during the construction phase. This would create noise and dust, affecting the orchard and farmstead, and spoiling the sense of place for this period;
- As the owners are absent most of the time, and only one labourer family lives on the property, security issues were also raised in connection with the road, which would bring "feet and eyes" during the construction (and operational) phases (Biesenbach, pers. comm).

The owners of De Fonteine have indicated that they have no problems with the WEF (turbines, etc) but that use of the farm road as an access road would be unacceptable for the reasons stated above. The owners proposed that the developers investigate an alternative access road which would affect only WEF properties, e.g. via Gemsbokfontein (Biesenbach, pers. comm). This proponent confirmed that this issue has been addressed to the satisfaction or Mr Biesenbach.

Photograph 4.1: Access road from the south viewed from low kopje on De Fonteine

Photograph 4.2: View of the access road (now to Anysrivier) north of De Fonteine

The local farmers also noted that grazing is the main productive resource in the study area and that the veld in the area was sensitive to disturbances, such as movement of heavy vehicles. The movement of construction related traffic should therefore be confined to designated roads.

Experience from other renewable projects also indicates that the transportation of construction workers to and from the site can result in the generation of waste along the route (packaging and bottles etc. thrown out of windows etc.)

Table 4.7: **Assessment of the impacts associated with construction related activities**

Nature: Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No-Go option

There is no impact as it maintains the current status quo.

Recommended mitigation measures

- The final selection of access roads should be discussed with the affected landowners, specifically Mr Myburg (Wilgerboom Farm) and the owners of De Fonteine;
- Where possible the identification of access roads should be confined to properties on which wind turbines are located;
- The contractor must ensure that damage caused by construction related traffic to local public and internal farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor. Experience for other renewable energy projects is that the maintenance for roads is the responsibility of the local district roads authority. In many instances the local district roads authority lack the resources to maintain the local road network. In addition, due to legal restrictions, it is not possible for the contractor to repair damage to public roads. This can result in damage to roads not being repaired before the construction phase is completed. This is an issue that should be addressed with the local district roads authority prior to the commencement of the construction phase;
- As far as possible, the transport of components to the site along the N1 should be planned to avoid weekends and holiday periods;
- Laydown and construction areas should be clearly defined. No vehicles or activities should be permitted outside of these areas;
- Movement of vehicles on the site must be confined to access road. No vehicles be allowed to drive into the veld;
- The contractor must ensure that all construction vehicles adhere to speed limits and vehicles used to transport sand and building materials must be fitted with tarpaulins or covers;
- All workers should receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly;
- All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits;

- The Contractor should ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows should be fined;
- The Contractor should be required to collect waste along the road reserve on a weekly basis;
- Waste generated during the construction phase should be transported to the local landfill site;
- EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times;
- EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.

4.3.9 Impacts associated with loss of farmland

As indicated above, grazing is the main productive resource in the study area. For some operations it provides crucial seasonal grazing. As generally the case in arid areas, the study area veld is very vulnerable to disturbance, and takes decades to recover. The key construction phase related issues are linked to the movement of heavy construction vehicles on the site, establishment of laydown areas, construction roads and trenching in cultivated areas. All of these activities would impact on productive land. The key concern is therefore to avoid or minimize such impacts on arable land. Key issues raised by farmers included:

- Loss of potential productive land due to internal access roads[22];
- Loss of productive land due to turbine or pylons.

Komsberg West WEF

It would appear that the majority of the turbines, the substation and other supporting infrastructure would be located on properties belonging to Mr Andries le Roux. These properties are used for seasonal grazing and are not currently inhabited. The properties are large and only accessible by 4x4. Mr le Roux indicated that the portions proposed for WEF infrastructure would not significantly affect the grazing resource. In addition a small portion of land on Schalkwykskraal identified by the owner as having the potential for future seed/ fodder cropping, would not be affected by the WEF infrastructure (le Roux, pers. comm). Only 4 turbines are proposed on the Myburgh property (Wilgerboom). The turbines are located on low hills south of the farmstead and are unlikely to impact significantly on grazing. However, Mr Myburg was opposed to the initially proposed on-site road <500m from the farmstead and the proposed power lines. The concern raised by Mr Myburg has been addressed by the proponent. Mr Myburg in correspondence with the proponent confirmed that the revised access road effectively address his concerns.

Komsberg East WEF

Properties belonging to four owners would be affected. The bulk of turbines are proposed on kopjes and ridges in the inaccessible northern portions of Anysrivier (Muller) and Putterskraal (Stofberg). The substation and other supporting infrastructure would be located on Putterskraal. Seven turbines are proposed on Gemsbokfontein (Mr. Francois Conradie), and none on Brinksfontein. The relevant owners have indicated that the proposed turbine and substation locations would not significantly impact on grazing, and would not affect any areas suitable for cropping.

[22] The findings of the agricultural assessment indicate that no high potential areas will be impacted.

Table 4.8: Assessment of impact on farmland due to construction related activities

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the WEFs and power lines will damage farmlands and result in a loss of farmlands for grazing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	L	Negative	Low	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No-Go option

There is no impact as it maintains the current status quo.

Recommended mitigation measures

- The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils should be avoided;
- The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowners in the finalisation process and inputs provided should be implemented in the layout as best as possible;
- The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible. No vehicles or activities should be permitted outside of these areas;
- Movement of vehicles on the site must be confined to access road. No vehicles be allowed to drive into the veld;
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from a botanist with experience in arid regions;
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA;
- The implementation of the Rehabilitation Programme should be monitored by the ECO;
- All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;
- EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld;
- Disturbance footprints should be reduced to the minimum.

4.3 OPERATIONAL PHASE SOCIAL IMPACTS

The following key social issues are of relevance to the operational phase:

Potential positive impacts

- Creation of employment and business opportunities and support for local economic development;
- Benefits associated with the establishment of a Community Trust;
- The establishment of renewable energy infrastructure.

Potential negative impacts

- The visual impacts and associated impact on sense of place;
- Potential impact on tourism.

4.4.1 Creation of employment and business opportunities and support for local economic development and development

Based on information from other wind projects the establishment of the Komsberg East and West WEFs would create ~ 60 permanent employment opportunities. Of this total ~ 40 are low skilled workers, 15 semi-skilled and 5 skilled. The annual wage bill for the operational phase will be ~ R 6 million (2015 Rand value). The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community.

It will also be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting employment and skills development contained in the LLM IDP. However, as indicated above, the experience with other renewable energy projects located near small rural towns, such as Laingsburg and Sutherland, is that the the commitment to the implementation of a skills development prior to the commencement of construction phase tends to be limited.

Given the location of the proposed facility the majority of permanent staff is likely to reside in Laingsburg and Sutherland. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in the town, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20 year operational lifespan of the project. The local hospitality industry in Laingsburg and Sutherland is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

Table 4.9: Impact assessment of employment and business creation opportunities

Nature: Creation of employment and business opportunities associated with the operational phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Positive	Low	M	High
With Mitigation/ Enhancement	M	M	M	Positive	Medium	High	High

Assessment of No-Go option

There is no impact as it maintains the current status quo. However, the potential opportunity costs in terms of the loss of employment and skills and development training would be lost which would also represent a negative impact.

Recommended enhancement measures

The enhancement measures listed in Section 4.4.1, i.e. to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition:

- The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project;
- The proponent, in consultation with the LLM, should investigate the options for the establishment of a Community Development Trust (see below).

4.4.2 Benefits associated with the establishment of a Community Trust

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy.

Community Trusts and other socio-economic investments provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. This revenue can be used to fund development initiatives in the area and support the local community. The long term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. In terms of the requirement the minimum ownership percentage for local community is 2.5 %. However, projects generally exceed this figure in order to increase the competitiveness of the project. The revenue for the Community Trusts is via dividend pay-outs once the wind farm is fully operational and revenue generating.

The revenue from the proposed WEF plant can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development;

- Support for SMME's.

Based on the findings of the site visit there are limited economic and associated employment opportunities in Laingsburg and Sutherland. There is a high dependency on social grants, including child support grants. Given these conditions the benefits associated with the establishment of a Community Trust funded by revenue from the proposed WEFs represents the most significant positive socio-economic opportunity for Laingsburg and Sutherland.

In addition, the establishment of the WEFs is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

Table 4.10: Assessment of benefits associated with establishment of community trust

Nature: Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	M	Positive	Medium	M	High
With Mitigation/ Enhancement[23]	M	H	H	Positive	High	H	High

Assessment of No-Go option

There is no impact as it maintains the current status quo. However, the potential opportunity costs in terms of the supporting the social and economic development in the area would be lost. This would also represent a negative impact.

Recommended enhancement measures

- The LLM and members from the Laingsburg and Sutherland community should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the LLM that should be consulted include the Municipal Managers Office, IDP and LED Manager.
- Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community;
- Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEFs.

4.4.3 Development of infrastructure for the generation of clean, renewable energy

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is the nineteenth largest per capita producer of carbon emissions in the world, and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions.

[23] Assumes effective management of Community Trust

The overall contribution to South Africa's total energy requirements of the proposed WEFs is relatively small. However, the development of two 140 MW WEFs will help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

Table 4.11: Implementation of clean, renewable energy infrastructure

Nature: Promotion of clean, renewable energy							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement[24]	H	H	L	Positive	Medium	H	High
With Mitigation/ Enhancement	H	H	H	Positive	Medium	H	High

Assessment of No-Go option

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. This would represent a negative opportunity cost.

Recommended mitigation measures

- The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.
- In order to maximise the benefits of the proposed project the proponent should use the project to promote and increase the contribution of renewable energy to the national energy supply.

4.4.4 Impact on sense of place and rural character of the landscape

The components associated with the proposed facility will have a visual impact and, in so doing, impact on the landscape and rural sense of the place of the area. However, due to the isolated location of the site will not be visible from the N1 to the south.

Komsberg West WEF

It would appear that the majority of the turbines, the substation and other supporting infrastructure would be located on properties belonging to Mr Andries le Roux. These properties are used for seasonal grazing and are not currently inhabited. The properties are large and only accessible by 4x4. Mr le Roux did not raise any concerns regarding impact on the visual character and sense of place of the area. Only 4 turbines (Alternative 2) are proposed on the Myburgh property (Wilgerboom). The turbines would be located on kopjes ~6 km north of the farmstead, and are unlikely to impact significantly on views from the farmstead. However, as indicated above Mr Myburg was initially opposed to the proposed new on-site road which is located <500m from the farmstead and the proposed Tx alignment. As indicated above, the concerns raised by Mr Myburg have been addressed by the proponent.

Komsberg East WEF

Properties belonging to four owners will be affected. The bulk of turbines are proposed on kopjes and ridges in the inaccessible northern portions of Anysrivier

[24] Assumes that the proposed WEF will not be established

(Muller) and Putterskraal (Stofberg). The substation and other supporting infrastructure would be located on Putterskraal. Seven turbines are proposed on Gemsbokfontein (Mr. Francois Conradie), and none on Brinksfontein. Certain turbine positons were a concern to the Mullers but these issues have been settled with the proponent.

The authors experience with this issue is that a number of people have commented positively on a number of wind energy facilities that have been established in the last 12-24 months, such as the facilities located near Vredenburg, Caledon and Humansdorp in the Western and Eastern Cape respectively (Photograph 4.3). All of these facilities are clearly visible from the roads in the area, including the N2 in the case of Caledon and Humansdorp. Some observers have however commented that the turbines have a negative impact on the visual quality of the landscape. The visual impact and the significance thereof associated with a 280 MW WEF on the areas sense of place is therefore likely to vary from individual to individual.

Photograph 4.3: Wind turbines associated with West Coast 1 WEF near Vredenburg

Table 4.12: Visual impact and impact on sense of place

Nature: Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	H	Negative	High	M	Medium
With Mitigation/ Enhancement	M	M	M	Negative	Medium	M	Medium

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The final placement of wind turbines associated with the Komsberg East and West WEFs should be discussed with the affected landowners, specifically Mr Myburg and Muller;
- The recommendations of the VIA should be implemented.

4.4.5 Potential impacts on tourism

The N1 is an important tourism route linking Cape Town with Gauteng. However the area is not a tourism destination in itself and none of the turbine structures will be visible from the N1 due to the distance of the site from the N1 (~ 40km). Based on the findings of the SIA there appear to be no major tourism activities and or destinations in the immediate vicinity of the site that would potentially be impacted by the proposed WEF, such as game lodges etc. The impact on tourism in the area is therefore likely to be limited.

Careful placing would reduce the overall visual impact of the proposed WEF on the areas sense of place. However, this is unlikely to change the significance rating in terms of impact on tourism. The proposed WEF may also attract visitors to the area. However, the significance of this positive impact is also likely to be minor.

Table 4.13: Potential impact on tourism

Nature: Potential impact of the WEF on local tourism							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
With Mitigation/ Enhancement	M	M	L	Negative	Low	M	High

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The final placement of wind turbines associated with the Komsberg East and West WEFs should be discussed with the affected landowners, specifically Mr Myburg and Muller;
- The recommendations of the VIA should be implemented.

4.4 ASSESSMENT OF POWER LINES

Komsberg West Transmission Line

The proposed Komsberg West Tx line would affect 5 land owners, two of whom are also affected by the proposed Komsberg East and West WEF's, namely Mr Andries le Roux (West WEF) and Mr Francois Conradie (East WEF). In addition, the relevant properties of four of the five land owners form part of other WEF sites, namely Great Karoo and Karusa. With the exception of the le Roux properties, all farms are permanently inhabited by their owners and are accessed off the Komsberg gravel road.

An existing 400 kV Eskom line is located across two of the relevant farms (Saaiplaas and Damslaagte). The proposed Komsberg West Tx line would follow the existing line (within ~200 m) over more than a third of its course. An additional existing Tx corridor is located across the southern portions of Saaiplaas (Mr. Francois Conradie) and Schalkwykskraal (Mr. Andries le Roux).

As indicated, the le Roux properties are uninhabited and used only for winter grazing. With the exception of ~200m on Saaiplaas, the proposed line would not traverse any cropping areas on the relevant properties. The line would be located ~600m (Damslaagte), ~900m (Saaiplaas), ~1.2 km (De Plaat) and ~5.5 km (De Hoop) from farmsteads on the relevant properties. The new Tx line would traverse one public road, namely the Komsberg gravel road (twice).

No issues were raised by the relevant owners. From a map shown by Mr Eldri van Zyl, the proposed alignment across De Plaat, De Hoop, Damslaagte and Saaiplaas appears to be similar to the Tx line proposed for the Great Karoo WEF.

Komsberg East Transmission Line

All properties affected by the West Tx alignment would also be affected by the East Tx alignment. In addition, the line would traverse all the site farms located to the west of the le Roux properties, i.e. all the farms comprising the East WEF, as well as Wilgerboom (Mr. Bilie Myburgh).

The relevant area is not currently traversed by any Eskom Tx lines, but is by a Eskom 66kV Dx line. The proposed Tx line would traverse one public road, namely the Koornplaats-Komsberg gravel road. With the exception of Wilgerboom and Brinksfontein (both <1km), the proposed line is not located in meaningful proximity to any farmsteads.

Only the owners of Wilgerboom and Brinksfontein have raised issues with regard to the proposed line. In that regard, the owner has indicated that the line would traverse the property at the entrance gate to the farm, detracting from the current sense of place and views from the farmstead. It is furthermore felt that the line would be too close to the farmstead, posing a security risk during the operational phase. The owner has indicated that he is not averse to a Tx line crossing his property, but that it should be located to well to the north of the farmstead, and out of the farmstead's view shed (Myburgh, pers. comm). As indicated above, the concerns raised by Mr Myburg have been addressed by the proponent.

Based on the findings of the SIA the social impacts associated with the transmission lines for the Komsberg East and West WEFs can be mitigated with careful route selection. The significance with careful route selection would be low negative.

Table 4.14: Assessment of power line alternatives

Nature: Potential visual impact and impact on sense of place associated with power lines							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	M	Negative	Medium	M	Medium
With Mitigation/ Enhancement	M	M	L	Negative	Low	M	Medium

Assessment of No-Go option

There is no impact as it maintains the current status quo.

Recommended mitigation measures

- The alignment of the transmission power line should be done so as to ensure that the concerns raised by the owners of Wilgerboom and Brinksfontein Farm are addressed;
- The recommendations of the VIA should be implemented.

4.5 ASSESSMENT OF DECOMMISSIONING PHASE

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase may also involve the disassembly and replacement of the existing components with more modern technology. This would take place in the 20 - 25 years post commissioning. The decommissioning phase therefore has the potential to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning. The number of people employed during the operational phase of a single 140 MW WEF will be in the region of 15-20. Given the relatively low number of people employed during the operational phase the decommissioning of the facility is unlikely to have a significant negative social impact on the local community. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme.

Table 4.15: Impacts associated with decommissioning

Nature: social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	M	High

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures

- The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned;
- All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning;
- All disturbed areas should be rehabilitated on decommissioning;
- The proponent should investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site.

4.6 POTENTIAL HEALTH IMPACTS

The potential health impacts typically associated with WEFs include, noise, shadow flicker and electromagnetic radiation. As indicated above, the findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation, and may therefore in fact result in the minimization of adverse health impacts for the population as a whole (WHO, 2004).

Based on these findings it is assumed that the significance of the potential health risks posed by the proposed WEFs is of low significance. None of the local landowners interviewed raised concerns regarding the potential noise impacts generated by the movement of the turbines.

The noise produced by wind turbines is associated with their internal operation and the movement of the turbine blades through the air. The noise levels are dependent on a number of factors, including, the number of turbines operating, wind speed and direction. Noise levels diminish with distance from the WEF. However, while noise emissions increase with increasing wind speed, this is often, but not always, accompanied by an increase in the background noise environment. The background noise is associated with wind blowing past or through objects, such as trees or buildings. As a result, the background noise near a dwelling may be high enough to 'mask' the sound of the turbines. This may not, however, always be the case.

Concerns have also been raised regarding the potential health impacts associated with low frequency noise (rumbling, thumping) and infrasound (noise below the normal frequency range of human hearing) from wind farms. Research undertaken in Australia indicates that low frequency noise and infrasound levels generated by wind farms are normally at levels that are well below the uppermost levels required to cause any health effects. However, this does not mean that the low, subliminal noise levels that are associated with WEFs do not impact on the psychological well-being of affected parties if not setback. All wind turbines are well over 1 km away from any noise receptors on the sites with 650m being the internationally accepted minimum.

The potential impacts associated with noise form the basis for a separate noise study. The SIA is therefore not in position to assess the significance of noise impacts. However, as indicated above, sensitivity to noise impacts will differ from individual to individual.

4.7 CUMULATIVE IMPACT ON SENSE OF PLACE

The Australian Wind Farm Development Guidelines (Draft, July 2010) indicate that the cumulative impact of multiple wind farm facilities is likely to become an increasingly important issue for wind farm developments in Australia. The key concerns in terms of cumulative impacts are linked to visual impacts and the impact on rural, undeveloped landscapes.

The Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. The relevant issues raised by the Scottish Natural Heritage Report include:

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

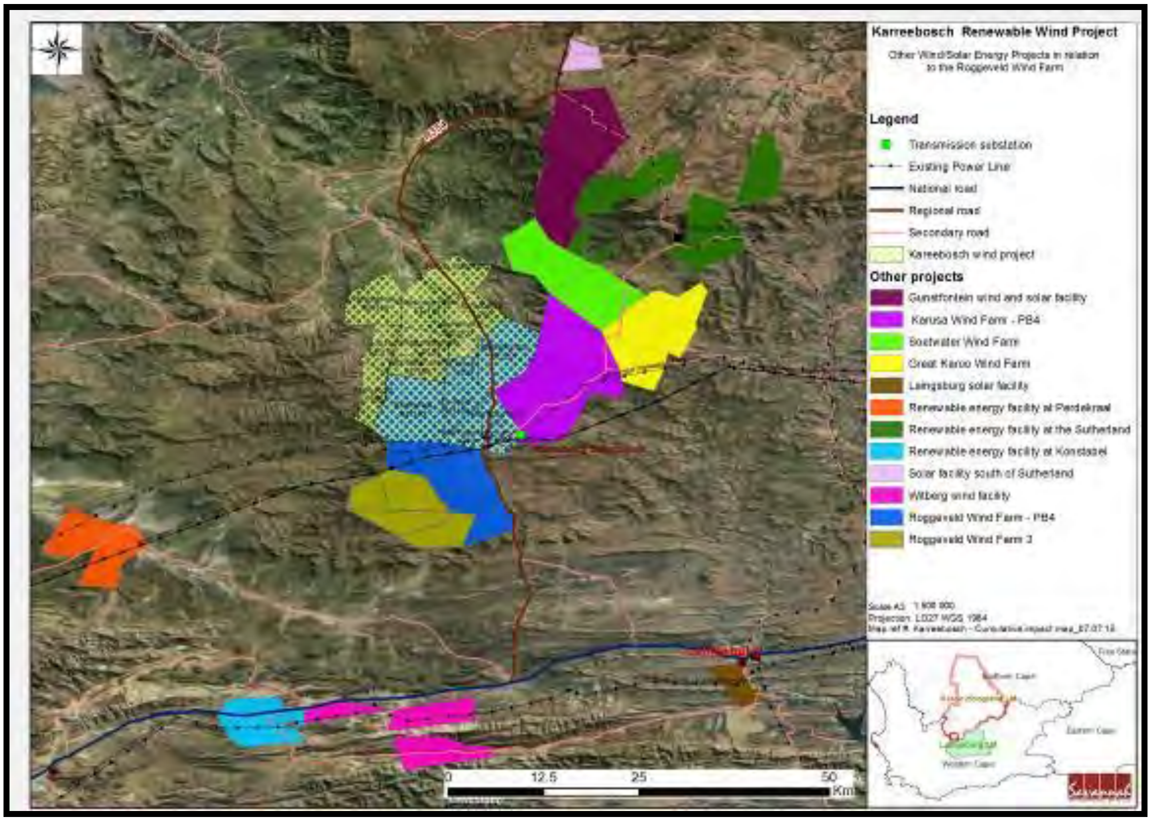
The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Research on wind farms undertaken by Warren and Birnie (2009) also highlights the visual and cumulative impacts on landscape character. The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and diametrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries. The paper also identifies two factors that are important in shaping people's perceptions of wind farms' landscape impacts. The first of these is the cumulative impact of increasing numbers of wind farms (Campbell, 2008). The research found that if people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. This relates to people's perception and relationship with the landscape. In the South African context, many South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape.

As indicated in Figure 4.1 there are 12 renewable energy projects, including 10 WEFs and associated power lines, located in the study area. The potential for cumulative impacts associated with combined visibility (whether two or more wind facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. However, this should be viewed within the context of the identification of the area as a renewable energy development zone. The area has therefore been identified as an area where renewable energy should be concentrated.

In addition, due to the proximity of the different sites the various WEFs and associated power lines could be viewed as a single large WEF as opposed to a number of separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impacts associated with combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). This therefore reduces the potential cumulative impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the areas sense of place in to one area as opposed to impacting on a number of more spread out areas.

However, the potential impact of wind energy facilities on the landscape is an issue that does need to be considered, specifically given South African's strong attachment to the land and the growing number of wind facility applications. With regard to the area, a number of WEFs have been proposed in the Western Cape Province. The Environmental Authorities should therefore be aware of the potential cumulative impacts when evaluating applications.



Source: Savannah Consulting (2014)
Figure 4.1: Location of approved and planned WEFs in the study area

Table 4.16: Cumulative impacts on sense of place and the landscape

Nature: Cumulative visual impact associated with the establishment of a WEF on the on the areas rural sense of place and character of the landscape							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	H	H	M	Negative	High	M	Medium
With Mitigation/ Enhancement	M	M	M	Negative	Medium	M	Medium

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The final placement of wind turbines associated with the Komsberg East and West WEFs should be discussed with the affected landowners, specifically Mr Myburg and Muller;
- The recommendations of the VIA should be implemented;

The establishment of a number of large renewable energy facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of such facilities in an area. This must, however, also be considered in terms of the area being determined a

Renewable Energy Development Zone by the CSIR under the DEAs SEA process and that clustering sites does reduce impact.

4.8 CUMULATIVE IMPACT ON LOCAL ECONOMY

In addition to the potential negative impacts, the establishment of the Komsberg East and West WEFs has the potential to result in significant positive cumulative socio-economic opportunities for the region, which, in turn, will result in a positive social benefit.

As indicated above, there are 12 renewable energy projects proposed in the study area. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The Community Trusts associated with each project will also create significant socio-economic benefits for the LLM and KHLM. However, in order to maximise the benefits these trusts will need to be properly managed.

Table 4.17: Cumulative impacts on local economy

Nature: The establishment of a number of renewable energy facilities in the region will create employment, skills development and training opportunities, creation of downstream business opportunities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	M	Positive	Medium	M	High
With Mitigation/ Enhancement	H	H	M	Positive	High	M	High

Assessment of No-Go option

There is no impact as it maintains the current status quo. This would represent a lost socio-economic opportunity for the LLM and KHLM.

Recommended enhancement measures

- Recommendations associated with the creation of employment opportunities during the construction phase and operational phase apply;
- Recommendations pertaining to the establishment of Community Trusts apply.

4.9 ASSESSMENT OF NO-DEVELOPMENT OPTION

As indicated above, South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost. However, at a provincial and national level, it should be noted that the proposed WEF development is not unique. In this regard, a significant number of other renewable energy developments are currently proposed in the Western Cape and other parts of South Africa. Foregoing the proposed establishment of WEFs would therefore not necessarily compromise the development of renewable energy facilities in the Western Cape Province and or South Africa. However, the socio-economic benefits for local communities in Laingsburg, Sutherland and the LLM would be forfeited.

Table 4.18: Assessment of no-development option

Nature: The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy and a lost opportunity for the towns of Laingsburg, Sutherland and LLM.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	L	Negative	Medium	M	High
With Mitigation/ Enhancement[25]	H	H	M	Positive	High	M	High

Recommended enhancement measures

- The recommendations associated with the creation of employment opportunities during the construction phase and operational phase, and the recommendations pertaining to the establishment of Community Trusts apply;
- The recommendations relating to visual impact and impact on sense of place also apply.

[25] Assumes establishment of a Community Trust that is well managed

SECTION 5: KEY FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

Section 5 lists the key findings of the study and recommendations. These findings are based on:

- A review of the issues identified during the Scoping Process;
- A review of key planning and policy documents pertaining to the area;
- Semi-structured interviews with interested and affected parties;
- A review of social and economic issues associated with similar developments;
- A review of selected specialist studies undertaken as part of the EIA;
- A review of relevant literature on social and economic impacts;
- The experience of the authors with other wind energy projects in South Africa

5.2 SUMMARY OF KEY FINDINGS

The key findings of the study are summarised under the following sections:

- Fit with policy and planning;
- Construction phase impacts;
- Operational phase impacts;
- Cumulative Impacts;
- Decommissioning phase impacts;
- No-development option.

5.2.1 Policy and planning issues

For the purposes of the meeting the objectives of the SIA the following national, provincial and local level policy and planning documents were reviewed, namely:

National
- National Energy Act (2008);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- White Paper on Renewable Energy (November 2003);
- Integrated Resource Plan (IRP) for South Africa (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012);
- Astronomy Geographic Advantage (AGA) Act (Act 21 of 2007).

Provincial and local
- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014;
- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);

- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2010);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006); and
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002).
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Laingsburg Local Municipality Integrated Development Plan (2012-2017).
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

As indicated above, small section of the site is located in the Karoo Hoogland Municipality (KHLM) within the Northern Cape Province. The following provincial level policy and planning documents were reviewed:

- Karoo Hoogland Local Municipality Integrated Development Plan (2012-2017);
- Northern Cape Provincial Growth and Development Strategy (2004-2014);
- Northern Cape Climate Change Response Strategy;
- Northern Cape Spatial Development Framework;

The findings of the review indicated that renewable energy is strongly supported at a national and local level. At a national level the White Paper on Energy Policy (1998) notes:

- Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future; and,
- The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

The IRP 2010 also allocates 43% of energy generation in South Africa to renewables, while the New Growth Path Framework and the National Infrastructure Plan both support the development of the renewable energy sector.

The development of and investment in renewable energy is also supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all make reference to renewable energy. At a provincial level the development of renewable energy is supported by the Northern Cape Provincial Growth and Development Strategy, Northern Cape Provincial Spatial Development Framework, White Paper on Sustainable Energy for the Western Cape, Climate Change Strategy and Action Plan for the Western Cape and Western Cape Growth and Development Strategy.

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that the development of renewable energy is supported at a national and provincial level. The area has also been identified as an area where renewable energy should be concentrated. It is therefore the opinion of the authors that the establishment of the proposed WEF is supported by the relevant policies and planning documents.

However, the provincial and local policy and planning documents also make reference to the importance of tourism and the region's natural resources. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed facility, does not materially impact on the region's natural resources and the tourism potential of the Province.

5.1.1 Construction phase impacts

The key social issues associated with the construction phase include:

Potential positive impacts

- Creation of employment and business opportunities, and the opportunity for skills development and on-site training;
- Benefits associated with providing technical advice on wind energy to local farmers and municipalities;
- Improved cell phone reception.

The construction phase for a single 280 MW WEF is expected to extend over a period of 18-24 months and create approximately ~ 400 employment opportunities. It is anticipated that approximately 55% (220) of the employment opportunities will be available to low skilled workers (construction labourers, security staff etc.), 30% (120) to semi-skilled workers (drivers, equipment operators etc.) and 15% (60) for skilled personnel (engineers, land surveyors, project managers etc.). The construction of the Komsberg East and West WEFs (550 MW) will not create an additional 400 new employment opportunities. Assuming that the construction of Komsberg East and West WEFs follow on from each other it is highly likely that the majority of the original 400 workers will be employed for the construction of the first 280 MWs will be employed for the construction of the second 280 MWs. For the purposes of the assessment is it assumed that 80% (320) of the original 400 workers working on the construction of the first 280 MW WEF will be employed for the construction of the second 280 MW WEF. The total number of employment opportunities created by Komsberg East and West WEFs will therefore be ~ 480.

Members from the local community in the area may be in a position to qualify for the majority of the low skilled and semi-skilled employment opportunities. The levels of unemployment in Laingsburg, Sutherland and the LLM are high. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from Laingsburg, Sutherland and the LLM. The creation of potential employment opportunities, even temporary employment, will therefore represent a significant, if localised, social benefit. While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited the construction of three wind energy projects in the area which is planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Komsberg WEFs. It is estimated that these projects will employ 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy.

The total wage bill for the 18-24 month construction phase of a single 240 MW WEF will be in the region of R 100 million (2015 Rand value). The total wage bill for the construction of 550 MWs (Komsberg East and West) would therefore be ~ R 200 million (2015 Rand value). A percentage of the wage bill will be spent in the local economy and will create significant opportunities for local businesses in Laingsburg, Sutherland and the LLM. Given the high unemployment and low income levels in Laingsburg, Sutherland and the LLM even a small percentage of the monthly salary bill spend would represent a significant opportunity. This benefit will extend over a period of ~ 4 years assuming that the construction of the Komsberg East and West WEFs follow on from each other.

The capital expenditure associated with the construction of a 280 MW WEF will be in the region of R 5 billion (2015 Rand value). The total combined capital expenditure for the Komsberg East and West WEFs will therefore be ~ R 10 billion (2015 Rand value). A percentage of the capital expenditure associated with the construction phase has the potential to benefit local companies. However, the opportunities for local companies in Laingsburg, Sutherland and the LLM will be limited. In this regard the benefits are likely to accrue to building contractors and suppliers based in towns based further afield, such as Worcester, Paarl and Cape Town.

The sector of the local Laingsburg and Sutherland economy that will benefit from the proposed development is the local service industry. This is also confirmed by the experience with the other renewable projects. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the meeting the needs of 400 construction workers who will need to be accommodated, transported to site and fed (3 meals a day) over a period of 4 years (Komsberg East and West). Experience for other renewable energy projects located near small towns, such as Pofadder in the Northern Cape Province, is that local residents and businesses have benefitted significantly from meeting the needs of construction workers. However, the presence of construction workers also has the potential to impact negatively on local family and social networks.

However, based on the findings of the site visit there may not be not sufficient accommodation in Laingsburg and Sutherland and surrounds to accommodate all the construction workers. The issue of accommodation therefore represents a potential challenge and will need to addressed in consultation with the LLM, community representatives and local farmers from the area should the project proceed.

The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors which would support local economic development in the LLM.

Potential negative impacts

- Impacts associated with the presence of construction workers on site and in the area;
- Influx of job seekers to the area;
- Increased safety risk to farmers, risk of stock theft and damage to farm infrastructure associated with presence of construction workers on the site;
- Increased risk of veld fires;
- Impact of heavy vehicles, including damage to roads, safety and dust;
- Potential loss of productive farmland associated with construction-related activities.

The findings of the SIA indicate that the significance rating for all of the potential negative impacts with mitigation is **Low Negative**. All of the potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. However, in order to effectively mitigate the impact of construction workers on the local community of Laingsburg and Sutherland will require a commitment to employing local community members. In the absence of such a commitment the impact of construction workers on the local community of Laingsburg and Sutherland was assessed to be **Medium Negative**.

Table 5.1 summarises the significance of the impacts associated with the construction phase.

Table 5.1: Summary of social impacts during construction phase

Impact	Significance No Mitigation	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Medium (Positive)	High (Positive)
Benefits associated with providing technical advice to local farmers and municipalities	N/A	Low (Positive)
Improved cell-phone coverage	N/A	Low (Positive)
Presence of construction workers and potential impacts on family structures and social networks	Medium (Negative for community as a whole)	Low (Negative for community as a whole)
Influx of job seekers	Low (Negative)	Low (Negative)
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Medium (Negative)	Low (Negative)
Increased risk of veld fires	Medium (Negative)	Low (Negative)
Impact of heavy vehicles and construction activities	Medium (Negative)	Low (Negative)
Loss of farmland	Low (Negative)	Low (Negative)

5.2.2 Operational phase

The key social issues affecting the operational phase include:

Potential positive impacts

- Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
- Benefits associated with the establishment of a Community Trust and other Economic Development commitments and programmes associated with the bidding requirements set out by the Department of Energy;
- The establishment of infrastructure to generate renewable energy.

The total number of permanent employment opportunities associated with the Komsberg East and West WEFs would be ~ 60. Of this total ~ 40 are low skilled workers, 15 semi-skilled and 5 skilled. The annual wage bill for the operational phase will be ~ R 6 million (2015 Rand value). The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. Given the location of the proposed facility the majority of permanent staff is likely to reside in Laingsburg and Sutherland which will benefit the local economy.

The establishment of a Community Trust and other economic development commitments and initiatives also creates an opportunity to support local economic development in the area. Community Trusts provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. The revenue from the proposed WEFs can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development;
- Support for SMME's.

The long term duration of the revenue stream associated with a WEF linked Community Trust also enables local municipalities and communities to undertake long term planning for the area. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change and a lack of generation capacity in South Africa, represents a positive social benefit for society as a whole.

Potential negative impacts

- The visual impacts and associated impact on sense of place;
- Potential impact on tourism.

The visual impacts on landscape character associated with large renewable energy facilities, such as WEFs, are highlighted in the research undertaken by Warren and Birnie (2009). In the South African context, the many of South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape. The impact of large, WEFs on the landscape is therefore a key issue in wind farm development South Africa, specifically given South African's strong attachment to the land and the growing number of renewable energy applications. Based on the findings of the SIA the significance of the visual impact associated with the Komsberg WEFs with mitigation was rated **Medium Negative**.

Table 5.2 summarises the significance of the impacts associated with the operational phase.

Table 5.2: Summary of social impacts during operational phase

Impact	Significance No Mitigation	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Low (Positive)	Medium (Positive)
Establishment of Community Trust	Medium (Positive)	High (Positive)
Promotion of renewable energy projects	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	High (Negative)	Medium (Negative)
Impact on tourism	Low	Low

5.2.3 Assessment of cumulative impacts

Twelve (12) renewable energy projects, including 10 WEFs, are located in the study area. The potential for cumulative impacts associated with combined visibility (whether two or more wind facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. The significance with mitigation is rated a **Medium Negative**. However, this should be viewed within the context of the area being identified as a Renewable Energy Development Zone by the CSIR under the DEAs SEA process. The area has therefore been identified as an area where renewable energy should be concentrated.

In addition, due to the proximity of the different sites the various WEFs could be viewed as a single large WEF as opposed to a number of separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impacts associated with combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). This therefore reduces the potential cumulative impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the areas sense of place in to one area as opposed to impacting on a number of more spread out areas.

In addition to the potential negative impacts, the establishment of the proposed WEF and other renewable energy projects in the area also has the potential to create a number of socio-economic opportunities for the LLM and KHLM, which, in turn, will result in a positive social benefit. The positive cumulative impacts include the creation of employment, skills development and training opportunities, creation of downstream business opportunities. This benefit is rated as **High Positive** with enhancement.

5.2.4 Power line options

Based on the findings of the SIA the social impacts associated with the transmission lines for the Komsberg East and West WEFs can be mitigated with careful route selection. The significance with careful route selection would be **Low Negative**.

5.2.5 Potential health impacts

The potential health impacts typically associated with WEFs include, noise, shadow flicker and electromagnetic radiation. As indicated above, the findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation and in fact will have positive health benefits (WHO, 2004). Based on these findings it is assumed that the significance of the potential health risks posed by the proposed Komsberg East and West WEFs is of **Low Negative** significance.

5.2.6 Assessment of no-development option

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a High negative social cost. The no-development option also represents a lost opportunity in terms of the employment and business opportunities (construction and operational phase) associated with the proposed Komsberg East and West WEFs, and the benefits associated with the establishment of a Community Trust. This also represents a negative social cost. The significance of this cost is rated as **Medium Negative**.

However, at a provincial and national level, it should be noted that the proposed WEFs are not unique. In this regard, a significant number of renewable energy developments, including WEFs, are currently proposed in the Western Cape and South Africa. Foregoing the development of the proposed Komsberg East and West WEFs would therefore not necessarily compromise the development of renewable energy facilities in the Western Cape and or South Africa. However, the socio-economic benefits the local communities in Laingsburg, Sutherland and the LLM would be forgone.

5.2.7 Decommissioning phase

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the WEFs decommissioning phase may involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20-25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

Given the number people associated with the operational phase for Komsberg East and West WEFs (~ 60), the potential social impacts linked to the decommissioning of the facility will need to be managed through the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be **Low Negative.**

5.3 CONCLUSIONS AND RECOMMENDATIONS

The findings of the SIA indicate that the development of the proposed Komsberg East and West WEFs will create employment and business opportunities for the local economy, specifically during the construction phase. However, for the community of Laingsburg and Sutherland to benefit from these opportunities will require a commitment to employ local community members and implement an effective training and skills development programme where required. The establishment of a Community Trust will also benefit the local community. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change and a lack of generation capacity in South Africa, represents a positive social benefit for society as a whole.

The potential visual impacts associated with the proposed Komsberg East and West WEFs can be effectively addressed with careful siting of selected wind turbines. In addition, the recommendations contained in the VIA should be implemented.

It is therefore recommended that the Komsberg East and West WEFs be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the SIA and VIA Report.

5.4 IMPACT STATEMENT

The findings of the SIA undertaken for the proposed Komsberg East and West WEFs indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the area. It is therefore recommended that the Komsberg East and West WEFs be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the SIA report and other key specialist studies.

ANNEXURE A

INTERVIEWS

- Biesenbach, Mr. Johann (20-10-2015). De Fonteine Boerdery, Laingsburg.
- Le Roux, Mr. Andries (19-10-2015). Die Plaat 205/1; Schalkwykskraal 204/2; Vlakkloof 11/0; Welgemoed 268/1&2.
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- Muller, Mr Hennie (20-10-2015). Anysriviersplaat 13/0; Dwarsrivier 14/RE.
- Myburgh, Mr Billie (19-10-2015). Taayboschkraal 12/2&3
- Stofberg, Mr Pieter (telephonic – 14-10-2015). Taayboschkraal 12/1; Koornplaats 41/2; Boschmanskloof 9/3
- Van Zyl, Mr. Eldri (19-10-2015). Kentucky 206.

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- Conradie, Mr. Francois (14-10-2015). Taayboschkraal 12/4; Standvastigheid 210/RE.

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[26] Actual datasets for specific portions of WEF site range from 2003-2011.

ANNEXURE B

ASSESSMENT METHODOLOGY

The evaluation method for determining significance of impacts is shown below.[27]

Note that an adjustment was made, which involved changing the consequence column to the significance column, due to the fact that probability should not necessarily determine significance, as, for example, catastrophic events would be highly significant, even though the probability of such an event occurring is low.

Definitions of or criteria for environmental impact parameters

The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

Extent (spatial scale):

Ranking criteria

L	M	H
Impact is localized within site boundary	Widespread impact beyond site boundary; Local	Impact widespread far beyond site boundary; Regional/national

Take into consideration:
Access to resources; amenity
Threats to lifestyles, traditions and values
Cumulative impacts, including possible changes to land uses at and around the site.

Duration:

Ranking criteria

L	M	H
Quickly reversible, less than project life, short term (0-5 years)	Reversible over time; medium term to life of project (5-15 years)	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

Take into consideration:
Cost – benefit economically and socially (e.g. long or short term costs/benefits)

[27] (Adapted from T Hacking, AATS – Envirolink, 1998: An innovative approach to structuring environmental impact assessment reports. In: IAIA SA 1998 Conference Papers and Notes

Intensity (severity):

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration, death, illness or injury, loss of habitat/ diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, Partial loss of habitat/biodiversity/ resource or slight or alteration	Minor deterioration, nuisance or irritation, minor change in species/habitat/ diversity or resource, no or very little quality deterioration.	Minor improvement, restoration, improved management	Moderate improvement, restoration, improved management, substitution	Substantial improvement, substitution
Quantitative	Measurable deterioration Recommended level will often be violated (e.g. pollution)	Measurable deterioration Recommended level will occasionally be violated	No measurable change; Recommended level will never be violated	No measurable change; Within or better than recommended level.	Measurable improvement	Measurable improvement
Community response	Vigorous	Widespread complaints	Sporadic complaints	No observed reaction	Some support	Favourable publicity

Take into consideration:
Cost – benefit economically and socially (e.g. high nett cost = substantial deterioration)
Impacts on human-induced climate change
Impacts on future management (e.g. easy/practical to manage with change or recommendation)

Probability of occurrence:

Ranking criteria

L	M	H
Unlikely; low likelihood; Seldom No known risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent Low to medium risk or vulnerability to natural or induced hazards.	Definite (regardless of prevention measures), highly likely, continuous High risk or vulnerability to natural or induced hazards.

The specialist study must attempt to quantify the magnitude of impacts and outline the rationale used. Where appropriate, international standards are to be used as a measure of the level of impact.

Status of the impact:

Describe whether the impact is positive, negative or neutral for each parameter. The ranking criteria are described in negative terms. Where positive impacts are identified, use the opposite, positive descriptions for criteria.

Based on a synthesis of the information contained in (a) to (e) above, the specialist will be required to assess the significance of potential impacts in terms of the following criteria:

Significance: (Duration X Extent X Intensity)

Intensity = L				
Duration	H			
	M			Medium
	L	Low		
Intensity = M				
Duration	H			High
	M		Medium	
	L	Low		
Intensity = H				
Duration	H			
	M			High
	L	Medium		
		L	M	H
		Extent		

Positive impacts would be ranked in the same way as negative impacts, but result in high, medium or low positive consequence.

Degree of confidence in predictions:

State the degree of confidence in the predictions, based on the availability of information and specialist knowledge.

Significance Table Format:

Example of how significance tables should be formatted.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation							
With Mitigation							

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED KOMSBERG EAST AND WEST WIND FARMS AND ASSOCIATED GRID CONNECTION INFRASTRUCTURE:

FAUNA & FLORA SPECIALIST IMPACT ASSESSMENT REPORT

PRODUCED FOR ARCUS

ON BEHALF OF KOMSBERG WIND FARMS (Pty) Ltd

BY

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December 2015

CONTENTS

1 INTRODUCTION

Komsberg Windfarms (Pty) Ltd proposes the establishment of a two phase wind energy facility located 60km NE of Laingsburg and 40km SE of Sutherland in the foothills of the Komsberg mountain range along the Great Escarpment. The site falls within the Karoo Hoogland Local Municipality, Northern Cape and Laingsburg Local Municipality, Western Cape. The proposed facility would consist of two phases, Komsberg East and Komsberg West, with up to 55 wind turbines with a total output of up to 275MW each. An approximately 35km (Komsberg West) and approximately 55km (Komsberg East) high voltage power line from the onsite substation to the National Grid at the Eskom Komsberg Main Transmission Substation would also be required. As the development has two phases, two applications for authorization would be required and so each phase and the grid connection for each facility are assessed independently within the report.

As part of the above EIA process, this ecological specialist study details the ecological characteristics of the site and provides an assessment of the likely ecological impacts associated with the development of two phases of wind energy development and associated grid connection at the site. Impacts are assessed for the preconstruction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the EMPr for the development. The full scope of study is detailed in Section 2 below.

1.1 Relevant Aspects of the Development

Overall, there are four components to the proposed development, comprising two WEFs and their associated grid connections. These are:

- Komsberg East Wind Energy Facility, Western Cape Province;
- Komsberg West Wind Energy Facility, Western and Northern Cape Provinces;
- Komsberg East Grid Connection, Western and Northern Cape Provinces; and
- Komsberg West Grid Connection, Western and Northern Cape Provinces.

The maximum capacity of the proposed facilities exceeds the current Department of Energy (DoE) limit of 140MW installed capacity. However, the applicant is applying for up to 275MW in order to cater for a potential change in policy in future Government procurement processes where the limit may be increased. Furthermore, the technical feasibility of 5MW wind turbines would also need to be verified at implementation.

Wind Energy Facility Components will include the following:

- 55 Wind turbines each between 3MW and 5MW in capacity with a rotor diameter of up to 140m and a hub height of up to 120m.

- Maximum generation capacity of up to 275MW each.
- Foundations and hardstands associated with the wind turbines of up to 50m x 30m.
- During construction access roads will be up 20m wide but would be rehabilitated to 6-8m wide during operation. Road length will be up to 50km in total.
- Medium voltage cabling between turbines and the substation, to be laid underground where practical.
- Overhead medium voltage cables between turbine strings or rows.
- 100 x150m on-site substation complex to facilitate stepping up the voltage from medium to high voltage (up to 400kV) to enable the connection of the wind farm to the national grid.

Grid Connection components will include the following:

- An approximately 35km (Komsberg West) and approximately 55km (Komsberg East) 132kV power line from the onsite substation to the National Grid at the Eskom Komsberg Main Transmission Substation.
- 100 x150m Switching Station
- A 30 x50m operations and services workshop area / office building for control, maintenance and storage; and
- Temporary infrastructure including a site camp, laydown areas and a batching plant totaling 150 x100m in extent.

More details on the construction and operation of the facility are provided in the main EIA report and are not repeated here.

2 STUDY APPROACH

2.1 SCOPE OF STUDY

The scope of the study includes the following activities

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (incl. using direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct indirect and cumulative impacts in terms of the following criteria :

- the nature of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
- the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
- the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
- the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (Impact will occur regardless of any preventable measures)
- the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit) severe/beneficial (long-term impact that could be mitigated/long-term benefit) moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
- the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
- the status which will be described as either positive, negative or neutral
- the degree to which the impact can be reversed
- the degree to which the impact may cause irreplaceable loss of resources
- the degree to which the impact can be mitigated

- a description and comparative assessment of all alternatives including cumulative impacts
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement which contains :
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity;
    - a comparative assessment of the positive and negative implications of identified alternatives

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for faunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided which will be separated into the following project phases:

- Preconstruction
- Construction
- Operational Phase
- Decommissioning

2.2 ASSESSMENT APPROACH & PHILOSOPHY

The assessment will be conducted according to the EIA Regulations, published by the Department of Environmental Affairs (2014) as well as within the best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).

This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should.

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;

- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show (through the EIA process) how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc.*).

Species level

- Red Data Book species (giving location if possible using GPS)
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify species of special concern (SSC) and that are known to be:

- endemic to the region;
- that are considered to be of conservational concern;
- that are in commercial trade (CITES listed species);
- or, are of cultural significance.

- Provide monitoring requirements as input into the Environmental Management Plan (EMP) for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

2.3 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas for the site and surroundings were extracted from the *Namakwa District Biodiversity Sector Plan* (Desmet & Marsh 2008) as well as the *Biodiversity Assessment of the Central Karoo District Municipality* (Skowno et al. 2009).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 3220DB 3220DD 3221CA 3221CC was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
- The IUCN conservation status (Figure 1) of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2013).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2015 (See Figure 1) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

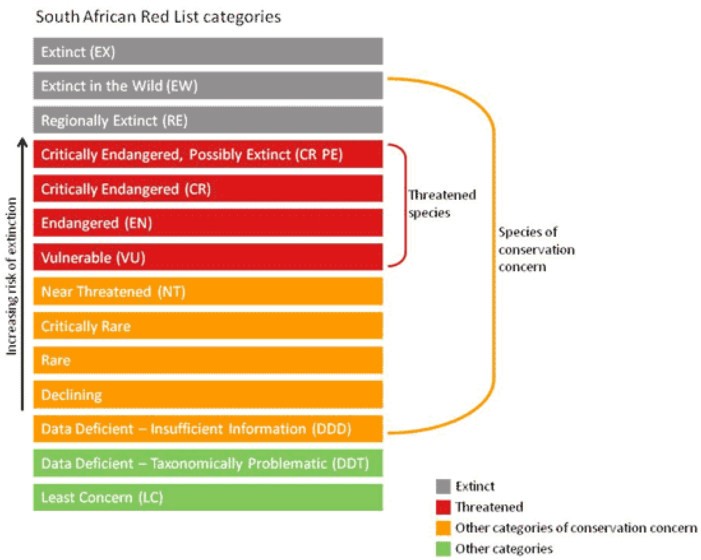

Figure 1. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

2.4 Site Visit

A site visit to the study area was conducted from the 4rd-6th December 2015. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were investigated in the field. Most parts of the potentially affected ridges are not accessible and had to be accessed on foot. The ridges were accessed at multiple sites and large sections of the ridges were hiked on foot and full plant species lists recorded. Specific attention was also paid to the presence of sensitive features and habitats along the ridges that might be impacted by the development. During the site visit, all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

Apart from the current site visit, the area has also been visited in the past at different times of the year for a variety of other assessments. This includes the adjacent Mainstream Sutherland WEF which includes adjacent portions of some of the same ridges as the current study. This information is used to inform the current study as appropriate.

2.5 Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low –** Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High –** Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High –** Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

2.6 Limitations & Assumptions

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be critically evaluated.

The site visit for the current study took place in summer. There is however no optimal season for site visits to the area as it lies along a gradient from predominantly winter rainfall in the west to predominantly summer or seasonal rainfall in the east. Although it was relatively dry at the time, due to it having been a relatively low rainfall growing season, the vegetation was sufficiently grown-out and active that most perennial species were growing or in flower and few species were present that could not be identified. It is however likely that the number of annuals, forbs and geophytes recorded is relatively low and that more such species would be present in wetter years. However, having visited the area in the past during wet seasons, this is not seen as a significant limitation for the current study and the timing and extent of the current site visit is not considered to be a limiting factor which might compromise the results in any way.

The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. Several site visits have been conducted during various seasons to the area and information on fauna observed in the area is included where relevant. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map, four vegetation types occur within the study area (Figure 2); the majority of the site falls within the Central Mountain Shale Renosterveld vegetation type, followed with a much smaller extent by Koedoesberge-Moordenaars Karoo and Gamka Karoo and a minor extent of Roggeveld Shale Renosterveld along the northern borders of the site.

According to Mucina & Rutherford (2006) Central Mountain Shale Renosterveld occurs in the Western and Northern Cape on the southern and southeastern slopes of the Klein Roggeveldberge and Komsberg below the Komsberg section of the Great Escarpment as well as farther east below Besemgoedberg and Suurkop and in the west in the Karookop area. It is associated with clayey soils overlying Adelaide Subgroup mudstones and subordinate sandstones with landtypes mostly Ib and Fc. Although this vegetation type is classified as Least Threatened, it has a very limited extent of 1236km^2 and is not formally conserved anywhere. Levels of transformation are however low and it is considered to be 99% intact. Although no endemic species are known to occur within this vegetation type, little is known about this Renosterveld type and it has been poorly sampled. Experience from this and other projects in the area indicate that this should be considered to be a relatively sensitive vegetation type with a relatively high abundance of species of conservation concern and in context of the site should in fact be considered to have a higher sensitivity than those areas of Koedoesberge-Moordenaars Karoo. The Komsberg area is also a recognized centre of plant diversity and endemism and the majority of this diversity is associated with the high elevation areas of Central Mountain Shale Renosterveld (Clark et al. 2011).

The Koedoesberge-Moordenaars Karoo vegetation type has an extent of 4714km^2. This unit occurs in the Western and Northern Cape on the Koedesberge and Pienaar se Berg low mountain ranges bordering on the southern Tanqua Karoo and separated by the Klein

Roggeveld Mountains from the Moordenaars Karoo in the broad area of Laingsburg and Merweville. Koedoesberge-Moordenaars Karoo is associated with slightly undulating to hilly landscape covered by low succulent scrub with scattered tall shrubs. It occurs on mudstones, shale and sandstone of various origins including Adelaide Subgroup, Ecca Group and Dwyka Group diamictites, which give rise to shallow skeletal soils. Land types are mainly Fc and lesser extents of Ib. This vegetation type is classified as Least Threatened and has not been significantly impacted by transformation. Conservation status is however poor and of the target of 19% only a very small proportion is conserved within the Gamkapoort Nature Reserve. At least 14 endemic species are known from this vegetation type, which is high number considering that this vegetation unit occupies less than 5000km^2. In addition, the majority of listed species known from the broader area are associated with this vegetation type. It is however very poorly known and little research has been conducted within this unit.

The Gamka Karoo vegetation type has a total extent of 20324 km2 and occurs in the large basin bounded by the Nuweveld Mountains in the north and northwest and the Swartberg and adjacent Cape Fold Mountains in the south. Gamka Karoo is classified as Least Threatened and less than 1% has been transformed (Mucina & Rutherford 2006). The vegetation type is however poorly protected as less than 2% falls within formal protected areas compared to the target of 16%. Gamka Karoo is characterised by irregular to slightly undulating plains covered in dwarf spiny shrubland dominated by karoo dwarf shrubs, with occasional low trees. Dense stands of perennial bunchgrasses cover broad sandy bottomlands. Geology consists of mudstones and sandstones of the Beaufort Group with some Ecca shales supporting very shallow and stony soils of the Glenrosa and Mispah forms, typical of the Fc land type. The latter stony soils are likely to be characteristic of the site. It is regarded as one of the most arid units of the Nama-Karoo Biome, with rainfall varying from 100mm in some areas in the rain shadow of the Cape Fold Mountains to about 240mm against the great escarpment.

In addition, the Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered is known to occur within this vegetation unit in the broad area and may occur along the northern margin of the site associated with this vegetation unit.

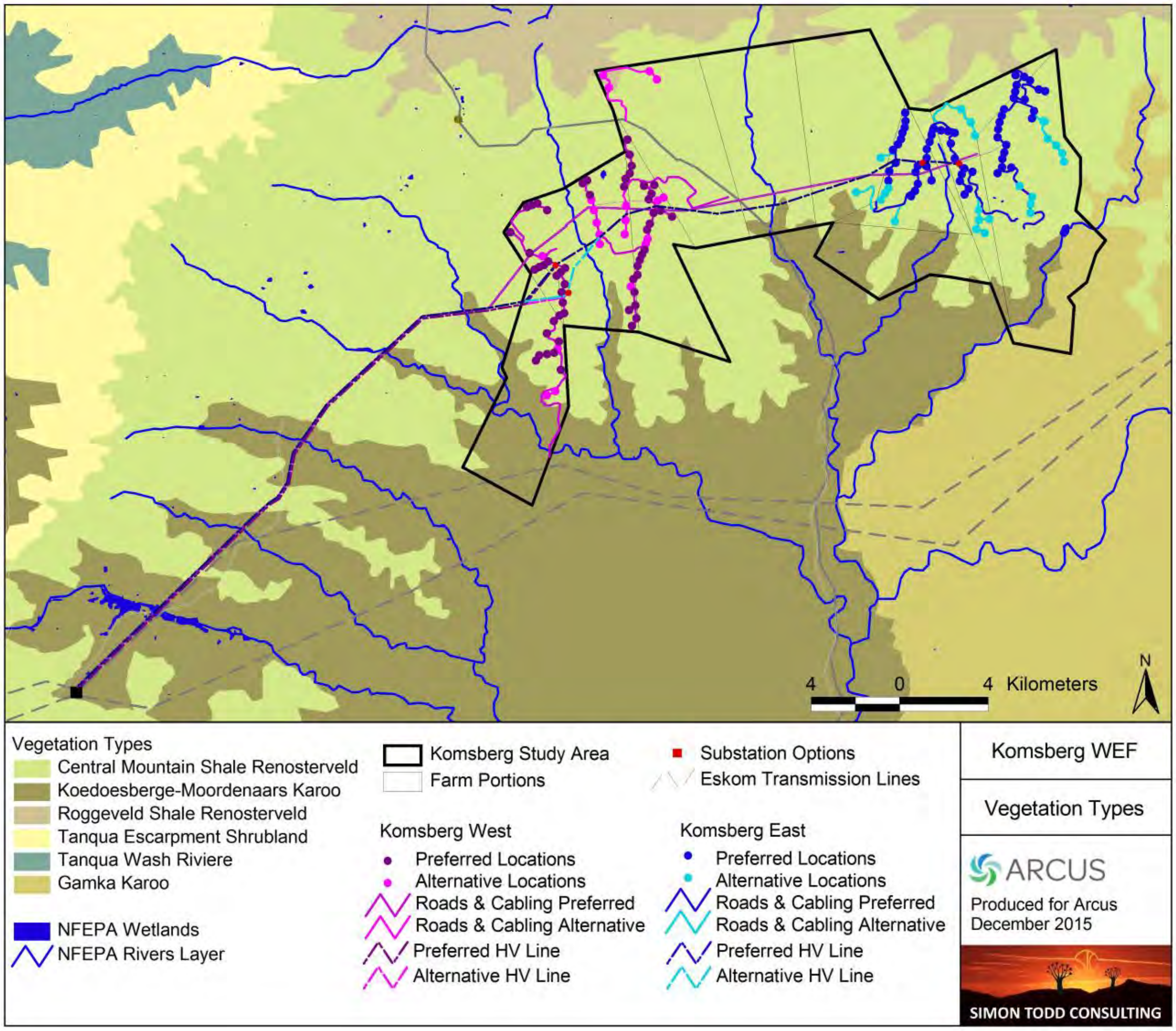

Figure 2. Vegetation map (Mucina and Rutherford 2006) of the Komsberg East and Komsberg West Wind Farms and grid connection options. The majority of the affected area falls within the Central Mountain Shale Renosterveld with smaller amounts of Koedoesberg-Moordenaars Karoo in the south and Gamka Karoo in the southeast.

3.2 HABITAT TYPES

3.2.1 Komsberg West

Typical ridgeline habitat on identified wind turbine target ridges within the Komsberg West study area. The ridges are rocky and typically consist of areas of exposed bedrock or broken rockfields interspersed with areas on higher plant cover on deeper soils.

Typical large drainage line, as exemplified by the upper reaches of the Komsberg River within the Komsberg West area, dominated by *Acacia karoo*, *Searsia lancea* and *Salix mucronata*.

3.2.2 Komsberg East

Typical ridgeline habitat on identified wind turbine target ridges within the Komsberg East study area. These ridges are noticeably more arid than the ridges to the west within the Komsberg West WEF.

Drainage system within the Komsberg East study area, dominated by *Acacia karoo* with *Phragmites australis* in the foreground.

3.3 Listed & Protected Plant Species

According to the SANBI SIBIS database, 514 indigenous species have been recorded from the four quarter degree squares around the site. This includes 22 species of moderate to high conservation concern. Species that can be confirmed present include *Boophone disticha* (Declining), *Brunsvigia josephinae* (VU), *Eriocephalus grandiflorus* (Rare) *Drimia altissima* (Declining) and *Adromischus phillipsiae* (Rare). However, no species of very high conservation concern were observed at the site. In broader context of the Roggeveld and escarpment, the abundance of listed species is generally concentrated along the higher, wetter ground to the west of the site and the areas affected by the turbines are not considered to be within the areas which have been observed to have high densities and diversity of listed and local endemic species. Within the site, such species are concentrated along the higher ridges in the west and along the drainage lines, especially within the higher-lying ground before these enter the lower more arid plains of the site.

Table 1. Numbers of the species within the different conservation status categories as indicated below, data derived from the SANBI SIBIS database.

Status/ IUCN Red List Category	No. Species
Critically Endangered (CR)	0
Endangered (EN)	1
Vulnerable (VU)	5
Near Threatened (NT)	3
Rare	12
Declining	1
Data Deficient - Insufficient Information (DDD)	2
Data Deficient - Taxonomically Problematic (DDT)	5
Least Concern	485
Total	**514**

3.4 Critical Biodiversity Areas & Broad Scale Ecological Processes

The site lies along the boundary of two fine-scale conservation plans, with the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008) in the Northern Cape and the *Biodiversity Assessment of the Central Karoo District Municipality* (Skowno et al. 2009) covering those parts of the site within the Western Cape. These district-wide biodiversity assessments were commissioned to inform Spatial Development Frameworks (SDFs), Biodiversity Sector plans, Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and the Environmental Impact Assessment (EIA) process.

The Biodiversity Assessments identify Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. The CBA map for the general area surrounding the site is depicted below in Figure 3.

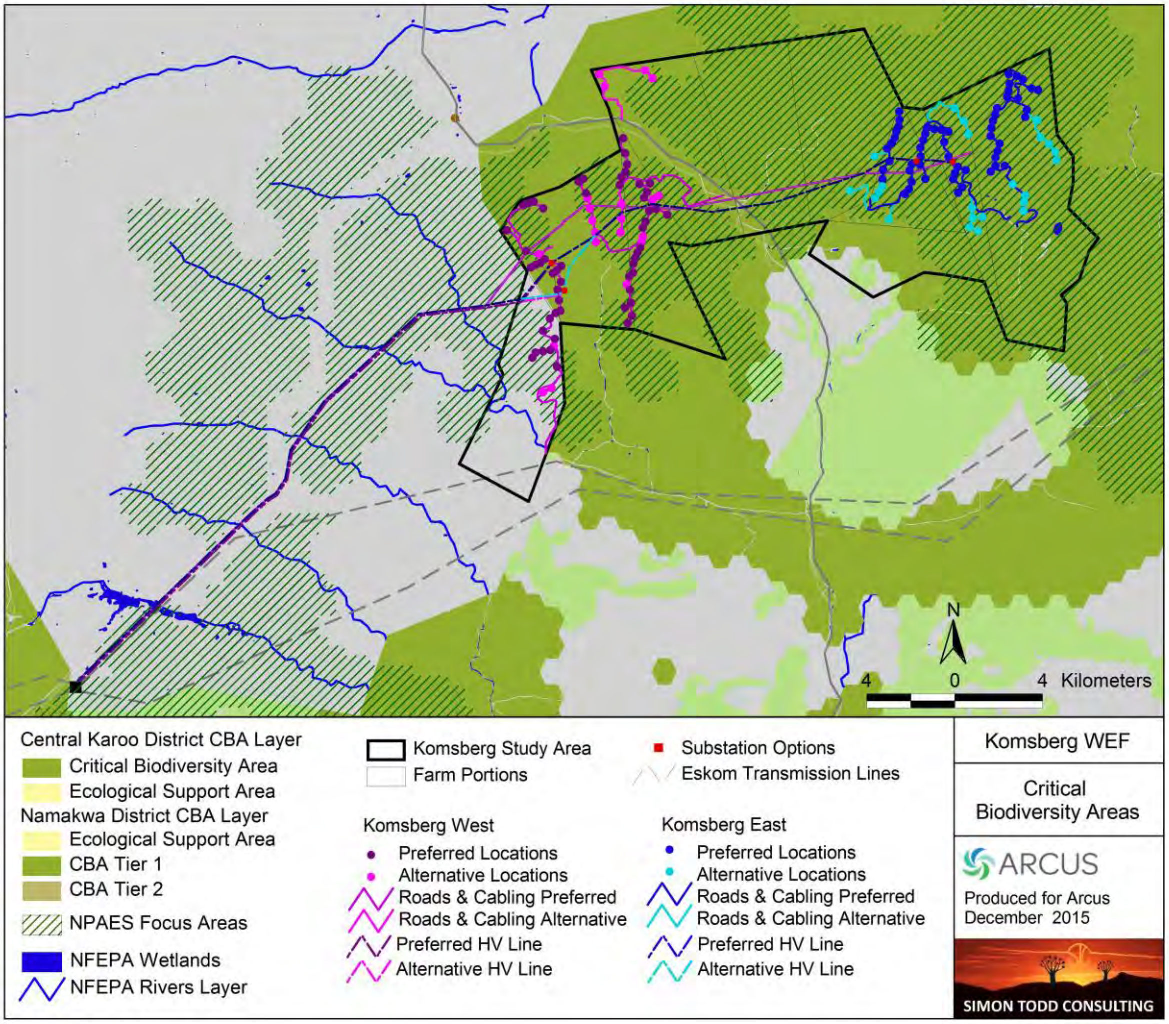

Figure 3. Critical Biodiversity Areas map of the proposed Komsberg Wind Farm and the surrounding area.

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within these areas is not encouraged and may not be compatible with the objectives of the CBA if there are significant impacts on areas of high biodiversity or species not found elsewhere. The likely implications and impacts of development within the CBAs and their immediate environment is a potential concern for the development that needs to be carefully addressed through avoidance of sensitive areas identified in the EIA as well as thereafter through the implementation of a robust and effective environmental management plan that reduces construction and persistent operational phase impacts. Pertinent issues in this regard include establishing the underlying reasons that an area has been identified as a CBA and if there are any mitigation measures that can be implemented that can significantly reduce or avoid impacts on the CBAs or those receptors which were identified as being significant.

In terms of the two CBA maps and the implications of their potentially competing coverage of the study area, the *Biodiversity Assessment of the Central Karoo District Municipality* should receive precedence as it is more recent and is based on more data than the CBA map for the Namakwa District which does not have verified biodiversity features within the study area. Within the study area, a large proportion of the CBA is related to the fact that is has been identified as a priority area within the National Protected Area Expansion Strategy for South Africa (NPAES). This area was identified as priority area on the grounds that apart from being an extensive tract of unfragmented natural vegetation, it is also an area of high climate and landscape variation which is likely to be resilient to climate change. Such areas are likely to be more climatically stable over time, providing refugia where plants and animals can persist. In this context it is important to recognize that there are not similar areas that can perform the same function and which contain a similar set of species available elsewhere. Therefore any impacts on species or features of concern need to be managed on-site.

The development of each facility would result in an expected maximum direct habitat loss of 100ha within each facility. The direct impact of this habitat loss is likely to be relatively low following mitigation, particularly local adjustment of the final turbine locations based on a preconstruction walk-through of the site. This would be effective at reducing the abundance of species and habitats of conservation concern within the development footprint. However, for many fauna, impacts spread beyond the direct footprint of the roads and turbines and for sensitive fauna, particularly those which avoid the proximity of the turbines due to turbine movement (flicker) or noise, the footprint of the facility would be much larger. Approximately 800ha of each facility is within 250m of the wind turbines and turbine noise would typically still be significant for many fauna at this distance. Within this area, the noise would amount to habitat degradation and be likely to reduce the abundance of affected species within this area. However, given the distribution of the turbines along the ridges, there are still extensive areas of unaffected habitat between the strings of turbines which would facilitate and maintain connectivity of the landscape. Furthermore, the major direction of faunal movement at the site would be between the higher-lying and low-lying parts of the site and not across the ridges. As such the valleys are likely to more important for faunal movement than the ridges themselves. With all these different factors taken into consideration, a significant impact on broad-scale landscape connectivity would be unlikely.

3.5 Cumulative Impact

According to the map of DEA-registered projects as at October 2015, there are a large number of renewable energy project applications in the area (Figure 4). These are concentrated along the escarpment as well as on the Elandsberge south of the escarpment. In terms of cumulative impact it is important to consider the vegetation types and habitats that would bear the brunt of development in the area.

The broad area is quite diverse in terms of the different vegetation types present in the area, with the result that each development tends to impact different vegetation types. Exceptions include Roggeveld Shale Renosterveld which occurs on the escarpment and would be impacted by several different facilities and Central Mountains Shale Renosterveld, which occurs on the rugged hills and mountains south of the escarpment. Cumulative impacts on Central Mountains Shale Renosterveld appear to be a particular concern as this vegetation type has a relatively limited extent and a significant proportion, especially in the west is within renewable energy development application areas. It is also important to note that within those developments below the escarpment, it is the higher lying ridges that are usually targeted for development and it is often these that also contain the highest levels of species of conservation concern. As the ridges themselves represent a specialized and relatively confined habitat, development of these ridges would result in larger cumulative impact on these areas, compared to the landscape in general. In addition, it is usually the access roads rather than the turbines themselves which generate the majority of impact. The total extent of direct habitat loss resulting from each phase would be less than 100ha. Although this would be concentrated along the higher-lying ridges, the composition of the ridges within the east and west facility is not the same and so the impact cannot be considered to be to the same environment. Therefore, the overall contribution of the current development to direct cumulative habitat loss is considered to be relatively small.

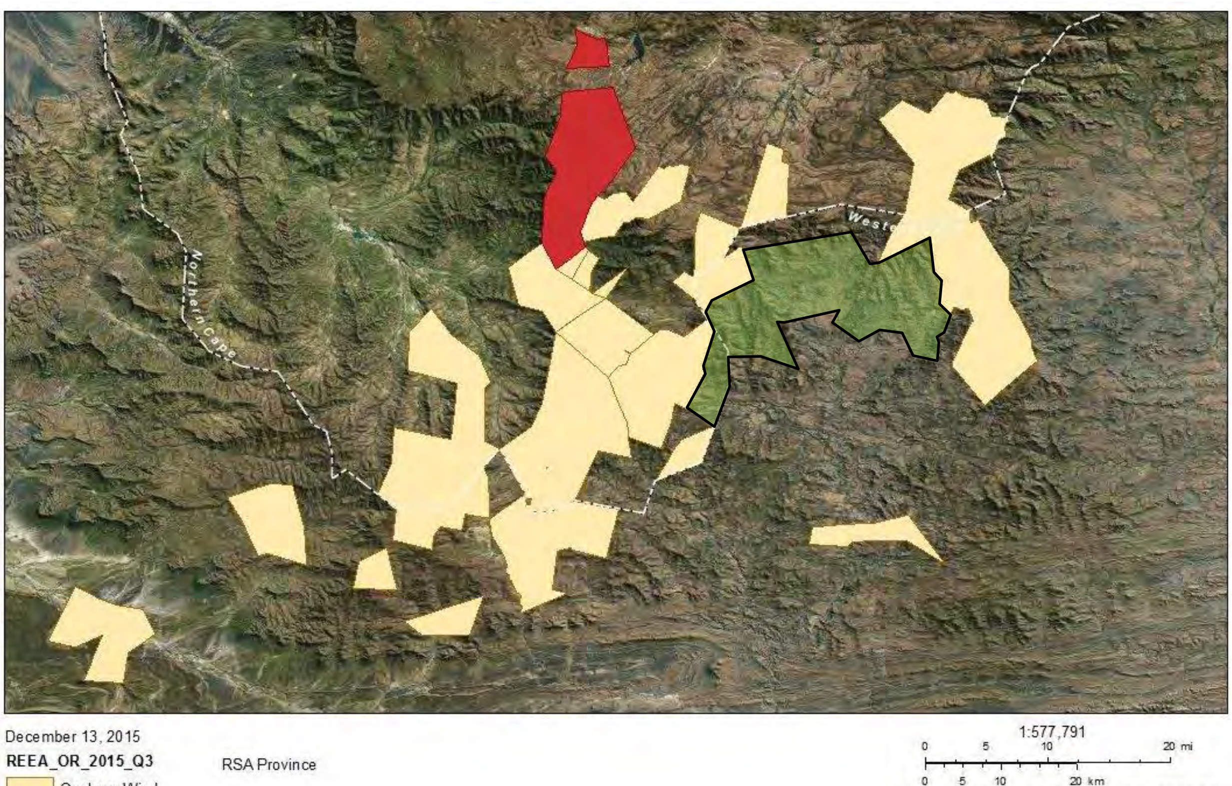

Figure 4. Current (October 2015) DEA-registered projects known from the vicinity of the Komsberg Wind Farm, which is shown in green with black border. Yellow polygons are wind energy developments and red are solar projects (The red area is however a wind energy development and not solar), but it is important to note that wind turbines may be restricted to a small proportion of the indicated areas.

3.6 Faunal Communities

Mammals

At least 50 mammal species potentially occur at the site (Appendix 2). Due to the diversity of habitats available, which includes rocky uplands, densely vegetated kloofs and riparian areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the broader site. The mammalian community is therefore relatively rich and due to the remote and inaccessible nature of large parts of the area probably has not been highly impacted by human activities aside from livestock grazing, which is largely compatible with most biodiversity processes.

Despite trapping and hunting by the local landowners, medium sized carnivores such as jackal and caracal appear to remain relatively common in the area. The ridges, hills and uplands of the site, with rocky outcrops, rocky bluffs and cliffs provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, *Elephantulus edwardii*, Hewitt's Red Rock Hare *Pronolagus saundersiae*, Namaqua Rock Mouse *Micaelamys namaquensis* and Rock Hyrax, *Procavia capensis*. The lowlands are likely to contain an abundance of species associated with lowland habitats such as deeper soils and floodplain habitats, which includes Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy-footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*.

A number of antelope are relatively common at the site and would potentially be impacted by the development. Springbuck are confined by fences and occur only where farmers have introduced them or allowed them to persist and should be considered as part of the farming system rather than as wildlife *per se*. Both Duiker and Steenbok *Raphicerus campestris* are adaptable species that are able to tolerate moderate to high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Klipspringer *Oreotragus oreotragus* and Grey Rhebok *Pelea capreolus* are present along the ridges of the area and are somewhat more specialized in their habitat requirements. Klipspringer are associated with steep slopes, cliffs and rocky outcrops and of the antelope present may be most vulnerable to impact from the development due to greater overlap between their habitat and the distribution of the wind turbines. While the turbines would not be located on the cliffs as such, they would generate impact through noise, disturbance and turbine blade movement. Kudu are present along the wooded drainage lines which characterise the lowlands of the site and while they are likely to move away from the area during construction, long-term impacts on this habitat are likely to be low.

The Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered and is regarded as the most threatened mammal in South Africa is known to occur in the area. This species is usually associated with alluvial terraces and floodplains of ephemeral rivers of the Karoo. In context of the site, it is likely to be largely restricted to the Komsberg area and the areas on top of the plateau, which would not be impacted by the development. As such, it is likely to be present within the Komsberg West development area but is not likely to be present within the Komsberg East wind farm as there is no typically suitable habitat present within the affected areas. In terms of impact, the drainage lines where Riverine Rabbits are likely to occur are not likely to be significantly affected by the development, however, the large amount of traffic present in the area during construction is likely to pose a threat to this species. It appears to be vulnerable to collisions with vehicles in the vicinity of drainage lines and it is likely that some individuals may be lost to collisions with vehicles during the course of construction at the site.

Reptiles

There is a wide range of habitats for reptiles present at the site, including rocky uplands and cliffs, open flat and lowlands and densely vegetated riparian areas. As a result the site is likely to have a relatively rich reptile fauna which is potentially composed of 7 tortoise species, 20 snakes, 17 lizards and skinks, two chameleons and 10 geckos. The area has however been very poorly sampled as illustrated by the fact that there are only 18 records representing 9 species for the 4 quarter degree squares around the site, within the ReptileMap database of the ADU. Consequently, the estimate of potential richness is based on broad-scale distribution maps in the literature and not the ADU database. Some little-known species which have previously been listed but have been recently downgraded to Least Concern may occur in the area, this includes Fisk's House Snake *Lamprophis fiskii* and the Namaqua Plated Lizard *Gerrhosaurus typicus*. The only currently listed species which may occur at the site is the Karoo Padloper *Homopus boulengeri* which is listed as Near Threatened.

Species observed in the area include Karoo Tent Tortoise *Psammobates tentorius tentorius*, Angulate Tortoise *Chersina angulata*, Puff Adder *Bitis arietans*, Karoo Girdled Lizard *Cordylus polyzonus*, Southern Rock Agama *Agama atra*, Namaqua Plated Lizard *Gerrhosaurus typicus*, Cape Skink *Mabuya capensis*, Namaqua Sand Lizard *Pedioplanis namaquensis* and Cape Cobra *Naja nivea*. Although there are a variety of different habitats present, the generally intact nature of the area means that most habitats have associated reptiles. Habitats of specific sensitivity include drainage lines and vleis and the rocky bluffs and cliffs of the site. However, along the ridges, there are few habitats present of specific significance and the majority of impact on reptiles would probably result from habitat loss, especially from the access roads of the site which may be to 20m in width during construction.

In general, the predominant potential impact associated with the development would be habitat loss and fragmentation for reptiles, with the potential for increased levels of predation being a secondary impact which may occur as a result of vegetation clearing for roads and turbine pads.


Namaqua Sand Lizard *Pedioplanis namaquensis* and Southern Rock Agama *Agama atra* are common reptiles observed at the site.

Amphibians

Although there are no perennial rivers within the site, many of the larger drainage lines contain pools which have water on a near-perennial basis (For a full description of the surface hydrological systems of the site, see the specialist aquatic assessment for the site). Cape River Frogs were observed using these pools and other species are likely to be breeding in them as well. In addition, there are a number of pans and irrigation dams at the site which would also represent important breeding sites for water-dependent species. The amphibian diversity at the site is however likely to be relatively low as the site lies within the distribution range of only eight frog and toad species. The only species observed during the site visit was the Cape River Frog *Amietia fuscigula* which was observed in pools in the rivers within the Komsberg West WEF. No species of conservation concern are known from the area and all the species which may be present are quite widespread species of low conservation concern.

The Karoo Dainty Frog, *Cacosternum karooicum* is listed as Data Deficient reflecting the little-known distribution and ecology of this species. To date, the Karoo Dainty Frog has been recorded from a few scattered locations across the Karoo in the Western and Northern Cape, but it is likely that it occurs more widely across the karoo in general. The site also falls within the distribution of two other regional endemic species, the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The Cape Sand Frog occurs in lowlands and valleys in fynbos and Succulent Karoo throughout most of the Western Cape and into Namaqualand. The Raucous Toad is more widely distributed and occurs throughout much of South Africa inland and along the east coast into Gauteng and Mpumalanga. There do not therefore appear to be any range-restricted species which occur at the site which would be vulnerable to population-level impacts.

In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams which occur in the area. As these are widely recognized as sensitive habitats, impacts to these areas are avoided largely at the design phase of the development and a minimum amount of infrastructure has been located in the vicinity of these features. Consequently, direct impacts on amphibians at the site are likely to be fairly low. Amphibians are however highly sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

3.7 Site Sensitivity Assessment

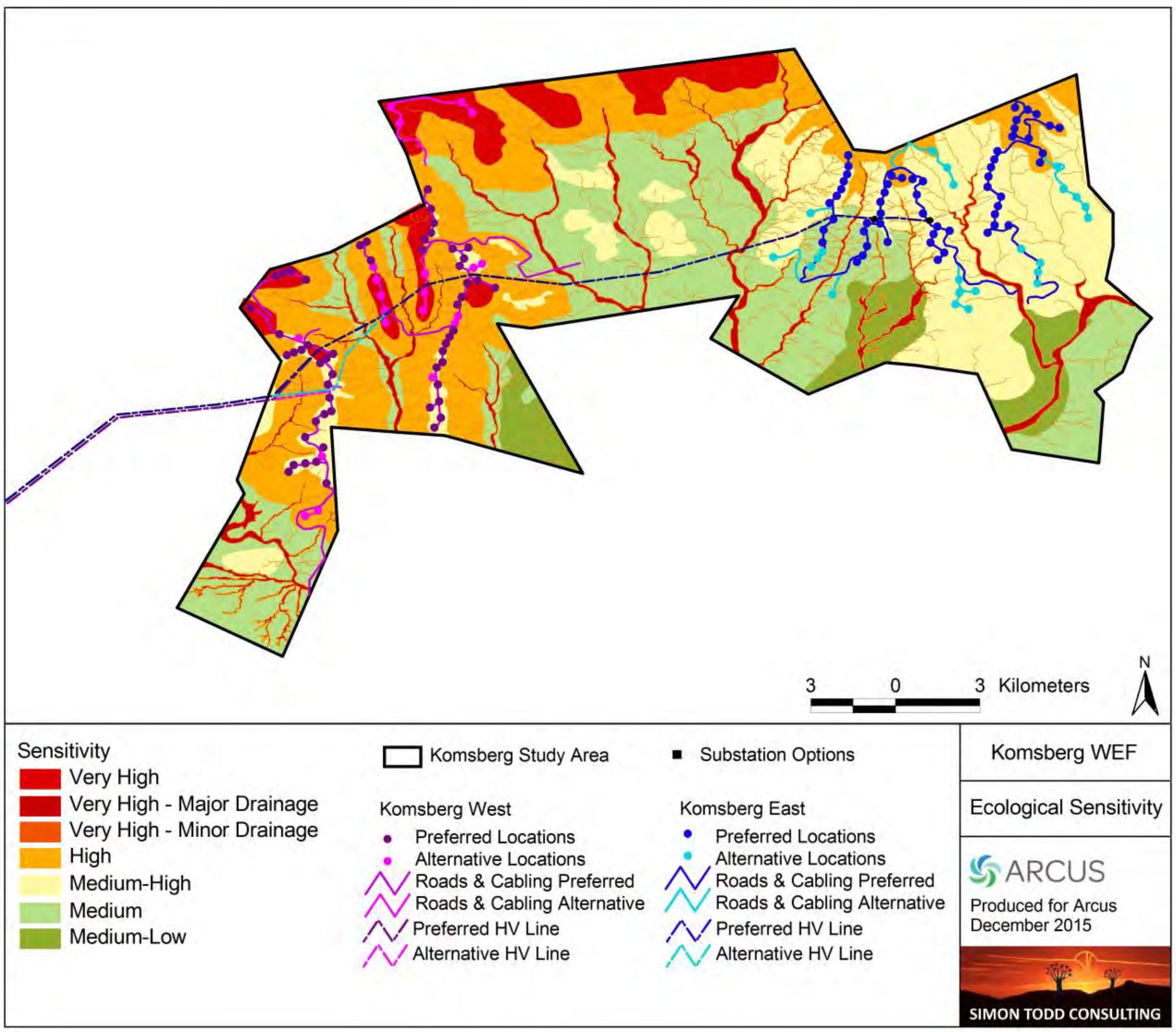

Figure 5. Ecological sensitivity map of the Komsberg Wind Farm with the layout provided for the EIA assessment depicted.

The ecological sensitivity map of the site is depicted in Figure 5 above. At a broad scale, the sensitivity of the area increases from east to west and from south to north, driven largely by the increase in rainfall with elevation and towards the west and an associated increase in the density and diversity of species of conservation concern. Several of the ridges were identified as specifically sensitive on account of the presence of flora of conservation concern or because of the local topography of the area and the likely significance of the identified areas for fauna and flora. Areas of specific sensitivity that should preferably be avoided include the following areas, all of which are located within the Komsberg West Facility:

- Preferred Turbines 22-26 (5 turbines)
- Alternative Turbine 73-76 (4 turbines)
- Alternative Turbines 60-63 (4 turbines)
- Alternative Turbines 66-68 (3 turbines)

There are a number of other turbines located along the margin of high sensitivity areas, but these are considered acceptable. The above recommendations should not impact the overall proposed output of the facility, as there are still 50 preferred turbine locations remaining in acceptable positions as well as 10 alternative positions that would still be available.

There are no areas within the Komsberg East Facility that are considered highly sensitive, which relates to the aridity of this area compared to the east and the lower abundance of species of concern. Therefore, there are no recommendations with regard to the placement or reduction in the number of turbines within the Komsberg East Facility. The most sensitive area here is the high elevation node of development in the northeast of the site. Any localized sensitive features here can be avoided through turbine micrositing following a preconstruction walk-through of the facility. The identified high sensitivity areas are important for flora as well as fauna and effective environmental management in these areas will be important for reducing the overall cumulative impact of the development.

4 IDENTIFICATION OF POTENTIAL IMPACTS AND ASSOCIATED ACTIVITIES

Potential ecological impacts resulting from the development of the Komsberg East and West Wind Farms and grid connections would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

Construction Phase

- Vegetation clearing for access roads, turbine pads, electrical trenches etc. is likely to impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
- Increased erosion risk could occur due to the loss of plant cover and soil disturbance created during the construction phase. Parts of the site are steep and risk of erosion would be high. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems.
- Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operational Phase

- The operation of the facility will generate noise and disturbance which may deter some fauna from the area.
- The presence of the facility will disrupt the connectivity of the landscape for some species which will avoid traversing the cleared areas and may impact their ability to disperse or maintain gene flow between subpopulations.
- The facility will require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants, herbicides or pesticides.

Cumulative Impacts

- The cumulative loss of sensitive habitats may result in biodiversity loss and reduced future ability to meet conservation targets for these habitats.
- Transformation of intact habitat with CBAs could compromise the ecological functioning of the CBAs and would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

4.1 Identification of Impacts to be Assessed in the EIA Phase

The likely impacts on the terrestrial ecology of the site resulting from the development of the Komsberg Wind Farm are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarized below before the impacts are assessed.

Impact 1. *Impacts on vegetation and listed or protected plant species*

The development would require vegetation clearing for turbines, roads and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species are also highly likely to be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be low.

Impact 2. *Direct Faunal Impacts*

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Many of these impacts can however be effectively managed or mitigated. During the operational phase some fauna, particularly those that use sound to find their prey or avoid predators would be affected by the noise generated by the turbines when in operation. Research has shown that increased levels of background noise increases vigilance in fauna at the cost of foraging and other activities and for fauna this is tantamount to habitat degradation as their fitness is reduced when in these areas.

Impact 3. *Increased Erosion Risk*

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion, especially as many parts of the site are steep. The soil disturbance associated with the development will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be a key element of mitigation measures at the site. Furthermore, if the eroded material were to enter streams and rivers at the site it could have significant impact on these systems through siltation of pools and changes in the chemistry and turbidity of the water.

Impact 4. *Alien Plant Invasion*

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien invasion is inevitable and regular alien clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion.

Cumulative Impact 1. *Impacts on Critical Biodiversity Areas and broad-scale ecological processes*

The site contains Critical Biodiversity Areas which are within the development footprint. While CBAs are not no-go areas, development within CBAs is not encouraged as such development may compromise the ecological functioning of the CBA or result in direct biodiversity loss within the CBA if not approached carefully and managed effectively. This impact can result from the presence of the facility as well as habitat loss within the CBAs. In addition, the presence of the wind turbines and daily operational activities at the site may deter certain species from the area, resulting in a loss in broad-scale landscape connectivity. The extent of this impact would depend on the location of the infrastructure as well as the total development footprint. In this regard it is important to note that while the development footprint is low in comparison with the total extent of the site, this impact should be considered in context of the impact on the affected ridges and their specific habitats which may be much more restricted, as well as the presence of the other similar developments in the area.

5 ASSESSMENT METHODOLOGY

The assessment methodology will be in accordance with the recent revised 2014 EIA regulations. The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

a) Extent (spatial scale):

Ranking criteria

L	M	H
Impact is localized within site boundary	Widespread impact beyond site boundary; Local	Impact widespread far beyond site boundary; Regional/national

b) Duration:

Ranking criteria

L	M	H
Quickly reversible, less than project life, short term (0-5 years)	Reversible over time; medium term to life of project (5-15 years)	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

c) Intensity (severity):

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration, death, illness or injury, loss of habitat/diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, Partial loss of habitat/biodive rsity/resource or slight or alteration	Minor deterioration, nuisance or irritation, minor change in species/habitat/ diversity or resource, no or very little quality deterioration.	Minor improvement, restoration, improved management	Moderate improvement, restoration, improved management, substitution	Substantial improvement, substitution
Quantitative	Measurable deterioration Recommended level will often be violated (e.g. pollution)	Measurable deterioration Recommended level will occasionally be violated	No measurable change; Recommended level will never be violated	No measurable change; Within or better than recommended level.	Measurable improvement	Measurable improvement

d) Probability of occurrence:

Ranking criteria

L	M	H
Unlikely; low likelihood; Seldom No known risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent Low to medium risk or vulnerability to natural or induced hazards.	Definite (regardless of prevention measures), highly likely, continuous High risk or vulnerability to natural or induced hazards.

e) Status of the impact:

Describe whether the impact is positive, negative or neutral for each parameter. The ranking criteria are described in negative terms. Where positive impacts are identified, use the opposite, positive descriptions for criteria.

Based on a synthesis of the information contained in (a) to (e) above, the specialist will be required to assess the significance of potential impacts in terms of the following criteria:

f) Significance: (Duration X Extent X Intensity)

Intensity = L				
Duration	**H**			
	M			Medium
	L	Low		

Intensity = M				
Duration	**H**			High
	M		Medium	
	L	Low		
Intensity = H				
Duration	**H**			
	M			High
	L	Medium		
		L	M	H
		Extent		

Positive impacts would be ranked in the same way as negative impacts, but result in high, medium or low positive consequence.

g) Degree of confidence in predictions:

State the degree of confidence in the predictions, based on the availability of information and specialist knowledge.

6 ASSESSMENT OF IMPACTS

An assessment of the likely extent and significance of each impact identified above is made below for each phase of the development as relevant.

6.1 Komsberg West WEF

6.1.1 Planning & Construction Phase

Impact 1. *Impact on vegetation and listed plant species.*

Impact Phase: Construction							
Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**L**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
Can the impact be reversed?			No – some transformation is a necessary outcome of the development.				

Will impact cause irreplaceable loss or resources?	Yes, some loss of rare habitats or species may occur.
Can impact be avoided, managed or mitigated?	Possibly, through avoidance, but some residual impact is likely
<u>Mitigation measures:</u> 1. Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are be avoided where possible. 2. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 3. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. 4. A large proportion of the impact of the development stems from the access roads and the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible, as informed by a preconstruction walk-though survey. 5. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 6. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.	
Can any residual risk be monitored/managed?	No. Once the habitat is lost it cannot practically be restored to former levels of diversity and function. However, additional impact in the operational phase can be limited through access control to the site as well as ensuring effective management of alien plants and soil erosion.
Will this impact contribute to any cumulative impacts?	Yes. Transformation for roads, turbines and other infrastructure will contribute to cumulative transformation and habitat loss in the area (about 150ha), however, the total extent of transformation is considered to be low to moderate.

Impact 2. *Direct faunal impacts during construction*

Impact Phase: Preconstruction & Construction							
Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbit.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
Can the impact be reversed?			Construction phase disturbance will be transient, but some habitat loss would be long term.				
Will impact cause irreplaceable loss of resources?			Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.				

Can impact be avoided, managed or mitigated?	No. Full mitigation is unlikely as noise and construction phase disturbance cannot be entirely avoided or reduced to low levels.

Mitigation measures:

1. Preconstruction walk-through of the facility to identify areas of faunal sensitivity.
2. During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
3. The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
4. No fires should be allowed within the site as there is a risk of runaway veld fires.
5. No fuelwood collection should be allowed on-site.
6. No dogs should be allowed on site apart from that of the landowners.
7. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards.
8. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
9. No unauthorized persons should be allowed onto the site and site access should be strictly controlled and vehicles which need to roam around the site should be accompanied by the ECO or security personnel.
10. All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises as well as the Riverine Rabbit. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
11. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.

Can any residual risk be monitored/managed?	Yes. All mortalities of fauna on access roads within or to the site should be recorded with a view towards intervention and additional mitigation. If any Riverine Rabbits are killed this should be reported to the EWT Riverine Rabbit programme and additional mitigation implemented.
Will this impact contribute to any cumulative impacts?	Yes. Construction phase disturbance will contribute towards cumulative faunal impacts in the area, this will however be transient and localised.

Impact 3. *Soil Erosion Risk*

Impact Phase: Planning & Construction

Impact Description: During construction, the site will be highly vulnerable to soil erosion due to all the disturbed ground present.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	**M**	**H**	**H**	**-‘tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-‘tve**	**Low**	**H**	**High**

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated

Will impact cause irreplaceable loss or resources?	The loss of large amounts of topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated
Mitigation measures: 1. Runoff management and erosion control should be integrated into the project design 2. Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided. 3. Dust suppression and erosion management should be an integrated component of the construction approach. 4. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas. 5. Regular monitoring for erosion problems along the access roads and other cleared areas. 6. Erosion problems should be rectified on a regular basis. 7. Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season. 8. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the construction phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

6.1.2 Operational Phase

Impact 1. *Faunal Impacts due to Operation*

Impact Phase: Operation							
Impact Description: Faunal impacts due to operational-phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**H**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
Can the impact be reversed?	The impact will persist for the lifespan of the facility, but will be reversed if the turbines are removed and disturbed areas rehabilitated.						
Will impact cause irreplaceable loss or resources?	No, this is unlikely						
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from the wind turbines and general disturbance will persist.						
Mitigation measures: 1. Management of the site should take place within the context of an Open Space Management Plan. 2. No unauthorized persons should be allowed onto the site.							

3. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. 4. The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone expect landowners with the appropriate permits where required. 5. If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. 6. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 7. All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 8. If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.

Can any residual risk be monitored/managed?	Partially. Some risks such as those associated with the presence and activities of personnel at the site can be managed, but a proportion of the impact results from the presence and operation of the wind turbines and this cannot be avoided or mitigated.
Will this impact contribute to any cumulative impacts?	Yes. The presence and operation of the facility will contribute towards faunal habitat loss and disturbance in the area. For most fauna this is considered to be relatively low.

Impact 2. *Soil Erosion Risk During Operation*

Impact Phase: Operation							
Impact Description: Following construction, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be mitigated				
<u>Mitigation measures:</u> 1. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 2. All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 3. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.							

4. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 5. All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the operational phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 3. *Alien Plant Invasion*

Impact Phase: Operation							
Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			With mitigation there would not be loss of resources				
Can impact be avoided, managed or mitigated?			With appropriate control measures, alien plants can be controlled and reduced to very low impact				
<u>Mitigation measures:</u> 1. Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. The recovery of the indigenous shrub/grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 3. Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled. 4. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 5. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							
Can any residual risk be monitored/managed?			Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to an Alien Management Plan.				
Will this impact contribute to any cumulative impacts?			Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.				

6.1.3 Decommissioning

Impact 1. *Faunal Impacts due to Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Faunal impacts due to decommissioning-phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**L**	**H**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**M**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	Yes. This impact will be transient and restricted to the decommissioning period.						
Will impact cause irreplaceable loss or resources?	No, this is unlikely						
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.						
<u>Mitigation measures:</u> 1. Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. 2. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 3. All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 4. All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact.							
Can any residual risk be monitored/managed?	Yes. Speed control can be implemented and disturbance at the site can be minimized.						
Will this impact contribute to any cumulative impacts?	Yes. The noise and activity will contribute towards disturbance in the area, but this will be transient and the contribution would be low to moderate						

Impact 2. *Soil Erosion Risk Following Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						

Will impact cause irreplaceable loss or resources?	The loss of large amounts of topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated
Mitigation measures: 1. Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 2. There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. 3. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 4. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems for at least 2 years after decommissioning, with immediate interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 3. *Alien plant invasion following decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources						
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact						
Mitigation measures: 1. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. 3. Regular monitoring for alien plants within the disturbed areas. 4. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems following decommissioning.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.1.4 Cumulative Impacts

Impact 1. *Impact on CBAs and Broad-Scale Ecological Processes*

Impact Phase: Operation							
Impact Description: Cumulative impact on CBAs and broad scale ecological processes							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
Can the impact be reversed?	The impact would last for the lifetime of the development. (20-25 years).						
Will impact cause irreplaceable loss or resources?	Unlikely						
Can impact be avoided, managed or mitigated?	To some extent, but the main impact results from the loss and transformation of habitat as well as the presence and operation of the facility which cannot be avoided but would be of local significance only.						
Mitigation measures: 1. The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. 2. An Open Space Management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent rangeland. 3. Avoid impact to potential corridors such as the riparian corridors associated with the larger drainage lines within the facility area.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for degradation problems during the operational phase such as alien plants and erosion, with management and remedial actions as necessary.						
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.						

6.2 Komsberg East WEF

6.2.1 Planning & Construction Phase

Impact 1. *Impact on vegetation and listed plant species.*

<table>
<tr><td colspan="8">Impact Phase: Construction</td></tr>
<tr><td colspan="8">Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint</td></tr>
<tr><td></td><td>Extent</td><td>Duration</td><td>Intensity</td><td>Status</td><td>Significance</td><td>Probability</td><td>Confidence</td></tr>
<tr><td>Without Mitigation</td><td>L</td><td>M</td><td>H</td><td>-‘tve</td><td>High</td><td>H</td><td>High</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>M</td><td>M</td><td>-‘tve</td><td>Medium-Low</td><td>H</td><td>High</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">No - transformation is a necessary outcome of the development</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">Yes, some loss of rare habitats or species may occur</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">Possibly, through avoidance, but some residual impact is likely</td></tr>
<tr><td colspan="8"><u>Mitigation measures:</u>
1. Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are be avoided where possible.
2. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
3. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.
4. A large proportion of the impact of the development stems from the access roads and the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity, as informed by a preconstruction walk-though survey. .
5. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
6. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.</td></tr>
<tr><td colspan="3">Can any residual risk be monitored/managed?</td><td colspan="5">No. Once the habitat is lost is cannot practically be restored to former levels of diversity and function. However, additional impact in the operational phase can be limited through access control to the site as well as ensuring effective management of alien plants and soil erosion.</td></tr>
<tr><td colspan="3">Will this impact contribute to any cumulative impacts?</td><td colspan="5">Yes. Transformation for roads, turbines and other infrastructure will contribute to cumulative transformation and habitat loss in the area, the contribution after avoidance and mitigation is however considered low</td></tr>
</table>

Impact 2. *Direct faunal impacts during construction*

<table>
<tr><td colspan="8">Impact Phase: Preconstruction & Construction</td></tr>
<tr><td colspan="8">Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbit.</td></tr>
<tr><td></td><td>Extent</td><td>Duration</td><td>Intensity</td><td>Status</td><td>Significance</td><td>Probability</td><td>Confidence</td></tr>
</table>

Without Mitigation	**M**	**M**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**

Can the impact be reversed?	Construction phase disturbance will be transient, but some habitat loss would be long term.
Will impact cause irreplaceable loss of resources?	Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.
Can impact be avoided, managed or mitigated?	No. Full mitigation is unlikely as noise and construction phase disturbance cannot be entirely avoided or reduced to low levels.

Mitigation measures:

1. Preconstruction walk-through of the facility to identify areas of faunal sensitivity.
2. During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
3. The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
4. No fires should be allowed within the site as there is a risk of runaway veld fires.
5. No fuelwood collection should be allowed on-site.
6. No dogs should be allowed on site.
7. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards.
8. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
9. No unauthorized persons should be allowed onto the site and site access should be strictly controlled and vehicles which need to roam around the site should be accompanied by the ECO or security personnel.
10. All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises as well as the Riverine Rabbit. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
11. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.

Can any residual risk be monitored/managed?	Yes. All mortalities of fauna on access roads within or to the site should be recorded with a view towards intervention and additional mitigation. If any Riverine Rabbits are killed this should be reported to the EWT Riverine Rabbit programme and additional mitigation implemented.
Will this impact contribute to any cumulative impacts?	Yes. Construction phase disturbance will contribute towards faunal impacts in the area and the overall contribution would be moderate but transient

Impact 3. *Soil Erosion Risk*

Impact Phase: Planning & Construction

Impact Description: During construction, the site will be highly vulnerable to soil erosion due to all the disturbed ground present.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated						
Mitigation measures: 1. Runoff management and erosion control should be integrated into the project design 2. Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided. 3. Dust suppression and erosion management should be an integrated component of the construction approach. 4. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas. 5. Regular monitoring for erosion problems along the access roads and other cleared areas. 6. Erosion problems should be rectified on a regular basis. 7. Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season. 8. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the construction phase, with interventions implemented where actual and potential problems are observed.						
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.						

6.2.2 Operational Phase

Impact 1. *Faunal Impacts due to Operation*

Impact Phase: Operation							
Impact Description: Faunal impacts due to operational-phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**

Can the impact be reversed?	The impact will persist for the lifespan of the facility, but will be reversed if the turbines are removed and disturbed areas rehabilitated.
Will impact cause irreplaceable loss or resources?	No, this is unlikely
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from the wind turbines and general disturbance will persist.
Mitigation measures: 1. Management of the site should take place within the context of an Open Space Management Plan. 2. No unauthorized persons should be allowed onto the site. 3. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. 4. The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone expect landowners with the appropriate permits where required. 5. If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. 6. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 7. All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 8. If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.	
Can any residual risk be monitored/managed?	Partially. Some risks such as those associated with the presence and activities of personnel at the site can be managed, but a proportion of the impact results from the presence and operation of the wind turbines and this cannot be avoided or mitigated.
Will this impact contribute to any cumulative impacts?	Yes. The presence and operation of the facility will contribute towards faunal habitat loss and disturbance in the area.

Impact 2. *Soil Erosion Risk during Operation*

Impact Phase: Operation							
Impact Description: Following construction, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						

Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated
<u>Mitigation measures:</u> 1. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 2. All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 3. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. 4. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 5. All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the operational phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 3. *Alien Plant Invasion*

Impact Phase: Operation							
Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources						
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact						
<u>Mitigation measures:</u> 1. Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. The recovery of the indigenous shrub/grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 3. Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as Prosopis are already present in the area and are likely to increase rapidly if not controlled.							

4. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 5. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to the Alien Management Plan.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.2.3 Decommissioning

Impact 1. *Faunal Impacts due to Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Faunal impacts due to decommissioning-phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**L**	**H**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**M**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	Yes. This impact will be transient and restricted to the decommissioning period.						
Will impact cause irreplaceable loss or resources?	No, this is unlikely						
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.						
<u>Mitigation measures:</u> 1. Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. 2. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 3. All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 4. All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact.							
Can any residual risk be monitored/managed?	Yes. Speed control can be implemented and disturbance at the site can be minimized.						
Will this impact contribute to any cumulative impacts?	Yes. Construction phase disturbance will contribute towards faunal impacts in the area and the overall contribution would be moderate but transient.						

Impact 2. *Soil Erosion Risk Following Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**H**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be mitigated				
Mitigation measures: 1. Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 2. There should be regular monitoring for erosion for at least 2 years after decommissioning to ensure that no erosion problems develop as result of the disturbance. 3. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 4. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.							
Can any residual risk be monitored/managed?			Yes. There should be regular monitoring for erosion problems for at least 2 years after decommissioning, with interventions implemented where actual and potential problems are observed.				
Will this impact contribute to any cumulative impacts?			Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.				

Impact 3. *Alien plant invasion following decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			With mitigation there would not be loss of resources				

Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact
Mitigation measures: 1. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. 3. Regular monitoring for alien plants within the disturbed areas. 4. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems following decommissioning.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.2.4 Cumulative Impacts

Impact 1. *Impact on CBAs and Broad-Scale Ecological Processes*

Impact Phase: Operation							
Impact Description: Cumulative impact on CBAs and broad scale ecological processes							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**High**	**H**	**High**
With Mitigation	**L**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
Can the impact be reversed?	The impact would last for the lifetime of the development						
Will impact cause irreplaceable loss or resources?	Unlikely						
Can impact be avoided, managed or mitigated?	To some extent, but the main impact results from the loss and transformation of habitat as well as the presence and operation of the facility which cannot be avoided						
Mitigation measures: 1. The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. 2. An Open Space Management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent rangeland. 3. Avoid impact to potential corridors such as the riparian corridors associated with the larger drainage lines within the facility area.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for degradation problems such as erosion and alien invasion during the operational phase, with management and remedial actions as required.						

Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.3 Komsberg West Grid Connection

6.3.1 Planning & Construction Phase

Impact 1. *Impact on vegetation and listed plant species.*

Impact Phase: Construction							
Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**M**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	No - transformation is a necessary outcome of the development						
Will impact cause irreplaceable loss or resources?	No. The footprint is low and no irreplaceable loss is unlikely.						
Can impact be avoided, managed or mitigated?	Yes, a preconstruction walk-through should be used to ensure that impacts on listed species is minimized.						
Mitigation measures: 1. Preconstruction walk-through of the approved power line route to ensure that sensitive habitats and species can be avoided if possible. 2. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 3. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. 4. If possible a permanent access road beneath the line should not be constructed. A veld track for construction and maintenance is however likely to be necessary. 5. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 6. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.							
Can any residual risk be monitored/managed?	Yes, there should be follow-up checks for erosion and aliens to ensure that impact is limited.						
Will this impact contribute to any cumulative impacts?	Yes. Some transformation will occur and will contribute to cumulative transformation and habitat loss in the area, but with mitigation this can be reduced to a low level.						

Impact 2. *Direct faunal impacts during construction*

Impact Phase: Preconstruction & Construction							
Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbit.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**M**	**L**	**-'tve**	**Low**	**H**	**High**

Can the impact be reversed?	Yes. Construction phase disturbance will be transient.
Will impact cause irreplaceable loss of resources?	Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.
Can impact be avoided, managed or mitigated?	Yes. The footprint of the power line can be maintained at a low level and sensitive features avoided.

<u>Mitigation measures:</u>

1. Preconstruction walk-through of the approved power line route to identify areas of faunal sensitivity.
2. During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
3. No fires should be allowed within the site as there is a risk of runaway veld fires.
4. No fuelwood collection should be allowed on-site.
5. No dogs should be allowed on site.
6. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards.
7. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
8. All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises as well as the Riverine Rabbit. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
9. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.

Can any residual risk be monitored/managed?	Yes. All mortalities of fauna on access roads within or to the site should be recorded with a view towards intervention and additional mitigation. If any Riverine Rabbits are killed this should be reported to the EWT Riverine Rabbit programme and additional mitigation implemented.
Will this impact contribute to any cumulative impacts?	Construction phase disturbance will contribute towards faunal impacts in the area and the overall contribution would be moderate but transient.

Impact 3. *Soil Erosion Risk*

Impact Phase: Planning & Construction

Impact Description: During construction, disturbed areas along the power line route will be highly vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated						
Mitigation measures: 1. Runoff management and erosion control should be integrated into the project design. 2. Some parts of the power line route are on steep slopes and specific avoidance and mitigation should be implemented in such areas to prevent erosion. 3. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas. 4. Regular monitoring for erosion problems along the access roads and other cleared areas. 5. Erosion problems should be rectified on a regular basis. 6. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the construction phase, with interventions implemented where actual and potential problems are observed.						
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.						

6.3.2 Operational Phase

Impact 1. *Soil Erosion Risk during Operation*

Impact Phase: Operation							
Impact Description: Following construction, disturbed areas along the power line route will be vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil during operation would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated						

<u>Mitigation measures:</u> 1. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 2. All roads should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 3. Regular monitoring for erosion during operation to ensure that no erosion problems have developed as result of the disturbance. 4. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems along the power line route during the operational phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 2. *Alien Plant Invasion*

Impact Phase: Operation

Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact

<u>Mitigation measures:</u> 1. Alien plant species are likely to be a long-term problem within disturbed areas and a long-term control plan will need to be implemented. 2. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 3. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to the Alien Management Plan.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.3.3 Decommissioning

Impact 1. *Faunal Impacts due to Decommissioning*

Impact Phase: Decommissioning of the power line							
Impact Description: Faunal impacts due to decommissioning-phase activities along the power line.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**L**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			Yes. This impact will be transient and restricted to the decommissioning period.				
Will impact cause irreplaceable loss or resources?			No, this is unlikely				
Can impact be avoided, managed or mitigated?			Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.				
<u>Mitigation measures:</u> 1. Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. 2. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 3. All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 4. All above-ground infrastructure should be removed from the site and disturbed areas rehabilitated.							
Can any residual risk be monitored/managed?			Yes. Disturbance at the site can be minimized and the speed of vehicles at the site controlled.				
Will this impact contribute to any cumulative impacts?			Yes. Construction phase disturbance will contribute towards faunal impacts in the area and the overall contribution would be moderate but transient				

Impact 2. *Soil Erosion Risk Following Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated
Mitigation measures: 1. Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 2. There should be regular monitoring for erosion for at least 2 years after decommissioning to ensure that no erosion problems develop as result of the disturbance. 3. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 4. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems for at least 2 years after decommissioning, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 3. *Alien plant invasion following decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, disturbed areas along the power line route will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources						
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact						
Mitigation measures: 1. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. 3. Regular monitoring for alien plants within the disturbed areas. 4. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems following decommissioning.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.4 Komsberg East Grid Connection

6.4.1 Planning & Construction Phase

Impact 1. *Impact on vegetation and listed plant species.*

Impact Phase: Construction							
Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**L**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**M**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	No - transformation is a necessary outcome of the development						
Will impact cause irreplaceable loss or resources?	No. The footprint is low and no irreplaceable loss is likely.						
Can impact be avoided, managed or mitigated?	Yes, a preconstruction walk-through should be used to ensure that impacts on listed species is minimized.						
<u>Mitigation measures:</u> 1. Preconstruction walk-though of the power line route to ensure that sensitive habitats and species can be avoided, where possible. 2. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 3. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. 4. If possible a permanent access road beneath the line should not be constructed. A veld track for construction and maintenance is however likely to be necessary. 5. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 6. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.							
Can any residual risk be monitored/managed?	Yes, there should be follow-up checks for erosion and aliens to ensure that impact is limited.						
Will this impact contribute to any cumulative impacts?	Yes. Some transformation will occur and will contribute to cumulative transformation and habitat loss in the area, but with mitigation this can be reduced to a low level.						

Impact 2. *Direct faunal impacts during construction*

Impact Phase: Preconstruction & Construction							
Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbit.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**M**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			Yes. Construction phase disturbance will be transient.				
Will impact cause irreplaceable loss of resources?			Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.				
Can impact be avoided, managed or mitigated?			Yes. The footprint of the power line can be maintained at a low level and sensitive features avoided.				
Mitigation measures: 1. Preconstruction walk-through of the power line route to identify areas of faunal sensitivity. 2. During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. 3. No fires should be allowed within the site as there is a risk of runaway veld fires. 4. No fuelwood collection should be allowed on-site. 5. No dogs should be allowed on site. 6. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards. 7. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 8. All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises as well as the Riverine Rabbit. Speed limits should apply within the facility as well as on the public gravel access roads to the site. 9. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.							
Can any residual risk be monitored/managed?			Yes. All mortalities of fauna on access roads within or to the site should be recorded with a view towards intervention and additional mitigation. If any Riverine Rabbits are killed this should be reported to the EWT Riverine Rabbit programme and additional mitigation implemented.				
Will this impact contribute to any cumulative impacts?			Yes. Construction phase disturbance will contribute towards faunal impacts in the area, but this will be transient.				

Impact 3. *Soil Erosion Risk*

Impact Phase: Planning & Construction

Impact Description: During construction, disturbed areas along the power line route will be highly vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated						
<u>Mitigation measures:</u> 1. Runoff management and erosion control should be integrated into the project design. 2. Some parts of the power line route are on steep slopes and specific avoidance and mitigation should be implemented in such areas to prevent erosion. 3. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas. 4. Regular monitoring for erosion problems along the access roads and other cleared areas. 5. Erosion problems should be rectified on a regular basis. 6. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the construction phase, with interventions implemented where actual and potential problems are observed.						
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.						

6.4.2 Operational Phase

Impact 1. *Soil Erosion Risk During Operation*

Impact Phase: Operation							
Impact Description: Following construction, disturbed areas along the power line route will be vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated						

<u>Mitigation measures:</u> 1. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 2. All roads should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 3. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. 4. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems along the power line route during the operational phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 2. *Alien Plant Invasion*

Impact Phase: Operation							
Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**H**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact

<u>Mitigation measures:</u> 1. Alien plant species are likely to be a long-term problem within disturbed areas and a long-term control plan will need to be implemented. 2. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 3. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to the Alien Management Plan.
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

6.4.3 Decommissioning

Impact 1. *Faunal Impacts due to Decommissioning*

Impact Phase: Decommissioning of the power line							
Impact Description: Faunal impacts due to decommissioning-phase activities along the power line.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**L**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			Yes. This impact will be transient and restricted to the decommissioning period.				
Will impact cause irreplaceable loss or resources?			No, this is unlikely				
Can impact be avoided, managed or mitigated?			Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.				
Mitigation measures: 1. Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. 2. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 3. All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 4. All above-ground infrastructure should be removed from the site and disturbed areas rehabilitated.							
Can any residual risk be monitored/managed?			Yes. Disturbance at the site can be minimized and the speed of vehicles at the site controlled.				
Will this impact contribute to any cumulative impacts?			Yes. The noise and activity will contribute towards disturbance in the area, but this will be transient.				

Impact 2. *Soil Erosion Risk Following Decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.				

Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated
Mitigation measures: 1. Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 2. There should be regular monitoring for erosion for at least 2 years after decommissioning to ensure that no erosion problems develop as result of the disturbance. 3. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 4. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.	
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems for at least 2 years after decommissioning, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Impact 3. *Alien plant invasion following decommissioning*

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, disturbed areas along the power line route will be highly vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**M**	**M**	**M**	**-'tve**	**Medium**	**H**	**High**
With Mitigation	**L**	**L**	**L**	**-'tve**	**Low**	**H**	**High**
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated						
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources						
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact						
Mitigation measures: 1. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. 3. Regular monitoring for alien plants within the disturbed areas. 4. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems following decommissioning.						

Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

7 CONCLUSIONS & RECOMMENDATIONS

7.1 KOMSBERG WEST WEF

The terrain of the Komsberg West site is largely very rugged and consists of numerous hills and valleys with drainage lines, with relatively few flat areas within the site. The target areas for the turbines are located along the higher-lying ridges of the site which receive higher rainfall than the lower-lying parts of the site. The site in general should be considered moderate to high sensitivity due to the high diversity of the area as well as the presence of a number of listed fauna and flora at the site. This includes the Critically Endangered Riverine Rabbit, which would not be likely to suffer significant habitat loss at the site as it is not present along the high ridges of the site, but may be vulnerable to impact from the increased number of vehicles that will be operating in the area during the construction phase. Impacts on Riverine Rabbits can be minimized through restricting night driving as well as ensuring that construction vehicles maintain a low speed limit.

A number of the higher-lying ridges were identified as being particularly sensitive due to the presence of species of concern or their context within the broader topography and landscape of the site. It is recommended that development within the following areas is curtailed.

- Preferred Turbines 22-26 (5 turbines)
- Alternative Turbine 73-76 (4 turbines)
- Alternative Turbines 60-63 (4 turbines)
- Alternative Turbines 66-68 (3 turbines)

The identified high sensitivity areas are important for flora as well as fauna and avoidance of these areas will be important for reducing the overall cumulative impact of the development. As this includes only 16 of the potential 76 turbine positions, this is not likely to prove to be a significant obstacle for the development.

The slopes of the site contain similar species to the ridges but would be highly vulnerable to erosion impacts and the large access roads that would be required to get the turbine components to the top of the ridges during construction would pose a significant erosion risk. Although the Komsberg West site is fairly arid and most of the site receives less than 350mm annual rainfall, it is important to recognize that this does not significantly reduce the erosion risk. The highest levels of sediment yield occur in the semi-arid environments as plant cover is not high enough to limit runoff, yet these areas can experience occasional intense rainfall events which are able to generate significant amounts of erosion in a single event. Some of the access roads traverse steep slopes en-route to the ridges where the turbines are located and in these areas, the access roads will require significant cut and fill and this may increase the actual footprint of the roads beyond their technical requirements in parts. On steep slopes the large surface area of the road will generate significant runoff which must be managed. Once erosion is initiated on a steep slope, it is difficult to prevent it from propagating down the slope and increasing in magnitude.

Overall, the site is considered significantly less sensitive than the escarpment itself or the mountainous areas to the west of the site, which contain a significantly greater abundance and diversity of listed species. The vegetation of the site is relatively homogenous and while there is some difference between the uplands and lowlands of the site, this difference is not very large and many of the common and dominant species occur throughout the site. The major differentiating feature of the lowlands from the uplands, is the presence of large well-wooded drainage systems in the low-lying areas. These are ecologically significant and disturbance to these ecosystems should be minimized.

The major impact of the Komsberg West development would be on ecological processes rather than on biodiversity pattern. While there are some parts of the target ridges that should be avoided, direct impacts on species and habitats can be mitigated to a low level through design and preconstruction walk-throughs to inform the final approved layout. However, potential impacts on broad-scale ecological processes will remain regardless of mitigation. This impact is however partially mitigated by the position of the turbines along the ridges and the valley’s being the most important routes for faunal movement in the area.

Overall, after mitigation which includes avoidance of the sensitive turbine locations indicated, the impact of the Komsberg West Wind Energy Facility would be of moderate significance. While there are no impacts associated with the development that are considered to be of very high significance, there are several impacts which are likely to remain of moderate significance after mitigation. Of particular concern would be erosion risk due to the presence of access roads on the steep slopes of the site as well as potential impacts on Critical Biodiversity Areas and broad-scale ecological processes. However, with mitigation and avoidance implemented, these impacts are considered acceptable.

Summary assessment for the Komsberg West Wind Energy Facility, before and after mitigation.

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	High	Medium
Faunal impacts due to construction activities	High	Medium
Increased erosion risk during construction	High	Low
Operational Phase Impacts		

Faunal impacts due to operational activities	Medium	Medium
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	High	Low
Decommissioning		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk after decommissioning	Medium	Low
Increased erosion risk following decommissioning	High	Low
Cumulative Impacts		
Impacts on broad-scale ecological processes	High	Medium

7.2 Komsberg West Grid Connection

The area affected by the Komsberg West Grid Connection is similar to the habitat within the Komsberg West Wind Energy Facility and traverses rugged terrain on the way to the Komsberg Substation. There are no significant differences between the two alternatives and the differences are considered non-substantive as they share the majority of their route. As such, there is no preferred alternative from an ecological perspective and both are considered to have a similar impact.

Although the footprint of the power line can be kept to a low level, it would generate some erosion risk after construction on the steep slopes it traverses. In addition, the power line traverses an area with a known population of Riverine Rabbits and construction-phase impacts on Riverine Rabbits will need to be monitored and mitigation implemented if necessary. The risks associated with the power line construction and operation can be mitigated to a low level and there are no impacts likely to be associated with the power line that cannot be mitigated to a low level.

Summary assessment for the Komsberg West Grid Connection, before and after mitigation.

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	Medium	Low
Faunal impacts due to construction activities	Medium	Low
Increased erosion risk during construction	Medium	Low
Operational Phase Impacts		
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	Medium	Low
Decommissioning		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk after decommissioning	Medium	Low

Increased erosion risk following decommissioning	Medium	Low

7.3 Komsberg East WEF

The terrain of the Komsberg East site is largely very rugged and consists of large hills and ridges broken by valleys and drainage systems. The target areas for the turbines are located along the higher-lying ridges of the site. Although there are some species restricted to these ridges, they are generally not more sensitive than the slopes and lower plains of the site. However, the site in general should be considered to be of a moderate to high sensitivity level due to the high diversity of the area as well as the presence of a number of listed fauna and flora at the site. However, unlike the areas to the west of the site, it is not likely that the Riverine Rabbit is present at the site and area is very dry and there does not appear to be any suitable habitat within the site that might be impacted by the development. However, if construction vehicles are accessing the site from the Komsberg area, then some mitigation to reduce the likelihood of vehicle collisions may be necessary.

The slopes of the site would be highly vulnerable to erosion impacts and the large access roads that would be required to get the turbine components to the top of the ridges during construction would pose a significant erosion risk. Although the Komsberg East site is arid and most of the site receives less than 250mm annual rainfall, it is important to recognize that this does not significantly reduce the erosion risk. The highest levels of sediment yield occur in the semi-arid environments as plant cover is not high enough to limit runoff, yet these areas can experience occasional intense rainfall events which are able to generate significant amounts of erosion in a single event. On the steep slopes of the site, the access roads may require significant cut and fill and this may increase the actual footprint of the roads beyond their technical requirements in these parts. On steep slopes the large surface area of the road will generate significant runoff which must be managed. Once erosion is initiated on a steep slope, it is difficult to prevent it from propagating down the slope and increasing in magnitude.

Overall, the Komsberg East site is considered moderately sensitive, with the steep and rugged nature of the site being the major driver of the sensitivity of the site. The vegetation of the site is relatively homogenous and there is not a lot of variation in composition along the ridges. The low-lying parts of the site are however significantly hotter and drier than the uplands and consequently more karroid in nature. A characteristic feature of the lowlands, is the presence of large well-wooded drainage systems dominated by *Acacia karoo*. These are ecologically significant and disturbance to these ecosystems should be minimized.

The major impact of the Komsberg East development would be on ecological processes rather than on biodiversity pattern. While there are some parts of the target ridges that should be avoided, direct impacts on species and habitats can be mitigated to a low level through design and preconstruction walk-throughs to inform the final layout and micrositing of turbines.

However, potential impacts on broad-scale ecological processes will remain regardless of mitigation. This impact is however partially mitigated by the position of the turbines along the ridges and the valley's being the most important routes for faunal movement in the area.

Overall, after mitigation, impacts associated with the Komsberg East Wind Energy Facility are likely to be of moderate to low significance. While there are no impacts associated with the development and operation of the Komsberg East WEF that are considered to be of very high significance, there are some impacts which are likely to remain of moderate significance after mitigation. Of particular concern would be erosion risk due to the presence of access roads on the steep slopes of the site as well as potential impacts on Critical Biodiversity Areas and broad-scale ecological processes. With mitigation and avoidance implemented, these impacts are not likely to generate impacts beyond the site and are considered acceptable.

Summary assessment for the Komsberg East Wind Energy Facility, before and after mitigation.

Phase & Impact	**Before Mitigation**	**After Mitigation**
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	High	Medium-Low
Faunal impacts due to construction activities	High	Medium
Increased erosion risk during construction	High	Low
Operational Phase Impacts		
Faunal impacts due to operational activities	Medium	Medium
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	High	Low
Decommissioning		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk after decommissioning	Medium	Low
Increased erosion risk following decommissioning	High	Low
Cumulative Impacts		
Impacts on broad-scale ecological processes	High	Medium

7.4 Komsberg East Grid Connection

The area affected by the Komsberg East Grid Connection includes the Komsberg East WEF, the intervening area as well as the Komsberg West WEF and the final 28km outside of the site to the Komsberg substation. There are no significant differences between the two alternatives and the differences are considered non-substantive as they share the majority of their route. As such, there is no preferred alternative from an ecological perspective and both are considered to have a similar impact.

The Komsberg East Grid Connection route includes numerous steep ridges where the risk of erosion following construction would be high. The footprint of the line would however be relatively low and impacts on sensitive features and species can be avoided. Although the Riverine Rabbit is not likely to occur within the area affected by the Komsberg East WEF, the power line traverses an area where this species is known to be present towards the Komsberg Substation. Construction-phase impacts on Riverine Rabbits would result mostly from the risk of collisions with vehicles and would need to be monitored and mitigation implemented if necessary. Overall, the risks associated with the Komsberg East grid connection construction and operation can be mitigated to a low level and there are no impacts likely to be associated with the power line that cannot be mitigated to an acceptably low level.

Summary assessment for the Komsberg East Grid Connection, before and after mitigation.

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	Medium	Low
Faunal impacts due to construction activities	Medium	Low
Increased erosion risk during construction	Medium	Low
Operational Phase Impacts		
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	Medium	Low
Decommissioning		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk after decommissioning	Medium	Low
Increased erosion risk following decommissioning	Medium	Low

7.5 FINAL MITIGATED LAYOUT

In response to the results of this as well as the other specialist studies, the developer has provided a final 'mitigated' layout of the intended development. This is illustrated below in Figure 6 and illustrates that all turbines have be relocated outside of the Very High sensitivity areas. While all attempts to avoid these areas have been made, there are however still some very short sections of access road which traverse them. This is acceptable to the Specialist and any micrositing and further mitigation required will be carried out during pre-construction walk-through surveys. For Komsberg West, a significant number of turbines have been relocated from the high elevation areas to the lower ridges to the south and east. This also has the effect of concentrating the development within a smaller area and the overall impact would be to significantly lower the impact from the pre-mitigated layout and is consistent with the recommendations of this report. There have also been significant changes to the location of the turbines within the Komsberg East facility, but largely due to avifaunal considerations. Here there has been a significant increase in turbines on the lower ridges in the south and all turbines on several of the eastern ridges have been removed to reduce potential avifaunal impacts. This is ultimately also positive from a terrestrial ecological perspective as a large number of turbines have been moved from areas which are considered to be Medium-High sensitivity to areas which are Medium sensitivity. As the lower ridges are more arid and contain a lower abundance of species of conservation concern, the impact of the additional turbines on the lower ridges should lower the overall impact of the development compared to the assessed layout. The recommended mitigation and avoidance measures for both facilities should however remain unchanged and a preconstruction walk-though of the final development footprint should be conducted to enable micrositing of the turbines and access roads to reduce impact on species and habitats of conservation concern.

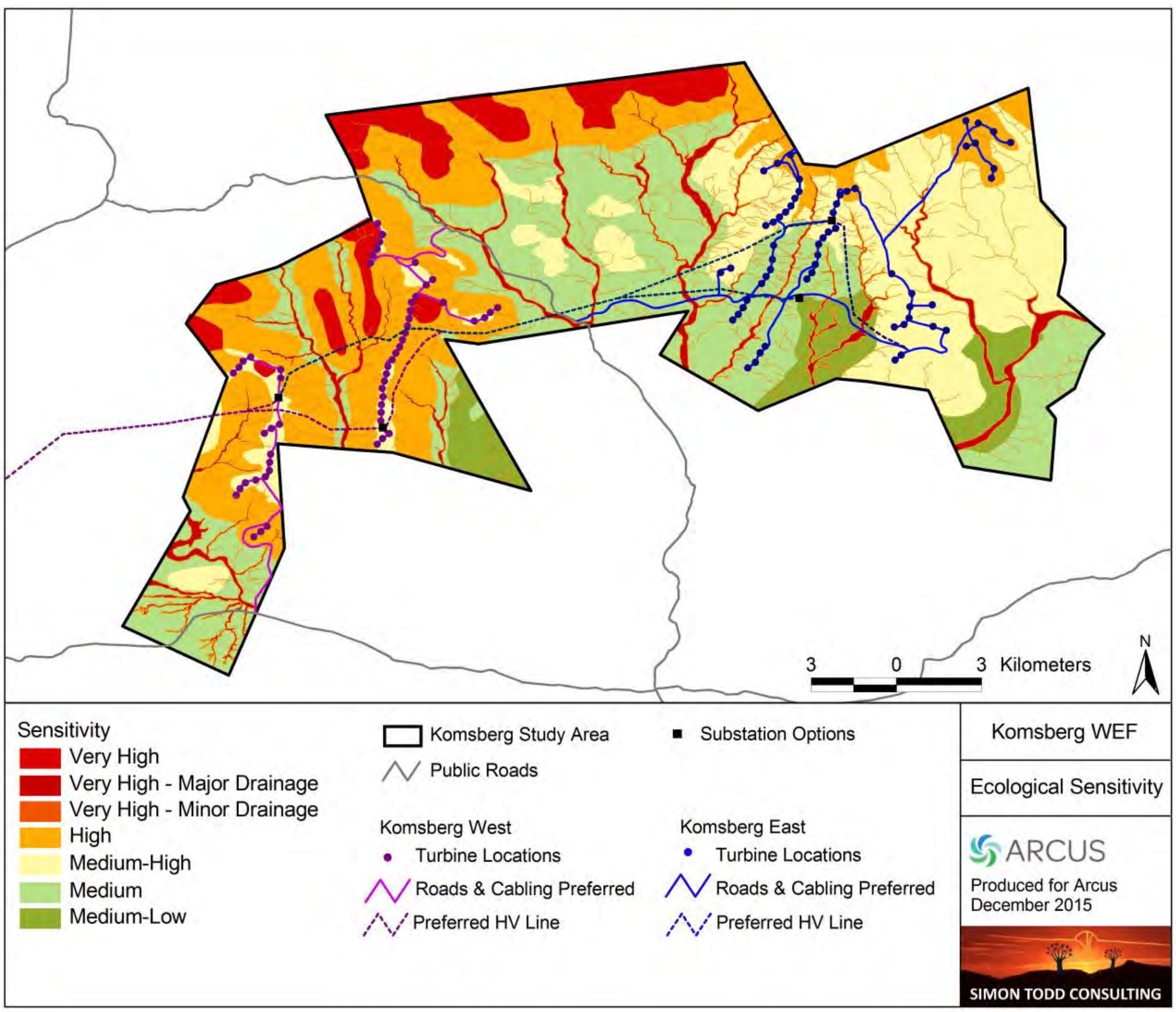

Figure 6. Final 'mitigated' layout of the Komsberg East and West facilities overlayed on the sensitivity map for the site.

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9 APPENDIX 1. LISTED PLANT SPECIES

List of plant species of conservation concern which are known to occur in the vicinity of the Komsberg Wind Farm. The list is derived from the SIBIS:SABIF website as at June 2015. Species in **bold** were observed at the site.

Family	Species	IUCN Status
AMARYLLIDACEAE	***Boophone disticha***	**Declining**
AMARYLLIDACEAE	*Strumaria karooica*	Rare
AMARYLLIDACEAE	***Brunsvigia josephinae***	**VU**
APOCYNACEAE	*Hoodia gordonii*	DDD
APOCYNACEAE	*Hoodia pilifera subsp. pillansii*	DDT
ASPHODELACEAE	*Bulbine torta*	Rare
ASTERACEAE	*Gnaphalium declinatum*	NT
ASTERACEAE	***Eriocephalus grandiflorus***	**Rare**
ASTERACEAE	*Euryops marlothii*	Rare
ASTERACEAE	*Euryops petraeus*	Rare
ASTERACEAE	*Phymaspermum schroeteri*	Rare
CRASSULACEAE	*Adromischus humilis*	Rare
CRASSULACEAE	***Adromischus phillipsiae***	**Rare**
CRASSULACEAE	*Crassula roggeveldii*	Rare
CRASSULACEAE	*Crassula rupestris subsp. commutata*	Rare
ERICACEAE	*Erica caffrorum var. glomerata*	DDT
HYACINTHACEAE	*Lachenalia congesta*	Rare
IRIDACEAE	*Romulea komsbergensis*	NT
IRIDACEAE	*Romulea subfistulosa*	NT
IRIDACEAE	*Ixia brevituba*	Rare
IRIDACEAE	*Romulea multifida*	VU
IRIDACEAE	*Romulea syringodeoflora*	VU
MESEMBRYANTHEMACEAE	*Delosperma sphalmanthoides*	DDT
MESEMBRYANTHEMACEAE	*Ruschia inclusa*	DDT
POACEAE	*Helictotrichon namaquense*	VU
PROTEACEAE	*Protea venusta*	EN
ROSACEAE	*Cliffortia arborea*	VU
SANTALACEAE	*Thesium marlothii*	DDT
SCROPHULARIACEAE	*Manulea incana*	DDD

10 APPENDIX 2. LIST OF MAMMALS

List of Mammals which potentially occur at the Komsberg Wind Farm site. Taxonomy and habitat notes are derived from Skinner & Chimimba (2005), while conservation status is according to the IUCN 2015.

Scientific Name	Common Name	Status	Habitat	Likelihood
Afrosoricida (Golden Moles):				
Chlorotalpa sclateri	Sclater's Golden Mole	LC	Montane grasslands, scrub and forested kloofs of the Nama Karoo and grassland biomes	High
Chrysochloris asiatica	Cape Golden Mole	LC	Coastal parts of the Northern and Western Cape	High
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus edwardii	Cape Rock Elephant Shrew	LC	From rocky slopes, with or without vegetation, from hard sandy ground bearing little vegetation, quite small rocky outcrops	High
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	High
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	High
Lagomorpha (Hares and Rabbits):				
Bunolagus monticularis	Riverine Rabbit	CR	Confined to riparian bush on the narrow alluvial fringe of seasonally dry watercourses in the Central Karoo.	Possible
Pronolagus saundersiae	Hewitt's Red Rock Hare	LR/LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	High
Lepus capensis	Cape Hare	LR/LC	Dry, open regions, with palatable bush and grass	High
Lepus saxatilis	Scrub Hare	LR/LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	High
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	High

Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	High
Acomys subspinosus	Cape Spiny Mouse	LC	Associated with rocky areas on mountain slopes in Fynbos	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Micaelamys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	High
Micaelamys granti	Grant’s Rock Mouse	LC	Restricted to the karoo where they are associated with rocky terrain.	High
Parotomys brantsii	Brants's Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale’s Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	Low
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	High
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Tatera afra	Cape Gerbil	LC	Confined to areas of loose, sandy soils of sandy alluvium. Common on cultivated lands.	Low
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Dendromus melanotis	Grey Climbing Mouse	LC	Often associated with stands of tall grass especially if thickened with bushes and other vegetation	High
Primates:				
Papio hamadryas	Chacma Baboon	LR/LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
Eulipotyphla (Shrews):				
Myosorex varius	Forest Shrew	LC	Prefers moist, densely vegetated habitat	High

Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristatus	Aardwolf	LR/LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Panthera pardus	Leopard	SARDB NT	Wide habitat tolerance, associated with areas of rocky koppies and hills, mountain ranges and forest	Low/Moderate
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LR/LC	Occur in open arid associations	High
Genetta tigrina	Large-spotted genet	LR/LC	Fynbos and savanna particularly along riverine areas	Low
Suricata suricatta	Meerkat	LR/LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	High
Cynictis penicillata	Yellow Mongoose	LR/LC	Semi-arid country on a sandy substrate	High
Galerella pulverulenta	Cape Grey Mongoose	LR/LC	Wide habitat tolerance	High
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
Aonyx capensis	Cape Clawless Otter	LC	Predominantly aquatic and do not occur far from permanenetpermanenet water	Medium
Ictonyx striatus	Striped Polecat	LR/LC	Widely distributed throughout the sub-region	High
Mellivora capensis	Ratel/Honey Badger	SARDB EN	Catholic habitat requirements	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LR/LC	Presence of bushes is essential	High
Pelea capreolus	Grey Rhebok	LC	Associated with rocky hills, rocky mountainsides, mountain plateaux with good grass cover.	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	High
Raphicerus campestris	Steenbok	LR/LC	Inhabits open country,	High

Raphicerus melanotis	Cape Grysbok	LC	Thick scrub bush, particularly along the lower levels of hills	Medium
Oreotragus oreotragus	Klipspringer	LR/cd	Closely confined to rocky habitat.	High

11 APPENDIX 3. LIST OF REPTILES.

List of reptiles which are known from the broad area around the Komsberg Wind Farm site, according to the SARCA database, derived for the degree squares 3220 and 3221. Status is according to Bates et al. (2014). Species in bold were observed at the site.

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Agamidae	***Agama***	***atra***		**Southern Rock Agama**	**Least Concern**	**20**
Agamidae	*Agama*	*hispida*		Spiny Ground Agama	Least Concern	1
Chamaeleonidae	*Bradypodion*	*gutturale*		Little Karoo Dwarf Chameleon	Least Concern	2
Chamaeleonidae	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern	1
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern	2
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern	1
Colubridae	*Lamprophis*	*guttatus*		Spotted House Snake	Least Concern	2
Colubridae	*Prosymna*	*sundevallii*		Sundevall's Shovel-snout	Least Concern	1
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern	1
Colubridae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern	4
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Least Concern	1
Cordylidae	*Cordylus*	*cloetei*		Cloete's Girdled Lizard	Least Concern	14
Cordylidae	*Cordylus*	*minor*		Western Dwarf Girdled Lizard	Least Concern	6
Cordylidae	***Karusasaurus***	***polyzonus***		**Karoo Girdled Lizard**	**Least Concern**	**22**
Cordylidae	*Pseudocordylus*	*microlepidotus*	*namaquensis*	Nuweveldberg Crag Lizard	Least Concern	4
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed	2
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Least Concern	4
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern	2
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern	1
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern	4
Gekkonidae	*Goggia*	*lineata*		Striped Pygmy Gecko	Least Concern	1
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern	3
Gekkonidae	*Pachydactylus*	*geitje*		Ocellated Gecko	Least Concern	5
Gekkonidae	*Pachydactylus*	*kladaroderma*		Thin-skinned Gecko	Least Concern	13
Gekkonidae	*Pachydactylus*	*mariquensis*		Marico Gecko	Least Concern	3
Gekkonidae	*Pachydactylus*	*oculatus*		Golden Spotted Gecko	Least Concern	27
Gekkonidae	*Pachydactylus*	*purcelli*		Purcell's Gecko	Least Concern	7
Gekkonidae	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern	1
Gerrhosauridae	*Tetradactylus*	*tetradactylus*		Cape Long-tailed Seps	Least Concern	1
Lacertidae	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern	1
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern	4

Lacertidae	*Pedioplanis*	*burchelli*		Burchell's Sand Lizard	Least Concern	3
Lacertidae	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern	13
Lacertidae	***Pedioplanis***	***namaquensis***		**Namaqua Sand Lizard**	**Least Concern**	**2**
Scincidae	***Trachylepis***	***sulcata***	***sulcata***	**Western Rock Skink**	**Least Concern**	**4**
Scincidae	***Trachylepis***	***variegata***		**Variegated Skink**	**Least Concern**	**9**
Testudinidae	***Chersina***	***angulata***		**Angulate Tortoise**	**Least Concern**	**4**
Testudinidae	*Homopus*	*boulengeri*		Karoo Padloper	Near Threatened	2
Testudinidae	*Homopus*	*femoralis*		Greater Padloper	Least Concern	3
Testudinidae	***Psammobates***	***tentorius***	***tentorius***	**Karoo Tent Tortoise**	**Not listed**	**8**
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed	1

12 APPENDIX 4. LIST OF AMPHIBIANS

List of amphibians which potentially occur at the Komsberg Wind Farm. Taxonomy and habitat notes are from du Preez and Carruthers (2009) and conservation status from the Minter et al. (2004).

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Amietophrynus rangeri	Raucous Toad	Not Threatened	Rivers and stream in grassland and fynbos	Endemic	High
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	High
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	High
Amietia fuscigula	**Cape River Frog**	**Not Threatened**	**Large still bodies of water or permanent streams and rivers.**	**Widespread**	**Confirmed**
Cacosternum karooicum	Karoo Dainty Frog	Data Deficient	Arid areas with unpredictable rainfall. Breeds in small streams as well as man-made dams.	Karoo Endemic	High
Tomopterna delalandii	Cape Sand Frog	Not Threatened	Lowlands in fynbos and Succulent Karoo	Endemic	High
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanan	Widespread	High