








Amendment Application for the Proposed Kokerboom 1 Wind Energy Facility in the Northern Cape Province

Draft Amendment Report for Public Comment

Date: 6 March 2019

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Business Venture Investments No. 1788 (Pty) Ltd

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Document prepared by:

Aurecon South Africa (Pty) Ltd
1977/003711/07
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City
Cape Town
7441
PO Box 494
Cape Town
8000
South Africa

T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W aurecongroup.com

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Approval			
Reviewer signature		Approver signature	
Name	Franci Gresse	Name	Andries van der Merwe
Title	Senior Environmental Consultant	Title	Project Director

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Contents

Figures

Tables

Appendices

1 Introduction

The applicant, *Business Venture Investments No. 1788 (Pty) Ltd (BVI)*, received Environmental Authorisation (EA) on 29 November 2017[1] to construct a 256MW Wind Energy Facility (WEF) and its associated infrastructure on Farm Leeuwbergrivier (Farm no. 1163) and the Remainder of Farm Kleine Rooiberg (Farm 227) near Loeriesfontein in the Northern Cape. The authorisation process commenced with the appointment of Aurecon South Africa (Pty) Ltd (Aurecon) to undertake the requisite environmental impact assessment process in terms of the Environmental Impact Assessment (EIA) Regulations (Government Notice Regulation (GN R) 982 of 4 December 2014, as amended of the National Environmental Management Act (No. 107 of 1998), as amended.

Subsequent advances in turbine technology and refinement of the wind farm design has resulted in a change in the authorised scope of the development. The applicant has therefore appointed Aurecon to manage the amendment process in terms of the 2014 EIA Regulations. The proposed amendments relate to turbine specifications, the rotor diameter and turbine generation capacity. New locations are also proposed for the substation, construction camps and laydown areas due to an optimized layout.

This report was thus compiled in fulfilment of the legal requirements for a Part 2 amendment process in terms of Regulation 32 of GN R 982, as amended. It provides a description of and motivation for the proposed changes and evaluates the advantages and disadvantages thereof. Additional mitigation measures are also proposed by the specialists (namely avifauna, bats and terrestrial ecology) where relevant.

1.1 Description of the Authorised Development

The project, as authorised by the DEA, allows for the construction of a 256MW wind farm and its associated infrastructure near Loeriesfontein, within the Hantam Local Municipality in the Northern Cape Province. Figure 1 provides the location and authorised site layout.

The authorised facility and its associated infrastructure include the following major components as described in the EA (DEA, 2017, page 11):

- A maximum generating capacity of up to 256MW;
- Up to 64 wind turbines with a generating capacity of up to 4MW per turbine, with a rotor diameter of up to 150m and a hub height up to 150m;
- Foundations and hard stands and associated with each wind turbine. Concrete foundations would be approximately 26m in diameter and up to approximately 3m deep per turbine. Each hard stand would be approximately 50m X 25m;
- Construction laydown areas: up to 34 100m² (including site camp and cement batching area);
- Permanent laydown areas: approximately 80 000m² (hard stands);
- Area occupied by substation facility: approximately 14 400m² (120m X120m);
- Permanent Operations and Maintenance (O&M) Facilities will include offices, ablution facilities, workshop and storage areas, control rooms, parking area and other facilities required for the monitoring, operation and management of the facility. It will occupy a total area of approximately 14 400m² (approximately 120m X 120m);
- Medium voltage (MV) (approximately 33kV) power cables between the turbines and the substation facility;

[1] Department of Environmental Affairs (DEA) reference number: 14/12/16/3/3/2/985.

- High voltage (HV) (approximately 132kV) overhead powerline linking the facility substation to the switching station;
- Lighting protection system;
- Grounding system;
- Access road and internal roads;
- Fencing of the site, substation and O&M facilities; and
- Potential alarm and video surveillance system.

1.2 Environmental Process and Impacts

Table 1 below provides a summary of the legal processes undertaken to date for the Kokerboom 1 Wind Farm. Copies of the EA authorisation, appeal statement and amended EA are available in Appendix A.

Table 1: Legal processes undertaken to date for Kokerboom 1

Process	Description	Outcome
Application for Environmental Authorisation in terms of the NEMA EIA Regulations (Government Notice Regulation (GN R) 982, 983,984 and 985 of 4 December 2014, as amended)	An EIA was undertaken and documented in the Final EIA Report dated 17 August 2017 (Aurecon, 2017).	The EA issued on 29 November 2017 by DEA.
Appeal pursuant to section 43(2) of the NEMA, 1998 (retracted).	An appeal was lodged against the EA concerning the potential wake effect and associated impacts of the Kokerboom 1 Wind Farm on two neighbouring wind energy facilities.	An agreement was reached between BVI and the Appellants in terms of which the Appellants agreed to withdraw their appeal. It was also agreed to amend the EA to include specific conditions to address the Appellants' wake loss concerns.
Application for amendment of the EA in terms of Regulation 32 of GN R 982, as amended.	An amendment process was undertaken to include additional conditions relating to the management of potential wake effects as agreed with the Appellants and to remove one condition that was not applicable to the project.	An amendment EA was issued on 7 November 2018 in terms of Chapter 5 of the EIA Regulations.

1.2.1 Listed Activities

The following listed activities were included in the Final EIA Report (Aurecon, 2017) and subsequently authorised:

Table 2: Listed activities in terms of NEMA GN 983, 984 and 985 as amended, authorised for the proposed Kokerboom 1 Wind Farm

No.	Listed Activity	Description
GN R983, 4 December 2014 (as amended)		
11	The development of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV;	An on-site collector substation will be required for the Kokerboom 1 Wind Farm. Turbines will be linked to each other and the on-site substation via overhead and/or subterranean medium voltage cables (~33kV). A high voltage transmission line (132kV) will be required to connect the on-site substation to the proposed grid connection infrastructure which is the subject of a separate BA process.
12	The development of – (ii) infrastructure or structures with a physical footprint of 100 m^2 or more; Where such development occurs – (a) within a watercourse; (c) if no development setback exists, within 32 m of a water course, measured from the edge of a watercourse; -	Drainage lines are scattered across the proposed site and one or more roads, powerlines, and/or buildings are likely to cross these lines or be within 32 m thereof. All wind turbines and buildings have been located more than 32m away from a watercourse.
19	The infilling or depositing of any material of more than 10 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m^3 from a watercourse;	The infilling or depositing of any material of more than 10 m^3 into a watercourse may be triggered with the construction of internal service roads or cables across drainage lines.
24	The development of - (ii) a road with a reserve wider than 13.5 metres, or where no reserve exists where the road is wider than 8 metres;	Permanent roads of sufficient width (~8m) for crawler cranes may be required for the proposed wind farm. During construction these roads may need to be up to ~20m wide to accommodate the movement of heavy vehicles and cable trenching activities.
28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 1 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 ha...	The proposed farm on which the project is proposed is likely to have or is still being used for livestock grazing (mostly sheep).
56	The widening of a road by more than 6 m, or lengthening of a road by more than 1 km – (ii) where no reserve exists, where the existing road is wider than 8 m.	Access roads of approximately 8 m in width, with a reserve/ buffer of approximately 12m, would be required to develop the proposed wind farm and in combination would exceed 1 km. Existing roads would be used as far as practically possible and feasible, but would likely require widening by more than 6 m.
GN R984, 4 December 2014 (as amended)		
1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.	The proposed wind farm would have a maximum generation capacity of up to 256 MW.

No.	Listed Activity	Description
15	The clearance of an area of 20 hectares or more of indigenous vegetation…	Physical alteration of undeveloped land for industrial use would take place. The total area to be disturbed is expected to be approximately 155ha (to be rehabilitated down to ~80ha permanent footprint).
GN R985, 4 December 2014 (as amended)		
18	The widening of a road by more than four metres, or the lengthening of a road by more than one kilometre. (g) In Northern Cape Province: (ii) Outside urban areas, in: (ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.	Access roads of approximately 8m in width (with a buffer/ road reserve area of approximately 12m) would be required to develop the proposed wind farm and in combination would exceed 1 km. Existing roads would be used as far as practically possible and feasible, but would likely require widening by more than 4 m. Some of these roads will fall within 100m of the delineated watercourses on the site.

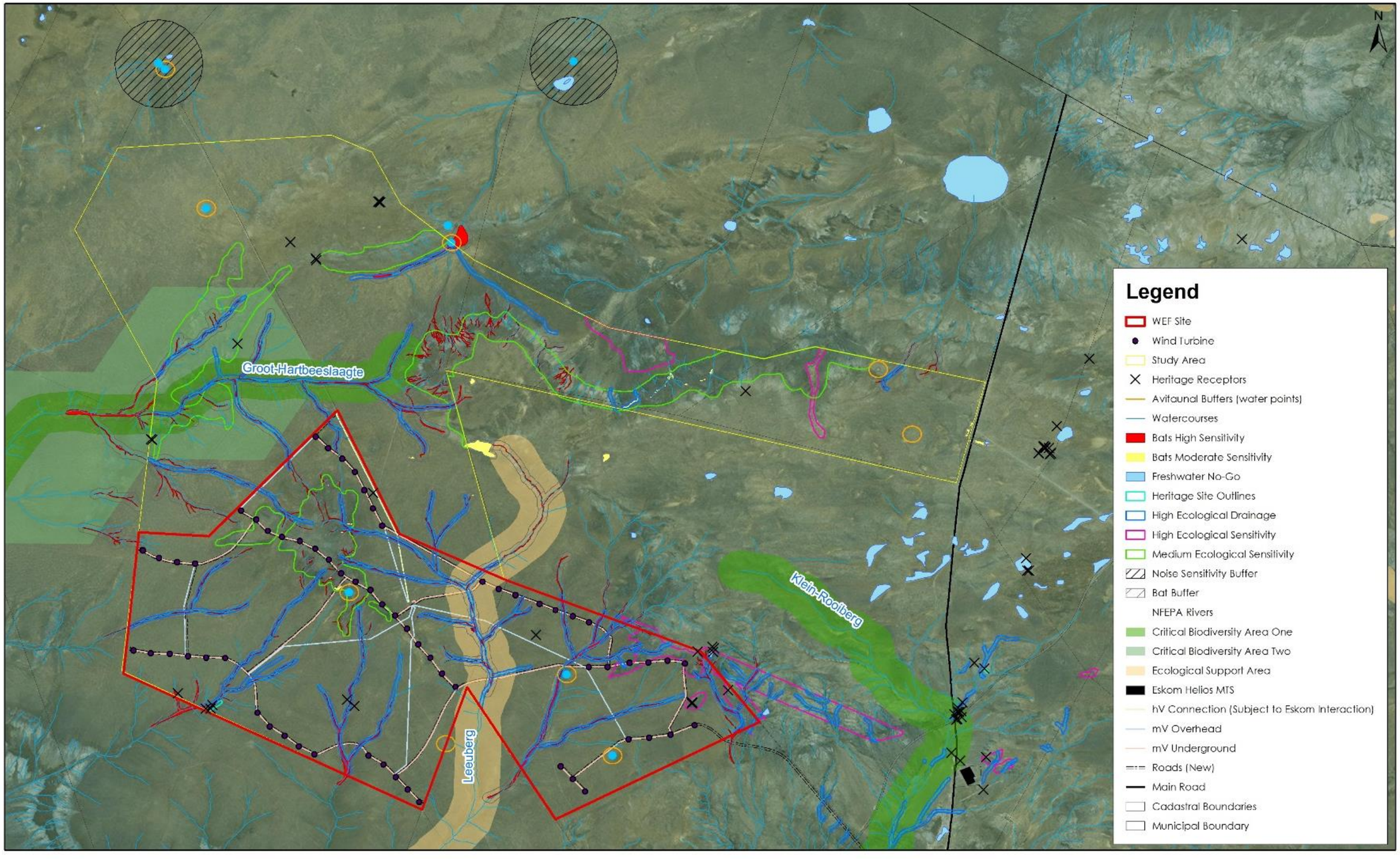

Figure 1: Authorised layout for Kokerboom 1 Wind Farm and associated infrastructure superimposed over mapped environmental sensitivities

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2 Description and Motivation for the Proposed Amendments

2.1 Proposed Amendments

Business Venture Investments No 1788 (Pty) Ltd, is applying for an amendment that would allow for increased hub height, rotor diameter, the power generation capacity of the turbines and larger foundation areas. As a result, the Kokerboom 1 Wind Farm layout would need to be re-designed/ re-optimised in response to the revised turbine specifications, while taking into account environmental sensitivities (Figure 2). Table 3 below provides describes the amendments required to the authorised project specifications and scope.

Table 3: Proposed amendments to the Kokerboom 1 Wind Farm specifications and scope

Component	Authorised	Proposed Amendment
Facility area	• Proposed project footprint: 6,716ha • Temporary construction footprint: approximately 155ha • Permanent footprint: approximately 80ha	• Proposed project footprint: 6,716ha • Temporary construction footprint: approximately 154ha • Permanent footprint: approximately 75ha
Site access	The site will be accessed via a proposed new access road on Farm RE/227, which will branch off the Nuwepos Road (preferred alternative).	No amendment required.
Export capacity	Up to 256MW.	No amendment required.
Number of turbines	Up to a maximum of 64.	Up to a maximum of 60[2].
Turbine generation capacity	Up to 4MW.	Up to 6.5MW.
Hub height from ground level	Up to 150m.	No amendment required.
Rotor diameter	Up to 150m.	Up to 180m.
Blade Tip Height[2]	Maximum upper tip height: 225m Minimum lower tip height: 40m	Maximum upper tip height: 240m Minimum lower tip height: 40m
Area occupied by substations	Approximately 14,400m[2].	No amendment required.
Location of substation	30º27'36.92"S 19º26'1.58"E	A new location is proposed approximately 850m southeast of the authorised substation location (30°28'6.42"S 19°26'15.88"E).

[2] The actual number of turbines constructed will depend on the available turbine technology in South Africa at the specific point in time that construction commence, i.e. the larger the turbine that is utilised, the fewer turbines required. The generation capacity of the wind farm will however be capped at 256MW, as authorised by the Department of Environmental Affairs (DEA).

Component	Authorised	Proposed Amendment
Area occupied by both permanent and construction laydown areas	Total: approximately 114,100 m^2: • Construction laydown areas: up to 34 100m^2 (including site camp and cement batching area). • Permanent laydown areas: approximately 80 000m^2 (hard stands).	Total: approximately 109,100 m^2: • Construction laydown areas: up to 34 100m^2 (including site camp and cement batching area). • Permanent laydown areas: approximately 75 000m^2 (hard stands).
Location of construction camps/ laydown areas	• Construction camp/laydown area 1: 30º29'10.54"S 19º29'38.18"E • Construction camp/laydown area 2: 30º27'43.14"S 19º25'57.72"E	The two construction camps/ laydown areas (combined footprint of approximately 34,100m^2) will be located in the most practical location/s as determined by the contractor closer to the time of construction. These locations will remain outside sensitive areas and must be approved by the Environmental Control Officer prior to construction commencing.
Width and length of internal roads	Total: approximately 1,960,000m^2 • Construction: up to approximately 20m (width) x approximately 70km (length) =1,400,000m^2. • Permanent: approximately 8m (width) x approximately 70km (length) = 560,000m^2.	Total: approximately 1,820,000m^2 • Construction: up to approximately 20m (width) x approximately 65km (length) =1,300,000m^2. • Permanent: approximately 8m (width) x approximately 65km (length) = 520,000m^2.
Proximity to grid connection	Approximately 12km from proposed substation to existing Eskom Helios Substation as the crow flies.	No amendment required.
Internal powerline/cables	The final layout included in the Final EIA Report (2017) includes MV powerlines that does not follow internal access roads. However, Condition 58 of the EA states that: *"All internal powerline/cables must follow internal access roads."* In addition, Condition 59 requires *"all powerlines linking the turbines to the onsite substation must be buried."* The total length of potential MV lines is approximately 22km according to the original layout.	In the new lay-out internal MV powerlines/cables have been aligned with internal access roads. Approximately 32km of potential MV overhead powerlines have been proposed in order to provide efficiencies in the plant design, to limit energy losses between the turbines and substation, and in the event that trenching cannot be implemented in some ecologically sensitive areas, or for geological reasons. In addition, a length of overhead high voltage (HV) powerline is required to link the substation to the Eskom switching station (the latter forms part of a separate EA) in order to export the electricity generated by the wind farm. The most direct route between the substation and switching station was authorised to minimise the length of the powerline. The authorised HV powerline followed an internal road over approximately 3.3 km and deviated from it over a distance of approximately 1.7km. The new proposed HV powerline follows more or less the same route but deviates from the authorised route to the new proposed location of the substation that is 850m southeast of the authorised substation location.

The above changes would also require amendments to specific sections of the EA as shown in Figure 2.

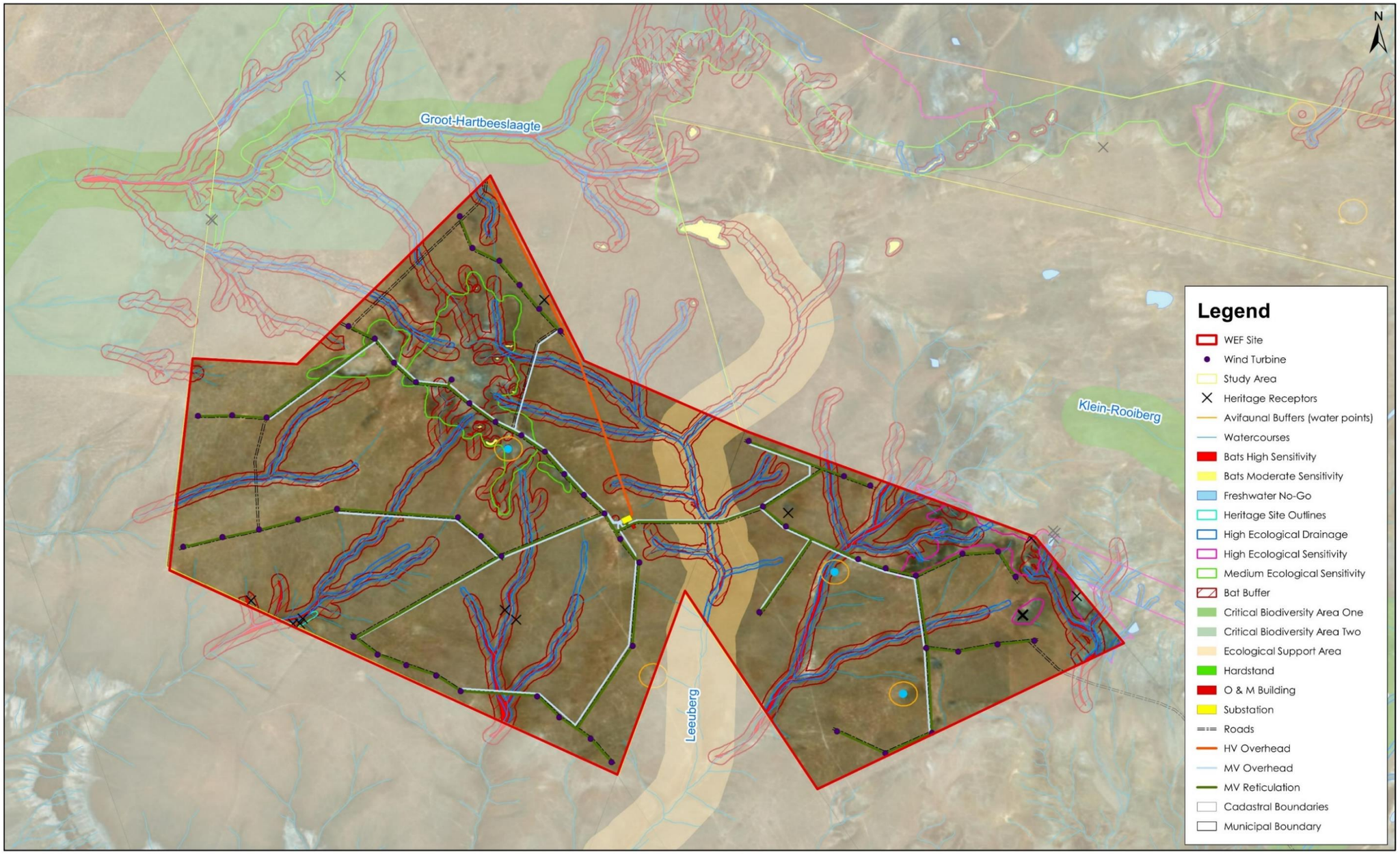

Figure 2: Proposed optimised layout for Kokerboom 1 Wind Farm and associated infrastructure superimposed over mapped environmental sensitivities

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Table 4: Proposed amendments with reference to the relevant section of the Environmental Authorisation and Amendment Environmental Authorisation (proposed changes underlined)

Page 3, 4 and 5 of EA – Table of listed activities		
Listed Activity	**Authorised Description**	**Proposed Description**
GN No. R984: Item 15 The clearance of an area of 20 hectares or more of indigenous vegetation…	Physical alteration of undeveloped land for industrial use would take place. The total area to be disturbed is expected to be approximately 155ha (to be rehabilitated down to ~80ha permanent footprint).	Physical alteration of undeveloped land for industrial use would take place. The total area to be disturbed is expected to be approximately 154ha (to be rehabilitated down to approximately 75ha permanent footprint).

Page 5 of EA – Location of project and components	
Authorised Description	**Proposed Description**
Substation: 30º27'36.92"S 19º26'1.58"E	Substation: 30°28'6.42"S 19°26'15.88"E
Construction camp/laydown area 1: 30º29'10.54"S 19º29'38.18"E Construction camp/laydown area 2: 30º27'43.14"S 19º25'57.72"E	The two construction camps/ laydown areas (combined footprint of approximately 34,100m^2) will be located in the most practical location/s as determined by the contractor closer to the time of construction. These locations will remain outside sensitive areas and must be approved by the Environmental Control Officer prior to construction commencing

Page 6 of EA – Project components	
Authorised Description	**Proposed Description**
Up to 64 wind turbines with a generating capacity of up to 4MW per turbine, with a rotor diameter of up to 150m and a hub height up to 150m;	Up to 60 wind turbines with a generating capacity of up to 6.5MW per turbine, with a rotor diameter of up to 180m and a hub height up to 150m;
Permanent laydown areas: approximately 80 000m^2 (hard stands);	Permanent laydown areas: approximately 75 000m^2 (hard stands);

Page 7-Technical details of the proposed facility		
Component	**Authorised Description**	**Proposed Description**
Proposed technology	Wind energy-Onshore turbines, up to 4MW per turbine (depending on selected technology).	Wind energy-Onshore turbines, up to 6.5MW per turbine (depending on selected technology).
Number of turbines	Up to a maximum of 64 turbines.	Up to a maximum of 60 turbines.

Page 7-Technical details of the proposed facility		
Component	**Authorised Description**	**Proposed Description**
Rotor diameter	Up to 150m.	Up to 180m.
Blade tip height	Maximum upper tip height: up to 225m Minimum lower tip height: at least 40m	Maximum upper tip height: up to 240m Minimum lower tip height: at least 40m
Width and length of internal roads	Construction: up to approximately 20m (width) x approximately 70km (length) =1,400,000m^2. Permanent: approximately 8m (width) x approximately 70km (length) = 560,000m^2.	Construction: up to approximately 20m (width) x approximately 65km (length) =1,300,000m^2. Permanent: approximately 8m (width) x approximately 65km (length) = 520,000m^2.
Conditions of the Environmental Authorisation		
Condition	**Authorised Description**	**Proposed Description**
Condition 26	The holder of the authorisation may apply for an amendment of an EMPr, if such amendment is required before an audit is required. The holder must notify the Department of its intention to amend the EMPr at least 60 days prior to submitting such amendments to the EMPr to the Department for approval. In assessing whether to grant such approval or not, the Department will consider the processes and requirements prescribed in Regulation 37 of GNR 982.	The holder of the authorisation may apply for an amendment of an EMPr, if such amendment is required before an audit is required, in accordance with Regulation 37 of GNR 982, as amended. ~~The holder must notify the Department of its intention to amend the EMPr at least 60 days prior to submitting such amendments to the EMPr to the Department for approval~~. In assessing whether to grant such approval or not, the Department will consider the processes and requirements prescribed in Regulation 37 of GNR 982, as amended.[3]
Condition 37	Up to 64 wind turbines are approved.	Up to 60 wind turbines are approved.

[3] The proposed amendment will align Condition 26 with the latest requirements of Regulation 37 of GNR 982, as amended.

Conditions of the Environmental Authorisation		
Component	**Authorised Description**	**Proposed Description**
Condition 56	Anti-collision devices such as bird flappers must be installed where powerlines cross avifaunal corridors (e.g. grasslands, rivers, wetlands and dams). The input of an avifaunal specialist must be obtained for the fitting of the anti-collision devices onto specific sections of the line once the exact positions of the towers have been surveyed and pegged. Additional areas of high sensitivity along the preferred alignment must also be identified by the avifaunal specialist for the fitment of anti-collision devices. These devices must be according to Eskom's Transmission and EWT's Guidelines.	Anti-collision devices such as bird flappers must be installed where powerlines cross avifaunal corridors (e.g. grasslands, rivers, wetlands and dams). The input of an avifaunal specialist must be obtained for the fitting of the anti-collision devices onto specific sections of the line once the exact positions of the towers have been surveyed and pegged. Additional areas of high sensitivity along the preferred alignment must also be identified by the avifaunal specialist for the fitment of anti-collision devices. These devices must be according to Eskom's Transmission and EWT's Guidelines. In addition, the avifaunal specialist and the EWT Wildlife and Energy Working Group must be engaged by the developer to provide input into the design of the proposed poles to be used, and they must approve the final design of all poles i.e. suspension poles, strain poles and terminal poles. This must include the physical inspection of a replica of an actual pole, or a three-dimensional digital model showing all details, because the two-dimensional design drawings do not always show adequate technical details of aspects which could be highly dangerous for birds.
Condition 58	All internal powerlines/cables must follow internal access roads	All internal MV powerlines/ cables linking the turbines to the substation must follow internal access roads
Condition 59	All powerlines linking the turbines to the onsite substation must be buried.	All powerlines linking the turbines to the onsite substation must be buried, except where it is not feasible or desirable to do so due to ecological or geological conditions, or due to excessive energy losses. The total length of overhead powerlines may not exceed the 22km length originally assessed by the specialists.

2.2 Motivation for Proposed Amendments

BVI intends to bid and develop the Kokerboom 1 Wind Farm under the South African Government's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). To-date there have been four bidding windows in the REIPPPP, with the last of these bid windows taking place in 2014. Due to various socio-economic, political and legal reasons the fifth bid window – which was initially expected in 2015/2016 – has been delayed by some years. The next REIPPPP bid window is now anticipated in the second half of 2019.

During the delays in the REIPPP Programme, wind turbine technology has continued to advance rapidly with turbines becoming ever larger, more powerful and more efficient. In the time since the original EIA was undertaken and the EA issued, the turbines that are available on the market have increased in both size and output power. The applicant wishes to amend the EA in order to cater for the larger turbine specifications, to enable the applicant to utilise the latest, most efficient turbines available on the market, which will increase the energy output and overall efficiency of the Kokerboom 1 Project. This in turn will increase the overall competitiveness of the Project in the REIPPPP, and will allow the applicant to charge a lower tariff for the energy produced by the Project – which would be for the benefit of all electricity consumers in South Africa.

The applicant is also taking a long-term view towards likely improvements in turbine technology and is seeking to authorise turbine specifications that are not yet commercially available in South Africa, but which are expected to become available within the next 2-3 years.

The final turbine type will be selected closer to the time of construction, based on the most optimal turbine available on the market at the time. The final turbine specifications will not exceed the proposed maximum specifications (i.e. 180m rotor diameter, 150m hub height and 6.5MW rated power), and the overall capacity of the wind farm will not exceed the authorised maximum (256MW). The final turbine selection will determine the number of turbines installed on site: the more powerful the turbine, the fewer turbines that will be required to achieve the authorised maximum capacity of the wind farm.

In order to cater for the larger turbine specifications, it is necessary to revise the site layout plan to provide sufficient spacing between the larger turbines, for safety reasons and to reduce internal wake effects between turbines. The balance-of-plant infrastructure (i.e. internal roads, cables, substation, hard stands etc.) has been revised and optimised in order to cater for the revised turbine positions. The revised turbine locations and associated balance-of-plant infrastructure are all located within the footprint that was previously assessed in the original EIA.

In addition, a length of overhead high voltage (HV) powerline is required to link the wind farm's substation to the Eskom switching station (the latter forms part of a separate EA) in order to export the electricity generated by the wind farm. Due to the costs associated with the HV powerline, the most direct route between the substation and switching station has been proposed, to minimise the length of the powerline. As a result, the proposed overhead HV routing deviates from the internal road network.[4]

[4] This length of overhead HV powerline was assessed in the original EIA and forms part of the site layout plan that was submitted to DEA with the final EIA Report (Figure 1). However, Condition 58 of the EA stipulates that all cables must follow internal roads. It is now requested that this condition be amended (see Table 4) in order to allow for the overhead HV powerline to deviate from the road network and follow a more direct route to the new onsite substation location as shown in Figure 2.

3 Public Participation Process

This Amendment Report is subject to a 30-day public participation process (PPP) to comply with Regulation 32 of the EIA Regulations (GN R 982). This commenting period is between **6 March 2019 and 8 April 2019**. The aim of the PPP is to inform potential and registered Interested and Affected Parties (I&APs) (including organs of state, which have any jurisdiction in respect of any aspect of the relevant activity and the competent authority) of the proposed amendment and associated changes in impacts and allow for them to comment on the application. The I&APs are listed in Appendix E. The PPP included the following:

- An advert was placed in *Die Burger* on Tuesday 06 March 2019;
- Site notice boards in English and Afrikaans, were placed at the entrance of the site and the Loeriesfontein Public Library;
- Written notification was sent by email and mail to all registered I&APs;
- A hard copy of the Amendment Report was placed in the Loeriesfontein Public Library; and
- Electronic copies of the Amendment Report and associated historical documentation were made available on Aurecon's website (http://www.aurecongroup.com/en/public-participation.aspx) and Dropbox (https://www.dropbox.com/sh/s1c4yydv8ao7s49/AAAN1QxCzf0TCsbzcOKRPcQka?dl=0).

Proof of the notification will be included in the Final Amendment Report.

Following the closure of this comment period, the Amendment Report will be updated where appropriate. All comments submitted will be recorded and responded to in a Comments and Response Table in the Public Participation Report (Appendix E). This table will be circulated to all registered I&APs and will be included in the final Amendment Report submitted to the DEA for decision-making.

4 Assessment of Impacts Related to the Proposed Amendment

4.1 Introduction

A number of impacts were identified and assessed in the Final EIA Report (Aurecon, 2017) as indicated in Table 5 below. Of these impacts it was determined that the proposed amendments may potentially alter the original significance ratings and mitigation measures of specific environmental considerations. As such, these impacts were revisited for the construction, operational and decommissioning phases and where necessary the original specialists provided their opinion on the changes to the impacts should the proposed amendments be approved. These specialist reports are attached as follows:

- Appendix B: Avifauna – Chris van Rooyen of Chris van Rooyen Consulting;
- Appendix C: Bats - Werner Marais of Animalia; and
- Appendix D: Terrestrial Ecology - Simon Todd of 3Foxes Biodiversity Solutions.

A section has also been included on potential visual and Electromagnetic and Radio Frequency Interference (i.e. EMI and RFI) considerations.

Note that information used within this chapter has been taken from the Final EIA Report (Aurecon, 2017) and the above listed specialist reports.

4.2 Summary of Initial Impacts

The potential impacts that were assessed for the authorised Kokerboom 1 Wind Farm and associated infrastructure are summarised below in Table 5. With implementation of the mitigation measures detailed in the EMPr (Appendix F), post-mitigation impacts are anticipated to range between very low to medium negative significance, and up to highly positive.

Table 5: Summary of the significance of initial impacts assessed in the final EIA Report

Aspect	Impact	Pre-mitigation	Post-mitigation
Pre-construction			
No impacts have been identified for the pre-construction phase.			
Construction			
Terrestrial Ecology	Loss of vegetation cover and listed or protected plant species	Medium (-)	Low (-)
	Short term direct faunal harm or disturbance	Low (-)	Low (-)
	Increased risk of erosion during	Low (-)	Low (-)
Bats	Destruction of bat roosts due to earthworks and blasting	Medium (-)	Low (-)
	Loss of foraging and habitat	Low (-)	Very Low (-)
Avifauna	Displacement of priority species due to disturbance	Low (-)	Low (-)
	Displacement of priorities species due to habitat loss	Medium (-)	Medium (-)
Aquatic Ecology	Loss of riparian systems and disturbance to alluvial watercourses	Medium (-)	Low (-)
	Increase in sedimentation and erosion	Medium (-)	Low (-)

Aspect	Impact	Pre-mitigation	Post-mitigation
	Pollution of localised surface water quality with general and hazardous waste materials	Medium (-)	Low (-)
Heritage	Impact to archaeological resources	Low (-)	Very Low (-)
Socio-economic	Creation of employment and business opportunities	Low (+)	Medium (+)
	Harm to social networks associated with the presence of external construction workers	Medium (-)	Low (-)
	Harm to social networks associated with the influx of job seekers	Low (-)	Low (-)
	Risk to safety of farmers and farm workers, livestock and damage to farm infrastructure	Low (-)	Low (-)
	Increased risk of grass fires	Medium (-)	Low (-)
	Loss of grazing resources	Medium (-)	Low (-)
Nuisance impacts	Increase in dust	Low (-)	Low (-)
	Increase of noise	Very Low (-)	N/A
	Generation of litter and general waste pollution	Low (-)	Very Low (-)
	Increase in traffic to the area (local)	Very Low (-)	Very Low (-)
	Increase in traffic to the area (regional)	Low (-)	Very Low (-)
Visual	Presence of large construction vehicles (including cranes)	Medium (-)	Low (-)
	Aircraft warning lights at night time	High (-)	Medium (-)
Operation			
Terrestrial Ecology	Long term direct faunal harm or disturbance during operation	Medium (-)	Low (-)
	Increased risk of erosion during	Medium (-)	Low (-)
	Alien plant invasion	Medium (-)	Low (-)
Bats	Bat mortalities caused by attraction to turbines from artificial lighting	Medium (-)	Low (-)
	Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)	High (-)	Medium (-)
Avifauna	Collision mortality on the wind turbines	Medium (-)	Low (-)
	Electrocution on the internal overhead powerlines	Medium (-)	Low (-)
	Collisions with the internal overhead powerlines	Medium (-)	Low (-)
Aquatic Ecology	Change to downstream riparian form and function caused by impacts on drainage alteration	Medium (-)	Low (-)
	Increase in sedimentation and erosion	Medium (-)	Low (-)
Socio-economic	Creation of employment and business opportunities	Low (+)	Low (+)
	Generation of income for affected landowners	Low (+)	Medium (+)
	Long term benefits associated with the Community Trust	Low (+)	High (+)
	Development of infrastructure for the generation of clean, renewable energy	Low (+)	Medium (+)
	Potential impact on property values	Low (-)	Low (-)

Aspect	Impact	Pre-mitigation	Post-mitigation
	Potential impact on tourism	Neutral	Neutral
Nuisance impacts	Increase of noise	Very Low (-)	N/A
	Increase in traffic to the area (local)	Very Low (-)	Very Low (-)
	Increase in traffic to the area (regional)	Low (-)	Very Low (-)
Visual	Presence of large construction vehicles (including cranes)	Medium (-)	Low (-)
	Aircraft warning lights at night time	High (-)	Medium (-)
	Presence of wind turbine on landscape	High (-)	Medium (-)
	Loss of sense of place	Medium (-)	Medium (-)
EMI/ RFI	Electromagnetic and radio frequency interference on SKA infrastructure	Medium – High (-)	Low (-)
Decommissioning			
Terrestrial Ecology	Long term direct faunal harm or disturbance	Medium (-)	Low (-)
	Increased risk of erosion	Medium (-)	Low (-)
	Alien plant invasion	Medium (-)	Low (-)
Bats	Loss of foraging and habitat	Low (-)	Very Low (-)
Avifauna	Displacement of priority species due to disturbance	Low (-)	Low (-)
Aquatic Ecology	Loss of riparian systems and disturbance to alluvial watercourses	Medium (-)	Low (-)
	Change to downstream riparian form and function caused by impacts on drainage alteration	Medium (-)	Low (-)
	Increase in sedimentation and erosion	Medium (-)	Low (-)
	Pollution of localised surface water quality with general and hazardous waste materials	Medium (-)	Low (-)
Socio-economic	Creation of employment and business opportunities	Low (+)	Medium (+)
	Harm to social networks associated with the presence of external construction workers	Medium (-)	Low (-)
	Harm to social networks associated with the influx of job seekers	Low (-)	Low (-)
	Risk to safety of farmers and farm workers, livestock and damage to farm infrastructure	Low (-)	Low (-)
	Increased risk of grass fires	Medium (-)	Low (-)
	Long Term benefits associated with the establishment of a Community Trust	Low (+)	High (+)
	Loss of jobs and associated income due to decommissioning	Medium (-)	Very Low (-)
Nuisance impacts	Increase of noise	Very Low (-)	N/A
	Increase in traffic to the area (local)	Very Low (-)	Very Low (-)
	Increase in traffic to the area (regional)	Low (-)	Very Low (-)
Visual	Presence of large construction vehicles (including cranes)	Medium (-)	Low (-)
	Aircraft warning lights at night time	High (-)	Medium (-)

4.3 Revised Impact Assessments

The following sections provide a comparison between the original impacts that were assessed (where relevant) and the revised assessments. Additions and amendments to mitigation measures and conditions of the EA are also provided. Specialists were required to:

- Address the implications of the proposed amendments in terms of the potential impact(s);
- Conduct a re-assessment of the significance (before and after mitigation) of the identified impact(s) considering the proposed amendments (as required in terms of the 2014 EIA Regulations);
- Include a statement as to whether the proposed amendments will result in a change to the significance of the impact assessed in the original EIA for the proposed project (and if so, how the significance would change); and
- Review and revise if necessary, the mitigation measures proposed in the original report.

Where applicable, the Environmental Management Programme (EMPr) has been updated to include the additional mitigation measures. Conditions of the EA have also been included where feasible at this point in time but will mainly be incorporated during the final design phase prior to the commencement of construction.

4.3.1 Avifauna

The Kokerboom 1 Wind Farm study area comprises habitat that may sustain several bird species which may be impacted by the authorised wind farm. In accordance with the best practice guidelines, 12 months of monitoring was undertaken (commencing in November 2015) by an avifaunal specialist, Mr Chris van Rooyen, of Chris van Rooyen Consulting. The monitoring period consisted of four site visits roughly every three months to represent the four seasons. The objective of the pre-construction monitoring was to obtain baseline data on the abundance and diversity of birds at the site, with a suitable control site to measure the potential displacement effect of the wind farm. In addition, the monitoring period was used to identify flight patterns of priority species at the site to measure the potential collision risk with the turbines. Due to the potential changes that the proposed amendments may have on the assessed impacts, Mr van Rooyen was appointed to reconsider his original assessment. Please refer to Appendix B for a copy of Mr van Rooyen's revised assessment.

4.3.1.1 Impact Statement

The following impacts where re-assessed by the specialist:

- Collision mortality on the wind turbines;
- Collisions with the internal overhead powerlines;
- Electrocution on the internal overhead powerlines; and
- Displacement of priority species due to disturbance.

Table 6 provides a comparison of the original and revised assessments. All three impacts are applicable to the operational phase of the Kokerboom 1 Wind Farm.

Table 6: Revised anticipated impacts on avifauna

POTENTIAL IMPACTS ON AVIFAUNA	
Collision mortality on the wind turbines (Operational Phase)	
Initial Assessment	Bird fatalities due to collisions with wind turbines have consistently been identified as the main ecological drawback of wind farms, although these collisions appear to kill fewer birds than other man-made infrastructure such as powerlines, buildings or even traffic. However, even with the low fatality rates, these mortalities may have significant impacts on population levels for some species. The most effective mitigation measure to prevent collision mortality is the avoidance of sensitive areas, points or flight paths. Mitigation measures depend on the characteristics of the site, as well as the diversity of species. The species-specific factors include morphological features; sensorial perception, phenology, bird behaviour, avoidance behaviours and bird abundance. The site-specific factors may include the landscape features, flight paths, food availability, and weather. The wind-farm specific features would include the turbine features, blade visibility, and wind farm configuration. These features are all described generally, and specifically to Kokerboom 1, in the avifaunal impact assessment included in Annexure D of the Final EIA Report (Aurecon 2017). Importantly, there is some indication that flight activity for all priority species (both soaring and terrestrial) is most prevalent during light to gentle breezes, and less so during moderate to high winds when the wind turbine activity increases.
Revised Assessment	Should the proposed amendments be granted, the number of turbines could either stay the same (i.e. 64) if 4MW turbines are constructed, or it could potentially be reduced to accommodate the large turbines of up to 6.5MW (depending on the available technology in South Africa). According to recent research, larger turbine capacity (MWs) increased collision rates; however, deploying a smaller number of large turbines with greater energy output reduced total collision risk per unit energy output. In other words, although there was a positive relationship between wind turbine capacity and collision rate per turbine, the strength of this relationship was insufficient to offset the reduced number of turbines required per unit energy generation with larger turbines. Therefore, to minimize bird collisions, wind farm electricity generation capacity should be met through deploying fewer, large turbines, rather than many, smaller ones. Based on the most recent research on this topic, it is concluded that the overall risk of collision to birds will either remain as it is, or it could potentially be reduced. Worst case scenario would be if the 64 4MW turbines are constructed, which means the overall risk will remain as assessed originally. **The proposed amendment will therefore not affect the original assessment as far as the risk of mortality through collisions with the turbines are concerned**.

POTENTIAL IMPACTS ON AVIFAUNA	
Collisions with the internal overhead powerlines (Operational Phase)	
Initial Assessment	As with collisions with turbines, there are likely to be several site-specific reasons for birds colliding with the internal overhead medium and high voltage powerlines. The risk of collision is likely to vary between groups of birds, as well as landscape and weather conditions. Most heavily impacted upon, are heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid collision. For the proposed Kokerboom 1 Wind Farm, this impact is therefore most likely to affect Ludwig's Bustard, Karoo Korhaan, Northern Black Korhaan and Secretary bird.
Revised Assessment	The original lay-out which was approved contained a potential overhead MV network amounting to a maximum of approximately 22km. In the new proposed lay-out, the maximum network size is increased to about 32km, which constitutes a potential increase of 50% in the length of the overhead MV powerlines. **Consequently, the increased length of the MV overhead network, would also result in an increased mortality risk from collisions with the overhead powerlines.**
Electrocution on the internal overhead powerlines (Operational Phase)	
Initial Assessment	Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. The electrocution risk is largely determined by the pole/ tower design and the size of the bird. For the Kokerboom 1 Wind Farm, the species most at risk of electrocution on the internal overhead medium and high voltage powerline network are the large raptors, particularly the Martial Eagle.
Revised Assessment	According to the Final EIA Report (Aurecon 2017), each turbine will be connected to the on-site substation via medium voltage cables (~33kV powerlines). Where feasible, these cables will be laid underground in trenches running generally alongside internal roads. Where burying of cables is not possible due to technical, geological, environmental or topographical constraints, then overhead powerlines (on basic wooden or concrete monopoles) will be erected. The original lay-out which was approved contained a potential overhead MV network amounting to a maximum of approximately 22km. In the new proposed lay-out, the maximum network size is increased to about 32km, which constitutes a potential increase of 50% in the length of the overhead MV powerlines. **Consequently, the increased length of the MV overhead network, would also result in an increased mortality risk from electrocutions on the overhead powerlines.**
Displacement of priority species due to disturbance (Construction and Decommissioning Phases)	
Initial Assessment	During the construction and decommissioning phases of the project, there will be an increase of vehicle and personnel movement which may disturb the resident

POTENTIAL IMPACTS ON AVIFAUNA	
	avifauna. Although the literature reviewed by the specialist was not considered conclusive, the consequences of displacement for breeding productivity and survival are crucial to whether there is likely to be a significant impact on population size. It is also possible that disturbance may be caused on birds altering their migration flyways or local flight paths to avoid a wind farm, which could result in increased energy expenditure if they need to fly further. It may also result in the disruption of linkages between distant feeding, roosting, moulting and breeding areas otherwise unaffected by the wind farm. Specifically, for the proposed Kokerboom 1 Wind Farm, it is unlikely that any of the priority species would be displaced permanently, although it is very likely that they will be displaced for the construction and decommissioning phases. If the wind farm follows the modern trend of fewer, larger turbines (which seems to be the case), the risk of displacement due to disturbance is also lower. However, this will only be conclusively established through a post-construction monitoring programme.
Revised Assessment	The relocation of the construction camps has the potential for disturbance of priority species, unless the relocation does not infringe on any of the avifaunal buffer zones. The proposed amendment states that these locations will remain outside sensitive areas. **If this is indeed the case, then the original assessment will not be affected.**

4.3.1.2 Mitigation Measures

All mitigation measures that were originally identified by the specialist remains applicable to the project. The following additional mitigation measures are however required in response to the proposed amendments.

Table 7: Revisions required to the authorised mitigation measures

Mitigation measure	Applicable Phase
Additional mitigation measures	
The original mitigation proposed to reduce the risk of collision was to have all the powerlines marked with bird flight diverters for their entire length on the conductors of the line, 5m apart, alternating black and white. This recommendation remains valid, but it must be supplemented as follows to reduce the potential risk of collision mortality and/or electrocution: • All powerlines linking the turbines to the onsite substation must be buried, unless compelling reasons exist, verified by a suitably qualified, independent ecologist and/or geologist, for a section of powerline to be constructed above ground. Under no circumstances should the overhead lines exceed the 22km length as assessed in the original lay-out. • The avifaunal specialist and the Endangered Wildlife Trust's (EWT) Wildlife and Energy Working Group must be engaged by the developer to provide input into the design of the proposed poles to be used, and they must approve the final design of all poles i.e. suspension poles, strain poles and terminal poles. This must	Operational

Mitigation measure	Applicable Phase
Additional mitigation measures	
include the physical inspection of a replica of an actual pole or a three-dimensional digital model, because the design drawings do not always show adequate technical details of aspects which could be highly dangerous for birds.	

4.3.1.3 Impact Rating

The significance of potential impacts on avifauna as a result of the proposed amendments occur during the operational phase and would remain unchanged with regards to the collision mortality risks. However, the risk of collision with internal overhead lines and electrocutions on the powerlines were re-assessed as **High (-)** without any additional mitigation measures. By implementing the proposed additional mitigation measures (Table 7) identified by the specialist, these impacts can be reduced to **Low (-)**.

Table 8: Comparison of the significance of potential impacts on avifauna, with mitigation

IMPACT DESCRIPTION	Initial Impact	Revised Impact	
	Post - mitigation	Pre-mitigation	Post-mitigation
Collision mortality on the wind turbines (Operational Phase)	Low (-)	Low (-)	Low (-)
Collisions with the internal overhead powerlines (Operational Phase)	Low (-)	High (-)	Low (-)
Electrocution on the internal overhead powerlines (Operational Phase)	Low (-)	High (-)	Low (-)
Displacement of priority species due to disturbance (Construction and Decommissioning Phases)	Low (-)	Low (-)	Low (-)

4.3.2 Bats

Bat impact assessments, which in South Africa are required to gain input from 12 months of pre-construction bat monitoring, are a key specialist component of the EIA process for a wind farm. The completion of this monitoring period is a condition of the EIR phase for wind farms by DEA. The pre-construction monitoring was undertaken between 1 October 2015 and 16 October 2016 and was undertaken in terms of the best practice guidelines used at the time. Mr Werner Marais and Ms Monika Moir of Animalia, conducted five site visits over the 12-month period, during which active monitoring was undertaken using transects with general observation and recording devices. This data was supported by passive monitoring for the duration of the 12 months with recording devices fixed to three meteorological masts as well as five short masts. The meteorological masts (commonly referred to as met masts), provide climatic data used for wind modelling required for the technical feasibility of the project. They are tall and allow the recording devices to reach up to 80m high with a second device fitted at 10m. The short masts were erected by the bat specialists and monitored bat movement at a height of 10m. More detail on the assessment can be found in the specialist report in Annexure D of the Final EIA Report (Aurecon 2017). Please refer to Appendix C for a copy of Mr Marais' assessment of the proposed amendments.

4.3.2.1 Impact Statement

Table 9 provides a comparison of the original and revised assessments of the following potential impacts:

- Loss of foraging habitat; and
- Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration).

The specialist indicated that all other proposed amendments do not significantly influence the risk levels on bats in the area and are therefore also acceptable.

Table 9: Revised anticipated impacts on bats

POTENTIAL IMPACTS ON BATS	
Loss of foraging habitat (Construction Phase)	
Initial Assessment	Minimal foraging habitat will be permanently lost by site clearance required for the construction and decommissioning processes. Temporary foraging habitat loss will occur during these periods due to storage areas and movement of heavy vehicles.
Revised Assessment	**The proposed amendments on the locations of the substation and construction/laydown areas are acceptable, as long as all high bat sensitivity areas and their buffers remains to be avoided.**
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration) (Operational Phase)	
Initial Assessment	Bats may be killed by direct collision with the blades, or barotrauma, during foraging activities. If the number of bat mortalities is significant, local bat populations may not recover.
Revised Assessment	Although the proposed amendment of larger turbine dimensions will result in a larger airspace of moving blades per turbine, the subsequent iteration of the turbine layout still respects the bat sensitivity map in the sense that the proposed larger 90m blades are all outside of the high bat sensitivity buffer zones. Meaning turbines are proposed to be further from bat sensitivities. Bat activity measured during the preconstruction assessment showed a negative correlation with height, since less bat passes as well as a lower species diversity was recorded on higher microphones. Therefore, the proposed maximum hub height above ground is preferable, even though the minimum lower blade tip height remains at 40m. **The proposed amendment to the turbine dimensions does not significantly change the impacts ratings as identified in the original bat EIA report.**

4.3.2.2 Mitigation Measures

All mitigation measures that were originally identified by the specialist in the EIA phase remain applicable to the project. The following revisions are however required in response to the proposed amendments.

Table 10: Amendment required to the authorised mitigation measures

Mitigation measure	Applicable Phase
Additional mitigation measures	
The following table showing periods and weather conditions during which peak bat activity was recorded, shall be included in the Environmental Management Programme to guide and inform future operational monitoring and adaptive management/mitigation measures. **Peak Activity Period 1**: Time period: 20 August – 10 October from the time of sunset to 02:00; Environmental Conditions: Wind speed below 6m/s; AND Temperature above 17°C **Peak Activity Period 2**: Time period: 1 March – 15 May from the time of sunset to 23:00; Environmental Conditions: Wind speed below 6m/s; AND Temperature above 16°C	Operational

4.3.2.3 Impact Rating

The significance of potential impacts on bats as a result of the proposed amendments remains unaffected with and without additional mitigation measures.

Table 11: Comparison of the significance of potential impacts on bats, with mitigation

IMPACT DESCRIPTION	Initial Impact	Revised Impact	
	Post - mitigation	Pre-mitigation	Post-mitigation
Loss of foraging habitat (Construction Phase)	Very Low (-)	Very Low (-)	Very Low (-)
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration) (Operational Phase)	Medium (-)	Medium (-)	Medium (-)

4.3.3 Terrestrial Ecology (excluding birds and bats)

The construction of the authorised Kokerboom 1 Wind Farm and associated infrastructure would require approximately 155ha of land to be transformed/ disturbed. Whilst some of the degradation will be rehabilitated, approximately 80ha will be permanently transformed. The loss of this natural vegetation and groundcover has the potential to impact the ecological systems and processes that currently exist. Mr Simon Todd, of Simon Todd Consulting, was appointed to undertake a fauna and flora specialist impact assessment which is available in Annexure D of the Final EIA Report (Aurecon 2017). Please refer to Appendix D for a copy of Mr Todd's assessment of the proposed amendments.

4.3.3.1 Impact Statement

The development of the proposed Kokerboom 1 Wind Farm and associated infrastructure is likely to result in a variety of direct and indirect impacts associated largely with the disturbance, loss and

transformation of intact vegetation and faunal habitat to hard infrastructure such as turbine foundations and service areas, roads, operational buildings and substations, etc. Table 12 provides a comparison of the combined original and revised assessments of the following potential impacts:

- Loss of vegetation cover and listed or protected plant species;
- Direct faunal harm or disturbance;
- Increased risk of erosion; and
- Alien plant invasion.

Table 12: Revised anticipated impacts on terrestrial ecology

POTENTIAL IMPACTS ON TERRESTRIAL ECOLOGY	
Direct and indirect impacts associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat (Construction, Operational and Decommissioning Phases)	
Initial Assessment	The majority of the Kokerboom 1 Wind Farm consists of low open shrubland or grassland on flat plains and gently sloping hills that are medium-low sensitivity and are considered suitable for wind energy development. The final layout assessed is considered acceptable by the ecologist given that none of the turbines or major non-linear infrastructure have been placed in the high sensitivity areas. Whilst some of the access roads will need to traverse drainage lines and other sensitive areas, it is considered that with mitigation, the impacts on these areas would be reduced to acceptable levels.
Revised Assessment	The ecological impact of the current proposed turbine layout would be similar to the original 64 turbine layout. The total footprint of the layout is similar and the extent of the footprint within the different sensitivity categories would be similar. The larger turbines that could be used are not considered to generate additional terrestrial ecological impact compared to the use of smaller turbines. Where larger turbines are used, this would result in fewer turbines being required to achieve the required output and this is seen as having potentially positive impacts as there would be larger gaps between the turbines, which may have some beneficial consequences for fauna. An aspect that requires some attention is the distribution of underground vs. overhead cabling at the site. The current amendment allows for the extent of internal overhead powerlines to be increased compared to the assessed layout. While this is not seen as having significant direct impacts on terrestrial ecology, there are some potential consequences of this that should be considered. Most importantly, this is likely to have some implications for avifauna and as such, the recommendations of the avifaunal specialist in this regard should take precedence. There are no parts of the site, within the development footprint, that are considered very high sensitivity and where cable trenches are considered unacceptable. As such, there are no ecological reasons to justify the use of overhead lines above trenches at the site, given the potential negative effects on avifauna. As such, the extent of overhead lines on the site should be guided by avifaunal considerations and not ecological ones.

POTENTIAL IMPACTS ON TERRESTRIAL ECOLOGY	
	Although the proposed amendments do not result in a significant decrease in impact, there are likely to be some advantages of the reduced number of turbines potentially associated with the amended layout, such as reduced noise or increased average distance between wind turbines. As such, the amended layout has a similar impact or is potentially a slight improvement on the original layout in terms of ecological impacts. **The significance of impacts as assessed in the original studies are considered still valid and applicable for the current assessment. No upward or downward adjustment of impacts is justified based on the changes to the layout and the turbine size and number**. **The amendment is thus supported from an ecological perspective as it would not increase or change any impacts associated with the development.**

4.3.3.2 Mitigation Measures

All mitigation measures that were originally identified by the specialist in the EIA phase remain applicable to the project. The following additional mitigation measures are however required in response to the proposed amendments.

Table 13: Amendment required to the authorised mitigation measures

Mitigation measure	Applicable Phase
Additional mitigation measures	
• Any changes to the road or turbine positions shall be confirmed by the specialist. • The mitigation measures addressing avifauna impacts related to overhead powerlines and trenching shall take precedence. There are no parts of the development footprint where trenches should not be allowed. • The final development footprint shall be subject to a preconstruction walk-through to locate and identify species of conservation concern that are within the development footprint. Search and rescue of plant species of conservation concern may be required.	Construction Operational

4.3.3.3 Impact rating

The significance of potential impacts on terrestrial ecology remains unaffected, even with the additional mitigation measures provided in Table 13. The specialist concluded that overall the impact of the amended layout on fauna and flora would be low and there are no fatal flaws or critical issues associated with the proposed amendments.

Table 14: Comparison of the significance of potential impacts on terrestrial ecology, with mitigation

IMPACT DESCRIPTION	Initial Impact	Revised Impact	
	Post - mitigation	Pre-mitigation	Post-mitigation
Loss of vegetation cover and listed or protected plant species (Construction Phase)	Low (-)	Low (-)	Low (-)
Short term direct faunal harm or disturbance (Construction Phase)	Low (-)	Low (-)	Low (-)
Increased risk of erosion during (Construction Phase)	Low (-)	Low (-)	Low (-)
Long term direct faunal harm or disturbance during operation (Operational Phase)	Low (-)	Low (-)	Low (-)
Increased risk of erosion during (Operational Phase)	Low (-)	Low (-)	Low (-)
Alien plant invasion (Operational Phase)	Low (-)	Low (-)	Low (-)
Long term direct faunal harm or disturbance (Decommissioning Phase)	Low (-)	Low (-)	Low (-)
Increased risk of erosion (Decommissioning Phase)	Low (-)	Low (-)	Low (-)
Alien plant invasion (Decommissioning Phase)	Low (-)	Low (-)	Low (-)

4.3.4 Visual Landscape

The portion of Kokerboom 1 Wind Farm falling within the Leeuwbergriver farm (RE/1163) is located on a generally flat terrain that tends towards the south. A 'koppie' spanning approximately 2.5 km (in a north-south direction) lies at the northern area of the property. The remainder of Kokerboom 1 Wind Farm falling within the Kleine Rooiberg Farm (RE/227) is located on a terrain that is slightly less flat. The slope tends down towards the southeast altitude across the study area for the project and varies between approximately 900 m and 1000 m above sea-level. The general landscape is considered predominantly flat and has no key topographic features apart from the Klein Rooiberg hill that stands approximately 7km south of the proposed site.

The current landuse is low intensity sheep farming and land coverage is dominated by low shrubs and grasses, resulting in a low natural visual absorption capacity. There are very few houses and buildings in the area, but there is a growing presence of industrial infrastructure. These include the Sishen-Saldanha Railway Line, the existing Eskom Helios Main Transmission Substation, the existing Eskom 400kV transmission lines, gravel farm roads (including the Nuwepos Road) and the operational Loeriesfontein and Khobab Wind Farms - all of which increase the visual absorption capacity of the landscape surrounding the site. Mr Stephen Stead of Visual Resource Management (VRM) Africa was appointed to undertake a visual specialist report which is available in Annexure D of the Final EIA Report (Aurecon, 2017).

4.3.4.1 Impact Statement

The specialist assessment indicated, through modelling, that the combination of the relatively flat landscape and the large turbines specifications, suggested that the turbines would be seen for up to

28km[5]. It was determined that no permanent receptors (e.g. farm houses of which the closest is 12km to the north of the site) are located within the High Exposure (2km) and Medium to High Exposure (6km) areas, which are only accessed by farmers via the farm roads. The nearest receptor was identified as the gravel road that is located in the Medium to Low distance zone. This road is mainly used for agricultural purposes but is currently also used as the main access route for the Khobab and Loeriesfontein Wind Farms. It was also noted that this remote area is sparsely populated with no tourist activities making use of the scenic resources. The area is not formally protected as a conservancy or nature reserve and hence is rated Low as a Special Area. The overall Receptor Sensitivity to landscape change is rated Low.

With regards to sense of place, the specialist assessment showed that even though the rural landscape would be impacted by the construction of Kokerboom 1, the addition of industrial-type structures has already commenced with the construction of the Khobab and Loeriesfontein Wind Farms and have therefore set a precedent.

Due to the remote location of the site, lack of permanent receptors within the High and Medium to High exposure zones and the low receptor sensitivity rating, no additional specialist input was requested to assess the proposed amendments to the turbine specifications and layout. The existing mitigation measures are deemed to be adequate to address impacts on the visual landscape of the Kokerboom 1 Wind Farm during the operational phase.

4.3.5 Electromagnetic and Radio Frequency Interference

During the Scoping Phase for Kokerboom 1 Wind Farm, a comment was received from the Square Kilometre Array (SKA) South African Project Office. This comment indicated that the proposed Kokerboom WEF development was located approximately 37km away from the nearest SKA station, Rem-Opt-7. As such, it was anticipated that the wind farm and associated infrastructure may pose a medium to high risk of detrimental impact on the SKA. Further electromagnetic interference (EMI) and radio frequency interference (RFI) assessments were requested. Mr Callie Fouche of Interference Testing and Consulting Services (Pty) Ltd (ITC Services) was therefore appointed to undertake the requisite investigation for the Kokerboom 1 Wind Farm in response to SKA's comment. The technical assessment is included in Annexure D of the Final EIA Report (Aurecon 2017).

4.3.5.1 Impact Statement

The manner in which the various wind turbine components interact with one another, has the potential to cause interference, by emitting radio or electromagnetic waves at various frequencies. Components/ systems of an individual turbine that can be viewed as potential interference sources include:

- Control/ monitoring systems (including environmental sensors, and warning lights etc.);
- Power conversion equipment (such as rectifier or invertor systems); and
- Control and operations centre (which includes computer equipment).

The installation of turbines in proximity to the SKA infrastructure has the potential to cause electromagnetic and radio frequency interference. It is therefore important that the concerns be raised at the start of the planning process, so that appropriate mitigation measures may be implemented and built into the design of the wind farm as needed.

Given the current uncertainties and delays in the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), it could be a number of years before the project is in a position to be developed, and it is uncertain what turbines would be available on the market at that time. The turbine technology cannot be confirmed at this stage of the process, and it is thus not possible to develop an accurate or detailed turbine-specific EMC Technical Control Plan (a Technical Control Plan must be

[5] The visual impact from turbines during operation are defined by the slow rotation of the turbine blades which, due to their movement and reflective white colour, attract the attention of the casual observer.

specific to the specific turbine that will actually be installed on site). The SKA indicated that it was not necessary to compile a detailed Control Plan as part of the 2017 EIA process, but that this must be done during the selection of the final turbine technology. The SKA did however request that as part of the EIA process, a high-level EMC Control Plan be developed, that prescribes the process to be followed when developing the Technical Control Plan (after turbine selection). This high-level EMC Control Plan was compiled in accordance with the SKA's requirements and is included as part of the EMI Report in Annexure D of the Final EIA Report (Aurecon 2017). This report remains applicable to the Kokerboom 1 Wind Energy Facility and will be finalised during the detail design phase.

Furthermore, the developer remains committed to strictly adhere to the original mitigation measures during the detail design phase which require:

- During the selection of the final turbine, the EMI characteristics of prospective turbine models must be taken into consideration and used to guide the final turbine selection process. The worst-case assessment undertaken during the EIA process indicated that the final selected turbine should have an emission profile 46dB below that of the relevant CISPR 11 Class A emissions standards, across the 100MHz to 6GHz band.
- Once the final turbine technology has been selected, the EMI emissions from the turbine shall be characterized in accordance with the EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)) in order to confirm whether the selected turbine will in fact pose a risk to the SKA, and if so to confirm/ quantify the amount of residual attenuation required for the selected turbine.
- A Technical Control Plan (detailed mitigation strategy) to reduce EMI emissions to below the acceptable thresholds must be developed and submitted to SKA for approval, as per the requirements of the EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)). Once approved by SKA the Control Plan must be implemented.
- The Technical Control Plan and associated attenuation measures should be developed by an EMI specialist in consultation with the SKA and must be appropriate for the final selected turbine. Mitigation measures may include locating potential interference sources at the base of the turbine rather than the nacelle; incorporating appropriate shielding into the design of the cabinets; shielding of cables and well controlled installation. Equipment installed in the control and operations centre should comply with EN55022 Class B. The control and operations building shielding effectiveness should be at least 25dB, unless a 25dB safety margin is added to the EN55022 Class B limit.
- The communication among the wind turbines, the met masts and wind turbines and the substation should be through an Ethernet optical fibre network to reduce radiated emissions from the site wide communications.
- To verify overall windfarm emissions, ambient measurements should be done at the new site before construction starts. Tests points should be carefully selected based on test equipment sensitivity with the objective to observe the increase in ambient emissions as construction progresses. Testing should continue during construction and post-construction in accordance with the Technical Control Plan.
- Final site tests should be done on completion of the project to confirm the radiated emission levels.
- Any transmitters that are to be established, or have been established, at the site for the purposes of voice and data communication will be required to comply with the relevant Astronomy Geographic Advantage Act regulations concerning the restriction of use of the radio frequency spectrum that applies in the area concerned.

To conclude, achieving the required dB reduction is a technical solution that will be incorporated into the detail design phase of the project, under the guidance of an EMI specialist and in accordance with the

EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)). The final attenuation measures (where required) will be specific to the final selected turbine model, which will only be known closer to the time of construction. With the implementation of the necessary attenuation measures, there will be no/ negligible impact to the SKA. The EMC Control Plan as well as the final comment received from the SKA during the 2017 EIA process confirmed that it would be possible to achieve the required mitigation via the implementation of a Technical Control Plan. It is recommended that confirmation that the required attenuation will be achieved be submitted to SKA for their approval during the detail design phase, prior to construction – in accordance with the EMC Control Plan. This confirmation may take the form of a letter from the EMI specialist contracted during the design phase, a report or a more detailed EMC control plan – depending on the SKA's requirements.

4.4 Summary

The table below, Table 15, has been adapted from the original impact summary tables in the Final EIA Report (Aurecon, 2017), to show the change in impact ratings with regards to avifauna, bats and terrestrial ecology related impacts.

Table 15: Summary of impact assessment (post mitigation)

IMPACT DESCRIPTION		Initial Impact	Revised Impact	
		Post - mitigation	Pre-mitigation	Post-mitigation
Construction Phase				
Avifauna	Displacement of priority species due to disturbance	Low (-)	Low (-)	Low (-)
Bats	Loss of foraging habitat	Very Low (-)	Very Low (-)	Very Low (-)
Terrestrial Ecology	Loss of vegetation cover and listed or protected plant species	Low (-)	Low (-)	Low (-)
	Short term direct faunal harm or disturbance	Low (-)	Low (-)	Low (-)
	Increased risk of erosion during	Low (-)	Low (-)	Low (-)
Operational Phase				
Avifauna	Collision mortality on the wind turbines	Low (-)	Low (-)	Low (-)
	Collisions with the internal overhead powerlines	Low (-)	High (-)	Low (-)
	Electrocution on the internal overhead powerlines	Low (-)	High (-)	Low (-)
Bats	Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)	Medium (-)	Medium (-)	Medium (-)
Terrestrial Ecology	Long term direct faunal harm or disturbance during operation	Low (-)	Low (-)	Low (-)

IMPACT DESCRIPTION		Initial Impact	Revised Impact	
		Post - mitigation	Pre-mitigation	Post-mitigation
	Increased risk of erosion during	Low (-)	Low (-)	Low (-)
	Alien plant invasion	Low (-)	Low (-)	Low (-)
Decommissioning Phase				
Avifauna	Displacement of priority species due to disturbance	Low (-)	Low (-)	Low (-)
Terrestrial Ecology	Long term direct faunal harm or disturbance	Low (-)	Low (-)	Low (-)
	Increased risk of erosion	Low (-)	Low (-)	Low (-)
	Alien plant invasion	Low (-)	Low (-)	Low (-)

5 Summary and Conclusions

5.1 Summary of Revised Impact Assessments

5.1.1 Construction, Operational and Decommissioning Impacts

Section 3 above details the impacts as originally assessed in comparison to the impacts arising from the proposed amendments. These key changes in impact significance ratings have been included in Table 15.

During construction the proposed amendments would impact on avifauna, bats and terrestrial ecology. The impact ratings remain however unchanged at **Low (-)** and **Very Low (-)**, respectively, with and without additional mitigation measures.

The significance of potential impacts on avifauna as a result of the proposed amendments occur during the operational phase and would remain unchanged with regards to the collision mortality risks. However, the risk of collision with internal overhead powerlines and electrocutions on the powerlines were re-assessed as **High (-)** without any additional mitigation measures. By implementing the two proposed additional mitigation measures (Table 7) identified by the specialist, these impacts can be reduced to **Low (-)**. The impact ratings remain however unchanged for bats (**Medium (-)**) and terrestrial ecology (**Low (-)**) with and without additional mitigation measures.

During the decommissioning phase, the potential impacts mainly relates to avifauna and terrestrial ecology and remains **Low (-)**. No additional mitigation measures were required by the specialists.

5.1.2 Cumulative Impacts

The cumulative impacts of the Wind Farm in the context of the other proposed and constructed renewable energy projects in the area are acknowledged and were previously assessed in the Final EIA Report (2017). Given the scale of the changes identified for the individual impacts, when considered in the context of the proposed amendments, it is not considered that there would be an increase in overall significance of impacts, because some of the impacts negate one another. For example, larger but fewer turbines.

5.2 Summary of Proposed Mitigation

The following additional mitigation measures have been identified by the relevant specialist:

5.2.1 Avifauna

- The original mitigation proposed to reduce the risk of collision was to have all the powerlines marked with bird flight diverters for their entire length on the conductors of the powerline, 5m apart, alternating black and white. This recommendation remains valid, but it must be supplemented as follows to reduce the potential risk of collision mortality and/or electrocution:
  - All powerlines linking the turbines to the onsite substation must be buried, unless compelling reasons exist, verified by a suitably qualified, independent ecologist and/or geologist, for a section of powerline to be constructed above ground. Under no circumstances should the overhead powerlines exceed the 22km length as assessed in the original lay-out.
  - The avifaunal specialist and the Endangered Wildlife Trust's (EWT) Wildlife and Energy Working Group must be engaged by the developer to provide input into the design of the proposed poles to be used, and they must approve the final design of all poles i.e. suspension poles, strain poles and terminal poles. This must include the physical inspection of a replica of an actual pole or a three-

dimensional digital model, because the design drawings do not always show adequate technical details of aspects which could be highly dangerous for birds.

5.2.2 Bats

- The following table showing periods and weather conditions during which peak bat activity was recorded, shall be included in the Environmental Management Programme to guide and inform future operational monitoring and adaptive management/mitigation measures.

Peak Activity Period 1	Time period: 20 August – 10 October from the time of sunset to 02:00 Environmental Conditions: Wind speed below 6m/s; AND Temperature above 17°C
Peak Activity Period 2	Time period: 1 March – 15 May from the time of sunset to 23:00 Environmental Conditions: Wind speed below 6m/s; AND Temperature above 16°C

5.2.3 Terrestrial Ecology

- Any changes to the road or turbine positions shall be confirmed by the specialist.
- The mitigation measures addressing avifauna impacts related to overhead powerlines and trenching shall take precedence. There are no parts of the development footprint where trenches should not be allowed.
- The final development footprint shall be subject to a preconstruction walk-through to locate and identify species of conservation concern that are within the development footprint. Search and rescue of plant species of conservation concern may be required.

5.3 Other Considerations

5.3.1 Visual Landscape

Due to the remote location of the site, lack of permanent receptors within the high and high to medium exposure zones and the low receptor sensitivity rating, no additional specialist input was requested to assess the proposed amendments to the turbine specifications and layout. The existing mitigation measures are deemed to be adequate to address impacts on the visual landscape of the Kokerboom 1 Wind Farm during the operational phase.

5.3.2 Electromagnetic Interference

Given the current uncertainties and delays in the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), it could be a number of years before the project is in a position to be developed, and it is uncertain what turbines would be available on the market at that time. The turbine technology cannot be confirmed at this stage of the process, and it is thus not possible to develop an accurate or detailed turbine-specific EMC Technical Control Plan (a Technical Control Plan must be specific to the specific turbine that will actually be installed on site). The SKA indicated that it was not necessary to compile a detailed Control Plan as part of the 2017 EIA process, but that this must be done during the selection of the final turbine technology. The SKA did however request that as part of the EIA process, a high-level EMC Control Plan be developed, which will prescribe the process to be followed when developing the Technical Control Plan (after turbine selection). This high-level EMC Control Plan has been compiled in accordance with the SKA's requirements and is included as part of the EMI Report

in Annexure D of the Final EIA Report (Aurecon 2017). This report remains applicable to the Kokerboom 1 Wind Energy Facility and will be finalised during the detail design phase.

Furthermore, the developer remains committed to strictly adhere to the original mitigation measures during the detail design phase which require:

- During the selection of the final turbine, the EMI characteristics of prospective turbine models must be taken into consideration and used to guide the final turbine selection process. The worst-case assessment undertaken during the EIA indicates that the final selected turbine should have an emission profile 46dB below that of the relevant CISPR 11 Class A emissions standards, across the 100MHz to 6GHz band.
- Once the final turbine technology has been selected, the EMI emissions from the turbine shall be characterized in accordance with the EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)) in order to confirm whether the selected turbine will in fact pose a risk to the SKA, and if so to confirm/ quantify the amount of residual attenuation required for the selected turbine.
- A Technical Control Plan (detailed mitigation strategy) to reduce EMI emissions to below the acceptable thresholds must be developed and submitted to SKA for approval, as per the requirements of the EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)). Once approved by SKA the Control Plan must be implemented.
- The Technical Control Plan and associated attenuation measures should be developed by an EMI specialist in consultation with the SKA and must be appropriate for the final selected turbine. Mitigation measures may include locating potential interference sources at the base of the turbine rather than the nacelle; incorporating appropriate shielding into the design of the cabinets; shielding of cables and well controlled installation. Equipment installed in the control and operations centre should comply with EN55022 Class B. The control and operations building shielding effectiveness should be at least 25dB, unless a 25dB safety margin is added to the EN55022 Class B limit.
- The communication among the wind turbines, the met masts and wind turbines and the substation should be through an Ethernet optical fibre network to reduce radiated emissions from the site wide communications.
- To verify overall windfarm emissions, ambient measurements should be done at the new site before construction starts. Tests points should be carefully selected based on test equipment sensitivity with the objective to observe the increase in ambient emissions as construction progresses. Testing should continue during construction and post-construction in accordance with the Technical Control Plan.
- Final site tests should be done on completion of the project to confirm the radiated emission levels.
- Any transmitters that are to be established, or have been established, at the site for the purposes of voice and data communication will be required to comply with the relevant Astronomy Geographic Advantage Act regulations concerning the restriction of use of the radio frequency spectrum that applies in the area concerned.

The applicant will also undertake the necessary process to obtain permits as required in terms of the Regulations on the Protection of the Karoo Central Astronomy Advantage Areas (GN 1411 of 15 December 2017) in Terms of the Astronomy Geographic Advantage Act, 2007.

To conclude, achieving the required dB reduction is a technical solution that will be incorporated into the detail design phase of the project, under the guidance of an EMI specialist and in accordance with the EMC Control Plan (Annexure D of the Final EIA Report (Aurecon 2017)). The final attenuation measures (where required) will be specific to the final selected turbine model, which will only be known closer to the time of construction. With the implementation of the necessary attenuation measures, there will be

no/ negligible impact to the SKA. The EMC Control Plan as well as the final comment received from the SKA during the 2017 EIA process confirmed that it would be possible to achieve the required mitigation via the implementation of a Technical Control Plan. It is recommended that confirmation that the required attenuation will be achieved be submitted to SKA for their approval during the detail design phase, prior to construction – in accordance with the EMC Control Plan. This confirmation may take the form of a letter from the EMI specialist contracted during the design phase, a report or a more detailed EMC control plan – depending on the SKA's requirements.

5.4 Disadvantages and Advantages Associated with the Proposed Amendment

It has been found that the proposed amendments are favourable by the specialists, especially since the revised/ re-optimised layout is more effective at avoiding the environmentally sensitive areas. Overall, the impact ratings remained unchanged, except for the risk of birds colliding with internal overhead powerlines and being electrocuted on the powerlines. The significance of these impacts can however be reduced to the same significance level as the authorised specifications and layout by implementing additional mitigation measures identified by the specialists.

Furthermore, there is also a possibility that even less turbines[6] would actually be required once construction commences should 6.5MW turbines be available in South Africa at that time. This would have an overall positive impact on the Kokerboom 1 Wind Farm by reducing the scale of the development's disturbance footprint and the impacts that were identified and assessed by the specialists – especially with regards to the impact on birds.

One of the proposed amendments that were assessed by the specialists is for the removal of specific locations for construction camps and laydown areas. This amendment is specifically based on experienced gained during the construction of other wind farms by the applicant. It was found that laydown areas and construction camp locations identified during the EIA process are generally not practical during construction which may add additional complexities to this phase. The proposed amendment would allow for the most practical location/s to be determined by the contractor closer to the time of construction. These locations (restricted to the authorised 34 100m^2 footprint size) would remain outside sensitive areas and must be approved by the Environmental Control Officer prior to construction commencing. This proposed amendment was acceptable by all three specialists.

A length of overhead HV powerline is also required to link the wind farm's substation to the Eskom switching station (the latter forms part of a separate EA) in order to export the electricity generated by the wind farm. Due to the costs associated with the HV powerline, the most direct route between the substation and switching station has been proposed, to minimise the length of the powerline. As a result, the proposed overhead HV routing deviates from the internal road network.[7] The proposed amendment to the HV overhead powerline was acceptable to all specialists.

In conclusion there are both advantages and disadvantages to the proposed amendments. As a whole the environmental impacts due to the amendments are not considered to differ significantly from the project as originally assessed and authorised. Where certain impacts do differ, mitigation measures have been provided. With mitigation, all impacts associated with the proposed amendments remain the same as that previously assessed in the EIA and authorised in the EA.

[6] The revised layout and amended turbine specifications has resulted in the number of turbines to have been reduced from 64 to 60.

[7] This length of overhead HV powerline was assessed in the original EIA and forms part of the site layout plan that was submitted to DEA with the final EIA Report (Figure 1). However, Condition 58 of the EA stipulates that all cables must follow internal roads. It is now requested that this condition be amended (see Table 4) in order to allow for the overhead HV powerline to deviate from the road network and follow a more direct route to the new onsite substation location as shown in Figure 2.