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**KARUSA WIND ENERGY FACILITY**  
**SPECIALIST COMPARATIVE ASSESSMENT: AVIFAUNA**

**DRAFTED BY:**

MEGAN DIAMOND  
FEATHERS ENVIRONMENTAL SERVICES  
P.O. BOX 786962, SANDTON, 2146  
MEGAN@FEATHERSENV.CO.ZA

**PREPARED FOR:**

TEBOGO MAPINGA  
SAVANNAH ENVIRONMENTAL (PTY) LTD  
P.O. BOX 148, SUNNINGHILL, 2157  
TEBOGO@SAVANNAHSA.COM



## PROFESSIONAL EXPERIENCE

Megan completed a Bachelor of Science degree in Environmental Management from the University of South Africa and has been involved in conservation for 18 years. She has more than ten years' experience in the field of bird interactions with electrical infrastructure (both linear and footprint) and during this time has completed impact assessments for over 80 projects. In various roles (including Programme Manager) with the Endangered Wildlife Trust's Wildlife & Energy Programme and the Programme's primary project (Eskom-EWT Partnership) from 2006 to 2013, Megan was responsible for assisting the energy industry and the national utility in minimising the negative impacts (associated with electrical infrastructure) on wildlife through the provision of strategic guidance, risk and impact assessments, training and research. Megan currently owns and manages *Feathers Environmental Services* and is tasked with providing strategic guidance to the industry through the development of best practice procedures and guidelines, reviewing and commenting on methodologies, specialist studies and EIA reports for Renewable Energy projects as well as providing specialist avifaunal input into renewable energy and power line developments within South Africa, elsewhere in Africa and across the globe. Megan peer reviewed the Hidden Valley Pre-Construction Bird Monitoring Report compiled by the Endangered Wildlife Trust (2014). Megan peer reviewed the Hidden Valley Pre-Construction Bird Monitoring Report compiled by the Endangered Wildlife Trust (2014). In addition, Megan has attended and presented at several conferences and facilitated workshops, as a subject expert, since 2007. Megan has co-authored seven academic papers, several research reports and energy industry related guidelines, including the *BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* and the *Avian Wind Farm Sensitivity Map for South Africa* (2015), and played an instrumental role in facilitating the endorsement of these two products by the South African Wind Energy Association (SAWEA), IAIA (International Association for Impact Assessment South Africa) and Eskom. In 2011/2012, she chaired the Birds and Wind Energy Specialist Group in South Africa. From 2013 to 2015, Megan chaired the IUCN/SSC Crane Specialist Group's Crane and Powerline Network, a working group comprised of subject matter experts from across the world, working in partnership to share lessons, develop capacity, pool resources, and accelerate collective learning towards finding innovative solutions to mitigate this impact on threatened crane populations.


## **DECLARATION OF INDEPENDENCE**

I, **Megan Diamond**, in my capacity as a specialist consultant, hereby declare that I:

- » Act as an independent specialist to Savannah Environmental (Pty) Ltd for this project.
- » Do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Amendment to Environmental Impact Assessment Regulations, 2017.
- » Will not be affected by the outcome of the environmental process, of which this report forms part of.
- » Do not have any influence over the decisions made by the governing authorities.
- » Do not object to or endorse the proposed development, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- » Undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Amendment to Environmental Impact Assessment Regulations, 2017.

## **INDEMNITY**

- » This comparative assessment report is based on assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- » This comparative assessment report is based on a desktop investigation using the available information and data related to the site to be affected.
- » The Precautionary Principle has been applied throughout this investigation.
- » The findings, results, observations, conclusions and recommendations given in this report are based on the specialist's best scientific and professional knowledge as well as available information at the time of the assessment.
- » Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this comparative assessment report.
- » The specialist investigator reserves the right to modify this report, recommendations and conclusions at any stage should additional information become available.
- » Information, recommendations and conclusions in this comparative assessment report cannot be applied to any other area without proper investigation.
- » This comparative assessment report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- » Acceptance of this comparative assessment report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

  
19 October 2017

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## **1. INTRODUCTION**

ACED Renewables Hidden Valley (Pty) Ltd obtained an Environmental Authorisation (EA) from the National Department of Environmental Affairs (DEA) on 12 August 2014, for the construction and operation of the Karusa Wind Energy Facility (WEF). The WEF and its associated infrastructure (including grid connections) are located approximately 30km south of Sutherland (Northern Cape) and 30km north of Matjiesfontein (Western Cape). DEA approved a wind turbine layout comprised of 57 wind turbines, each with a generating capacity of between 2MW - 3.5MW, a 120m rotor diameter and a hub height of up to 120m. Karusa WEF has been awarded Preferred Bidder status within the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) Round Four bid window. Based on various technical and efficiency aspects, ACED Renewables Hidden Valley (Pty) Ltd is proposing to amend the turbine specifications for the Karusa WEF, increasing the rotor diameter from 120m to 50m as well as an increase in generating capacity up to 4.5MW per turbine, with the total generating capacity of the WEF not exceeding 140MW. These proposed amendments will result the reduction in the number of wind turbines from 57 to 43 turbines at this facility and minor amendments to the approved turbine layout.

As per the Regulations, DEA requires a Part 2 amendment to be conducted necessitating specialist input. This input must detail the identified impacts associated with the construction and operation of the WEF based on the turbine specifications and layout assessed within the Environmental Impact Assessment report (EIAr) compared to the potential impacts associated with the proposed increased rotor diameter and turbine layout amendments. Savannah Environmental (Pty) Ltd (hereinafter referred to as Savannah) was appointed by ACED Renewables Hidden Valley (Pty) Ltd as the independent environmental assessment practitioner to conduct the required Part 2 amendment. Feathers Environmental Services was subsequently appointed as the avifaunal specialist to conduct the required specialist avifaunal comparative assessment. This comparative assessment report is based on a desktop review, using a set methodology and various data sets (discussed elsewhere) to identify the impacts related to the increased rotor diameter, increased turbine capacity and turbine layout amendments. This report will also determine if the proposed amendments will result in a change to the significance of the identified avian impacts assessed in the EIAr. Measures to ensure avoidance, management and mitigation of the identified impacts associated with the proposed amendments, in addition to any changes to the EMPr for the Karusa WEF are also included.

## **2. COMPARATIVE ASSESSMENT METHODOLOGY**

### **2.1 Terms of Reference**

This report has been compiled according to the following Terms of Reference (ToR) supplied by Savannah:

- » An assessment of all impacts related to the proposed changes;
- » Advantages and disadvantages associated with the changes;
- » Comparative assessment of the impacts before and after the proposed changes; and
- » Measures to ensure avoidance, management and mitigation of impacts associated with such proposed changes, and any changes to the EMPr.

The assessment must be clear on whether each of the proposed changes to the EA will:

- » Increase the significance of impacts originally identified in the EIAr or lead to any additional impacts; or
- » Have a zero or negligible effect on the significance of impacts identified in the EIAr; or
- » Lead to a reduction in any of the identified impacts in the EIAr.

### **2.2 Methods**

The following methodology was used to evaluate the significance of the impacts assessed in the final Avifaunal Impact Assessment Report (EWT, 2014) in relation to the potential impacts associated with the proposed amendments:

- » Various avifaunal data sets (listed below) and documents were examined to assess the distribution and abundance of sensitive Red Data (as well as non-Red Data) species that may be vulnerable to the impacts associated with construction and operation of the proposed Karusa WEF and associated infrastructure, with particular reference to the proposed turbine specification and minor layout adjustments.
- » The potential impacts associated with the amendments at the proposed Karusa WEF on the avifaunal community were predicted on the basis of experience in gathering and analysing data on avian impacts with various forms of developments in southern Africa and supplemented with the pre-construction monitoring data contained within the final avifaunal impact assessment report, dated April 2014.

## 2.3 Data Sources Used

The data sources and reports listed below were examined for the purpose of this study. These are divided into 1) technical project related information, 2) primary data sources and 3) secondary data sources:

### 2.3.1 Technical project related information

*General reference information and data that provide the technical details related to the project.*

- » KMZ/KML shapefile detailing the approved Karusa WEF Site Development Plan (SDP);
- » KMZ/KML shapefile detailing the proposed adjusted Karusa WEF SDP;
- » KMZ/KML shapefiles detailing the recommended avifaunal exclusion zones and river, stream and farm dam buffers described in the final avifaunal impact assessment report; and
- » Letter of Appointment: Specialist Input for Karusa Wind Energy Facility (Phase 1) (Savannah Reference No.: SE1886) detailing the proposed turbine specification amendments, terms of reference and impact assessment methodology for this comparative assessment.

### 2.3.2 Primary data sources

*Original data and information collected during monitoring surveys. This data is relatively current and specific to the assessment of the impacts associated with the proposed amendments at the Karusa WEF.*

- » The Avifaunal Impact Assessment Report compiled by the Endangered Wildlife Trust (EWT, 2012);
- » Hidden Valley Pre-Construction Bird Monitoring Report compiled by the Endangered Wildlife Trust (2014); and
- » Hidden Valley Amended Final EIA Report compiled by Savannah (2014).

### 2.3.3 Secondary data source

*Data that was compiled for other purposes but has relevance to the Karusa WEF and this comparative assessment.*

- » The Southern African Bird Atlas Project 2 (<http://sabap2.adu.org.za/v1/index.php>) to determine which species occur within an area consisting of nine pentad grid cells within which the study area is situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. Between 2007 and 2017, a total of 41 full protocol cards (i.e. 41 bird surveys lasting a minimum of two

hours each) have been completed for the study area and its immediate surrounds. The relevant pentads within the study area include: 3240\_2030; 3240\_2035; 3240\_2040; 3245\_2030; 3245\_2035; 3245\_2040; 3250\_2030; 3250\_2035 and 3250\_2040. This data set was accessed on 26 September 2017;

- » The conservation status of all bird species (Taylor et al, 2015) and the IUCN 2016 Red List;
- » Birdlife South Africa/Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa (Jenkins *et al.* 2011); and
- » Wind Energy's Impacts on Birds in South Africa: A preliminary view of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa (Ralston-Paton *et al.*, 2017).

### **3. COMPARATIVE ASSESSMENT RESULTS**

#### **3.1 Avifaunal Impact Assessment (AIA - February 2012)**

ACED Renewables Hidden Valley (Pty) Ltd is proposing to construct and operate the Karusa Wind Energy Facility (WEF) in the Northern Cape Province. The National Environmental Management Act (NEMA) (Act 107 of 1998) requires an Environmental Impact Assessment (EIA) for any development which could have a significant effect on the environment, with the objective to identify, predict and evaluate the actual and potential impacts of these activities on ecological systems; identify alternatives; and provide recommendations for mitigation to minimise the negative impacts. In order to meet these requirements, ACED Renewables Hidden Valley (Pty) Ltd appointed Savannah as independent environmental assessment practitioners (EAP) to manage the EIA process for the proposed development. The Endangered Wildlife Trust (EWT) was subsequently appointed, by the EAP, as the avifaunal specialist to conduct the required avifaunal comparative study for proposed development.

An avifaunal impact assessment (AIA), dated February 2012 (EWT, 2012), was conducted for the broader Hidden Valley WEF, comprised of three development phases i.e. Karusa (Phase 1), Soetwater (Phase 2), and Great Karoo (Phase 3) WEFs, during which the establishment of the wind energy facilities and the associated infrastructure within an area of approximately 320km<sup>2</sup> was assessed. At the time of the assessment, the wind energy facility would include a maximum of 207 turbines (of which Karusa WEF comprised of 74 turbines), four on-site substations, 132kV and 400kV power lines linking the turbines to the substations and the national grid.

Following an extensive review of relevant literature on wind energy impacts on avifauna and an analysis of the avifaunal data available at the time of the study, it was concluded that the proposed development site is moderately sensitive in avian terms. Nineteen priority species

(which includes both Red Data and non-Red Data species) were identified, based on records emanating from the South African Bird Atlas Projects 1 and 2 (SABAP1 and SABAP2), ten of which were observed during a three-day site visit to the development area, in addition to Southern Black Korhaan, an additional Red Data species that was subsequently added to the priority species list.

Impacts associated with the construction and operation of the proposed Karusa WEF (Phase 1) development were rated as being of moderate to high significance for the local avifauna. Impacts would mainly be through collision with the wind turbines and power line infrastructure, an impact of particular concern for Ludwig's Bustard *Neotis ludwigi*, Black Stork *Ciconia nigra* and various raptor species (i.e. eagles, buzzards, kestrels and kites) in addition to the displacement impacts as a result of habitat destruction and disturbance, associated with construction of the wind farm. The fragmentation of habitat is another less direct impact, resulting from the wind farm clusters forming barriers to the birds' movement within this area. However, due to the lack of operational experience in this field in South Africa, the nature, extent and probability of the aforementioned impacts could not be determined with certainty.

Exclusion zones, based on sensitive habitat (river systems, streams, farm dams and ridges) likely to support priority species, were mapped with the recommendation that construction of turbines within these areas be prohibited. Thirty-two turbines were deemed to be sited within avian sensitivity zones.

The AIA (EWT, 2012) concluded that, while impacts were considered to be significant, the site did not present with any fatal flaws. Following the mitigation hierarchy, the AIA recommended that construction be avoided in the identified sensitivity zones, thereby reducing the displacement and collision impacts. Further recommendations were made to manage and mitigate the residual impacts. It was furthermore suggested that a pre-construction monitoring programme be implemented in order to establish a pre-impact baseline of bird numbers, distributions and movements and to mitigate impacts by informing the final layout design, construction and management strategy of the development.

### **3.2 Avifaunal Preconstruction Monitoring Programme & Final AIA (April, 2014)**

Following submission of the Final Environmental Impact Report (FEIR) to the DEA in 2012, it was requested by DEA that four seasons of site specific bird monitoring be conducted prior to Environmental Authorisation (EA) being granted. The baseline data, obtained during the seasonal monitoring visits to the proposed development site, were to inform the final AIA that would detail the updated assessment of the potential avifaunal impacts associated with the construction and operation of proposed three-phase Hidden Valley WEF. The EWT was contracted to develop and implement the required monitoring programme which was developed according to the Best Practice Guidelines for Avian Monitoring and Impact

Mitigation at Proposed Wind Energy Development Sites in Southern Africa (Jenkins et al 2011). The monitoring programme commenced in winter 2013 and was completed in 2014 following the autumn survey. The Hidden Valley Pre-Construction Bird Monitoring Report compiled by the Endangered Wildlife Trust (2014) and peer reviewed by the author of this report provides a detailed description of the primary aims of the pre-construction monitoring programme and the survey methods employed during each of the four seasonal surveys.

With the completion of the four seasonal surveys, the preconstruction monitoring report (EWT, 2014) confirmed that the proposed site was found to be moderately sensitive in terms of avifauna with areas of high, medium and unknown sensitivity being present on site. Based on observations made during the seasonal site visits, Rock Kestrel *Falco rupicolus* and Gabar Goshawk *Melierax gabar* were added to the site-specific priority species list. Priority species that were recorded in various abundances included: Black Harrier *Circus maurus*, Southern Pale Chanting Goshawk *Melierax canorus*, Spotted Eagle Owl *Bubo africanus*, Cape Eagle Owl *Bubo capensis*, Martial Eagle *Polemaetus bellicosus*, Verreaux's Eagle *Aquila verreauxii*, African Harrier Hawk *Polyboroides typus*, Black-shouldered Kite *Elanus caeruleus*, Rufous-chested Sparrowhawk *Accipiter rufiventris*, Lanner Falcon *Falco biarmicus*, Black Sparrowhawk *Accipiter melanoleucus*, Jackal Buzzard *Buteo rufofuscus*, Grey-winged Francolin *Scleroptila afra*, Southern Black Korhaan *Afrotis afra*, Black Stork *Ciconia nigra* and Ludwig's Bustard. The report concluded that the impact of most concern for these species is that of collision with the turbines, but also the less direct displacement impacts associated with habitat transformation, disturbance and wind farm clusters forming barriers to the bird's movement within this area.

Collision is dependent on a number of variables, specifically the frequency and height of flights and flights in the relevant areas. One of the primary aims of the monitoring programme, was to determine the number of flights of priority species and the proportion of flying time spent within the upper, medium and lower height limits as determined by the rotor diameter and hub height of the turbines to be used. Medium flight heights, defined as 30m–160m, represented flights within the Rotor Swept Area (RSA). Species frequently recorded flying within the RSA were considered to be highly susceptible to collision with the proposed turbines. A total of 600 priority species flights were recorded across all observation periods. Of these, 268 were medium height flights (i.e. within the RSA). Thirteen priority species were observed flying within the general height of the RSA, with Rock Kestrel, Jackal Buzzard, Verreaux's Eagle, Martial Eagle and Ludwig's Bustard having more than 50% of their flights recorded at medium height. Notably, Booted Eagle *Hieraaetus pennatus* had 100% of its recorded flights observed at rotor height. These species are considered to be at significant risk with regards to turbine collision, should turbines be placed in their preferred flight paths.

Due to the size of the site, risk modelling was undertaken to predict the use of the site by the species at most risk. The most preferred modelled flight areas were the ridges running north-

south along the western boundary of the proposed Karusa WEF development area. Based on the results of this analysis, particularly the flight activity of Verreaux's Eagle, the exclusion zones defined within the AIA (EWT, 2012) were updated to include flight data in the *high sensitivity* category, in favour of the ridge buffers (delineated in the AIA).

Similarly, the findings of the pre-construction monitoring were used to update the impact assessment previously undertaken in the EIA phase. The updated impact assessment considered the analysis of the avifaunal data emanating from the seasonal surveys and, in particular, the final turbine layout comprised of a reduced number of turbines (n=57 from n=74) sited in the *medium* and *low* sensitivity areas only, thereby avoiding the *high sensitivity* exclusion zones. With the exception of the collision impact (both with the turbines and the overhead power lines), the significance of all the other identified impacts were assessed to be the same as that described in the AIA (EWT, 2012). With a reduction in the number of turbines and their location outside of the *high sensitivity* exclusion zones, the collision impact was finally assessed to be of only moderate (medium) significance opposed to the high significance rating assigned to this impact in the initial AIA (EWT, 2012).

The final AIA concluded that, while impacts were considered to be moderately significant, the site still did not present any fatal flaws. The report concurred with the recommendations, contained within the Environmental Management Programme report for the Karusa WEF, to manage and mitigate the residual impacts. It was furthermore suggested that a post-construction monitoring programme be implemented in order to collect much needed, relevant and accurate data on the numbers of birds affected by wind energy facilities in South African conditions.

### **3.3 Assessment of the Impacts - Proposed Turbine Specification Amendments**

This assessment of impact significance is based on the following amended turbine specifications and the avifaunal data/information currently available:

- » An increase in rotor diameter from 120m to 150m;
- » An increase in generating capacity up to 4.5MW per turbine;
- » A reduction in the number of wind turbines from 57 to 43 turbines;
- » A minor adjustment to the approved facility layout;
- » The updated SABAP2 occurrence and report rates for priority species recorded within the pentads relevant to the Karusa WEF;
- » Information documenting the impacts of operational WEFs in South Africa; and
- » The findings of the AIA report (EWT, 2012) and the pre-construction monitoring and final AIA report (EWT, 2014)

### 3.3.1 Relevant bird populations - SABAP2 Data

The study area was defined by nine SABAP2 pentads. Although the proposed Karusa WEF development is located within two pentads (i.e. 3245\_2035 and 3250\_2035), a larger area is necessary to obtain a dataset that is large enough to ensure that reasonable conclusions about species diversity and densities, in a particular habitat type, can be drawn. Coverage by SABAP2 has unfortunately not been extensive with a total of only 41 full protocol data cards being completed for the study area over the ten-year survey period to date. However, primary data obtained through first-hand investigation during the pre-construction monitoring surveys supplemented the SABAP2 data and was instrumental in assessing the impacts associated with the construction and operation of the Karusa WEF, based on the proposed turbine specification amendments.

Sixteen priority species have been recorded by SABAP2 (TABLE 3.1), seven of which are Red Data species i.e. Ludwig's Bustard, Martial Eagle, Verreaux's Eagle, Black Harrier, Karoo Korhaan *Eupodotis vigorsii*, Southern Black Korhaan and Black Stork. The pre-construction monitoring surveys considered each of the aforementioned priority species with the addition of Rock Kestrel and Gabar Goshawk. Priority species with relatively high reporting rates, considering the low number of surveys conducted, include: Jackal Buzzard, Martial Eagle, Verreaux's Eagle, Spotted Eagle-owl, Grey-winged Francolin, Southern Pale Chanting Goshawk and Southern Black Korhaan.

**TABLE 3.1** Priority species recorded by the relevant SABAP2 pentads (accessed 26.09.2017)

SPECIES	TAXONOMIC NAME	PRIORITY SCORE	CONS. STATUS	REPORT RATE	NO. OF INDIVIDUALS
Bustard, Ludwig's	<i>Neotis ludwigii</i>	320	EN	2.44	1
Buzzard, Jackal	<i>Buteo rufofuscus</i>	250	-	51.22	21
Buzzard, Steppe	<i>Buteo vulpinus</i>	210	-	9.76	4
Eagle, Booted	<i>Aquila pennatus</i>	230	-	7.32	3
Eagle, Martial	<i>Polemaetus bellicosus</i>	350	EN	14.63	6
Eagle, Verreaux's	<i>Aquila verreauxii</i>	360	VU	29.27	12
Eagle-owl, Spotted	<i>Bubo africanus</i>	170	-	21.95	9
Francolin, Grey-winged	<i>Scleroptila africanus</i>	190	-	21.95	9
Goshawk, Southern Pale Chanting	<i>Melierax canorus</i>	200	-	34.15	14
Harrier, Black	<i>Circus maurus</i>	345	EN	9.76	4
Kestrel, Lesser	<i>Falco naumanni</i>	214	-	2.44	1
Kite, Black-shouldered	<i>Elanus caeruleus</i>	174	-	2.44	1
Korhaan, Karoo	<i>Eupodotis vigorsii</i>	240	NT	4.88	2
Korhaan, Southern Black	<i>Afrotis afra</i>	270	VU	14.63	6
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>	230	-	2.44	1
Stork, Black	<i>Ciconia nigra</i>	330	VU	2.44	1
EN = Endangered; VU = Vulnerable; NT = Near-threatened					

Although, Black-chested Snake-eagle *Circaetus pectoralis*, Booted Eagle, Grey-winged Francolin and Verreaux's Eagle were not included or observed in the AIA, dated February

2012, these species were recorded in various abundances during the pre-construction monitoring surveys. Their presence within the study area and susceptibility to the impacts associated with WEFs, particularly collision, were key factors in assessing the significance of the identified impacts in the final AIA dated April 2014. Therefore, in terms of priority species, the significance ratings detailed in the final AIA are likely to be a true reflection of the anticipated impacts.

### *3.3.2 Understanding the factors that influence collision risk*

International literature confirms that there are a number of factors that influence collision risk at WEFs. Drewitt & Langston (2006) found that the rate of bird collisions per turbine are highly variable. This variability can be attributed to the alignment of turbines and rotor speed (Barrios & Rodriguez, 2004; Stewart et al, 2007), turbine height (De Lucas et al, 2008), as well as species utilization of the site and behaviour (NWCC, 2010). There is however consensus that an increase in RSA does not automatically translate into an increase in collision risk (Barclay et al, 2007; Krijgveld et al, 2009; Everaert, 2014, Smallwood et al, 2013 and Hotker, 2006). The proposed Karusa WEF comprised of 57 turbines with a rotor diameter of 120m would have a combine RSA of 644,328m<sup>2</sup>, while the proposed 43 turbines with a maximum rotor diameter of 150m would have a combined RSA of 759,487m<sup>2</sup>. Despite the reduction in the number of turbines that RSA has increased by 115,159m<sup>2</sup>. This could be perceived as potentially more perilous to the bird species utilizing the site. However, based on literature cited above, RSA is not considered to be a key factor in determining collision risk. **The number of turbines in conjunction with their location as well as species abundance, morphology and flight behaviour are likely to be more relevant when assessing the significance of the collision risk.**

### *3.3.3 Impact Assessment*

The following impact tables detail the revised significance ratings for each of the identified impacts, during both the construction and operational phases of the proposed Karusa WEF development. These ratings are based on current species information, in addition to the amended turbine specifications, the reduction in the number of turbines from 57 to 43 and the slightly adjusted turbine layout. The impacts are quantified and assessed based on the criteria in APPENDIX 2. This assessment has considered only those impacts that are directly associated with the application for amendment. Therefore, the impacts associated with the overhead power lines, that were assessed in the final AIA report dated April 2014, have not been reassessed in this report. Impacts were rated for both *Without Mitigation* and *With Mitigation* scenarios. **The revised turbine layout (APPENDIX 1), which has taken cognizance of the exclusion zones delineated in the final AIA report, is considered in the *Without Mitigation* significance rating. The significance ratings are based on information emanating from some of South Africa's large-scale operational wind farms (Ralston-Paton et al, 2016), international literature and the specialists**

**experience working in the avifaunal specialist field since 2006.** It must be noted that, it is often not possible to entirely eliminate the impacts associated with a development of this nature. Assessments such as this attempt to minimise the risk as far as possible, and although the impacts will be unavoidable, they may be temporary.

**TABLE 3.2** Impact table detailing the comparative evaluation of the displacement impact as a result of disturbance during construction.

<b>Nature of the Impact:</b> Displacement as a result of disturbance associated with noise and movement of construction equipment and personnel at the Karusa WEF, resulting in a negative impact on the resident avifauna, particularly the priority species (including Red Data species) recorded within the development area and the smaller passerine species.				
CONSTRUCTION PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	2 local area	2 local area	2 local area	1 site bound
Duration	2 short term	2 short term	2 short term	2 short term
Magnitude	6 moderate	6 moderate	6 moderate	4 low
Probability	4 highly probable	3 probable	4 highly probable	3 probable
Significance	Medium (40)	Medium (30)	Medium (40)	Low (21)
Status	Negative	Negative	Negative	Negative
Reversibility	Medium	High	Medium	Medium
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	Partially		Partially	
Mitigation	» Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. » Sensitive zones as identified by EWT, 2014 should be avoided where possible. » Environmental measures will be detailed in the site specific EMPr and will be enforced and overseen by the ECO for the project.			
Residual Impacts	Low - The majority of species observed in the development area may return once the construction activity is completed.			

The significance of the displacement impact rating (as a result of disturbance) decreased from Medium to Low with the implementation of the recommended mitigation. Avoiding sensitive avifaunal zones and controlling construction activities, particularly in terms of vehicle and staff movements will likely result in an impact that is site bound and cause a slight impact on processes. Observations of breeding Blue Cranes and Martial Eagle have been reported at operational WEFs which suggests that certain species may not be negatively affected by construction and operational activities and may in fact co-exist with the turbines.

**TABLE 3.3** Impact table detailing the comparative evaluation of the displacement impact as a result of habitat transformation during construction.

<b>Nature of the Impact:</b> Displacement as a result of habitat transformation associated with the construction of the Karusa WEF resulting in a negative impact on the resident avifauna, particularly the priority species (including Red Data species) recorded within the development area and the smaller passerine species.				
CONSTRUCTION PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	2 local area	2 local area	2 local area	1 site bound
Duration	4 long term	4 long term	4 long term	4 long term
Magnitude	6 moderate	4 low	4 low	2 minor
Probability	5 definite	4 highly probable	5 definite	5 definite
Significance	High (60)	Medium (40)	Medium (50)	Medium (35)
Status	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Medium	Medium
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	Partially		Partially	
Mitigation	» Strict control over contractors, to ensure only the minimum required areas is cleared. » No off-road driving. » Minimise footprint areas, road lengths, road widths, wherever possible during the final layout design. » Where possible existing roads must be used and batching plants, labour camps, equipment storage, etc. should be situated in areas that are already disturbed. » A full site specific EMP must also be compiled to specify all of the impacts and mitigation measures and provide a step by step programme to follow for the ECO on site. » <u>Clearing of alien vegetation, particularly stands of alien trees must be approved by an avifaunal specialist.</u> » <u>Following construction, rehabilitation of disturbed areas must be conducted to ensure habitat restoration (an appropriate plan must be developed and included in the EMPr).</u>			
Residual Impacts	Low			

Considering the proposed amendments, specifically the reduction in the number of turbines, coupled with their position outside of the high sensitivity exclusion zones, the habitat transformation impact is assessed as being of Medium significance. Although the impact remains of Medium significance with the implementation of the recommended mitigation measures, the impact is likely to be site bound with a minor impact on processes.

**TABLE 3.4** Impact table detailing the comparative evaluation of the collision impact during operation.

<b>Nature of the Impact:</b> Mortality as a result of collisions with the wind turbines resulting in a negative direct impact on priority species.				
OPERATIONAL PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	2 local area	2 local area	2 local area	2 local area
Duration	4 long term	4 long term	4 long term	4 long term
Magnitude	10 very high	10 very high	8 high	8 high
Probability	3 probable	3 probable	3 probable	2 improbable
Significance	Medium (48)	Medium (48)	Medium (42)	Low (28)
Status	Negative	Negative	Negative	Negative
Reversibility	Irreversible	Irreversible	Low	Low
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Partially		Partially, if operational phase mitigation is implemented in the event that mortalities are encountered during operational phase (post-construction) monitoring.	
Mitigation	<ul style="list-style-type: none"><li>» The most important mitigation option is the correct positioning of turbines outside of the identified high sensitivity zones, and where possible, outside of the medium sensitivity zones. <b>This mitigation measure, the micro-siting, has already been undertaken and has guided the final turbine layout with the high-risk turbines being moved into medium/low sensitivity areas.</b></li><li>» Implement a 24-month post-construction monitoring programme that replicates the pre-construction monitoring surveys. <u>Ongoing nest searches and nest monitoring must be implemented.</u></li><li>» <u>A carcass search programme for birds during the first 24 months of operation must be implemented.</u></li><li>» Additional available or potential mitigation options, if required, would need to be employed once the turbines are already operational, if monitoring reveals significant impacts. Some mitigation options that can be employed if monitoring reveals significant numbers of collisions, include: the installation of deterrent devices curtailment and any others that may be identified as our understanding of the impacts progresses.</li></ul>			
Residual Impacts	Low			

Although the proposed amendment will result in a reduced number of turbines, the collision risk is dependent on other factors such as species abundance, morphology and flight behaviour. Therefore, the significance of the collision risk remains Medium, with a small reduction in the magnitude of the impact based on the proposed amendments and the position of the turbines outside of the high sensitivity areas. Mitigation measures emanating from the post construction monitoring results will in all likelihood reduce this impact further to a rating of Low significance.

**TABLE 3.5** Impact table detailing the comparative evaluation of the displacement impact as a result of disturbance during operation and maintenance.

<b>Nature of the Impact:</b> Displacement as a result of disturbance associated with noise and movement of operational equipment and personnel at the Karusa WEF, resulting in a negative impact on the resident avifauna, particularly the priority species (including Red Data species).				
OPERATIONAL PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	1 site bound	1 site bound	1 site bound	1 site bound
Duration	1 short term	1 short term	2 short term	2 short term
Magnitude	5 low moderate	4 low	5 low moderate	4 low
Probability	3 probable	2 improbable	2 improbable	2 improbable
Significance	Low (21)	Low (12)	Low (16)	Low (14)
Status	Negative	Negative	Negative	Negative
Reversibility	Medium	High	Medium	Medium
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	Partially		Partially	
Mitigation	» An Operational Environmental Management Plan must be developed, implemented and strictly adhered to. » The WEF manager and/or Environmental Manager must identify and report the presence of priority species, and in particular any indications of breeding activities by these species. Training of the WEF manager and/or Environmental Manager may be required. If a nest or breeding site is identified, it is imperative that this site is not disturbed that an avifaunal specialist is contacted for further instruction. » Strict control should be maintained over all maintenance activities, in particular heavy machinery and vehicle movements, and staff. » Operating procedures and maintenance schedules must be properly followed.			
Residual Impacts	Low			

Avoiding sensitive avifaunal zones and controlling operational activities, particularly in terms of vehicle and staff movements during breeding will likely result in an impact that is site bound and cause a slight impact on processes. As previously mentioned, observations of breeding Blue Cranes and Martial Eagle have been reported at operational WEFs which suggests that certain species may not be negatively affected by construction and operational activities and may in fact co-exist with the turbines.

**TABLE 3.6** Impact table detailing the comparative evaluation of the barrier effect impact resulting in a disruption to local bird movement patterns.

<b>Nature of the Impact:</b> Large scale wind energy facilities are a likely obstacle in the landscape that may result in a disruption to local bird movement patterns. This avoidance behaviour may lead to increased energy costs to the bird as they expend more energy flying from one point to another. This in turn may result in decreased breeding productivity and ultimately population level impacts.				
OPERATIONAL PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	3 local regional	3 local regional	2 local	2 local
Duration	4 long term	4 long term	4 long term	4 long term
Magnitude	5 low moderate	5 low moderate	4 low	4 low
Probability	3 probable	3 probable	3 probable	3 probable
Significance	Medium (36)	Medium (36)	Medium (30)	Medium (30)
Status	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Low	Low
Irreplaceable loss of resources?	Possible	Possible	Possible	Possible
Can impacts be mitigated?	Unknown		Unknown	
Mitigation	» <u>Lighting on turbines must be minimal and preferably provide intermittent light and where possible coloured (opposed to constant white light).</u>			
Residual Impacts	Undetermined			

Assessment of the barrier effect impact, based on the proposed amendments, has resulted in a risk rating of Medium. Avoidance of high sensitivity exclusion zones, coupled with the reduction in the number of turbines at the facility will likely result in a slight impact on processes and therefore a small decrease in the quantitative risk rating associated with this impact compared to the assessment provided in the final AIA dated April 2014. This impact is difficult to mitigate for therefore the risk rating after mitigation remains the same.

**TABLE 3.7** Impact table detailing the comparative evaluation of the cumulative collision impact.

<b>Nature of the Impact:</b> Cumulative collision impact.				
OPERATIONAL PHASE	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
<b>Extent</b>	3 regional	3 regional	3 regional	3 regional
<b>Duration</b>	3 medium term	3 medium term	3 medium term	3 medium term
<b>Magnitude</b>	8 high	8 high	6 moderate	6 moderate
<b>Probability</b>	3 probable	3 probable	3 probable	3 probable

<b>Significance</b>	<b>Medium (39)</b>	<b>Medium (39)</b>	<b>Medium (36)</b>	<b>Medium (36)</b>
<b>Status</b>	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Low	Low	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	Yes	Yes	Yes
<b>Can impacts be mitigated?</b>	Limited		Unknown	

**TABLE 3.8** Impact table detailing the comparative evaluation of the cumulative barrier effect impact.

<b>Nature of the Impact:</b> Cumulative barrier effect impact.				
<b>OPERATIONAL PHASE</b>	<b>AUTHORISED</b>		<b>PROPOSED AMENDMENT</b>	
	<b>Without Mitigation</b>	<b>With Mitigation</b>	<b>Without Mitigation</b>	<b>With Mitigation</b>
<b>Extent</b>	3 regional	3 regional	3 regional	3 regional
<b>Duration</b>	3 medium term	3 medium term	3 medium term	3 medium term
<b>Magnitude</b>	6 moderate	6 moderate	4 low	4 low
<b>Probability</b>	4 highly probable	4 highly probable	4 highly probable	4 highly probable
<b>Significance</b>	<b>Medium (48)</b>	<b>Medium (48)</b>	<b>Medium (40)</b>	<b>Medium (40)</b>
<b>Status</b>	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Low	Low	Low	Low
<b>Irreplaceable loss of resources?</b>	No	No	No	No
<b>Can impacts be mitigated?</b>	No		Partially	

Similar to the assessment of the cumulative collision and barrier effect impacts detailed in the final AIA (April, 2014), the assessment of these cumulative impacts based on the proposed turbine specification and minor layout adjustments also yielded a significance rating of Medium, although slightly reduced from a quantitative rating of 48 to 40. This decrease is largely attributed to the reduction in the number of turbines and the role that this factor plays in reducing the potential collision risk.

#### 4. CONCLUSION

In conclusion, the proposed amendments to the turbine specifications have not resulted in any increased changes to the significance ratings for each of the identified impacts. In some cases, the quantitative value has changed (reduced) but this has not resulted in a change to the qualitative (i.e. Low, Medium, High) significance rating. The only impact that saw a reduction in significance due to the proposed amendment is the displacement impact as a

result of habitat transformation. Based on the revised turbine layout and the fact that the proposed turbines have been sited in such a manner as to avoid areas of high sensitivity, the rating for this impact was reduced from high to medium significance. No additional impacts, as a result of the proposed amendments were identified.

While the proposed amendments will result in an increase in the Rotor Swept Area (RSA) however, the number of turbines have been reduced substantially from 57 to 43 (n=14). It is generally accepted in published literature that the number of turbines (rather than the turbine specification and the resultant RSA) is an important and decisive factor in determining collision risk. Collision risk is also dependent on the frequency and height of flights and flights in the relevant areas. One of the primary aims of the monitoring programme conducted in 2013/2014, was to determine the number of flights of priority species and the proportion of flying time spent within the upper, medium and lower height limits as determined by the rotor diameter and rotor hub height of the turbines to be used. Medium flight heights, defined as 30m–160m, represented flights within RSA. The range assigned to medium flight heights, comfortably accommodates the change in turbine specifications, therefore the calculated collision risk for priority species remains relevant. Species frequently recorded flying within the RSA were considered to be highly susceptible to collision with the proposed turbines and this informed the high sensitivity exclusion zones, which have been completely avoided by all turbines. The reduction in the number of turbines, coupled with their position outside of the high sensitivity exclusion zones (APPENDIX 1) are considered to be adequate mitigatory factors that could potentially even reduce the collision impact associated with a development of this nature and the amendment proposed.

Based on the findings of this assessment, the significance of the potential impacts associated with the proposed amendments are considered acceptable. Therefore, construction of the Karusa WEF may proceed in accordance with the proposed amendments and the recommended mitigation measures provided.

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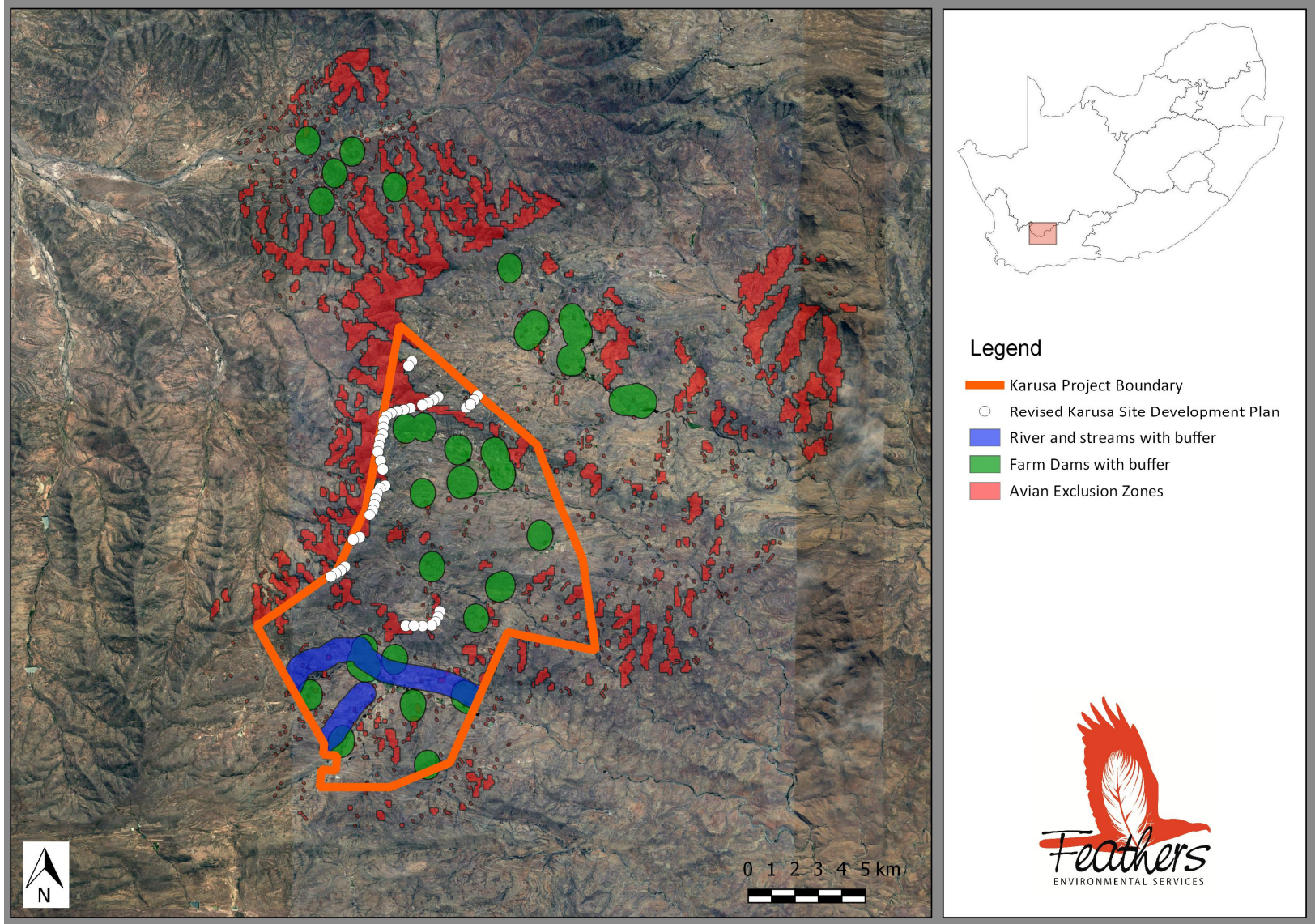
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**APPENDIX 1 - REVISED KARUSA WEF TURBINE REDUCED LAYOUT & EXCLUSION ZONES FROM AIA 2014**



## APPENDIX 2 - IMPACT ASSESSMENT CRITERIA AND IMPACT TABLE FORMAT

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

- » The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- » The **duration**, wherein it will be indicated whether:
  - \* The lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1.
  - \* The lifetime of the impact will be of a short duration (2 – 5 years) - assigned a score of 2.
  - \* Medium-term (5 – 15 years) – assigned a score of 3.
  - \* Long term (> 15 years) - assigned a score of 4.
  - \* Permanent - assigned a score of 5.
- » The **consequences (magnitude)**, quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 – 5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- » The **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- » 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.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E + D + M) P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area).
- » 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated).
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. The table must be completed and associated ratings for **each** impact identified during the assessment should also be included.

Example of Impact table summarising the significance of impacts (with and without mitigation) when the impact has increased or decreased:

Nature of the Impact: [Outline and describe fully the impact anticipated as per the assessment undertaken]				
	AUTHORISED		PROPOSED AMENDMENT	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	Low (1)	Low (1)	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Very Improbable (1)	Very Improbable (1)	Very Improbable (1)	Very Improbable (1)
Significance	8 (Low)	8 (Low)	8 (Low)	8 (Low)
Status	Negative	Negative	Negative	Negative
Reversibility	Very low	Very low	Very low	Very low
Irreplaceable loss of resources?	Yes	No	yes	No
Can impacts be mitigated?	Yes		Yes	
Mitigation	Mitigation, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.  Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind.  [Please underline all new mitigation measures which were not included in the EIA].			
Cumulative Impacts	Cumulative Impact, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.			
Residual Impacts	Residual Risk, means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).			