AVIFAUNAL COMPARATIVE ASSESSMENT

PART 1 EA AMENDMENT APPLICATION: 100 MW Loeriesfontein 3 Photovoltaic (PV) Solar Energy Facility (SEF), 33/132kV IPP Portion of the Shared On-site Substation (including the Transformer) and associated infrastructure, near Loeriesfontein, Hantam Local Municipality, Northern Cape

Province – DFFE Reference Number: 12/12/20/2321/2/1

AFRIMAGE Photography (Pty) Ltd t/a:
Chris van Rooyen Consulting
VAT#: 4580238113
email: vanrooyen.chris@gmail.com
Tel: +27 (0)82 4549570 cell

Expertise of Specialist

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	26 years

Key Experience

Chris van Rooyen has decades of experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Expertise of Specialist

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	24 years

Key Qualifications

Albert Froneman (Pr.Sci.Nat) has more than 18 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at

international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

1 BACKGROUND

South Africa Mainstream Renewable Power Loeriesfontein 3 (Pty) Ltd received the original Environmental Authorisation (EA) for the 100 megawatt (MW) Loeriesfontein 3 Photovoltaic (PV) Solar Energy Facility (SEF) and Grid Connection infrastructure on 29 October 2012 (DFFE Ref: 12/12/20/2321/2). Further to this, the original EA was amended on 10 July 2014 (DFFE Ref: 12/12/20/2321/2/A1), 27 October 2015 (DFFE Ref: 12/12/20/2321/2/AM2), 04 October 2017 (DFFE Ref: 12/12/20/2321/2/AM3) and 24 September 2019 (DFFE Ref: 12/12/20/2321/2/AM4). In addition, following the 2019 amendment, the EA was subsequently split into two separate EAs (1 for the 100MW PV SEF and 1 for the grid connection infrastructure), both dated 21 May 2021, as follows:

1) EA for the 100MW Loeriesfontein 3 PV SEF, 33/132kV Independent Power Producer (IPP) portion of the shared on-site substation (including Transformer) and associated infrastructure (DFFE Ref: 12/12/20/2321/2/1); and
2) EA for the 132kV Grid Alignment and 132kV Eskom Portion of the shared on-site substation to service the 100 MW Loeriesfontein 3 PV SEF (DFFE Ref: 12/12/20/2321/2/2).

It should be noted that the split EAs for the Loeriesfontein 3 PV SEF (DFFE Ref:.12/12/20/2321/2/1) and Grid Connection infrastructure (DFFE Ref: 12/12/20/2321/2/2) dated 21 May 2021 respectively replaced the original EA dated 29 October 2012, as well as the subsequent amendments. **This report however addresses the Loeriesfontein 3 PV SEF EA extension application specifically, and the EA extension application for the Grid Connection infrastructure has been assessed and reported on as part of a separate standalone report.**

The validity of the split EA for the 100MW Loeriesfontein 3 PV SEF and associated infrastructure lapsed on 29 October 2022, however, a Part 1 EA Amendment Application to extend the validity of the EA by 5 years (i.e., EA lapses on 29 October 2027) was submitted to the Department of Forestry, Fisheries and the Environment (DFFE) on 26 October 2022. It is important to note that according to Regulation 28(1B) of the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014 (as amended), "*an environmental authorisation which is the subject of an amendment application contemplated in this Chapter remains valid pending the finalisation of such amendment application.*" The Part 1 EA Amendment Application was acknowledged by the DFFE on 07 November 2022 and additional information was requested to be submitted to the DFFE for consideration. Following this, comparative assessments are to be undertaken to motivate why the Department should extend the validity period of the EA for a further 5 years.

The 100MW Loeriesfontein 3 PV SEF and associated infrastructure will comprise the following (as authorised as part of split EA dated 21 May 2021 with reference: 12/12/20/2321/2/1):

- PV array with a height of between 5-10m on approximately 405,77 hectares;
- Internal cabling network to connect the PV panels to the substation;
- A new substation of approximately 10 800m^2 and associated transformers (IPP portion of the shared on-site substation);
- Access roads of 6-10m wide which includes an internal road network;
- Temporary construction area; and

- Administration and warehouse building with a maximum area of up to 5000m^2.

As mentioned above, the EA for the Loeriesfontein 3 PV SEF and associated infrastructure (as authorised under 12/12/20/2321/2, and as amended in 12/12/20/2321/2/A1; 12/12/20/2321/2/AM2; 12/12/20/2321/2/AM3; 12/12/20/2321/2/AM4 and 12/12/20/2321/2/1) lapsed on 29 October 2022. The Applicant therefore wishes to extend the validity period of the EA for a period of five (5) years (i.e., EA lapses on 29 October 2027).

As mentioned, Regulation 28(1B) of the NEMA EIA Regulations of 2014 (as amended) state that "*an environmental authorisation which is the subject of an amendment application contemplated in this Chapter remains valid pending the finalisation of such amendment application."* A Part 1 EA Amendment Application to extend the validity of the EA was submitted to the DFFE on 26 October 2022 and acknowledged on 07 November 2022.

See Figures 1 and 2 for the location and lay-out of the proposed PV facility.

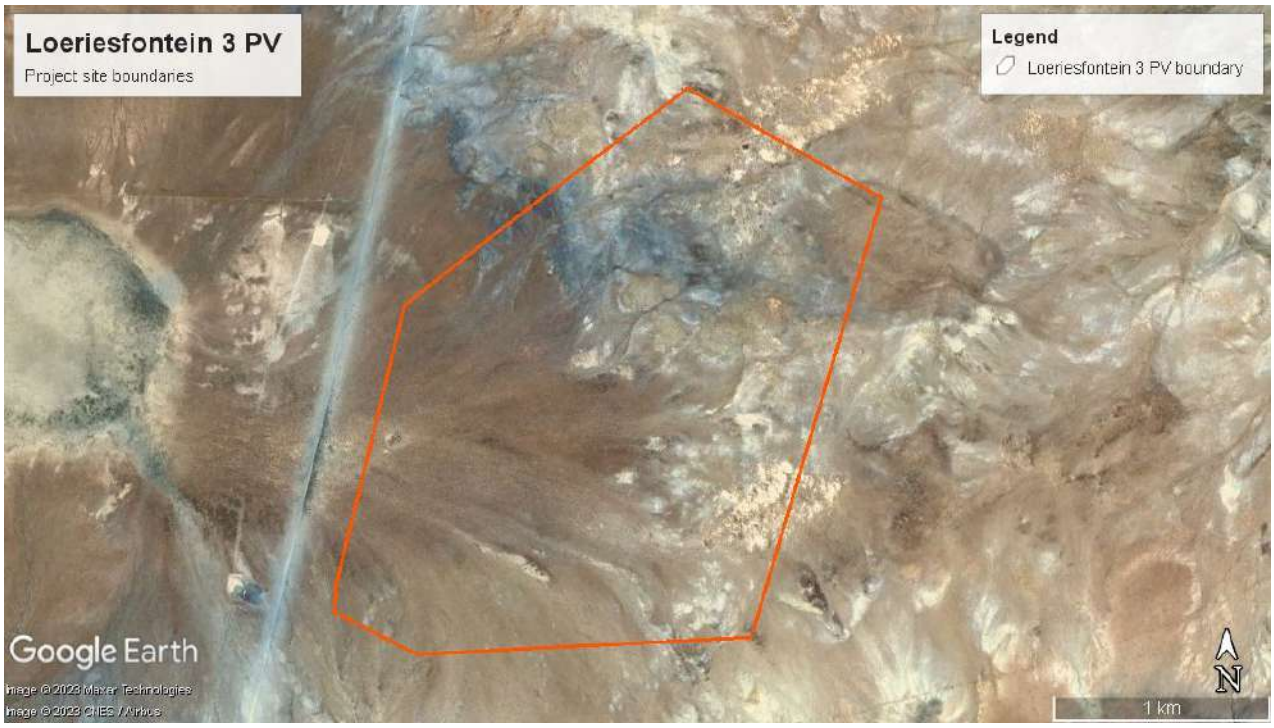

Figure 1: The locality of the proposed development area, showing the location of the site boundary.

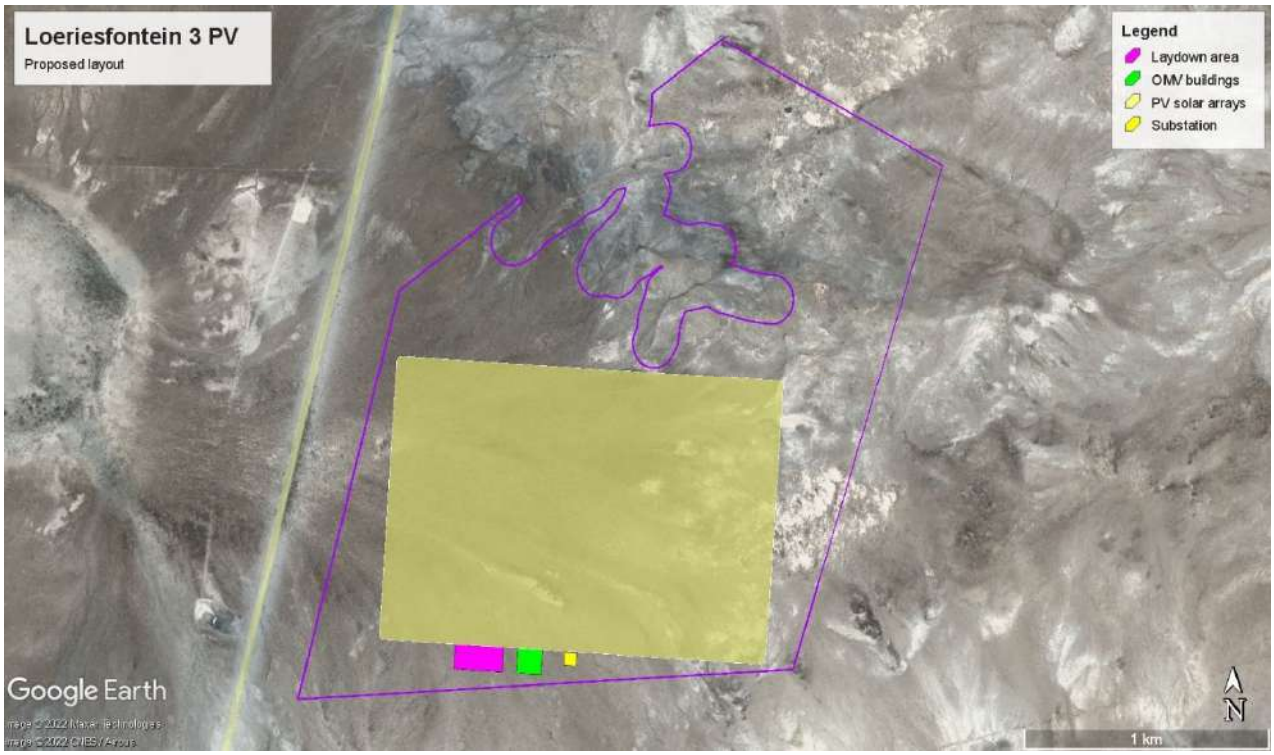

Figure 2: The layout of the proposed Loeriesfontein 3 PV development.

2 TERMS OF REFERENCE

The following terms of reference are applicable to this specialist comment:

- Undertake a site visit to the authorised Loeriesfontein 3 PV project site and compile a specialist comment/statement addressing the following:

    - The implications of the proposed amendment, if any, in terms of the potential impacts within your area of expertise;
    - An investigation to determine if the baseline environment has changed significantly since the original assessment, which was conducted approximately 10 years ago. This will be required for the proposed amendment to extend the validity period of the EA.
    - A statement as to whether or not the proposed amendments will result in an increased level or change in the nature of the impact, which was initially assessed and considered when application was made for the environmental authorisation.
    - If the mitigation measures provided in the initial assessment are still applicable; or if there are any new mitigation measures which need to be included into the EA, should the request to extend the commencement period be granted by the Department.
    - An assessment of the cumulative impact of the proposed amendment.

3 FINDINGS OF PREVIOUS ASSESSMENTS

The key findings relevant to the Loeriesfontein 3 PV site in the Final Environmental Impact Report which was compiled for the Loeriesfontein Wind Farm (SiVEST 2012) are summarised below:

- The proposed PV site is situated in an ecological transitional zone between the Nama Karoo and Succulent Karoo biomes (Harrison et.al. 1997). Both Karoo biomes support a particularly high diversity of species endemic to southern Africa. The ecotonal nature of the study area is apparent from the presence of typical species of both Succulent and Nama Karoo at the wind farm site e.g. Karoo Eremomela *Eremomela gregalis* and Red Lark *Calendulauda burra*.
- An important feature of the arid landscape where the proposed site is located is the presence of pans. Pans are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are of poorly drained, relatively flat and dry regions. Water loss is mainly through evaporation, sometimes resulting in saline conditions, especially in the most arid regions. Water depth is shallow (<3m) and flooding characteristically ephemeral (Harrison *et al.* 1997).
- Although the site itself does not contain any significant pans, there are several large pans situated in a 20km radius around the site. When these pans hold water, waterbird movement between them are likely, including Greater Flamingo *Phoenicopterus roseus* and Lesser Flamingo *Phoenicopterus minor*. Some of that movement might take place over the proposed PV site.
- It is estimated that at least 76 bird species could potentially occur at the site, of which 60 were recorded during pre-construction monitoring in similar habitat at the adjacent Loeriesfontein wind farm in September 2011 – September 2013. The species potentially occurring at the site can be broadly classified in four groupings namely large terrestrial species, soaring species, waterbirds and small birds:

- Large terrestrial species: Medium to large birds that spend most of the time foraging on the ground. They do not fly often and then generally short distances at low to medium altitude, usually powered flight. Some species undertake longer distance flights at higher altitudes, when commuting between foraging and roosting areas. At the wind farm site, cranes, bustards and korhaans are included in this category.
- Soaring species: Species that spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering and gliding at medium to high altitudes. These are mostly raptors.
- Waterbirds: These are species that are generally associated with aquatic habitats, e.g. pans. In the vicinity of solar PV site, these comprise ducks, waders and flamingos.
- Small birds: These are mainly several species of passerines. These species generally spend most of the time on the ground or calling from perches. Sandgrouse undertake long distance flights.

- A number of Red Data species could occur at the site. These are listed in Table 1:

Table 1: Red Data species potentially occurring at the proposed Loeriesfontein 3 PV site (SiVEST 2012)

Species	*Scientific Name*	Conservation Status (Taylor *et al.* 2015)	Recorded on the Site and immediate environment?
Martial Eagle	*Polemaetus bellicosus*	Endangered	Y
Karoo Korhaan	*Eupodotis vigorsii*	Near threatened	Y
Lanner Falcon	*Falco biarmicus*	Vulnerable	Y
Kori Bustard	*Ardeotis kori*	Near threatened	Y
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Y
Sclater's Lark	*Spizocorys sclateri*	Near threatened	Y
Red Lark	*Certhilauda burra*	Vulnerable	Y

- A number of overall impact tables have been prepared in terms of two primary impacts that the solar components could exert on the avifauna on the site. These are presented below.

Loss of Physical Habitat

Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to habitat destruction during construction phase
Extent	The impact will only affect the site.
Probability	Impact will certainly occur (greater than a 75% chance of occurrence)
Reversibility	Irreversible. The footprint of the PV plant is inevitable result of the development.
Irreplaceable loss of resources	Marginal loss of resources. The overall physical footprint is likely to amount to less than 5% of the development area.
Duration	Long term. The habitat transformation will be permanent
Cumulative effect	Low cumulative impact. The overall physical footprint is likely to amount to less than 5% of the development area.

Intensity/magnitude	Low. The overall physical footprint is likely to amount to less than 5% of the development area.
Significance Rating	Low significance. The overall physical footprint is likely to amount to less than 5% of the development area.

IMPACT TABLE 2		
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-16 (low negative)	-16 (low negative)
Mitigation measures	No mitigation is possible to prevent the permanent habitat transformation caused by the construction of the PV plant infrastructure. To prevent unnecessary habitat destruction (i.e. more than is inevitable), the recommendations of the specialist ecological study must be strictly adhered to.	

Disturbance Factor

Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance during construction phase.
IMPACT TABLE	
Extent	The impact will only affect the site.
Probability	Impact will certainly occur (greater than a 75% chance of occurrence) for some species, particularly the larger ones. With appropriate mitigation measures the impacts can be partially avoided.
Reversibility	Completely reversible. The construction activities will inevitably cause temporary displacement of some priority species. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should recolonise the areas which have not been transformed by the footprint.
Irreplaceable loss of resources	Marginal loss of resources. The displacement is likely to be temporary.
Duration	Short term. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should recolonise the areas which have not been transformed by the footprint.

Cumulative effect	Low cumulative impact. The priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (except Red Lark and Sclater's Lark which are more range restricted), the cumulative impact of displacement would therefore be locally significant, rather than regional or national.
Intensity/magnitude	High. Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease.
Significance Rating	Medium significance. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should recolonise the areas which have not been transformed by the footprint.

	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	3	2
IMPACT TABLE 1		
Reversibility	1	1
Irreplaceable loss	3	2
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-30 (Medium negative)	-22 (low negative)
Mitigation measures	Restrict the construction activities to the construction footprint area. Do not allow any access to the remainder of the property during the construction period. A 250m exclusion zone should be implemented around the existing Greater Kestrel breeding pair where no construction activity should take place.	

4 SUBSEQUENT ASSESSMENTS

The site was inspected on 21 November 2022 to assess whether the conditions at the site have changed materially from when the original assessment was done in February 2012. The development area was inspected with a 4 x 4 vehicle and on foot for one day. Photographs of the development area were taken to record the habitat and a bird list was compiled.

5 RECEIVING ENVIRONMENT

5.1 DFFE National Screening Tool

The project development area is classified as **High** sensitivity for avifauna, according to the DFFE online screening tool. The development sites contain confirmed habitat for Red Data species. The classification of

High sensitivity is linked to the potential occurrence of Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered), Red Lark *Calendulauda burra* (Regionally and Globally Vulnerable) and Secretarybird *Saggitarius serpentarius* (Regionally Vulnerable Globally Endangered) (Figure 3).

The occurrence of Species of Conservation Concern (SCC) was confirmed during the original surveys in the adjacent Loeriesfontein Wind Farm, which took place in the period of September 2011 through to September 2013. Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard (Regionally and Globally Endangered), Red Lark, Martial Eagle (Regionally and Globally Endangered) Sclater's Lark (Globally and Regionally Near threatened) were recorded at the site. The subsequent site visit in November 2022 **confirmed that the habitat has not changed and that habitat for the above listed SCC, as well as the other SCC listed in Table 1, exists at the development area**. This classification is assessed to be accurate as far as the potential presence of SCC is concerned, based on actual conditions recorded on the ground during the site visits in September 2011 through to September 2013, and the subsequent site visit conducted in November 2022.

See Appendix 1 for the Site Sensitivity Report

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Neotis ludwigii
High	Aves-Calendulauda burra
Medium	Aves-Sagittarius serpentarius

Figure 3: The classification of the Project Site according to the animal species theme in the DFFE National Screening Tool. The High sensitivity is linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii (*Regionally and Globally Endangered), Red Lark Red Lark *Calendulauda burra* (Regionally and Globally Vulnerable).

5.2 Avifauna

Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (2022), as a means to ascertain which species occur within the broader area i.e., within a block

consisting of 4 pentads where the proposed project development area will be located (Figure 4). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 41 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 56 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed. The broader area was selected on the basis of the number of checklists that had been completed, in order to get a more representative view of the avifauna that could occur at the project site.

According to the SABAP2 project surveys, a total of 95 species occurs in the broader area (Table 1). The species that were recorded on and around the project development area during the pre-construction monitoring at the adjacent Loeriesfontein Wind Farm (September 2011 – September 2013) and the subsequent site visit in November 2022 are listed in Table 2.

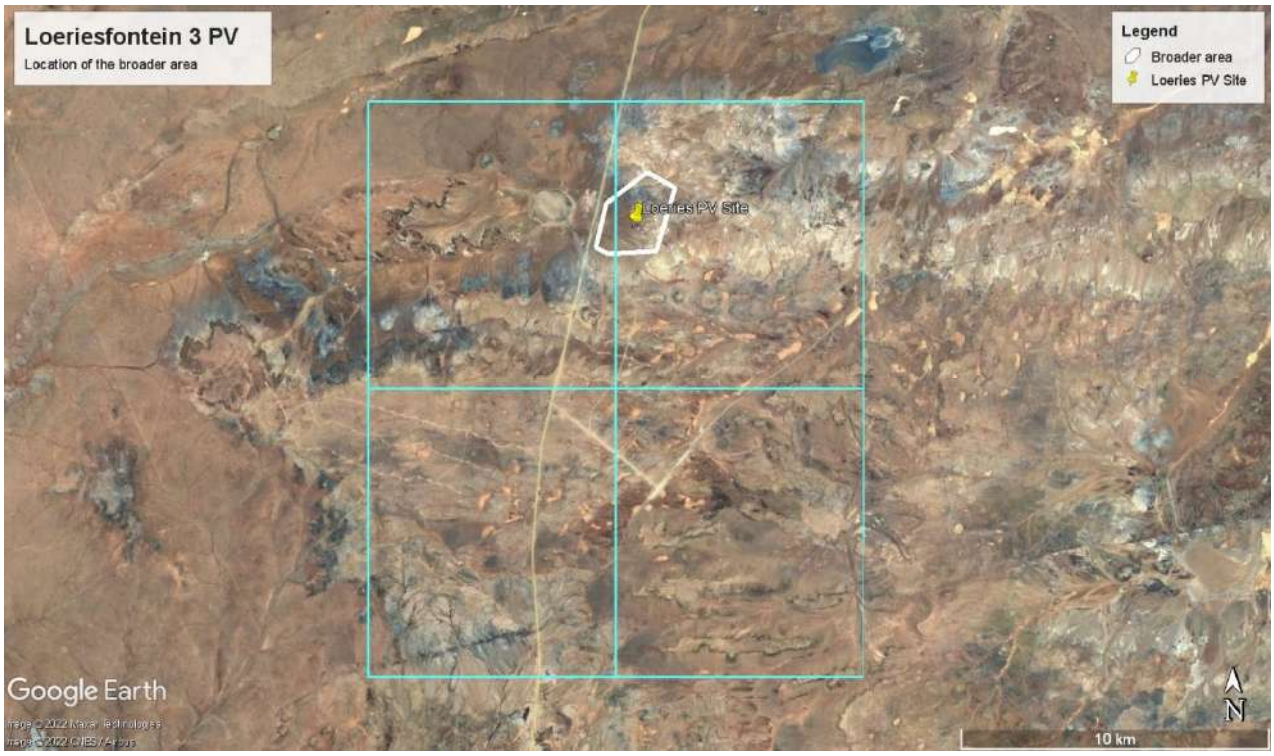

Figure 4: The broader area (4 x pentad grid cells) where the project development area is located.

Table 2: Avifauna recorded by SABAP 2 and during surveys in the broader area in September 2011 – September 2013 and at the Loeriesfontein 3 PV site in November 2022. Species of conservation concern (SCC) are shaded in green.

Species name	*Scientific name*	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring 2011-2013	Recorded during monitoring 2022
Acacia Pied Barbet	*Tricholaema leucomelas*	12.20	0.00	-	-		
African Black Duck	*Anas sparsa*	2.44	0.00	-	-		
African Pipit	*Anthus cinnamomeus*	9.76	3.57	-	-		x
African Red-eyed Bulbul	*Pycnonotus nigricans*	2.44	0.00	-	-		
Ant-eating Chat	*Myrmecocichla formicivora*	29.27	3.57	-	-		
Barn Swallow	*Hirundo rustica*	21.95	5.36	-	-	x	

Black-chested Prinia	*Prinia flavicans*	2.44	0.00	-	-		
Black-chested Snake Eagle	*Circaetus pectoralis*	2.44	3.57	-	-	x	
Black-eared Sparrow-Lark	*Eremopterix australis*	58.54	8.93	-	-	x	
Black-headed Canary	*Serinus alario*	9.76	3.57	-	-		
Blacksmith Lapwing	*Vanellus armatus*	2.44	0.00	-	-		
Black-winged Stilt	*Himantopus himantopus*	2.44	0.00	-	-		
Bokmakierie	*Telophorus zeylonus*	70.73	3.57	-	-	x	x
Booted Eagle	*Hieraaetus pennatus*	4.88	0.00	-	-		
Burchell's Courser	*Cursorius rufus*	7.32	0.00	-	VU		
Cape Bunting	*Emberiza capensis*	43.90	14.29	-	-	x	x
Cape Crow	*Corvus capensis*	24.39	7.14	-	-		
Cape Penduline Tit	*Anthoscopus minutus*	43.90	5.36	-	-	x	x
Cape Sparrow	*Passer melanurus*	97.56	46.43	-	-	x	x
Cape Turtle Dove	*Streptopelia capicola*	51.22	0.00	-	-		
Cape Wagtail	*Motacilla capensis*	29.27	0.00	-	-		
Capped Wheatear	*Oenanthe pileata*	48.78	7.14	-	-	x	
Chat Flycatcher	*Melaenornis infuscatus*	73.17	17.86	-	-	x	
Common Quail	*Coturnix coturnix*	2.44	0.00	-	-		
Common Swift	*Apus apus*	14.63	0.00	-	-		
Crowned Lapwing	*Vanellus coronatus*	4.88	1.79	-	-		
Double-banded Courser	*Rhinoptilus africanus*	24.39	5.36	-	-		
Dusky Sunbird	*Cinnyris fuscus*	12.20	0.00	-	-	x	
European Bee-eater	*Merops apiaster*	12.20	3.57	-	-		x
Familiar Chat	*Oenanthe familiaris*	41.46	8.93	-	-		x
Greater Kestrel	*Falco rupicoloides*	68.29	12.50	-	-	x	x
Greater Striped Swallow	*Cecropis cucullata*	4.88	0.00	-	-		
Grey Tit	*Melaniparus afer*	29.27	5.36	-	-		
Grey-backed Cisticola	*Cisticola subruficapilla*	24.39	5.36	-	-	x	x
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	46.34	17.86	-	-		
House Sparrow	*Passer domesticus*	34.15	3.57	-	-		x
Jackal Buzzard	*Buteo rufofuscus*	7.32	3.57	-	-	x	x
Karoo Chat	*Emarginata schlegelii*	90.24	55.36	-	-	x	x
Karoo Eremomela	*Eremomela gregalis*	63.41	21.43	-	-	x	x
Karoo Korhaan	*Eupodotis vigorsii*	90.24	37.50	-	NT	x	x
Karoo Long-billed Lark	*Certhilauda subcoronata*	92.68	23.21	-	-	x	
Karoo Prinia	*Prinia maculosa*	24.39	7.14	-	-	x	x
Karoo Scrub Robin	*Cercotrichas coryphoeus*	78.05	5.36	-	-	x	x
Lanner Falcon	*Falco biarmicus*	7.32	0.00	-	VU	x	
Lappet-faced Vulture	*Torgos tracheliotos*	2.44	0.00	EN	EN		
Large-billed Lark	*Galerida magnirostris*	87.80	35.71	-	-	x	
Lark-like Bunting	*Emberiza impetuani*	78.05	21.43	-	-	x	
Laughing Dove	*Spilopelia senegalensis*	39.02	1.79	-	-		x
Layard's Warbler	*Curruca layardi*	4.88	0.00	-	-	x	
Lesser Flamingo	*Phoeniconaias minor*	2.44	0.00	NT	NT		
Little Swift	*Apus affinis*	9.76	0.00	-	-	x	
Ludwig's Bustard	*Neotis ludwigii*	58.54	8.93	EN	EN	x	
Malachite Sunbird	*Nectarinia famosa*	0.00	1.79	-	-		
Martial Eagle	*Polemaetus bellicosus*	14.63	3.57	EN	EN	x	x
Namaqua Dove	*Oena capensis*	36.59	3.57	-	-		x
Namaqua Sandgrouse	*Pterocles namaqua*	87.80	26.79	-	-	x	
Nicholson's Pipit	*Anthus nicholsoni*	4.88	0.00	-	-		
Northern Black Korhaan	*Afrotis afraoides*	2.44	0.00	-	-	x	
Pale Chanting Goshawk	*Melierax canorus*	78.05	17.86	-	-	x	x
Pied Crow	*Corvus albus*	90.24	32.14	-	-	x	x

Pied Starling	*Lamprotornis bicolor*	0.00	1.79	-	-		x
Red Lark	*Calendulauda burra*	92.68	25.00	VU	VU	x	x
Red-capped Lark	*Calandrella cinerea*	82.93	17.86	-	-	x	
Red-headed Finch	*Amadina erythrocephala*	2.44	0.00	-	-		
Rock Kestrel	*Falco rupicolus*	17.07	17.86	-	-	x	x
Rock Martin	*Ptyonoprogne fuligula*	53.66	7.14	-	-		
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	4.88	0.00	-	-		
Rufous-eared Warbler	*Malcorus pectoralis*	90.24	33.93	-	-	x	
Sclater's Lark	*Spizocorys sclateri*	41.46	0.00	NT	NT	x	
Sickle-winged Chat	*Emarginata sinuata*	4.88	17.86	-	-	x	
South African Shelduck	*Tadorna cana*	7.32	0.00	-	-		
Southern Double-collared Sunbird	*Cinnyris chalybeus*	2.44	0.00	-	-		
Southern Fiscal	*Lanius collaris*	68.29	3.57	-	-		x
Southern Masked Weaver	*Ploceus velatus*	46.34	0.00	-	-		
Speckled Pigeon	*Columba guinea*	70.73	8.93	-	-		
Spike-heeled Lark	*Chersomanes albofasciata*	92.68	35.71	-	-	x	
Spotted Eagle-Owl	*Bubo africanus*	26.83	0.00	-	-	x	
Spotted Flycatcher	*Muscicapa striata*	2.44	0.00	-	-		
Spotted Thick-knee	*Burhinus capensis*	19.51	3.57	-	-		
Spur-winged Goose	*Plectropterus gambensis*	2.44	0.00	-	-		
Stark's Lark	*Spizocorys starki*	7.32	5.36	-	-		
Three-banded Plover	*Charadrius tricollaris*	9.76	0.00	-	-		
Tractrac Chat	*Emarginata tractrac*	97.56	44.64	-	-	x	
Western Barn Owl	*Tyto alba*	0.00	1.79	-	-		x
White-backed Mousebird	*Colius colius*	2.44	0.00	-	-		
White-rumped Swift	*Apus caffer*	4.88	0.00	-	-		
White-throated Canary	*Crithagra albogularis*	58.54	10.71	-	-		x
Yellow Canary	*Crithagra flaviventris*	100.00	50.00	-	-	x	x
Yellow-bellied Eremomela	*Eremomela icteropygialis*	41.46	1.79	-	-	x	
Yellow-billed Kite	*Milvus aegyptius*	2.44	0.00	-	-		
Kori Bustard	*Ardeotis kori*	0.00	0.00			x	
Fairy Flycatcher	*Stenostira scita*	0.00	0.00			x	
African Hoopoe	*Upupa africana*	0.00	0.00				x
Yellow-fronted Canary	*Crithagra mozambica*	0.00	0.00				x

6 CUMULATIVE IMPACTS

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change in an area, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy projects within a 30 km radius that have received an EA or are in process at the time of starting the environmental impact process, as well as the proposed Loeriesfontein PV project (the subject of this report). There are currently twelve (12) renewable energy projects authorised, operational or in process within a 30 km radius around the proposed Loeriesfontein 3 PV SEF (Figure 5). The projects were identified using the latest (Q3 2022) Renewable Energy EIA Application Database for SA from the Department of Fisheries, Forestry and Environment (DFFE) and publically available documents on the internet.

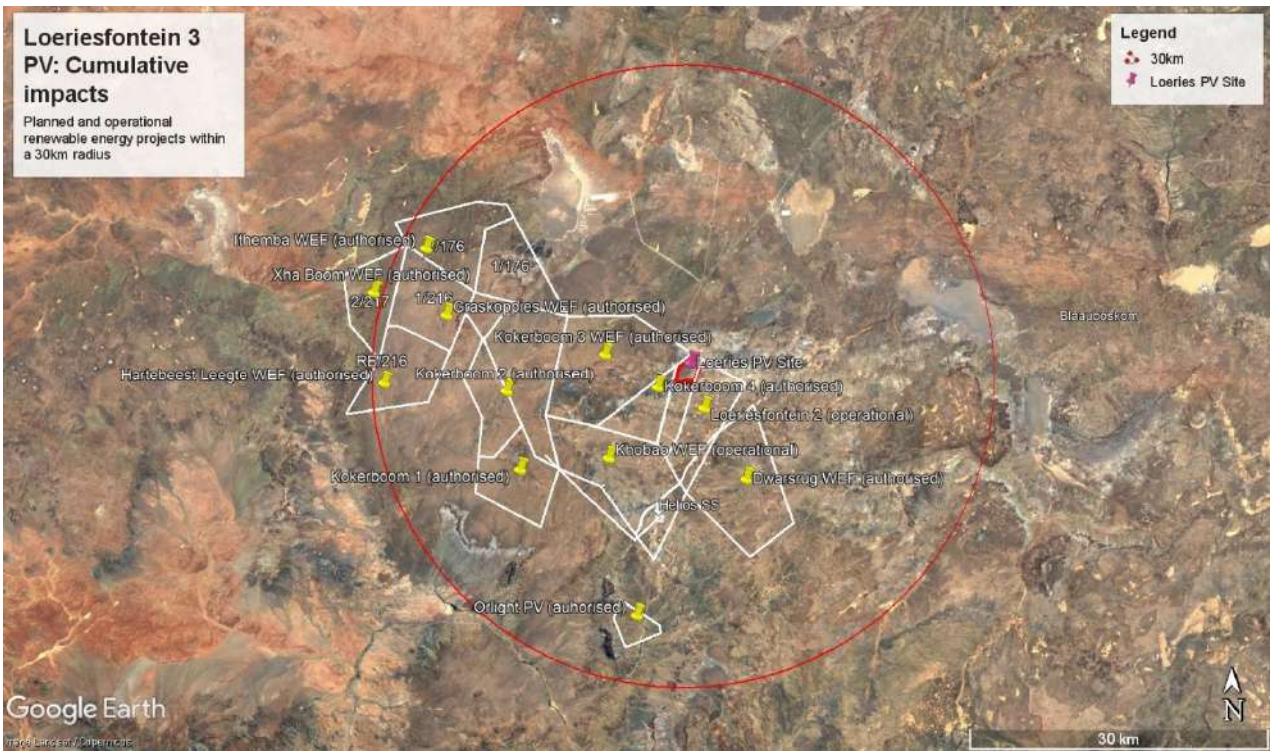

Figure 5: The planned renewable energy project land parcels within a 30km radius around the proposed Loeriesfontein 3 PV project.

The total affected land parcel area taken up by authorised and operational renewable energy projects within the 30 km radius, including the Loeriesfontein 3 PV SEF Project, is approximately 788 km². The total affected land parcel area affected by the Loeriesfontein 3 PV SEF Project equates to approximately 4.8km², and the solar array footprint only 1.76m². The proposed Loeriesfontein 3 PV SEF Project land parcel area thus constitute approximately 0.6% of the total areas taken up by the authorised and planned renewable energy projects, and the actual footprint approximately 0.2%. The cumulative impact of the proposed Loeriesfontein 3 PV SEF Project is thus anticipated to be **low**.

The total area within the 30km radius around the proposed Loeriesfontein 3 PV SEF Project equates to about 2 827km² of similar habitat. The total combined size of the land parcels potentially affected by renewable energy projects will equate to approximately 34% of the available habitat in the 30km radius. Assuming that all the projects are actually constructed, the cumulative impact of all the proposed renewable energy projects is estimated to be **high**. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves. Furthermore, several of these projects must still be subject to a competitive bidding process, where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction. If all mitigation measures listed in the specialist reports are strictly implemented, the cumulative impact could be reduced to **medium**.

Table 3 below summarise the post-mitigation cumulative impacts associated with the proposed development. For the assessment criteria, please see Appendix 4.

Table 3: Cumulative impacts associated with the renewable energy projects within a 30km radius

Nature: *Cumulative impacts associated with renewable energy facilities* • *Displacement due to disturbance associated with the construction of the renewable energy facility and associated infrastructure* • *Displacement due to habitat transformation associated with the construction and operation of the renewable energy facility and associated infrastructure* • *Collisions with the solar panels* • *Collison with wind turbines* • *Entrapment in perimeter fences* • *Displacement due to disturbance associated with the decommissioning of the renewable energy facilities and associated infrastructure* • *Mortality of priority species due to electrocution on the medium voltage internal reticulation networks* • *Mortality of priority species due to collisions with the medium voltage internal reticulation networks*		
	Cumulative impact of the proposed Pixley Park Renewable Energy Project within a 30km radius (post mitigation).	**Cumulative impact of other renewable energy projects within a 30km radius (post mitigation)**
Extent	3 regional	3 regional
Duration	4 long term	4 long term
Magnitude	2 minor	6 moderate
Probability	3 probable	3 probable
Significance	**27 LOW**	**39 MEDIUM**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	No	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • All mitigation measures listed in this report for the Loeriesfontein 3 PV Renewable Energy Project and all mitigation measures relevant to avifauna listed in the various specialist reports for the other planned projects within a 30km radius of the Pixley Park Renewable Energy Project should be followed.		

7 ASSESSMENT OF IMPACTS

Due to the long period that had transpired since the original impact assessment was completed (9 years), and due to experience gained in assessing the potential impacts of solar PV facilities on avifauna since the original impact study, it was decided that the impacts and proposed mitigation measures need to be re-assessed before a recommendation can be made with regard to the proposed extension of the EA. The following potential impacts were identified:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure;
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure;
- Collisions with the solar panels;

- Entrapment in perimeter fences;
- Electrocution of priority species on the internal medium voltage reticulation network; and
- Mortality of avifauna due to collision with the internal medium voltage lines.

7.1 Displacement due to disturbance associated with the construction of the solar PV facility

As far as disturbance is concerned, it is likely that all the avifauna will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g., increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance.

At the PV facility, the species which would be most severely affected by disturbance would be ground dwelling species, those that utilise low shrubs for nesting, and raptors which predate these bird species, and on other ground/shrub-dwelling fauna.

See Table 4 for an assessment of the impact. The assessment criteria are explained in Appendix 2

Table 4: Displacement due to disturbance associated with the construction and decommissioning of the solar PV facility

Nature: Displacement of avifauna due to disturbance associated with construction and decommissioning of the Loeriesfontein 3 PV facility and associated infrastructure.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	1 very short	1 very short
Magnitude	8 high	6 moderate
Probability	5 definite	5 definite
Significance	**55 MEDIUM**	**45 MEDIUM**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, but to a limited extent	
Mitigation: • Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of solar priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.		
Residual Risks: The residual risk of displacement will be reduced but remain at a medium level after mitigation, if the proposed mitigation is implemented.		

7.2 Displacement due to habitat transformation associated with the construction of the solar PV facility

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2019) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. Her most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser *et al.* 2018).

As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that a pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. Ground nesting species, shrubland specialists and some raptors are likely to be impacted most by the habitat transformation, raptors particularly as a result of reduced prey availability and accessibility. Regularly occurring species which fall in this category are Red Lark, Ludwig's Bustard, Northern Black Korhaan, Karoo Korhaan and Spotted Eagle-Owl and some which may occur but less regularly such as Sclater's Lark and Kori Bustard. Some species might be able to recolonise the area after the completion of the construction phase, but for some species this might only be partially the case, resulting in lower densities than before once the SEF is operational, due to the disturbance factor of the operational facility.

Micro-habitat modelling has shown that the adjacent Kokerboom Wind Farm site with similar habitat contains areas of good to very good habitat for the endemic and range restricted Red Lark, with an expected density of 0.015 birds per/hectare averaged over all habitat types (Spatiallytics 2020). These areas are mostly sandy areas with grasses and shrubs which is similar to where the proposed Loeriesfontein 3 PV solar arrays footprint (182 ha) are planned. This translates into a population of approximately 2.7 birds for the 182 hectares which comprise the total surface area covered by the PV footprint. The current global population of Red Larks is estimated to exceed 10 000 mature individuals (Taylor et al. 2015), therefore the displacement of 2 - 3 birds should not be biologically significant as far as the national population is concerned i.e. having a statistically significant effect that has a noteworthy impact on survival.

See Table 5 for an assessment of the impact. The assessment criteria are explained in Appendix 2

Table 5: Displacement due to habitat transformation associated with the construction of the solar PV facility

Nature: During construction: Displacement of avifauna due to habitat transformation associated with construction of the Loeriesfontein PV facility and associated infrastructure.		
	Without mitigation	**With mitigation**
Extent	1 site only	1 site only
Duration	4 long term	4 long term
Magnitude	8 high	6 moderate
Probability	5 definite	4 improbable
Significance	**65 HIGH**	**44 MEDIUM**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To a limited extent	
Mitigation: • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • The mitigation measures proposed by the biodiversity and vegetation specialists must be strictly implemented.		
Residual Risks: The residual risk of displacement will be reduced after mitigation but will remain for some species due to the change in habitat.		

7.3 Mortality of avifauna due to collisions with the solar panels

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. Kosciuch *et al*. (2020) synthesized results from fatality monitoring studies at 10 photovoltaic solar facilities across 13 site years in California and Nevada in the USA. Annual fatality rates never exceeded 2.99 fatalities/MW/year (1.03 fatalities/hectare/year), and 3 of the four top species detected were ground-dwelling species.

Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them.

*Based on the lack of evidence to the contrary, it is **not foreseen that collisions with the solar panels at the PV facility will be a significant impact**. The solar priority species which would most likely be potentially affected by this impact include small terrestrial birds which forage between the solar panels, and raptors which predate these small birds or forage for insects and other animals between the PV panels, e.g., Greater Kestrels (i.e., if they are not completely displaced due to the habitat transformation).*

See Table 6 for an assessment of the impact. The assessment criteria are explained in Appendix 2

Table 6: Mortality due to collisions with the solar panels

Nature: Mortality of avifauna due to collisions with solar panels at the Loeriesfontein 3 PV facility.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	4 low	4 low
Probability	2 probable	2 probable
Significance	**20 LOW**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No mitigation required	
Mitigation: • Due to the expected low significance of this impact, no mitigation measures are recommended.		
Residual Risks: Not applicable		

7.4 Entrapment in perimeter fences

Visser *et al*. (2019) recorded a fence-line fatality of an Orange River Francolin *Scleroptila gutturalis* resulting being trapped between the inner and outer perimeter fence of the facility; additionally, three Red-crested Korhaans were claimed to be unable to escape between these two fences without intervention from facility personnel. Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence. Potentially, too-close a parallel configuration of double-fenced perimeters can cause fatalities, particularly of larger terrestrial birds, by way of entrapment, and especially if disturbed by people. This risk remains low, however, with Visser *et al.* (2019) tentatively presenting a fatality rate of 0.002 birds per km per month from this risk factor, although qualifying that the single documented fatality was inadequate for robust extrapolations. Owls are also prone to getting entangled in barbed wire fences (personal observation).

*It is **not foreseen that entrapment of solar priority species in perimeter fences will be a significant impact at the PV facility**. The solar priority species which could potentially be affected by this impact are most likely medium to large terrestrial species, and large owls.*

See Table 7 for an assessment of the impact. The assessment criteria are explained in Appendix 2

Table 7: Mortality due to entrapment in the perimeter fences

Nature: Entrapment of large-bodied birds in the double perimeter fence lines of the Loeriesfontein 3 PV facility.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	6 moderate	4 low
Probability	3 possible	2 improbable
Significance	**36 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • It is recommended that a single perimeter fence is used • Increasing the spacing between at least the top two wires (to a minimum of 30cm) and ensuring they are correctly tensioned will reduce the snaring risk for owls		
Residual Risks: The residual risk of electrocution will be low once mitigation is implemented.		

7.5 Electrocution of avifauna on the internal medium voltage reticulation network

Medium voltage electricity poles (33kV) could potentially pose an electrocution risk to raptors. 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 (van Rooyen 2000). The electrocution risk is largely determined by the design of the electrical hardware.

While the intention is to place the majority of the medium voltage reticulation network underground at the PV facility, there is the possibility that some of the lines could run above ground. Electrocutions at the on-site substations are also a probability.

See Table 8 for an assessment of the impact. The assessment criteria are explained in Appendix 2

Table 8: Mortality due to electrocution on medium voltage reticulation poles

Nature: Mortality due to electrocution on medium voltage internal reticulation poles		
	Without mitigation	**With mitigation**
Extent	2 local	2 local

Duration	4 long term	4 long term
Magnitude	8 high	4 low
Probability	3 possible	1 very improbable
Significance	**42 MEDIUM**	**10 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • Use underground cables as much as possible. • A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.		
Residual Risks: The residual risk of electrocution will be low once mitigation is implemented.		

7.6 Mortality of avifauna due to collisions with the internal medium voltage reticulation network

Power line collisions are generally accepted as a key threat to bustards in South Africa (Shaw 2013). In one study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

While the intention is to place the majority of the medium voltage reticulation network underground at the PV facility, there are areas where the lines might run above ground. These spans will pose a collision risk to avifauna.

See Table 9 for an assessment of the impact. The assessment criteria are explained in Appendix 2.

Table 9: Mortality due to collisions with the medium voltage internal reticulation networks

Nature: Mortality of priority species due to collisions with the medium voltage internal reticulation networks

	Without mitigation	With mitigation
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	6 medium	4 low
Probability	3 possible	2 improbable
Significance	**36 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: • Use underground cables as much as possible. • All internal medium voltage lines must be marked with Eskom approved Bird Flight Diverters according to the latest official Eskom Engineering Instruction.		
Residual Risks: The residual risk of collision will still be present for Ludwig's Bustard, but significantly reduced for other species.		

The impacts are summarized, and a comparison made between pre-and post-mitigation phases as shown in Table 10 below. The rating of environmental issues associated with different parameters prior to, and post mitigation of a proposed activity was averaged.

Table 10: Comparison of summarised impacts on environmental parameters

Environmental Parameter	Nature of the Impact	Rating prior to mitigation	Rating post mitigation
Avifauna	Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure.	55 MEDIUM	45 MEDIUM
	Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure.	65 HIGH	44 MEDIUM
	Mortality of priority species due to collisions with solar panels.	20 LOW	20 LOW
	Entrapment of large-bodied birds in the double perimeter fence.	36 MEDIUM	20 LOW
	Mortality of priority species due to electrocution on the medium voltage internal reticulation network	42 MEDIUM	10 LOW
	Mortality of priority species due to collisions with the medium voltage internal reticulation network	36 MEDIUM	20 LOW
	Displacement of priority species due to disturbance associated with decommissioning of the PV plant and associated infrastructure.	55 MEDIUM	45 MEDIUM

Environmental Parameter	Nature of the Impact	Rating prior to mitigation	Rating post mitigation
	AVERAGE SIGNIFICANCE RATING	44 MEDIUM	29 LOW

8 CONCLUSIONS

- A number of additional impacts on avifauna were recorded during the site inspection in November 2022 that had not been identified previously in the Final Impact Assessment Report (SiVEST 2012).
- No nests of Red Data priority species were recorded at the project site during the site inspection in November 2022.
- The site inspection in November 2022 **confirmed that the receiving environment had not changed in any material way**.
- A number **additional mitigation measures were identified as a result of the site inspection in November 2022 (see Section 7 and Appendix 3)**.
- Although several additional impacts were identified during the follow up inspection in November 2022, the post-mitigation aggregate ratings of all the impacts did not differ from the original ratings i.e. **low post mitigation.**

9 RECOMMENDATION

It is recommended that the validity of the EA be extended by an additional 5 years, provided the recommendations in this report (Section 7 and Appendix 3) are strictly implemented.

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APPENDIX 1: SITE SENSITIVITY VERIFICATION REPORT

SITE SENSITIVITY VERIFICATION REPORT (SSVR)

1 Introduction

A site verification visit has been undertaken on 19 November 2022 in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

2 Site Sensitivity Verification

The following methods and sources were used to compile this report:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (2022), as a means to ascertain which species occur within the broader area i.e., within a block consisting of 4 pentads where the proposed project development area will be located (Figure 4). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 41 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 56 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed. The broader area was selected on the basis of the number of checklists that had been completed, in order to get a more representative view of the avifauna that could occur at the project site.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015).
- The global threatened status of all priority species was determined by consulting the (2022) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the project site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- Satellite imagery (Google Earth ©2022) was used in order to view the broader area on a landscape level and to help identify sensitive bird habitat.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the project site.
- A one-day site survey was conducted on 19 November 2022 to assess the habitat and record the avifauna at the development area. See Appendix 1 for the avifauna recorded during the site survey.

3 Outcome of Site Sensitivity Verification

The proposed site is situated approximately 62km north of the town of Loeriesfontein, in the Northern Cape Province. The habitat in the broader development area is highly homogenous and consists of extensive sandy and gravel plains with low shrub. The vegetation on the site itself consists mostly of shrubs scattered between bare patches of sand and gravel. The dominant vegetation is a mixture of Bushmanland Arid Grassland and Bushmanland Basin Shrubland. These vegetation types consist of dwarf shrubland dominated by a mixture of low, sturdy and spiny (and sometimes also succulent) shrubs (*Rhigozum sp., Salsola sp., Pentzia sp.,* and *Eriocephalus sp.*), 'white' grasses (*Stipagrostis sp.*) and in years of high rainfall also abundant annual flowering

plants such as species of *Gazania sp.* and *Leysera sp*. (Mucina & Rutherford 2006). The closest Important Bird Area (IBA), the Bitterputs Conservation Area IBA SA036, is located approximately 75km to the north (Birdlife 2014) and falls outside the zone of influence of this development.

SABAP1 recognises six primary vegetation divisions within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. Using this classification system, the natural vegetation in the study area is classified as Nama Karoo.

Nama Karoo as dominated by low shrubs and grasses; peak rainfall occurs in summer from December to May. Trees, e.g. *Vachellia karroo* are mainly restricted to ephemeral watercourses, but in the proposed development area, due to the extreme aridity the ephemeral watercourses are devoid of trees. The warmest month (with the highest average high temperature) is January (29.7°C). The months with the lowest average high temperature are June and July (15.1°C). The month with the highest average low temperature is February (17.7°C). The coldest month (with the lowest average low temperature) is July (5.7°C) (www.weatheratlas.com).

The project site lies in an ecotonal area between the Nama Karoo and the Succulent Karoo. In comparison with the Succulent Karoo, the Nama Karoo has higher proportions of grass and tree cover. The two Karoo vegetation types support a particularly high diversity of bird species endemic to Southern Africa, particularly in the family *Alaudidae* (Larks). Its avifauna typically comprises ground-dwelling species of open habitats. Because rainfall in the Nama Karoo falls mainly in summer, while peak rainfall in the Succulent Karoo occurs mainly in winter, it provides opportunities for birds to migrate between the Succulent and Nama Karoo, to exploit the enhanced conditions associated with rainfall. Many typical karroid species are nomads, able to use resources that are patchy in time and space (Barnes 1998).

Figure 1 below is a sample of the typical habitat at the Loeriesfontein 3 PV development area

Figure 1: Typical Bushmanland habitat at the project site in the solar array footprint.

4 National Environmental Screening Tool

The project development area is classified as **High** sensitivity for avifauna, according to the DFFE online screening tool. The development sites contain confirmed habitat for Red Data species. The classification of High sensitivity is linked to the potential occurrence of Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered), Red Lark *Calendulauda burra* (Regionally and Globally Vulnerable) and Secretarybird (Rgionally Vulnerable Globally Endangered) *Saggitarius serpentarius* (Figure 3).

The occurrence of SCC was confirmed during the original surveys in the adjacent Loeriesfontein Wind Farm, in September 2012 to September 2013. Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard (Regionally and Globally Endangered), Red Lark, Martial Eagle (Regionally and Globally Endangered) Sclater's Lark (Globally and Regionally Near threatened) were recorded at the site. The subsequent site visit in November 2022 confirmed that the habitat has not changed and that habitat for the above listed SCC, as well as the other SCC listed in Table 1, exists at the development area. This classification is assessed to be accurate as far as the potential presence of SCC is concerned, based on actual conditions recorded on the ground during the site visits in September 2012 to September 2013, and the subsequent site visit conducted in November 2022.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Neotis ludwigii
High	Aves-Calendulauda burra
Medium	Aves-Sagittarius serpentarius

Figure 3: The classification of the Project Site according to the animal species theme in the DFFE National Screening Tool. The High sensitivity is linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered), Red Lark Red Lark *Calendulauda burra* (Regionally and Globally Vulnerable).

5 Conclusion

The proposed classification of **High Sensitivity** in the screening tool was confirmed during the site sensitivity verification survey which was conducted on 11 November 2022.

6 References

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APPENDIX 2: AVIFAUNA RECORDED DURING THE SITE SENSITIVITY SURVEY

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring 2022
Greater Kestrel	Falco rupicoloides	68.29	12.50	-	-	x
Jackal Buzzard	Buteo rufofuscus	7.32	3.57	-	-	x
Karoo Eremomela	Eremomela gregalis	63.41	21.43	-	-	x
Karoo Korhaan	Eupodotis vigorsii	90.24	37.50	-	NT	x
Karoo Prinia	Prinia maculosa	24.39	7.14	-	-	x
Martial Eagle	Polemaetus bellicosus	14.63	3.57	EN	EN	x
Pale Chanting Goshawk	Melierax canorus	78.05	17.86	-	-	x
Pied Starling	Lamprotornis bicolor	0.00	1.79	-	-	x
Red Lark	Calendulauda burra	92.68	25.00	VU	VU	x
Rock Kestrel	Falco rupicolus	17.07	17.86	-	-	x
Western Barn Owl	Tyto alba	0.00	1.79	-	-	x

APPENDIX 3: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[1].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Mortality due to electrocutions on the internal 33kV network					
Electrocution of priority species on the 33kV network	Prevention of electrocution mortality	1. Design the facility with underground cables as much as possible. 2. A raptor -friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.	Design the facility with underground cabling and where impractical, use a bird friendly pole design approved by the avifaunal specialist.	Once-off during the planning phase.	Project Developer

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice;	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly.	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

[1] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100 mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
Mortality of priority species due to collisions with the medium voltage internal reticulation network	Prevention of powerline collision mortality	Eskom approved bird flight diverters should be installed on the full span length of all 33kV overhead lines according to the applicable Eskom Engineering Instruction. These devices must be installed as soon as the conductors are strung.	Bird Flight Diverters must be installed as soon as the conductors are strung	1. Once-off	1. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP). 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 3. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Project Developer 2. Facility Environmental Manager 3. Project Developer and Facility Operational Manager

APPENDIX 4: ASSESSMENT CRITERIA

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

Determination of Significance of Impacts

Direct, indirect and cumulative impacts of the issues identified through the EIA process were assessed in terms of the following criteria:

- The nature, which includes a description of what causes the effect, what will be affected and how it will be affected.

- The extent, wherein it is indicated whether the impact will be
    - 1 = site only
    - 2 = local
    - 3 = regional
    - 4 = national
    - 5 = international

- The duration, wherein is indicated whether:
    - 1 = the lifetime of the impact will be of a very short duration (0–1 years)
    - 2 = the lifetime of the impact will be of a short duration (2-5 years)
    - 3 = medium-term (5–15 years)
    - 4 = long term (> 15 years)
    - 5 = permanent

- The consequences (magnitude), quantified on a scale from 0-10, where:
    - 0 = small and will have no effect on the environment
    - 2 = minor and will not result in an impact on processes
    - 4 = low and will cause a slight impact on processes
    - 6 = moderate and will result in processes continuing but in a modified way
    - 8 = high (processes are altered to the extent that they temporarily cease)
    - 10 = very high and results in complete destruction of patterns and permanent cessation of processes.

- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale of 1–5, where:
    - 1 = very improbable (probably will not happen)
    - 2 = improbable (some possibility, but low likelihood)
    - 3 = probable (distinct possibility)

    - 4 = highly probable (most likely)
    - 5 is definite (impact will occur regardless of any prevention measures)

- The significance, which is determined through a synthesis of the characteristics described above and is assessed as low, medium or high
- The status, which is 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).