ARCUS

An ERM Group Company

AVIFAUNAL DRAFT SCOPING REPORT FOR THE PROPOSED UMMBILA EMOYENI RENEWABLE ENERGY DEVELOPMENT NEAR BETHAL, MPUMALANGA

For

Windlab Developments SA (Pty) Ltd

April 2022

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

240 Main Road
1st Floor Great Westerford
Rondebosch
7700

T +27 (0) 21 412 1529 l **E** Ashlin.Bodasing@arcusconsulting.co.za
W www.arcusconsulting.co.za

Registered in South Africa No. 2015/416206/07

TABLE OF CONTENTS

1 INTRODUCTION

Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus) was appointed by Windlab Developments SA (Pty) Ltd ('Windlab') to conduct an avifaunal specialist study for the proposed Ummbila Emoyeni ('UmmE') Wind Energy Facility ('WEF') located approximately 10 km south-east of the town of Bethal in the Mpumalanga Province of South Africa (Figure 1).

The project will include a 150 MW Solar Photovoltaic ('PV') Facility and associated grid infrastructure that is required to connect the facilities to the national grid. The grid connection solution entails establishing a 400/132 kV Main Transmission Substation ('MTS'), between Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400 kV line. The location of the MTS will be refined through an ongoing process of communication with Eskom Planning but will be within close proximity to the 400kV line in order to cut into this line.

The WEF Wind Turbine Generators ('WTGs'), Solar PV and grid connection infrastructure and the MTS will fall within the proposed project area assessed in this report, however the exact location of these facilities is unknown at this stage. The high level assessment (as per EAP requirements) contained for these facilities is considered the same as for the WEF as the proposed impacts for the WEF can be seen as higher than for the solar facility with respect to the avifauna of the receiving environment. A high level assessment for the proposed 400 kV grid connection is also provided.

1.1 Terms of Reference

This report was developed to align with Government Gazette 43110 (GN. 320) "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifaunal Species by Onshore Wind Energy Generation Facilities where the Electricity Output is 20 Megawatts or more" dated 20 March 2020 ('The Protocol'), the Species Environmental Assessment Guideline[1] and the Birds and Wind-Energy Best-Practice Guidelines[2] and the requirements prescribed therein. The Protocol generally exceeds the assessment and reporting requirements for Solar PV Facilities and grid connection infrastructure with respect to avifauna. This report also takes into consideration the National Environment Management Act, 1998 (Act 107 0f 1998).

The aims of the study were to:

- Determine the proposed Project Area of Influence ('PAOI') in relation to avifauna;
- Determine the avifaunal habitats present across the PAOI;
- Determine the potential avifaunal species that could occur across the PAOI;
- Determine the potential avifaunal Species of Conservation Concern ('SCCs') relevant to the proposed development activities;
- Determine the Site Ecological Importance ('SEI') of the PAOI in relation to the development activity proposed and relevant avifaunal SCCs;
- Produce an avifaunal sensitivity map to inform potential layout designs;
- Identify the potential impacts of the proposed development to the avifaunal community;

[1] South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 2.1 2021.

[2] Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. and Ralston, S. 2015. Birds and Wind-Energy Best-Practice Guidelines: Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa. Third Edition. BirdLife South Africa / Endangered Wildlife Trust.

- Identify relevant mitigation measures (if any) to reduce the potential impact to the avifaunal community.

2 METHODS

The Protocol indicates that a site-specific Avifaunal Specialist Assessment is to be undertaken for all sensitivity ratings provided by the National Web-based Screening Tool as the present level of knowledge on bird behaviour and species population precludes confident predictions on the sustainability of priority or threatened species nationally.

The process for undertaking the Avifaunal Impact Assessment will therefore comprise:

- A Reconnaissance Study including:
  - Desktop Study; and
  - Initial Site Visit.
- The preparation of a Pre-Application Avifaunal Monitoring Plan ('PAAMP');
- Seasonal Pre-Construction Avifaunal Monitoring Data collection; and
- The Avifaunal Impact Assessment Reporting.

2.1 Reconnaissance Study

2.1.1 Desktop Study

The desktop study included data obtained from the following sources:

- Broad vegetation types present on the project site were obtained from the updated National Vegetation Map 2018 (NVM 2018) database[3] and the vegetation descriptions were obtained from Mucina & Rutherford (2006)[4];
- Bird distribution data of the Southern African Bird Atlas Project 2 (SABAP2) obtained from the Avian Demography Unit of the University of Cape Town[5];
- Co-ordinated Avifaunal Road Count (CAR) project[6];
- Co-ordinated Water-bird Count (CWAC) project[7];
- The Important Bird Areas of southern Africa (IBA) project[8];
- Output from the National Web-based Screening Tool[9] ('Screening Tool');
- Habitat suitability maps compiled by BirdLife South Africa;
- Desk-top pre-screening study of possible impacts on birds of the proposed Ummbila Emoyeni Wind Farm in the Ermelo area of Mpumalanga, South Africa. Avisense Consulting, June 2020[10].
- Publically available satellite imagery; and
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland[11].

[3] South African National Biodiversity Institute (2006-2018). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online, http://bgis.sanbi.org/Projects/Detail/186, Version 2018 accessed January 20 2020.

[4] Mucina, L. and Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland, in Strelitzia 19. South African National Biodiversity Institute, Pretoria.

[5] http://sabap2.birdmap.africa/ Accessed 17 June 2021.

[6] Young, D.J., Harrison, J.A, Navarro, R.A., Anderson, M.A., & Colahan, B.D. (Eds). 2003. Big birds on farms: Mazda CAR Report 1993-2001. Avian Demography Unit: Cape Town.

[7] Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. Coordinated waterbird Counts in South Africa, 1992-1997. Avian Demography Unit, Cape Town.

[8] Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

[9] https://screening.environment.gov.za/

[10] Unpublished report prepared for Windlab Developments South Africa (Pty) Ltd.

[11] Taylor, M.R., Peacock, F., and Wanless, R.M. 2015. Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

2.1.2 Initial Site Visit

- Date: 2021-05-26 to 2021-05-29
- Duration: 2 days.
- Season: Autumn.
- Season Relevance: The timing of the site inspection coincided with the predicted presence of avifaunal SCCs of relevance to WEFs such as Black Harrier and was sufficient to determine the current land-use in the area as well as the identification of suitable vantage points (VPs) for the avifaunal monitoring programme.

2.1.3 Pre-Application Avifaunal Monitoring Plan (PAAMP)

The PAAMP was informed by the desktop study and reconnaissance site visit and outlined the recommended avifaunal monitoring programme (Appendix A).

2.1.4 Site Ecological Importance (SEI)

Site Ecological Importance (SEI) is considered to be a function of the biodiversity importance (BI) of the receiving environment (e.g. species of conservation concern and the habitat type present on the site) and its resilience to impacts (i.e. receptor resilience [RR]). The BI of the receiving environment is in turn a function of the conservation importance (CI) and the functional integrity (FI) of the receiving environment.

Conservation importance is defined as: '*The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.*' The CI of each impact receptor is listed in Table 4 below.

Functional integrity (FI) of the receiving environment/habitats is defined as its current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions, i.e. a measure of the ecological condition of the receiving environment as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts. The degree of connectivity between habitat patches varies greatly with the dispersal ability of the taxa in question and similarly, existing impacts will have differential effects on each species.

As biodiversity importance (BI) is a function of conservation importance (BI) and the functional integrity (FI), the biodiversity importance can be determined.

Receptor resilience (RR) is the intrinsic capacity of the receptor to resist major damage from an impact and/or to recover to its original state with limited or no human intervention. Resilience can be linked to a particular disturbance/impact or time of year; e.g. large birds of prey have different levels of resilience to noise disturbance depending on whether they are breeding or not.

The highest calculated SEI corresponding with each habitat/land-use category that represented the preferred habitats used by each species was mapped.

2.1.5 Impact Assessment Rating System

Significance ratings of the potential impacts to be carried out during the EIA phase will be determined following the methods outlined in Appendix B. The impact assessment is to consider the results of the avifaunal monitoring programme in the context of the receiving environment, the conservation status of the species observed/expected, the susceptibility of species to the potential impacts and the species' utilisation of the proposed development site.

The outcomes of the impact assessment will inform the suitability of the proposed development site for the proposed development activity from an avifaunal perspective, identify any relevant mitigation measures to reduce the residual impacts to avifauna, and ultimately inform the decision to develop the area as proposed.

2.2 Reporting

The following definitions were applied in the compilation of the report:

- Priority species: all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list[12]. This list consists of 107 species with a priority score of 170 or more. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs including physical size, species behaviour, endemism, range size and conservation status;
- Red Data species: Species whose regional conservation status is listed as Near Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al. 2015)[13];
- Endemic or Near-endemic: Endemic or near endemic (i.e., ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BLSA Checklist of Birds in South Africa, 2022.
- Species of Conservation Concern (SCC): all species that are assessed according to the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD), as well as range-restricted species which are not declining and are nationally listed as Rare or Extremely Rare (also referred to in some Red Lists as Critically Rare)[1]. These species and subspecies are important for South Africa's conservation decision-making processes.
- Target species: those particular bird species that are to be recorded by a specific survey method. Target species per survey method:
    - Vantage Point (VP) Surveys: all raptors; all large (non-passerine) priority species;
    - Walked Transects (WT): all birds;
    - Incidental Observations: all raptors; all large (non-passerine) priority species.

3 RESULTS

3.1 Assumptions and Limitations

Many areas of South Africa have not been well studied, with the result that the species lists derived for an area do not always adequately reflect the actual species present at a site. To address this potential limitation database searches were extended well beyond the proposed development site.

Species not confirmed to be on site during the site visit have been assumed to occur on the proposed development site following the precautionary principal and their probability of occurrence in each habitat type was evaluated based on the species' habitat preference.

[12] Retief, E, Anderson, M., Diamond, M., Smit, H., Jenkins, A. & Brooks, M., 2011. Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures used. Priority species list updated in 2014 by BLSA.

[13] Taylor, M.R., Peacock, F., and Wanless, R.M., 2015. Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Updated in 2020 by BLSA.

3.2 Desktop Study

3.2.1 Project Area of Influence (PAOI)

The PAOI for the purposes of the more detailed mapping generated for this report was considered to be the proposed development area of interest provided by the client. It is acknowledged that the potential area of influence of a WEF could extend beyond the boundary of the project area, particularly with respect to the avifaunal community being assessed as several species are highly mobile. Therefore, the potential impacts on local and regional populations of species have been considered during the assessment process as well as habitats in the surrounding area through the incorporation of avifaunal data from multiple sources to provide a broader context.

3.2.2 Regional Context

The proposed development site falls within a gently to moderately undulating landscape on the Highveld plateau that has been extensively modified through agricultural practices with some remaining natural patches of dense, tufted grassland classified as Soweto Highveld Grassland (Figure 1). The Amersfoort-Bethal-Carolina (SA018) Important Bird and Biodiversity Area (IBA) is a large IBA is bounded by the roads connecting Bethal, Carolina, Ermelo and Amersfoort (Figure 1, insert). The proposed development area is largely located within this IBA. The key species within this IBA is the globally Endangered Botha's Lark. Other globally threatened species include Blue Crane, Southern Bald Ibis, Black Harrier, Blue Korhaan, Black-winged Pratincole, Secretarybird, Martial Eagle and Denham's Bustard. Regionally threatened species include African Grass Owl, White-bellied Korhaan and Lanner Falcon. Range- and biome-restricted species include Kurrichane Thrush and Buff-streaked Chat. The Chrissie Pans (SA019) IBA is a grouping of lakes and pans and situated approximately 45 km north-east of the proposed development area. This IBA supports a large population of threatened birds, both wetland and grassland, such as Southern Bald Ibis, Wattled and Blue Crane, Lesser Flamingo and Chestnut-banded Plover.

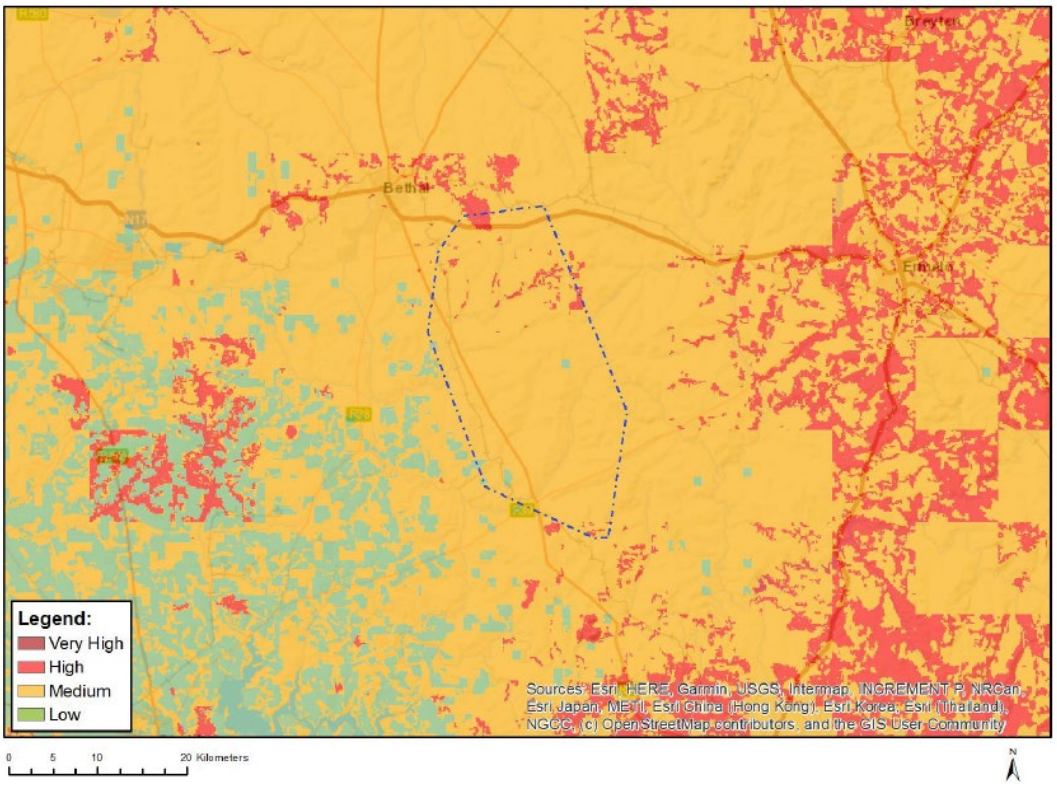
3.2.3 Local Context

A large portion of the proposed development site has been transformed through agricultural practices such as ploughed maize fields as well as cattle and small stock grazing, which occurs throughout. Available avifaunal habitats also include watercourses and drainage lines cross the site with several wetlands and man-made farm dams under various degrees of existing impact and transformation from farming practices. Unploughed grassland areas have been considered to be in a natural or near-natural state of function for avifauna even if utilised for low density grazing (Figure 2).

3.2.4 Screening Tool

The output from the Screening Tool (as of 2022-03-23) indicated that the majority of the site was of medium sensitivity in the Animal Species Theme, with patches of high sensitivity due to the potential presence of Southern Bald Ibis, Denham's Bustard, Secretarybird, African Grass Owl and African Marsh Harrier (Figure 3).

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Sensitive species 2
High	Aves-Sagittarius serpentarius
High	Aves-Neotis denhami
High	Aves-Geronticus calvus
Low	Low sensitivity
Medium	Aves-Tyto capensis
Medium	Sensitive species 2
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Geronticus calvus
Medium	Aves-Circus ranivorus
Medium	Aves-Neotis denhami
Medium	Insecta-Lepidochrysops procera
Medium	Mammalia-Crocidura maquassiensis

Figure 3: Output from the National Web-based Screening Tool

The areas identified by the Screening Tool to be of High Sensitivity (Figure 3) are derived from habitat suitability model results for Southern Bald Ibis.

The broader project area was determined by the Screening Tool to be outside of sensitivities in the Avian (Wind) Theme as it did not intersect with any sensitivity layers contained in the database at the time of reporting.

3.2.5 South African Bird Atlas Project 2 (SABAP2)

SABAP2 data were examined for 10 pentads (which are approximately 8 km x 8 km squares) in and around the PAOI (Appendix C, Figure 1). Adjacent pentads were included to ensure that all species potentially occurring within the PAOI, whether resident, nomadic, or migratory, are identified. A total of 172 species were recorded during full protocol SABAP2. This includes 25 Priority Species, 12 species classified as Endangered, Near Threatened or Vulnerable and 10 endemic, near-endemic species or range-restricted species. Due to the relatively few full protocol surveys conducted in some of the pentads (indicated by the number of cards submitted) this list is not considered to be complete.

3.2.6 Co-ordinated Avifaunal Roadcounts Project (CAR)

There are three CAR routes that run in close proximity to the proposed development area. Located 6 km north east of the proposed development, MC01 is 72 km long and loops from Breyten, west towards the proposed development and back east. The second is MC07, situated east of the proposed development and 77 km in length. The third CAR route is MT01 and lies south of the proposed development, with a length of 81 km. Blue Korhaan, Blue Crane, White Stork and Northern Black Korhaan have been recorded along these routes (Figure 1).

3.2.7 Co-ordinated Waterbird Counts Project (CWAC)

Two CWAC sites (New Denmark Dam and Styferfontein Colliery Dams) are located near the proposed development site and are approximately 22 km and 30 km to the west and north west of the area respectively (Figure 1). New Denmark Dam is located midway between Bethal and Standerton and has been counted 12 times, with the last survey in July 2009. Styferfontein Colliery Dams are situated adjacent to a coal mine and was last surveyed in March 2016, with a total of 14 surveys being completed in total.

3.2.8 Pre-screening Study (Avisense 2020)

The preliminary findings based on a desktop assessment conducted by Avisense (2020) suggested that a short-list of 25 threatened and/or 'impact susceptible priority species' (or a subset of this list) could be important in the area.

3.2.9 Expected Species

A list of possible species that could occur within the proposed project area was consolidated from the various data sources used during the desktop study. Threatened, Near-Threatened, Endemic/Near-endemic and Priority Species were identified as potential impact receptors of the proposed development that could occur in the area (Table 1).

Table 1: Consolidated list of Threatened, Near-Threatened, Endemic/Near-endemic and Priority Species potentially occurring on the proposed development site as identified during the desktop study.

Species	Global Status	Regional Status	Priority Score	Data Source					
				IBA	Screening Tool	SABAP 2	CAR	CWAC	Avisense (2020)
African Fish-eagle	LC	LC	290			x			
African Grass Owl	LC	VU (A2c; C1)	289	x	x				x
African Harrier-hawk	LC	LC	190			x			

Species	Global Status	Regional Status	Priority Score	Data Source					
				IBA	Screening Tool	SABAP 2	CAR	CWAC	Avisense (2020)
African Marsh Harrier	LC	EN (A2c+3c+4c; C1)	300		x				x
Amur Falcon	LC	LC	210			x			x
Black Harrier	EN (C2a(ii))	EN (C1+2a(ii))	345	x		x			x
Black Sparrowhawk	LC	LC	170			x			
Black Stork	LC	VU (A2c; D1)	330						x
Black-chested Snake-eagle	LC	LC	230			x			
Black-winged Kite	LC	LC	174			x			
Black-winged Pratincole	NT (A2bc+3bc+4bc)	NT (A2bc+3bc+4bc)	202	x		x			x
Blue Crane	VU (A3cde+4cde)	NT (A2acde)	320	x		x	x		x
Blue Korhaan	NT (A3c; C1)	LC	270	x		x	x		x
Botha's Lark	EN (A3c+4c)	EN (B2ab(ii,iii,iv,v); C1+2a(i))	-	x					x
Buff-streaked Chat	LC	LC	-	x					
Burchell's Courser	LC	VU (A2c+4c; C1+2a(i))	210						x
Cape Eagle-owl	LC	LC	250						x
Cape Vulture	VU (A2acde+3cde+4acde; C2a(ii))	EN (A2a)	405						x
Caspian Tern	LC	VU (A2a;C1; D1, D2)	240						x
Chestnut-banded Plover	LC	NT (C1+2a(i))	230	x					
Common Buzzard	LC	LC	210			x			
Denham's Bustard	LC	VU (A2bcd+3bcd+4bcd; C1)	300	x	x				x
Greater Flamingo	LC	NT (A2bd)	290			x		x	x

Species	Global Status	Regional Status	Priority Score	Data Source					
				IBA	Screening Tool	SABAP 2	CAR	CWAC	Avisense (2020)
[Redacted]	**EN (A2acd+ 4acd)**	**EN (A2acd+ 4acd)**	**[Red]**		x	x			x
Grey-winged Francolin	LC	LC	190			x			
Jackal Buzzard	LC	LC	250			x			
Kurrichane Thrush	LC	LC	-	x					
Lanner Falcon	LC	VU (A2bc; C1)	300	x		x			x
Lesser Flamingo	NT (A2c+3c+ 4c)	NT (A2c+3c+ 4c)	290	x		x			x
Maccoa Duck	EN (A2acde)	NT (C1)	-			x			x
Marsh Owl	LC	LC	190			x			
Martial Eagle	EN (A2acde+ 3cde+4ac de)	EN (A2cde ; C1)	350	x					x
Montagu's Harrier	LC	LC	210			x			
Northern Black Korhaan	LC	LC	180				x		
Pallid Harrier	NT (A2cde+3 cde+4cde)	NT (A2cde+3c de+4cde)	260			x			
Rudd's Lark	EN (A2bc+3b c+4bc)	EN(A2c+3c+4 c; B2ab(i,ii,iii, iv,v); C1)	230						x
Secretarybir d	EN (A2acde+ 3cde+4ac de)	VU (A4acd; C1)	320	x	x	x			x
Southern Bald Ibis	VU (C1+2a(ii))	VU (C1+2a(ii))	330	x	x	x			x
Spotted Eagle-owl	LC	LC	170			x			
Wattled Crane	VU (A2acde+ 3cde+4ac de)	CR (C1+2a(ii))	349	x					
White Stork	LC	LC	220			x	x		
White-bellied Korhaan	LC	VU (A2c+3c+ 4c; C1)	270	x					x
Yellow-billed Stork	LC	EN (B2c(i,v); D)	330						x

Species	Global Status	Regional Status	Priority Score	Data Source					
				IBA	Screening Tool	SABAP 2	CAR	CWAC	Avisense (2020)
Yellow-breasted Pipit	VU (A3c; C2a(i); D1)	VU (A2b,c+4c; B1b,c,+2b, c; C1)	245						x

Several species listed by Avisense (2020) were not considered highly likely to occur across the proposed project area as they were not identified in any of the other data sources examined. For example, Botha's Lark, Rudd's Lark and Yellow-breasted Pipit were not listed by the Screening Tool despite habitat suitability layers for those species existing in the Screening Tool. This indicates that the habitat suitability for those species is likely to be low across the proposed project area and they are unlikely to be present. Avisense (2020) noted that the potential presence of these species in the area would largely depend on the level of habitat modification present on the site and suggested that any vestigial areas of open Highveld grassland that might still remain could support small populations of these species and recommended that these areas be surveyed, particularly from September/October into mid-summer to coincide with the peak during breeding/display period when the birds are at their most conspicuous.

3.3 Observed Species

Greater Kestrel was recorded on site during pre-construction monitoring despite this species not being identified in the list above. No Botha's Lark, Rudd's Lark or Yellow-breasted Pipit have been recorded on site to-date.

3.4 Avifaunal Species of Conservation Concern

The expected and observed species informed the list of avifaunal SCCs (and other notable avifaunal species) as relevant impact receptors for the proposed development and taken forward for further assessment and consideration. Botha's Lark, Rudd's Lark, Yellow-breasted Pipit and Buff-streaked Chat were not included at this stage due to the lack of preferred habitat/low habitat suitability found across the proposed project site. Avifaunal monitoring will however include surveys designed to increase the likelihood of locating these species if they are present across the proposed development site.

3.5 Sensitivity Mapping

3.5.1 Current Impacts

Several impacts are already present across the proposed project area. These include highly modified ploughed agricultural fields, road networks and areas used for various levels of livestock grazing. Some areas have experienced overgrazing and subsequent erosion. Erosion has channelled water and drained smaller wetlands. Relatively high levels of disturbance exist across the project site associated with the regular use of agricultural machinery required for commercial crop production, this not only includes the operational farmland but remaining areas of natural or near-natural habitat surrounded by crops. Man-made farm dams are scattered throughout and impede the natural flow of water, but provide habitat for species attracted to these features.

3.5.2 Site Ecological Importance (SEI)

Additional avifaunal sensitivities may become apparent following the analysis of flight path and occurrence data from all four seasons of avifaunal surveys (the final survey is currently

underway), as well as results from increased effort conducted to locate nesting locations (e.g. of Secretarybird). It is nevertheless possible to map areas of elevated avifaunal site ecological importance at this stage. The SEI has been calculated for each species through the combination of various attributes (Table 4) through the consideration of site-specific factors (e.g. land-use, habitat functionality etc.) in combination with the nature of the potential impacts associated with the proposed development. The highest SEI corresponding with each habitat/land-use category that represented the preferred habitats used by each species was mapped for the PAOI.

This has effectively resulted in the identification of wetland environments to be of Very High avifaunal SEI, natural grasslands to be of High avifaunal SEI and agricultural/cultivated fields to be of Very Low avifaunal SEI (Figure 4).

The interpretation of the SEI classifications in relation to proposed development activities as outlined in the guidelines is presented in Table 3 below.

Table 3: Interpretation of Site Ecological Importance Classifications

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

Table 4: Site Ecological Importance evaluated for each potential Species of Conservation Concern (and other notable species) that may occur in the area

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
African Fish-eagle	Dams		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
African Grass-owl	Wetlands, Rank Grasslands	> 10	VU (A2, C1)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High - Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
African Harrier-hawk	Dams, Wetlands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
African Marsh-harrier	Wetlands	> 10	EN (A2, 3, 4, C1)	High – Highly likely occurrence of EN species that has a global EOO of > 10 km^2 and listed under	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning	**Medium**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				any criterion other than A. Is a Priority Species for WEFs.	suitable habitat patches.		once the disturbance or impact has been removed.	
Amur Falcon	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Black Harrier	Grasslands	> 10	EN (C1+2)	High – Highly likely occurrence of EN species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed. Increasingly susceptible to population level impacts, however.	**High**
Black Sparrowhawk	Woodland		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Low – Almost no habitat connectivity between heavily wooded areas but migrations still possible by flying across some modified or degraded natural habitat.	Low	Medium – Would be slow to restore habitat functionality if wooded habitats removed.	**Low**
Black Stork	Wetlands, Rivers	> 10	VU (A2, D1)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under	Very High – Habitats appear to be well connected for this mobile species and likely	Very High	High – Highly mobile species and this species has a high likelihood of remaining in the area even when a disturbance or impact is	**High**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				any criterion other than A. Is a Priority Species for WEFs.	serve as ecological corridors between suitable habitat patches.		occurring, or a high likelihood of returning once the disturbance or impact has been removed. More sensitive to disturbance, however.	
Black-chested Snake-eagle	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Black-winged Kite	Grasslands, Cultivated Fields		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Black-winged Pratincole	Dam Edges		NT (A2, 3, 4)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Blue Crane	Grasslands, Wetlands, Dams	> 10	VU (A3, 4)	Medium – Threatened species listed under Criterion A only and known from more than 10 locations. Is a	Very High – Habitats appear to be well connected for this mobile species and likely	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or	**Low**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				Priority Species for WEFs.	serve as ecological corridors between suitable habitat patches.		impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	
Blue Korhaan	Grasslands		NT (A3; C1)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Burchell's Courser	Cultivated Fields	> 10	VU (A2, 4, C1, 2)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Low – While habitat connectivity is likely present this is due to the utilisation of highly modified areas rather than natural habitat. Several minor and major current negative ecological impacts exist in utilised areas.	Medium	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Very Low**
Cape Eagle-owl	Rocky Slopes		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Low – Almost no habitat connectivity between rocky slopes as very little suitable habitat is present, but migrations still possible by flying across some modified or degraded natural habitat.	Low	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Very Low**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Cape Vulture	Grasslands	> 10	EN (A2)	Medium – Threatened species listed under Criterion A only and known from more than 10 locations.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Caspian Tern	Dams	> 10	VU (A2, C1, D1, 2)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Chestnut-banded Plover	Dams, Wetlands		NT (C1+2)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Common Buzzard	Grasslands, Cultivated Fields		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Denham's Bustard	Grasslands	> 10	VU (A2, 3, 4, C1)	High – Highly likely occurrence of VU species that has a	Very High – Habitats appear to be well connected for this mobile	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even	**Medium**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	species and likely serve as ecological corridors between suitable habitat patches.		when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	
Greater Flamingo	Dams		NT (A2)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Greater Kestrel	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
[Redacted]	Wetlands	> 10	EN (A2, 4)	High – Highly likely occurrence of EN species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	High – Highly mobile species and this species has a high likelihood of remaining in the area even when a disturbance or impact is occurring, or a high likelihood of returning once the disturbance or impact has been removed. More sensitive to disturbance, however.	**High**
Grey-winged Francolin	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very	**Low**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	corridors between suitable habitat patches.		high likelihood of returning once the disturbance or impact has been removed.	
Jackal Buzzard	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Lanner Falcon	Grasslands	> 10	VU (A2, C1)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Lesser Flamingo	Dams		NT (A2, 3, 4)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Maccoa Duck	Dams	> 10	EN (A2)	Medium – Threatened species listed under Criterion A only and known from more than 10 locations.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Marsh Owl	Grasslands, Wetlands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Martial Eagle	Grasslands	> 10	EN (A2; C1)	High – Highly likely occurrence of EN species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Montagu's Harrier	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Northern Black Korhaan	Grasslands		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Pallid Harrier	Grasslands		NT (A2, 3, 4)	Medium – Highly likely occurrence of populations of NT species. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Secretarybird	Grasslands	> 10	EN (A2 , 3, 4)	Medium - Threatened species listed under Criterion A only and known from more than 10 locations. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Southern Bald Ibis	Grasslands	> 10	VU (C1, 2)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Spotted Eagle-owl	Grasslands, Cultivated Fields		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
Wattled Crane	Wetlands	> 10	CR (C1, 2)	High – Highly likely occurrence of CR species that has a	Very High – Habitats appear to be well connected for this mobile	Very High	Medium – This species is sensitive to human disturbance and relies on wetland environments with	**Very High**

Species	Habitat	EOO (km^2)	Status Used	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
				global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	species and likely serve as ecological corridors between suitable habitat patches.		minimal disturbance. This is a highly mobile species and suitable wetlands are likely present nearby. There is therefore a moderate likelihood of the species returning to the site once the disturbance or impact has been removed.	
White Stork	Grasslands, Cultivated Fields		LC	Medium – Species is of Least Concern, however remaining natural habitat within the PAOI is classified as VU and may be of conservation importance for species' persistence in the local context. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Low**
White-bellied Bustard	Grasslands	> 10	VU (A2, 3, 4, C1)	High – Highly likely occurrence of VU species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**
Yellow-billed Stork	Wetlands	> 10	EN (B2, D)	High – Highly likely occurrence of EN species that has a global EOO of > 10 km^2 and listed under any criterion other than A. Is a Priority Species for WEFs.	Very High – Habitats appear to be well connected for this mobile species and likely serve as ecological corridors between suitable habitat patches.	Very High	Very High – Highly mobile species and this species has a very high likelihood of remaining in the area even when a disturbance or impact is occurring, or a very high likelihood of returning once the disturbance or impact has been removed.	**Medium**

4 IDENTIFICATION OF IMPACTS

The following key potential impacts on avifauna, arising from the proposed development of the WEF and Solar PV facilities (and associated infrastructure) have been identified for assessment:

- Construction Phase:
  - Direct Habitat Destruction – modification, removal and clearing of vegetation for development of infrastructure such as temporary laydown areas, site buildings, WTG bases, Solar PV arrays, access roads and servitudes;
  - Disturbance/Displacement – indirect habitat loss and/or reduced breeding success due to displacement by noise and activity associated with machinery and construction activity; and
  - Direct Mortality – fatalities of avifauna due to vehicle collision, entrapment, entanglement or collision with temporary infrastructure (e.g. fencing), entrapment in uncovered excavations and increased predation pressure.
- Operational Phase:
  - Direct Habitat Destruction – Contamination of habitats due to routine operational maintenance activity (e.g. cleaning of Solar PV arrays);
  - Disturbance/Displacement – indirect habitat loss, reduced breeding success, obstruction of movement corridors due to displacement by infrastructure and noise/activity associated with ongoing, routine operational tasks/maintenance activity; and
  - Direct Mortality – fatalities of avifauna due to WTG collision, collision with Solar PV arrays, collision or entrapment with perimeter fencing, collision with overhead power lines, and electrocution from electrical components.
- Decommissioning Phase:
  - As per construction phase.

4.1 Construction Phase

4.1.1 Direct Habitat Destruction

The removal and/or destruction and/or alteration of habitat during the construction phase is potentially the most significant impact associated with solar PV developments as the vegetation within the development footprint is cleared for the installation of the solar PV arrays. This could result in the exclusion of several species from the development footprint for the duration of the operation of the facility. Contamination of the immediate and local downstream environment could occur through leaks or spills of hazardous material. Direct habitat destruction associated with WEFs is generally low relative to the overall size of the project area. This impact is largely unavoidable, resulting in some birds being displaced from the project site.

Impact Displacement of avifauna as a result of habitat loss during the construction phase.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Displacement of avifaunal species	Direct impacts: • Loss of habitat will potentially lead to displacement of avifaunal species Indirect impacts:	Local	Wetland and Aquatic habitats

	• None		
Description of expected significance of impact The habitats present in the proposed development site are not unique to the site and the agricultural/natural matrix is similar throughout the broader area. The more natural or near-natural grasslands that remain in these areas are, however, under increasing pressure from various other impacts such coal mining, especially strip-mining (which is expanding rapidly in Mpumalanga), urban sprawl, commercial crop production and rangeland grazing/burning mismanagement. Habitat suitability models predict a low likelihood that the proposed development area supports significant populations of SCCs such as Botha's Lark, Rudd's Lark or Yellow-breasted Pipit, nor does it appear to cover highly suitable foraging habitat for Black Harrier. The loss of habitat associated with clearing will not likely have a significant negative impact on the long-term viability or persistence of avifaunal species or populations in the area following the implementation of appropriate mitigation measures.			
Gaps in knowledge & recommendations for further study • Spatio-temporal utilisation of the site by target species and species of special concern including levels of flight activity; • Mapping of all target species and species of special concern within the development footprint; • Mapping of known and potential habitats used in breeding, foraging and roosting; • Describing the current land use and indicating these on a sensitivity map; and • An indication of the potential of target species to occur on the proposed development site. **Recommendations with regards to general field surveys** • Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan; • Walk transects to include the period between September/October to mid-summer to coincide with peak breeding/display periods of larks and pipits to increase the chances of their detection; and • Surveys to include periods when Black Harrier are predicted to be in the area (i.e. April/May).			

Mitigation measures largely include avoiding areas of elevated sensitivity wherever possible, utilising existing access routes as far as possible and implementing appropriate erosion control measures to reduce down-stream effects of erosion, associated habitat loss, sedimentation and changes to infiltration/flow regimes.

4.1.2 Disturbance and Displacement

Indirect loss of habitat from disturbance during the construction phase is temporary in nature and is expected to result largely from the presence of heavy machinery and increased activity of construction personnel.

Impact Displacement of avifauna as a result of disturbance during the construction phase.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Displacement of avifaunal species	Direct impacts: • Disturbance will potentially lead to displacement of avifaunal species Indirect impacts: • Loss of habitat	Local	Wetland and Aquatic habitats
Description of expected significance of impact			

The remaining patches of natural or near-natural vegetation that occur across the site are already under existing levels of disturbance from agricultural activities that include the regular use of large agricultural machinery required for commercial crop production in immediately adjacent fields. Similarly, disturbance resulting from grazing of livestock occur within the natural or near-natural areas themselves and therefore it is expected that any species particularly sensitive to anthropogenic disturbance are unlikely to occur within the proposed project area through displacement by existing impacts.

The habitats present in vicinity of the proposed development are not unique to the site and are relatively widespread in the area so any displacement from the immediate vicinity that may occur will not likely incur a high energetic cost as suitable habitat is widely available nearby. The proximity of nearby suitable habitat makes it likely that species will return to areas that have not been physically altered by the proposed development once construction activity ceases.

Gaps in knowledge & recommendations for further study

- Describing the current land use and indicating these on a sensitivity map;
- Nesting locations of target species that may occur on the proposed development site are unknown;
- Indication of the nesting locations of target species to occur on the proposed development site.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan;
- Avifaunal activity recorded across the proposed development site to be used to inform focus areas for a nest survey; and
- Walk transects to include the period between September/October to mid-summer to coincide with peak breeding/display periods of larks and pipits to increase the chances of their detection.

4.1.3 Direct Mortality

Impact
Direct mortality through vehicular collision, entrapment/entanglement with temporary fencing and/or uncovered excavations.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Loss of avifaunal species	Direct impacts: • Fatalities of individuals Indirect impacts: • Loss of breeding potential and reduced recruitment into the local population	Local	Wetland and Aquatic habitats

Description of expected significance of impact

Fatalities of avifaunal species can occur through collision with vehicles as traffic in the area increases due to construction activity. Large-bodied and ground dwelling species (e.g. korhaans and bustards) are at increased risk, but this impact can be effectively mitigated against. Temporary fencing can result in collisions, entrapment or entanglement if not suitably installed. Similarly ground dwelling avifauna (particularly chicks) can fall into uncovered excavations and become entrapped.

The construction phase is finite and relatively short in duration. The expected significance of this impact is likely to be low.

Gaps in knowledge & recommendations for further study

- Describing the current land use and indicating these on a sensitivity map; and
- Indication of the nesting locations of target species to occur on the proposed development site.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan;
- Avifaunal activity of larger-bodied terrestrial species to recorded across the proposed development site through walk-transects, drive transects and incidental records.

4.2 Operational Phase

4.2.1 Direct Habitat Destruction

Mesic Highveld grasslands receive relatively high rainfall and habitats are sensitive to alterations of flow regimes and infiltration rates, with wetlands forming an important component for many avifaunal species in the area. Potential risks to the long-term functioning and persistence of these environments exist which, if unmitigated, could result in the long-term degradation or permanent loss of habitats. Fortunately, the potential risks are relatively easy to mitigate very effectively and are largely standard practice for these types of developments.

The utilisation of dust suppression or cleaning chemicals used on solar PV arrays could impose a risk of contamination of pollution of water resources. However, this potential impact can be easily mitigated. The production of wastewater is to be appropriately collected and not released into the receiving environment prior to appropriate treatment to reduce the likelihood of downstream habitat contamination.

Increased runoff from hard surfaces during the operational phase (e.g. pylon bases, solar PV arrays, roads etc.) has the potential to increase the risk of habitat destruction through erosion which can alter flow regimes and water tables, drain wetland environments or increase sedimentation downstream. These potential impacts are also easy to mitigate through the appropriate use of flow and erosion control measures.

Impact
Displacement of avifauna as a result of habitat loss during the operational phase.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Displacement of avifaunal species	Direct impacts: • Loss of habitat will potentially lead to displacement of avifaunal species Indirect impacts: • None	Local	Wetland and Aquatic habitats

Description of expected significance of impact

The natural or near-natural habitats present are linked to fire and rainfall/water regimes and are particularly sensitive to alterations of flow characteristics, infiltration rates and the water table. Contamination of water sources and uncontrolled runoff from hard surfaces would lead to habitat loss and negative down-stream effects on habitats beyond the proposed development site.

There are, however, highly effective mitigation measures available to reduce the likelihood of this impact occurring to acceptable levels and these measures are largely standard practice for this type of development and therefore the impact significance is expected to be low.

Gaps in knowledge & recommendations for further study

- Utilisation of the proposed development site by species reliant on wetland and aquatic habitats (e.g. cranes);

- Aquatic study to be undertaken.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan; and
- Surveys to include the rainy season (i.e. summer).

4.2.2 Disturbance and Displacement

Indirect loss of habitat from disturbance during the operational phase is associated with ongoing operational activity as well as more discrete periods of routine maintenance tasks. Similar to the construction phase, the avifauna in the area already experience levels of disturbance and therefore species particularly sensitive to disturbance are unlikely to frequent the area.

Impact
Displacement of avifauna as a result of disturbance during the operational phase.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Displacement of avifaunal species	Direct impacts: • Disturbance will potentially lead to displacement of avifaunal species Indirect impacts: • Loss of habitat	Local	Wetland and Aquatic habitats

Description of expected significance of impact

The remaining patches of natural or near-natural vegetation that occur across the site are already under existing levels of disturbance from agricultural activities that include the regular use of large agricultural machinery required for commercial crop production in immediately adjacent fields. Similarly, disturbance resulting from grazing of livestock occur within the natural or near-natural areas themselves and therefore it is expected that any species particularly sensitive to anthropogenic disturbance are unlikely to occur within the proposed project area through displacement by existing impacts.

The habitats present in vicinity of the proposed development are not unique to the site and are relatively widespread in the area so any displacement from the immediate vicinity that may occur will not likely incur a high energetic cost as suitable habitat is widely available nearby. The proximity of nearby suitable habitat makes it likely that species will return to areas that have not been physically altered by the proposed development during the operational phase. This impact is therefore expected to have a low significance.

Gaps in knowledge & recommendations for further study

- Describing the current land use and indicating these on a sensitivity map;
- Nesting locations of target species that may occur on the proposed development site are unknown;
- Indication of the nesting locations of target species to occur on the proposed development site.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan;
- Avifaunal activity recorded across the proposed development site to be used to inform focus areas for a nest survey; and
- Walk transects to include the period between September/October to mid-summer to coincide with peak breeding/display periods of larks and pipits to increase the chances of their detection.

4.2.3 Direct Mortality

4.2.3.1 Collision with Infrastructure

WEFs can cause bird fatalities through the collision of birds with moving turbine blades, the most effective mitigation for collision impacts currently available is wind farm placement, as well as specific turbine placement within a WEF to avoid high use areas[14]. Smaller passerine (songbird) species seem to account for the majority records of fatality due to collision with Solar PV arrays[15]. Collisions with large (132 kV or above) power lines are a well-documented threat to birds in southern Africa[16,17]. Heavy-bodies birds such as bustards, cranes and waterbirds, with limited manoeuvrability, are susceptible to this impact[16]. The most common mitigation measures currently available (i.e. bird flight diverters) appear to be more effective at reducing collisions for some species (e.g. cranes) than others (e.g. bustards and korhaans)[18].

There is currently no widely accepted effective mitigation for reducing the collisions of bustards with overhead powerlines, however there is some indication that bustards collide more often with mid-span areas than they do nearer the supporting pylons suggesting that they see the pylons and take avoiding action[19]. It is recommended that the overhead power line transmission corridor follows existing linear infrastructure wherever possible and that the pylons be placed in a staggered manner relative to existing pylon locations. The staggering of pylons for novel transmission infrastructure between pylons (rather than next to, i.e. in the mid-span) of adjacent transmission lines may reduce bustard collisions by ~45%[19].

The significance of this potential impact is often the most critical to understand during the assessment process and can be highly dependent on site-specific attributes, infrastructure layout and WTG positions. The avifaunal species of particular relevance to the proposed development (as per the SEI determination above) included Wattled Crane, [Redacted], Black Stork, Black Harrier.

Impact Direct mortality through collision with infrastructure during the operational phase.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Loss of avifaunal species	Direct impacts: • Fatalities of individuals Indirect impacts: • Loss of breeding potential and reduced recruitment into the local population	Broader Area	Wetland and Aquatic habitats

[14] Murgatroyd, M, Bouten, W, Amar, A. A predictive model for improving placement of wind turbines to minimise collision risk potential for a large soaring raptor. J Appl Ecol. 2020; 00: 1– 12. https://doi.org/10.1111/1365-2664.13799.

[15] Visser, E., Perlod, V., Ralston-Paton, S., Cardenal, A.C., Ryan, P.G. 2019. Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Renewable Energy. 2019; 133: 1285–1294. https://doi.org/10.1016/j.renene.2018.08.106

[16] van Rooyen, C.S. 2004. The Management of Wildlife Interactions with over-headlines. In The fundamentals and practice of Over-head Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

[17] Shaw, J.M, Jenkins, A.R., Smallie, J.J & Ryan, P.G. 2010. Modelling power-line collision risk for the Blue Crane *Anthropoids paradiseus* in South Africa. Ibis 152: 590-599

[18] Shaw, J.M., Reid, T.A., Gibbons, B.K., Pretorius, M., Jenkins, A.R., Visage, R., Michael, M.D., Ryan, P.G. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds, but not bustards, in the Karoo, South Africa, Ornithological Applications, Volume 123, Issue 1, 1 February 2021, duaa067, https://doi.org/10.1093/ornithapp/duaa067

[19] Simmons, R.E., Pallett, J. & Brown, C.J. In prep.

Description of expected significance of impact

Habitat suitability models predict a low likelihood that the proposed development area supports significant populations of SCCs such as Botha's Lark, Rudd's Lark or Yellow-breasted Pipit, nor does it appear to cover highly suitable foraging habitat for Black Harrier. If avifaunal monitoring survey results indicate otherwise, the extent of the impact may increase to regional or national scales depending on the species concerned.

At this stage, however, this impact is expected to have a medium to low significance based on the SCCs predicted to occur across the proposed development site and the relatively low availability of suitable natural or near-natural habitat indicated by habitat suitability models.

Gaps in knowledge & recommendations for further study

- Spatio-temporal utilisation of the site by target species and species of special concern including levels of flight activity;
- Mapping of all target species and species of special concern within the development footprint;
- Mapping of known and potential habitats used in breeding, foraging and roosting;
- Describing the current land use and indicating these on a sensitivity map;
- Indication of the nesting locations of target species to occur on the proposed development site; and
- Indication of the potential of target species to occur on the proposed development site.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan;
- Avifaunal activity of larger-bodied terrestrial species to recorded across the proposed development site through vantage points, walk-transects, drive transects and incidental records; and
- Surveys to include periods of expected species-specific peak avifaunal abundance (e.g. autumn for Black Harrier).

4.2.3.2 Electrocution

Electrocution refers to the scenario where a bird is perched or attempts to perch on energized structures and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components.

Impact
Direct mortality through electrocution from energized infrastructure.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Loss of avifaunal species	Direct impacts: • Fatalities of individuals Indirect impacts: • Loss of breeding potential and reduced recruitment into the local population	Local	Wetland and Aquatic habitats

Description of expected significance of impact

Overhead power line infrastructure with a capacity of 132 kV or more do not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or vultures. Mitigation measures nevertheless remain effective at reducing the potential risk of electrocution. This impact is therefore expected to have a low significance.

Gaps in knowledge & recommendations for further study

- Spatio-temporal utilisation of the site by target species and species of special concern including levels of flight activity;
- Mapping of all target species and species of special concern within the development footprint;
- Mapping of known and potential habitats used in breeding, foraging and roosting;
- Describing the current land use and indicating these on a sensitivity map;
- Indication of the nesting locations of target species to occur on the proposed development site; and
- Indication of the potential of target species to occur on the proposed development site.

Recommendations with regards to general field surveys

- Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan.

4.3 Decommissioning Phase

The impacts of the decommissioning phase are similar to those of the construction phase, with the exception of a reduced impact of habitat destruction. Temporary disassembly and storage areas associated with the decommission phase are to be positioned on the same sites as those used for temporary laydown areas during the construction phase where possible to reduce the incidence of novel habitat destruction.

4.4 Cumulative Impact

The Screening Tool has identified one solar PV facility within 30 km of the proposed project area, namely Tutuka Solar Energy Facility (DFFE Ref. No. 14/12/16/3/3/2/754), a 65.9MW solar energy facility within the Tutuka coal fired power station. Other than the Tutuka power station the remaining area is largely dominated by commercial agricultural activity. It is unlikely that the proposed development will contribute significantly to the cumulative impact in the area beyond those impacts already identified.

Impact
The cumulative impact of the proposed development in the context of the land-use activities found in the broader local area.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Loss of avifaunal species	Direct impacts: • Fatalities of individuals; • Loss of habitat Indirect impacts: • Loss of breeding potential and reduced recruitment into the local population	Local	Wetland and Aquatic habitats

Description of expected significance of impact

The highest potential impacts prior to mitigation would relate to the effects on aquatic habitats (particularly during the operational phase), such as possible contamination and uncontrolled runoff from hard surfaces that may result in erosion and subsequent degradation of wetlands. However, highly effective mitigation measures exist to address these impacts.

The highest potential impacts following the implementation of mitigation measures relate to the direct destruction of habitat (primarily during the construction phase). While habitat destruction is generally low relative to the overall size of WEFs, the construction of solar PV arrays is often associated with vegetation clearing and the loss of habitat excluding avifaunal species from the area over the longer-term. This impact is nevertheless unlikely to have a significant negative effect on the long-term viability

or persistence of avifaunal populations in the area, particularly if large portions of the proposed development are focussed on highly modified/agricultural areas.
Gaps in knowledge & recommendations for further study • Spatio-temporal utilisation of the site by target species and species of special concern including levels of flight activity; • Mapping of all target species and species of special concern within the development footprint; • Mapping of known and potential habitats used in breeding, foraging and roosting; • Describing the current land use and indicating these on a sensitivity map; • Indication of the nesting locations of target species to occur on the proposed development site; and • Indication of the potential of target species to occur on the proposed development site. **Recommendations with regards to general field surveys** • Avifaunal pre-construction monitoring surveys to be informed by a pre-application avifaunal monitoring plan.

4.5 'No-Go' Alternative

The 'No-Go' alternative considers that the proposed development is not constructed. Most of the potential impacts associated with the development itself and assessed above would therefore not be imposed on the avifaunal community of the receiving environment.

From an avifaunal perspective, however, the proposed development presents an opportunity to afford some level of long-term protection for the habitats present across the proposed development area from activities potentially less compatible with the persistence and rehabilitation of avifaunal habitats (e.g. wetlands) such as coal mining.

Furthermore, the 'No-Go' alternative reduces the opportunity to progress the de-carbonisation transition of the economy and achieve various climate change mitigation targets outlined by the South Africa's Low Emission Development Strategy, The National Development Plan, The National Climate Change Response Policy, Integrated Resource Plan, the National Climate Change Adaptation Strategy (amongst others) and ultimately South Africa's commitment to the Paris Agreement. The proposed development site appears to be well suited for the development of renewable energy facilities as proposed.

5 CONCLUSION

The avifaunal SEI map (Figure 4) should be used at this stage to inform the layout to reduce the potential impacts on the avifauna of the receiving environment. Infrastructure layout should focus on previously transformed areas such as agricultural fields (Very Low avifaunal SEI) and avoid areas of indicative elevated avifaunal sensitivity wherever practically possible. Additional effort to be included in the avifaunal monitoring surveys to locate possible nesting locations of species observed across the proposed development area. The data from avifaunal monitoring will be analysed together with the existing avifaunal data to determine passage rates across the proposed project area and be included in collision risk determinations. Any additional avifaunal sensitivities identified will be duly considered during the EIA process and assessment of infrastructure positions and layout. Similarly, the SEI of some areas may be reduced following the assessment of all activity data once a more complete understanding of how the proposed project area is utilised by certain species is obtained.

6 AVIFAUNAL SPECIALIST IMPACT STATEMENT

Based on the scoping impact assessment conducted for the Ummbila Emoyeni WEF and associated infrastructure (including cumulative impacts), it is the avifaunal specialist's informed opinion at this stage that the proposed development will not have a significant negative impact on the viability or persistence of avifaunal populations (particularly avifaunal SCCs) in the area following the implementation of mitigation measures. At this stage it's the specialist opinion that the project can proceed into the EIA phase.

APPENDIX A: PRE-APPLICATION AVIFAUNAL MONITORING PLAN (PAAMP)

The terrain is gently undulating reducing the opportunity to utilise a practical number of elevated vantage points to offer complete coverage of the proposed development area (Figure 1). It is recommended that a total of 12 VPs be surveyed across the proposed development area by two teams of two experienced observers operating in pairs. Drive transects are recommended in areas where the topography precludes effective vantage point monitoring and it is recommended that the survey schedule be designed in such a way to increase the time spent traversing these areas and likelihood of incidentally detecting species of conservation concern.

It is recommended that avifaunal surveys include periods from September/October into mid-summer to coincide with the peak breeding/display period of larks and pipits to increase the likelihood of detecting otherwise cryptic species such as Botha's Lark. Similarly, it is recommended that walk transects include natural or near-natural grasslands and preferred habitats for this species. Given that the desktop study does not indicate that the area is of particular importance for species such as Black Harrier, Cape Vulture or Verreaux's Eagle it is assumed at this stage that the species-specific guidelines for those species need not apply. It is therefore recommended that each vantage point be monitored for 12 hours per season and that surveys be conducted at least once per season to account for variability in the utilisation of the site by various avifaunal species. It is recommended that pre-construction avifaunal monitoring surveys include the periods when Black Harrier are predicted to be in the area (i.e. April/May).

APPENDIX B: IMPACT ASSESSMENT SCORING METHODOLOGY

- 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; or
  - permanent - assigned a score of 5.
- The **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 (as per the calculation below;
- 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; and
- The degree to which the impact can be mitigated.

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

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

where:

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); and
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

APPENDIX C: SABAP2 RECORDS FROM PENTADS IN AND AROUND THE PROJECT SITE

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Harrier, Black	EN, EN	NE	345	5.1									50
Ibis, Southern Bald	VU, VU	SLS	330	35.9	25		33.3						25
Secretarybird	VU, EN		320	30.8	50								50
Crane, Blue	NT, VU		320	2.6					50				
Crane, Grey Crowned	EN, EN		314	2.6									
Falcon, Lanner	VU, LC		300	7.7								33.3	
Flamingo, Greater	NT, LC		290	33.3	50	100							25
Eagle, African Fish			290	56.4									
Flamingo, Lesser	NT, NT		290		50								25
Harrier, Pallid	NT, NT		260	5.1									
Buzzard, Jackal		NE	250	7.7							33.3		
Korhaan, Blue	LC, NT	SLS	240	59	25	33.3	66.7		50		100		25
Eagle, Black-chested Snake			230	2.6									
Pipit, Nicholson's			230			33.3	33.3				33.3		
Stork, White			220	33.3						50			
Falcon, Amur			210	46.2			33.3	50	50	100	66.7	33.3	25
Buzzard, Common			210	33.3	25				50	50			25
Harrier, Montagu's			210	12.8									
Pratincole, Black-winged	NT, NT		202	7.7			33.3			50	33.3		
Harrier-Hawk, African			190	2.6									
Francolin, Grey-winged		SLS	190	46.2	25		33.3					33.3	

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Owl, Marsh			190	41	25								25
Kite, Black-winged			174	82.1	100	100	100	50	100	100	100	66.7	100
Sparrowhawk, Black			170	41	25		33.3						
Eagle-Owl, Spotted			170	69.2									
Ostrich, Common				71.8		33.3	100						
Grebe, Black-necked				2.6									
Grebe, Little				53.8	25	66.7	33.3	50	50		33.3	66.7	100
Cormorant, White-breasted				10.3			33.3						25
Cormorant, Reed				71.8	50	100	66.7	50		100	100	66.7	100
Darter, African				33.3	25								25
Heron, Grey				46.2	75	33.3	33.3	50		50		66.7	50
Heron, Black-headed				64.1	100	100	66.7	100	50	50	33.3	33.3	100
Heron, Goliath				10.3						50			
Heron, Purple				12.8									
Egret, Little				43.6	25					50	33.3		
Egret, Intermediate				25.6	75					50	33.3	33.3	50
Egret, Western Cattle				76.9	75	33.3	66.7	100	100	100	66.7	66.7	25
Heron, Squacco				5.1									
Heron, Black				2.6									
Heron, Black-crowned Night				2.6							66.7		
Hamerkop				2.6						50			
Ibis, African Sacred				74.4	75	33.3	100	100					100
Ibis, Glossy				59	75	66.7		50				33.3	
Ibis, Hadada				97.4	100	100	100	100	50	100	100	100	100
Spoonbill, African				38.5	75	100	33.3	50		50	66.7		75

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Goose, Spur-winged				61.5	25	100	66.7	100	50	50	33.3		25
Goose, Egyptian				97.4	100	100	100	100	100	50	66.7	66.7	100
Shelduck, South African				5.1									
Shoveler, Cape				46.2	25	100		50	50				100
Duck, African Black				23.1							33.3		
Duck, Yellow-billed				82.1	50	100	100	100	100	100	66.7	66.7	100
Teal, Red-billed				59	50	100	33.3	50		50	33.3	33.3	75
Teal, Cape				15.4	25		33.3				66.7		
Teal, Blue-billed				10.3									
Duck, White-faced Whistling				7.7									25
Pochard, Southern				15.4	50	66.7		50					25
Duck, Maccoa	NT, VU			25.6									
Kestrel, Rock				7.7	50						33.3		
Spurfowl, Swainson's				87.2	75	100	66.7	100		50	100	66.7	100
Quail, Common				46.2	25	33.3	33.3	50	100	100	66.7	66.7	
Quail, Harlequin				2.6									
Guineafowl, Helmeted				87.2	25	100	66.7	100	100	100	66.7	100	25
Buttonquail, Common				7.7									
Moorhen, Common				17.9			33.3				33.3		
Coot, Red-knobbed				94.9	75	100	100	100	100	100	100	100	100
Plover, Kittlitz's				2.6	25			50					
Plover, Three-banded				82.1	50	33.3	33.3	100		50	66.7	33.3	25
Lapwing, Crowned				87.2	100	66.7	100	100	50	100	100	100	75
Lapwing, Blacksmith				100	100	100	100	100	100	100	100	66.7	100
Lapwing, African Wattled				35.9		66.7	33.3						

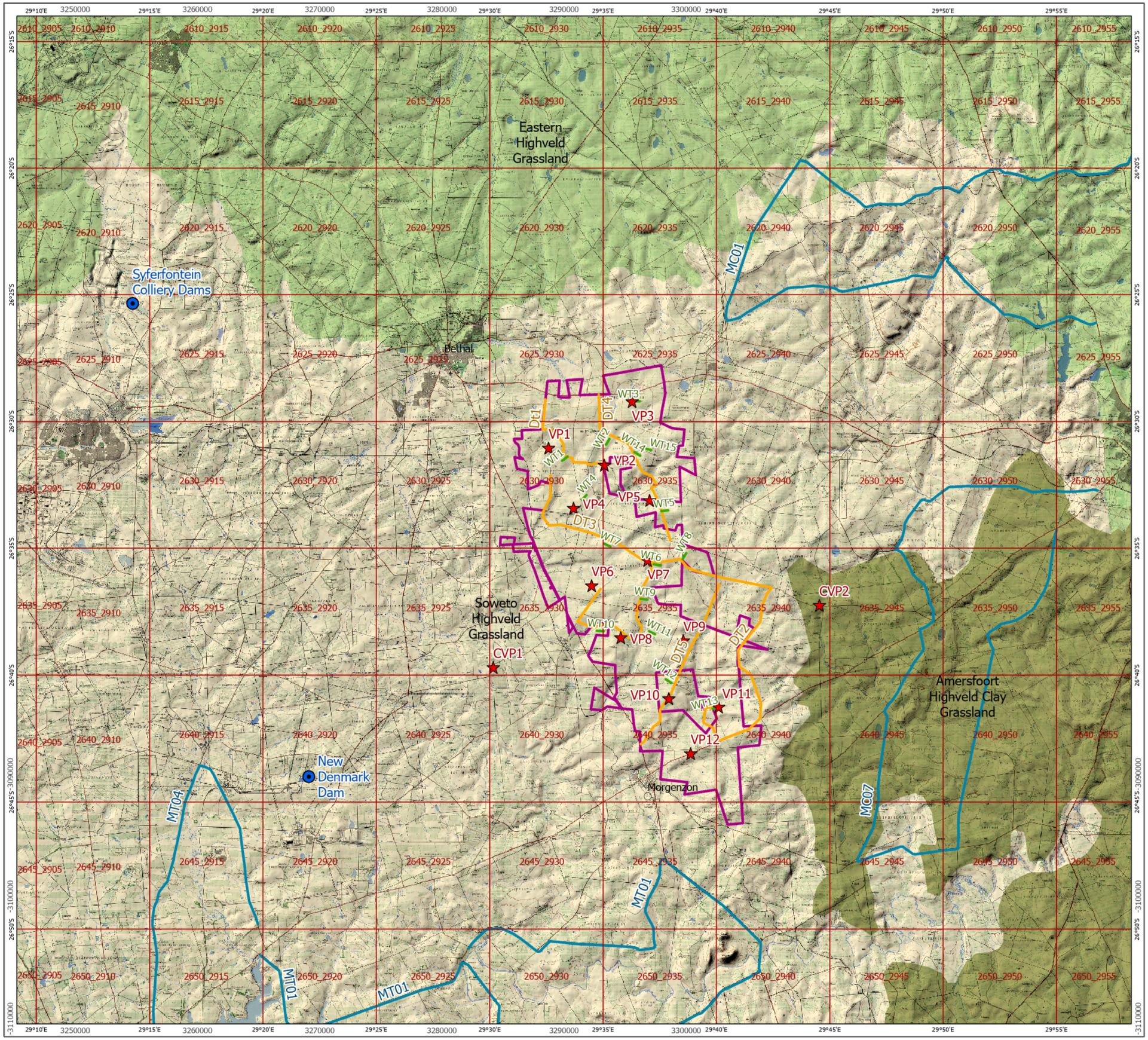
Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Snipe, African				48.7				50					
Stint, Little				5.1	50			50					
Ruff				2.6	75								
Sandpiper, Marsh				5.1	75								
Sandpiper, Wood				2.6	25			50					
Avocet, Pied				10.3	50								
Stilt, Black-winged				20.5	75			50					
Thick-knee, Spotted				74.4		33.3	100	100					
Gull, Grey-headed				5.1	25								
Tern, Whiskered				38.5		33.3		50		100		33.3	
Pigeon, Speckled				92.3	75	33.3	100	100		50	100	33.3	75
Dove, Red-eyed				97.4	25		33.3	100	50	50	100	66.7	75
Dove, Cape Turtle				94.9	75	100	100	100	100	100	100	100	100
Dove, Laughing				94.9	50	66.7	66.7	100	100	100	100	100	100
Cuckoo, Diederik				48.7			33.3	50	50	100	33.3	66.7	
Owl, Western Barn				35.9									
Swift, White-rumped				28.2	25	66.7	33.3		50	50	66.7		
Swift, Little				2.6	25						66.7		
Mousebird, Speckled				66.7							66.7		
Kingfisher, Pied				20.5							33.3		
Hoopoe, African				15.4									
Wood Hoopoe, Green				69.2							33.3		
Barbet, Black-collared				69.2							66.7	33.3	
Barbet, Crested				76.9	25							33.3	
Wryneck, Red-throated				46.2	25					50	66.7	33.3	

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Lark, Rufous-naped				2.6									
Lark, Spike-heeled				17.9	50		33.3		50	50	66.7	33.3	75
Lark, Red-capped				64.1	75	33.3	100	50	100	100	100	100	100
Swallow, Barn				56.4	50	33.3	33.3	50	100	100	66.7	66.7	25
Swallow, White-throated				61.5	50	33.3	33.3	100		50	66.7		25
Swallow, Greater Striped				74.4	50	66.7	66.7	50	50	100	66.7	66.7	25
Martin, Rock				2.6				50			33.3		
Martin, Common House				5.1									
Martin, Brown-throated				2.6		33.3					33.3	33.3	50
Martin, Banded				2.6		33.3						33.3	25
Bulbul, Dark-capped				30.8	25						66.7	33.3	
Wheatear, Mountain				56.4			33.3						
Wheatear, Capped				20.5	75							33.3	
Chat, Ant-eating				30.8	75	66.7	66.7		50	100	33.3	100	100
Stonechat, African				87.2	100	100	100	100	100	100	100	100	100
Robin-Chat, Cape				71.8			66.7				100	33.3	
Cisticola, Zitting				2.6	25	33.3	66.7	50	100	100	66.7	100	50
Cisticola, Wing-snapping				2.6	50	33.3	33.3		100	50	33.3	66.7	25
Cisticola, Pale-crowned				7.7					50	100			25
Neddicky				38.5			33.3		50				
Cisticola, Levaillant's				69.2	100	100	66.7	50	100	100	66.7	66.7	100
Prinia, Tawny-flanked				41	25		33.3						
Flycatcher, Spotted				25.6			33.3						
Flycatcher, African Paradise				2.6									
Wagtail, Cape				87.2	50	100	33.3	100	50	50	100	33.3	100

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Pipit, African				84.6	75	66.7	66.7	50	100	100	66.7	100	75
Longclaw, Cape				94.9	100	100	100	100	100	100	100	100	100
Fiscal, Southern				97.4	75	66.7	100	100	100	50	100	100	100
Myna, Common				48.7	50		66.7	100	50		100		25
Starling, Cape				84.6							33.3	33.3	25
Sparrow-Weaver, White-browed				7.7									
Sparrow, House				76.9	50	33.3	33.3	50			66.7		
Sparrow, Cape				15.4	50	100	100	100	100	100	100	100	100
Weaver, Southern Masked				87.2	75	100	100	100	100	100	100	100	100
Quelea, Red-billed				87.2	75	33.3	66.7	100	50	100		100	100
Bishop, Southern Red				74.4	75	100	100	100	100	100	100	100	100
Bishop, Yellow-crowned				56.4	25	66.7	66.7	50	100	100	66.7	66.7	25
Widowbird, White-winged				20.5			33.3		100	100		33.3	
Widowbird, Fan-tailed				46.2	25	33.3	33.3	50	100	100	33.3	33.3	25
Widowbird, Long-tailed				94.9	75	100	100	100	100	100	100	100	100
Waxbill, Common				30.8	25	66.7	33.3	50		100		66.7	
Quailfinch				5.1	25	33.3	33.3	50	100	100	100	100	75
Whydah, Pin-tailed				53.8	50	33.3	100	50		100	33.3	66.7	
Canary, Cape				51.3			33.3			100	100	33.3	50
Canary, Yellow-fronted				2.6									
Canary, Black-throated				66.7	50	100	33.3	100	100	50	100	33.3	100
Thrush, Karoo		NE		74.4							66.7		
White-eye, Cape		NE		43.6							66.7	33.3	
Sparrow, Southern Grey-headed				74.4	25	66.7	100	50	100	50	100	66.7	25
Grebe, Great Crested					25								

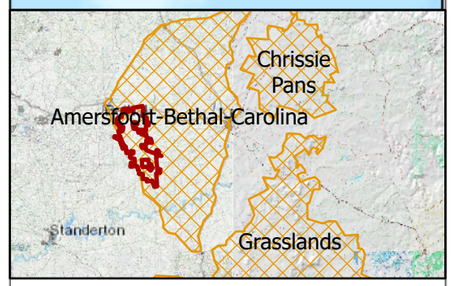
Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Egret, Great					75								25
Greenshank, Common					50	33.3							
Swift, African Palm					25								
Swallow, South African Cliff		BNE			50	66.7	33.3		50	100	33.3	33.3	25
Crow, Pied					25								
Cisticola, Cloud		NE			25	66.7	66.7	50	100	50	33.3	33.3	
Prinia, Black-chested					25	33.3	33.3	50	50		66.7	33.3	50
Bokmakierie					25		33.3				66.7	66.7	
Canary, Yellow					25	33.3	33.3	50	50	100	66.7	66.7	25
Warbler, Lesser Swamp						33.3							
Oriole, Black-headed							33.3						
Warbler, African Reed							33.3						
Starling, Pied		SLS					66.7		50				
Waxbill, Orange-breasted							33.3						
Tern, White-winged								50					
Shrike, Red-backed								50			33.3		
Finch, Red-headed								50			33.3		
Bunting, Cape								50			33.3		
Bunting, Cinnamon-breasted									50	50		33.3	
Warbler, Willow										50		33.3	
Dove, Rock										50	100	33.3	
Barbet, Acacia Pied											33.3		
Crow, Cape											33.3		25
Starling, Red-winged											33.3		
Lark, Eastern Clapper											33.3	33.3	

Species	Red Data Species (Regional, Global)	Endemic or Near-endemic	Priority Score	Reporting Rate (%)									
				2625_2930 39 cards	**2625_2935** 4 cards	**2630_2930** 3 cards	**2630_2935** 3 cards	**2635_2930** 2 cards	**2635_2935** 2 cards	**2635_2940** 2 cards	**2640_2935** 3 cards	**2640_2940** 3 cards	**2645_2940** 4 cards
Francolin, Red-winged												33.3	



ARCUS

- Project Area of Influence (PAOI)
- Pentads
- Vantage Point
- CWAC Site
- Walked Transect
- Drive Transect
- CAR Route



1:300,000 Scale @ A3

0 6 12 km

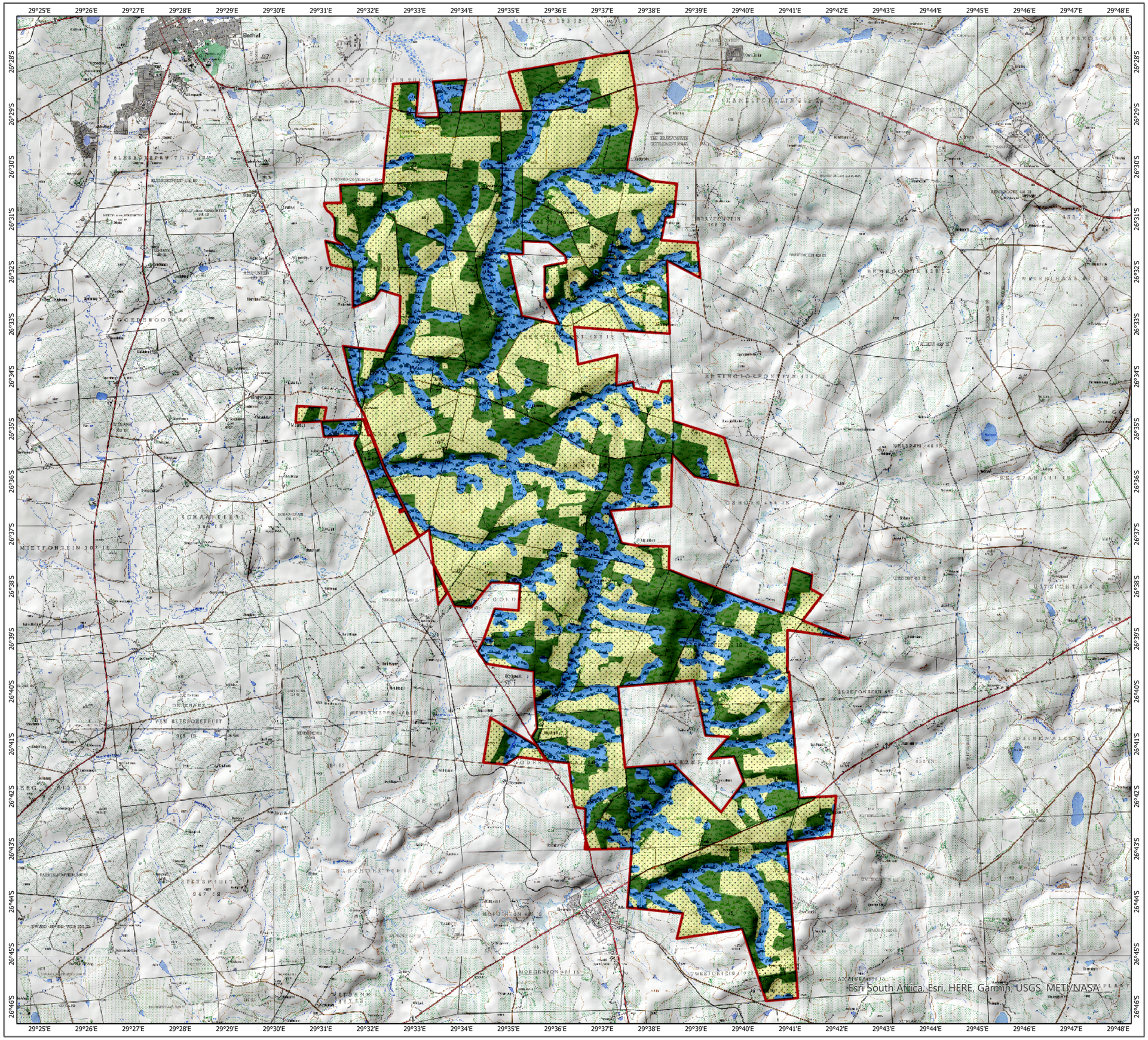
NORTH

Produced By: OD	Ref: 4307-SCR-0001
Checked By: AB	Date: 4/27/2022

Location and Vegetation
Figure 1

Ummbila Emoyeni
Avifaunal Specialist Assessment
Scoping Report

\\Uksprdgisapp01\sa-gis\Projects\4307 Ummbila Emoyeni WEF\4307 Ummbila Emoyeni WEF2.aprx\4307 - UmmE - Fig 1- Locations



ARCUS

- Project Area Of Influence (PAOI)
- Wetland and Aquatic Habitat
- Natural or Near-natural Grassland
- Agricultural Land (Highly Modified)

1:145,000 Scale @ A3

0 2.5 5 km

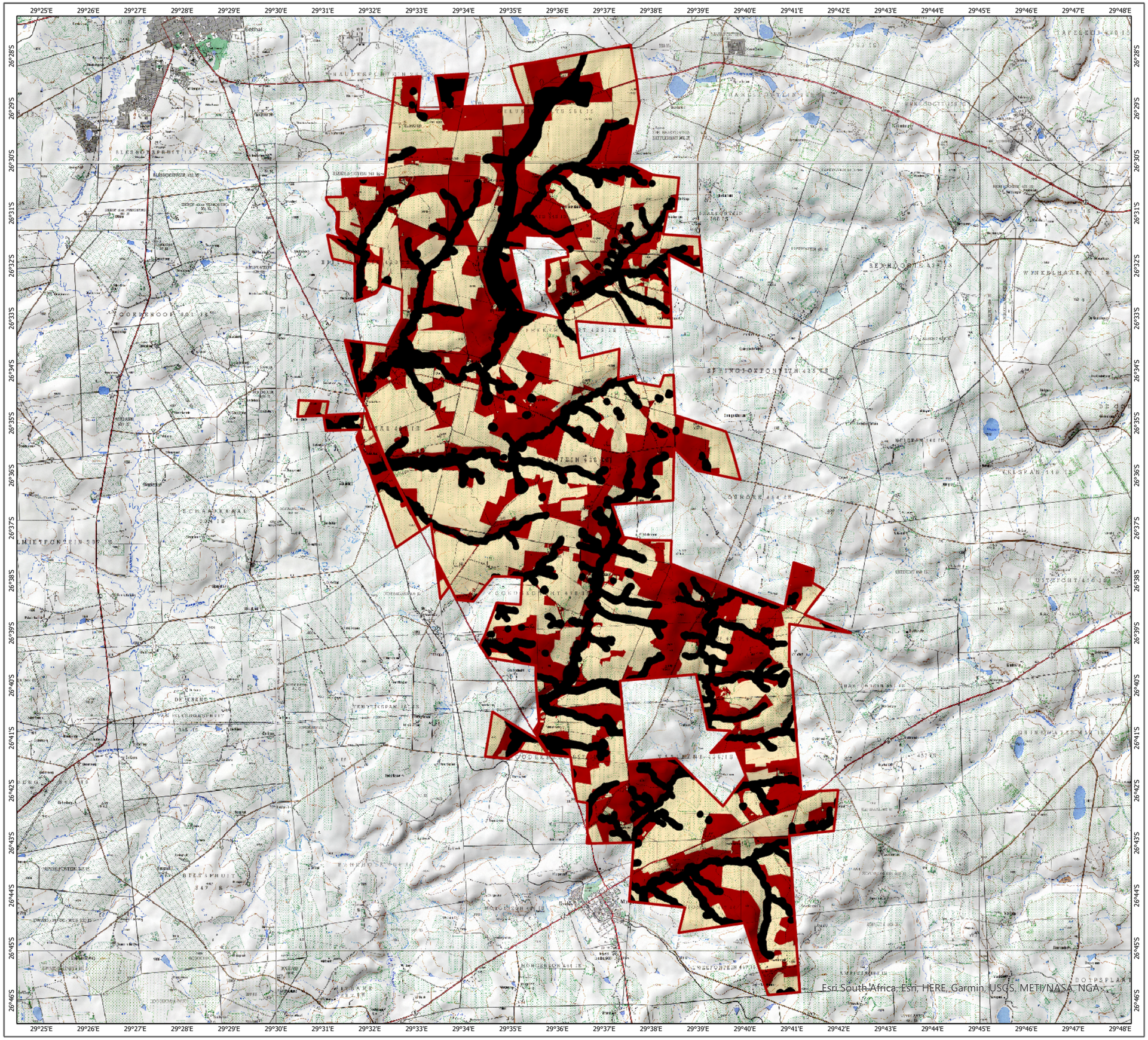
NORTH

Produced By: OD	Ref: 4307-SCR-0002
Checked By: AB	Date: 4/27/2022

Land Cover
Figure 2

Ummbila Emoyeni
Avifaunal Specialist Assessment
Scoping Report

\\Uksprdgisapp01\sa-gis\Projects\4307 Ummbila Emoyeni WEF\4307 Ummbila Emoyeni WEF2.aprx\4307 - UmmE - Fig 2 - Landcover



ARCUS

- Project Area of Influence (PAOI)
- Very High Avifaunal SEI
- High Avifaunal SEI
- Very Low Avifaunal SEI (Preferred Development Areas)

1:145,000 Scale @ A3

0 2.5 5 km

NORTH

Produced By: OD	Ref: 4307-SCR-0003
Checked By: AB	Date: 4/27/2022

Avifaunal Site Ecological Importance
Figure 4

Ummbila Emoyeni Avifaunal Specialist Assessment Scoping Report

\\Uksprdgisapp01\sa-gis\Projects\4307 Ummbila Emoyeni WEF\4307 Ummbila Emoyeni WEF2.aprx\4307 - UmmE- Fig 3 - SEI

CURRICULUM VITAE

Dr Owen Davies Pr. Sci. Nat. (Ecology)
Senior Ecologist – Avifaunal Specialist
Email:OwenD@arcusconsulting.co.za

Specialisms

- Avifaunal surveys
- Ecological surveys
- Field research
- Data analysis and assessment of ecological data

Summary of Experience

Owen is a Professional Natural Scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and obtained his doctoral degree from the Percy FitzPatrick Institute of African Ornithology, a DST-NRF Centre of Excellence at the University of Cape Town. Owen has been involved in avifaunal monitoring activities for renewable energy projects since 2013. Extensive field research has given Owen experience in the techniques required for conducting biological surveys on a variety of taxa including observations, physical trapping and identification of small terrestrial birds, raptors, bats, small mammals, rodents, snakes, reptiles, scorpions and fish. He is also qualified to conduct observations and acoustic monitoring of marine mammals in the offshore environment. Data collection in a diversity of habitats and ecosystems, combined with formal training in field skills such as off-road driving, enables Owen to conduct ecological surveys across southern Africa. In addition, his skills in data analysis and scientific writing at the PhD level enable him to produce high quality assessments and reports.

Qualifications and Professional Interests

- **University of Cape Town, Percy FitzPatrick Institute of African Ornithology, 2010 to 2015**
  PhD Zoology
- **University of Cape Town, Percy FitzPatrick Institute of African Ornithology, 2008 to 2010**
  MSc Zoology (upgraded to PhD)
- **University of Cape Town, 2007**
  BSc Zoology (Hons)
- **University of Cape Town, 2003 to 2006**
  BSc Zoology
  BSc Botany

Professional History

2019 to present - Avifaunal Specialist, Ecologist, field team leader, Arcus Consultancy Services South Africa (Pty) Ltd, Cape Town
2015 to 2017 - Ecologist, Avifaunal Field Team Leader, Arcus Consultancy Services
2014 to 2015 - Bat monitoring field assistant, Arcus Consultancy Services
2013 to 2015 - Avifaunal observer, Arcus Consultancy Services
2009 to 2013 - Research Assistant (birds) to Dr J. Fuchs (Curator of Birds at the Muséum national d'Histoire naturelle, Paris), throughout South Africa
2007 to 2013 - Research Assistant (birds) to Prof T. M. Crowe (Percy FitzPatrick Institute of African Ornithology, Department of Zoology, University of Cape Town), throughout South Africa
2011 - Research Assistant (birds) to Dr I. Little, Endangered Wildlife Trust, Uganda
2010 - Research Assistant (bats) to Asst. Prof Hassan Salata, Department of Wildlife (South Sudan), Northern Cape
2010 to 2011 - Research Assistant (small mammals) to Dr B. Smit, University of Pretoria, Northern Cape
2010 - Research Assistant to Dr H. Smit-Robinson, Birdlife SA, Western and Northern Cape

CURRICULUM VITAE

Project Experience

- Confidential WEF near Beaufort West, Western Cape Province (Avifaunal monitoring, data analysis and reporting)
- Confidential WEF near Lutzville, Western Cape Province (Ecological assessment and reporting)
- Umsinde Emoyeni WEF (Avifaunal assessment, data analysis and reporting)
- Confidential WEF near Molteno, Northern Cape Province (Avifaunal monitoring data analysis and reporting)
- Confidential Battery Energy Storage System (BESS) near De Aar, Northern Cape Province (Avifaunal assessment, Ecological Assessment, site-walkthrough and reporting)
- Confidential Grid Connection near De Aar, Northern Cape Province (Avifaunal assessment, Ecological assessment, site-walkthrough, data analysis and reporting)
- Confidential WEF near Yzerfontein, Western Cape Province (Avifaunal assessment, Ecological assessment, site-walkthrough, data analysis and reporting)
- Confidential WEF near Kuruman, Northern Cape Province (Ecological Assessment and reporting)
- Confidential WEF near Pofadder, Northern Cape Province (Avifaunal assessment and reporting)
- Confidential WEF near Nelspoort, Western Cape Province (Avifaunal assessment and reporting)
- Metsimatala Solar (Field team leader, bird observations, data analysis and reporting in collaboration with specialists)
- Kolkies WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Karee WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Gouda WEF (Field team leader, bird observations – post construction)
- Hopefield WEF (Field team leader, bird observations, data analysis and reporting in collaboration with specialists – post construction)
- Spitzkop West WEF (Bird observations, bat mast commission)
- Pofadder WEF (Bat mast commission)
- Cookhouse WEF (Bat mast commission and decommission)
- Komsberg WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Bokpoort Solar (Avifaunal assessment, bird observations, data analysis and reporting)

Publications

FJELDSÅ, J., DINESEN, L., DAVIES, O.R., IRESTEDT, M., KRABBE, N.K., HANSEN, L.A. AND BOWIE, R.C. 2021. Description of two new Cisticola species endemic to the marshes of the Kilombero floodplain of southwestern Tanzania. Ibis. https://doi.org/10.1111/ibi.12971

JUNKER, K., SPICKETT, A., DAVIES, O.R., JANSEN, R., KRASNOV, B. R. 2021. Gastrointestinal nematodes in two galliform birds from South Africa: patterns associated with host sex and age. Parasitology Research. https://doi.org/10.1007/s00436-021-07254-0

DAVIES, O.R, JUNKER, K, JANSEN, R, CROWE, T.M. & BOOMKER, J. 2008. Age- and sex-based variation in helminth infection of Helmeted Guineafowl (*Numida meleagris*) with comments on Swainson's Spurfowl (*Pternistis swainsonii*) and Orange River Francolin (*Scleroptila levaillantoides*). South African Journal of Wildlife Research 38 (2): 163-170.

JUNKER, K., DAVIES, O.R., JANSEN, R., CROWE, T.M. & BOOMKER, J. 2008. Nematodes of Swainson's Spurfowl *Pternistis swainsonii* and Orange River Francolin *Scleroptila levaillantoides* from the Free State province, South Africa, with a description of *Tetrameres swainsonii*, sp. nov. (Nematoda: Tetrameridae). Journal of Helminthology 82: 365-371.