AVIFAUNAL IMPACT ASSESSMENT

Proposed Wagt Grid Connection, near De Aar

Northern Cape Province

December 2022

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EXECUTIVE SUMMARY

Wagt Solar PV1 (Pty) is planning the construction and operation of grid connection infrastructure, to be known as the Wagt Grid Connection, consisting of an up to 132kV double circuit powerline on the Remaining Extent of the Farm Wagt en Bittje No. 5, the infrastructure will be located approximately 10km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province. The Wagt Grid Connection will connect the Wagt Solar PV1 Facility to the national grid. The Wagt Solar PV1 Facility forms part of a cluster of renewable energy facilities to be known as Pixley Park Renewable Energy Project, which will include four Solar PV Facilities (Carolus Solar PV1, Fountain Solar PV1, Riet Fountain Solar PV1, and Wagt Solar PV1).

The Grid connection infrastructure will include a 132 kV IPP Substation and a powerline with a capacity of up to 132 kV which is being assessed within a 200m wide and between 3km and 9km long corridor connecting to either the new proposed Vetlaagte MTS or the new proposed Wag-'n-Bietjie MTS, which will respectively be located on the farm Vetlaagte (RE/4) or Wagt en Bittje (RE/5).

The Vetlaagte MTS will Loop into the Hydra-Perseus 2 or Hydra-Perseus 3 line (400 kV). Substations to be located on either end of the line: Hydra and Perseus. The Wag-'n-Bietjie MTS will loop into the Hydra-Beta 1 line (400 kV). Substations to be located on either end of the line: Hydra and Beta. These sites are currently under a separate Basic Assessment process.

The grid connection corridor will consist of:

- Onsite 132kV IPP substation including the HV Step-up transformer, MV interconnection building (footprint up to 100m x 100m located within the 200m wide corridor).
- Onsite 132kV Eskom switching station - 100m x 100m and 30m height, metering, relay and control buildings, laydown area, ablutions with conservancy tanks and water storage tanks, and access roads which is handed back to Eskom (Separate EA).
- 132kV Overhead Powerline (OHPL) – 30m height from the switching station to the Main Transmission Substation (MTS) located on either Vetlaagte (RE/4) or Wag en Bittje (RE/5) farms which will be handed back to Eskom (within 300m wide corridor and a 31m wide servitude).
- Access roads to substation sites (up to 8 m wide) and service tracks (up to 6 m wide) where no existing roads are available.

AVIFAUNA

The SABAP2 data indicates that a total of 162 bird species could potentially occur within the Project Area of Impact (PAOI) and immediate surroundings – **Appendix 1** provides a comprehensive list of all bird species. Of these, 51 species are classified as powerline sensitive species (see definition of powerline sensitive species in section 4), and 11 of these are South African Red List species. Of the 51 powerline sensitive species, 33 are likely to occur regularly within the PAOI and immediate surroundings, and another 18 could occur sporadically.

POTENTIAL IMPACTS

The following impacts on powerline sensitive avifauna have been identified in the Avifauna Specialist Assessment.

Construction Phase

- Displacement due to disturbance associated with the construction of the 132kV on-site IPP substation, the 132 kV switching station, and 132kV powerline; and

- Displacement due to habitat transformation associated with the construction of the 132kV on-site IPP substation, the 132 kV switching station, and to a lesser extent the 132kV powerline.

Operational Phase

- Collisions with the 132kV powerline;
- Electrocutions within the substation yard; and
- Electrocutions of Cape Vultures on the 132kV powerline.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the 132kV IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline.

Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the 132kV IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline;
- Displacement due to habitat transformation associated with the 132kV IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline;
- Collisions with the 132kV powerline;
- Electrocutions of Cape Vultures on the 132kV powerline
- Electrocutions within the substation yard.

ENVIRONMENTAL SENSITIVITIES

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys. The following SSC were observed: Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Secretarybird *Sagittarius serpentarius* (Globally and Regionally Endangered), Cape Vulture *Gyps coprotheres* (Globally Vulnerable and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable and Regionally Endangered). Habitat for Ludwig's Bustard was also confirmed. Based on the field surveys and available data, a classification of HIGH sensitivity for avifauna in the screening tool is suggested, which requires the marking of the entire grid connection with Bird Flight Diverters.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Conduct a pre-construction inspection (avifaunal walk-through) of the final on-site substation layout and powerline alignment to identify powerline sensitive species that may be breeding within the substation area and to record the status of the eagle nests on the existing transmission powerlines. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimizing the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the activities until after the breeding season.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced.
- To avoid Cape Vulture electrocutions on the 132kV powerline, construct a double circuit OHPL using a minimum clearance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture thereby eliminating the electrocution risk.

Operational phase

- Bird Flight Diverters must be fitted to the entire powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors are strung.
- The hardware within the proposed on-site substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List powerline sensitive species are unlikely to frequent the switching station and substation and be electrocuted.
- Construction of the powerline must be undertaken using an approved bird friendly pole/tower design in accordance with the applicable Eskom standard relating to bird friendly structures. The avifaunal specialist must sign off on the final design.

De-commissioning phase

- The existing transmission lines must be inspected for active raptor nests prior to the commencement of the decommissioning activities. Should any active nests be present, decommissioning activities during the breeding season should be avoided, if possible.
- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

STATEMENT AND REASONED OPINION

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Environmental Parameter	Nature of the Impact	Rating prior to mitigation	Rating post mitigation
Avifauna	*Displacement of powerline sensitive species due to **disturbance** associated with construction of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline).*	44 MEDIUM	18 LOW
	*Displacement of powerline sensitive species due to **habitat transformation** associated with construction of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline).*	33 MEDIUM	18 LOW
	*Mortality of powerline sensitive species due to **collisions** with the Wagt Grid Connection (132kV powerline).*	56 MEDIUM	36 MEDIUM
	*Mortality of powerline sensitive species due to **electrocution** within the Wagt Grid Connection on-site substation.*	42 MEDIUM	20 LOW
	*Mortality of Cape Vultures due to **electrocution** on the 132kV Wagt Grid Connection overhead powerline.*	56 MEDIUM	20 LOW
	*Displacement of powerline sensitive species due to **disturbance** associated with decommissioning of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline.*	44 MEDIUM	18 LOW
	AVERAGE SIGNIFICANCE RATING	**46 MEDIUM**	**22 LOW**

CUMULATIVE IMPACTS

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. According to the DFFE database on renewable energy projects (DFFE 2022), there are currently at least 14 renewable energy projects authorised or in process within a 30km radius around the Pixley Park Renewable Energy Project's proposed grid connections.

The four proposed Pixley Park Renewable Energy Project grid infrastructure projects equates to a maximum combined length of 38.3km. However, large sections of the grids will be routed in the same corridor, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 11.5km. There are several hundred kilometres of existing and planned high voltage lines within the 30km radius around the Pixley Park Renewable Energy Project grid infrastructure projects. The Pixley Park Renewable Energy Project grid infrastructure projects will thus increase the total number of planned and existing high voltage lines by only a few percentage points. The cumulative impact of the planned Pixley Park Renewable Energy Project's grid connections is therefore considered to be low from a potential bird collision perspective, after mitigation. However, the combined cumulative impact of the existing and planned powerlines within a 30km radius is considered to be high.

The cumulative impact of displacement due to habitat transformation in the onsite substations associated with the renewable energy projects is considered to be low, due to the small size of the footprints, and the availability of similar habitat within the 30km radius area. The cumulative impact of potential electrocutions in the substation yards of the onsite substations is also likely to be low as it is expected to be a rare event.

NO-GO ALTERNATIVE

The no-go alternative will result in the current status quo being maintained within the proposed PAOI as far as the avifauna is concerned. The PAOI itself consists mostly of Nama Karoo scrub. The no-go option would maintain the natural habitat which would be beneficial to the avifauna currently occurring there.

CONCLUDING STATEMENT

The expected impacts of the Wagt Grid Connection (132kV IPP substation, the 132 kV switching station, and 132kV overhead powerline) were rated to be of MEDIUM significance and negative status pre-mitigation. However, with appropriate mitigation, the overall post-mitigation significance of the identified impacts should be reduced to LOW negative (see Table above). All the proposed line route alternatives are deemed to be acceptable from an avifaunal impact perspective. No fatal flaws were discovered during the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 9 of the report) and the EMPr (Appendix 4) are strictly implemented.

CONTENTS

DETAILS OF THE SPECIALIST AND EXPERTISE TO COMPILE A SPECIALIST REPORT

Chris van Rooyen (Avifaunal Specialist)

Chris has 26 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous powerline and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Avifaunal and GIS Specialist)

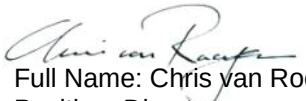
Albert has an M. Sc. in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Megan Loftie-Eaton (Ecologist and Avifaunal Specialist)

Megan is a registered Professional Natural Scientist with the South African Council of Natural Scientific Professionals (SACNASP) in the field of Ecology, and she is a member of the Zoological Society of Southern Africa (ZSSA). Megan is also an Environmental Assessment Practitioner and assists with Environmental Impact Assessments (EIA's), Basic Assessments (BA's) and provides specialist input within the avifaunal and ecological fields. She obtained her BSc in Environmental & Conservation Sciences with distinction through the University of Alberta in Edmonton, Canada. After moving back to South Africa in 2011 she went on to complete her MSc in Zoology (2014) at the University of Cape Town, and her PhD in Biological Sciences (2018), looking at the impacts of bush encroachment on bird distributions in the savanna biome of South Africa. Megan has conducted avifaunal field surveys and has experience with conducting avifaunal impact assessments.

SPECIALIST DECLARATION

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Savannah Environmental was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Basic Assessment for the proposed Wagt Grid Connection project.



Full Name: Chris van Rooyen
Position: Director

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		Clause	Section in Report
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Pg.8
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Pg.8
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Pg.8
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 2
	(cA)	An indication of the quality and age of base data used for the specialist report;	Section 3
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	Section 3
	(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 6 - 9
	(g)	An indication of any areas to be avoided, including buffers;	Not applicable
	(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Not applicable
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Sections 9 and 10
	(k)	Any mitigation measures for inclusion in the EMPr;	Section 9
	(l)	Any conditions for inclusion in the environmental authorization;	Section 9 Appendix 4
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Not applicable
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Sections 9 -10

		(iA) regarding the acceptability of the proposed activity or activities; and	Sections 9 -10
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	No comments received
	(q)	Any other information requested by the authority.	Not applicable
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

1 INTRODUCTION

Wagt Solar PV1 (Pty) is planning the construction and operation of grid connection infrastructure, to be known as the Wagt Grid Connection, consisting of an up to 132kV double circuit powerline on Remaining Extent of the Farm Wagt en Bittje No. 5, the infrastructure will be located approximately 10km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province (**Figure 1**). The Wagt Grid Connection will connect the Wagt Solar PV1 Facility to the national grid. The Wagt Solar PV1 Facility forms part of a cluster of renewable energy facilities to be known as Pixley Park Renewable Energy Project, which will include four Solar PV Facilities (Carolus Solar PV1, Fountain Solar PV1, Riet Fountain Solar PV1, and Wagt Solar PV1).

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- Access roads to substation sites (up to 8 m wide) and service tracks (up to 6 m wide) where no existing roads are available.

Mulilo has a number of other wind and solar PV developments in the area around De Aar (in various phases of development, from feasibility studies to operational projects). Mulilo has acquired a great deal of experience regarding site conditions, community and specialist engagement. Mulilo has used this experience to ensure all the required studies are conducted and permits are obtained in a manner that ensures successful execution of these projects. Mulilo hopes to build on this experience with the development of Wagt Solar PV1.

Regarding site desirability, various specialist studies have already been conducted that indicate site conditions favourable to the development of a solar PV facility. De Aar also has excellent solar resources when compared to most other regions in South Africa.

By developing this cluster of PV projects, Mulilo will be able to potentially share infrastructure between the different PV facilities. This will result in lower tariffs for each of the individual projects. The lower tariffs will result in cost savings to both Eskom and electricity consumers in South Africa.

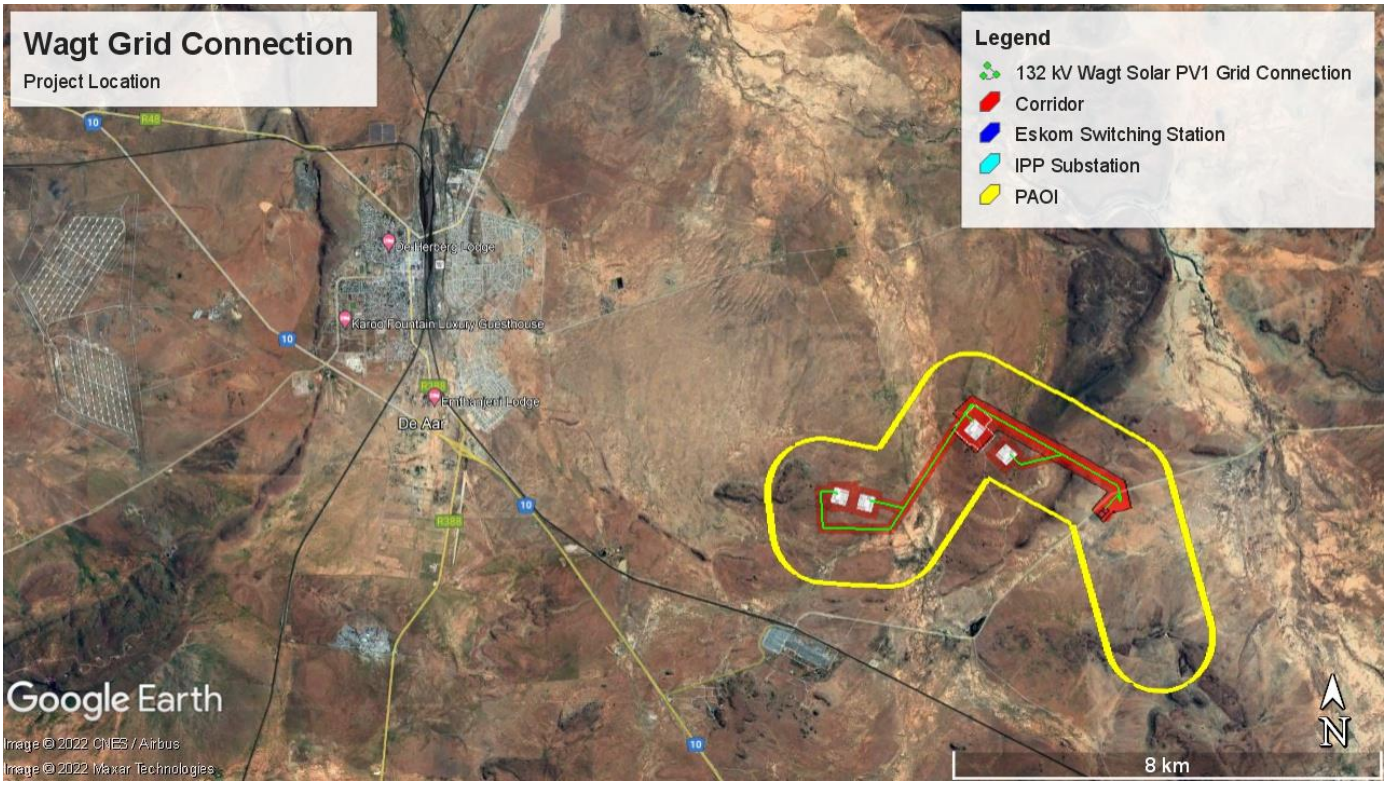

Figure 1: Locality map indicating the location of the Wagt Grid Connection project area of impact (PAOI) near De Aar, Northern Cape Province.

2 PROJECT SCOPE

The terms of reference for this assessment report are as follows:

- Conduct a site sensitivity verification (**Appendix 3**) using a desktop analysis of species occurrence data originating from pre-construction monitoring, conducted at the proposed Pixley Park Solar PV Renewable Energy Project, in addition to secondary avifaunal datasets (detailed below).
- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations.
- List and describe the expected impacts associated with the proposed 132kV on-site switching and substation and the 132kV powerline grid connection.
- Perform an assessment of the potential impacts; and
- Recommend mitigation measures to reduce the significance of the expected impacts.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

- The Project Area of Impact (PAOI) was defined as a 1km zone around the proposed 132kV on-site switching and substation, and 132kV powerline grid connection.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, to ascertain which species occur within the Broader Area i.e., within a block consisting of 9 pentad grid cells within which the proposed PAOI is situated (**Figure 2**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 20 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 29 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- A classification of the vegetation types in the PAOI was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all powerline sensitive species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all powerline sensitive species was determined by consulting the latest (2022.1) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2022) was used in order to view the Broader Area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the PAOI relative to National Protected Areas, National Protected Areas Expansion Strategy (NPEAS) focus areas and Critical Biodiversity Areas in the Northern Cape Province.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the PAOI (July 2022).
- Guidelines for the Implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020) were used to assist with the interpretation of the relevant protocol as prescribed in the Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA (Gazetted October 2020).
- The main source of information on the avifaunal diversity and abundance at the PAOI came from the integrated pre-construction monitoring programme implemented at the Pixley Park Renewable Energy PAOI, covering the 4 proposed Pixley Park Renewable Energy Project's development areas (Survey 01 was conducted from 03 to 05 February 2022 and Survey 02 from 04 to 08 April 2022).The pre-construction avifaunal monitoring programme followed an adapted Regime 2 protocol as defined in the Solar Guidelines (Jenkins *et al.* 2017) which require a minimum of two surveys over a six month period. The surveys also covered the grid connection PAOI.

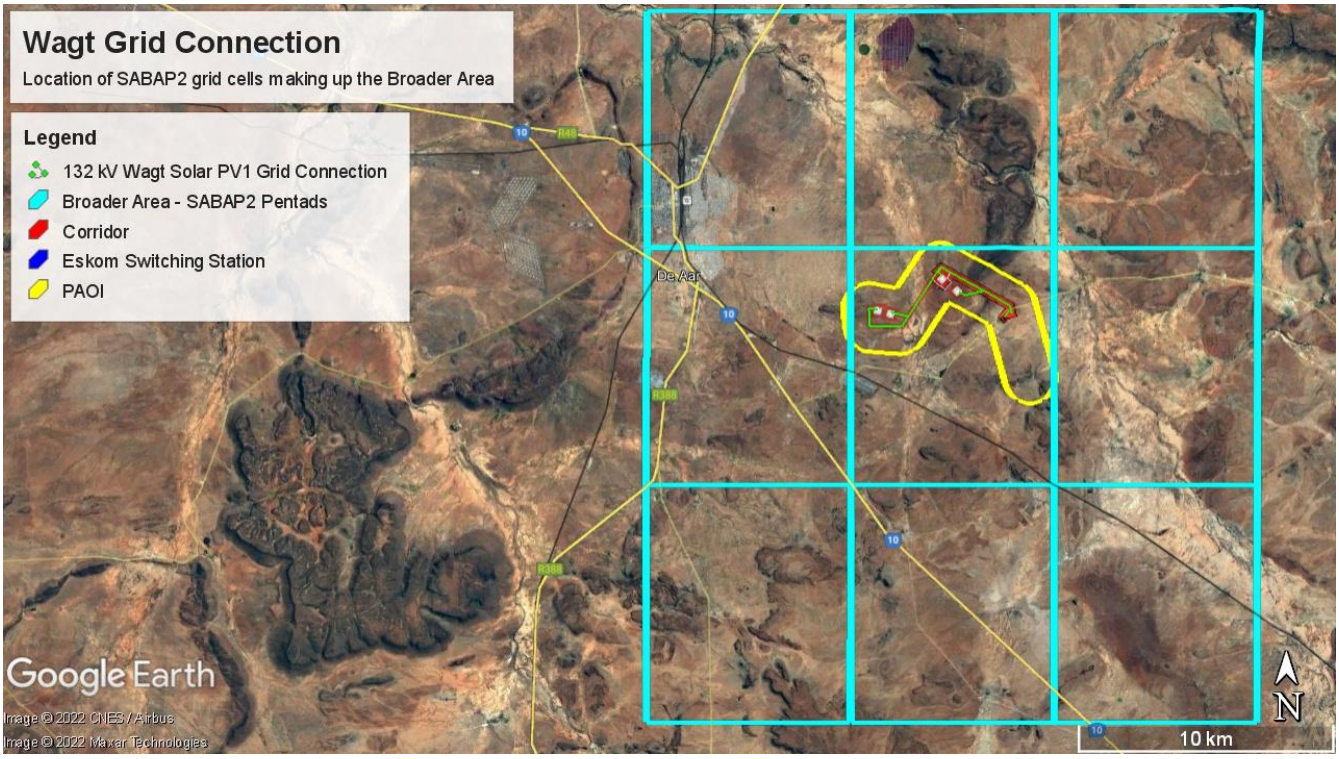

Figure 2: Location of the nine (9) Southern African Bird Atlas Project 2 (SABAP2) pentad grid cells that were considered for the proposed Wagt Grid Connection project.

4 ASSUMPTIONS AND LIMITATIONS

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- The focus of this assessment is primarily on the potential impacts of the proposed Wagt Grid Connection on powerline sensitive species. Powerline sensitive species are defined as species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Powerline sensitive species were further subdivided into raptors, waterbirds and terrestrial birds.
- The assessment of impacts is based on the baseline environment as it currently exists in the PAOI.
- Cumulative impacts include all WEF and SEF (PV) projects with grid connections for which information could be sourced in the public domain, within a 30km radius that currently have open applications or have been approved by the Competent Authority as per the 2022 database from the Department of Forest Fisheries and Environment (DFFE). An intensive internet search was conducted to source information on the grid connections of the abovementioned projects, but in some instances no information could be obtained.
- The **Broader Area** is defined as the area covered by the nine (9) SABAP2 pentads where the PAOI is located (see **Figure 2** above). The **PAOI** is defined as a 1km zone around the proposed 132kV on-site substation and 132kV powerline grid connection.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.

LEGISLATIVE CONTEXT

4.1 Agreements and conventions

Table 1 below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna[1].

Table 1: Agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

4.2 National legislation

4.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

  (i) prevent pollution and ecological degradation;

  (ii) promote conservation; and

[1] (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-08-27).

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

5.2.2 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species was published on 30 October 2020. This protocol applies also for the assessment of impacts caused by powerlines and substations on avifauna.

5.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

5.2.4 The National Environmental Management: Protected Areas Act 57 of 2003

The National Environmental Management: Protected Areas Act (No. 57 of 2003), as amended in 2014, provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. The Act also provides for the establishment of a national register of all national, provincial and local protected areas that are managed in accordance with national norms and standards; and to endure intergovernmental co-operation and public consultation in matters concerning protected areas. Protected areas are declared in order to regulate the area as a buffer zone for protection of a special nature reserve, world heritage site or nature reserve; to enable owners of land to take collective action to conserve biodiversity on their land and to seek legal recognition therefor; to protect the area if the area is sensitive to development due to its- (i) biological diversity; (ii) natural characteristics; (iii) scientific, cultural, historical, archaeological or geological value; (iv) scenic and landscape value; or (v) provision of environmental goods and services; to protect a specific ecosystem outside of a special nature reserve, world heritage site or nature reserve; to ensure that the use of natural resources in the area is sustainable. This Act explicitly states that no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority.

5.2.5 The National Environmental Management Act 107 of 1998 (NEMA) Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal and Avifaunal Species

This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on terrestrial animal and/or avifaunal species for activities requiring environmental authorisation. This protocol replaces the requirements of Appendix 4 of the Environmental Impact Assessment Regulations. The assessment and reporting requirements of this protocol are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool) for terrestrial animal species. The relevant terrestrial animal species data in the screening tool has been provided by the South African National Biodiversity Institute (SANBI).

4.3 Provincial Legislation

5.3.1 Northern Cape Nature Conservation Act No 9 of 2009

The current legislation applicable to the conservation of fauna and flora in the Northern Cape is the Northern Cape Nature Conservation Act No 9 of 2009. It provides for the sustainable utilisation of wild animals, aquatic biota and plants; the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; describes offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; provides for the issuing of permits and other authorisations; and provides for matters connected therewith.

5 BASELINE ASSESSMENT

5.1 DFFE National Screening Tool

The PAOI and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (**Figure 3**). The High and Medium sensitivity classifications are linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, and Tawny Eagle *Aquila rapax*. The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys. The following SSC were observed: Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Secretarybird *Sagittarius serpentarius* (Globally and Regionally Endangered), Cape Vulture *Gyps coprotheres* (Globally Vulnerable and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable and Regionally Endangered). Habitat for Ludwig's Bustard was also confirmed.

Based on the available SABAP2 data and the Site Sensitivity Verification (Appendix 3) survey conducted on 21 April 2022 and subsequent surveys, the classification of **High** sensitivity for avifauna in the screening tool is suggested for the whole PAOI.

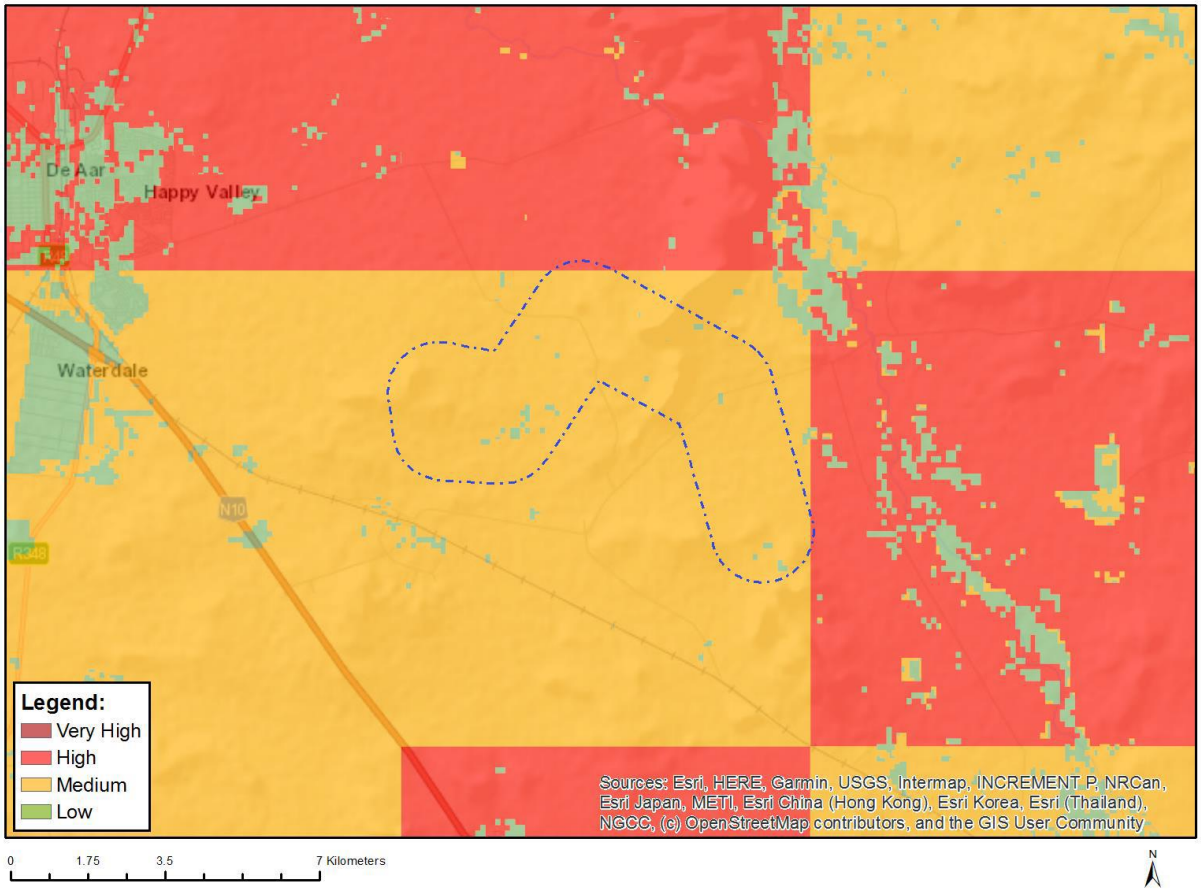

Figure 3: The National Web-Based Environmental Screening Tool map of the Project Area of Impact (PAOI), indicating sensitivities for the Terrestrial Animal Species theme. The High and Medium sensitivity classifications are linked to Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, and Tawny Eagle *Aquila rapax*.

5.2 Protected Areas

South Africa's protected area network currently falls far short of representing all ecosystems and maintaining ecological processes. In this context, the goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for improved ecosystem representation, ecological sustainability, and resilience to climate change. It sets protected area targets, maps priority areas for protected area expansion, and makes recommendations on mechanisms to achieve this (National Protected Area Expansion Strategy 2016).

The PAOI does not fall within a protected area or a National Protected Areas Expansion Strategy (NPAES) focus area.

5.3 Important Bird Areas

The PAOI falls within the Platberg-Karoo Conservancy Important Bird Area (Marnewick *et al.* 2015). The Platberg–Karoo Conservancy IBA covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. The ephemeral Brak River flows in an arc from south-east to north-west, eventually feeding into the Orange River basin. Other ephemeral rivers include the Hondeblaf, Seekoei, Elandsfontein and Ongers rivers with a network of tributaries. Vanderkloof Dam is on the north-eastern boundary (Marnewick *et al.* 2015). This IBA is in the Nama Karoo and Grassland Biomes. The eastern Nama Karoo has the highest rainfall of all the Nama Karoo vegetation types and is thus ecotonal to grassland, with a complex mix of grass- and shrub-dominated vegetation types (Marnewick et al. 2015).

The land is used primarily for livestock grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. Less than 5% of this IBA is cultivated under dry-land or irrigated conditions and includes lucerne and prickly pear *Opuntia ficus-indica* orchards (Marnewick et al. 2015).

This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane *Anthropoides paradiseus*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*, Blue Korhaan *Eupodotis caerulescens*, Black Stork *Ciconia nigra*, Secretarybird *Sagittarius serpentarius*, Martial Eagle *Polemaetus bellicosus*, Verreauxs' Eagle *Aquila verreauxii* and Tawny Eagle *Aquila rapax*.

A total of 289 bird species are known to occur in the IBA. IBA trigger species that could potentially occur in the PAOI are the following:

- Blue Crane (Globally Vulnerable, Regionally Near-threatened)
- Blue Korhaan (Globally Near-threatened)
- Martial Eagle (Globally and regionally Endangered)
- Verreaux's Eagle (Regionally Vulnerable)
- Ludwig's Bustard (Globally and Regionally Endangered)
- Secretarybird (Globally Endangered, Regionally Vulnerable.

5.4 Biomes and Vegetation Types

The PAOI is situated on a vast grassy Karoo plain, with its centre approximately 14 km south-east of the town of De Aar in the Northern Cape Province. The PAOI falls within the Nama Karoo Biome, in the Upper Karoo Bioregion, with some patches that are classified as Dry Highveld Grassland Bioregion (Mucina & Rutherford 2006).

The habitat in the PAOI is highly homogenous and consist of extensive plains with low shrubs and a prominent grassy component. Mucina & Rutherford (2006) classify the vegetation in the PAOI as Northern Upper Karoo on the plains, with Besemkaree Koppies Shrubland on the ridges. Northern Upper Karoo consist of shrubland dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains, as is the case currently in the PAOI). Besemkaree Koppies Shrubland consist of two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs (Mucina & Rutherford). There is one prominent drainage line north of the PAOI.

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. Using this classification system, the natural vegetation in the PAOI is classified as Grassy Karoo, a sub-category of the Nama Karoo biome. Grassy Karoo can be viewed as a transitional zone between the Nama Karoo and grassland biomes, although also primarily a dwarf shrub habitat, it shows a higher proportion of grass cover (Harrison *et al*. 1997).

The De Aar has a semi-arid climate with hot summers and cold winters. The average temperature during summer is 24.3 °C (January) and 9.1 °C during winter (June) (SA Atlas of Climatology and Agrohydrology, Schulze, 2009). The average annual precipitation is about 280 mm, with most rainfall occurring during summer and autumn. De Aar experiences frost during the winter with 25.4 frost days per year on average (SA Atlas of Climatology and Agrohydrology, Schulze, 2009).

The priority species most likely associated with the various bird habitat features are listed in **Table 2, Section 6**.

5.5 Bird Habitats

See **Appendix 2** for photographic records of habitat features in the PAOI and immediate surroundings.

5.5.1 Nama Karoo Shrubland

The main vegetation type within the development areas consists of Nama Karoo shrubland with a strong grassy component.

5.5.2 Drainage Lines and Wetlands

There is a large riverine and wetland system to the north and east of the PAOI. This habitat feature is most likely very important feeding, breeding, and nesting habitat for several priority and non-priority species, especially waterbirds. It should be noted that this riverine system falls outside of the PAOI.

5.5.3 Water Reservoirs and Dams

Surface water is of specific importance to avifauna in this arid area. The PAOI contains man-made dams (earthen dams) and water reservoirs. Boreholes with open water troughs are important sources of surface water for priority avifauna for drinking and bathing.

5.5.4 Alien Trees

The PAOI is generally devoid of trees, except for isolated clumps of trees at boreholes, where a mixture of alien and indigenous trees is growing. The trees could attract a variety of bird species for the purposes of nesting and roosting.

5.5.5 High Voltage Lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the Karoo (Jenkins *et al*. 2013). There are several existing high voltage lines that bisect the PAOI. There is increasing evidence that vultures are using high voltage lines in the Karoo (personal observation), mostly in the non-breeding season (January to March), and that they could be encountered anywhere in the Broader Area.

5.5.6 Rocky Ridges

The PAOI contains a prominent ridge (koppie) known as Rietfontein in the south-east of the PAOI, which rises to a height of 1352 m/asl. There is also a prominent ridgeline in the north-west of the PAOI (Wachteenbeetje 1466 m/asl). There are a number of other ridges in the Broader Area too. Ridges provide important habitat for several bird species, especially certain raptors, who use these areas for foraging.

6 AVIFAUNA IN THE PAOI

7.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 162 bird species could potentially occur within the PAOI and immediate surroundings – **Appendix 1** provides a comprehensive list of all species. Of these, 51 species are classified as powerline sensitive species (see definition of powerline sensitive species in section 4), and 11 of these are South African Red List species. Of the 51 powerline sensitive species, 33 are likely to occur regularly within the PAOI and immediate surroundings, and another 18 could occur sporadically.

Table 2 below lists all the powerline sensitive species and the possible impact on the respective species by the proposed Wagt Grid Connection project. The following abbreviations and acronyms are used:

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened

- H = High
- M = Medium
- L = Low

Table 2: Powerline sensitive species potentially occurring within the PAOI and immediate surroundings.

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Karoo shrub	Drainage lines and wetlands	Water reservoirs and dams	High voltage lines	Alien trees	Rocky ridges	Displacement: Disturbance (breeding)	Displacement: Habitat transformation	Electrocution: Substations	Electrocution: 132kV OHL	Collisions: 132kV OHL
		Full protocol	Ad hoc protocol															
African Black Duck	*Anas sparsa*	5,00	0,00	-	-		L		x	x								x
African Harrier-Hawk	*Polyboroides typus*	5,00	3,45	-	-	x	L		x			x			x	x		
African Sacred Ibis	*Threskiornis aethiopicus*	55,00	3,45	-	-		H		x	x								x
Amur Falcon	*Falco amurensis*	15,00	6,90	-	-	x	M	x			x	x	x		x	x		
Black Stork	*Ciconia nigra*	10,00	0,00	-	VU		M		x	x			x					x
Black-chested Snake Eagle	*Circaetus pectoralis*	5,00	0,00	-	-		M	x			x	x			x	x		x
Black-headed Heron	*Ardea melanocephala*	20,00	0,00	-	-		M		x	x		x			x	x		
Black-winged Kite	*Elanus caeruleus*	10,00	0,00	-	-		M	x			x	x	x		x	x		
Blue Crane	*Grus paradisea*	45,00	6,90	VU	NT		H	x	x					x	x			x
Blue Korhaan	*Eupodotis caerulescens*	15,00	6,90	NT	LC		M	x						x	x			x
Booted Eagle	*Hieraaetus pennatus*	15,00	3,45	-	-	x	M	x			x	x	x		x	x		
Cape Shoveler	*Spatula smithii*	5,00	0,00	-	-		L		x	x								x
Cape Teal	*Anas capensis*	15,00	0,00	-	-		M		x	x								x
Cape Vulture	*Gyps coprotheres*	5,00	0,00	EN	EN	x	M	x		x	x		x		x	x	x	x
Common Buzzard	*Buteo buteo*	10,00	6,90	-	-		M		x	x					x	x		
Common Moorhen	*Gallinula chloropus*	25,00	0,00	-	-		M		x	x								x
Egyptian Goose	*Alopochen aegyptiaca*	60,00	13,79	-	-	x	H					x			x	x		x
Gabar Goshawk	*Micronisus gabar*	5,00	0,00	-	-		L					x	x			x		
Glossy Ibis	*Plegadis falcinellus*	30,00	0,00	-	-		M		x	x								x
Greater Flamingo	*Phoenicopterus roseus*	15,00	0,00	-	NT		L		x									x
Greater Kestrel	*Falco rupicoloides*	10,00	17,24	-	-	x	M	x					x	x	x	x		
Grey Heron	*Ardea cinerea*	20,00	0,00	-	-		M		x	x								x
Hadada Ibis	*Bostrychia hagedash*	65,00	0,00	-	-		H		x	x		x				x		x

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Karoo shrub	Drainage lines and wetlands	Water reservoirs and dams	High voltage lines	Alien trees	Rocky ridges	Displacement: Disturbance (breeding)	Displacement: Habitat transformation	Electrocution: Substations	Electrocution: 132kV OHL	Collisions: 132kV OHL
		Full protocol	Ad hoc protocol															
Hamerkop	*Scopus umbretta*	5,00	0,00	-	-		L		x	x						x		x
Helmeted Guineafowl	*Numida meleagris*	55,00	3,45	-	-	x	H	x						x	x	x		x
Jackal Buzzard	*Buteo rufofuscus*	10,00	10,34	-	-	x	H	x				x	x	x	x	x		
Karoo Korhaan	*Eupodotis vigorsii*	5,00	0,00	-	NT		L	x						x	x			x
Lanner Falcon	*Falco biarmicus*	10,00	3,45	-	VU	x	M					x	x	x	x	x		
Lesser Kestrel	*Falco naumanni*	55,00	6,90	-	-	x	H	x				x	x		x	x		x
Little Egret	*Egretta garzetta*	5,00	0,00	-	-		L		x	x								x
Little Grebe	*Tachybaptus ruficollis*	5,00	0,00	-	-		L		x	x								x
Ludwig's Bustard	*Neotis ludwigii*	25,00	0,00	EN	EN		M	x						x	x			x
Martial Eagle	*Polemaetus bellicosus*	5,00	3,45	EN	EN	x	M	x			x	x			x	x		x
Northern Black Korhaan	*Afrotis afraoides*	75,00	6,90	-	-	x	H	x						x	x			x
Pale Chanting Goshawk	*Melierax canorus*	50,00	13,79	-	-	x	H		x	x				x	x	x		
Pied Crow	*Corvus albus*	95,00	34,48	-	-	x	H	x			x	x	x	x	x	x		
Red-billed Teal	*Anas erythrorhyncha*	10,00	0,00	-	-	x	L		x	x								x
Red-knobbed Coot	*Fulica cristata*	10,00	0,00	-	-		L		x	x								x
Rock Kestrel	*Falco rupicolus*	20,00	3,45	-	-		M	x				x	x	x	x	x		
Secretarybird	*Sagittarius serpentarius*	5,00	10,34	EN	VU	x	M	x						x	x	x		x
South African Shelduck	*Tadorna cana*	30,00	6,90	-	-		H		x	x								x
Spotted Eagle-Owl	*Bubo africanus*	5,00	0,00	-	-		M		x			x	x	x	x	x		x
Spur-winged Goose	*Plectropterus gambensis*	35,00	3,45	-	-	x	M		x	x					x	x		x
Tawny Eagle	*Aquila rapax*	5,00	3,45	VU	EN	x	L		x	x					x	x		x
Verreaux's Eagle	*Aquila verreauxii*	0,00	3,45	-	VU		L	x			x		x		x	x		x
Western Cattle Egret	*Bubulcus ibis*	5,00	0,00	-	-		L			x						x		x
White Stork	*Ciconia ciconia*	5,00	0,00	-	-		L		x	x								x
White-breasted Cormorant	*Phalacrocorax lucidus*	5,00	0,00	-	-		L		x	x								x

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Karoo shrub	Drainage lines and wetlands	Water reservoirs and dams	High voltage lines	Alien trees	Rocky ridges	Displacement: Disturbance (breeding)	Displacement: Habitat transformation	Electrocution: Substations	Electrocution: 132kV OHL	Collisions: 132kV OHL
		Full protocol	Ad hoc protocol															
White-faced Whistling Duck	*Dendrocygna viduata*	5,00	0,00	-	-		L		x	x								x
White-necked Raven	*Corvus albicollis*	5,00	0,00	-	-		L	x			x	x	x		x	x		
Yellow-billed Duck	*Anas undulata*	20,00	3,45	-	-	x	M		x	x								x

7.4 On-site surveys

Pre-construction avifaunal surveys were undertaken at the Pixley Park Solar PV development areas and the PAOI during the following time envelopes:

- 03 to 05 February 2022 (Survey 1)
- 04 to 08 April 2022 (Survey 2)

Surveys were conducted according to an adapted Regime 2 site as defined in the Solar Guidelines (Jenkins *et al.* 2017) i.e., a minimum of two surveys conducted over 6 months.

The development areas where the site surveys were conducted largely overlap with the Wagt Grid Connection PAOI and contain identical habitat.

7 IMPACT ASSESSMENT

8.1 General

Negative impacts on avifauna by electricity infrastructure generally take two (2) main forms, namely electrocution and collisions (Ledger & Annegarn, 1981; Ledger 1983; Ledger, 1984; Hobbs and Ledger, 1986a; Hobbs & Ledger, 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn, 1996; Kruger & Van Rooyen, 1998; Van Rooyen, 1998; Kruger, 1999; Van Rooyen, 1999; Van Rooyen, 2000; Van Rooyen, 2004; Jenkins *et al*., 2010). Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure and other associated infrastructure is another impact that could potentially impact on avifauna.

The following potential impacts have been identified:

8.1.1 Construction Phase

- Displacement due to disturbance associated with the construction of the 132kV on-site IPP substation, the 132 kV switching station, and 132kV powerline; and
- Displacement due to habitat transformation associated with the construction of the 132kV on-site substation, associated infrastructure and to a lesser extent the 132kV powerline.

8.1.2 Operational Phase

- Collisions with the 132kV powerline;
- Electrocutions within the substation yard; and
- Electrocutions of Cape Vultures on the 132kV powerline

8.1.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the 132kV on-site IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline.

8.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the 132kV on-site IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline;
- Displacement due to habitat transformation associated with the 132kV on-site IPP substation, the 132 kV switching station, associated infrastructure and 132kV powerline;
- Collisions with the 132kV powerline;
- Electrocutions within the substation yard; and
- Electrocutions of Cape Vultures on the 132kV powerline.

8.2 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. Relevant to the proposed 132kV OHPL, the significance of the electrocution impact on the majority of priority species will be low.

The only priority species capable of bridging the clearance distances of the proposed powerline infrastructure is the Cape Vulture recorded in the study area, due to their size and gregarious nature. SABAP2 data suggests that the species is unlikely to occur regularly in the study area, however their presence was confirmed during site visits to the study area. Pastoral activities feature prevalently, so their sporadic occurrence cannot be ruled out. The only envisaged high risk scenario would be when a carcass becomes available within a few hundred metres of the proposed powerline, attracting vultures which may cluster on a few towers. Both technological alternatives i.e., the steel lattice and standard steel monopole tower structures pose an electrocution risk to this SCC.

The only mitigation option is the construction of the double circuit design using a minimum clearance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture thereby eliminating the electrocution risk.

Electrocutions within the proposed switching station and on-site substation is possible, however the likelihood of this impact on the more sensitive Red List priority species is remote, as these species are unlikely to regularly utilise the infrastructure within the switching station for perching or roosting. Species that are more vulnerable to this impact are medium-sized raptors, corvids, owls and certain species of waterbirds. The powerline sensitive species which are potentially vulnerable to this impact are listed in **Table 2**, and below:

- African Harrier-Hawk
- Amur Falcon
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Booted Eagle
- Cape Vulture
- Common Buzzard
- Egyptian Goose
- Gabar Goshawk
- Greater Kestrel
- Hadada Ibis
- Hamerkop
- Helmeted Guineafowl
- Jackal Buzzard
- Lanner Falcon
- Lesser Kestrel
- Martial Eagle
- Pale Chanting Goshawk
- Pied Crow
- Rock Kestrel
- Secretarybird
- Spotted Eagle-Owl
- Spur-winged Goose
- Tawny Eagle
- Verreaux's Eagle

- Western Cattle Egret
- White-necked Raven

8.3 Collisions

Collisions are the biggest threat posed by high voltage powerlines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with high voltage powerlines (Van Rooyen 2004, Anderson 2001). In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by powerlines is complex and problems are often localised. While any bird flying near a powerline is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to powerlines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Powerlines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with powerlines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of powerline design and siting also play a big part in collision risk. Grouping similar powerlines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on powerlines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to powerline collisions in South Africa (**Figure 4**).

Powerline collisions are generally accepted as a key threat to bustards (Jenkins & Smallie 2009; Raab *et al*. 2011; Barrientos *et al*. 2012, Shaw 2013). Carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with powerlines (Shaw 2013).

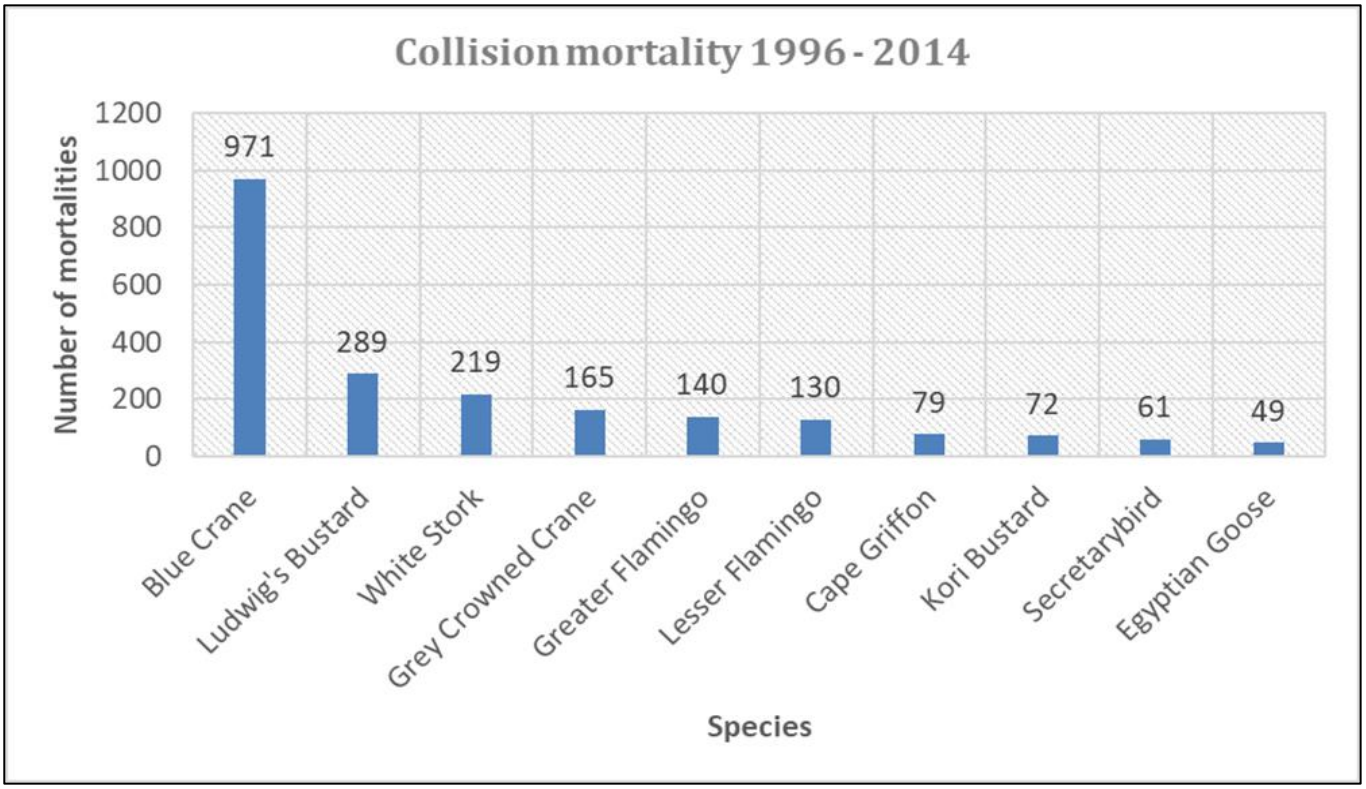

Figure 4: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data).

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and powerline configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as powerlines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with powerlines i.e. Kori Bustards *Ardeotis kori*, Blue Cranes and White Storks *Ciconia ciconia*. In all species, the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the

effective mitigation of collisions with human artefacts including wind turbines and powerlines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to powerline collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al*. 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al*. 2011; Jenkins *et al*. 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al*. 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al*. (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al*. 2010).

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

The powerline sensitive species which are potentially vulnerable to this impact are listed in Table 2, and below:

- African Black Duck
- African Sacred Ibis
- Black Stork
- Black-chested Snake Eagle
- Blue Crane
- Blue Korhaan
- Cape Shoveler
- Cape Teal
- Cape Vulture
- Common Moorhen
- Egyptian Goose
- Glossy Ibis
- Greater Flamingo
- Grey Heron
- Hadada Ibis
- Hamerkop
- Helmeted Guineafowl
- Karoo Korhaan

- Lesser Kestrel
- Little Egret
- Little Grebe
- Ludwig's Bustard
- Martial Eagle
- Northern Black Korhaan
- Red-billed Teal
- Red-knobbed Coot
- Secretarybird
- South African Shelduck
- Spotted Eagle-Owl
- Spur-winged Goose
- Tawny Eagle
- Verreaux's Eagle
- Western Cattle Egret
- White Stork
- White-breasted Cormorant
- White-faced Whistling Duck
- Yellow-billed Duck

8.4 Displacement due to habitat destruction and disturbance

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. The construction activities will constitute the following:

- Site clearance and preparation;
- Excavations for infrastructure;
- Construction of the infrastructure (i.e., the 132kV on-site substation and witching station, and 132kV powerline); and
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.

These activities could impact on birds breeding, foraging, and roosting in or in close proximity of the proposed 132kV on-site substation, switching station, and 132kV powerline through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the 132kV overhead powerline, the direct habitat transformation is limited to the pole/tower footprints and the narrow access road/track under the powerline. The habitat in the PAOI is highly uniform from a bird impact perspective. The loss of habitat is a relatively small quantity of the habitat for powerline sensitive species due to direct habitat transformation associated with the construction of the proposed Wagt Grid Connection is likely to be fairly minimal.

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle. Terrestrial species and the raptors breeding on the existing powerline infrastructure are most likely to be affected by displacement due to disturbance.

The powerline sensitive species which are potentially vulnerable to this impact are listed in **Table 2**, and below:

- African Harrier-Hawk
- Amur Falcon
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Blue Crane
- Blue Korhaan
- Booted Eagle
- Cape Vulture
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Helmeted Guineafowl
- Jackal Buzzard
- Karoo Korhaan
- Lanner Falcon
- Lesser Kestrel
- Ludwig's Bustard
- Martial Eagle
- Northern Black Korhaan
- Pale Chanting Goshawk
- Pied Crow
- Rock Kestrel
- Secretarybird
- Spotted Eagle-Owl
- Spur-winged Goose
- Tawny Eagle
- Verreaux's Eagle
- White-necked Raven

8 IMPACT RATING

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

8.1 Determination of Significance of Impacts

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

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

- The extent, wherein it is indicated whether the impact will be
    - 1 = site only
    - 2 = local

- 3 = regional
- 4 = national
- 5 = international

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

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

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

- The significance, which is determined through a synthesis of the characteristics described above and is assessed as low, medium or high
- The status, which is described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

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

S = (E+D+M)P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

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

8.2 Impact Assessment

The impact assessments are summarised in the tables below.

9.2.1 Construction Phase

Nature: *Displacement of powerline sensitive species due to* ***disturbance*** *associated with construction of the Wagt Grid Connection 132kV on-site substation and 132kV overhead powerline.*		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	1 very short	1 very short
Magnitude	8 high	6 moderate
Probability	4 highly probable	2 improbable
Significance	**44 MEDIUM**	**18 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • Conduct a pre-construction inspection (avifaunal walk-through) of the final on-site substation layout and powerline alignment to identify powerline sensitive species that may be breeding within the substation area and to record the status of the eagle nests on the existing transmission powerlines. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the activities until after the breeding season. • Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.		
Residual Risks: The residual risk of displacement will be reduced to a low level after mitigation, if the proposed mitigation measures are implemented.		

Nature: *Displacement of powerline sensitive species due to* ***habitat transformation*** *associated with construction of the Wagt Grid Connection 132kV on-site substation and 132kV overhead powerline.*		
	Without mitigation	**With mitigation**
Extent	1 site only	1 site only
Duration	4 long term	4 long term
Magnitude	6 moderate	4 low
Probability	3 probable	2 improbable
Significance	**33 MEDIUM**	**18 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	To a limited extent	
Mitigation: • Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the biodiversity specialist must be strictly enforced.		
Residual Risks: The residual risk of displacement will be further reduced after mitigation.		

9.2.2 Operational Phase

Nature: *Mortality of powerline sensitive species due to* ***collisions*** *with the Wagt Grid Connection 132kV powerline*		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	8 high	6 moderate
Probability	4 highly probable	3 improbable
Significance	**56 MEDIUM**	**36 MEDIUM**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • Bird Flight Diverters must be fitted to the entire powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors are strung.		
Residual Risks: There will be an ongoing residual risk of collisions with the grid connection powerline, but mitigation should make a marked difference.		

Nature: *Mortality of powerline sensitive species due to* ***electrocution*** *within the Wagt Grid Connection on-site substations*		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	8 high	4 low
Probability	3 possible	2 improbable
Significance	**42 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • The hardware within the proposed on-site substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List powerline sensitive species are unlikely to frequent the switching station and substation and be electrocuted.		
Residual Risks: The residual risk of electrocution will be low once mitigation is implemented.		

Nature: *Mortality of Cape Vultures due to* ***electrocution*** *on the 132kV Wagt Grid Connection overhead powerline*		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	8 high	4 low
Probability	4 highly probable	2 improbable
Significance	**56 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • The only mitigation option is the construction of the double circuit design using a minimum clearance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture thereby eliminating the electrocution risk.		
Residual Risks: The residual risk of electrocution will be low once mitigation is implemented.		

9.2.3 Decommissioning Phase

Nature: *Displacement of powerline sensitive species due to* ***disturbance*** *associated with decommissioning of the Wagt Grid Connection 132kV on-site substation and 132kV overhead powerline.*		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	1 very short	1 very short
Magnitude	8 high	6 moderate
Probability	4 highly probable	2 improbable
Significance	**44 MEDIUM**	**18 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • The existing transmission lines must be inspected for active raptor nests prior to the commencement of the decommissioning activities. Should any active nests be present, decommissioning activities during the breeding season should be avoided, if possible. • Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.		
Residual Risks: The residual risk of displacement will be reduced to a low level after mitigation, if the proposed mitigation is implemented.		

The impacts are summarized, and a comparison made between pre-and post-mitigation phases as shown in **Table 3** below. The rating of environmental issues associated with different parameters prior to, and post mitigation of a proposed activity was averaged.

Table 3: Comparison of summarised impacts on environmental parameters

Environmental Parameter	Nature of the Impact	Rating prior to mitigation	Rating post mitigation
Avifauna	*Displacement of powerline sensitive species due to* ***disturbance*** *associated with construction of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline).*	44 MEDIUM	18 LOW
	Displacement of powerline sensitive species due to ***habitat transformation*** *associated with construction of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline).*	33 MEDIUM	18 LOW
	Mortality of powerline sensitive species due to ***collisions*** *with the Wagt Grid Connection (132kV powerline).*	56 MEDIUM	36 MEDIUM
	Mortality of powerline sensitive species due to ***electrocution*** *within the Wagt Grid Connection on-site substation.*	42 MEDIUM	20 LOW
	Mortality of Cape Vultures due to ***electrocution*** *on the 132kV Wagt Grid Connection overhead powerline.*	56 MEDIUM	20 LOW

Environmental Parameter	Nature of the Impact	Rating prior to mitigation	Rating post mitigation
	*Displacement of powerline sensitive species due to **disturbance** associated with decommissioning of the Wagt Grid Connection (132kV on-site substation and 132kV overhead powerline.*	44 MEDIUM	18 LOW
	AVERAGE SIGNIFICANCE RATING	**46 MEDIUM**	**22 LOW**

8.3 Cumulative Impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section addresses whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment
- Unacceptable increase in impact

According to the DFFE database on renewable energy projects (DFFE 2022), there are currently at least 14 renewable energy projects authorised or in process within a 30km radius around the Pixley Park Renewable Energy Project's proposed grid connections (**Figure 5**).

The four proposed Pixley Park Renewable Energy Project grid infrastructure projects equates to a maximum combined length of 38.3km. However, large sections of the grids will be routed in the same corridor, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 11.5km. There are several hundred kilometres of existing and planned high voltage lines within the 30km radius around the Pixley Park Renewable Energy Project grid infrastructure projects. The Pixley Park Renewable Energy Project grid infrastructure projects will thus increase the total number of planned and existing high voltage lines by only a few percentage points. The cumulative impact of the planned Pixley Park Renewable Energy Project's grid connections is therefore considered to be low from a potential bird collision perspective, after mitigation. However, the combined cumulative impact of the existing and planned powerlines within a 30km radius is considered to be high.

The cumulative impact of displacement due to habitat transformation in the onsite substations associated with the renewable energy projects is considered to be low, due to the small size of the footprints, and the availability of similar habitat within the 30km radius area. The cumulative impact of potential electrocutions in the substation yards of the onsite substations is also likely to be low as it is expected to be a rare event.

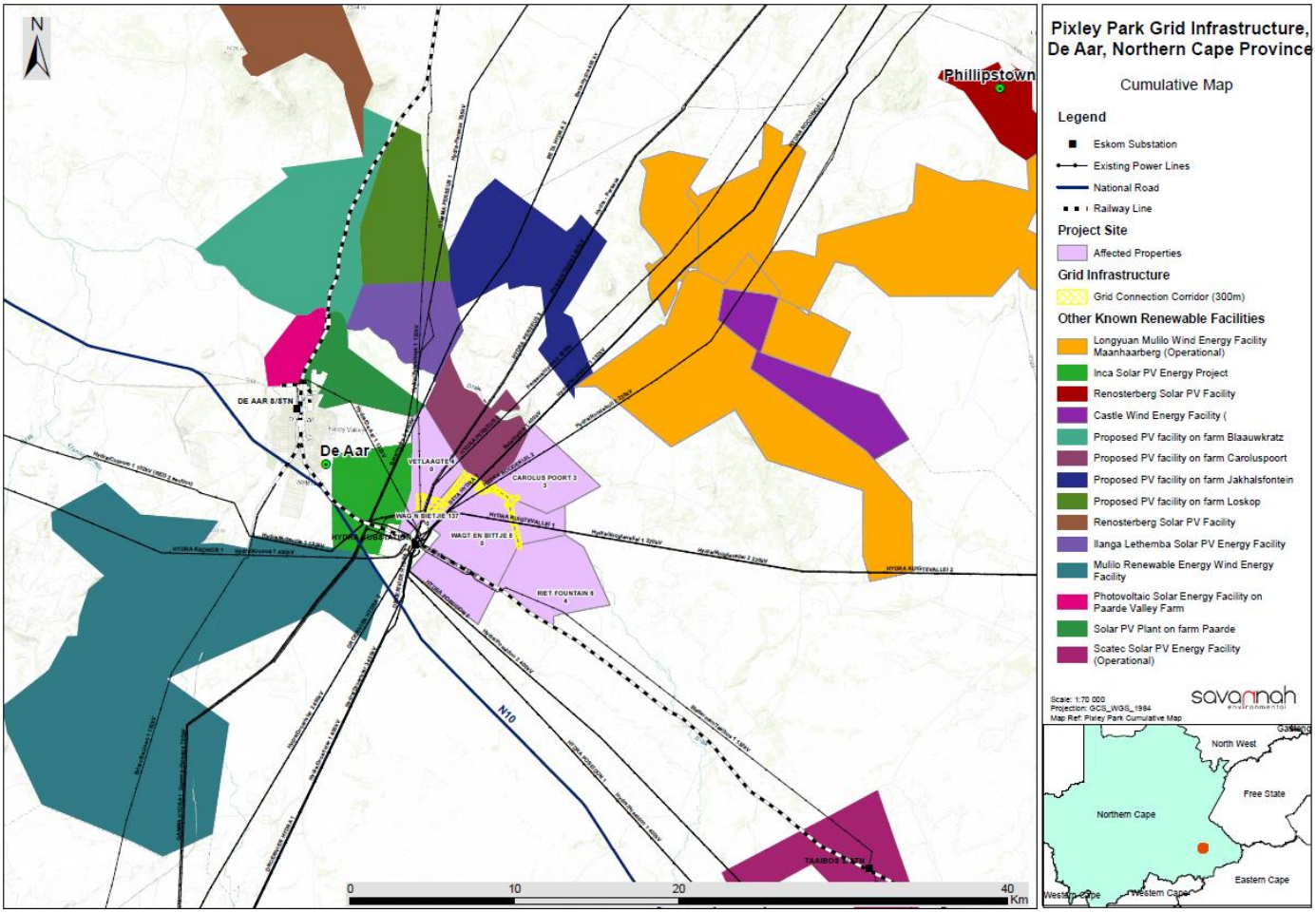

Figure 5: Cumulative Impacts Map of the Pixley Park Grid Infrastructure.

The tables below summarise the post-mitigation cumulative impacts associated with the proposed development.

Nature: *Displacement of priority avifauna due to disturbance due to the construction of the 132kV powerline and on-site substation*		
	Cumulative impact of the proposed Pixley Park Grid Infrastructure within a 30km radius (post mitigation).	**Cumulative impact of the proposed Pixley Park Grid Infrastructure and other planned and existing powerlines and substations within a 30km radius (post mitigation)**
Extent	2 local	3 regional
Duration	1 very short	2 short term
Magnitude	4 low	6 moderate
Probability	2 improbable	4 highly probable
Significance	**14 LOW**	**44 MEDIUM**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • Conduct a pre-construction inspection (avifaunal walk-through) of the final on-site substation layout and powerline alignment to identify powerline sensitive species that may be breeding within the substation and to record the status of the eagle nests on the existing transmission powerlines. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the activities until after the breeding season. • Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.		

Nature: *Displacement of priority avifauna due to habitat transformation due to the construction of the 132kV powerline and on-site substation*		
	Cumulative impact of the proposed Pixley Park Grid Infrastructure within a 30km radius (post mitigation).	**Cumulative impact of the proposed Pixley Park Grid Infrastructure and other planned and existing powerlines and substations within a 30km radius (post mitigation)**
Extent	1 site only	3 regional
Duration	4 long term	4 long term
Magnitude	2 minor	4 low
Probability	2 improbable	3 probable
Significance	**14 LOW**	**33 MEDIUM**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, but only to some extent	
Confidence in findings: Medium.		
Mitigation: • Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the biodiversity specialist must be strictly enforced.		

Nature: *Collision mortality of priority avifauna due to the construction of the 132kV powerline.*		
	Cumulative impact of the proposed Pixley Park Grid Infrastructure within a 30km radius (post mitigation).	**Cumulative impact of the proposed Pixley Park Grid Infrastructure and other planned and existing powerlines and substations within a 30km radius (post mitigation)**
Extent	2 local	3 regional
Duration	4 long term	4 long term
Magnitude	4 low	6 moderate
Probability	2 improbable	3 probable
Significance	**20 LOW**	**39 MEDIUM**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • Bird Flight Diverters must be fitted to the entire powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors are strung.		

Nature: *Electrocution of priority avifauna due to the construction of the on-site substations*		
	Cumulative impact of the proposed Pixley Park Grid Infrastructure within a 30km radius (post mitigation).	**Cumulative impact of the proposed Pixley Park Grid Infrastructure and other planned and existing powerlines and substations within a 30km radius (post mitigation)**
Extent	2 local	3 regional
Duration	4 long term	4 long term
Magnitude	2 minor	4 low
Probability	2 improbable	2 improbable
Significance	**16 LOW**	**22 LOW**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • The hardware within the proposed on-site substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List powerline sensitive species are unlikely to frequent the switching station and substation and be electrocuted		

Nature: *Electrocution of Cape Vultures on the 132kV Overhead Powerline*		
	Cumulative impact of the proposed Pixley Park Grid Infrastructure within a 30km radius (post mitigation).	**Cumulative impact of the proposed Pixley Park Grid Infrastructure and other planned and existing powerlines and substations within a 30km radius (post mitigation)**
Extent	2 local	3 regional
Duration	4 long term	4 long term
Magnitude	2 minor	4 low
Probability	2 improbable	2 improbable
Significance	**16 LOW**	**22 LOW**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • The only mitigation option is the construction of the double circuit design using a minimum clearance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture thereby eliminating the electrocution risk.		

8.4 No-Go Alternative

The no-go alternative will result in the current status quo being maintained within the proposed PAOI as far as the avifauna is concerned. The PAOI itself consists mostly of Nama Karoo grassy shrubland. The no-go option would result in no additional impacts on priority avifauna which would be beneficial to the avifauna currently occurring in the area.

8.5 Environmental sensitivities

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys. The following SSC were observed: Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Secretarybird *Sagittarius serpentarius* (Globally and Regionally Endangered), Cape Vulture *Gyps coprotheres* (Globally Vulnerable and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable and Regionally Endangered). Habitat for Ludwig's Bustard was also confirmed. Based on the field surveys and available data, a classification of HIGH sensitivity for avifauna in the screening tool is suggested, which requires the marking of the entire grid connection with Bird Flight Diverters.

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

Refer to **Appendix 4** for a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

11. FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

10.1 Statement and Reasoned Opinion

The expected impacts of the Wagt Grid Connection (132kV IPP substation, the 132 kV switching station, and 132kV overhead powerline) were rated to be of MEDIUM significance and negative status pre-mitigation. However, with appropriate mitigation, the overall post-mitigation significance of the identified impacts should be reduced to LOW negative (see **Table 3, Section 8** above). All the proposed line route alternatives are deemed to be acceptable from an avifaunal impact perspective. No fatal flaws were discovered during the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (**Section 9** of the report) and the EMPr (**Appendix 4**) are strictly implemented.

10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in the Environmental Management Programme (EMPr) attached as **Appendix 4**.

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APPENDIX 1: SABAP 2 SPECIES LIST FOR THE PAOI AND SURROUNDINGS

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status
		Full protocol	Ad hoc protocol		
Acacia Pied Barbet	*Tricholaema leucomelas*	55	10,34	-	-
African Black Duck	*Anas sparsa*	5,00	0,00	-	-
African Harrier-Hawk	*Polyboroides typus*	5,00	3,45	-	-
African Hoopoe	*Upupa africana*	25	0,00	-	-
African Pipit	*Anthus cinnamomeus*	70	13,79	-	-
African Red-eyed Bulbul	*Pycnonotus nigricans*	60	3,45	-	-
African Reed Warbler	*Acrocephalus baeticatus*	30	3,45	-	-
African Rock Pipit	*Anthus crenatus*	0	3,45	NT	NT
African Sacred Ibis	*Threskiornis aethiopicus*	55,00	3,45	-	-
African Stonechat	*Saxicola torquatus*	35	6,90	-	-
Amur Falcon	*Falco amurensis*	15,00	6,90	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	75	34,48	-	-
Barn Swallow	*Hirundo rustica*	65	17,24	-	-
Black Crake	*Zapornia flavirostra*	5	0,00	-	-
Black Stork	*Ciconia nigra*	10,00	0,00	-	VU
Black-chested Prinia	*Prinia flavicans*	5	3,45	-	-
Black-chested Snake Eagle	*Circaetus pectoralis*	5,00	0,00	-	-
Black-headed Heron	*Ardea melanocephala*	20,00	0,00	-	-
Blacksmith Lapwing	*Vanellus armatus*	55	3,45	-	-
Black-throated Canary	*Crithagra atrogularis*	20	3,45	-	-
Black-winged Kite	*Elanus caeruleus*	10,00	0,00	-	-
Black-winged Stilt	*Himantopus himantopus*	35	6,90	-	-
Blue Crane	*Grus paradisea*	45,00	6,90	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	15,00	6,90	NT	LC
Bokmakierie	*Telophorus zeylonus*	60	6,90	-	-
Booted Eagle	*Hieraaetus pennatus*	15,00	3,45	-	-
Brown-throated Martin	*Riparia paludicola*	10	0,00	-	-
Cape Bunting	*Emberiza capensis*	10	0,00	-	-
Cape Robin-Chat	*Cossypha caffra*	50	0,00	-	-
Cape Shoveler	*Spatula smithii*	5,00	0,00	-	-
Cape Sparrow	*Passer melanurus*	100	24,14	-	-
Cape Starling	*Lamprotornis nitens*	10	3,45	-	-
Cape Teal	*Anas capensis*	15,00	0,00	-	-
Cape Turtle Dove	*Streptopelia capicola*	75	17,24	-	-
Cape Vulture	*Gyps coprotheres*	5,00	0,00	EN	EN
Cape Wagtail	*Motacilla capensis*	60	3,45	-	-
Cape Weaver	*Ploceus capensis*	5	3,45	-	-
Cape White-eye	*Zosterops virens*	20	0,00	-	-
Capped Wheatear	*Oenanthe pileata*	50	6,90	-	-
Chat Flycatcher	*Melaenornis infuscatus*	15	13,79	-	-
Chestnut-vented Warbler	*Curruca subcoerulea*	10	0,00	-	-
Cinnamon-breasted Bunting	*Emberiza tahapisi*	0	3,45	-	-
Cloud Cisticola	*Cisticola textrix*	0	0,00	-	-
Common Greenshank	*Tringa nebularia*	15	0,00	-	-
Common Buzzard	*Buteo buteo*	10,00	6,90	-	-
Common Ostrich	*Struthio camelus*	10	0,00	-	-
Common Quail	*Coturnix coturnix*	0	3,45	-	-
Common Sandpiper	*Actitis hypoleucos*	0	3,45	-	-
Common Starling	*Sturnus vulgaris*	25	0,00	-	-

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status
		Full protocol	Ad hoc protocol		
Common Swift	*Apus apus*	5	0,00	-	-
Common Waxbill	*Estrilda astrild*	15	0,00	-	-
Crowned Lapwing	*Vanellus coronatus*	15	3,45	-	-
Curlew Sandpiper	*Calidris ferruginea*	5	0,00	NT	LC
Desert Cisticola	*Cisticola aridulus*	40	6,90	-	-
Diederik Cuckoo	*Chrysococcyx caprius*	25	3,45	-	-
Dusky Sunbird	*Cinnyris fuscus*	5	0,00	-	-
Eastern Clapper Lark	*Mirafra fasciolata*	65	13,79	-	-
Common Moorhen	*Gallinula chloropus*	25,00	0,00	-	-
European Bee-eater	*Merops apiaster*	45	13,79	-	-
Familiar Chat	*Oenanthe familiaris*	55	20,69	-	-
Fiscal Flycatcher	*Melaenornis silens*	15	6,90	-	-
Egyptian Goose	*Alopochen aegyptiaca*	60,00	13,79	-	-
Gabar Goshawk	*Micronisus gabar*	5,00	0,00	-	-
Glossy Ibis	*Plegadis falcinellus*	30,00	0,00	-	-
Greater Flamingo	*Phoenicopterus roseus*	15,00	0,00	-	NT
Greater Striped Swallow	*Cecropis cucullata*	60	3,45	-	-
Greater Kestrel	*Falco rupicoloides*	10,00	17,24	-	-
Grey Tit	*Melaniparus afer*	5	0,00	-	-
Grey-backed Cisticola	*Cisticola subruficapilla*	30	3,45	-	-
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	20	3,45	-	-
Grey-headed Gull	*Chroicocephalus cirrocephalus*	5	0,00	-	-
Grey-winged Francolin	*Scleroptila afra*	5	3,45	-	-
Grey Heron	*Ardea cinerea*	20,00	0,00	-	-
Hadada Ibis	*Bostrychia hagedash*	65,00	0,00	-	-
Hamerkop	*Scopus umbretta*	5,00	0,00	-	-
House Sparrow	*Passer domesticus*	35	13,79	-	-
Helmeted Guineafowl	*Numida meleagris*	55,00	3,45	-	-
Kalahari Scrub Robin	*Cercotrichas paena*	5	0,00	-	-
Karoo Chat	*Emarginata schlegelii*	10	0,00	-	-
Jackal Buzzard	*Buteo rufofuscus*	10,00	10,34	-	-
Karoo Lark	*Calendulauda albescens*	10	0,00	-	-
Karoo Long-billed Lark	*Certhilauda subcoronata*	10	6,90	-	-
Karoo Prinia	*Prinia maculosa*	25	3,45	-	-
Karoo Scrub Robin	*Cercotrichas coryphoeus*	70	13,79	-	-
Karoo Thrush	*Turdus smithi*	50	3,45	-	-
Kittlitz's Plover	*Charadrius pecuarius*	10	0,00	-	-
Karoo Korhaan	*Eupodotis vigorsii*	5,00	0,00	-	NT
Large-billed Lark	*Galerida magnirostris*	30	13,79	-	-
Lark-like Bunting	*Emberiza impetuani*	25	6,90	-	-
Laughing Dove	*Spilopelia senegalensis*	70	6,90	-	-
Layard's Warbler	*Curruca layardi*	5	0,00	-	-
Lanner Falcon	*Falco biarmicus*	10,00	3,45	-	VU
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	15	0,00	-	-
Levaillant's Cisticola	*Cisticola tinniens*	10	3,45	-	-
Lesser Kestrel	*Falco naumanni*	55,00	6,90	-	-
Little Egret	*Egretta garzetta*	5,00	0,00	-	-
Little Stint	*Calidris minuta*	10	0,00	-	-
Little Swift	*Apus affinis*	50	3,45	-	-
Little Grebe	*Tachybaptus ruficollis*	5,00	0,00	-	-
Malachite Kingfisher	*Corythornis cristatus*	5	0,00	-	-
Ludwig's Bustard	*Neotis ludwigii*	25,00	0,00	EN	EN

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status
		Full protocol	Ad hoc protocol		
Melodious Lark	*Mirafra cheniana*	0	0,00	-	-
Mountain Wheatear	*Myrmecocichla monticola*	15	6,90	-	-
Namaqua Dove	*Oena capensis*	20	3,45	-	-
Namaqua Sandgrouse	*Pterocles namaqua*	5	0,00	-	-
Nicholson's Pipit	*Anthus nicholsoni*	5	0,00	-	-
Martial Eagle	*Polemaetus bellicosus*	5,00	3,45	EN	EN
Orange River White-eye	*Zosterops pallidus*	20	3,45	-	-
Northern Black Korhaan	*Afrotis afraoides*	75,00	6,90	-	-
Pale-winged Starling	*Onychognathus nabouroup*	20	0,00	-	-
Pied Avocet	*Recurvirostra avosetta*	20	0,00	-	-
Pale Chanting Goshawk	*Melierax canorus*	50,00	13,79	-	-
Pied Starling	*Lamprotornis bicolor*	40	6,90	-	-
Pink-billed Lark	*Spizocorys conirostris*	5	0,00	-	-
Pin-tailed Whydah	*Vidua macroura*	15	0,00	-	-
Quailfinch	*Ortygospiza atricollis*	0	3,45	-	-
Red-billed Quelea	*Quelea quelea*	25	3,45	-	-
Pied Crow	*Corvus albus*	95,00	34,48	-	-
Red-eyed Dove	*Streptopelia semitorquata*	35	3,45	-	-
Red-faced Mousebird	*Urocolius indicus*	30	0,00	-	-
Red-headed Finch	*Amadina erythrocephala*	20	3,45	-	-
Red-billed Teal	*Anas erythrorhyncha*	10,00	0,00	-	-
Rock Dove	*Columba livia*	15	0,00	-	-
Red-knobbed Coot	*Fulica cristata*	10,00	0,00	-	-
Rock Martin	*Ptyonoprogne fuligula*	35	10,34	-	-
Ruff	*Calidris pugnax*	15	0,00	-	-
Rufous-eared Warbler	*Malcorus pectoralis*	90	17,24	-	-
Sabota Lark	*Calendulauda sabota*	50	6,90	-	-
Rock Kestrel	*Falco rupicolus*	20,00	3,45	-	-
Short-toed Rock Thrush	*Monticola brevipes*	0	3,45	-	-
Sickle-winged Chat	*Emarginata sinuata*	10	6,90	-	-
South African Cliff Swallow	*Petrochelidon spilodera*	40	0,00	-	-
Secretarybird	*Sagittarius serpentarius*	5,00	10,34	EN	VU
Southern Fiscal	*Lanius collaris*	70	10,34	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	15	3,45	-	-
Southern Masked Weaver	*Ploceus velatus*	90	13,79	-	-
Southern Red Bishop	*Euplectes orix*	50	10,34	-	-
Speckled Pigeon	*Columba guinea*	60	13,79	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	70	10,34	-	-
South African Shelduck	*Tadorna cana*	30,00	6,90	-	-
Spotted Flycatcher	*Muscicapa striata*	15	0,00	-	-
Spotted Thick-knee	*Burhinus capensis*	10	0,00	-	-
Spotted Eagle-Owl	*Bubo africanus*	5,00	0,00	-	-
Spur-winged Goose	*Plectropterus gambensis*	35,00	3,45	-	-
Three-banded Plover	*Charadrius tricollaris*	45	6,90	-	-
Tawny Eagle	*Aquila rapax*	5,00	3,45	VU	EN
Wattled Starling	*Creatophora cinerea*	5	6,90	-	-
Verreaux's Eagle	*Aquila verreauxii*	0,00	3,45	-	VU
Western Cattle Egret	*Bubulcus ibis*	5,00	0,00	-	-
White-backed Mousebird	*Colius colius*	55	0,00	-	-
White Stork	*Ciconia ciconia*	5,00	0,00	-	-
White-browed Sparrow-Weaver	*Plocepasser mahali*	10	0,00	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	5,00	0,00	-	-

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status
		Full protocol	Ad hoc protocol		
White-faced Whistling Duck	*Dendrocygna viduata*	5,00	0,00	-	-
White-rumped Swift	*Apus caffer*	35	0,00	-	-
White-throated Canary	*Crithagra albogularis*	40	10,34	-	-
White-throated Swallow	*Hirundo albigularis*	35	0,00	-	-
Wood Sandpiper	*Tringa glareola*	5	3,45	-	-
Yellow-bellied Eremomela	*Eremomela icteropygialis*	20	3,45	-	-
White-necked Raven	*Corvus albicollis*	5,00	0,00	-	-
Zitting Cisticola	*Cisticola juncidis*	55	3,45	-	-
Yellow-billed Duck	*Anas undulata*	20,00	3,45	-	-

APPENDIX 2: HABITAT WITHIN THE PAOI

Figure 1: Strong grassy layer within the PAOI.

Figure 2: Typical Nama Karoo habitat in the PAOI.

Figure 3: Alien trees in the Broader Area near the PAOI.

Figure 4: High voltage powerlines running through the PAOI.

APPENDIX 3: SITE SENSITIVITY VERIFICATION

Introduction

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool). NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable in the case of solar PV developments.

The details of the site sensitivity verification (SSV) are noted below:

Date of Site Visits	21 April 2022
Supervising Specialist Name	Albert Froneman
Professional Registration Number	MSc Conservation Biology (SACNASP Zoological Science Registration number 400177/09)
Specialist Affiliation / Company	Chris van Rooyen Consulting

Methodology

The following methods were used to compile the SSV report:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, as a means to ascertain which species occur within the Broader Area i.e., within a block consisting of 9 pentad grid cells within which the proposed project is situated (see Figure 1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 20 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 29 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.1) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the habitat in the Study Area was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org). Study Area is the area covered by the land parcels where PV1 – 15 will be located.
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2022) was used in order to view the PAOI on a landscape level and to help identify sensitive bird habitat.
- Powerline sensitive species are defined as species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Powerline sensitive species were further subdivided into raptors, waterbirds, and terrestrial birds.
- The SANBI BGIS map viewer was used to determine the locality of the PAOI relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The Department of Forestry, Fisheries, and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.

- Data collected during previous site visits to the Broader Area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- A Site Sensitivity Verification site visit to the PAOI was conducted on 21 April 2022 during which time the habitat was classified, and all birds were recorded.

Results of Site Assessment

The PAOI and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (**Figure 1**). The High and Medium sensitivity classifications are linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, and Tawny Eagle *Aquila rapax*. The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys and subsequent surveys. The following SSC were observed: Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Secretarybird *Sagittarius serpentarius* (Globally and Regionally Endangered), Cape Vulture *Gyps coprotheres* (Globally Vulnerable and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable and Regionally Endangered). Habitat for Ludwig's Bustard was also confirmed.

Based on the available SABAP2 data and the Site Sensitivity Verification survey conducted on 21 April 2022 and subsequent surveys, a classification of **High** sensitivity for avifauna is suggested for the PAOI.

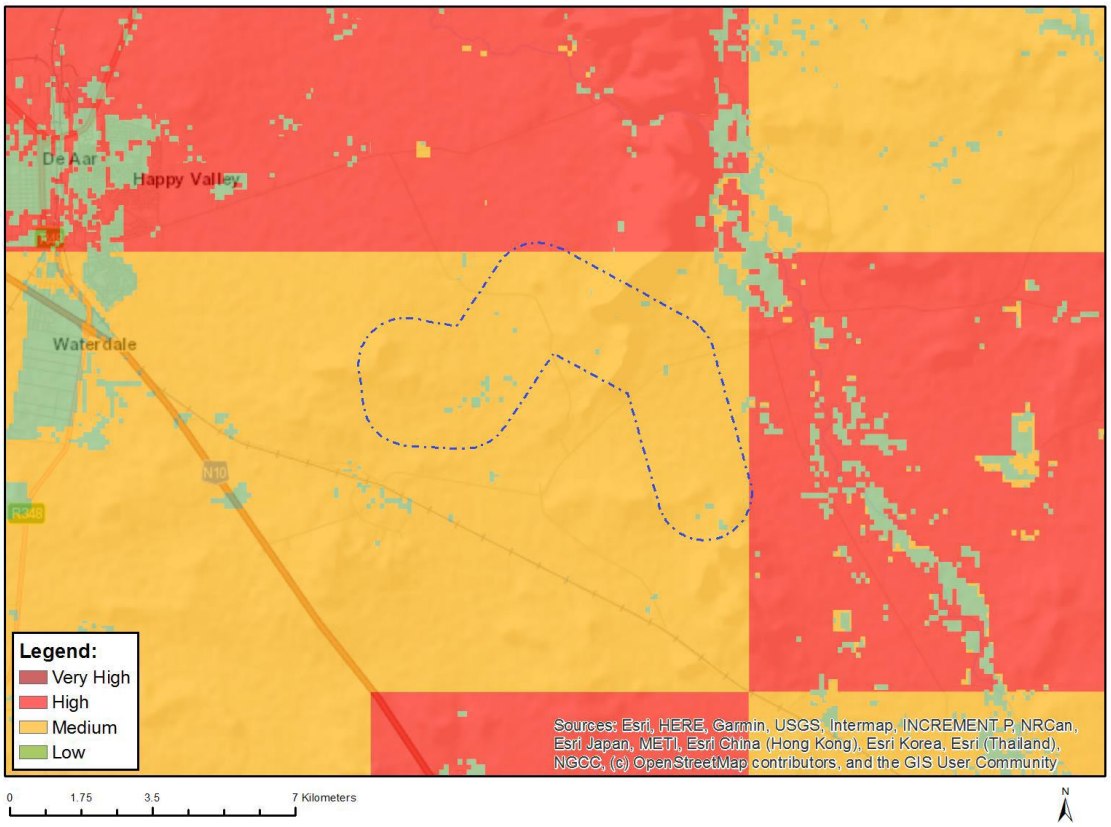

Figure 1: The National Web-Based Environmental Screening Tool map of the Project Area of Impact (PAOI), indicating sensitivities for the Terrestrial Animal Species theme. The High and Medium sensitivity classifications are linked to Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, and Tawny Eagle *Aquila rapax.*

Avifauna

The SABAP2 data indicates that a total of 162 bird species could potentially occur within the PAOI and immediate surroundings. Of these, 51 species are classified as powerline sensitive species, and 11 of these are South African Red List species. Of the 51 powerline sensitive species, 33 are likely to occur regularly within the PAOI and immediate

surroundings, and another 18 could occur sporadically. Five Red Data species were recorded during the site surveys, namely Cape Vulture, Lanner Falcon, Martial Eagle, Secretarybird, and Tawny Eagle.

The species recorded during the SSV visit is listed in Table 1.

Table 1: Priority species recorded during the SSV site visit.

Common Name	Scientific Name	Species of Conservation Concern
African Harrier-Hawk	*Polyboroides typus*	-
Amur Falcon	*Falco amurensis*	-
Booted Eagle	*Hieraaetus pennatus*	-
Cape Vulture	*Gyps coprotheres*	EN
Cloud Cisticola	*Cisticola textrix*	-
Egyptian Goose	*Alopochen aegyptiaca*	-
Greater Kestrel	*Falco rupicoloides*	-
Jackal Buzzard	*Buteo rufofuscus*	-
Karoo Prinia	*Prinia maculosa*	-
Lanner Falcon	*Falco biarmicus*	VU
Large-billed Lark	*Galerida magnirostris*	-
Lesser Kestrel	*Falco naumanni*	-
Martial Eagle	*Polemaetus bellicosus*	EN
Melodious Lark	*Mirafra cheniana*	-
Pale Chanting Goshawk	*Melierax canorus*	-
Red-billed Teal	*Anas erythrorhyncha*	-
Secretarybird	*Sagittarius serpentarius*	VU
Sickle-winged Chat	*Emarginata sinuata*	-
Spur-winged Goose	*Plectropterus gambensis*	-
Tawny Eagle	*Aquila rapax*	EN
Yellow-billed Duck	*Anas undulata*	-

Bird Habitat

The following bird habitat features were recorded at and/or near the PAOI:

Biomes And Vegetation Types

The PAOI is situated on a vast grassy Karoo plain, with its centre approximately 14 km south-east of the town of De Aar in the Northern Cape Province. The PAOI falls within the Nama Karoo Biome, in the Upper Karoo Bioregion, with some patches that are classified as Dry Highveld Grassland Bioregion (Mucina & Rutherford 2006).

The habitat in the PAOI is highly homogenous and consist of extensive plains with low shrubs and a prominent grassy component. Mucina & Rutherford (2006) classify the vegetation in the PAOI as Northern Upper Karoo on the plains, with Besemkaree Koppies Shrubland on the ridges. Northern Upper Karoo consist of shrubland dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains, as is the case currently in the PAOI). Besemkaree Koppies Shrubland consist of two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs (Mucina & Rutherford). There is one prominent drainage line north of the PAOI.

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. Using this classification system, the natural vegetation in the PAOI is classified as Grassy Karoo, a sub-category of the Nama Karoo biome. Grassy Karoo can be viewed as a transitional zone between the Nama Karoo and grassland biomes, although also primarily a dwarf shrub habitat, it shows a higher proportion of grass cover (Harrison et al. 1997).

The De Aar has an arid climate with hot summers and cold winters. The average temperature during summer is 24.3 °C (January) and 9.1 °C during winter (June) (SA Atlas of Climatology and Agrohydrology, Schulze, 2009). The average annual precipitation is about 280 mm, with most rainfall occurring during summer and autumn. De Aar experiences frost during the winter with 25.4 frost days per year on average (SA Atlas of Climatology and Agrohydrology, Schulze, 2009).

1) Nama Karoo Shrubland

Figures 2 and 3 illustrate the typical grassy Nama Karoo Shrubland habitat in the PAOI.

Figure 2: Typical Karoo shrubland on the plains in the PAOI.

Figure 3: Clumps of grass interspersed with low shrubs in the PAOI.

2) Drainage Lines and Wetlands

There is a large riverine and wetland system in the north of the PAOI (Figure 4). This habitat feature is most likely very important feeding, breeding, and nesting habitat for several priority and non-priority species, especially waterbirds.

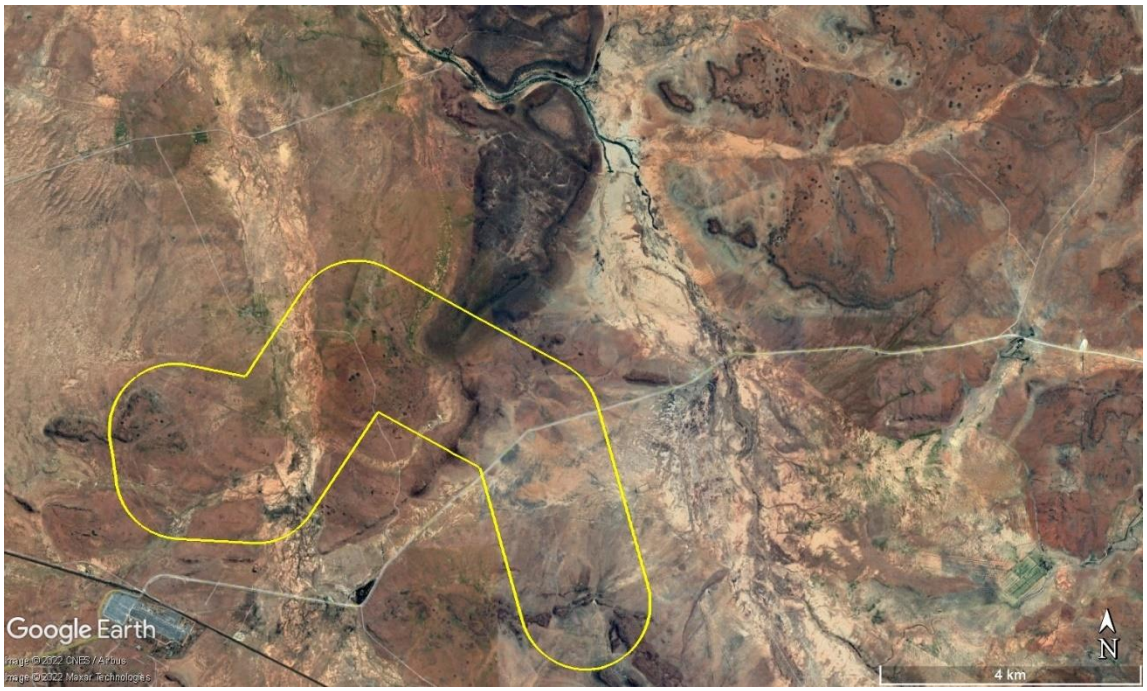

Figure 4: Riverine and wetland habitat north of the PAOI. PAOI boundary indicated in yellow.

3) Water Reservoirs and Dams

Surface water is of specific importance to avifauna in this arid region. The PAOI contains man-made dams (ground dams) and water reservoirs (Figure 5 and 6). Boreholes with open water troughs are important sources of surface water for priority avifauna for drinking and bathing.

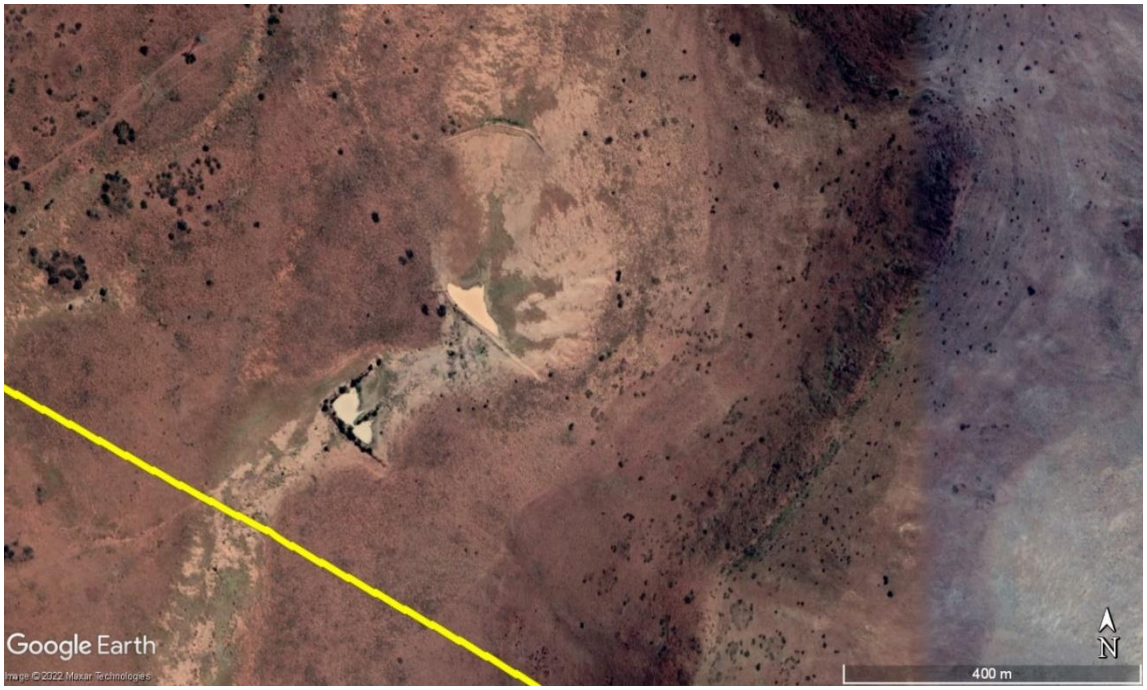

Figure 5: One of the earthen dams in the PAOI.

Figure 6: One of several water reservoirs present in the PAOI.

4) Alien Trees

The PAOI is generally devoid of trees, except for isolated clumps of trees at boreholes, where a mixture of alien and indigenous trees is growing. The trees could attract a variety of bird species for the purposes of nesting and roosting.

5) High voltage lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the Karoo (Jenkins *et al*. 2013). There are several existing high voltage lines that bisect the PAOI (Figure 8). There is increasing evidence that vultures are using high voltage lines in the Karoo (personal observation), mostly in the non-breeding season (January to March), and that they could be encountered anywhere in the Broader Area.

Figure 8: Jackal Buzzard nest on high voltage powerline pylon near the PAOI.

6) Rocky Ridges

The PAOI contains a prominent ridge (koppie) known as Rietfontein in the south-east of the PAOI, which rises to a height of 1352 m/asl. There is also a prominent ridgeline in the north-west of the PAOI (Wachteenbeetje 1466 m/asl). There are a number of other ridges in the Broader Area too. Ridges provide important habitat for several bird species, especially certain raptors, who use these areas for foraging (Figure 9).

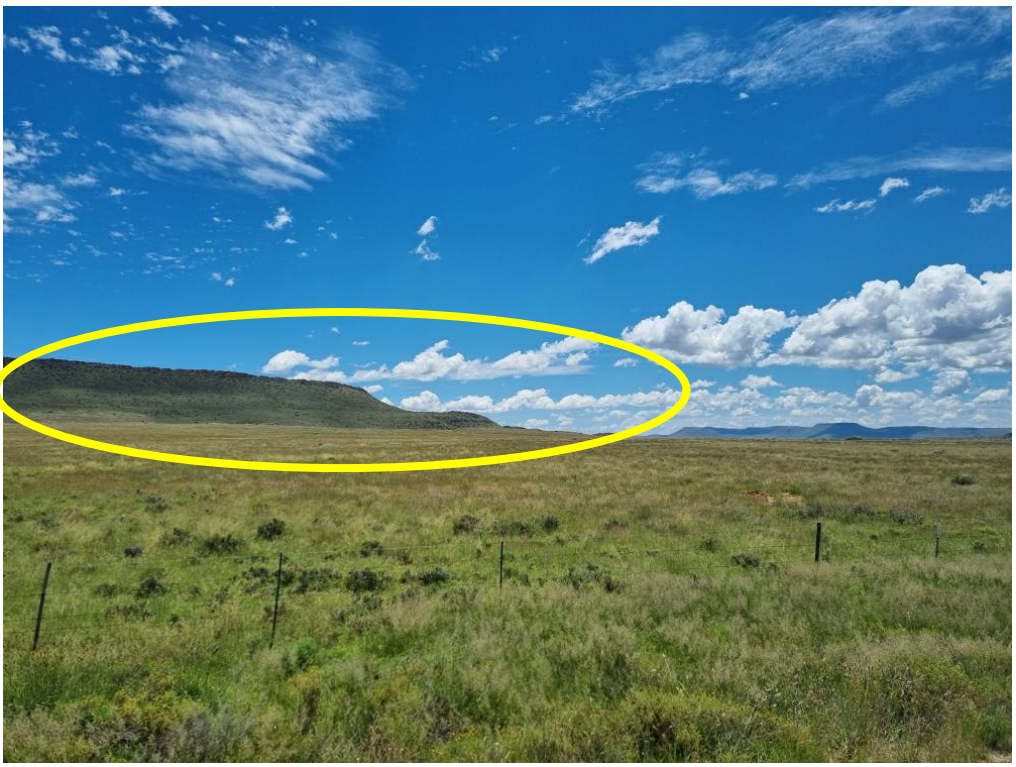

Figure 9: Rocky ridges present in the PAOI.

Conclusion

The PAOI and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme. The High and Medium sensitivity classifications are linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, and Tawny Eagle *Aquila rapax*. The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys. The following SSC were observed: Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Secretarybird *Sagittarius serpentarius* (Globally and Regionally Endangered), Cape Vulture *Gyps coprotheres* (Globally Vulnerable and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable and Regionally Endangered). Habitat for Ludwig's Bustard was also confirmed.

Based on the available SABAP2 data and the Site Sensitivity Verification survey conducted on 21 April 2022, the classification of **High** sensitivity for avifauna in the screening tool is confirmed for the PAOI.

APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct a pre-construction inspection (avifaunal walk-through) of the final on-site substation layout and powerline alignment to identify powerline sensitive species that may be breeding within the substation and to record the status of the eagle nests on the existing transmission powerlines. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the activities until after the breeding season. A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the biodiversity specialist report pertaining to the	1. Walk-through by avifaunal specialist to record eagle nests on the existing powerlines 2. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Repor and record any non-compliance. 3. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 4. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 5. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 6. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Once-off 2. On a daily basis 3. Weekly 4. Weekly 5. Weekly 6. Weekly	1. Avifaunal Specialist 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		limitation of the footprint.			
Avifauna: Mortality due to collision with the overhead powerline					
Mortality of avifauna due to collisions with the overhead powerline.	Reduction of avian collision mortality	Mark the powerline with Bird Flight Diverters	1. Bird Flight Diverters must be fitted to the entire powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors are strung.	1. Once-off	1. Contractor
Avifauna: Electrocution of Cape Vultures on the 132kV Overhead Powerline					
Mortality of Cape Vultures due to electrocution on the 132kV overhead powerline.	Reduction of Cape Vulture electrocution mortality	Construction of the double circuit OHPL using a minimum clearance distance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure.	Construct a double circuit design with a minimum clearance distance of 1.8m between the jumpers and/or insulators and the horizontal earthed component on the lattice/monopole structure.	1. Once-off	1. Contractor

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to habitat transformation in the substations					
Total or partial displacement of avifauna due to habitat transformation associated with vegetation clearance in the onsite substation area. .	Prevent unnecessary displacement of avifauna by ensuring that rehabilitation of transformed areas is implemented where possible by an appropriately qualified rehabilitation specialist, according to the recommendations of the biodiversity specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Facility operator
Avifauna: Mortality of avifauna due to electrocution in the on-site substations					
Mortality of avifauna due to electrocutions in the substation.	Reduction of avian electrocution mortality	1. Monitor the electrocution mortality in the substation. 2. Apply mitigation if electrocution happens regularly.	1. Regular inspections of the substation yard	1. Weekly	1. Facility operator

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area.	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO