

AVIFAUNAL IMPACT ASSESSMENT: SCOPING

Camden 1: Green Hydrogen and Ammonia Facility, Mpumalanga Province



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EXECUTIVE SUMMARY

Enertrag South Africa is proposing to develop the Camden Renewable Energy Complex in Mpumalanga, South Africa. The Complex is being developed in the context of the Department of Mineral Resources and Energy's (DMRE) Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) or similar programmes under the IRP. In addition, private off-take agreements are considered where possible.

The Cluster comprises eight (8) distinct projects, namely:

- i. Camden I Wind Energy Facility (up to 210MW).
- ii. Camden I Wind Grid Connection (up to 132kV).
- iii. Camden up to 400kV Grid Connection and Collector substation.
- iv. Camden I Solar (up to 100MW).
- v. Camden I Solar up to 132kV Grid Connection.
- vi. Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure.
- vii. Camden II Wind Energy Facility (up to 210MW).
- viii. Camden II Wind Energy Facility up to 132kV Grid Connection

This report deals with the Camden Green Hydrogen and Ammonia Facility.

Table: Summarised scoping level assessment of the anticipated impacts

Impact	Nature of Impact	Extent of Impact	Significance (pre-mitigation)	Preferred alternative	No-Go Areas	Mitigation measures
<p>Construction: Displacement due to habitat transformation associated with the construction of the facility and grid connection power line.</p>	<p>Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility 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 facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed facility and up to 132kV overhead power line is likely to be moderate due to the small size of the footprint, but ideally high quality grassland should be avoided if possible.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan, African Grass Owl.</p>	Local	Medium	<ul style="list-style-type: none"> Option 2 of the facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland. Option 1 of the switching station is not preferred as it is partially located in high quality grassland. 	<ul style="list-style-type: none"> 100m buffer around wetlands – all infrastructure barring essential road and gridline crossings 	<ul style="list-style-type: none"> Vegetation clearance should be limited to what is necessary. The mitigation measures proposed by the biodiversity specialist must be strictly enforced. Development in high sensitivity grassland must be limited as far as possible.
<p>Construction: Displacement due to disturbance associated with the construction of the facility and grid connection power line.</p>	<p>Construction 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 near 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</p>	Local	Medium	<ul style="list-style-type: none"> Option 2 of the facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland. 	<ul style="list-style-type: none"> 100m buffer around wetlands – all infrastructure barring essential road and gridline crossings 	<ul style="list-style-type: none"> Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.

	<p>activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance in the study area.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, Whitebellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan, African Grass Owl.</p>			<ul style="list-style-type: none"> Option 1 of the switching station is not preferred as it is partially located in high quality grassland 		<ul style="list-style-type: none"> Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Measures to control noise and dust should be applied according to current best practice in the industry. Development in high sensitivity grassland must be limited as far as possible.
<p>Operations: Mortality of priority species due to collisions with the up to 132kV grid connection power line.</p>	<p>Collisions are the biggest threat posed by transmission lines 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 transmission lines.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, White-</p>	Regional	Low	n/a	No exclusion areas have been identified	<p>Eskom approved Bird flight diverters should be installed on the entire line for the full span length on the earthwire (according to Eskom guidelines – five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively.</p>

	bellied Bustard, Blue Crane, Grey Crowned Crane, Wattled Crane, Southern Bald Ibis, Blue Korhaan, African Grass Owl, Cape Vulture.					
During operation: Mortality of priority species due to electrocution on the 132kV grid line	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. In the case of the proposed up to 132kV grid connection between the facility and the MTS, the electrocution risk is envisaged to be negligible because the small length of line (approximately 100m). The only priority species which may be potentially at risk of electrocution due to the up to 132kV grid connection power line is Cape Vulture (depending on which design will ultimately be used). However, the species is likely to occur sporadically, and the presence of large 400kV transmission lines near the proposed facility also helps to reduce the risk, in that the vultures would most likely prefer to perch on these 400kV towers.	Regional	Low	n/a	No exclusion areas have been identified	A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.

ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities, relative to the proposed Green Hydrogen and Ammonia Facility, were identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone (barring essential roads and grid line crossings) around drainage lines and associated wetlands.** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- **High sensitivity grassland - Limited infrastructure zone.** Development in the remaining high sensitivity grassland in the project site must be limited as far as possible. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham’s Bustard (SA Status Vulnerable) and Secretarybird (Global and SA status Endangered).

See Figure (i) below for the identified avifaunal sensitivities.

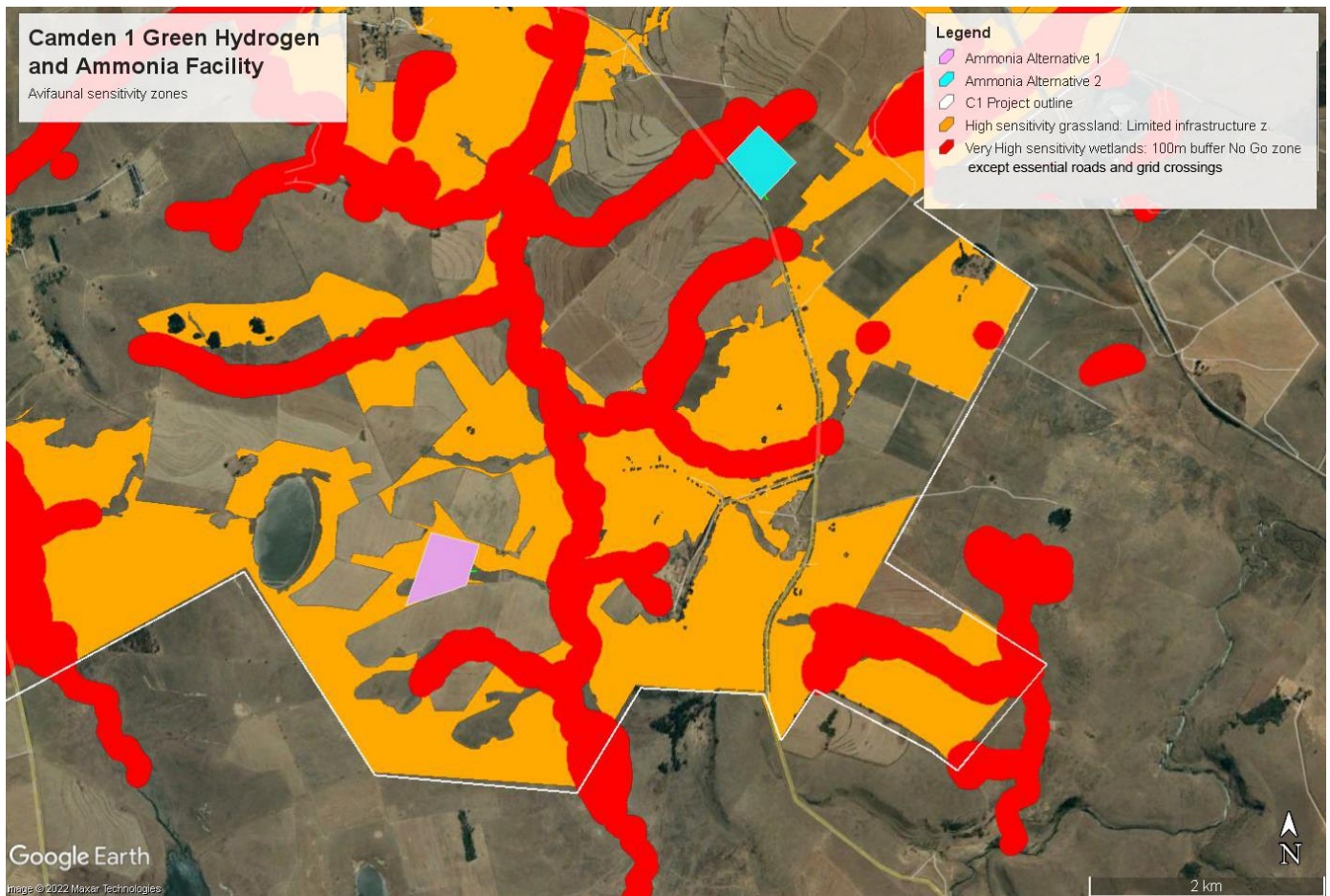


Figure (i) Avifaunal sensitivities

PRELIMINARY CONCLUSIONS

According to the DFFE national screening tool, the habitat within the Camden 1 wind farm project site is classified as **Medium and High sensitivity** for birds according to the Animal Species theme (see Figure 4). This classification is accurate, based on actual conditions recorded on the ground during the 12 months of pre-construction monitoring. The classification of **High** is justified due to the recorded presence of Red List priority species in the WEF development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered),

Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally Endangered), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Locally Vulnerable) and Cape Vulture (Globally and Locally Endangered).

The proposed facility will have an anticipated medium to low pre-mitigation negative impact on priority avifauna, which is expected to be reduced to low and very low with appropriate mitigation.

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DETAILS OF THE SPECIALIST

Chris van Rooyen (Bird Specialist)

Chris has 25 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 power line 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 (Bird 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.

1 INTRODUCTION

Enertrag South Africa is proposing to develop the Camden Renewable Energy Complex in Mpumalanga, South Africa. The Complex is being developed in the context of the Department of Mineral Resources and Energy's (DMRE) Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) or similar programmes under the IRP. In addition, private off-take agreements are considered where possible.

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This report deals with the Camden Green Hydrogen and Ammonia Facility.

Table 1 below summarises the main features of the proposed facility.

Table 1: Camden Green Hydrogen and Ammonia Facility summary (provisional, subject to change based on detailed design).

No.	Component	Footprint (Ha)	Storage Capacity (m3 / tons)	Maximum Throughput (m3 / tpa)
1	Water Reservoir	2	6 800 / 6 800	800 / 800
2	Water Treatment Unit	1.5	N/A	192 000 / 192 000
3	Electrolyser Unit	1	N/A	(1 239 157 – 301 932 367) / 20 000
4	Air Separation Unit	0.5	N/A	92 905 405 / 110 000
5	Ammonia Processing Unit	2	N/A	149 253 / 100 000
6	Liquid Air Storage System (LAES)	1	3 983/ 3 505	460 227 / 405 000
7	Liquid Ammonia Storage Tank	2	2 273/ 1 523	261 194 / 175 000
8	Hydrogen and Oxygen Storage Tank Farm	12	59 566/ 800	5 576 208 / 90 000
9	Ancillary infrastructure	3	n/a	n/a
	Total Footprint	25		

There will be a very short (100m) grid line (up to 132kV) for the ammonia plant as well to allow for a connection between the adjacent MTS and green hydrogen and ammonia plant.

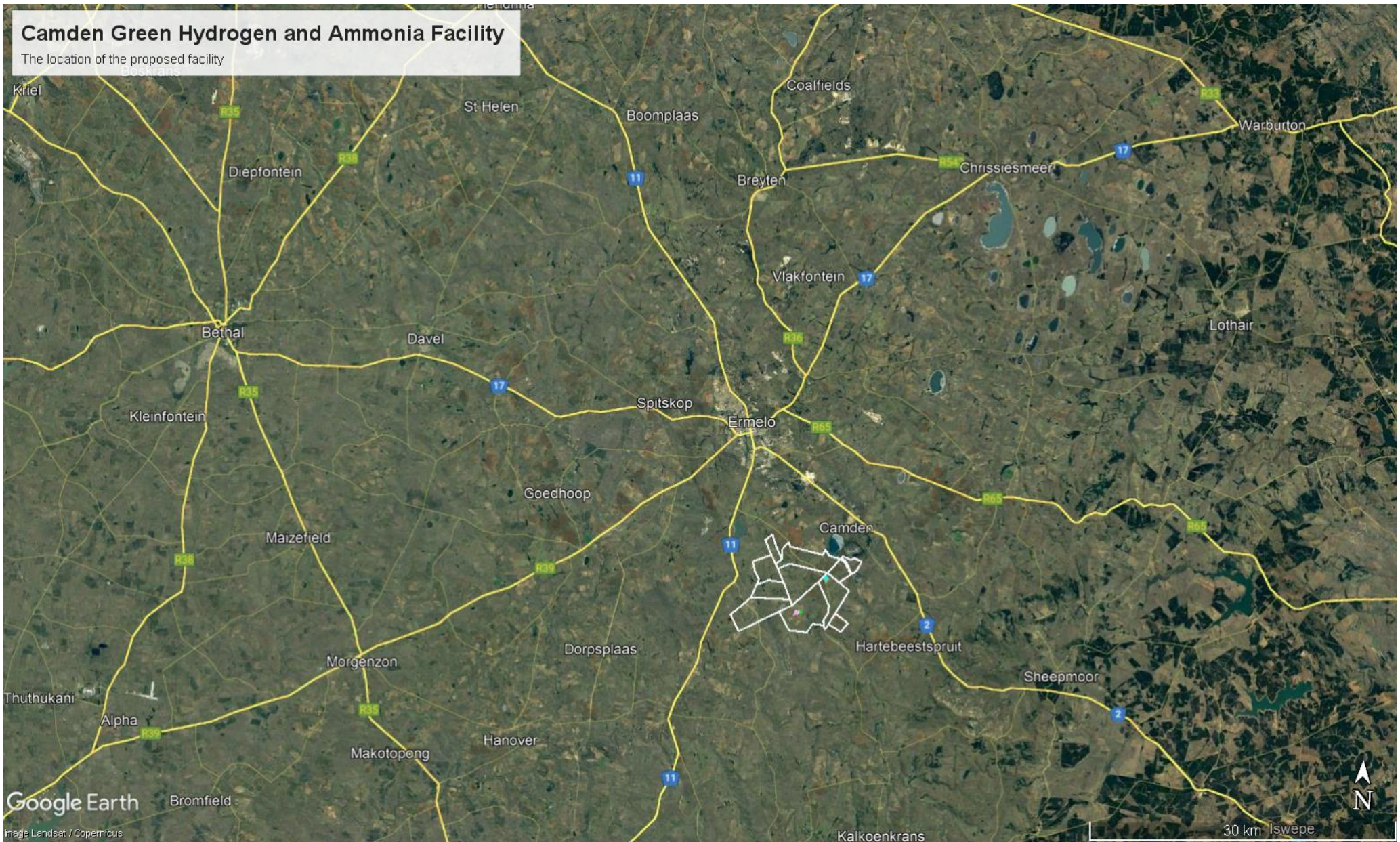


Figure 1: Locality map of the development area of the proposed Camden Green Hydrogen and Ammonia Facility within the Camden I Wind Energy Facility site (white parcels).

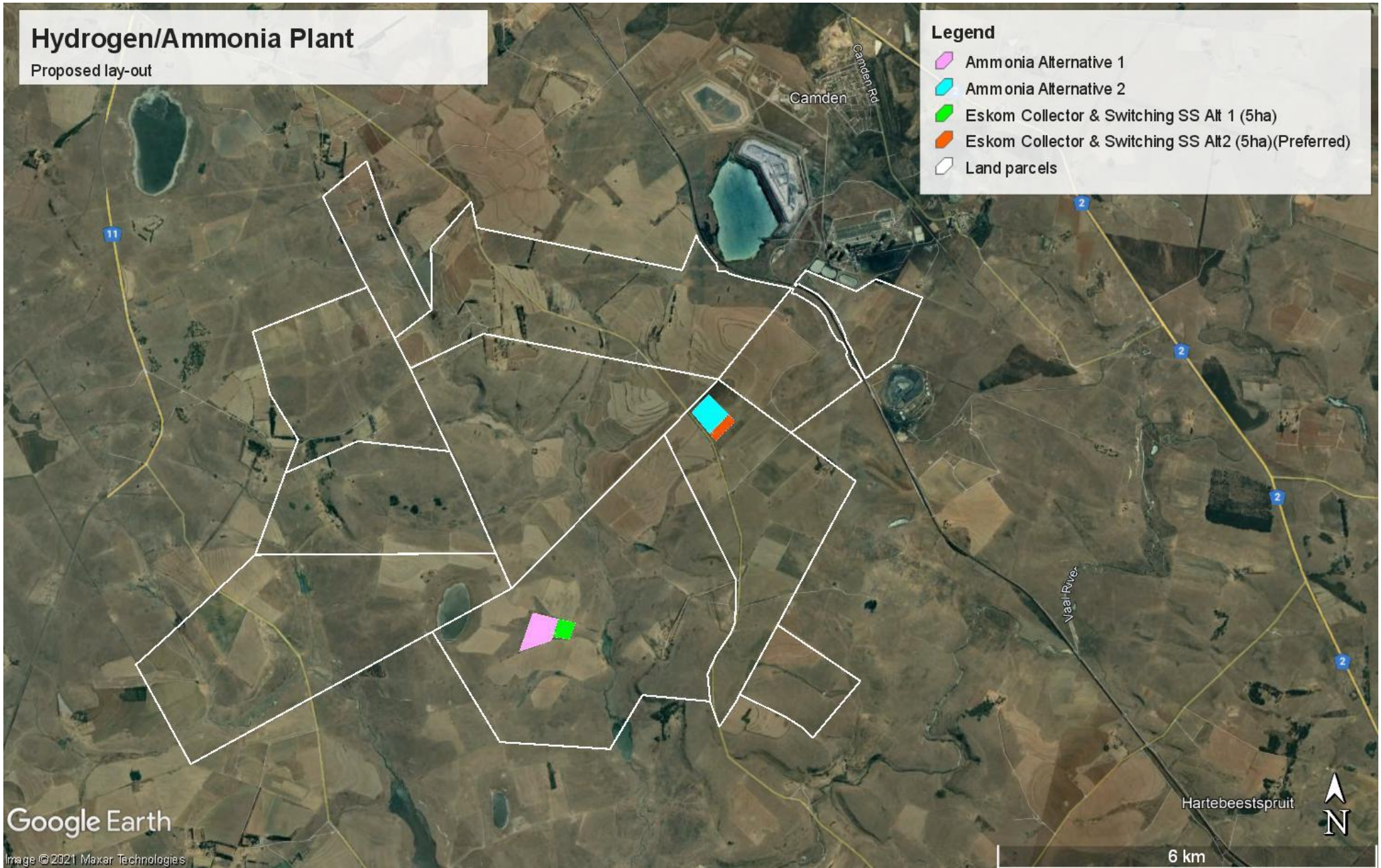


Figure 2: Conceptual lay-out of the proposed Camden Green Hydrogen and Ammonia Facility, showing the alternative locations.

2 TERMS OF REFERENCE

The purpose of the scoping phase report is to determine the main issues and potential impacts of the proposed project/s based on existing information and field assessments. The terms of reference are as follows:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the wind farm and associated infrastructure.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed facility and the types of impacts (i.e., direct, indirect, and cumulative) that are most likely to occur.
- Determine the nature and extent of potential impacts during the construction and operational phases.
- Identify 'No-Go' areas, where applicable.
- Summarise the potential impacts that will be considered further in the EIA Phase through specialist assessments.
- Recommend mitigation measures to reduce the impact of the expected impacts.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (<http://sabap2.adu.org.za/>), to ascertain which species, occur in the pentads where the proposed development is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 16 pentads some of which intersect and others that are near the development area, henceforth referred to as "the broader area" (see Figure 3). The decision to include multiple pentads around the development areas was to get a more representative picture of the bird abundance and variety in the region. The additional pentads and their data augment the bird distribution data. A total of 165 full protocol lists (i.e., bird listing surveys lasting a minimum of two hours each) and 227 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 16 pentads where the development area is located. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during site surveys and general knowledge of the area.
- A classification of the vegetation types in the development area 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 priority species was determined with the use of the most recent edition of the Red List 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 priority species was determined by consulting the latest (2021.2) 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 © 2021) was used 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 development area relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the development area.
- The following sources were consulted to determine the investigation protocol that is required for the site:

- 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 when applying for Environmental Authorisation (Gazetted October 2020). 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 the facility on birds.
- The main source of information on the avifaunal diversity and abundance at the project site and development area is an integrated pre-construction monitoring programme which was implemented at the project site, covering all eight proposed projects of the Camden Renewable Energy Complex (See Appendix 3).

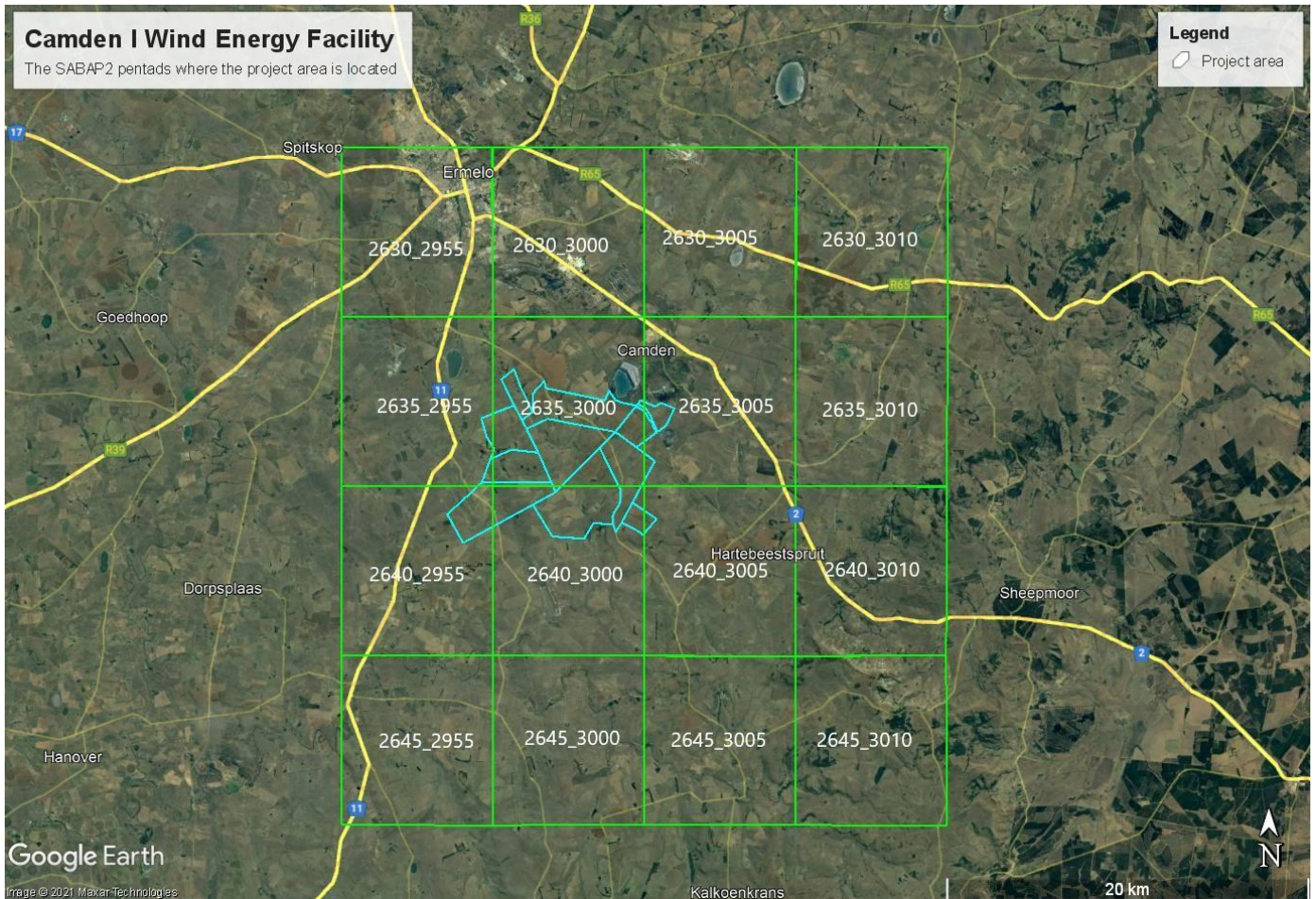


Figure 3: Area covered by the sixteen SABAP2 pentads.

4 ASSUMPTIONS AND LIMITATIONS

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring which was conducted over 12 months.
- Conclusions in this scoping report are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.

- The precautionary principle was applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: “in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.”
- The broader area refers to the area covered by sixteen SABAP2 pentads (see Figure 3).
- The assessment concentrated on the potential impact on priority species, which were defined as all species currently included in the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015).

5 LEGISLATIVE CONTEXT

5.1 Agreements and conventions

Table 2 below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna¹.

Table 2: 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 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

¹ (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-09-20).

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

5.2 National legislation

5.2.1 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
 - (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

5.3 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.

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 when applying for Environmental Authorisation (Gazetted October 2020). 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 any activity requiring environmental authorisation.

5.4 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.

5.5 Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in Mpumalanga is the Mpumalanga Nature Conservation Act 10 of 1998. It consolidated and amended the laws relating to nature conservation within the province and provides for matters connected therewith. All birds are classified as Protected Game (Section 4 (1) (b)), except those listed in Schedule 3, which are classified as Ordinary Game (Section 4 (1)(c)).

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

The proposed facility is located within the proposed Camden 1 wind farm project site. It is not located in an Important Bird Area (IBA), but it is located between three IBAs. The closest IBA to the project site is the Amersfoort-Bethal-Carolina IBA SA018, which is located within 1.5km from the site to the west. The Grasslands IBA SA020 is located 6-7km to the east of the site. The Chrissies Pans IBA SA019 is located 16-17km to the north-east of the site. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader areas and fall within this category are the following:

- Secretarybird
- Denham's Bustard
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- Martial Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl

7 DFFE NATIONAL SCREENING TOOL

According to the DFFE national screening tool, the habitat within the Camden 1 wind farm project site is classified as **Medium and High** sensitivity for birds according to the Animal Species theme (see Figure 4). This classification is accurate, based on actual conditions recorded on the ground during the 12 months of pre-construction monitoring. The classification of **High** is justified due to the recorded presence of Red List priority species in the WEF development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered), Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally

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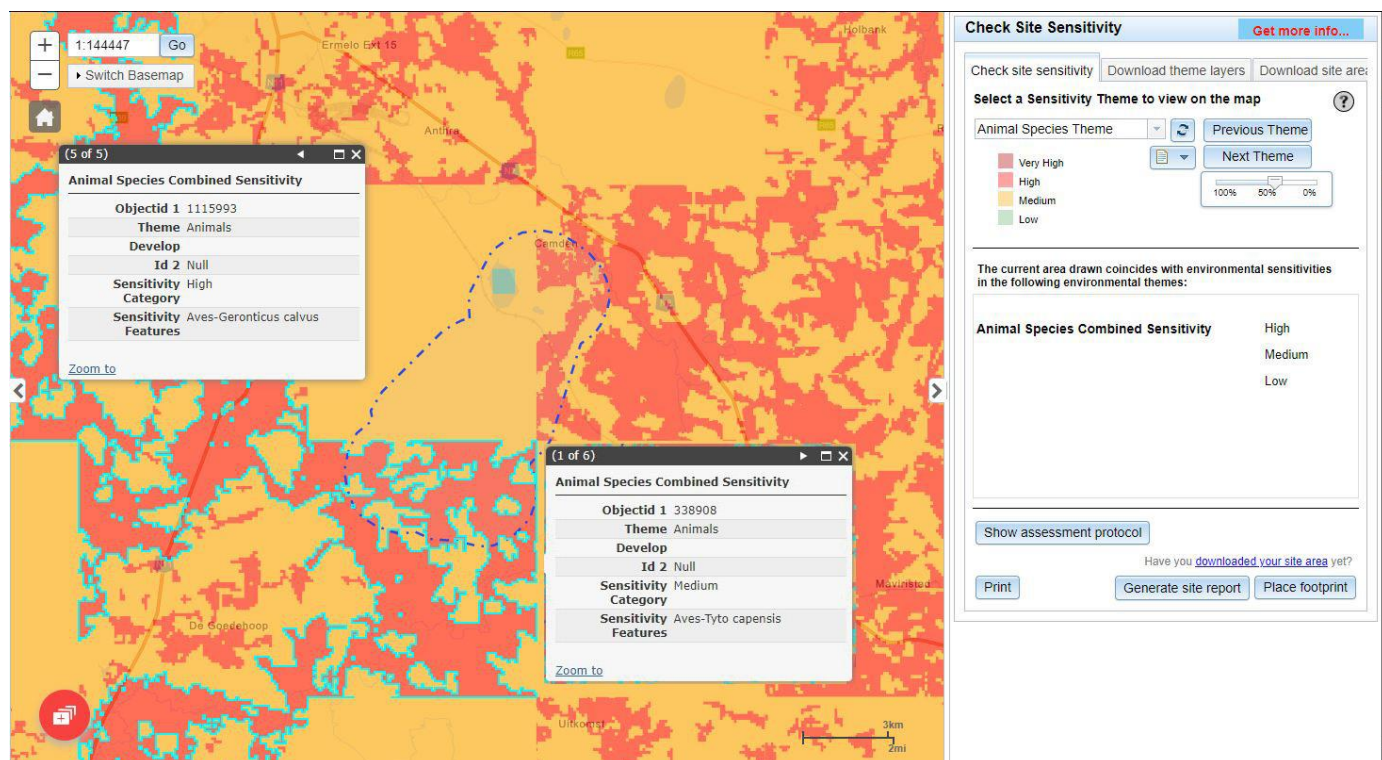


Figure 4: The National Web-Based Environmental Screening Tool map of the study area, indicating sensitivities for the Animal Species theme. The High sensitivity classification is linked to the presence of African Grass Owl and Southern Bald Ibis.

7.1 Protected Areas

According to the South African Protected Areas database (SAPAD), part of the site overlaps with the Langcarel Private Nature Reserve. No further information could be obtained about the nature reserve. However, from an avifaunal perspective the state of the habitat and land use at the project site is more important than the legal status, which has been surveyed and assessed for this assessment. The results provided are therefore applicable regardless of the legal status of the land parcels considered.

7.2 Biomes and vegetation types

The Camden 1 wind farm project site is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Muchina & Rutherford 2006). Vegetation on site consists predominantly Amersfoort Highveld Clay Grassland and Eastern Highveld Grassland, which is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006).

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021).

The topography in the Camden 1 wind farm project site is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the project site is a combination of mostly sheep and cattle, with a few horses.

7.3 Bird habitat

Whilst much of the distribution and abundance of the bird species in the Camden 1 wind farm project site can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.

The following bird habitat classes were identified relevant to the green hydrogen and ammonia facility (see Appendix 2 for examples of the habitat classes):

7.3.1 Grassland

Site alternative 1 is located in grassland. The priority species which could potentially use the grassland in the Camden 1 wind farm project site (including Site alternative 1) on a regular basis are the following:

- Secretarybird
- White-bellied Bustard
- Blue Crane
- Grey Crowned Crane
- Lanner Falcon
- Southern Bald Ibis
- Blue Korhaan
- African Grass Owl

The priority species which could occasionally use the grassland in the Camden 1 wind farm project site (including Site alternative 1) are the following:

- Denham's Bustard
- Martial Eagle
- African Marsh Harrier
- Black Harrier
- Montagu's Harrier
- Cape Vulture

7.3.2 Agricultural lands

The Camden 1 wind farm project site contains a patchwork of agricultural fields, where maize, soya beans and pastures are cultivated. Some fields are lying fallow or are in the process of being re-vegetated by grass. Site alternative 2 is located in an agricultural field. The priority species which could potentially use the agricultural fields on a regular basis in the Camden 1 wind farm project site (including Site alternative 2) are the following:

- Blue Crane
- Grey Crowned Crane
- Lanner Falcon
- Southern Bald Ibis

The priority species which could occasionally use the agricultural lands in the project site are the following:

- Denham's Bustard

- Martial Eagle
- Cape Vulture

See Appendix 2 for photographic record of habitat features at the site alternatives and immediate surroundings.

7.4 AVIFAUNA

7.4.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 234 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 15 species are classified as priority species (see definition of priority species in section 4). Of the priority species, 10 are likely to occur regularly in the development area (see Table 2 below).

Table 3 below lists all the priority species that are likely to occur regularly and the possible impact on the respective species by the proposed facility and associated grid line. The following abbreviations and acronyms are used:

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

Table 3: Priority species potentially occurring at the development area.

Species name	Scientific name	SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during surveys	Likelihood of regular occurrence	Grassland	Agriculture	Powerline - Collision	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: 132kV grid
African Grass Owl	<i>Tyto capensis</i>	2.4	0	-	VU	x	M	x		x	x	x	
Denham's Bustard	<i>Neotis denhami</i>	1.8	0	NT	VU		L	x		x	x	x	
Lanner Falcon	<i>Falco biarmicus</i>	7.3	0	-	VU	x	M	x	x				
Secretarybird	<i>Sagittarius serpentarius</i>	13	0	EN	VU	x	H	x		x	x	x	
Southern Bald Ibis	<i>Geronticus calvus</i>	23	3.1	VU	VU	x	H	x	x	x			
White-bellied Bustard	<i>Eupodotis senegalensis</i>	7.9	0	-	VU	x	M	x		x	x	x	
Blue Crane	<i>Grus paradisea</i>	12	0.4	VU	NT	x	H	x	x	x	x	x	
Greater Flamingo	<i>Phoenicopterus roseus</i>	3.6	4.4	-	NT	x	M			x			
Lesser Flamingo	<i>Phoeniconaias minor</i>	3.6	1.3	NT	NT	x	M			x			
African Marsh Harrier	<i>Circus ranivorus</i>	0.6	0	-	EN		L						
Black Harrier	<i>Circus maurus</i>	0	0.9	EN	EN		L	x					
Cape Vulture	<i>Gyps coprotheres</i>	0	0	EN	EN	x	L	x		x			x
Grey Crowned Crane	<i>Balearica regulorum</i>	5.5	0	EN	EN	x	M	x	x	x	x	x	
Martial Eagle	<i>Polemaetus bellicosus</i>	2.4	0	EN	EN	x	L	x					
Wattled Crane	<i>Grus carunculata</i>	0.6	0	VU	CR		L			x			

8 IMPACT ASSESSMENT

8.1 Displacement due to habitat destruction and disturbance

During the construction of the green hydrogen and ammonia facility and associated grid 132kV line, habitat destruction/transformation will inevitably take place. The construction activities will constitute the following:

- Site clearance and preparation;
- Construction of the infrastructure related to the hydrogen and ammonia plant (Water Reservoir, Water Treatment Unit, Electrolyser Unit, Air Separation Unit, Ammonia Processing Unit, Liquid Air Storage System (LAES), Liquid Air Storage System (LAES), Liquid Ammonia Storage Tank, Hydrogen Storage Tank and overhead power line);
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the proposed infrastructure and overhead power line, stockpiling of topsoil and cleared vegetation;
- Excavations for infrastructure;

These activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility 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 facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 21 ha proposed facility and approximately 100m of 132kV overhead power line is likely to be moderate due to the relatively small size of the footprint, but ideally high quality grassland should be avoided if possible.

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 timely identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance.

The priority species which are potentially vulnerable to this impact are listed in Table 3, and below:

- Secretarybird
- Denham's Bustard
- White-bellied Bustard
- Blue Crane
- Grey Crowned Crane
- Blue Korhaan
- African Grass Owl

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. In the case of the proposed up to 132kV grid connection between the facility and the MTS, the electrocution risk is envisaged to be negligible because the small length of line (approximately 100m). The only priority species which may be potentially at risk of electrocution due to the up to 132kV grid connection power line is Cape Vulture (depending on which design will ultimately be used). However, the species is likely to occur sporadically, and the presence of large 400kV transmission lines in close proximity to the proposed facility also helps to reduce the risk, in that the vultures would most likely prefer to perch on these 400kV towers.

8.3 Collisions

Collisions are perhaps the biggest threat posed by high voltage lines 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 transmission lines (Van Rooyen 2004, Shaw *et al.* 2017). However, the small length of line (approximately 100m) significantly reduces the potential collision risk.

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three up to 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. 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 priority species which are potentially vulnerable to this impact are listed in Table 3, and below:

- Secretarybird
- Denham's Bustard
- White-bellied Bustard
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- Southern Bald Ibis
- Blue Korhaan
- African Grass Owl
- Cape Vulture

9 IMPACT RATING

Table 4 below is a summarised scoping level assessment of the anticipated impacts.

Table 4: Summarised scoping level assessment of the anticipated impacts

Impact	Nature of Impact	Extent of Impact	Significance (pre-mitigation)	Preferred alternative	No-Go Areas	Mitigation measures
<p>Construction: Displacement due to habitat transformation associated with the construction of the facility and grid connection power line.</p>	<p>Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility 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 facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed facility and up to 132kV overhead power line is likely to be moderate due to the small size of the footprint, but ideally high quality grassland should be avoided if possible.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan, African Grass Owl.</p>	Local	Medium	<ul style="list-style-type: none"> Option 2 of the facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland. Option 1 of the switching station is not preferred as it is partially located in high quality grassland. 	<ul style="list-style-type: none"> 100m buffer around wetlands – all infrastructure barring essential road and gridline crossings 	<ul style="list-style-type: none"> Vegetation clearance should be limited to what is necessary. The mitigation measures proposed by the biodiversity specialist must be strictly enforced. Development in high sensitivity grassland must be limited as far as possible.
<p>Construction: Displacement due to disturbance associated with the construction of the facility and grid connection power line.</p>	<p>Construction 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 near 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</p>	Local	Medium	<ul style="list-style-type: none"> Option 2 of the facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland. 	<ul style="list-style-type: none"> 100m buffer around wetlands – all infrastructure barring essential road and gridline crossings 	<ul style="list-style-type: none"> Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.

	<p>activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance in the study area.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, Whitebellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan, African Grass Owl.</p>			<ul style="list-style-type: none"> Option 1 of the switching station is not preferred as it is partially located in high quality grassland 		<ul style="list-style-type: none"> Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Measures to control noise and dust should be applied according to current best practice in the industry. Development in high sensitivity grassland must be limited as far as possible.
<p>Operations: Mortality of priority species due to collisions with the up to 132kV grid connection power line.</p>	<p>Collisions are the biggest threat posed by transmission lines 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 transmission lines.</p> <p>The priority species which are potentially vulnerable to this impact are the following: Secretarybird, Denham's Bustard, White-</p>	Regional	Low	n/a	No exclusion areas have been identified	<p>Eskom approved Bird flight diverters should be installed on the entire line for the full span length on the earthwire (according to Eskom guidelines – five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively.</p>

	bellied Bustard, Blue Crane, Grey Crowned Crane, Wattled Crane, Southern Bald Ibis, Blue Korhaan, African Grass Owl, Cape Vulture.					
During operation: Mortality of priority species due to electrocution on the 132kV grid line	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. In the case of the proposed up to 132kV grid connection between the facility and the MTS, the electrocution risk is envisaged to be negligible because the small length of line (approximately 100m). The only priority species which may be potentially at risk of electrocution due to the up to 132kV grid connection power line is Cape Vulture (depending on which design will ultimately be used). However, the species is likely to occur sporadically, and the presence of large 400kV transmission lines near the proposed facility also helps to reduce the risk, in that the vultures would most likely prefer to perch on these 400kV towers.	Regional	Low	n/a	No exclusion areas have been identified	A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.

10 ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone (barring essential roads and grid crossings) around drainage lines and associated wetlands.** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- **High sensitivity grassland - Limited infrastructure zone.** Development in the remaining high sensitivity grassland in the project site must be limited as far as possible. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable) and Secretarybird (Global and SA status Endangered).

See Figure 6 for the identified avifaunal sensitivities.

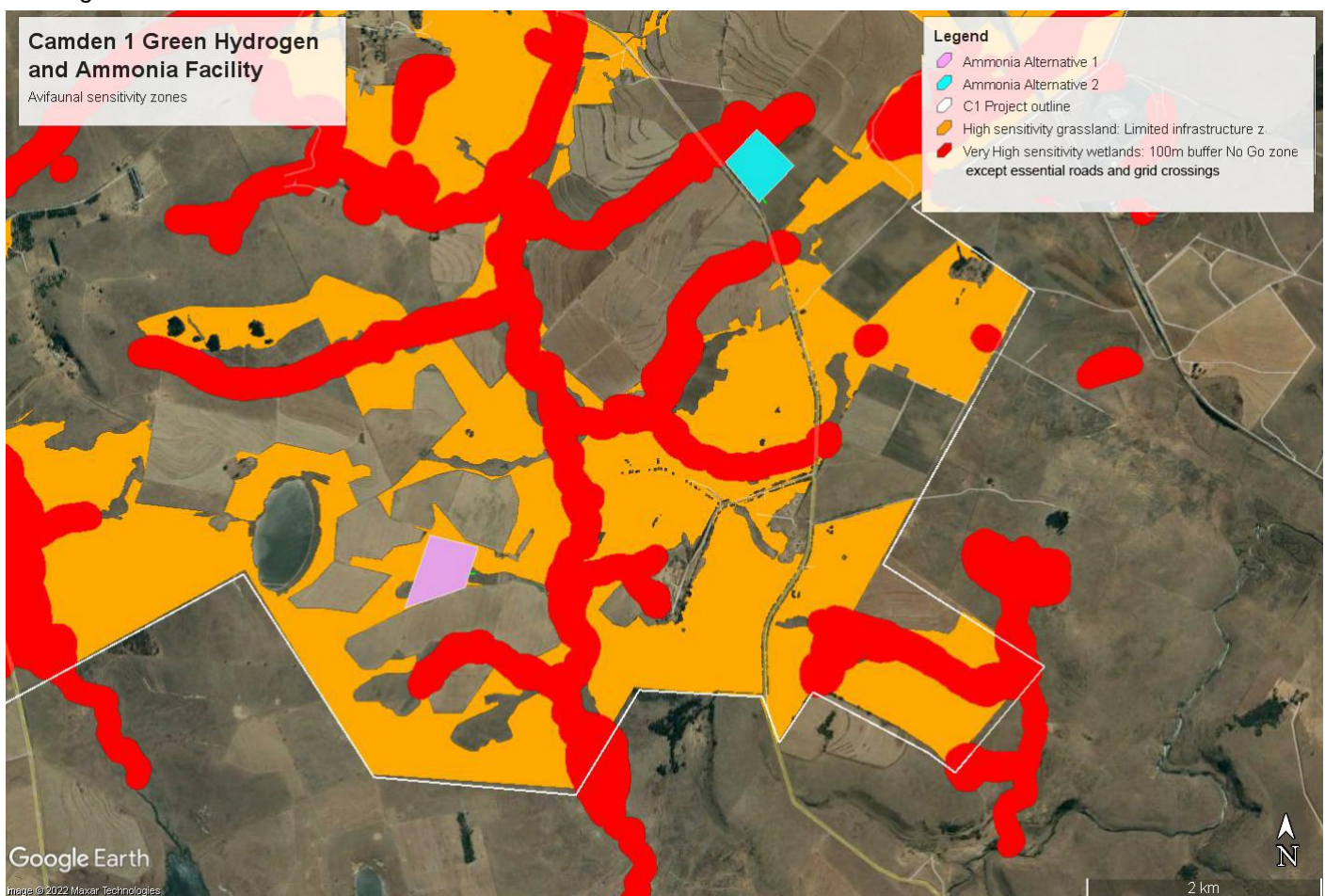


Figure 5: Avifaunal sensitivities .

11 EIA PHASE

11.1 Plan of study

The following are proposed for the EIA Phase:

- The implementation of at least one avifaunal survey in the high season to inform the assessment of the potential impacts of the planned infrastructure within the development footprint². The monitoring protocol is guided by the following:
 - 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 when applying for Environmental Authorisation (Gazetted October 2020). 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 all impacts requiring authorisation.
- The avifaunal specialists report will be structured around the following terms of reference:
 - Description of the affected environment from an avifaunal perspective.
 - Discussion of gaps in baseline data and other limitations.
 - Description of the methodology that was used for the field surveys.
 - Comparison of the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjustment if necessary.
 - Provision of an overview of all applicable legislation.
 - Provision of an overview of assessment methodology.
 - Identification and assessment of the potential impacts of the proposed development on avifauna including cumulative impacts.
 - Provision of sufficient mitigation measures to include in the Environmental Management Programme (EMPr).
 - Conclusion with an impact statement whether the project is fatally flawed or may be authorised.

11.2 Environmental Management Programme

For each anticipated impact, management recommendations for the design, construction, and operational phase (where appropriate) will be drafted for inclusion in the project EMPr.

12 PRELIMINARY CONCLUSIONS

According to the DFFE national screening tool, the habitat within the Camden 1 wind farm project site is classified as Medium and High sensitivity for birds according to the Animal Species theme (see Figure 4). This classification is accurate, based on actual conditions recorded on the ground during the 12 months of pre-construction monitoring. The classification of High is justified due to the recorded presence of Red List priority species in the WEF development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered), Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally Endangered), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Locally Vulnerable) and Cape Vulture (Globally and Locally Endangered).

The proposed facility will have an anticipated medium to low pre-mitigation negative impact on priority avifauna, which is expected to be reduced to low and very low with appropriate mitigation.

13 REFERENCES

² This has been completed.

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APPENDIX 1: SABAP 2 SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Bokmakierie	<i>Telophorus zeylonus</i>	64.85	4.41
Hamerkop	<i>Scopus umbretta</i>	11.52	0.00
Mallard	<i>Anas platyrhynchos</i>	0.61	0.44
Neddicky	<i>Cisticola fulvicapilla</i>	7.88	0.00
Quailfinch	<i>Ortygospiza atricollis</i>	47.88	1.76
Ruff	<i>Calidris pugnax</i>	1.82	0.44
Secretarybird	<i>Sagittarius serpentarius</i>	13.33	0.00
Bar-throated Apalis	<i>Apalis thoracica</i>	5.45	0.00
Pied Avocet	<i>Recurvirostra avosetta</i>	4.85	0.00
Black-collared Barbet	<i>Lybius torquatus</i>	28.48	0.88
Crested Barbet	<i>Trachyphonus vaillantii</i>	3.03	0.00
Cape Batis	<i>Batis capensis</i>	0.61	0.00
European Bee-eater	<i>Merops apiaster</i>	0.61	0.00
Southern Red Bishop	<i>Euplectes orix</i>	84.24	12.33
Yellow-crowned Bishop	<i>Euplectes afer</i>	34.55	3.96
Southern Boubou	<i>Laniarius ferrugineus</i>	15.15	0.88
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>	50.30	3.96
Cape Bunting	<i>Emberiza capensis</i>	13.94	0.44
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>	1.82	0.00
Golden-breasted Bunting	<i>Emberiza flaviventris</i>	5.45	0.44
Black-bellied Bustard	<i>Lissotis melanogaster</i>	0.61	0.00
Denham's Bustard	<i>Neotis denhami</i>	1.82	0.00
White-bellied Bustard	<i>Eupodotis senegalensis</i>	7.88	0.00
Common Buttonquail	<i>Turnix sylvaticus</i>	0.61	0.00
Common Buzzard	<i>Buteo buteo</i>	27.88	9.25
Jackal Buzzard	<i>Buteo rufofuscus</i>	19.39	2.20
Black-throated Canary	<i>Crithagra atrogularis</i>	67.88	2.20
Cape Canary	<i>Serinus canicollis</i>	75.15	7.05
Yellow Canary	<i>Crithagra flaviventris</i>	15.76	0.44
Yellow-fronted Canary	<i>Crithagra mozambica</i>	9.09	0.88
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	89.70	12.33
Buff-streaked Chat	<i>Campicoloides bifasciatus</i>	5.45	0.44
Familiar Chat	<i>Oenanthe familiaris</i>	0.61	0.00
Cloud Cisticola	<i>Cisticola textrix</i>	7.88	0.88
Lazy Cisticola	<i>Cisticola aberrans</i>	4.85	0.00
Levaillant's Cisticola	<i>Cisticola tinniens</i>	73.94	5.73
Pale-crowned Cisticola	<i>Cisticola cinnamomeus</i>	21.21	0.00
Wailing Cisticola	<i>Cisticola lais</i>	9.09	0.00
Wing-snapping Cisticola	<i>Cisticola ayresii</i>	45.45	6.17
Zitting Cisticola	<i>Cisticola juncidis</i>	41.21	2.64
Red-knobbed Coot	<i>Fulica cristata</i>	58.18	4.85

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Reed Cormorant	<i>Microcarbo africanus</i>	63.64	4.85
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	11.52	0.88
Temminck's Courser	<i>Cursorius temminckii</i>	1.82	0.00
Black Crake	<i>Zapornia flavirostra</i>	9.09	0.00
Blue Crane	<i>Grus paradisea</i>	11.52	0.44
Grey Crowned Crane	<i>Balearica regulorum</i>	5.45	0.00
Wattled Crane	<i>Grus carunculata</i>	0.61	0.00
Cape Crow	<i>Corvus capensis</i>	17.58	0.44
Pied Crow	<i>Corvus albus</i>	11.52	3.52
Diederik Cuckoo	<i>Chrysococcyx caprius</i>	24.24	0.88
Red-chested Cuckoo	<i>Cuculus solitarius</i>	4.85	0.44
African Darter	<i>Anhinga rufa</i>	16.36	2.20
Cape Turtle Dove	<i>Streptopelia capicola</i>	92.12	23.79
Laughing Dove	<i>Spilopelia senegalensis</i>	45.45	7.49
Namaqua Dove	<i>Oena capensis</i>	1.82	0.00
Red-eyed Dove	<i>Streptopelia semitorquata</i>	64.24	12.33
Rock Dove	<i>Columba livia</i>	6.06	4.41
Fork-tailed Drongo	<i>Dicurus adsimilis</i>	10.30	0.44
African Black Duck	<i>Anas sparsa</i>	10.91	0.00
Domestic Duck	<i>Anas platyrhynchos domestica</i>	0.61	0.00
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	0.00	0.44
White-backed Duck	<i>Thalassornis leuconotus</i>	6.67	0.00
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	0.61	0.00
Yellow-billed Duck	<i>Anas undulata</i>	61.82	4.41
African Fish Eagle	<i>Haliaeetus vocifer</i>	12.12	0.88
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	3.03	0.44
Brown Snake Eagle	<i>Circaetus cinereus</i>	1.82	0.00
Long-crested Eagle	<i>Lophaetus occipitalis</i>	6.67	9.25
Martial Eagle	<i>Polemaetus bellicosus</i>	2.42	0.00
Spotted Eagle-Owl	<i>Bubo africanus</i>	9.09	0.88
Great Egret	<i>Ardea alba</i>	7.88	1.32
Intermediate Egret	<i>Ardea intermedia</i>	13.94	1.76
Little Egret	<i>Egretta garzetta</i>	4.24	1.32
Western Cattle Egret	<i>Bubulcus ibis</i>	44.85	12.33
Amur Falcon	<i>Falco amurensis</i>	29.09	6.61
Lanner Falcon	<i>Falco biarmicus</i>	7.27	0.00
Peregrine Falcon	<i>Falco peregrinus</i>	1.21	0.00
Cuckoo Finch	<i>Anomalospiza imberbis</i>	1.21	0.00
Red-headed Finch	<i>Amadina erythrocephala</i>	1.82	0.00
Southern Fiscal	<i>Lanius collaris</i>	92.12	15.42
Greater Flamingo	<i>Phoenicopterus roseus</i>	3.64	4.41
Lesser Flamingo	<i>Phoeniconaias minor</i>	3.64	1.32
Red-chested Flufftail	<i>Sarothrura rufa</i>	0.61	0.00
African Paradise Flycatcher	<i>Terpsiphone viridis</i>	4.85	0.00
Fiscal Flycatcher	<i>Melaenornis silens</i>	16.97	0.88
Spotted Flycatcher	<i>Muscicapa striata</i>	4.24	0.44

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Grey-winged Francolin	<i>Scleroptila afra</i>	27.27	2.20
Red-winged Francolin	<i>Scleroptila levaillantii</i>	24.85	1.32
Egyptian Goose	<i>Alopochen aegyptiaca</i>	78.18	6.17
Spur-winged Goose	<i>Plectropterus gambensis</i>	44.24	1.76
Cape Grassbird	<i>Sphenoeacus afer</i>	24.85	0.88
Black-necked Grebe	<i>Podiceps nigricollis</i>	0.61	0.44
Little Grebe	<i>Tachybaptus ruficollis</i>	38.79	3.08
Common Greenshank	<i>Tringa nebularia</i>	5.45	0.00
Helmeted Guineafowl	<i>Numida meleagris</i>	49.09	3.08
Grey-headed Gull	<i>Chroicocephalus cirrocephalus</i>	3.64	0.44
African Marsh Harrier	<i>Circus ranivorus</i>	0.61	0.00
Black Harrier	<i>Circus maurus</i>	0.00	0.88
Montagu's Harrier	<i>Circus pygargus</i>	1.21	0.00
African Harrier-Hawk	<i>Polyboroides typus</i>	11.52	1.76
Black Heron	<i>Egretta ardesiaca</i>	0.61	0.00
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	0.61	0.00
Black-headed Heron	<i>Ardea melanocephala</i>	52.12	3.96
Goliath Heron	<i>Ardea goliath</i>	2.42	0.00
Grey Heron	<i>Ardea cinerea</i>	24.85	3.52
Purple Heron	<i>Ardea purpurea</i>	4.24	0.00
Squacco Heron	<i>Ardeola ralloides</i>	1.21	0.00
Lesser Honeyguide	<i>Indicator minor</i>	0.61	0.00
African Hoopoe	<i>Upupa africana</i>	12.73	0.88
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	47.88	6.17
Glossy Ibis	<i>Plegadis falcinellus</i>	4.24	1.76
Hadada Ibis	<i>Bostrychia hagedash</i>	89.70	13.66
Southern Bald Ibis	<i>Geronticus calvus</i>	23.03	3.08
African Jacana	<i>Actophilornis africanus</i>	1.82	1.32
Rock Kestrel	<i>Falco rupicolus</i>	5.45	0.88
Giant Kingfisher	<i>Megaceryle maxima</i>	4.85	0.00
Malachite Kingfisher	<i>Corythornis cristatus</i>	7.27	0.00
Pied Kingfisher	<i>Ceryle rudis</i>	12.73	0.44
Black-winged Kite	<i>Elanus caeruleus</i>	60.61	12.78
Yellow-billed Kite	<i>Milvus aegyptius</i>	2.42	0.00
Blue Korhaan	<i>Eupodotis caerulescens</i>	6.06	0.00
Northern Black Korhaan	<i>Afrotis afraoides</i>	0.61	0.00
African Wattled Lapwing	<i>Vanellus senegallus</i>	23.03	0.44
Black-winged Lapwing	<i>Vanellus melanopterus</i>	14.55	0.00
Blacksmith Lapwing	<i>Vanellus armatus</i>	67.88	7.05
Crowned Lapwing	<i>Vanellus coronatus</i>	61.21	3.08
Eastern Clapper Lark	<i>Mirafrasciolata</i>	6.67	0.00
Eastern Long-billed Lark	<i>Certhilauda semitorquata</i>	4.85	0.00
Red-capped Lark	<i>Calandrella cinerea</i>	56.36	2.20
Rufous-naped Lark	<i>Mirafrascicana</i>	1.21	0.88
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	48.48	1.32

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Cape Longclaw	<i>Macronyx capensis</i>	86.67	10.13
Banded Martin	<i>Riparia cincta</i>	42.42	3.08
Brown-throated Martin	<i>Riparia paludicola</i>	46.67	3.96
Common House Martin	<i>Delichon urbicum</i>	6.06	0.00
Rock Martin	<i>Ptyonoprogne fuligula</i>	13.94	1.76
Sand Martin	<i>Riparia riparia</i>	1.21	0.44
Common Moorhen	<i>Gallinula chloropus</i>	32.73	1.76
Lesser Moorhen	<i>Paragallinula angulata</i>	0.61	0.44
Red-faced Mousebird	<i>Urocolius indicus</i>	4.24	0.44
Speckled Mousebird	<i>Colius striatus</i>	25.45	0.88
Common Myna	<i>Acridotheres tristis</i>	21.21	10.13
Black-headed Oriole	<i>Oriolus larvatus</i>	13.94	1.76
Western Osprey	<i>Pandion haliaetus</i>	0.61	0.00
Common Ostrich	<i>Struthio camelus</i>	21.82	1.32
African Grass Owl	<i>Tyto capensis</i>	2.42	0.00
Marsh Owl	<i>Asio capensis</i>	5.45	0.44
Western Barn Owl	<i>Tyto alba</i>	3.03	0.44
Speckled Pigeon	<i>Columba guinea</i>	67.27	13.22
African Pipit	<i>Anthus cinnamomeus</i>	74.55	8.37
Nicholson's Pipit	<i>Anthus nicholsoni</i>	1.82	0.44
Plain-backed Pipit	<i>Anthus leucophrys</i>	1.21	0.00
Kittlitz's Plover	<i>Charadrius pecuarius</i>	7.27	0.44
Three-banded Plover	<i>Charadrius tricollaris</i>	35.15	0.88
Southern Pochard	<i>Netta erythrophthalma</i>	9.09	0.00
Black-chested Prinia	<i>Prinia flavicans</i>	16.36	0.00
Drakensberg Prinia	<i>Prinia hypoxantha</i>	18.79	0.00
Tawny-flanked Prinia	<i>Prinia subflava</i>	0.61	0.44
Common Quail	<i>Coturnix coturnix</i>	29.09	0.44
Red-billed Quelea	<i>Quelea quelea</i>	38.79	1.76
African Rail	<i>Rallus caerulescens</i>	5.45	0.00
Cape Robin-Chat	<i>Cossypha caffra</i>	60.00	3.52
Chorister Robin-Chat Robin-Chat	<i>Cossypha dichroa</i>	1.21	0.00
Common Sandpiper	<i>Actitis hypoleucos</i>	1.21	0.00
Wood Sandpiper	<i>Tringa glareola</i>	6.06	0.00
Streaky-headed Seedeater	<i>Crithagra gularis</i>	9.09	0.44
South African Shelduck	<i>Tadorna cana</i>	30.30	3.52
Cape Shoveler	<i>Spatula smithii</i>	18.79	0.00
Lesser Grey Shrike	<i>Lanius minor</i>	0.61	0.00
Red-backed Shrike	<i>Lanius collurio</i>	0.61	0.00
African Snipe	<i>Gallinago nigripennis</i>	20.00	0.88
Cape Sparrow	<i>Passer melanurus</i>	81.82	6.61
House Sparrow	<i>Passer domesticus</i>	20.00	9.25
Southern Grey-headed Sparrow	<i>Passer diffusus</i>	57.58	4.41
Black Sparrowhawk	<i>Accipiter melanoleucus</i>	12.12	0.88

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
African Spoonbill	<i>Platalea alba</i>	16.36	2.20
Swainson's Spurfowl	<i>Pternistis swainsonii</i>	61.21	2.64
Cape Starling	<i>Lamprotornis nitens</i>	6.06	0.00
Pied Starling	<i>Lamprotornis bicolor</i>	55.15	11.45
Red-winged Starling	<i>Onychognathus morio</i>	8.48	3.08
Wattled Starling	<i>Creatophora cinerea</i>	0.61	0.00
Black-winged Stilt	<i>Himantopus himantopus</i>	9.09	0.00
Little Stint	<i>Calidris minuta</i>	1.82	0.00
African Stonechat	<i>Saxicola torquatus</i>	87.88	10.57
White Stork	<i>Ciconia ciconia</i>	7.27	1.32
Amethyst Sunbird	<i>Chalcomitra amethystina</i>	11.52	0.44
Malachite Sunbird	<i>Nectarinia famosa</i>	11.52	0.44
Barn Swallow	<i>Hirundo rustica</i>	41.82	7.93
Greater Striped Swallow	<i>Cecropis cucullata</i>	55.76	7.93
Lesser Striped Swallow	<i>Cecropis abyssinica</i>	0.61	1.32
South African Cliff Swallow	<i>Petrochelidon spilodera</i>	38.18	3.52
White-throated Swallow	<i>Hirundo albigularis</i>	37.58	1.76
African Swamphen	<i>Porphyrio madagascariensis</i>	6.06	2.20
African Black Swift	<i>Apus barbatus</i>	3.03	0.44
African Palm Swift	<i>Cypsiurus parvus</i>	1.21	1.32
Horus Swift	<i>Apus horus</i>	1.21	0.00
Little Swift	<i>Apus affinis</i>	16.36	4.85
White-rumped Swift	<i>Apus caffer</i>	30.30	3.96
Blue-billed Teal	<i>Spatula hottentota</i>	1.21	0.00
Cape Teal	<i>Anas capensis</i>	3.03	0.00
Red-billed Teal	<i>Anas erythrorhyncha</i>	16.97	1.32
Whiskered Tern	<i>Chlidonias hybrida</i>	12.12	5.29
White-winged Tern	<i>Chlidonias leucopterus</i>	3.64	0.88
Spotted Thick-knee	<i>Burhinus capensis</i>	9.09	0.00
Groundscraper Thrush	<i>Turdus litsitsirupa</i>	0.61	0.00
Karoo Thrush	<i>Turdus smithi</i>	5.45	0.00
Kurrichane Thrush	<i>Turdus libonyana</i>	8.48	0.44
Olive Thrush	<i>Turdus olivaceus</i>	6.06	0.44
Sentinel Rock Thrush	<i>Monticola explorator</i>	2.42	0.00
Cape Wagtail	<i>Motacilla capensis</i>	78.18	3.52
African Reed Warbler	<i>Acrocephalus baeticatus</i>	3.03	0.44
African Yellow Warbler	<i>Iduna natalensis</i>	3.03	0.00
Lesser Swamp Warbler	<i>Acrocephalus gracilirostris</i>	12.73	0.44
Little Rush Warbler	<i>Bradypterus baboecala</i>	6.67	0.88
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	0.61	0.00
Willow Warbler	<i>Phylloscopus trochilus</i>	4.24	0.00
Common Waxbill	<i>Estrilda astrild</i>	52.73	3.52
Orange-breasted Waxbill	<i>Amandava subflava</i>	9.70	0.00
Cape Weaver	<i>Ploceus capensis</i>	33.94	2.20

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Southern Masked Weaver	<i>Ploceus velatus</i>	90.91	9.69
Village Weaver	<i>Ploceus cucullatus</i>	4.24	0.00
Capped Wheatear	<i>Oenanthe pileata</i>	10.30	0.00
Mountain Wheatear	<i>Myrmecocichla monticola</i>	4.85	0.88
Cape White-eye	<i>Zosterops virens</i>	35.15	1.32
Pin-tailed Whydah	<i>Vidua macroura</i>	44.85	2.64
Fan-tailed Widowbird	<i>Euplectes axillaris</i>	39.39	3.08
Long-tailed Widowbird	<i>Euplectes progne</i>	84.85	15.42
Red-collared Widowbird	<i>Euplectes ardens</i>	12.12	1.32
Green Wood Hoopoe	<i>Phoeniculus purpureus</i>	7.88	0.44
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	9.09	1.32
Olive Woodpecker	<i>Dendropicos griseocephalus</i>	3.03	0.00
Red-throated Wryneck	<i>Jynx ruficollis</i>	29.70	2.20
Cape Vulture	<i>Gyps coprotheres</i>	0.00	0.00

APPENDIX 2: HABITAT FEATURES AT THE PROJECT SITE



Figure 1: Agricultural lands at the locality of Site Alternative 2



Figure 2: High quality grassland near the locality of Site Alternative 1

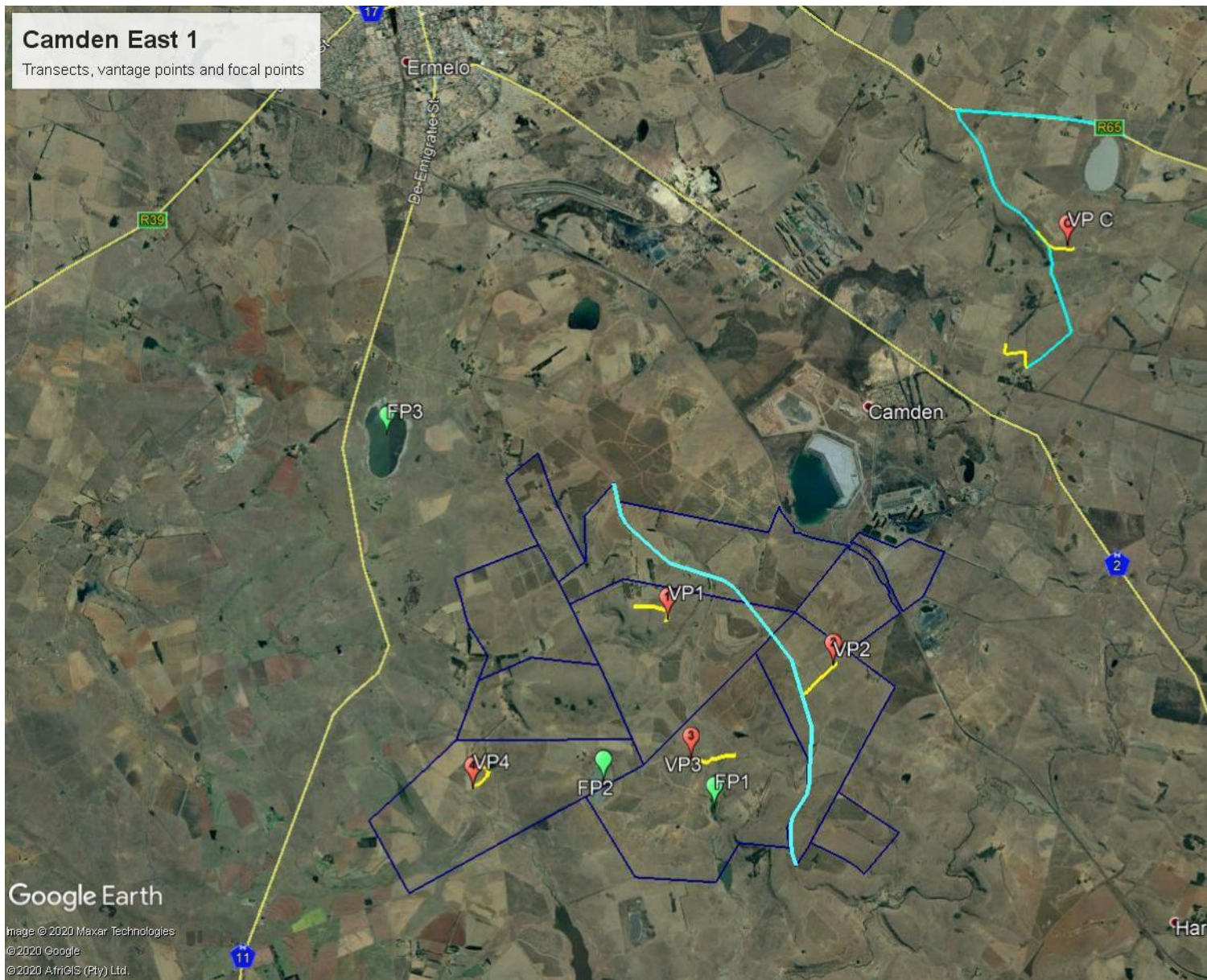


Figure 1: Area where monitoring is taking place, with position of VPs, focal points, drive transects, walk transects and land parcels (dark blue polygon). The area to the north-east of the land parcels is the control area.

