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SIYATHEMBA SWITCHING STATION AND 88KV LILO POWER LINE PROJECT

SPECIALIST AVIFAUNAL IMPACT ASSESSMENT REPORT

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PROFESSIONAL EXPERIENCE

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

DECLARATION OF INDEPENDENCE

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

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

INDEMNITY

- This avifaunal impact assessment report is based on assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- This avifaunal impact assessment report is based on a desktop investigation using the available information and data related to the site to be affected; and a one-day site visit to the project area on 9 March 2018. No long-term investigation or seasonal monitoring has been conducted.
- The Precautionary Principle has been applied throughout this investigation.
- The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this avifaunal impact assessment report.
- The specialist investigator reserves the right to modify this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this avifaunal impact assessment report cannot be applied to any other area without proper investigation.
- This avifaunal impact assessment report in its entirety, or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this avifaunal impact assessment report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

EXECUTIVE SUMMARY

In order to fulfil their mandate of providing a high-quality supply of electricity to support annual load growth and improve the operational flexibility of the existing Grootvlei 88kV network in the Balfour area, Eskom Distribution proposes to construct the Siyathemba Switching Station with a project footprint of approximately 60m x 50m, in addition to two 88kV Loop-In Loop-Out (LILO) power lines, approximately one kilometre in length, extending from the existing 88kV Burnstone power line to the proposed Siyathemba Switching Station. The project is located on Farm Vlakfontein 566IR Portion 5, within the jurisdiction of the Dipaleseng Local Municipality in southern Mpumalanga.

A total of 236 bird species have been recorded within the nine-pentad broader project area during the SABAP2 atlassing period to date. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur within the areas earmarked for the proposed development, particularly where pockets of natural vegetation/habitats persist. Of the 236 species, ten of these are considered to be of conservation concern i.e. Red Data species. In addition, nine species are near endemic to South Africa and a further 21 species are endemic to southern Africa. White Stork, which is not listed, but is protected internationally under the *Bonn Convention on Migratory Species*, was also recorded during the SABAP2 survey period and its presence was confirmed during the site visit. Red Data species have been recorded in low numbers, with less than 30 individuals being recorded over the ten-year survey period within the relevant pentads. The low report rates can be attributed to the high levels of disturbance caused by the surrounding land use practices both at the project site and within the broader project area. It is important to note that although Red Data species have been recorded in the broader project area, none have been recorded in the pentad within which the project site is located. The proposed project area does support a diversity of more common small terrestrial species and development in this area will undoubtedly displace these species temporarily as a result of disturbance associated with construction activities. However, similar habitat is available within the broader area, therefore it is highly unlikely that the displacement impact will be of regional or national significance. Although this assessment focuses on the impacts on Red Data species, as these are the species of highest conservation concern, the impact on waterbirds and raptors have also been considered.

Investigation of the project area and its immediate surrounds revealed the presence of at least seven avifaunal micro habitats: woodland, grassland, wetland areas, surface water (dams and pans) cultivated lands, exotic tree plantations and urban settlements. The project area is located within the Savanna Biome and is comprised of the Andesite Mountain Bushveld vegetation type. Relevant to the project area, small and isolated pockets of savanna or open woodland exist, none of which occur within the areas earmarked for the proposed switching station and power line developments. This is particularly evident in the SABAP2 data which contains no woodland dependent Red Data species and few raptor observations within the broader project area, both in terms of diversity and abundance. A fairly substantial expanse of natural and intact grassland occurs within the proposed project area, particularly the area earmarked for the proposed switching station and power line developments. Mesic grassland, associated with the wetland habitat located north west of the proposed development site, adjacent to the

Siyathemba settlement, is another key habitat feature. The utilisation of these grassland areas by Red Data species is however unlikely. SABAP2 reporting rates for the Red Data avifauna potentially occurring in grassland habitat in the project area are very low and is an indication of the significant levels of human activity and disturbance. Therefore, the potential displacement impacts as a result of habitat loss and disturbance associated with the construction and operation of the proposed Siyathemba Switching Station and the associated power line infrastructure are likely to be LOW for the Red Data species.

Potential impacts that were identified relating to the Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines include: displacement of birds as a result of habitat loss and disturbance associated with the construction and operation of the proposed switching station and the associated power lines; direct mortality as a result of collisions with the overhead cables and electrocutions on the live and earthed components of the 88kV poles/towers. It is important to note that birds may nest on the many forms of infrastructure within the switching station and on the power line poles/towers. While this is a positive impact for birds, nesting material and defecation may compromise the effective operation of the switching station and power line infrastructure.

In general, the habitat within which the proposed project area is located is low to moderately sensitive from an avifaunal impact perspective. In recent years, anthropogenic impacts, mostly in the form of settlement development and agriculture have largely transformed the landscape resulting in a negative impact on avifaunal diversity and abundance within the project area. This is reflected in the low diversity and reporting rates for Red Data species, indicating that levels of disturbance are high. The construction of the proposed Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines will result in various impacts of low significance to the birds occurring in the vicinity of the new infrastructure, which can be reduced to negligible levels through the application of mitigation measures. Given the presence of existing habitat degradation in places and fairly significant levels of disturbance, it is anticipated that the proposed Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines can be constructed within the project area with acceptable levels of impact on the resident avifauna subject to the following recommendations:

- Selecting **Option 1** for the proposed switching station location and its corresponding **Option 1** Burnstone-Siyathemba 88kV LILO power lines.
- 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 avifaunal species.
- Maximum use of existing access roads and the construction of new roads should be kept to a minimum.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.
- In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

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1. INTRODUCTION

In order to fulfil their mandate of providing a high-quality supply of electricity to support annual load growth and improve the operational flexibility of the existing Grootvlei 88kV network in the Balfour area, Eskom Distribution proposes to construct the Siyathemba Switching Station with a project footprint of approximately 60m x 50m, in addition to two 88kV Loop-In Loop-Out (LILO) power lines, approximately one kilometre in length, extending from the existing 88kV Burnstone power line to the proposed Siyathemba Switching Station. The project is located on Farm Vlakfontein 566IR Portion 5, within the jurisdiction of the Dipaleseng Local Municipality in southern Mpumalanga (FIGURE 1).

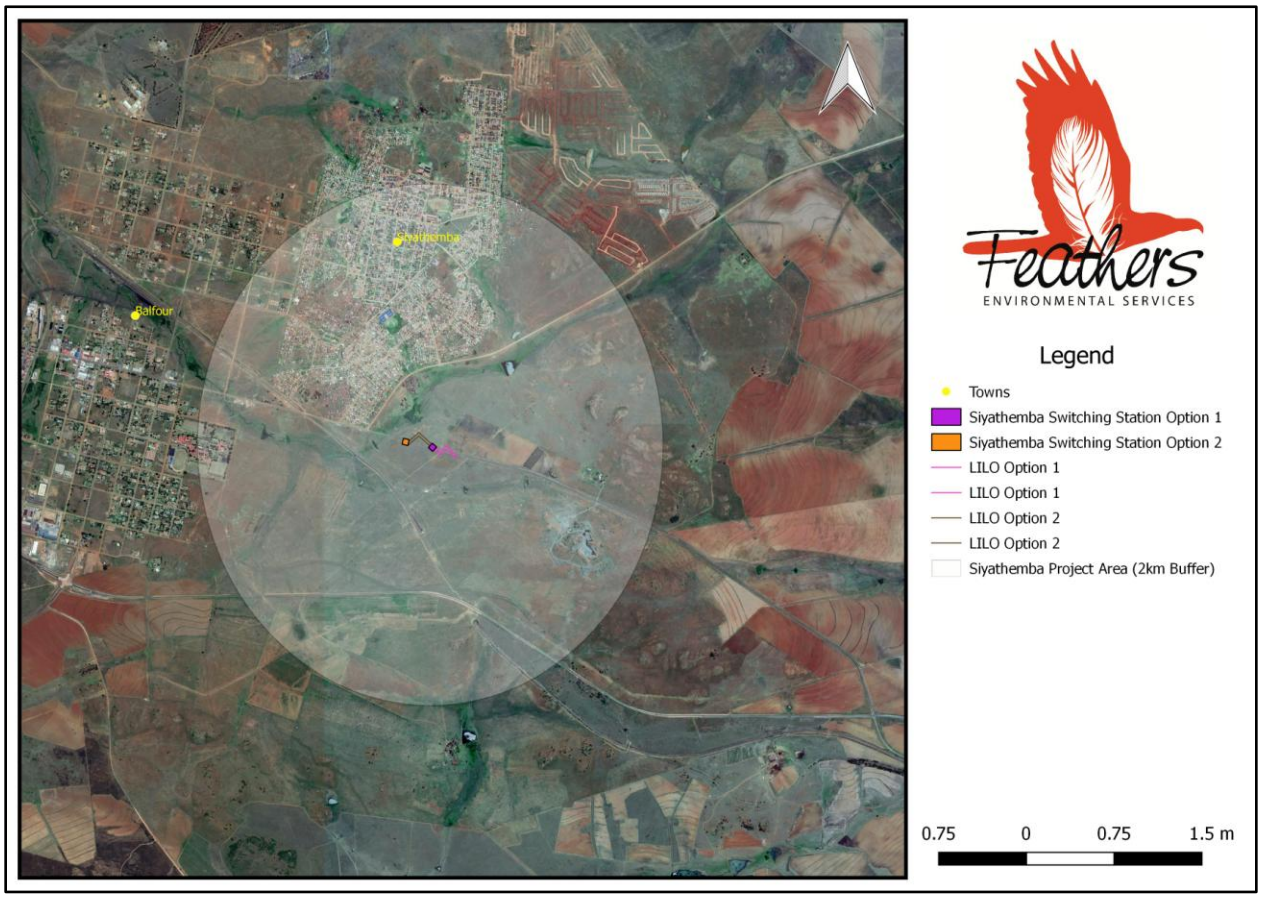

FIGURE 1: Regional map detailing the location of the proposed Siyathemba switching station project and broader study area (2km) in the Gauteng province.

The National Environmental Management Act (NEMA) (Act 107 of 1998) requires that an impact assessment be conducted for any development which could have a significant effect on the environment, with the objective to identify, predict and evaluate the actual and potential impacts of these activities on ecological systems; identify alternatives; and provide recommendations for mitigation to minimize the negative impacts. In order to meet the

Basic Assessment (BA) requirements as outlined in the 2014 National Environmental Management Act (No 107 of 1998) as amended in 2017, Eskom Distribution require detailed specialist studies that will document any potential fatal flaws, the impacts of the project and recommend measures to manage (maximise positive and minimise negative) and monitor those impacts. Eskom Distribution has appointed Nsovo Environmental Consulting as independent environmental assessment practitioners to manage the Basic Assessment process for the proposed development. Feathers Environmental Services was subsequently appointed to compile a specialist avifaunal assessment report (based on a desktop review and a one-day site visit) which uses a set methodology and various data sets (discussed elsewhere) to determine which avian species regularly occur within the project area, the availability of bird micro habitats (i.e. avifaunal sensitive areas), the possible impacts of the proposed development and their significance, the identification of a preferred alternative and the provision of recommendations for the mitigation of the anticipated impacts. In general terms, the impacts that could be associated with a project of this nature include: displacement of birds as a result of habitat loss and disturbance associated with the construction and operation of the proposed Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines; direct mortality as a result of collisions with the overhead cables and electrocutions on the live and earthed components of the 88kV poles/towers and within the switching station.

2. RELEVANT LEGISLATION AND GUIDELINES

The following pieces of legislation are applicable to the proposed development:

2.1 The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is an international convention (to which South Africa is a signatory) and represents a commitment to sustainable development. The Convention has three main objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources (http://www.cbd.int/convention/guide/). Although the convention has not developed specific recommendations or guidelines pertaining to birds and energy infrastructure interactions and impacts, it does make provision (in a general policy guideline) for keeping and restoring biodiversity. In addition to this the CBD is an ardent supporter of thorough assessment procedures (Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs)) and requires that Parties apply these processes when planning activities that will have a biodiversity impact. An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used as a reason for delaying management of these risks. The burden of proof that the impact will *not* occur lies with the proponent of the activity posing the threat. In addition, the Aichi Biodiversity Targets (CBD 2011) address several priority issues i.e. the loss of biodiversity and its causes; reducing direct pressure on biodiversity; safeguarding ecosystems, species and genetic diversity and participatory planning to enhance implementation of biodiversity conservation. Each of these is relevant in the case of energy infrastructure and bird conservation through all project phases from planning to the implementation of mitigation measures for existing developments.

2.2 The Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) is an intergovernmental treaty and is the most appropriate instrument to deal with the conservation of terrestrial, aquatic and avian migratory species. The convention includes policy and guidelines with regards to the impacts associated with man-made infrastructure. CMS requires that Parties (South Africa is a signatory) take measures to avoid migratory species from becoming endangered (Art II, par. 1 and 2) and to make every effort to prevent the adverse effects of activities and obstacles that seriously impede or prevent the migration of migratory species (Art III, par. 4b and 4c). At CMS/CoP7 (2002) Res. 7.2 on Impact Assessment and Migratory Species was accepted, requesting Parties to apply appropriate SEA and EIA procedures for all proposed developments, including energy infrastructure. An agreement developed in the framework of CMS, in force since November 1999, brings the 119 Range States of the Africa Eurasian Waterbird Agreement (AEWA) region together in a common policy to protect migratory waterbirds that use the flyway from the Arctic to southern Africa. The agreement contains a number of obligations that are relevant to migratory waterbirds and energy infrastructure. AEWA has also published a series of practical guidelines that enable Parties to effectively address conservation issues influencing the status of migratory waterbirds. The most relevant guideline for migratory birds and energy infrastructure is the *Guideline on how to avoid, minimise or mitigate impact of infrastructural developments and related disturbance affecting waterbirds* (Tucker & Treweek, 2008).

2.3 The Agreement on the Conservation of African-Eurasian Migratory Water Birds

The Agreement on the Conservation of African-Eurasian Migratory Water birds (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. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The core activities carried out under AEWA are described in its Action Plan, which is legally binding for all countries that have joined the Agreement. The AEWA Action Plan details the various measures to be undertaken by Contracting Parties (South Africa included) to guarantee the conservation of migratory waterbirds within their national boundaries. These include species and habitat protection, and the management of human activities, as well as legal and emergency measures.

2.4 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.

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

The National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) regulations on Threatened and Protected Species (TOPS) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. The national Act and several sets of provincial conservation legislation provide for among other things, the management and conservation of South Africa's biodiversity; protection of species and ecosystems that necessitate national protection and the sustainable use of indigenous biological resources.

3. STUDY METHODOLOGY

3.1 Terms of Reference

The avifaunal specialist has conducted this avifaunal impact assessment according to the following terms of reference:

- Describe the existing environment and the bird communities (particularly with reference to Red Data species) most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.
- Indicate how a resource or community will be affected. A full description of the positive and negative impacts (during construction and operation) that the proposed activity and alternatives will have on the environment and on the bird community, that may be affected.
- Map bird sensitive areas (if any) in a sensitivity map for easy reference.
- Identify and rank most and least suitable alternatives for the proposed project.
- Identify practical mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks. Provide practical mitigation measures to be included in the EMPr and conditions of authorisation.
- Provide a reasoned opinion, as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
- Describe any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed. The best available data sources will be used to predict the impacts, and extensive use will be made of local knowledge if available.

3.2 Methods

The following methodology was employed to compile this avifaunal impact assessment report:

- Various avifaunal data sets (listed below) were collected and examined to determine the location and abundance of sensitive Red Data (as well as non-Red Data) species that may be vulnerable to the impacts associated with the construction and operation of the proposed development.
- Suitable bird habitats and potential sensitive areas within the proposed project area, where the above impacts are likely to occur, were assessed using various Geographic Information System (GIS) layers and confirmed based on observations made during the site visit (late summer survey) to the proposed project area on 9 March 2018 (FIGURE 2).
- The impacts of the proposed switching station and power line on birds were identified and evaluated on the basis of experience in gathering and analysing data on avian impacts with electrical infrastructure throughout southern Africa since 1996 and supplemented with first hand data. The significance of each impact was assessed according to quantitative criteria (APPENDIX 3).
- Practical mitigation recommendations for potentially significant impacts were provided for inclusion in the EMPr.

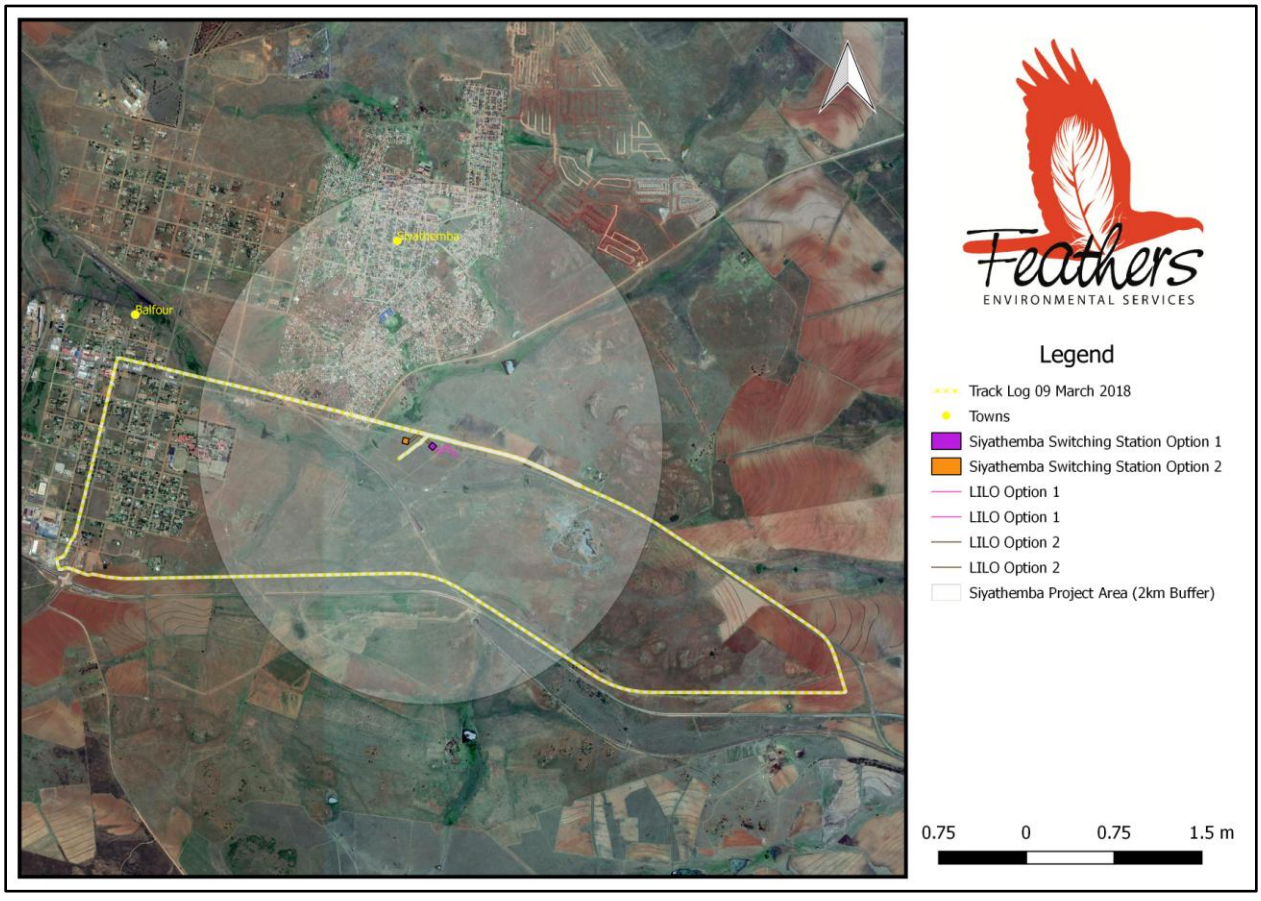

FIGURE 2: Track log detailing the areas assessed during the site visit conducted on 9 March 2018.

3.3 Data sources used

The following data sources and reports were used in varying levels of detail for this study:

- Bird distribution data of the South African Bird Atlas 2 (SABAP2) was obtained from the Animal Demography Unit of the University of Cape Town as a means to ascertain which species occur within the broader area, based on nine pentad grid cells within which the proposed development is situated. Each pentad is approximately 8 × 7.6 km. Between 2007 and 2017, a total of 164 full protocol cards (i.e. 164 bird surveys lasting a minimum of two hours each) have been completed for the proposed project site and its immediate surrounds (project area). The relevant pentads within the project area include: 2635_2830; 2635_2835; 2635_2840; 2640_2830; 2640_2835; 2640_2840; 2645_2830; 2645_2835 and 2645_2840.
- The Important Bird Areas (IBAs) report (Marnewick et al. 2015) was consulted to determine the location of the nearest IBAs and their importance for this study. Although the project site is not located within an IBA, the Mpumalanga/Gauteng IBA (SA130) has relevance to this study.
- The Co-ordinated Avifaunal Roadcount project (CAR) data was consulted to obtain relevant data on large terrestrial bird report rates in the area (Animal Demography Unit. 2017). CAR route GH02 has relevance to this study.
- The Co-ordinated Waterbird Count (CWAC) data was consulted to determine if large concentrations of water birds, associated with South African wetlands, may occur within the project area (Animal Demography Unit. 2015). The project area does not contain CWAC sites.
- The conservation status and endemism information of all bird species occurring in the aforementioned pentads was then determined with the use of the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al. 2015) and the IUCN Red List of Threatened Species (http://www.iucnredlist.org/) and the most recent and comprehensive summary of southern African bird biology (Hockey et al. 2005).
- The latest vegetation classification described in the Vegetation Map of South Africa (South African National Biodiversity Institute, 2012 and Mucina & Rutherford, 2006) was consulted in order to determine which vegetation types occur at the proposed site and the larger project area.
- Satellite Imagery of the area was studied using Google Earth ©2018.
- KMZ/KML shapefile detailing the location of the proposed switching station and power line options was obtained from Nsovo Environmental Consulting.
- A field visit to the project area was conducted on 9 March 2018 (late summer survey) to form a first-hand impression of the micro-habitat occurring within the proposed project area (FIGURE 2). This information, together with the SABAP2 data was used to compile a comprehensive list of species that could occur in the project area.
- Personal observations made during the aforementioned site visit to the project area coupled with the author's experience gained from assessing various infrastructure development projects in the Mpumalanga region have been used to formulate a professional opinion of the species likely to occur in the project area and the likely impacts that the proposed development may have on the resident avifaunal community.

3.4 Limitations & assumptions

The author made the assumption that the sources of information used are reliable. However, it must be noted that there are limiting factors and these may potentially detract from the accuracy of the predicted results:

- The report is the result of a short-term study and is based on a single one-day site visit to the proposed project area. No long-term monitoring was conducted by the avifaunal specialist. However, the comprehensive SABAP2 abundance dataset, which provides a valuable baseline against which any changes in species presence, abundance, and distribution can be monitored, has allowed for the identification and assessment of the anticipated impacts and the provision of recommendations for mitigation.
- The site visit to the project area and the resultant observations were made in a single season (i.e. late summer), during which time migrant species may no longer have been present or potential breeding activities for various species (specifically raptors) could not be determined. However, professional judgment based on extensive field experience played an important role in the identification and assessment of the potential impacts and the provision of mitigation recommendations.
- Although the proposed development is located within a single pentad (2640_2835), a larger area (comprised of nine pentads) is necessary to obtain a dataset that is large enough to ensure that reasonable conclusions about species diversity and densities, in a particular habitat type, can be drawn. Coverage by SABAP2 to date has been fairly extensive with a total of 164 full protocol data cards being completed for the nine pentads and therefore the SABAP2 data is regarded as a reliable record of the avifauna likely to occur within the project area.
- The core **project area** of the proposed switching station development was defined as a 2km zone around the proposed switching station sites and LILO power line options (FIGURE 1).
- The focus of the study is primarily on the potential impacts on South African Red Data species, but also considered other priority species i.e. South African endemics and near-endemics; waterbirds; and raptors that are particularly vulnerable to interactions with electrical infrastructure.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors' experience working in the avifaunal specialist field since 2006. However, bird behaviour can't be reduced to formulas that will hold true under all circumstances. It must also be noted that, it is often not possible to entirely eliminate the risk of the displacement impact (as a result of habitat loss and disturbance) associated with the proposed activities. Studies such as this attempt to minimise the risk as far as possible, and although the impacts will be unavoidable, they may be temporary.

The above limitations need to be stated as part of this study so that the reader fully understands the complexities. However, they do not detract from the confidence that this author has in the findings of this study and subsequent management recommendations for this project.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 Relevant Bird Populations

4.1.1. Important Bird Areas (IBAs)

Some sites are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur. Vigorous protection of the most critical sites is one important approach to conservation. Many species may be effectively conserved by this means. Patterns of bird distribution are such that, in most cases, it is possible to select sites that support many species. These sites, carefully identified on the basis of the bird numbers and species complements they hold, are termed Important Bird Areas (IBAs). IBAs are selected such that, taken together, they form a network throughout the species' biogeographic distributions. IBAs are key sites for conservation – small enough to be conserved in their entirety and often already part of a protected-area network. They are responsible for one (or more) of three factors i.e. 1) hold significant numbers of one or more globally threatened species 2) are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species or 3) have exceptionally large numbers of migratory or congregatory species.

Although the project area is not located within an IBA, the Devon Grasslands IBA (SA130) is located 4km east of the proposed project area (FIGURE 3). This IBA is comprised almost entirely of grassland but also includes several small rivers, numerous non-perennial drainage lines, natural wetlands and man-made dams. Although only a very small proportion of these are monitored regularly as part of Coordinated Waterbird Count (CWAC), waterbird diversity is known to be high with significant numbers of resident and migratory waterbirds occurring in the summer, particularly in wet years. The area is well known for Blue Crane *Anthropoides paradiseus* and flocks totalling 250–300 birds are recorded most winters. A single Wattled Crane *Bugeranus carunculatus* forages with the Blue Cranes. Blue Korhaan *Eupodotis caerulescens* and Secretarybird *Sagittarius serpentarius* breed here and are commonly observed. Four harrier species occur regularly: African Marsh-Harrier *Circus ranivorus* is resident, Black Harrier *Circus maurus* is a winter visitor and Pallid Harrier *Circus macrourus* and Montagu's Harrier *Circus pygargus* are summer migrants. African Grass Owl *Tyto capensis* is probably under-recorded as there is suitable habitat for this species throughout the IBA. Black-winged Pratincole *Glareola nordmanni* sometimes occurs in large numbers. Waterbird numbers fluctuate considerably as water levels change on the numerous dams and streams in the area (Marnewick *et al*. 2015).

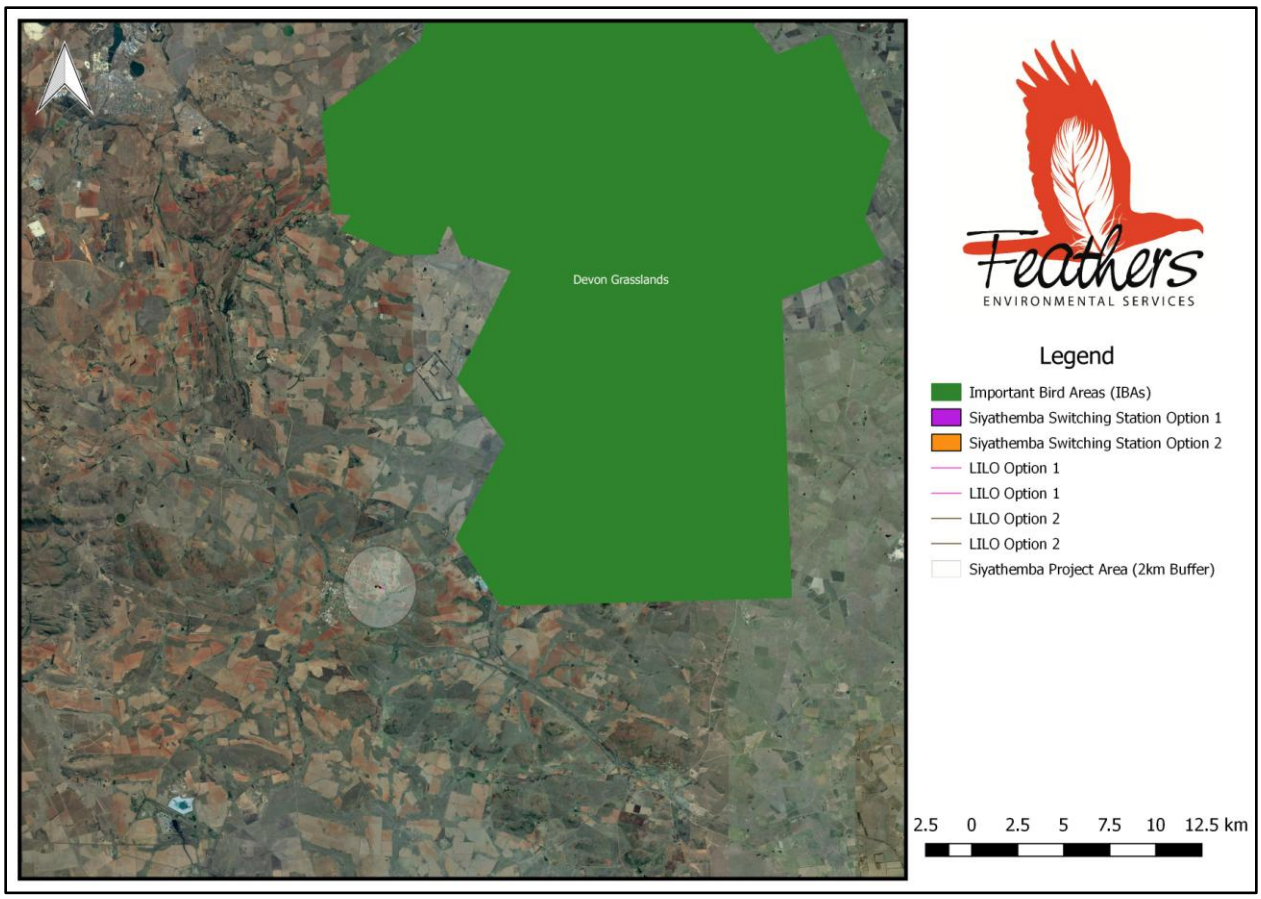

FIGURE 3: Regional map showing the Siyathemba project area in relation to the neighbouring Important Bird Areas.

Despite the proximity of the Devon Grasslands IBA to the project area and the reported occurrence of the aforementioned species within the broader project area (with the exception of Wattled Crane and Pallid Harrier) the construction and operation of the proposed Siyathemba Switching Station and the associated 88kV LILO power line are unlikely to have a direct negative impact on the IBA and the species it supports.

4.1.2. Coordinated Avifaunal Roadcount (CAR) Routes

Cranes, bustards, storks and other large birds that spend most of their time on the ground, need wide, open spaces and are certainly not restricted to protected areas. Agricultural habitats are used extensively for feeding, roosting and breeding, often because no natural, pristine habitats are available, and sometimes because the agricultural habitats are especially attractive to birds. Because of their size and conspicuous nature, these birds can be monitored using a relatively simple technique i.e. the road count. The Coordinated Avifaunal Roadcounts (CAR) project monitors the populations of 36 species of large terrestrial birds in agricultural habitats, in addition to gamebirds, raptors and corvids along 350 fixed routes covering over 19 000km (http://car.adu.org.za/). Although CAR road counts do not give an absolute count of all the individuals in a population, they do provide a measure of relative abundance in a particular area.

CAR route GH02 has relevance to this study area and is located approximately 2km west of the proposed project area (FIGURE 4). This route has recorded fairly significant numbers of Helmeted Guineafowl *Numida meleagri* (n=480), Black-headed Heron *Ardea melanocephala* (n=151) and Spur-winged Goose *Plectropterus gambensis* (n=111), over a four-year survey period (2012 to 2016). Northern Black Korhaan *Afrotis afraoides*, Swainson's Spurfowl *Pternistis swainsonii*, White Stork *Ciconia ciconia* and Goliath Heron *Ardea goliath* were also recorded, however these species were observed in significantly lower abundances. Although parts of the broader study area are heavily transformed and subject to significant disturbance, the presence of these species in the open grassland and cultivated areas cannot be ruled out. White Stork, Swainson's Spurfowl and Helmeted Guineafowl were observed during the site visit (FIGURE 4).

4.1.3. Coordinated Waterbird Count (CWAC) Sites

A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison et al, 2004). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). The presence of a CWAC site within the project area is an indication of a large number of waterbird species occurring there and the overall sensitivity of the area.

There are no CWAC sites within close proximity of the proposed project area, therefore CWAC data was not used as a criterion to assess the sensitivity and anticipated impacts in the project area.

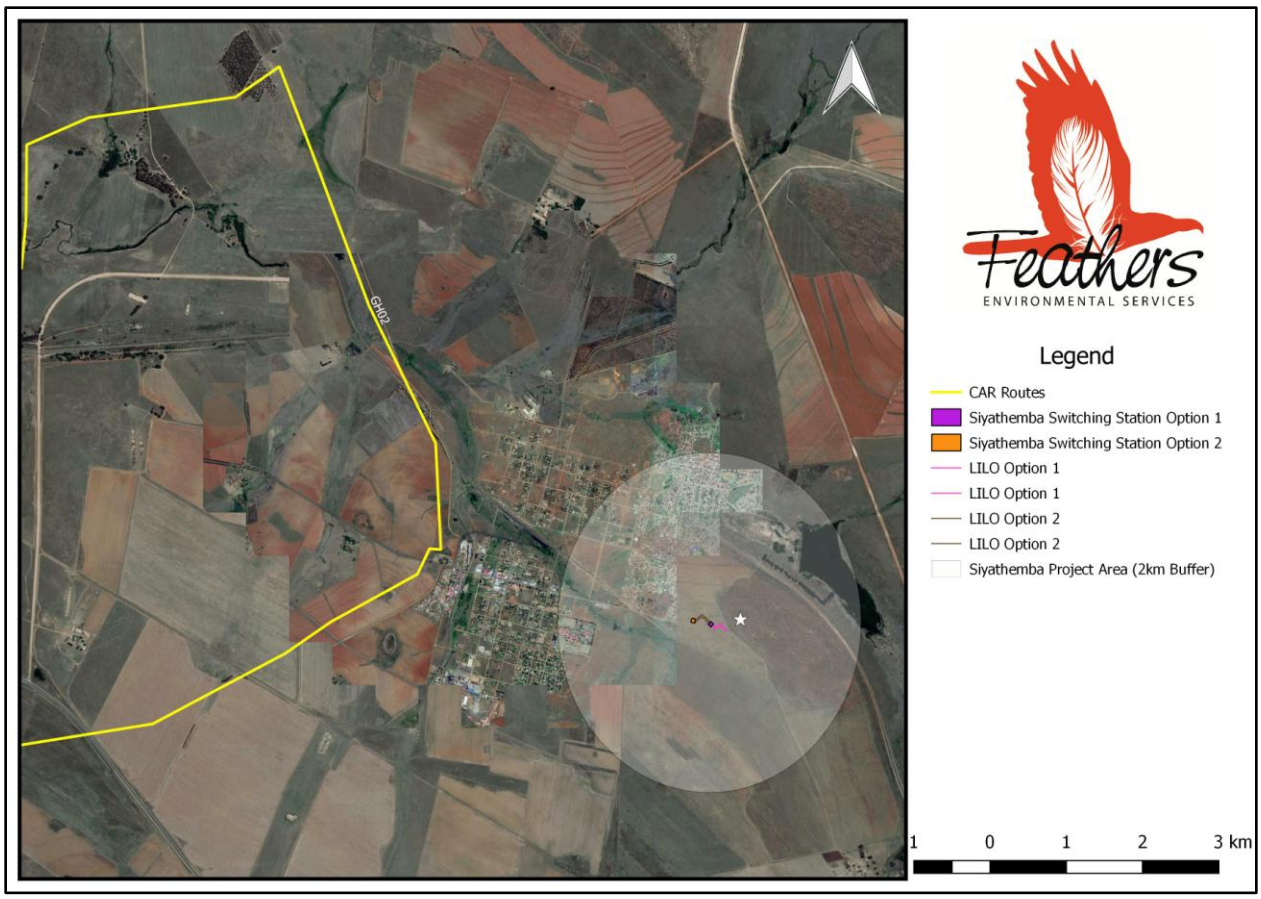

FIGURE 4: Regional map showing the Siyathemba project area in relation to Co-ordinated Avifaunal Roadcount route (GH02).

4.1.4. Southern African Bird Atlas Project (SABAP2)

A total of 236 bird species have been recorded within the nine-pentad broader project (FIGURE 5) area during the SABAP2 atlassing period to date (APPENDIX 2). The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur within the areas earmarked for the proposed development, particularly where pockets of natural vegetation/habitats persist. Of the 236 species, ten of these are considered to be of conservation concern i.e. Red Data species (Taylor et al, 2015 and the IUCN Red List, 2016). In addition, nine species are near endemic to South Africa (species whose range extends only marginally outside South Africa) and a further 21 species are endemic to southern Africa. White Stork, which is not listed, but is protected internationally under the *Bonn Convention on Migratory Species*, was also recorded.

Each of the above-mentioned Red Data species have been recorded in low numbers, with less than 30 individuals being recorded over the ten-year survey period within the relevant pentads. An incidental sighting of a single African Grass-owl *Tyto capensis* has been noted in the SABAP 2 data set - this sighting is within the broader study area and not within the pentad that contains the proposed development. The low report rates for these species of conservation concern can possibly be attributed to 1) the fact that not all of the nine pentad grid cells have been surveyed equally and extensively, or 2) a result of the fairly high levels of disturbance caused by the surrounding land use practices. The significant disturbance and habitat loss experienced in the project area has undoubtedly

displaced many of the naturally occurring species, that under optimum conditions, would inhabit these areas. It is important to note that although Red Data species have been recorded in the broader project area, none have been recorded in the pentad within which the project site is located. The proposed project area does support a diversity of more common small terrestrial species and development in this area will undoubtedly displace these species temporarily as a result of disturbance associated with construction activities. However, similar habitat is available within the broader area, therefore it is highly unlikely that the displacement impact will be of regional or national significance.

Although this report focuses on Red Data species, since the impacts associated with the construction and operation of the Siyathemba Switching Station and the associated 88kV LILO power lines are likely to be more biologically significant for these species, the impact on non-Red Data species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Data species will also protect non-Red Data species in the project area. The non-Red Data species that have been considered for this assessment include large eagles, buzzards, kestrels, herons, geese, ibis and various water bird species. Each Red Data species' potential for occurring in a specific habitat class is indicated in TABLE 4.1, in addition to the type of impact that could potentially affect each species.

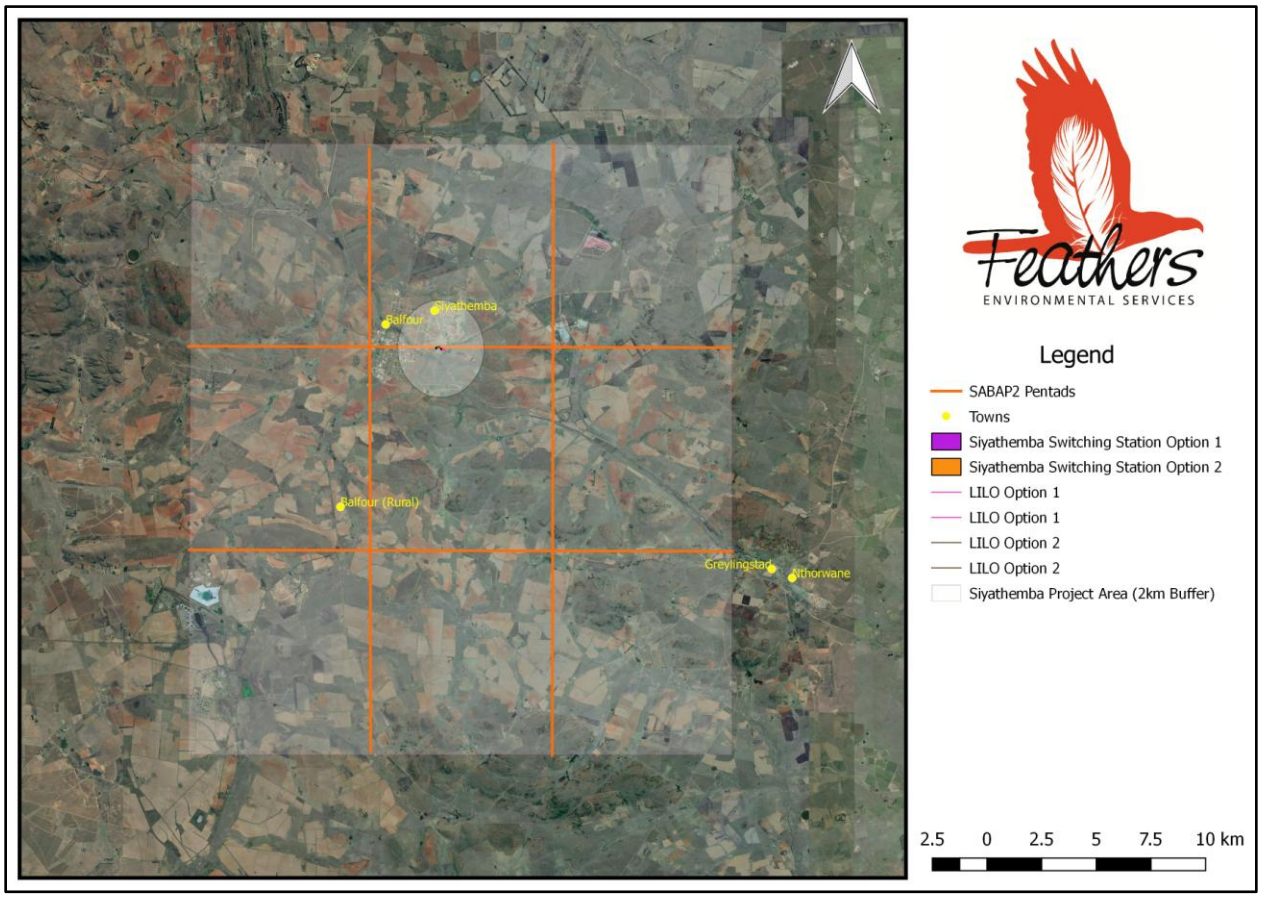

FIGURE 5: Regional map showing the Siyathemba project area in relation to the SABAP2 nine-pentad grid square

TABLE 4-1: Red Data species recorded in the broader project area during the SABAP2 survey period

SPECIES (Taxonomic Name)	REGIONAL CONS. STATUS	AV. REPORT RATE	NO. OF INDIVIDUALS	WETLANDS	WATERBODIES	WOODLAND	GRASSLAND	CULTIVATED LAND	COLLISION	ELECTROCUTION	DISPL. (HABITAT LOSS)	DISPL. (DISTURBANCE)
Crane, Blue *Anthropoides paradiseus*	NT	1.22	2	x	x	-	x	x	x	-	x	-
Duck, Moccoa *Oxyura maccoa*	NT	0.61	1	-	x	-	-	-	x	-	-	-
Falcon, Lanner *Falco biarmicus*	VU	2.44	4	-	-	open	x	x	x	-	x	x
Flamingo, Greater *Phoenicopterus ruber*	NT	17.07	28	-	x	-	-	-	x	-	-	-
Flamingo, Lesser Phoenicopterus minor	NT	7.93	13	-	x	-	-	-	x	-	-	-
Marsh-Harrier, African *Circus ranivorus*	EN	1.22	2	x	-	-	mesic	-	x	x	x	x
Pratincole, Black-winged *Glareola nordmanni*	NT	5.49	9	x	pans	-	x	x	-	-	x	x
Secretarybird *Sagittarius serpentarius*	VU	6.10	10	-	-	open	x	-	x	-	x	x
Stork, Yellow-billed *Mycteria ibis*	EN	6.71	11	x	x	-	mesic	-	x	-	-	-
Tern, Caspian *Sterna caspia*	VU	0.61	1	-	x	-	-	-	-	-	-	-
Stork, White *Ciconia ciconia*	BONN	3.05	5	x	-	open	x	x	x	-	x	x
EN = Endangered; VU = Vulnerable; NT = Near-threatened												

4.2 Bird Habitat Classes

Vegetation is one of the primary factors determining bird species distribution and abundance in an area. The following description of the vegetation on the site focuses on the vegetation structure and not species composition, since it is widely accepted within ornithological circles that vegetation structure is more important in determining which bird species will occur there. The classification of vegetation types is from Mucina & Rutherford (2006 and 2012), while from an avifaunal perspective, the Atlas of southern African Birds (SABAP1) recognises six primary vegetation divisions or biomes within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison et al. 1997). Whilst much of the distribution and abundance of bird species can be attributed to the broad vegetation types present in an area, it is the smaller spatial scale habitats (micro habitats) that support the requirements of a particular bird species that need to be examined in greater detail. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food availability, and various anthropogenic factors all of which will either attract or deter birds and are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing the mitigation requirements.

Investigation of the proposed development site and broader project area revealed the following bird micro habitats, with APPENDIX 1 providing a photographic record of the bird habitats:

4.2.1. Savanna (Open Woodland)

The project area is located within a single primary vegetation division namely the Savanna Biome which is defined by SABAP1 as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs (Harrison *et al* 1997). Any remaining natural woodland occurring within the project area, is likely to be comprised of Andesite Mountain Bushveld vegetation which occurs across Gauteng, North-West, Mpumalanga and Free State Provinces. Andesite Mountain Bushveld conforms to a dense, medium-tall thorny bushveld with a well-developed grass layer on hill slopes and some valleys with an undulating landscape (Mucina & Rutherford, 2006). Generally, this vegetation type has been largely transformed as a result of cultivation and urbanization.

Relevant to the project area, small and isolated pockets of savanna or open woodland exist, none of which occur within the areas earmarked for the proposed switching station and power line developments (FIGURE 6). In bird terms, the savanna/woodland biome it is the most species-rich community in southern Africa and is particularly rich in raptors. However, isolated pockets of woodland will influence the occurrence of large Red Data species that might otherwise be attracted to this habitat. This is particularly evident in the SABAP2 data which contains no Red Data species that are exclusively dependent on woodland habitat and few raptor observations within the broader project area, both in terms of diversity and abundance, indicating that human activity has impacted on the avifaunal community through habitat transformation and that levels of disturbance are high. Non-Red Data raptor species that have been recorded within the study area in varying abundances and that may be displaced from the area during the proposed development, include the migratory Steppe Buzzard *Buteo vulpinus*, Amur Falcon *Falco biarmicus*, and Black-shouldered Kite *Elanus caeruleus.*

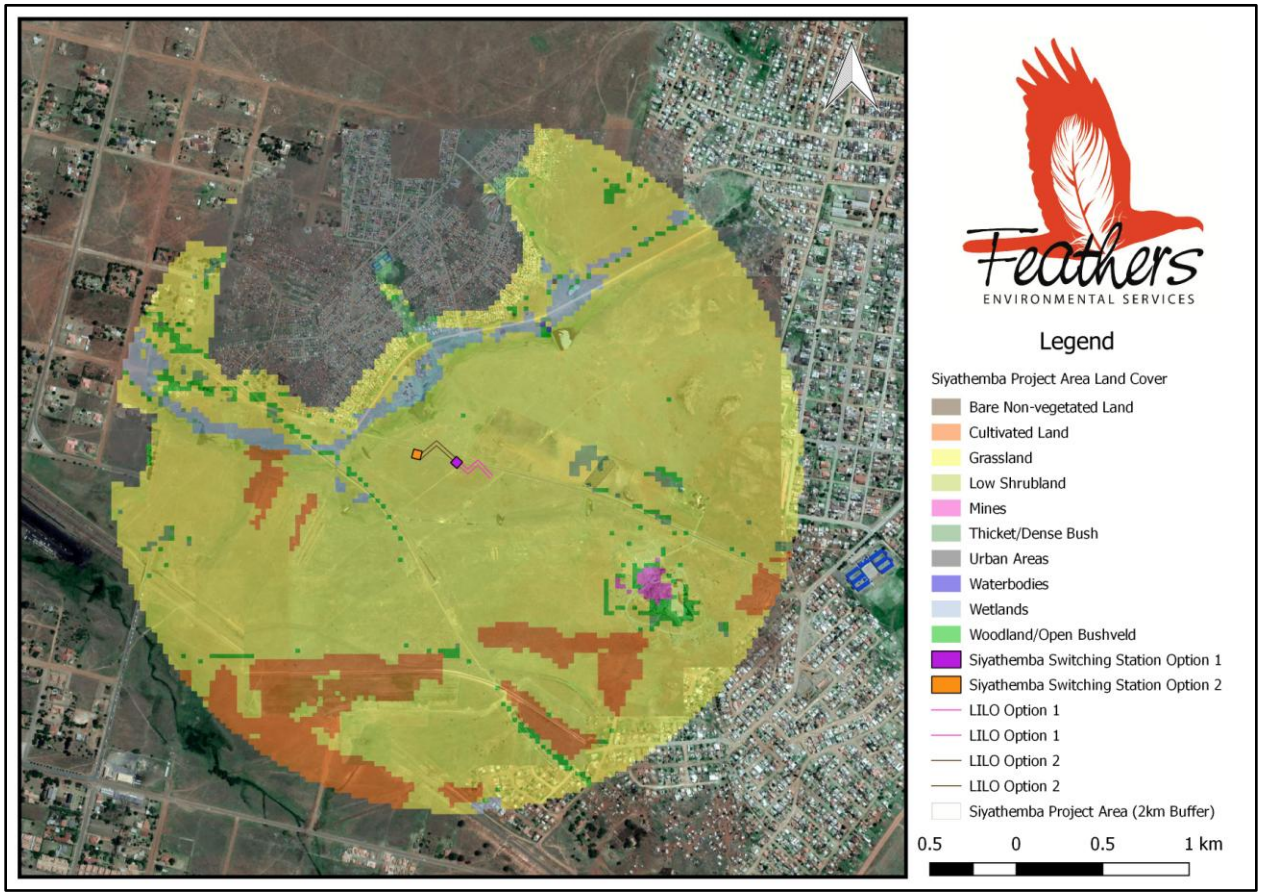

FIGURE 6: Regional map detailing the various habitat types occurring at the Siyathemba project site and within the broader project area.

4.2.2. Grassland Patches

Of South Africa's 841 bird species, 350 occur in the Grassland Biome. This includes 29 species of conservation concern (i.e. those species declining in numbers), ten endemics, and as many as 40 specialist species that are exclusively dependent on grassland habitat. Grasslands represent a significant feeding area for many bird species in densely populated areas and will typically attract Blue Crane, Lanner Falcon *Falco biarmicus*, African Marsh-Harrier, Black-winged Pratincole, Secretarybird and White Stork observed in the broader study area during the SABAP2 survey period. All the species mentioned above, are vulnerable to interactions with electrical infrastructure. Grassland patches are also a favourite foraging area for game birds such as francolin, spurfowl and Helmeted Guineafowl. This in turn could attract large raptors because of both the presence and accessibility of prey.

Parts of the broader project area have experienced transformation as a result of agricultural practices and urbanisation. However, a fairly substantial expanse of natural and intact grassland occurs within the proposed project area, particularly the area earmarked for the proposed switching station and power line developments

(FIGURE 6). Mesic grassland, associated with the wetland habitat located adjacent to the Siyathemba settlement to the north west of the proposed development site, is another key habitat feature within the broader project area, which could potentially support African Marsh-Harrier and White Stork. The utilisation of these grassland areas by the aforementioned species is however unlikely. SABAP2 reporting rates for the Red Data avifauna potentially occurring in grassland habitat in the project area are very low (see TABLE 4-1) and is an indication of the significant levels of human activity and disturbance. Therefore, the potential displacement impacts as a result of habitat loss and disturbance associated with the construction and operation of the proposed Siyathemba Switching Station and the associated power line infrastructure are likely to be low for the aforementioned grassland dependent species.

4.2.3. Wetlands

Wetlands are characterized by slow flowing seasonal water (or permanently wet) and tall emergent vegetation (rooted or floating) and provide habitat for many water birds. The conservation status of many of the bird species that are dependent on wetlands reflects the critical status of wetlands worldwide, with many having already been destroyed. There are examples of localized wetlands within the broader project area, to the north-west of the proposed development site (FIGURE 6), which may represent attractive foraging habitat for sensitive species such as Blue Crane, Black-winged Pratincole, Yellow-billed Stork *Mycteria ibis* and White Stork. It is also the preferred roosting and foraging habitat for the African Marsh Harrier (Hockey et al 2005). However, given the proximity of the wetland to the Siyathemba settlement, this habitat is fairly degraded and subject to significant human disturbance. It is unlikely that any of the aforementioned wetland dependent species will utilise this habitat. Various common species i.e. ibis, herons and geese will also utilise wetlands for their foraging needs and are likely to be tolerant of or accustomed to disturbance impacts associated with the construction of the proposed development.

4.2.4. Surface Water (Dams and Pans - both permanent & seasonal)

Many thousands of earthen and other dams exist in the southern African landscape. Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. Man-made impoundments, although artificial in nature, can be very important for variety of birds, particularly waterbirds. Apart from the water quality, the structure of the dam, and specifically the margins and the associated shoreline and vegetation, plays a big role in determining the species that will be attracted to the dam. Several dams and pans of varying sizes and water permanency were observed within the broader study area (FIGURE 6). Red Data species that could be attracted to these areas include Blue Crane, Greater Flamingo *Phoenicopterus ruber*, Lesser Flamingo *Phoenicopterus minor,* Maccoa Duck *Oxyura Maccoa* and White Stork. Non-threatened, impact sensitive species that could utilise these areas for their breeding, roosting and foraging needs include Reed Cormorant *Phalacrocorax africanus*, White-breasted Cormorant *Phalacrocorax carbo*, African Darter *Anhinga rufa*, Red-knobbed Coot *Fulica cristata*, Egyptian Goose *Alopochen aegyptiacus*, Spur-winged Goose, several duck, heron, egret and ibis species, African Spoonbill *Platalea alba* and Red-billed Teal *Anas erythrorhyncha*. At least four

waterbodies occur within 400m of the proposed development site, however it is unlikely that either of these will attract the aforementioned Red Data species and therefore the displacement impact, associated with the construction and operation of the proposed Siyathemba Switching Station and its LILO power lines, is likely to be LOW and temporary in duration.

4.2.5. Cultivated Land

The ploughing of soil for crop production is often thought to be an improvement of the environment, but, in fact, this activity completely destroys the structure and species composition of the natural vegetation, thus causing irrevocable damage. These alterations have an enormous impact on the bird species that are dependent on the natural vegetation that they inhabit. The birds least likely to show the effects of these transformations are the small species which are able to persist in small, fragmented remnants of undisturbed habitat (Harrison et al*,* 1997). Larger species with large home ranges will most likely show disrupted patterns of distribution. Conversely, agriculture may in fact cause some species to expand their distribution beyond the vegetation types in which they occurred naturally. The opening up of the soil surface and land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds; and the crop or pasture plants cultivated are often eaten by birds or attract insects and rodents which are in turn eaten by birds. Commercial dryland agriculture and pastures occur within the broader project area (FIGURE 6) and these may be draw cards for species such as Blue Crane, Lanner Falcon, White Stork and a variety of non-Red Data species e.g. Black-shouldered Kite, Steppe Buzzard, Spur-winged Goose, Helmeted Guineafowl, Hadeda Ibis *Bostrychia hagedash*, Cattle Egret *Bubulcus ibis*, Black-headed Heron and Barn Swallow *Hirundo rustica*. Any of the aforementioned species that have persisted and are utilising this habitat type within the broader project area, are likely to be accustomed to the existing disturbance experienced within the area and are therefore likely to be temporarily displaced from the area, should the Siyathemba Switching Station and its LILO power line development proceed.

4.2.6. Exotic Tree Plantations

Although exotic tree plantations are strictly speaking invader species, they have become important refuges for certain species of raptors, particularly Amur Falcon, a Palearctic migrant, which will commonly roost in small stands of *Eucalyptus* in suburbs of small towns. Black Sparrowhawk *Accipiter melanoleucus* is another species that use these trees for roosting and breeding purposes. Relevant to this study, Lanner Falcon is the only species of conservation concern that might be attracted to stands of invasive alien trees.

4.2.7. Urban Areas & Infrastructure

These areas include surface infrastructure such as roads, railways and buildings. Built-up areas generally are of little value to sensitive Red Data bird species due to their degraded nature and the associated disturbance factor. They do however play an important role in providing safe refuge and foraging opportunities for small passerine species that have become common in urban environments.

TABLE 4-1 details the micro habitats that each Red Data bird species (recorded by SABAP2) will typically frequent in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a

landscape from time to time. However, the analysis in TABLE 4-1 represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time which in turn provides an indication of where impacts on those species will be most significant.

5. GENERAL DESCRIPTION OF BIRD INTERACTIONS WITH ELECTRICAL INFRASTRUCURE

Poorly sited or designed facilities and infrastructure can negatively impact not only vulnerable species and habitats, but also entire ecological processes. The effects of any development on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and diversity of species present. With so many variables involved, the impacts of each development must be assessed individually. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss and disturbance causes a reduction in birds using an area which may then reduce the risk of collision). The principal impacts of concern for Red Data species related to the proposed Siyathemba Switching Station and the associated 88kV LILO power lines are:

* Displacement due to habitat loss in the physical infrastructure footprint;
* Displacement due to disturbance associated with construction and operation/maintenance; and
* Mortality due to collision with the earthwires and/or conductors of the power lines; and
* Mortality due to electrocution on the power line infrastructure and within the switching station.

5.1 Construction Phase

5.1.1. Displacement as a result of habitat loss or transformation

This impact is dependent on the location and the scale of the facility. Extensive areas of vegetation (habitat) may be cleared to accommodate the considerable amount of infrastructure required, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). The effect of the vegetation clearing is always more marked in woodland areas, where construction necessitates the removal of woody plants, and especially large trees. This development will undoubtedly modify a certain amount of habitat and is likely to impact the smaller passerine bird species with small home ranges as entire territories could be removed during construction activities.

Relevant to this assessment, the areas earmarked for the proposed switching station sites are comprised of fairly intact grassland habitat but the area does contain a significant amount of existing infrastructure in the form of an operational railway line, power line network and gas pipeline. Although the grassland habitat may be attractive to certain priority species for foraging, it is highly unlikely that Red Data species will utilise the grassland habitat contained within the area designated for the proposed development for breeding purposes. The loss of habitat may potentially be more significant for the smaller passerine species with small home ranges as entire territories could be removed during construction activities. However, based on the relatively small footprint and the location of the proposed switching station site and power line corridors, coupled with the low reporting rates for Red Data

species recorded in the broader project area, the proposed development is unlikely to have any long-term, significant negative displacement impact on the local avifauna as a result of habitat loss and is therefore rated to be of **LOW** significance and temporary as far as Red Data species are concerned.

5.1.2. Displacement as a result of disturbance

Excavation and construction activities are a source of significant disturbance particularly as a result of the machinery and construction personnel that are present on site for the duration of the construction of the facility. For most bird species, construction activities are likely to be a cause of temporary disturbance and may impact on foraging, breeding and roosting behaviours or in more extreme cases, result in displacement from the site entirely. The project area is already subjected to a fairly significant degree of disturbance due to the nearby settlement, railway operations, agricultural activities, a small mine (quarry) and considerable road traffic in the immediate vicinity of the proposed switching station sites and power line corridors. Similarly, based on the relatively small footprint and the location of the proposed switching station site and power line corridors, coupled with the low reporting rates for Red Data species recorded in the broader project area, the proposed development is unlikely to have any long-term, significant negative displacement impact on the local avifauna due to disturbance. The impact of disturbance is therefore likely to be **LOW** and temporary as far as Red Data species are concerned.

5.2 Operational Phase

5.2.1. Mortality due to collision with the earth wire of the power line

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds and birds colliding with power lines (Ledger and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Anderson 2001; Shaw 2013).

Collisions are the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term.

In a recent PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line 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 power lines, 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 low-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. Power lines 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 power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines 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 power lines 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, Bevanger 1994)."

A potential impact of the proposed 88kV LILO power lines is collisions with the earth wire and/or conductors present on the proposed power line infrastructure. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography,

population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust: Wildlife & Energy Programme it is possible to give a measure of what species are likely to be impacted upon (see FIGURE 7 below - Jenkins et al. 2010). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

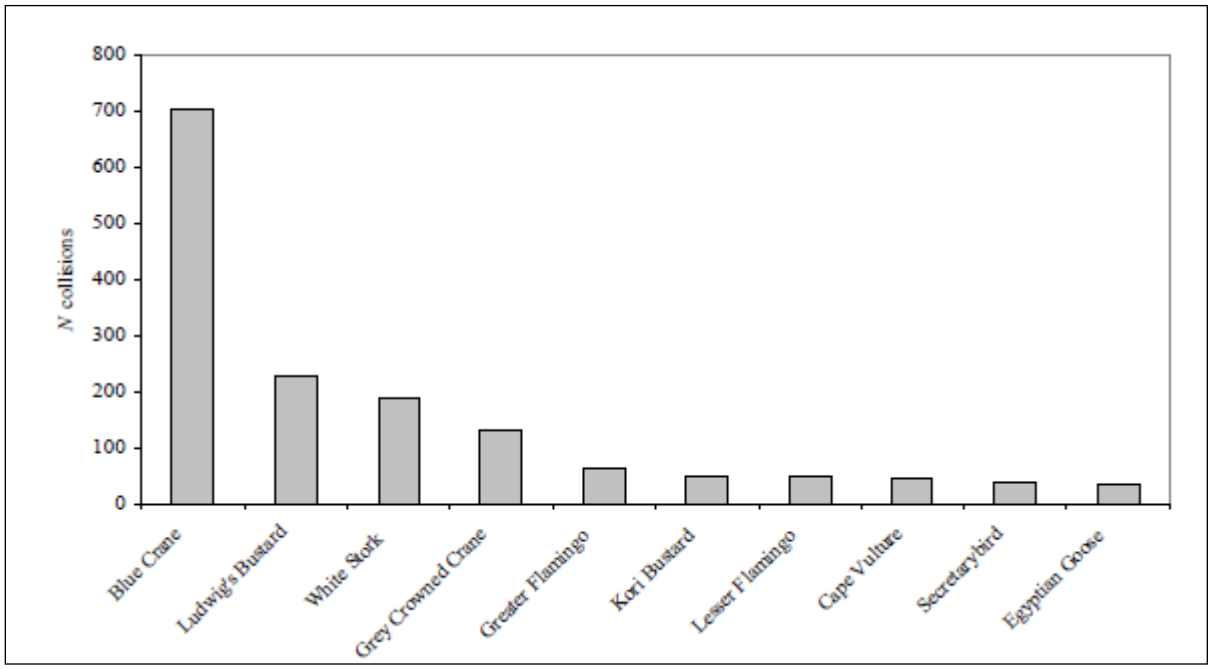

FIGURE 7: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2007 (Jenkins et al. 2010)

Although collision of large heavily-bodied Red Data species such as Blue Crane, Secretarybird and White Stork and to some lesser extent raptors, is possible, particularly along sections that traverse the open grassland area within the project site, the likelihood of these species frequenting the project sites is improbable, with the exception of White Stork which was observed during the site visit (FIGURE 4). This impact is rated to be of **LOW** significance and can be reduced to negligible levels by selecting Switching Station Option 1 which is located closer to the existing Grootvlei-Burnstone 88kV power line, thereby negating the need for longer LILO power lines with additional spans of overhead conductor, therefore posing the least risk to birds.

5.2.2. Mortality due to electrocution on the power line infrastructure and within the switching station

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). Electrocution risk is strongly influenced by the power line voltage of the and design of the pole structure and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components. Although electrocutions are possible on the 88kV power line infrastructure, it is assumed that the proposed Burnstone-Siyathemba 88kV LILO power lines will be constructed using the steel monopole structure type, with the standard bird perch. The risk of

electrocution on the proposed LILO power line poles/ towers is therefore evaluated to be of **LOW significance** based on the tower design and the low diversity and density of raptors in the project area.

Electrocutions within the proposed Siyathemba Switching Station are possible but should not affect the more sensitive Red Data bird species as these species are unlikely to use the infrastructure within the yard for perching or roosting. The risk of electrocution within the switching station is therefore evaluated to be **LOW**. Since it is difficult to predict with any certainty where birds are likely to nest within the switching station, coupled with the costs associated with insulating the infrastructure, electrocutions will need to be mitigated using site-specific recommendations if and when they occur. Given the site-specific nature of this impact, it will not be assessed in terms of its significance.

5.2.3. Impact on the quality of supply

Although this does not form part of the brief, it is important to mention that birds could have an impact on the proposed power lines. Both bird streamers and bird pollution occur as a result of birds perching and defecating on the towers, often directly above live conductors causing electrical faults on power lines. The more faults that occur on a line, the poorer the quality of electrical supply to the end users. It is assumed that the proposed Burnstone-Siyathemba 88kV LILO power lines will be constructed using the steel monopole structure type, with the standard bird perch which ensures that the perching space above the conductor strings is eliminated. As a result, streamer and faecal pollution induced faulting through conventional means is unlikely to occur on the proposed 88kV LILO power lines. The impact on the quality of supply through streamer/pollution induced faulting is not anticipated to be significant.

5.2.4. Nesting

Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners. Power line towers in turn provide *nesting substrate* for certain bird species, some of which might benefit through the increased availability of nesting substrates, particularly in largely treeless areas. Again, the use of the steel monopole tower design will in all likelihood mitigate for the nesting impact.

6. SELECTION OF A PREFERRED SWITCHING STATION SITE AND POWER LINE CORRIDOR

One of the objectives of this study is to determine the preferred switching station site location and power line corridor in terms of impacts on sensitive Red Data avifauna.

The areas that have been delineated for proposed Siyathemba Switching Station (Option 1 and Option 2) occur within the same pentad. They are comprised of identical vegetation and micro habitat and are subjected to identical land use practices and disturbances. Both sites are therefore likely to be identical in terms of species

diversity and density too. With this in mind, the selection of a preferred switching station has been determined based on the proximity of the switching station to the existing Grootvlei-Burnstone 88kV power line. As mentioned above, a shorter length of power line is likely to reduce the potential collision impact as well as the indirect displacement impact associated with habitat loss and disturbance. The location of Option 1 in relation to the existing transmission and distribution power line networks, makes this option preferable, negating the need for a slightly longer LILO power line. It is on this basis that **Option 1 (and its corresponding Option 1 LILO power lines) is recommended as the preferred switching station site alternative.**

7. ASSESSMENT OF EXPECTED IMPACTS

A quantitative methodology was used to describe, evaluate and rate the significance of the aforementioned impacts associated with the construction and operation the proposed switching station and power line developments. This assessment is presented in tabular format below (TABLE 7-1) for both pre- and post-mitigation according to set criteria described in APPENDIX 3. The potential impacts of the proposed Siyathemba switching station and the Burnstone-Siyathemba 88kV LILO power lines on the avifaunal community have been assessed separately given the characteristics of each development and nature of the avifaunal habitat present within each.

CONSTRUCTION PHASE									
Impact description	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance (pre-mitigation)**	**Significance (post-mitigation)**	**Reversibility**	**Mitigation**	**Confidence level**
IMPACT 1: Displacement of Red Data species as a result of habitat loss or transformation									
1.1 Avifaunal habitat is cleared to accommodate the Siyathemba switching station, reducing the amount of habitat available to birds for foraging, roosting and breeding	**Site (1)**	**Permanent (5)**	**Low (4)**	**Improbable (2)** natural grassland vegetation is present at both sites are but is subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red Data species.	**Low (20)**	**Low (16)**	**Low**	Construction activity should be restricted to the immediate footprint of the infrastructure. The recommendations of the ecological and botanical specialist studies **must be strictly implemented**, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Data species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.	**High**
1.2 Potential avifaunal habitat is cleared to accommodate the 88kV LILO	**Site (1)**	**Long term (4)**	**Low (4)**	**Improbable (2)**	**Low (18)**	**Low (14)**	**Medium**	The selection of switching station **Option 1** will reduce the significance of this impact, negating the need for a longer LILO	**High**

power line towers and the servitude for the stringing of the conductors reducing the amount of habitat available to birds for foraging, roosting and breeding								power lines. Construction activity should be restricted to the immediate footprint of the infrastructure. The recommendations of the ecological and botanical specialist studies **must be strictly implemented**, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Data species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.	

CONSTRUCTION PHASE									
Impact description	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance (without mitigation)**	**Significance (with mitigation)**	**Reversibility**	**Mitigation**	**Confidence level**

IMPACT 2: Displacement of Red Data species as a result of disturbance									
2.1 Displacement as a result of disturbance associated with the construction of the Siyathemba switching station (i.e. noise and movement of construction and operational equipment and personnel) resulting in a negative direct impact on the resident avifauna.	**Local (2)**	**Short term (2)**	**Moderate (6)**	**Improbable (2)** the areas earmarked for the proposed development are subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red Data species.	**Low (20**)	**Low (16)**	**Medium**	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 Red Data species. Measures to control noise should be applied according to current best practice in the industry.	**High**
2.2 Displacement as a result of disturbance associated with the construction of the 88kV LILO power lines (i.e. noise and movement of construction and operational equipment and personnel) resulting in a negative direct impact on the resident avifauna.	**Local (2)**	**Short term (2)**	**Moderate (6)**	**Improbable (2)** the areas earmarked for the proposed development are subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red Data species.	**Low (20)**	**Low (16)**	**Medium**	The selection of switching station **Option 1** will reduce the significance of this impact Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Data species. Measures to control noise should be applied according to current best practice in the industry.	**High**
OPERATIONAL PHASE									
Impact description	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance (without mitigation)**	**Significance (with mitigation)**	**Reversibility**	**Mitigation**	**Confidence level**

IMPACT 1: Mortality of Red Data species due to collision with the power line earth wire/conductors									
1.1 Collisions of Red Data avifauna with the earthwire of the 88kV LILO power lines**,** resulting in a negative direct mortality impact, particularly large terrestrial birds, waterbirds and raptors to a lesser extent.	**Local (2)**	**Long term (4)**	**Moderate (6)**	**Improbable (2)**	**Low (24**)	**Low (20)**	**High**	**The selection of switching station Option 1 will reduce the significance of this impact,** negating the need for a longer LILO power lines.	**High**
IMPACT 2: Mortality of Red Data species due to electrocution on the power line towers and within the switching station									
2.1 Electrocutions of Red Data avifauna on the live and earthed components on the 88kV power line towers**,** resulting in a negative direct mortality impact.	**Local (2)**	**Long term (4)**	**Low (4)**	**Improbable (2)**	**Low (20**)	**Low (16)**	**High**	It is highly recommended that the steel monopole design be used and that this incorporates the standard bird perch.	**High**
2.2 Electrocutions of Red Data avifauna on the live and earthed components within the Siyathemba switching station**,** resulting in a negative direct mortality impact.	**Local (2)**	**Long term (4)**	**Low (4)**	**Very Improbable (1)** Red Data species are unlikely to perch or roost within the confines of the switching station.	**Low (10**)	**Low (8)**	**High**	Should electrocutions become an issue, the impact can be mitigated reactively using a range of insulation devices that exist and site-specific recommendations should be sought from the Eskom-Endangered Wildlife Trust Strategic Partnership.	**High**

8. MEASURES FOR INCLUSION IN THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Based on the anticipated impacts described above the following recommendations are provided regarding practical mitigation measures for potentially significant impacts to be included in the Environmental Management Programme (EMPr).

OBJECTIVE: Assessment and mitigation of displacement and direct mortality impacts caused by the Siyathemba Switching Station and its associated 88kV power line infrastructure.	
Project component/s	Siyathemba Switching Station and its 88kV LILO power lines extending from the switching station to the existing Grootvlei-Burnstone 88kV power line.
Potential Impact	Permanent displacement and mortality of local populations of Red Data and non-Red Data species caused by habitat loss, disturbance, collisions with the overhead power line cabling and electrocution on the power line towers and within the on-site switching station.
Activity/risk source	* Construction of the Siyathemba Switching Station and its 88kV LILO power line infrastructure within sensitive avifaunal habitat. * Unmitigated construction and operational activities.
Mitigation: Target/Objective	Limit avifaunal mortality and displacement as far as practically possible for the duration of the operational life span of the Siyathemba Switching Station and its associated 88kV LILO power line infrastructure.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Displacement (Habitat Loss or Transformation & Disturbance): * Avoid construction in sensitive vegetation types and wetland areas. The recommendations of the ecological and botanical specialist studies **must be strictly implemented**, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. * Construction activities should be restricted to the immediate footprint of the infrastructure to avoid any additional disturbance impacts on bird species residing in the broader area. * Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Data species. * Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. * Measures to control noise should be applied according to current best practice in the industry.	Construction Manager and Environmental Control Officer.	From the commencement of construction (inclusive of all project components to the completion of construction.

Mortality as a result of collisions with the 88kV power line cables: Eskom line and servitude managers are requested to report all bird collisions encountered during routine line patrols of the power lines to the Eskom-Endangered Wildlife Trust Strategic Partnership.	Eskom Environmental Manager, Line and Servitude Manager, Environmental Control Officer and Eskom-Endangered Wildlife Trust Strategic Partnership.	For the duration of the operational life-span of the Burnstone-Siyathemba 88kV LILO power lines.
Mortality as a result of electrocutions on the Burnstone-Siyathemba 88kV power line infrastructure: It is highly recommended that the steel monopole design be used and that this incorporates the standard bird perch. Eskom line and servitude managers are requested to report all bird electrocutions encountered during routine line patrols of the power lines to the Eskom-Endangered Wildlife Trust Strategic Partnership.	Eskom Environmental Manager, Line and Servitude Manager, Environmental Control Officer and Eskom-Endangered Wildlife Trust Strategic Partnership.	For the duration of the operational life-span of the Burnstone-Siyathemba 88kV LILO power lines.
Mortality as a result of electrocutions within the Siyathemba Switching Station: Eskom line and servitude managers are requested to report all bird electrocutions encountered during inspections of the switching station to the Eskom-Endangered Wildlife Trust Strategic Partnership. Switching station mitigation to be applied reactively, if required.	Eskom Environmental Manager, Line and Servitude Manager, Environmental Control Officer and Eskom-Endangered Wildlife Trust Strategic Partnership.	For the duration of the operational life-span of the Siyathemba Switching Station.
Nest building within the switching station and on the power line infrastructure: If on-going impacts are recorded once the switching station and the associated 88kV LILO power lines are operational, it is recommended that these impacts be assessed by Eskom-Endangered Wildlife Trust Strategic Partnership and site-specific mitigation be applied reactively. While it is not illegal to remove an unoccupied nest that is posing a quality of supply risk, the removal of nests that contain eggs or chicks will require a permit to do so. Nest management strategies to be identified and implemented reactively, if required.	Eskom Environmental Manager, Line and Servitude Manager, Environmental Control Officer and Eskom-Endangered Wildlife Trust Strategic Partnership.	For the duration of the operational life-span of the Siyathemba Switching Station and the Burnstone-Siyathemba 88kV LILO power lines.

Performance Indicator	* The size and extent of sensitive habitat present at the start of construction remains intact at end of construction phase. * Sustainable levels of mortalities are reported on a monthly basis and the necessary mitigation measures are implemented.
Monitoring	* Environmental Control Officer to ensure that construction activities are confined to the site footprint to avoid any additional impacts on bird species residing in the broader area. * Environmental manager and/or line servitude staff to conduct regular inspections of the switching station and power line infrastructure to record the number of mortalities, nesting activity and faecal matter fouling and determine the effectiveness of the mitigation actions taken.

9. CONCLUSION & IMPACT STATEMENT

In conclusion, the habitat within which the proposed project area is located is low to moderately sensitive from a potential Red Data avifaunal impact perspective. In recent years, anthropogenic impacts, mostly in the form of urban settlement development and agriculture have largely transformed the landscape resulting in a negative impact on avifaunal diversity and abundance within the project area. This is reflected in the low diversity and reporting rates for Red Data species, indicating that levels of disturbance are high. The construction of the proposed Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines will result in various impacts of LOW significance to the birds occurring in the vicinity of the new infrastructure, which can be reduced to negligible levels through the application of mitigation measures. Given the presence of existing habitat degradation in places and fairly significant levels of disturbance, it is anticipated that the proposed Siyathemba Switching Station and its associated Burnstone-Siyathemba 88kV LILO power lines can be constructed within the project area with acceptable levels of impact on the resident avifauna subject to the following recommendations:

* Selecting **Option 1** for the proposed switching station location and its corresponding **Option 1** Burnstone-Siyathemba 88kV LILO power lines.
* 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 avifaunal species.
* Maximum use of existing access roads and the construction of new roads should be kept to a minimum.
* The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.
* In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

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APPENDIX 1
AVIFAUNAL HABITAT OBSERVED WITHIN THE PROJECT AREA

FIGURE 1: Open woodland located on the hilltops within the broader project area

FIGURE 2: Grassland habitat at the proposed project site

FIGURE 3: Degraded drainage line and wetland area within the project area

FIGURE 4: A typical waterbody located within the broader project area

FIGURE 5: Commercial cultivated lands within the broader project area

FIGURE 6: Fallow cultivated lands located opposite the proposed project site

FIGURE 7: Exotic/alien tree plantation

FIGURE 8: Siyathemba settlement

APPENDIX 2

SOUTH AFRICAN BIRD ATLAS PROJECT DATA (SABAP2) FOR THE PROPOSED PROJECT

SPECIES NAME	SCIENTIFIC NAME	REG. CON. STATUS	ENDEMNICITY SOUTH AFRICA	ENDEMNICITY SOUTHERN AFRICA	REPORT RATE	NO. OF BIRDS
Barbet, Acacia Pied	*Tricholaema leucomelas*			Near-endemic	23.17	38
Barbet, Black-collared	*Lybius torquatus*				37.80	62
Barbet, Crested	*Trachyphonus vaillantii*				45.73	75
Bee-eater, Swallow-tailed	*Merops hirundineus*				0.61	1
Bishop, Southern Red	*Euplectes orix*				84.15	138
Bishop, Yellow	*Euplectes capensis*				0.61	1
Bishop, Yellow-crowned	*Euplectes afer*				43.90	72
Bittern, Little	*Ixobrychus minutus*				0.61	1
Bokmakierie	*Telophorus zeylonus*			Near-endemic	37.20	61
Boubou, Southern	*Laniarius ferrugineus*			Endemic	0.61	1
Brubru	*Nilaus afer*				0.61	1
Bulbul, African Red-eyed	*Pycnonotus nigricans*			Near-endemic	31.71	52
Bulbul, Dark-capped	*Pycnonotus tricolor*				14.02	23
Bunting, Cape	*Emberiza capensis*			Near-endemic	7.93	13
Bunting, Cinnamon-breasted	*Emberiza tahapisi*				14.02	23
Buzzard, Jackal	*Buteo rufofuscus*		Near endemic	Endemic	1.22	2
Buzzard, Steppe	*Buteo buteo*				19.51	32
Canary, Black-throated	*Crithagra atrogularis*				72.56	119
Canary, Cape	*Serinus canicollis*			Endemic	1.83	3
Canary, Yellow	*Crithagra flaviventris*			Near-endemic	40.24	66
Canary, Yellow-fronted	*Crithagra mozambica*				9.76	16
Chat, Anteating	*Myrmecocichla formicivora*			Endemic	60.98	100
Chat, Familiar	*Cercomela familiaris*				3.66	6
Chat, Sickle-winged	*Cercomela sinuata*		Near endemic	Endemic	0.61	1
Cisticola, Cloud	*Cisticola textrix*		Near endemic	Near-endemic	29.88	49
Cisticola, Levaillant's	*Cisticola tinniens*				75.00	123
Cisticola, Pale-crowned	*Cisticola cinnamomeus*				0.61	1
Cisticola, Wailing	*Cisticola lais*				10.98	18
Cisticola, Wing-snapping	*Cisticola ayresii*				7.93	13
Cisticola, Zitting	*Cisticola juncidis*				42.68	70
Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*				1.22	2
Cliff-swallow, South African	*Petrochelidon spilodera*			Breeding-endemic	50.00	82
Coot, Red-knobbed	*Fulica cristata*				79.27	130
Cormorant, Reed	*Phalacrocorax africanus*				65.24	107
Cormorant, White-breasted	*Phalacrocorax lucidus*				14.02	23
Courser, Bronze-winged	*Rhinoptilus chalcopterus*				0.61	1
Crake, Black	*Amaurornis flavirostra*				1.83	3
Crane, Blue	*Anthropoides paradiseus*	NT		Endemic	1.22	2
Crombec, Long-billed	*Sylvietta rufescens*				0.61	1
Crow, Cape	*Corvus capensis*				3.66	6
Cuckoo, Diderick	*Chrysococcyx caprius*				31.10	51
Cuckoo, Red-chested	*Cuculus solitarius*				10.37	17
Darter, African	*Anhinga rufa*				16.46	27
Dove, Laughing	*Streptopelia senegalensis*				95.73	157
Dove, Namaqua	*Oena capensis*				19.51	32
Dove, Red-eyed	*Streptopelia semitorquata*				74.39	122

SPECIES NAME	SCIENTIFIC NAME	REG. CON. STATUS	ENDEMNICITY SOUTH AFRICA	ENDEMNICITY SOUTHERN AFRICA	REPORT RATE	NO. OF BIRDS
Dove, Rock	*Columba livia*				34.15	56
Duck, African Black	*Anas sparsa*				10.98	18
Duck, Comb	*Sarkidiornis melanotos*				0.61	1
Duck, Fulvous	*Dendrocygna bicolor*				1.22	2
Duck, Maccoa	*Oxyura maccoa*	NT			0.61	1
Duck, White-backed	*Thalassornis leuconotus*				1.83	3
Duck, White-faced	*Dendrocygna viduata*				17.68	29
Duck, Yellow-billed	*Anas undulata*				78.66	129
Eagle, Long-crested	*Lophaetus occipitalis*				0.61	1
Eagle-owl, Spotted	*Bubo africanus*				1.22	2
Egret, Cattle	*Bubulcus ibis*				65.85	108
Egret, Great	*Egretta alba*				9.15	15
Egret, Little	*Egretta garzetta*				15.24	25
Egret, Yellow-billed	*Egretta intermedia*				12.20	20
Falcon, Amur	*Falco amurensis*				20.73	34
Falcon, Lanner	*Falco biarmicus*	VU			2.44	4
Finch, Cuckoo	*Anomalospiza imberbis*				1.83	3
Finch, Red-headed	*Amadina erythrocephala*			Near-endemic	21.95	36
Fiscal, Common	*Lanius collaris*				95.12	156
Fish-eagle, African	*Haliaeetus vocifer*				1.22	2
Flamingo, Greater	*Phoenicopterus roseus*	NT			17.07	28
Flamingo, Lesser	*Phoeniconaias minor*	NT			7.93	13
Flycatcher, Fairy	*Stenostira scita*		Near endemic	Endemic	1.22	2
Flycatcher, Fiscal	*Sigelus silens*		Near endemic	Endemic	35.37	58
Flycatcher, Spotted	*Muscicapa striata*				6.10	10
Francolin, Orange River	*Scleroptila gutturalis*				35.37	58
Go-away-bird, Grey	*Corythaixoides concolor*				0.61	1
Goose, Domestic	*Anser anser*				1.22	2
Goose, Egyptian	*Alopochen aegyptiaca*				78.05	128
Goose, Spur-winged	*Plectropterus gambensis*				49.39	81
Grebe, Great Crested	*Podiceps cristatus*				4.88	8
Grebe, Little	*Tachybaptus ruficollis*				56.10	92
Greenshank, Common	*Tringa nebularia*				7.93	13
Guineafowl, Helmeted	*Numida meleagris*				70.12	115
Gull, Grey-headed	*Chroicocephalus cirrocephalus*				3.05	5
Hamerkop	*Scopus umbretta*				9.15	15
Harrier, Montagu's	*Circus pygargus*				0.61	1
Harrier-Hawk, African	*Polyboroides typus*				0.61	1
Heron, Black	*Egretta ardesiaca*				1.22	2
Heron, Black-headed	*Ardea melanocephala*				82.93	136
Heron, Goliath	*Ardea goliath*				5.49	9
Heron, Green-backed	*Butorides striata*				1.22	2
Heron, Grey	*Ardea cinerea*				39.63	65
Heron, Purple	*Ardea purpurea*				7.93	13
Heron, Squacco	*Ardeola ralloides*				1.83	3
Honeyguide, Greater	*Indicator indicator*				0.61	1
Honeyguide, Lesser	*Indicator minor*				0.61	1
Hoopoe, African	*Upupa africana*				11.59	19
House-martin, Common	*Delichon urbicum*				6.71	11
Ibis, African Sacred	*Threskiornis aethiopicus*				46.34	76
Ibis, Glossy	*Plegadis falcinellus*				26.22	43
Ibis, Hadeda	*Bostrychia hagedash*				88.41	145
Jacana, African	*Actophilornis africanus*				1.22	2

SPECIES NAME	SCIENTIFIC NAME	REG. CON. STATUS	ENDEMNICITY SOUTH AFRICA	ENDEMNICITY SOUTHERN AFRICA	REPORT RATE	NO. OF BIRDS
Kestrel, Greater	*Falco rupicoloides*				4.27	7
Kestrel, Rock	*Falco rupicolus*				3.66	6
Kingfisher, Giant	*Megaceryle maxima*				5.49	9
Kingfisher, Malachite	*Alcedo cristata*				9.15	15
Kingfisher, Pied	*Ceryle rudis*				7.93	13
Kite, Black-shouldered	*Elanus caeruleus*				88.41	145
Kite, Yellow-billed	*Milvus aegyptius*				0.61	1
Korhaan, Blue	*Eupodotis caerulescens*	LC		Endemic	10.37	17
Korhaan, Northern Black	*Afrotis afraoides*			Endemic	46.34	76
Lapwing, African Wattled	*Vanellus senegallus*				12.80	21
Lapwing, Blacksmith	*Vanellus armatus*				96.34	158
Lapwing, Crowned	*Vanellus coronatus*				85.98	141
Lark, Eastern Clapper	*Mirafra fasciolata*			Near-endemic	5.49	9
Lark, Eastern Long-billed	*Certhilauda semitorquata*			Endemic	1.83	3
Lark, Melodious	*Mirafra cheniana*	LC	Near endemic	Endemic	0.61	1
Lark, Pink-billed	*Spizocorys conirostris*			Near-endemic	4.27	7
Lark, Red-capped	*Calandrella cinerea*				51.22	84
Lark, Rufous-naped	*Mirafra africana*				48.17	79
Lark, Spike-heeled	*Chersomanes albofasciata*			Near-endemic	17.07	28
Longclaw, Cape	*Macronyx capensis*			Endemic	87.80	144
Mannikin, Bronze	*Lonchura cucullata*				0.61	1
Marsh-harrier, African	*Circus ranivorus*	EN			1.22	2
Martin, Banded	*Riparia cincta*				8.54	14
Martin, Brown-throated	*Riparia paludicola*				17.68	29
Martin, Rock	*Hirundo fuligula*				12.20	20
Masked-weaver, Southern	*Ploceus velatus*				93.90	154
Moorhen, Common	*Gallinula chloropus*				29.88	49
Mousebird, Red-faced	*Urocolius indicus*				28.05	46
Mousebird, Speckled	*Colius striatus*				16.46	27
Myna, Common	*Acridotheres tristis*				68.90	113
Neddicky, Neddicky	*Cisticola fulvicapilla*				23.17	38
Night-Heron, Black-crowned	*Nycticorax nycticorax*				3.66	6
Olive-pigeon, African	*Columba arquatrix*				0.61	1
Oriole, Black-headed	*Oriolus larvatus*				0.61	1
Ostrich, Common	*Struthio camelus*				15.24	25
Owl, Barn	*Tyto alba*				0.61	1
Owl, Marsh	*Asio capensis*				9.15	15
Palm-swift, African	*Cypsiurus parvus*				14.02	23
Paradise-flycatcher, African	*Terpsiphone viridis*				3.66	6
Paradise-whydah, Long-tailed	*Vidua paradisaea*				1.83	3
Pigeon, Speckled	*Columba guinea*				82.93	136
Pipit, African	*Anthus cinnamomeus*				76.22	125
Pipit, Long-billed	*Anthus similis*				1.83	3
Pipit, Plain-backed	*Anthus leucophrys*				0.61	1
Plover, Common Ringed	*Charadrius hiaticula*				1.22	2
Plover, Kittlitz's	*Charadrius pecuarius*				4.27	7
Plover, Three-banded	*Charadrius tricollaris*				31.71	52
Pochard, Southern	*Netta erythrophthalma*				20.73	34
Pratincole, Black-winged	*Glareola nordmanni*	NT			5.49	9
Prinia, Black-chested	*Prinia flavicans*			Near-endemic	57.32	94
Prinia, Tawny-flanked	*Prinia subflava*				4.88	8
Pytilia, Green-winged	*Pytilia melba*				3.05	5
Quail, Common	*Coturnix coturnix*				10.37	17

SPECIES NAME	SCIENTIFIC NAME	REG. CON. STATUS	ENDEMNICITY SOUTH AFRICA	ENDEMNICITY SOUTHERN AFRICA	REPORT RATE	NO. OF BIRDS
Quailfinch, African	*Ortygospiza fuscocrissa*				32.93	54
Quelea, Red-billed	*Quelea quelea*				68.90	113
Reed-warbler, African	*Acrocephalus baeticatus*				2.44	4
Robin-chat, Cape	*Cossypha caffra*				34.76	57
Rock-thrush, Cape	*Monticola rupestris*			Endemic	0.61	1
Rock-thrush, Sentinel	*Monticola explorator*			Endemic	0.61	1
Roller, Lilac-breasted	*Coracias caudatus*				1.22	2
Ruff	*Philomachus pugnax*				10.37	17
Rush-warbler, Little	*Bradypterus baboecala*				0.61	1
Sandpiper, Common	*Actitis hypoleucos*				2.44	4
Sandpiper, Curlew	*Calidris ferruginea*	LC			7.32	12
Sandpiper, Marsh	*Tringa stagnatilis*				4.88	8
Sandpiper, Wood	*Tringa glareola*				7.32	12
Scimitarbill, Common	*Rhinopomastus cyanomelas*				0.61	1
Secretarybird	*Sagittarius serpentarius*	VU			6.10	10
Seedeater, Streaky-headed	*Crithagra gularis*				6.71	11
Shelduck, South African	*Tadorna cana*			Endemic	9.76	16
Shoveler, Cape	*Anas smithii*			Near-endemic	26.22	43
Shrike, Lesser Grey	*Lanius minor*				1.22	2
Shrike, Red-backed	*Lanius collurio*				2.44	4
Snipe, African	*Gallinago nigripennis*				27.44	45
Sparrow, Cape	*Passer melanurus*			Near-endemic	85.98	141
Sparrow, House	*Passer domesticus*				46.34	76
Sparrow, Southern Grey-headed	*Passer diffusus*				60.98	100
Sparrow-weaver, White-browed	*Plocepasser mahali*				81.10	133
Sparrowhawk, Black	*Accipiter melanoleucus*				0.61	1
Sparrowlark, Chestnut-backed	*Eremopterix leucotis*				7.32	12
Spoonbill, African	*Platalea alba*				34.76	57
Spurfowl, Swainson's	*Pternistis swainsonii*				80.49	132
Starling, Cape Glossy	*Lamprotornis nitens*				45.12	74
Starling, Pied	*Lamprotornis bicolor*			Endemic	12.80	21
Starling, Red-winged	*Onychognathus morio*				5.49	9
Starling, Violet-backed	*Cinnyricinclus leucogaster*				0.61	1
Starling, Wattled	*Creatophora cinerea*				18.29	30
Stilt, Black-winged	*Himantopus himantopus*				21.95	36
Stint, Little	*Calidris minuta*				6.71	11
Stonechat, African	*Saxicola torquatus*				96.34	158
Stork, White	*Ciconia ciconia*				3.05	5
Stork, Yellow-billed	*Mycteria ibis*	EN			6.71	11
Sunbird, Amethyst	*Chalcomitra amethystina*				4.88	8
Sunbird, Malachite	*Nectarinia famosa*				4.88	8
Sunbird, White-bellied	*Cinnyris talatala*				2.44	4
Swallow, Barn	*Hirundo rustica*				41.46	68
Swallow, Greater Striped	*Cecropis cucullata*				54.88	90
Swallow, Lesser Striped	*Cecropis abyssinica*				3.66	6
Swallow, White-throated	*Hirundo albigularis*				45.12	74
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*				16.46	27
Swamphen, African Purple	*Porphyrio madagascariensis*				3.05	5
Swift, African Black	*Apus barbatus*				0.61	1
Swift, Alpine	*Tachymarptis melba*				0.61	1
Swift, Common	*Apus apus*				2.44	4
Swift, Horus	*Apus horus*				0.61	1
Swift, Little	*Apus affinis*				24.39	40

SPECIES NAME	SCIENTIFIC NAME	REG. CON. STATUS	ENDEMNICITY SOUTH AFRICA	ENDEMNICITY SOUTHERN AFRICA	REPORT RATE	NO. OF BIRDS
Swift, White-rumped	*Apus caffer*				45.12	74
Tchagra, Brown-crowned	*Tchagra australis*				1.22	2
Teal, Cape	*Anas capensis*				4.27	7
Teal, Hottentot	*Anas hottentota*				1.83	3
Teal, Red-billed	*Anas erythrorhyncha*				45.12	74
Tern, Caspian	*Sterna caspia*	VU			0.61	1
Tern, Whiskered	*Chlidonias hybrida*				20.12	33
Tern, White-winged	*Chlidonias leucopterus*				7.32	12
Thick-knee, Spotted	*Burhinus capensis*				11.59	19
Thrush, Karoo	*Turdus smithi*		Near endemic	Endemic	19.51	32
Tit, Ashy	*Parus cinerascens*			Near-endemic	0.61	1
Tit-babbler, Chestnut-vented	*Sylvia subcaerulea*			Near-endemic	1.22	2
Turtle-dove, Cape	*Streptopelia capicola*				90.85	149
Wagtail, Cape	*Motacilla capensis*				57.32	94
Warbler, Willow	*Phylloscopus trochilus*				6.10	10
Waxbill, Black-faced	*Estrilda erythronotos*				0.61	1
Waxbill, Common	*Estrilda astrild*				22.56	37
Waxbill, Orange-breasted	*Amandava subflava*				5.49	9
Weaver, Cape	*Ploceus capensis*		Near endemic	Endemic	1.83	3
Wheatear, Capped	*Oenanthe pileata*				15.24	25
Wheatear, Mountain	*Oenanthe monticola*			Near-endemic	15.85	26
White-eye, Cape	*Zosterops virens*		Near endemic	Endemic	18.90	31
Whydah, Pin-tailed	*Vidua macroura*				43.29	71
Widowbird, Fan-tailed	*Euplectes axillaris*				12.80	21
Widowbird, Long-tailed	*Euplectes progne*				87.20	143
Widowbird, Red-collared	*Euplectes ardens*				25.00	41
Widowbird, White-winged	*Euplectes albonotatus*				30.49	50
Wood-hoopoe, Green	*Phoeniculus purpureus*				17.68	29
Wryneck, Red-throated	*Jynx ruficollis*				25.61	42

APPENDIX 3

METHOD OF ASSESSING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS

The objective of the assessment of impacts is to identify and assess all the significant impacts that may arise as a result of the development of the proposed railway crossing loop extensions. The process of assessing the impacts of the project encompasses the following four activities:

* Identification and assessment of potential impacts
* Prediction of the nature, magnitude, extent and duration of potentially significant impacts
* Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity
* Evaluation of the significance of the impact after the mitigation measures have been implemented i.e. the significance of the residual impact.

In accordance with GNR 543, promulgated in terms of section 24 of the National Environmental Management Act, 1998 (Act 107 of 1998), specialists will be required to assess the significance of potential impacts in terms of the following criteria:

- Cumulative impacts
- Nature of the impact
- Extent of the impact
- Intensity of the impact
- Duration of the impact
- Probability of the impact occurring
- Impact non-reversibility
- Impact on irreplaceable resources
- Confidence level

Issues are assessed in terms of the following criteria:

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

- The physical extent, wherein it is indicated whether:

  1 - the impact will be limited to the site
  2 - the impact will be limited to the local area
  3 - the impact will be limited to the region
  4 - the impact will be national
  5 - the impact will be international

- The duration, wherein it is indicated whether the lifetime of the impact will be:

  1 - of a very short duration (0–1 years)
  2 - of a short duration (2-5 years)
  3 - medium-term (5–15 years)
  4 - long term (> 15 years)
  5 – permanent

- The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned:

  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 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 - definite (impact will occur regardless of any prevention measures)

- The significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be 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 determined by combining the criteria in the following formula:

S = (E + D + M) * P

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).