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WATER USE LICENSE APPLICATION (WULA)
ERF NUMBER 4038 FARM WOLHUTERSKOP 670

COMPILED BY:
MEGAN DIAMOND
FEATHERS ENVIRONMENTAL SERVICES
P.O. BOX 786962
SANDTON, 2146
MEGAN@FEATHERSENV.CO.ZA

PREPARED FOR:
SDUDUZO MDANDA
AFRIMAT AGGREGATES KZN
25 BLOEKOM STREET
VRYHEID, 3100
SDUDUZO.MDANDA@AFRIMAT.CO.ZA

PROFESSIONAL EXPERIENCE

Ms. Megan Diamond Megan completed a Bachelor of Science degree in Environmental Management from the University of South Africa and has been involved in conservation for 20 years. She has 15 years' worth of experience in the field of bird interactions with electrical infrastructure and during this time has completed impact assessments for over 140 projects. During her tenure at the Endangered Wildlife Trust's Wildlife & Energy Programme and the Programme's primary project (i.e. the Eskom-EWT Strategic Partnership) from 2006 to 2013, Megan was responsible for assisting the energy industry and the national utility in minimising the negative impacts, associated with the construction and operation of electrical infrastructure, on wildlife through the provision of strategic guidance, risk and impact assessments, training and research. Megan (SACNASP Environmental Science Registration number 300022/14) currently owns and manages *Feathers Environmental Services* and is tasked with providing guidance to industry through the development of best practice procedures and avifaunal specialist studies for various developments including renewable energy facilities, power lines, power stations and substation infrastructure in addition to railway infrastructure and residential properties within South Africa and elsewhere within Africa. Megan has attended and presented at several conferences and facilitated workshops, as a subject expert, since 2007. Megan has authored and co-authored several academic papers, 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), IAIIA (International Association for Impact Assessment South Africa) and Eskom. She chaired the Birds and Wind Energy Specialist Group in South Africa (2011/2012) and the IUCN/SSC Crane Specialist Group's Crane and Powerline Network (2013-2015), 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. She is currently a member of the IUCN Stork, Ibis and Spoonbill Specialist Group and the Eskom-EWT Strategic Partnership Ludwig's Bustard Working Group.

DECLARATION OF INDEPENDENCE

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

- * Act as an independent specialist to *Afrimat* 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 survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- * This report is based on a desktop investigation using the available information and data related to the site to be affected and a one-day, single season site visit to the study area on 18 October 2021. No long-term investigation or monitoring has been conducted.
- * The Precautionary Principle has been applied throughout this assessment.
- * 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 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 report cannot be applied to any other area without proper investigation.
- * This 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 report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.



5 November 2021

EXECUTIVE SUMMARY

Afrimat, a leader in open pit mining and supplier of construction materials, industrial products and bulk Commodities wishes to apply for a Water Use License (WULA) in order to drill a borehole on the property of their Bethlehem Aggregates facility. The quarrying process at this facility results in the generation of fine dust particles that pose a potential air pollution and health risk. In order to mitigate this impact, dust suppression systems need to be employed. Currently, the *Afrimat Bethlehem Aggregate* facility utilises potable municipal water to suppress dust at the quarry. To reduce the impact on the municipalities water supply, *Afrimat* intends to utilise borehole water as an alternative liquid source to restrict the airborne dissemination of the fine dust particles the quarry produces. The proposed borehole is located on the *Afrimat Bethlehem Aggregate* property, located within the Dihlabeng Local Municipality, within the boundaries of the Thabo Mofutsanyana District Municipality in the Free State Province.

Feathers Environmental Services CC (Feathers) was appointed by *Afrimat* to compile a specialist avifaunal assessment report for the proposed borehole in order to determine the potential impact on the flow of water at the Loch Athlone Dam and the resultant impact this may have on the avifaunal species that this dam supports.

Loch Athlone Dam is located within 500m of the proposed borehole site (FIGURE 4) and was registered as a CWAC site in 1993. Counts were made at this dam during both the summer and winter seasons in 1993 and repeated in the same seasons during 1994 (i.e. four surveys). Water levels were high during each of the four surveys. A total of 34 waterbird species were recorded during the survey period, of which White-breasted Cormorant, Cattle Egret, Yellow-billed Duck and Red-knobbed Coot were common. Grey Crowned Crane (n=1) and African Marsh Harrier (n=1) were the only Red List species recorded at the site. This dam has since been deregistered as a CWAC site.

A total of 282 bird species have been recorded within the proposed borehole study area pentad during the SABAP2 atlassing period to date. Of the 282 species, 21 of these are regional Red List species and 13 are endemic to South Africa, Lesotho and Swaziland. The majority of these species have been recorded in very low numbers. Seven of the recorded Red List species may utilise the Loch Athlone Dam, however the this waterbody habitat is not pristine. Sedimentation and the accumulation of pesticides and fertilizers in the water as well as the levels of residential and both heavy and light industry disturbance currently experienced within close proximity the dam are likely to preclude Red List species from regularly utilising the dam especially for breeding purposes.

The site visit produced a combined list of 46 species, covering both the study area and to a limited extent, the surrounding area. No Red List species were observed within the study area. The majority of observations were of passerine and waterbird species that are common to this area. These species have persisted despite existing

disturbance within the study area. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

Assessment of the study area revealed five broadly described avifaunal micro habitats i.e. grassland, surface waterbodies, cultivated lands, exotic tree stands and urban areas and infrastructure. The habitat within which the proposed study area is located is low to moderately sensitive from a potential bird impact perspective. The drilling and operation of the borehole will result in impacts of LOW to MODERATE significance to birds occurring in the vicinity of the new infrastructure, which can be reduced to through the application of mitigation measures. It is anticipated that the proposed borehole can be drilled and operated in the study area with acceptable levels of impact on the resident avifauna, subject to the following recommendations:

- * Drilling activities should be restricted to the immediate footprint of the infrastructure.
- * This groundwater resource must be carefully managed, with the appropriate environmental management strategies in place to ensure that the amount of water being extracted from the borehole, for dust suppression and for potential future uses, does not exceed the amount of water recharging the water table annually. The recommendations of the aquatic specialist must be strictly implemented to ensure the sustainability of the ground water resource.
- * 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

Afrimat, a leader in open pit mining and supplier of construction materials, industrial products and bulk Commodities wishes to apply for a Water Use License (WULA) in order to drill a borehole on the property of their Bethlehem Aggregates facility. The quarrying process at this facility results in the generation of fine dust particles that pose a potential air pollution and health risk. In order to mitigate this impact, dust suppression systems need to be employed. Currently, the *Afrimat Bethlehem Aggregate* facility utilises potable municipal water to suppress dust at the quarry. To reduce the impact on the municipalities water supply, *Afrimat* intends to utilise borehole water as an alternative liquid source to restrict the airborne dissemination of the fine dust particles the quarry produces. The proposed borehole is located on the *Afrimat Bethlehem Aggregate* property, located within the Dihlabeng Local Municipality, within the boundaries of the Thabo Mofutsanyana District Municipality in the Free State Province (FIGURE 1).

The National Water Act No. 36 of 1998 regulates the use of water across South Africa and requires that all water uses other the water needed to maintain the ecosystem and basic human needs must be authorised by the Department of Water and Sanitation or a Catchment Management Agency (CMA). Section 21(a) of the NWA has relevance to this project.

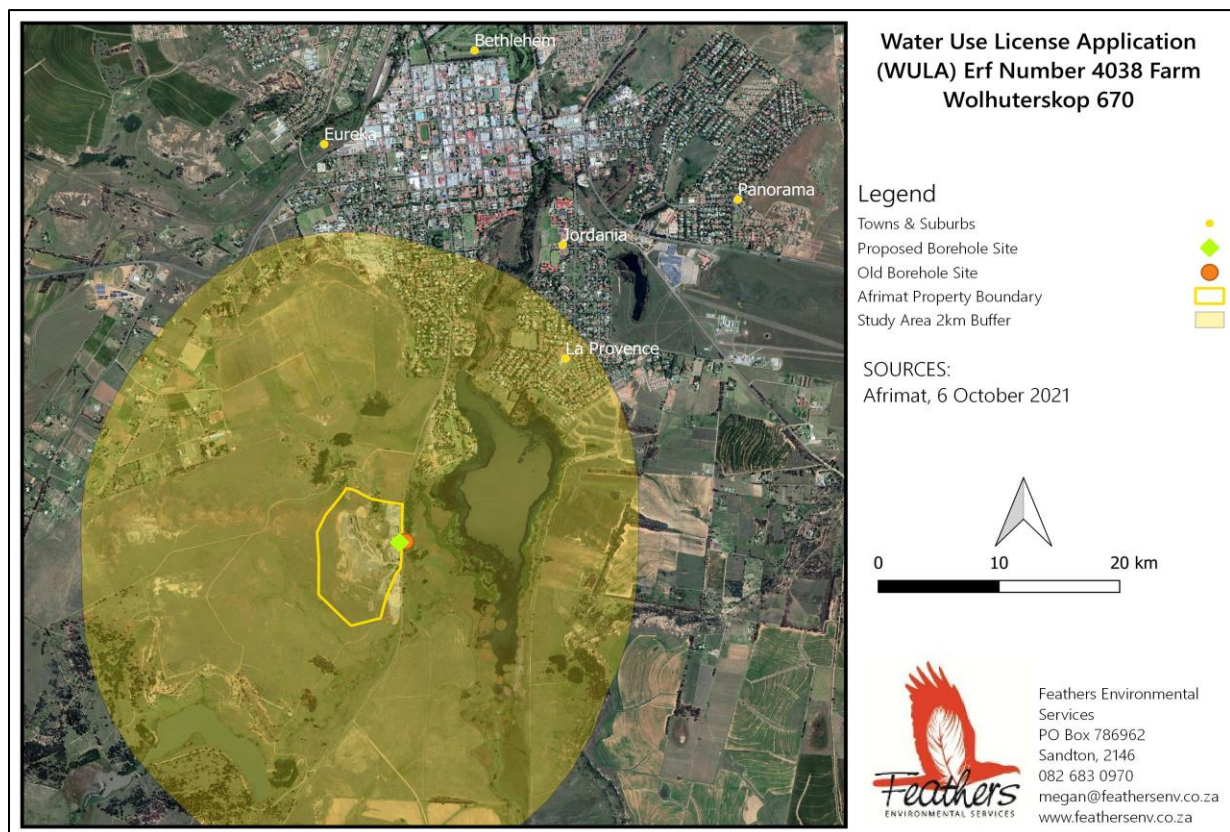


FIGURE 1: Regional map detailing the location of the study area, located within the Dihlabeng Local Municipality, Thabo Mofutsanyana District Municipality, Free State Province

2. SCOPE OF WORK

Feathers Environmental Services CC (Feathers) was appointed by *Afrimat* to compile a specialist avifaunal assessment report for the proposed borehole in order to determine the potential impact on the flow of water at the Loch Athlone Dam and the resultant impact this may have on the avifaunal species that this dam supports. This report is based on a desktop review of the proposed area earmarked for the borehole and a site visit conducted over a one-day period, which uses a set methodology and various data sets to determine which avian species regularly occur within the proposed study area, the availability of bird micro habitats (i.e. avifaunal sensitive areas), the possible impacts of the proposed borehole, the significance and the provision of recommendations for the mitigation of the potential impacts.

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

- * Assess various avifaunal datasets, including but not limited to Important Bird Areas (IBAs) and describe the avifaunal communities (particularly with reference to Red List species) most likely to be impacted on by the proposed borehole;
- * Identify and confirm avifaunal microhabitats within the study area and assess these for their suitability to support Red List and non-Red List priority species, in terms of breeding, roosting and foraging;
- * Describe the avifaunal communities (both Red List and non-Red List priority species) most likely to be impacted, based on data collected as part of a systematic and quantified data collection process;
- * Provide a detailed description of the impacts associated with the drilling and operation of the proposed borehole;
- * Assess the significance (rated according to a pre-determined set of criteria) of the identified direct, indirect and cumulative impacts, during the construction and operation phases of the proposed borehole, based on data collected in-field;
- * Recommend practical mitigation measures for the management of the identified impacts, at each stage of the development process;
- * Propose a monitoring programme for the sensitive areas, species or receptors (if necessary); and
- * Describe the gaps in baseline data and an indication of the confidence levels. The best available data sources will be used to predict the impacts.

3. APPLICABLE LEGISLATION, POLICIES AND GUIDELINES

The following pieces of legislation are applicable to this assessment:

- * The Convention on Biological Diversity;
- * The Convention on the Conservation of Migratory Species of Wild Animals;
- * The Agreement on the Conservation of Africa-Eurasian Migratory Water Birds (AEWA);
- * The National Environmental Management Act 107 of 1998 (NEMA);

- * The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations);
- * National Environmental Management: Protected Areas Act 27 of 2003;

4. APPROACH AND METHODOLOGY

4.1 Methodology

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

- * Collect and examine various avifaunal data sets (detailed in section 4.2) at a desktop level to determine the presence of sensitive Red List, as well as non-Red List priority species, that may be vulnerable to the impacts associated with the proposed drilling and operation of the borehole;
- * Suitable avifaunal habitats and potential sensitive areas within the immediate surrounds of the proposed area earmarked for the borehole, where impacts are likely to occur, were identified using various Geographic Information System (GIS) layers and Google Earth imagery and confirmed based on personal observations made during the site visit on 18 October 2021 (FIGURE 2);
- * Primary bird data was collected by means of a field survey to ground truth the information gleaned from secondary data sources and to collect primary bird occurrence data at the project site and its immediate surrounds;
- * The potential impacts, associated with the drilling and operation of the proposed borehole on the avifaunal community, and the significance were predicted and assessed according to quantitative criteria (APPENDIX 3); and
- * Practical recommendations for the management and mitigation of potentially significant impacts, related to the drilling and operation of the proposed borehole.

4.2 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 (SABAP 2) was obtained from the Animal Demography Unit of the University of Cape Town on 3 November 2021 December 2021 as a means to ascertain which species occur within the study area, based on the 2815_2815 pentad grid cell within which the proposed borehole will be located. Between 2007 and 2021, a total of 580 full protocol cards (i.e. 580 bird surveys lasting a minimum of two hours each) have been completed in this pentad (FIGURE 3);
- * 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. The study area is located within the Rooiberg-Riemland (SA048) IBA (FIGURE 3);
- * Co-ordinated Waterbird Count Database (CWAC – Taylor et al. 1999) was consulted to determine if large concentrations of water birds, associated with South African wetlands, may occur within the study

area. The Loch Athlone Bird Sanctuary CWAC site, is located within a 500m of the area earmarked for the proposed borehole (FIGURE 3) and has relevance to this study;

- * Coordinated Avifaunal Roadcount project database (CAR – Young et al, 2003) - was consulted to obtain relevant data on large terrestrial bird report rates in the area. There are no CAR routes within the proposed study area and therefore CAR data was not used as a criterion to assess the sensitivity and anticipated impacts within the project area;
- * 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 Version 2021-1 (<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 within the proposed study area;
- * High-resolution Google Earth ©2021 imagery was used to examine the microhabitats within the proposed study area;
- * KMZ. shapefiles detailing the location of the proposed project area, provided by *Afrimat* on 6 October 2021;
- * A one-day field visit to the proposed study area was conducted on 18 October 2021 (summer survey) to form a first-hand impression of avifaunal species presence and micro-habitat occurring within the larger study area surrounding 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 study area; and
- * Personal observations made during the aforementioned site visit to the proposed study area coupled with the author's experience gained from assessing various development projects have been used to formulate a professional opinion of the species likely to occur in the study area and the likely impacts that the proposed borehole may have on the resident avifaunal community.

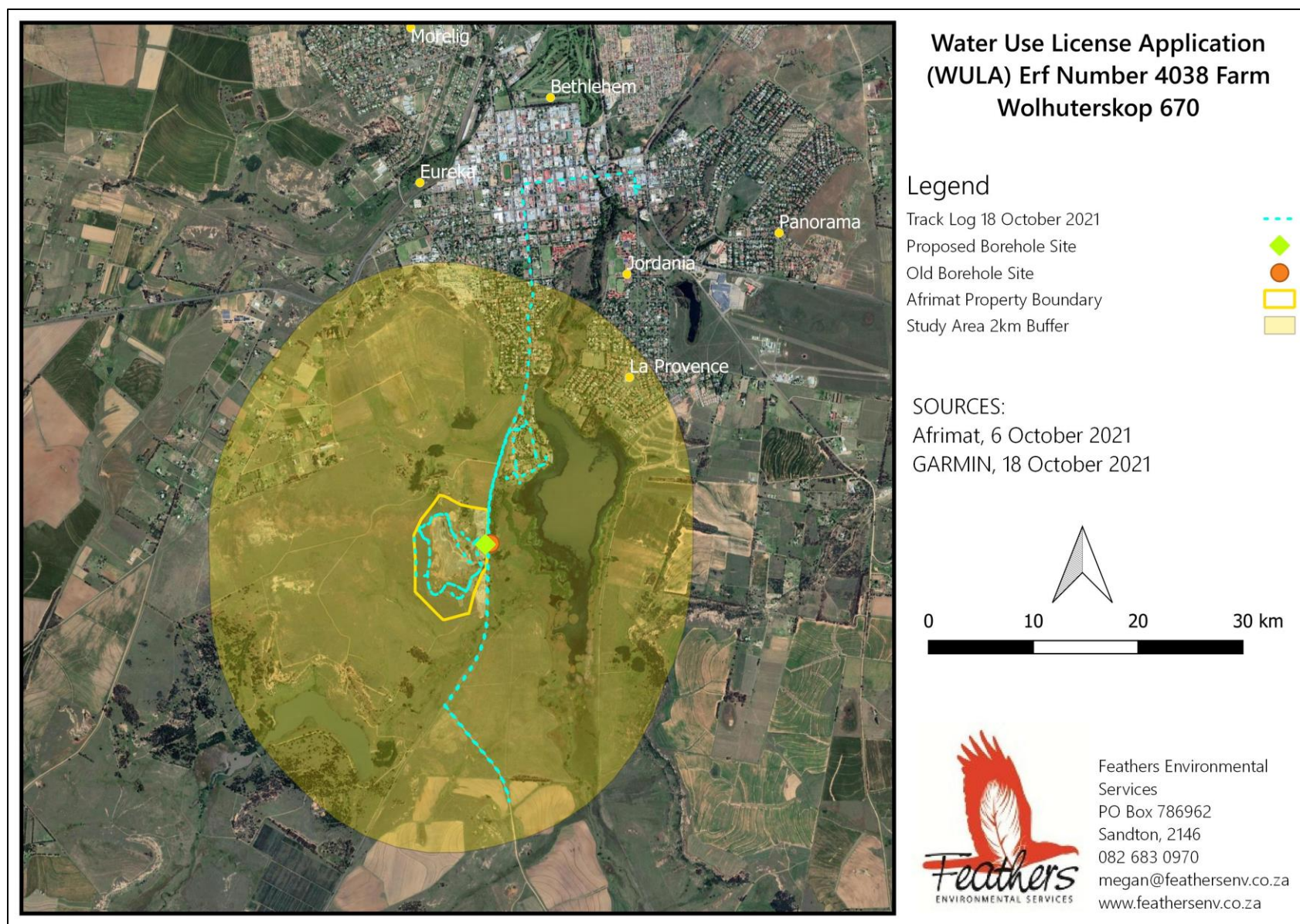


FIGURE 2. Regional map detailing the areas surveyed during the field survey to the study area conducted on 18 October 2021.

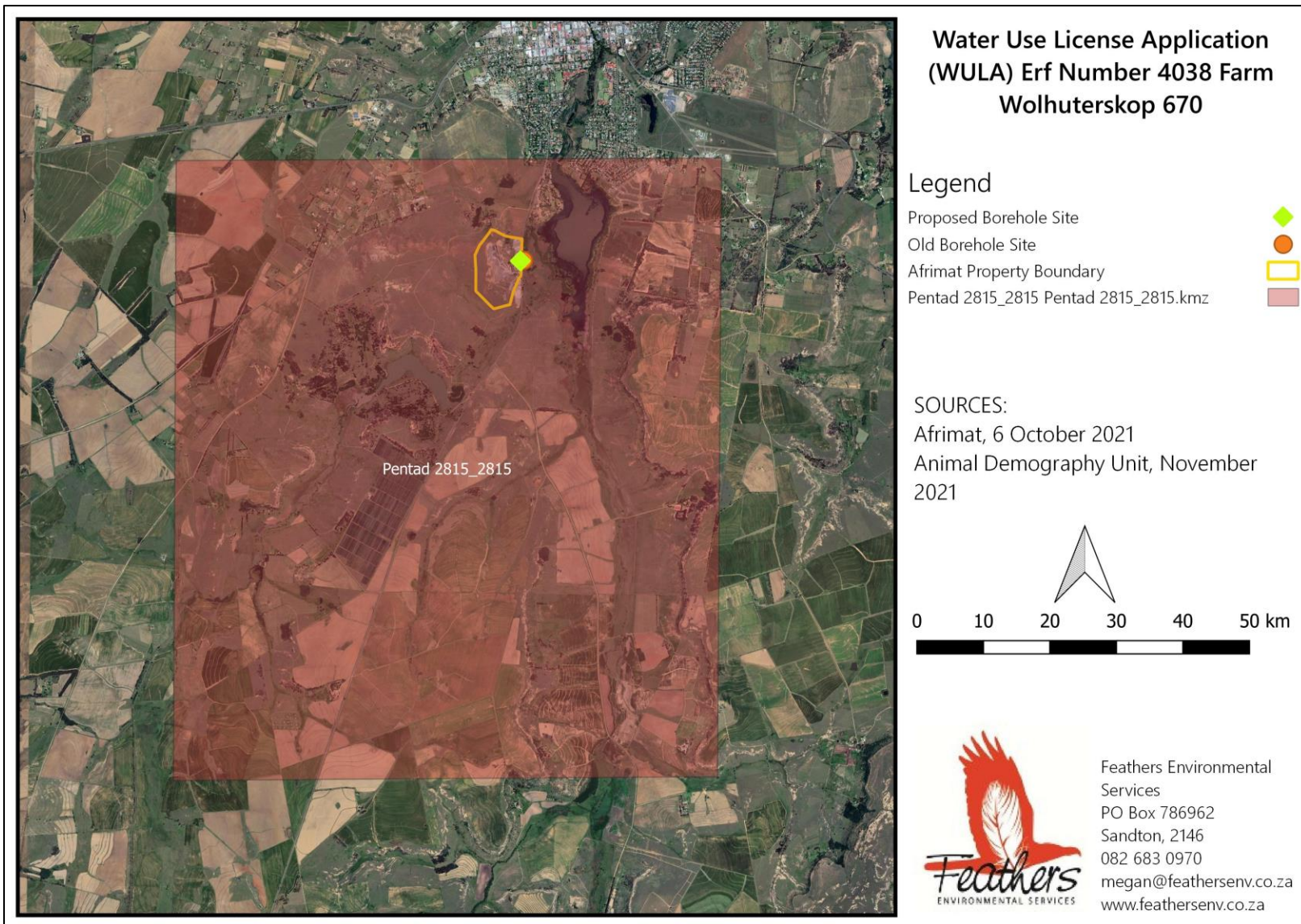


FIGURE 3: Location of the project area within the 2815_2815 African Bird Atlas Project 2 (SABAP2) pentad grid cell.

5. ASSUMPTIONS, UNCERTAINTIES & GAPS IN KNOWLEDGE

The avifaunal specialist assumed that the sources of information used for this assessment 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 one-day site verification visit to the proposed study area. No long-term, seasonal monitoring was conducted by the avifaunal specialist. This assessment relies upon secondary data sources with regards to bird occurrence and abundance such as the SABAP2 and IBA projects. These comprehensive datasets provide a valuable baseline against which any changes in species presence, abundance, and distribution can be monitored. However, primary information on bird habitat and avifaunal species occurrence collected during the site visit and together with professional judgement, based on extensive field experience since 2006, was used directly in determining which species of conservation importance are likely to occur within suitable avifaunal habitat types within the proposed development area;
- * 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 disturbance and displacement impacts associated with the construction and operational activities. Our best possible efforts can probably not ensure zero impact on birds. Assessments such as this attempt to minimise the risk as far as possible, and although the displacement impacts associated with the proposed chicken house expansion project will be unavoidable, they are likely to be temporary and of low significance.
- * The site visit to the proposed borehole study area and the resultant observations were made in a single season (austral summer), during which time temporal changes in water levels at Loch Athlone were not assessed;
- * The focus of this assessment is primarily on the potential impacts on regional Red List and priority species i.e., species that are vulnerable to the displacement, as a result of the drilling process and the potential changes in water flow associated with the operation of the proposed borehole. The impact on non-Red List species is also assessed, albeit in less detail.

The above limitations need to be stated as part of this assessment 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 impact assessment report and subsequent recommendations for this project.

6. DESCRIPTION OF THE BASELINE CONDITIONS

6.1 Relevant Bird Populations

6.1.1. Important Bird Areas

Some sites are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur. 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) and are key sites for conservation.

The proposed borehole study area is located within the Rooiberge-Riemland IBA (SA048). Most of this IBA is largely transformed and is comprised of private farmland, leaving only some patches of grassland, rocky outcrops, and sandstone cliffs deeply incised by rivers. Over 300 bird species have been recorded in the IBA. The area supports several globally threatened species, most notably breeding colonies of Southern Bald Ibis *Geronticus calvus* that forage alongside Blue Crane *Anthropoides paradiseus*, Grey Crowned Crane *Balearica regulorum*, Blue Korhaan *Eupodotis caerulescens* and Secretarybird *Sagittarius serpentarius* in the grasslands. Cape Vulture *Gyps coprotheres*, Bearded Vulture *Gypaetus barbatus* and Martial Eagle *Polemaetus bellicosus* are occasional visitors. The rocky scarps, cliffs and outcrops hold breeding Black Stork *Ciconia nigra*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Peregrine Falcon *Falco peregrinus* and Cape Eagle-Owl *Bubo capensis*. Lesser Kestrel *Falco naumanni* arrives as a regular summer visitor and Black Harrier *Circus maurus* as a regular winter visitor. None of the aforementioned species were observed during the field survey. The drilling and operation of the borehole will not have a significant negative impact on the IBA and the species it supports.

6.1.2. Coordinated Waterbird Count (CWAC) Sites

A CWAC site is a natural pan, vlei, marsh, lake, river, as well as a range of manmade impoundments (i.e. sewage works) which supports a significant number of waterbirds (~500 individuals) which use the site for feeding, and/or breeding and roosting (Harrison et al, 2004). The presence of a CWAC site within the study area is an indication of a large number of waterbird species occurring there and the overall sensitivity of the area.

Loch Athlone Dam is located within 500m of the proposed borehole site (FIGURE 4) and was registered as a CWAC site in 1993. Counts were made at this dam during both the summer and winter seasons in 1993 and repeated in the same seasons during 1994 (i.e. four surveys). Water levels were high during each of the four surveys. A total of 34 waterbird species were recorded during the survey period, of which White-breasted Cormorant *Phalacrocorax lucidus*, Cattle Egret *Bubulcus ibis*, Yellow-billed Duck *Anas undulata* and Red-knobbed Coot *Fulica cristata* were common. Grey Crowned Crane (n=1) and African Marsh Harrier *Circus*

ranivorus (n=1) were the only Red List species recorded at the site. This dam has since been deregistered as a CWAC site.

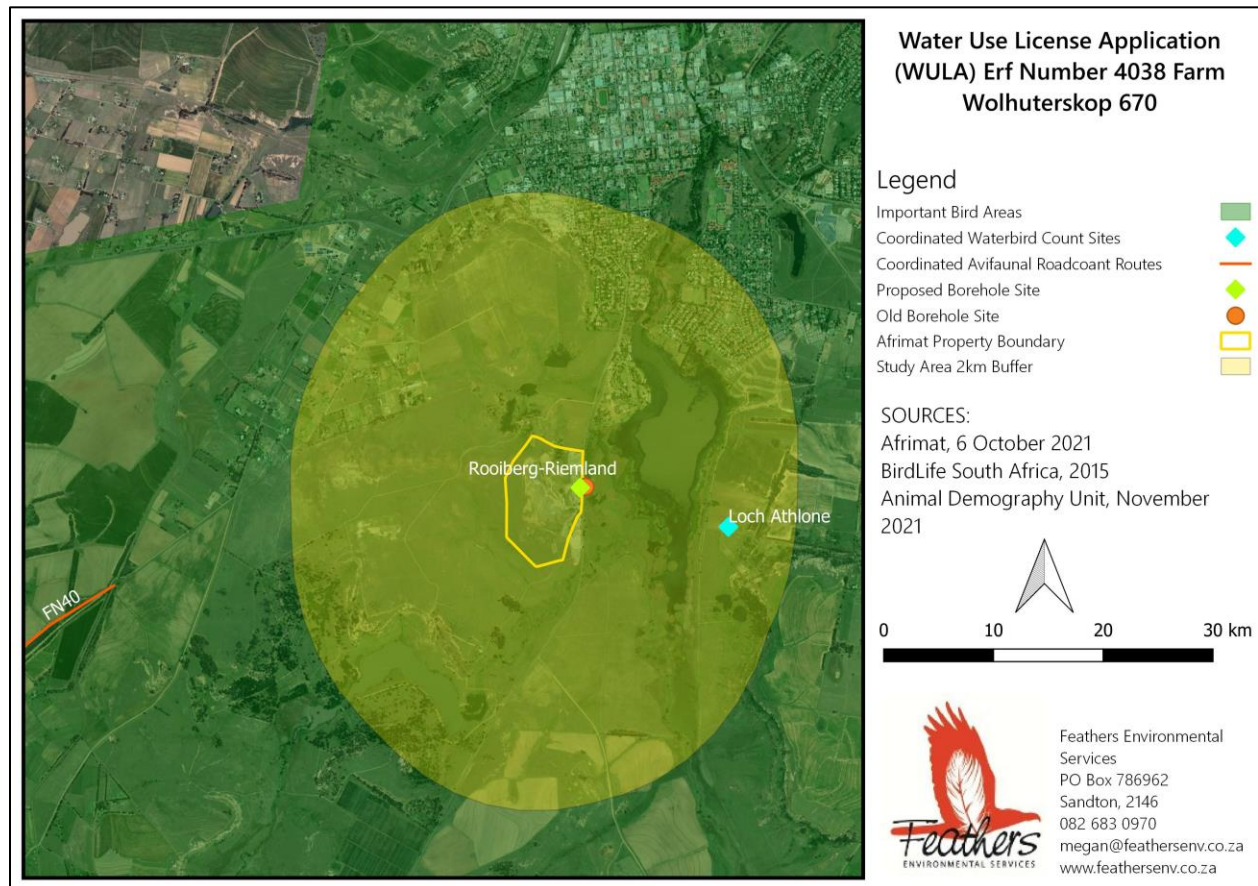


FIGURE 4: Regional map detailing the location of the proposed borehole site in relation to Important Bird Areas (IBAs) and Coordinated Waterbird Count (CAWC) Sites.

6.1.3. South African Bird Atlas Project 2 Data (SABAP2)

A total of 282 bird species have been recorded within the proposed borehole study area pentad during the SABAP2 atlassing period to date (APPENDIX 1). Of the 282 species, 21 of these are considered to be of regional conservation concern i.e. regional Red List species (Taylor et al, 2015) and 13 are endemic to South Africa, Lesotho and Swaziland.

It is important to note that with the exception of Southern Bald Ibis (n=327), Secretarybird (n=91) Lanner Falcon (n=49), Greater Flamingo *Phoenicopterus roseus* (n=28) and Grey Crowned Crane (n=51) the remaining 17 Red List species have been recorded in very low numbers, with 1-14 individual birds being recorded over the fifteen-year survey period. Seven of the recorded Red List species may utilise the Loch Athlone Dam, however the this waterbody habitat is not pristine. Sedimentation and the accumulation of pesticides and fertilizers in the

water as well as the levels of residential and both heavy and light industry disturbance currently experienced within close proximity the dam are likely to preclude Red List species from regularly utilising the dam especially for breeding purposes.

Although this report focuses on Red List species, since the impacts associated with the construction and operation of the proposed borehole are likely to be more biologically significant for these species, the impact on non-Red List species is also assessed, albeit in less detail. Furthermore, Red List species can often be used as surrogate species for the others in terms of impacts and the necessary mitigation. The non-Red List priority species that have been considered for this assessment include herons, geese, ibis and water dependent species. Each Red List species' potential for occurring in a specific habitat class is indicated in TABLE 1.

6.1.4. Primary Data Collection

A single summer survey was conducted on 18 October 2021 on both the *Afrimat* property, the Loch Athlone Dam and the immediate surrounds. In order to describe the avifaunal community present, a concerted effort was made to sample the avifauna in all of the primary habitats that were available within the study area. All species encountered (observed and heard) during the site visit were noted and are indicated (highlighted in grey) in APPENDIX 1.

The site visit produced a combined list of 46 species, covering both the study area and to a limited extent, the surrounding area. No Red List species were observed within the study area. The majority of observations were of passerine and waterbird species that are common to this area. These species have persisted despite existing disturbance within the study area. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

TABLE 1: Annotated list of regional Red List, southern African Endemic species that have been recorded in the relevant pentad surrounding the proposed borehole site

Family name	Scientific name	Red List Regional	Report Rate	No. of Birds	Grassland	Waterbodies	Exotic Trees	Cultivated Lands
Bustard, Denham's	<i>Neotis denhami</i>	VU	0.2	1	x			x
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	0.9	5	x			x
Crane, Grey Crowned	<i>Balearica regulorum</i>	EN	9.1	51	x			x
Duck, Maccoa	<i>Oxyura maccoa</i>	NT	0.7	4		x		
Eagle, Martial	<i>Polemaetus bellicosus</i>	EN	2.1	12	foraging			
Eagle, Tawny	<i>Aquila rapax</i>	EN	0.2	1	foraging			
Eagle, Verreaux's	<i>Aquila verreauxii</i>	VU	1.6	9	foraging			
Falcon, Lanner	<i>Falco biarmicus</i>	VU	8.7	49	x		x	x
Flamingo, Greater	<i>Phoenicopterus roseus</i>	NT	5.0	28		x		
Flamingo, Lesser	<i>Phoeniconaias minor</i>	NT	0.9	5		x		
Grass-Owl, African	<i>Tyto capensis</i>	VU	0.7	4	x			
Harrier, Black	<i>Circus maurus</i>	EN	1.2	7	x			x
Harrier, Pallid	<i>Circus macrourus</i>	NT	0.4	2	x			x
Ibis, Southern Bald	<i>Geronticus calvus</i>	VU	58.3	327	x			x
Marsh-Harrier, African	<i>Circus ranivorus</i>	EN	1.8	10	moist			
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT	0.5	3	x			x
Sandpiper, Curlew	<i>Calidris ferruginea</i>	LC	0.5	3		wetlands		
Secretarybird	<i>Sagittarius serpentarius</i>	VU	16.2	91	x		x	
Stork, Black	<i>Ciconia nigra</i>	VU	0.4	2		x		
Stork, Yellow-billed	<i>Mycteria ibis</i>	EN	1.2	7		x		
Tern, Caspian	<i>Hydroprogne caspia</i>	VU	2.5	14		x		
Vulture, Cape	<i>Gyps coprotheres</i>	EN	0.4	2	foraging			

6.2 Avifaunal Habitats

Vegetation is one of the primary factors determining bird species distribution and abundance in an area. 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 mitigation requirements. Assessment of the study area revealed three broadly described avifaunal micro habitats i.e. grassland, waterbody/wetland, quarries and built-up (residential and industrial) areas (FIGURE 5) with APPENDIX 2 providing a photographic record of the bird habitats.

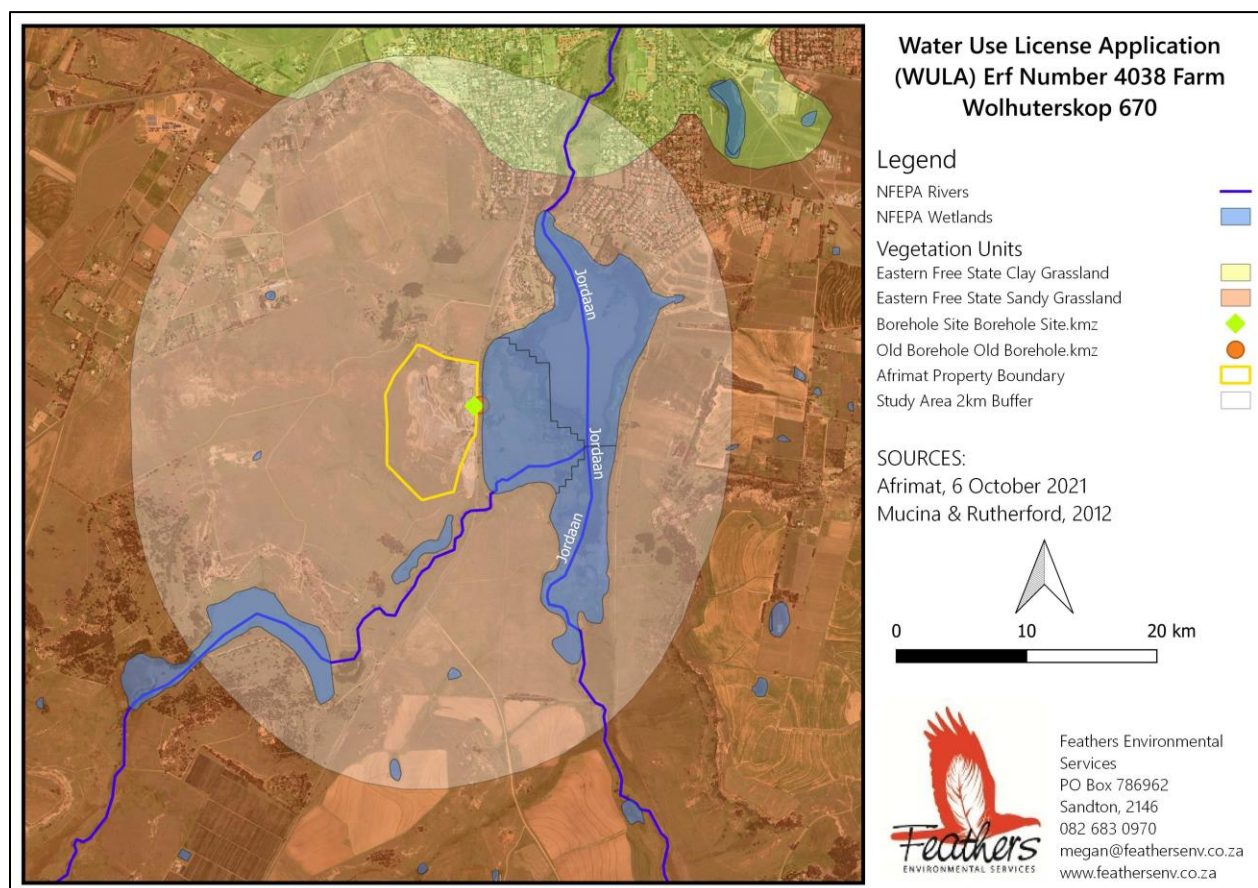


FIGURE 5: Regional map detailing the various vegetation types and river systems occurring within the proposed borehole study area.

7.3.1. Grassland

The broader study area is located within a single primary vegetation division namely the Grassland Biome, specifically the Eastern Free State Sandy Grassland vegetation unit (South African National Biodiversity Institute, 2012 and Mucina & Rutherford, 2006). Eastern Free State Sandy Grassland.

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. The grassland habitat both at the project site and in the broader study area has experienced fairly substantial transformation as a result of agricultural practices, dam construction and varying degrees of settlement, urbanisation, mining and industry related activities resulting in fairly significant levels of disturbance. Although tracts of intact grassland persist in the broader study area, the fragmented nature of the natural habitat both at the project site and its immediate surrounds is unlikely to regularly support Blue Crane, Grey Crowned Crane, Denham's Bustard *Neotis denhami*, Secretarybird, Southern Bald Ibis, Lanner Falcon and Black Harrier observed in this pentad during the SABAP2 survey period. This premise is supported by the low SABAP2 report rates for the majority of these species. However it is important to note that, grassland patches are a favourite foraging area for several common game birds such as francolins, spurfowl and Helmeted Guineafowl. This in turn could attract large raptors because of both the presence and accessibility of prey.

7.3.2. Surface Waterbodies (Dams)

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 resulting in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. Apart from the water quality, the structure of the dam, and specifically the margins and the associated shoreline and vegetation, plays a role in determining the species that will be attracted to the dam. Loch Athlone Dam is a prominent feature of the study area and, as a habitat that could potentially support several bird species, forms the basis of this assessment.

Ordinarily the species of conservation concern recorded in the study area by SABAP2 that may be attracted to Loch Athlone and other dams in the broader study area include Maccoa Duck *Oxyura maccoa*, Greater Flamingo, Lesser Flamingo *Phoeniconaias minor*, Grey Crowned Crane, Yellow-billed Stork *Mycteria ibis*, Black Stork and Caspian Tern *Hydroprogne caspia*. The low SABAP2 report rates for these species is a likely indication of the poor quality of the water, the existing levels of disturbance and the general anthropogenic impact on this habitat i.e. plastic pollutants. Several common species recorded in the study area i.e. African Darter *Anhinga rufa*, Red-knobbed Coot, as well as a variety of cormorants, ducks, geese and herons will also utilise dams for their breeding, roosting and foraging needs.

7.3.3. Cultivated Lands

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. Areas of commercial dryland agriculture occur within broader study area and may be draw cards for species such as Denham's Bustard, Blue Crane, Grey Crowned Crane, Lanner Falcon, Pallid Harrier *Circus macrourus*, Southern Bald Ibis, Lesser Kestrel and a variety of non-Red List species e.g. Black-shouldered Kite *Elanus caeruleus*, Steppe Buzzard *Buteo vulpinus*, Spur-winged Goose *Plectropterus gambensis*, Helmeted Guineafowl *Numida meleagris*, Hadedda Ibis *Bostrychia hagedash*, Cattle Egret, Black-headed Heron *Ardea melanocephala* and Barn Swallow *Hirundo rustica*.

7.3.4. 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 *Falco Falco amurensis*, a Palearctic migrant, which will commonly roost in small stands of *Eucalyptus* in suburbs of small towns. Black Sparrowhawk *Accipiter melanoleucus* Rufous-breasted Sparrowhawk *Accipiter rufiventris* and Little Sparrowhawk *Accipiter minullus* also use these trees for roosting and breeding purposes. Given the absence of large trees at the proposed borehole sit, the drilling of the borehole will not result in a permanent displacement impact, both in terms of disturbance and habitat transformation.

7.3.5. Urban Areas & Infrastructure

These areas include surface infrastructure such as roads and buildings. Built-up areas generally are of little value to sensitive Red List 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 1 details the micro habitats that each of the Red List 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 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.

8. IMPACT ASSESSMENT

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. The principal areas of concern for Red List and non-Red List priority species related to the drilling and operation of the borehole include:

8.1 Displacement as a result of habitat loss or transformation

Relevant to this project, the proposed borehole site is located on the *Afrimat* property is wholly transformed and is devoid of vegetation (habitat). The activities associated with the drilling of the borehole will not result in habitat loss if the construction activity is restricted to the immediate footprint of the infrastructure and strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.

8.2 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. For most bird species, construction activities are likely to be a cause of temporary disturbance impacting on foraging, and roosting behaviours but in more extreme cases, construction may impact on the breeding success of certain species particularly if the disturbance happens during a critical part of the breeding cycle, resulting in temporary breeding failure or permanent nest abandonment. The proposed borehole site is already subjected to a significant degree of disturbance. Any additional disturbance associated with the borehole drilling process will not cause permanent displacement from the area.

8.3 Altered water flow

Groundwater accounts for 13% of the country's total water use, with two-thirds of the country reliant on this resource (King, 2016). South Africa has an estimated 10 million cubic metres of renewable groundwater. Extracted groundwater can be replaced by rainwater, but if too much is taken, the resource will dry up indefinitely - only four percent of annual rainfall infiltrates the soil to recharge the water table. The project site and broader study area receives a considerable amount of rainfall (c. 600 mm per annum) as well as snow and frost at higher altitudes in winter, which will in all likelihood replenish the water table. This will ensure the sustainability of the borehole and more importantly the ecosystems that support the various avifaunal communities. However, it is vitally important that this groundwater resource must be carefully managed, with the appropriate environmental management strategies in place to ensure that the amount of water being extracted from the borehole, for dust suppression and for potential future uses, does not exceed the amount of water recharging the water table annually. Excessive water extraction by an operational borehole(s) can cause adverse impacts on ground water hydrology & ecology by 1) exposing the upper aquifer causing an intrusion of surface waste water into the deep ground water aquifer causing ground water contamination and 2) constant extraction depletes the water table to such an extent that it alters the habitats that support local biodiversity and ecology (Ozone in Agriculture, 2020).

8.5 Significance of the anticipated impacts

A quantitative methodology was used to describe, evaluate and rate the significance of the aforementioned impacts associated with the drilling and operation of the proposed borehole. This assessment is presented in tabular format below (TABLE 2 - 4) for both pre- and post-mitigation according to set criteria described in APPENDIX 3.

TABLE 2: Assessment of the habitat loss or transformation caused by the drilling of the proposed borehole

Activity:	Drilling of the borehole				
Impact:	Displacement of Red List species as a result of habitat loss & transformation				
Significance rating:	Magnitude	Duration	Scale	Probability	Significance
Pre-Mitigation	4	2	1	2	14 - LOW
Post-Mitigation	2	2	1	1	5 - LOW
Is the Impact Reversible?	High reversibility				
Residual impacts:	Species will return once the drilling activity is completed and the vegetation re-establishes itself.				

TABLE 3: Assessment of the disturbance impact caused by the drilling of the proposed borehole

Activity:	Drilling of the borehole				
Impact:	Displacement of Red List species as a result of disturbance				
Significance rating:	Magnitude	Duration	Scale	Probability	Significance
Pre-Mitigation	6	1	1	2	16 (LOW)
Post-Mitigation	4	1	1	1	6 (LOW)
Is the Impact Reversible?	High reversibility - After the drilling activities, have ceased, the source of displacement will cease.				
Residual impacts:	The majority of species observed in the study area will return once the drilling activity is completed				

TABLE 4: Assessment of the altering of the water flow at Loch Athlone as a result of the water extraction

Activity:	Operation of the borehole and the extraction of water				
Impact:	Alteration of water flow at surrounding dams and the impact on Red List species as a result of the extraction of the groundwater				
Significance rating:	Magnitude	Duration	Scale	Probability	Significance
Pre-Mitigation	6	4	2	3	36 (MODERATE)
Post-Mitigation	4	4	2	2	20 (LOW)
Is the Impact Reversible?	High reversibility - carefully managed water extraction will ensure that the water table is				
Residual impacts:	The species recorded in the study area will continue to thrive if the balance between the water extraction and water table recharging is achieved				

9. IMPACT STATEMENT

In conclusion, the habitat within which the proposed study area is located is low to moderately sensitive from a potential bird impact perspective. The drilling and operation of the borehole will result in impacts of LOW to MODERATE significance to birds occurring in the vicinity of the new infrastructure, which can be reduced to through the application of mitigation measures. It is anticipated that the proposed borehole can be drilled and operated in the study area with acceptable levels of impact on the resident avifauna, subject to the following recommendations:

- * Drilling activities should be restricted to the immediate footprint of the infrastructure.
- * This groundwater resource must be carefully managed, with the appropriate environmental management strategies in place to ensure that the amount of water being extracted from the borehole, for dust

suppression and for potential future uses, does not exceed the amount of water recharging the water table annually. The recommendations of the aquatic specialist must be strictly implemented to ensure the sustainability of the ground water resource.

- * 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: SOUTH AFRICAN BIRD ATLAS PROJECT DATA (SABAP2) FOR THE PROPOSED PROJECT SITE & BROADER STUDY AREA

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Avocet, Pied	<i>Recurvirostra avosetta</i>	8.7	49				
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>	2.5	14				Near-endemic
Barbet, Black-collared	<i>Lybius torquatus</i>	92.7	520				
Barbet, Crested	<i>Trachyphonus vaillantii</i>	92.9	521				
Batis, Cape	<i>Batis capensis</i>	0.2	1				Near-endemic
Batis, Pririt	<i>Batis pririt</i>	0.2	1				Near-endemic
Bee-eater, European	<i>Merops apiaster</i>	2.5	14				
Bee-eater, White-fronted	<i>Merops bullockoides</i>	0.4	2				
Bishop, Southern Red	<i>Euplectes orix</i>	97.5	547				
Bishop, Yellow	<i>Euplectes capensis</i>	0.2	1				
Bishop, Yellow-crowned	<i>Euplectes afer</i>	15.2	85				
Bittern, Dwarf	<i>Ixobrychus sturmii</i>	0.2	1				
Bittern, Little	<i>Ixobrychus minutus</i>	11.1	62				
Bokmakierie	<i>Telophorus zeylonus</i>	95.5	536				Near-endemic
Boubou, Southern	<i>Laniarius ferrugineus</i>	13.7	77				Endemic
Bulbul, African Red-eyed	<i>Pycnonotus nigricans</i>	96.6	542				Near-endemic
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>	0.2	1				
Bunting, Cape	<i>Emberiza capensis</i>	76.6	430				Near-endemic
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>	11.8	66				
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>	6.1	34				
Bustard, Denham's	<i>Neotis denhami</i>	0.2	1	NT	VU		
Buzzard, Jackal	<i>Buteo rufofuscus</i>	12.1	68			Near endemic	Endemic
Buzzard, steppe	<i>Buteo buteo</i>	21.9	123				
Canary, Black-throated	<i>Crithagra atrogularis</i>	73.4	412				
Canary, Brimstone	<i>Crithagra sulphurata</i>	1.2	7				
Canary, Cape	<i>Serinus canicollis</i>	95.4	535				Endemic
Canary, Forest	<i>Crithagra scotops</i>	0.4	2			Endemic	Endemic
Canary, Yellow	<i>Crithagra flaviventris</i>	2.1	12				Near-endemic
Chat, Anteating	<i>Myrmecocichla formicivora</i>	1.1	6				Endemic
Chat, Buff-streaked	<i>Campicoloides bifasciata</i>	58.6	329			Endemic	Endemic
Chat, Familiar	<i>Cercomela familiaris</i>	18.5	104				
Cisticola, Cloud	<i>Cisticola textrix</i>	68.6	385			Near endemic	Near-endemic
Cisticola, Desert	<i>Cisticola aridulus</i>	25.5	143				
Cisticola, Lazy	<i>Cisticola aberrans</i>	15.3	86				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Cisticola, Levallant's	<i>Cisticola tinniens</i>	0.4	2				
Cisticola, Pale-crowned	<i>Cisticola cinnameus</i>	93.6	525				
Cisticola, Wailing	<i>Cisticola lais</i>	3.7	21				
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>	84.0	471				
Cisticola, Zitting	<i>Cisticola juncidis</i>	21.9	123				
Cliff-Chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>	54.9	308				
Cliff-Swallow, South African	<i>Petrochelidon spilodera</i>	1.4	8			Endemic	Breeding-endemic
Coot, Red-knobbed	<i>Fulica cristata</i>	95.7	537				
Cormorant, Reed	<i>Phalacrocorax africanus</i>	94.3	529				
Cormorant, White-breasted	<i>Phalacrocorax lucidus</i>	43.3	243				
Coucal, Burchell's	<i>Centropus burchellii</i>	0.7	4				Near-endemic
Courser, Bronze-winged	<i>Rhinoptilus chalcopterus</i>	0.2	1				
Crake, Baillon's	<i>Porzana pusilla</i>	1.2	7				
Crake, Black	<i>Amaurornis flavirostra</i>	45.6	256				
Crane, Blue	<i>Anthropoides paradiseus</i>	0.9	5	VU	NT		Endemic
Crane, Grey Crowned	<i>Balearica regulorum</i>	9.1	51	EN	EN		
Crombec, Long-billed	<i>Sylvietta rufescens</i>	8.9	50				
Crow, Cape	<i>Corvus capensis</i>	3.7	21				
Crow, Pied	<i>Corvus albus</i>	8.4	47				
Cuckoo, Black	<i>Cuculus clamosus</i>	1.2	7				
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>	33.9	190				
Cuckoo, Jacobin	<i>Clamator jacobinus</i>	0.5	3				
Cuckoo, Red-chested	<i>Cuculus solitarius</i>	33.9	190				
Darter, African	<i>Anhinga rufa</i>	65.8	369				
Dove, Laughing	<i>Streptopelia senegalensis</i>	97.9	549				
Dove, Namaqua	<i>Oena capensis</i>	9.3	52				
Dove, Red-eyed	<i>Streptopelia semitorquata</i>	97.9	549				
Dove, Rock	<i>Columba livia</i>	82.4	462				
Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>	40.1	225				
Duck, African Black	<i>Anas sparsa</i>	18.0	101				
Duck, Fulvous	<i>Dendrocygna bicolor</i>	0.5	3				
Duck, Maccoa	<i>Oxyura maccoa</i>	0.7	4	VU	NT		
Duck, Mallard	<i>Anas platyrhynchos</i>	0.7	4				
Duck, White-backed	<i>Thalassornis leuconotus</i>	3.4	19				
Duck, White-faced	<i>Dendrocygna viduata</i>	2.9	16				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Duck, Yellow-billed	<i>Anas undulata</i>	95.0	533				
Eagle, Booted	<i>Hieraaetus pennatus</i>	3.9	22				
Eagle, Long-crested	<i>Lophaetus occipitalis</i>	13.2	74				
Eagle, Martial	<i>Polemaetus bellicosus</i>	2.1	12	VU	EN		
Eagle, Tawny	<i>Aquila rapax</i>	0.2	1	VU	EN		
Eagle, Verreaux's	<i>Aquila verreauxii</i>	1.6	9	LC	VU		
Eagle-Owl, Cape	<i>Bubo capensis</i>	19.4	109				
Eagle-Owl, Spotted	<i>Bubo africanus</i>	59.9	336				
Egret, Cattle	<i>Bubulcus ibis</i>	57.4	322				
Egret, Great	<i>Egretta alba</i>	3.0	17				
Egret, Little	<i>Egretta garzetta</i>	12.5	70				
Egret, Yellow-billed	<i>Egretta intermedia</i>	27.3	153				
Falcon, Amur	<i>Falco amurensis</i>	26.2	147				
Falcon, Lanner	<i>Falco biarmicus</i>	8.7	49	LC	VU		
Falcon, Peregrine	<i>Falco peregrinus</i>	8.2	46				
Finch, Cuckoo	<i>Anomalospiza imberbis</i>	0.5	3				
Finch, Red-headed	<i>Amadina erythrocephala</i>	11.8	66				Near-endemic
Firefinch, Red-billed	<i>Lagonosticta senegala</i>	1.2	7				
Fiscal, Common	<i>Lanius collaris</i>	98.6	553				
Fish-Eagle, African	<i>Haliaeetus vocifer</i>	85.7	481				
Flamingo, Greater	<i>Phoenicopterus roseus</i>	5.0	28	LC	NT		
Flamingo, Lesser	<i>Phoeniconaias minor</i>	0.9	5	NT	NT		
Flufftail, Red-chested	<i>Sarothrura rufa</i>	5.2	29				
Flycatcher, African Dusky	<i>Muscicapa adusta</i>	0.2	1				
Flycatcher, Fairy	<i>Stenostira scita</i>	13.4	75			Near endemic	Endemic
Flycatcher, Fiscal	<i>Sigelus silens</i>	29.8	167			Near endemic	Endemic
Flycatcher, Spotted	<i>Muscicapa striata</i>	2.7	15				
Francolin, Grey-winged	<i>Scleroptila afra</i>	16.9	95			Endemic	Endemic
Francolin, Red-winged	<i>Scleroptila levaillantii</i>	0.2	1				
Gallinule, Allen's	<i>Porphyrio alleni</i>	0.2	1				
Goose, Egyptian	<i>Alopochen aegyptiaca</i>	93.6	525				
Goose, Spur-winged	<i>Plectropterus gambensis</i>	56.1	315				
Goshawk, Gabar	<i>Melierax gabar</i>	7.8	44				
Goshawk, Southern Pale Chanting	<i>Melierax canorus</i>	0.2	1				Near-endemic
Grassbird, Cape	<i>Sphenoeacus afer</i>	48.5	272			Near endemic	Endemic

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Grass-Owl, African	<i>Tyto capensis</i>	0.7	4	LC	VU		
Grebe, Great Crested	<i>Podiceps cristatus</i>	0.4	2				
Grebe, Little	<i>Tachybaptus ruficollis</i>	80.2	450				
Greenshank, Common	<i>Tringa nebularia</i>	6.8	38				
Guineafowl, Helmeted	<i>Numida meleagris</i>	94.7	531				
Gull, Grey-headed	<i>Chroicocephalus cirrocephalus</i>	0.5	3				
Hamerkop	<i>Scopus umbretta</i>	12.5	70				
Harrier, Black	<i>Circus maurus</i>	1.2	7	EN	EN	Near endemic	Endemic
Harrier, Pallid	<i>Circus macrourus</i>	0.4	2	NT	NT		
Harrier-Hawk, African	<i>Polyboroides typus</i>	44.9	252				
Heron, Black	<i>Egretta ardesiaca</i>	1.6	9				
Heron, Black-headed	<i>Ardea melanocephala</i>	95.2	534				
Heron, Goliath	<i>Ardea goliath</i>	13.4	75				
Heron, Grey	<i>Ardea cinerea</i>	12.3	69				
Heron, Purple	<i>Ardea purpurea</i>	36.7	206				
Heron, Squacco	<i>Ardeola ralloides</i>	29.8	167				
Honeybird, Brown-backed	<i>Prodotiscus regulus</i>	5.0	28				
Honey-buzzard, European	<i>Pernis apivorus</i>	3.2	18				
Honeyguide, Greater	<i>Indicator indicator</i>	2.7	15				
Honeyguide, Lesser	<i>Indicator minor</i>	34.2	192				
Hoopoe, African	<i>Upupa africana</i>	73.3	411				
Hornbill, African Grey	<i>Tockus nasutus</i>	0.2	1				
House-Martin, Common	<i>Delichon urbicum</i>	18.4	103				
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	24.4	137				
Ibis, Glossy	<i>Plegadis falcinellus</i>	35.8	201				
Ibis, Hageda	<i>Bostrychia hagedash</i>	97.3	546				
Ibis, Southern Bald	<i>Geronticus calvus</i>	58.3	327	VU	VU	Endemic	Endemic
Jacana, African	<i>Actophilornis africanus</i>	0.7	4				
Kestrel, Lesser	<i>Falco naumanni</i>	13.7	77				
Kestrel, Rock	<i>Falco rupicolus</i>	2.7	15				
Kingfisher, Giant	<i>Megaceryle maxima</i>	49.9	280				
Kingfisher, Malachite	<i>Alcedo cristata</i>	15.3	86				
Kingfisher, Pied	<i>Ceryle rudis</i>	28.0	157				
Kite, Black	<i>Milvus migrans</i>	0.2	1				
Kite, Black-shouldered	<i>Elanus caeruleus</i>	94.3	529				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Kite, Yellow-billed	<i>Milvus aegyptius</i>	1.8	10				
Korhaan, Northern Black	<i>Afrotis afraoides</i>	0.2	1				Endemic
Lapwing, African Wattled	<i>Vanellus senegallus</i>	0.2	1				
Lapwing, Blacksmith	<i>Vanellus armatus</i>	95.7	537				
Lapwing, Crowned	<i>Vanellus coronatus</i>	49.0	275				
Lark, Eastern Clapper	<i>Mirafra fasciolata</i>	0.9	5				Near-endemic
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>	0.2	1			Endemic	Endemic
Lark, Red-capped	<i>Calandrella cinerea</i>	1.4	8				
Lark, Rufous-naped	<i>Mirafra africana</i>	0.9	5				
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>	0.4	2				Near-endemic
Longclaw, Cape	<i>Macronyx capensis</i>	95.0	533				Endemic
Marsh-Harrier, African	<i>Circus ranivorus</i>	1.8	10	LC	EN		
Martin, Banded	<i>Riparia cincta</i>	21.9	123				
Martin, Brown-throated	<i>Riparia paludicola</i>	89.3	501				
Martin, Rock	<i>Hirundo fuligula</i>	74.5	418				
Martin, Sand	<i>Riparia riparia</i>	0.5	3				
Masked-Weaver, Southern	<i>Ploceus velatus</i>	98.2	551				
Moorhen, Common	<i>Gallinula chloropus</i>	93.0	522				
Moorhen, Lesser	<i>Gallinula angulata</i>	0.7	4				
Mousebird, Red-faced	<i>Urocolius indicus</i>	91.3	512				
Mousebird, Speckled	<i>Colius striatus</i>	93.8	526				
Mousebird, White-backed	<i>Colius colius</i>	0.2	1				Endemic
Myna, Common	<i>Acridotheres tristis</i>	93.4	524				
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>	64.3	361				
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>	30.1	169				
Nightjar, Freckled	<i>Caprimulgus tristigma</i>	1.1	6				
Osprey, Osprey	<i>Pandion haliaetus</i>	2.3	13				
Ostrich, Common	<i>Struthio camelus</i>	30.7	172				
Owl, Barn	<i>Tyto alba</i>	21.7	122				
Owl, Marsh	<i>Asio capensis</i>	0.5	3				
Palm-Swift, African	<i>Cypsiurus parvus</i>	76.8	431				
Paradise-Flycatcher, African	<i>Terpsiphone viridis</i>	10.5	59				
Pigeon, Speckled	<i>Columba guinea</i>	97.0	544				
Pipit, African	<i>Anthus cinnamomeus</i>	10.5	59				
Plover, Common Ringed	<i>Charadrius hiaticula</i>	0.2	1				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Plover, Kittlitz's	<i>Charadrius pecuarius</i>	2.3	13				
Plover, Three-banded	<i>Charadrius tricollaris</i>	23.0	129				
Pochard, Southern	<i>Netta erythrophthalma</i>	10.9	61				
Pratincole, Black-winged	<i>Glareola nordmanni</i>	0.5	3	NT	NT		
Prinia, Black-chested	<i>Prinia flavicans</i>	87.9	493				Near-endemic
Prinia, Drakensberg	<i>Prinia hypoxantha</i>	0.2	1			Endemic	Endemic
Prinia, Karoo	<i>Prinia maculosa</i>	79.3	445			Near endemic	Endemic
Quail, Common	<i>Coturnix coturnix</i>	11.8	66				
Quailfinch, African	<i>Ortygospiza fuscocrissa</i>	70.9	398				
Quelea, Red-billed	<i>Quelea quelea</i>	93.2	523				
Rail, African	<i>Rallus caerulescens</i>	16.0	90				
Reed-Warbler, African	<i>Acrocephalus baeticatus</i>	47.8	268				
Reed-Warbler, Great	<i>Acrocephalus arundinaceus</i>	12.7	71				
Robin-Chat, Cape	<i>Cossypha caffra</i>	97.7	548				
Rock-Thrush, Cape	<i>Monticola rupestris</i>	72.4	406			Endemic	Endemic
Rock-Thrush, Sentinel	<i>Monticola explorator</i>	0.2	1			Endemic	Endemic
Roller, European	<i>Coracias garrulus</i>	0.0	0	LC	NT		
Ruff	<i>Philomachus pugnax</i>	6.1	34				
Rush-Warbler, Little	<i>Bradypterus baboecala</i>	36.5	205				
Sandpiper, Common	<i>Actitis hypoleucos</i>	0.4	2				
Sandpiper, Curlew	<i>Calidris ferruginea</i>	0.5	3	NT	LC		
Sandpiper, Marsh	<i>Tringa stagnatilis</i>	5.2	29				
Sandpiper, Wood	<i>Tringa glareola</i>	4.1	23				
Scrub-Robin, Karoo	<i>Erythropgia coryphoeus</i>	0.4	2				Endemic
Secretarybird	<i>Sagittarius serpentarius</i>	16.2	91	VU	VU		
Seedeater, Streaky-headed	<i>Crithagra gularis</i>	52.9	297				
Shelduck, South African	<i>Tadorna cana</i>	21.0	118				Endemic
Shoveler, Cape	<i>Anas smithii</i>	33.5	188				Near-endemic
Shrike, Lesser Grey	<i>Lanius minor</i>	0.2	1				
Shrike, Red-backed	<i>Lanius collurio</i>	1.1	6				
Siskin, Drakensberg	<i>Crithagra symonsi</i>	0.4	2			Endemic	Endemic
Snake-Eagle, Black-chested	<i>Circaetus pectoralis</i>	0.2	1				
Snake-Eagle, Brown	<i>Circaetus cinereus</i>	0.7	4				
Snipe, African	<i>Gallinago nigripennis</i>	23.9	134				
Sparrow, Cape	<i>Passer melanurus</i>	95.2	534				Near-endemic

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Sparrow, House	<i>Passer domesticus</i>	92.7	520				
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>	61.1	343				
Sparrowhawk, Black	<i>Accipiter melanoleucus</i>	29.9	168				
Sparrowhawk, Little	<i>Accipiter minullus</i>	2.5	14				
Sparrowhawk, Rufous-chested	<i>Accipiter rufiventris</i>	21.6	121				
Sparrow-Weaver, White-browed	<i>Plocepasser mahali</i>	63.3	355				
Spoonbill, African	<i>Platalea alba</i>	16.0	90				
Spurfowl, Natal	<i>Pternistis natalensis</i>	13.9	78				Near-endemic
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>	91.6	514				
Starling, Cape Glossy	<i>Lamprotornis nitens</i>	93.0	522				
Starling, Common	<i>Sturnus vulgaris</i>	35.3	198				
Starling, Pied	<i>Lamprotornis bicolor</i>	94.8	532			Endemic	Endemic
Starling, Red-winged	<i>Onychognathus morio</i>	87.0	488				
Starling, Wattled	<i>Creatophora cinerea</i>	57.8	324				
Stilt, Black-winged	<i>Himantopus himantopus</i>	24.8	139				
Stint, Little	<i>Calidris minuta</i>	8.0	45				
Stonechat, African	<i>Saxicola torquatus</i>	97.3	546				
Stork, Black	<i>Ciconia nigra</i>	0.4	2	LC	VU		
Stork, White	<i>Ciconia ciconia</i>	4.3	24				
Stork, Yellow-billed	<i>Mycteria ibis</i>	1.2	7	LC	EN		
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>	58.5	328				
Sunbird, Greater Double-collared	<i>Cinnyris afer</i>	28.2	158			Endemic	Endemic
Sunbird, Malachite	<i>Nectarinia famosa</i>	61.1	343				
Sunbird, Scarlet-chested	<i>Chalcomitra senegalensis</i>	0.2	1				
Sunbird, White-bellied	<i>Cinnyris talatala</i>	1.2	7				
Swallow, Barn	<i>Hirundo rustica</i>	47.6	267				
Swallow, Greater Striped	<i>Cecropis cucullata</i>	66.5	373				
Swallow, Pearl-breasted	<i>Hirundo dimidiata</i>	0.9	5				
Swallow, White-throated	<i>Hirundo albigularis</i>	60.4	339				
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>	37.1	208				
Swamp-Warbler, Lesser	<i>Acrocephalus gracilirostris</i>	96.4	541				
Swift, African Black	<i>Apus barbatus</i>	55.3	310				
Swift, Alpine	<i>Tachymarptis melba</i>	57.2	321				
Swift, Common	<i>Apus apus</i>	6.1	34				
Swift, Horus	<i>Apus horus</i>	32.1	180				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Swift, Little	<i>Apus affinis</i>	63.8	358				
Swift, White-rumped	<i>Apus caffer</i>	67.9	381				
Teal, Cape	<i>Anas capensis</i>	0.4	2				
Teal, Hottentot	<i>Anas hottentota</i>	12.1	68				
Teal, Red-billed	<i>Anas erythrorhyncha</i>	42.8	240				
Tern, Black	<i>Chlidonias niger</i>	0.2	1				
Tern, Caspian	<i>Hydroprogne caspia</i>	2.5	14	LC	VU		
Tern, Whiskered	<i>Chlidonias hybrida</i>	45.6	256				
Tern, White-winged	<i>Chlidonias leucopterus</i>	16.6	93				
Thick-knee, Spotted	<i>Burhinus capensis</i>	72.0	404				
Thrush, Karoo	<i>Turdus smithi</i>	93.9	527			Near endemic	Endemic
Thrush, Olive	<i>Turdus olivaceus</i>	1.1	6				
Tit-Babbler, Chestnut-vented	<i>Sylvia subcaerulea</i>	0.7	4				Near-endemic
Turtle-Dove, Cape	<i>Streptopelia capicola</i>	97.7	548				
Vulture, Cape	<i>Gyps coprotheres</i>	0.4	2	EN	EN		Near-endemic
Vulture, Palm-nut	<i>Gypohierax angolensis</i>	2.5	14				
Wagtail, Cape	<i>Motacilla capensis</i>	90.4	507				
Wagtail, Yellow	<i>Motacilla flava</i>	0.7	4				
Warbler, Garden	<i>Sylvia borin</i>	3.0	17				
Warbler, Marsh	<i>Acrocephalus palustris</i>	3.4	19				
Warbler, Sedge	<i>Acrocephalus schoenobaenus</i>	9.8	55				
Warbler, Willow	<i>Phylloscopus trochilus</i>	29.1	163				
Waxbill, Common	<i>Estrilda astrild</i>	85.9	482				
Waxbill, Orange-breasted	<i>Amandava subflava</i>	2.9	16				
Waxbill, Swee	<i>Coccyzygia melanotis</i>	0.2	1			Near endemic	Endemic
Weaver, Cape	<i>Ploceus capensis</i>	95.0	533			Near endemic	Endemic
Wheatear, Mountain	<i>Oenanthe monticola</i>	3.7	21				Near-endemic
White-eye, Cape	<i>Zosterops virens</i>	95.2	534			Near endemic	Endemic
Whitethroat, Common	<i>Sylvia communis</i>	0.4	2				
Whydah, Pin-tailed	<i>Vidua macroura</i>	93.4	524				
Widowbird, Fan-tailed	<i>Euplectes axillaris</i>	26.4	148				
Widowbird, Long-tailed	<i>Euplectes progne</i>	92.3	518				
Widowbird, Red-collared	<i>Euplectes ardens</i>	2.5	14				
Wood-Hoopoe, Green	<i>Phoeniculus purpureus</i>	37.4	210				
Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>	38.3	215				

Family name (ADU)	Scientific name	Report Rate	No. of Individuals	Red List Global	Red List Regional	Endemicity South Africa	Endemicity Southern Africa
Woodpecker, Ground	<i>Geocolaptes olivaceus</i>	72.4	406			Endemic	Endemic
Woodpecker, Olive	<i>Dendropicos griseocephalus</i>	0.4	2				
Wryneck, Red-throated	<i>Jynx ruficollis</i>	91.1	511				

APPENDIX 2: AVIFAUNAL HABITAT OBSERVED AT THE PROJECT SITE AND WITHIN THE BROADER STUDY AREA



FIGURE 1: Loch Athlone Dam



FIGURE 2: Loch Athlone Dam - bordered by exotic trees



FIGURE 3: Reed beds within the Loch Athlone Dam



FIGURE 4: Degraded grassland habitat



FIGURE 5: Afrimat quarry



FIGURE 6: Accumulation of water (small wetland) on the Afrimat property



FIGURE 7: Trees within the area earmarked for the proposed borehole



FIGURE 8: Cultivated lands and stands of exotic trees

APPENDIX 3: METHOD OF ASSESSING THE SIGNIFICANCE OF THE POTENTIAL ENVIRONMENTAL IMPACTS

The impact assessment was undertaken using a matrix selection process, the most used methodology, for determining the significance of potential environmental impacts/risks. This methodology is based on the minimum requirements as outlined in Appendix 3 of the EIA Regulations of 2014. The methodology incorporates four aspects for assessing the potential significance of impacts, namely direction, severity, probability of occurrence, and reversibility, which are further sub-divided as follows.

Table 1: Impact assessment factors

Direction	Severity			Probability	Reversibility
Positive/ negative	Magnitude	Duration	Scale/extent	Probability of occurrence	Reversible/ irreversible

To determine the significance of each potential impact/risk, the following four ranking scales are used

Table 2: Impact assessment scoring methodology

Value	Description
<i>Magnitude</i>	
10	Very high/unknown (of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural, and economic activities of communities are disrupted to such an extent that these come to a halt).
8	High
6	Moderate (impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and easily possible. Social, cultural, and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required).
4	Low (impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.)
2	Minor
<i>Duration</i>	
5	Permanent (Permanent or beyond closure)
4	Long term (more than 15 years)
3	Medium-term (5 to 15 years)
2	Short-term (1 to 5 years)

Value	Description
1	Immediate (less than 1 year)
<i>Scale</i>	
5	International
4	National
3	Regional
2	Local
1	Site only
0	None
<i>Probability</i>	
5	Definite/unknown (impact will definitely occur)
4	Highly probable (most likely, 60% to 90% chance)
3	Medium probability (40% to 60% chance)
2	Low probability (5% to 40% chance)
1	Improbable (less than 5% chance)
0	None

$$\text{Significance} = (\text{Magnitude} + \text{Duration} + \text{Scale}) \times \text{Probability}$$

Table 3: Significance of impact based on point allocation

Points	Significance	Description
SP>75	High environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 - 75	Moderate environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP<30	Low environmental significance	Impacts with little real effect and which will not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

For the methodology outlined above 2), the following definitions were used:

- * Direction of an impact may be positive, neutral, or negative with respect to the impact
- * Magnitude is a measure of the degree of change in a measurement or analysis (e.g., the severity of an impact on human health, well-being, and the environment), and is classified as none/negligible, low, moderate, high, or very high/unknown
- * Scale/geographic extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international
- * Duration refers to the length of time over which an environmental impact may occur i.e., immediate/transient, short-term, medium term, long-term, or permanent
- * Probability of occurrence is a description of the probability of the impact occurring as improbable, low probability, medium probability, highly probable or definite
- * Reversibility of an impact, which may be described as reversible or irreversible

APPENDIX 4: CURRICULUM VITAE

MEGAN DIAMOND

PERSONAL DETAILS

Date of Birth | 7 December 1978
Driver's License | Code A and B
Home Language | English
Other Languages | Afrikaans

EDUCATION

BSc Environmental Management | *University of South Africa (UNISA)* 2002 – 2009

ACCREDITATION

South African Council for Natural Scientific Professions | *Environmental Science*
Registration Number: 300022/14

EXPERIENCE

Owner & Avifaunal Specialist | *Feathers Environmental Services*
July 2013 – Present

- * Perform specialist avifaunal assessment studies to minimise the impact of industrial infrastructure on birds and their habitats;
- * Provide strategic guidance to industry through the development of best practice procedures and guidelines;
- * Review and comment on methodologies, specialist studies and EIA reports for Renewable Energy projects;
- * Provide input into renewable energy and power line developments elsewhere in Africa and across the globe;
- * Manage the collection and collation of relevant and complete desktop and/or field datasets;
- * Manage pre- and post-construction avifaunal monitoring data collected at wind and solar energy facilities;
- * Site assessments, either as part of the project team or independently;
- * Preparation of reports according to project deadlines, including the use of Geographic Information Systems (GIS) to portray data;
- * Attendance of specialist integration meetings; and
- * Liaison with stakeholders where necessary.

Programme management

- * Annually review the programme's conservation and research strategic objectives and update in accordance with the EWT's and programme's vision and mission including work plans for staff etc.;
- * Ensure timeous, professional delivery on all aspects of Wildlife & Energy Programme activities;
- * Formulate, prioritise and approve relevant research and conservation projects;
- * Ensure acceptable quality of all research projects and their outputs;
- * Participate in international network liaison as and when required;
- * Produce regular popular articles & media releases on the Wildlife & Energy Programme projects and outputs & contribute to the EWT publications;
- * Establish & maintain a network with relevant national & international stakeholders;
- * Deliver presentations at relevant meetings, functions, workshops & conferences on behalf of the programme;
- * Assist with compilation of newsletters, updating of webpage, compilation of press articles, any advocacy issues;
- * Identify & establish partnerships to achieve Wildlife & Energy Programme conservation goals.

Eskom –EWT Strategic Partnership

- * Ensure that this partnership is managed effectively and sustainably against its goals. Manage staff in this division;
- * Develop and maintain relationships with Eskom;
- * Negotiate the terms of reference for the annual service level agreements between EWT and Eskom, to ensure the sustainability of the relationship;
- * Compile annual report to Eskom Corporate Environment and Sustainability;
- * Produce monthly reports to Eskom's regional grids on the status of incident follow-up;
- * Attend applicable forums to interact with Eskom stakeholders;
- * Participate in international network liaison as and when required;
- * Maintain a network with all relevant local and regional level stakeholders (meetings, forums, workshops, etc.);
- * Identify research needs relating to the management of wildlife interaction with power lines;
- * Conduct research projects on wildlife and power line interaction and present the results at national and international conferences and workshops;
- * Development and implementation of training for Eskom field services staff (at various levels) in the management of wildlife interactions; and
- * Conduct special investigations on power lines relating to wildlife induced faulting.

Environmental Impact Assessment Division

- * Ensure that this division operates effectively and efficiently at all times and manage staff in this division; and

- * Conduct specialist avifaunal studies for new power lines developments including: tendering/quoting for the projects, conducting field work, preparing reports, presenting results & negotiating the acceptance of recommendations, final “walk through” as part of Environmental Management Plans; general project management, all liaison with clients, Eskom, authorities, Interested and Affected Parties etc.

Management and administration

- * Ensure all programme staff have relevant terms of reference;
- * Ensure that all programme staff are performance appraised against their terms of reference;
- * Compile and manage programme budgets, monthly reports, work plans and strategy;
- * Monitor expenditure and take corrective action if necessary; and
- * Ensure timely delivery on all projects to all stakeholders.

CONFERENCE ATTENDANCE

- * *Society for Conservation Biology 21st Annual Meeting (1-5 July 2007)*
- * *The 6th TAWIRI Scientific Conference (3 – 6 December 2007) Presented a paper titled “Co-operative management of wildlife and power line conflicts: an African solution”*
- * *Pan-African Ornithological Congress (7-12 September 2008)*
- * *International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. (29 March – 1 April 2010) Presented a paper titled “Bird’s eye view: how birds see is key to avoiding power line collision”*
- * *Windaba 2011 – Implementing South African Wind Energy (27-29 September 2011)*
- * *Pan African Vulture Summit (16-20 April 2012) Presented a paper titled “Electrification in Africa – Are our vultures being strung along”*
- * *4th Wind Power Africa Conference & Renewable Energy Exhibition (28-30 May 2012) Presented a paper titled “Wind Energy in Africa – what does this really mean for our continent’s birds”*
- * *13th Pan-African Ornithological Congress (14-21 October 2012) Presented a paper titled “Stringing South Africa’s Terrestrial Birds Along - Monitoring of Bird Interactions with Power Line and Experimental Testing of Bird Collision Mitigation at the Karoo Long Term Monitoring Site”*
- * *AEWA Single Species Action-Planning Workshop for the Conservation of the Grey Crowned Crane (10-13 September 2013) Presented and participated in the workshop as a subject expert (energy and bird interactions)*

AUTHORED & CO-AUTHORED PAPERS

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Diamond, M. and Hoogstad, C. (in press) Collisions and habitat loss associated with utility lines and wind turbines. IUCN SSC Crane Specialist Group – Crane Conservation Strategy.