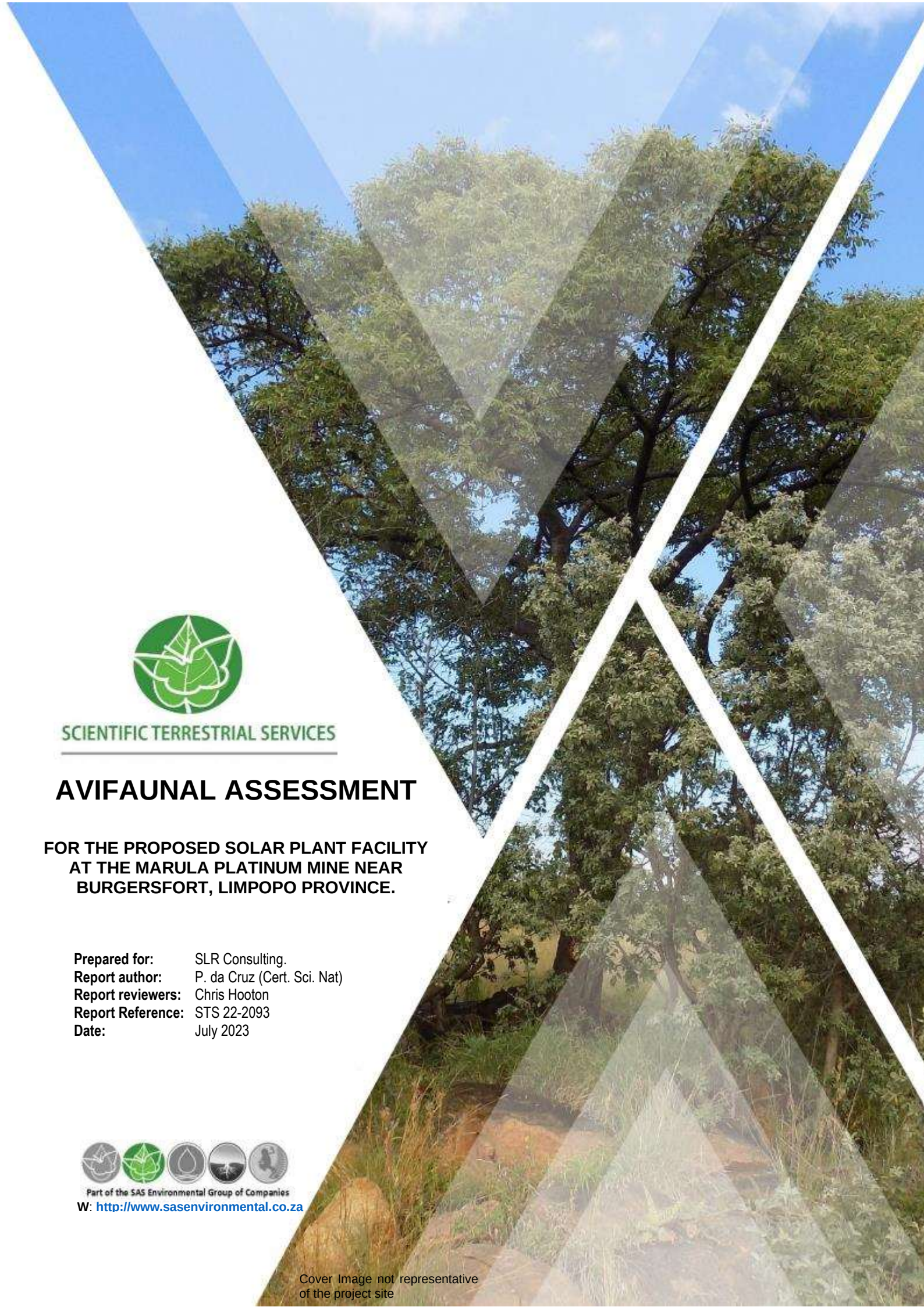

SCIENTIFIC TERRESTRIAL SERVICES

AVIFAUNAL ASSESSMENT

FOR THE PROPOSED SOLAR PLANT FACILITY AT THE MARULA PLATINUM MINE NEAR BURGERSFORT, LIMPOPO PROVINCE.

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Report Reference: STS 22-2093
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Cover Image not representative of the project site

EXECUTIVE SUMMARY

Based on the findings of the avifaunal assessment, it is the opinion of the ecologists that from an avifaunal perspective, the proposed components of the development can be considered acceptable. The most significant potential impact anticipated to occur is the alteration of areas of natural habitat, reducing avian abundance and diversity within the study area, especially within the solar array footprint. Impact scores are reduced as no sensitive habitat is proposed to be developed (due mainly to the high anthropogenic disturbance factor and degradation of the predominantly bushveld habitat unit), and as there is a low likelihood of the occurrence of threatened or sensitive species beyond very intermittent ranging and foraging onto the project area. Further impacts that may result from the proposed project are as a result of potential collisions and electrocutions with the proposed PV facilities. It is anticipated that should the proposed mitigation measures be implemented the risk of collisions. Due to the low potential of occurrence of Species of Conservation Concern (SCC), impacts to these priority species are not anticipated to be regionally significant. It is important that all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure the ecology within the proposed construction areas as well as surrounding zone of influence is protected or adequately rehabilitated in order to minimise the deviations from the Present Ecological State as much as possible.

Scientific Terrestrial Services (Pty) Ltd (STS) was appointed to conduct an avifaunal assessment as part of the environmental authorisation process for the proposed Marula Platinum Solar Plant Facility, located in the Burgersfort area, Limpopo Province.

Specific outcomes required from this report include the following:

- To determine the sensitivity of the habitat for avifauna and avifaunal Species of Conservation Concern (SCC), as well as the likelihood of the presence of SCC on the development site and its surrounds; and
- To determine the environmental impacts that the proposed development may have on the ecology associated with the study area, with emphasis on avifaunal SCC and to develop mitigation and management measures in terms of avifaunal SCC for all phases of the development.

AVIFAUNAL ASSESSMENT

- During the field investigation 4 broad habitats were identified in close proximity to the development footprint, they include Degraded Bushveld, Transformed Areas, freshwater habitat and Rocky Outcrops;
- From an avifaunal ecological perspective, the study area is considered to be of low sensitivity. In the context of the development site, no high or medium sensitivity criteria are met. Accordingly, considering the low level of possibility of the occurrence of SCC and very low potential for a regional impact on SCC to be created, the avifaunal sensitivity of the study area is considered to be low;
- Several SCC have broad distributions that encompass the study area; however due to the fragmentation of natural habitat high level of human activity on the site and in the study area, and due the very high degree of degradation of the residual bushveld habitat, only one species – *Falco biarmicus* (Lanner Falcon) has been confirmed to occur within the pentad in which the study area is located. The Verreaux's Eagle (*Aquila verreauxii*) is the only other SCC that has a possibility of occurring / ranging onto the site, with potential for occurrence of other SCC assessed to be very low;
- Despite habitat disturbance, fragmentation, and high levels of degradation the development site and its surrounds contain habitat for avifauna, with the avifaunal assemblage on the site considered to be partly representative of the typical species assemblage for mesic savannah in the wider area. In addition to the transformative / degrading factors, the absence of perennial

/ permanently inundated freshwater habitats, open grassland or grassy savannah and rocky, mountainous habitats on the project site limits avifaunal diversity;

- The proposed activities, i.e. the development of solar arrays, will lead to the transformation of woodland (thornveld) habitat in the development footprint to an extent that it will no longer be suitable for most avifauna. Minor migrations to adjacent habitat will likely occur decreasing species richness within the study area and increasing competition for resources in the surrounding habitat reducing avian abundances; and
- The proposed development is not deemed likely to pose a threat to avifaunal SCC within the study area, and no regional impacts are anticipated. However mitigation measures set out within this report must be adhered to due to the potential for avian collisions with power line or PV infrastructure.

AVIFAUNAL IMPACT ASSESSMENT:

It is assumed that a high level of mitigation will take place. From the impact tables it is evident that prior to mitigation, the impacts on avifauna and avifauna habitat and diversity as well as SCC are of low to medium significance as a result of the establishment of the proposed PV facility and associated infrastructure. This activity will likely result in a decrease in avian richness and abundance within the study area, while SCC diversity on a regional scale is highly unlikely to be reduced. If effective mitigation takes place, impacts may be reduced to lower significance impacts.

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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al*. (2011), Hui and Richardson (2017) and Wilson *et al*. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Plant (AIP) Species Regulations, 2020].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Avifauna	The birds of a particular region, habitat, or geological period.
Baseline (IEM Series)	Conditions that currently exist. Also called "existing conditions".
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and includes diversity within species, between species, and of ecosystems.
Biodiversity priority areas	Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: Protected Areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, Priority Areas for land-based protected area expansion, and Study Areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future. The different categories *are not mutually exclusive* and, in some cases, overlap, often because a particular area or site is important for more than one reason. They should be *complementary*, with overlaps *reinforcing the importance* of an area.
Biome - as per Mucina and Rutherford (2006)	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
Critically Endangered (CR) (IUCN[1] Red List category)	**Applied to both species/taxa and ecosystems**: A species is CR when the best available evidence indicates that it meets at least one of the five IUCN criteria for CR, indicating that the species is facing an extremely high risk of extinction. CR ecosystem types are at an extremely high risk of collapse. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost. CR species are those considered to be at extremely high risk of extinction.
Development footprint (as per the NEMA definition)	"in respect of land, means any evidence of its physical transformation as a result of the undertaking of any activity"

[1] International Union for Conservation of Nature (IUCN)

Degradation	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Driver (ecological)	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes, where indirect driver influences ecosystem processes through altering one or more direct drivers.
Ecological Condition	"ecological condition" means the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference condition of "natural". Various terminology can be used for precision of language: ➢ Fair ecological condition: Areas that are moderately modified, semi-natural. An ecological condition class in which ecological function is maintained even though composition and structure have been compromised. Can apply to a site or an ecosystem. ➢ Good ecological condition: Areas that are natural or near-natural. An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem. ➢ Poor ecological condition: Areas that are severely or irreversibly modified. An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem.
Ecological processes	The functions and processes that operate to maintain and generate biodiversity. In order to include ecological processes in a biodiversity plan, their spatial components need to be identified and mapped.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region."
Endangered (EN) (IUCN Red List category)	**Applied to both species/taxa and ecosystems**: A species is EN when the best available evidence indicates that it meets at least one of the five IUCN criteria for EN, indicating that the species is facing a very high risk of extinction. EN ecosystem types are at a very high risk of collapse. EN species are those considered to be at very high risk of extinction.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Fatal flaw **(IEM Series)**	Any problem, issue or conflict (real or perceived) that could result in proposals being rejected or stopped.
Faunal Class	In biological classification, class (Latin: classis) is a taxonomic rank, as well as a taxonomic unit. Class specifically refers to major groups, namely: mammals, avifauna (birds), reptiles and invertebrates.
Granivores	Birds that feed on grains and seeds.
Ground-truth	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
Habitat **(As per the definition in NEMBA)**	A place where a species or ecological community naturally occurs.
Habitat loss	Conversion of natural habitat in an ecosystem to a land use or land cover class that results in irreversible change in the composition, structure and functional characteristics of the ecosystem concerned.
Impact **(IEM Series, draft Offset policy, and NEMA)**	The positive or negative effects on human well-being and/or on the environment.

	Impact-related terminology: ➢ Cumulative impact: Past, current and reasonably foreseeable future impacts of an activity, considered together with the impact of the proposed activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities. ➢ Impact Significant/significance: Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e., intensity, duration, and likelihood). Impact significance is the value placed on the change by different affected parties (i.e., level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e., biophysical, social and economic). Such judgement reflects the political reality of impact assessment in which significance is translated into public acceptability of impacts. ➢ Residual negative impacts: Negative impacts that remain after the proponent has made all reasonable and practicable changes to the location, siting, scale, layout, technology and design of the proposed development, in consultation with the environmental assessment practitioner and specialists (including a biodiversity specialist), in order to avoid and minimise negative impacts, and/or rehabilitate and/or restore impacted areas within 30 years (*It is acknowledged that the time it takes for full restoration differs from ecosystem type to ecosystem type, as well as the local conditions. Given that there is no readily accessible information on the recovery times of the different ecosystem types in South Africa, a general timeframe had to be used. The 30-year general timeframe in the definition of "residual impact" reflects that the difficulty in restoring South African ecosystems once they have been disturbed. It is based on the risk-averse and cautious approach.*). ➢ Significant impact: An impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds, or targets.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (As per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Intra African	A migrant that visits southern Africa from other parts of Africa.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed invasive species	All alien species that are regulated in South Africa under the NEMBA, Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Migrant	In a southern African avifaunal context, birds that typically visit the subcontinent, usually in the summer months, spending the southern hemisphere winter in other parts of Africa (Intra-African migrant) or the Palaearctic.

Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Near Threatened (according to IUCN)	Close to being at high risk of extinction in the near future.
Niche (ecological)	The role and position a species have in its environment; how it meets its needs for food and shelter, how it survives, and how it reproduces. A species' niche includes all of its interactions with the biotic and abiotic factors of its environment.
Palaearctic	Zoogeographical region that incorporates Europe, northern Asia and northern Africa.
Protected	Species of high conservation value or national importance that require protection, according to TOPS 2007 and NEMBA.
Red Data Listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Refugia (ecological)	Refugium (plural: refugia) is a location which supports an isolated or relict population of a once more widespread species. This isolation can be caused by climatic changes, geography, or human activities such as deforestation and overhunting.
Resource (ecological)	A resource is a substance or object in the environment required by an organism for normal growth, maintenance, and reproduction. Resources can be consumed by one organism and, as a result, become unavailable to another organism.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as provincially and nationally protected species of relevance to the project.
Threatened ecosystem	An ecosystem that has been classified as CR, EN or VU, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function, or composition. The NEMBA allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the National Biodiversity Assessment (NBA) can be used as an interim list in planning and decision making.
Threatened species	A species that has been classified as CR, EN or VU, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.
Vulnerable (VU) (Red List category)	**Applied to both species/taxa and ecosystems**: A species is VU when the best available evidence indicates that it meets at least one of the five IUCN criteria for VU, indicating that the species is facing a high risk of extinction. An ecosystem type is VU when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.
Weeds	A plant is a weed '*if, in any specified geographical area, its populations grow entirely or predominantly in situations markedly disturbed by man (without, of course, being deliberately cultivated plants*)' (Baker 1965); in cultural terms, weeds are plants (**not necessarily alien**) that grow in sites where they are not wanted and that have detectable economic or environmental impacts (Pyšek et al. 2004).

LIST OF ACRONYMS

BARESG	Birds and Renewable Energy Specialist Group BARESG
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act, 1983 [Act No. 43 of 1983]
CBA	Critical Biodiversity Area
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GIS	Geographic Information Systems
GN	Government Notice
Ha	Hectares
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
IUCN	International Union for Conservation of Nature
kV	Kilovolt
LC	Least Concern
MAP	Mean annual precipitation
MAPE	Mean Annual Potential Evaporation
masl	Meters Above Mean Sea Level
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MW	Megawatt
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, 1998 [Act No. 107 of 1998]
NEMBA	National Environmental Management: Biodiversity Act, 2004 [Act No. 10 of 2004]
NPAES	National Protected Area Expansion Strategy
O&M	Operations and Maintenance
OHL	Overhead line
PGMs	Platinum Group Metals
PP	Poorly Protected
PV	Photovoltaic
QDS	Quarter Degree Squares
RDL	Red Data listed
SABAP 2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services
SWSA	Strategic Water Source Areas
TOPS	Threatened or Protected Species
VEGMAP	Vegetation Map Project
VU	Vulnerable
WM	Waste Management
WMP	Waste Management Plan

WSA	Water Source Area
WUL	Water Use Licence
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

Scientific Terrestrial Services (Pty) Ltd (STS) was appointed to conduct an avifaunal assessment as part of the environmental authorisation process for the proposed Marula Platinum Solar Plant Facility, located in the Burgersfort area, Limpopo Province. The (development site) study area, approximately 92 hectares (ha) in extent, is located within the Greater Tubatse Local Municipality located within the Sekhukhune District Municipality within the Limpopo Province. See Figures 1 & 2 for an indication of the extent and location of the study area in relation to surrounding areas. Figure 3 details the layout of the proposed development.

This report, after consideration of the description of the ecological integrity of the study area from an avifaunal perspective must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from an avifaunal perspective. This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

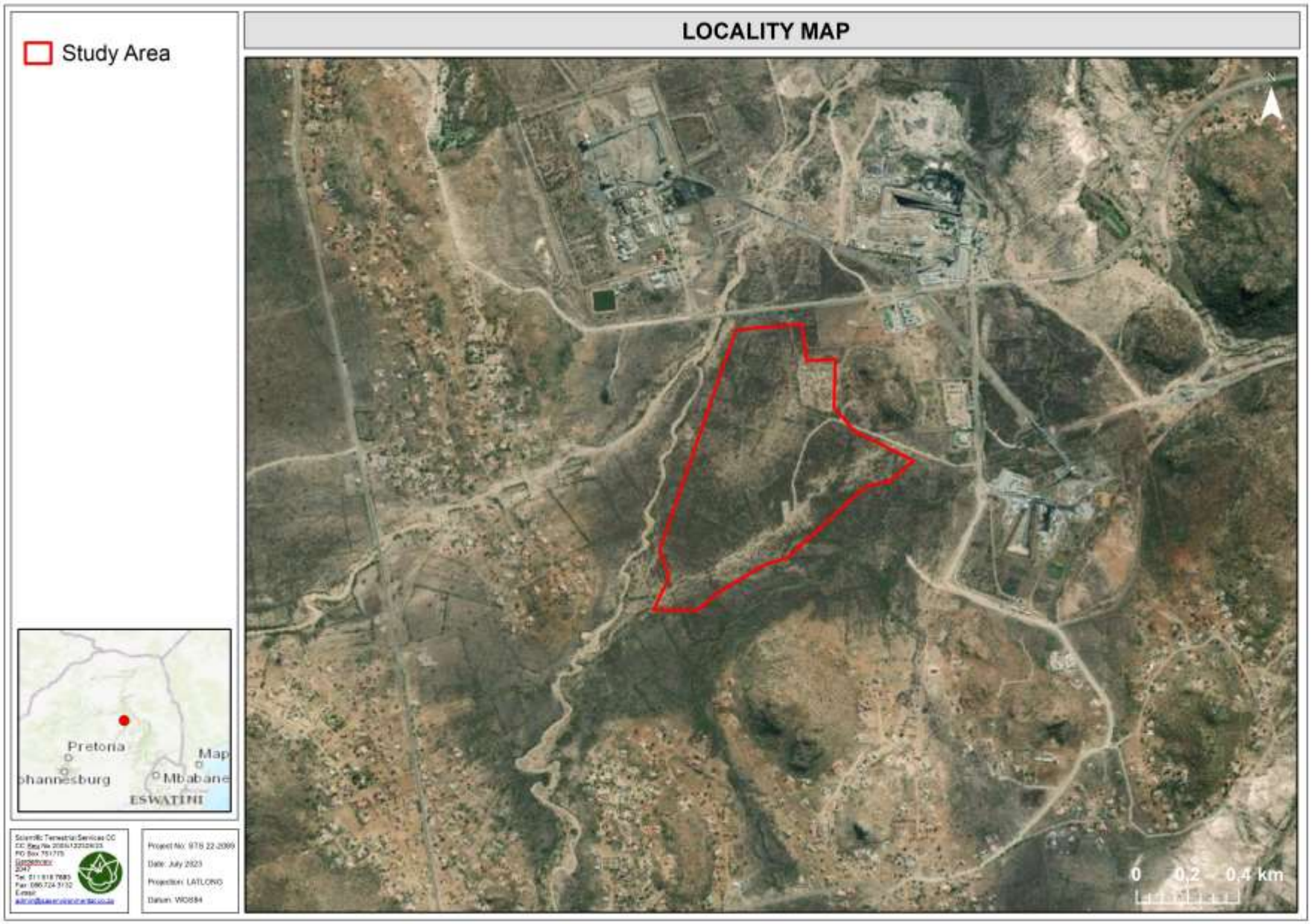

Figure 1: Digital satellite image depicting the study area in relation to surrounding area.

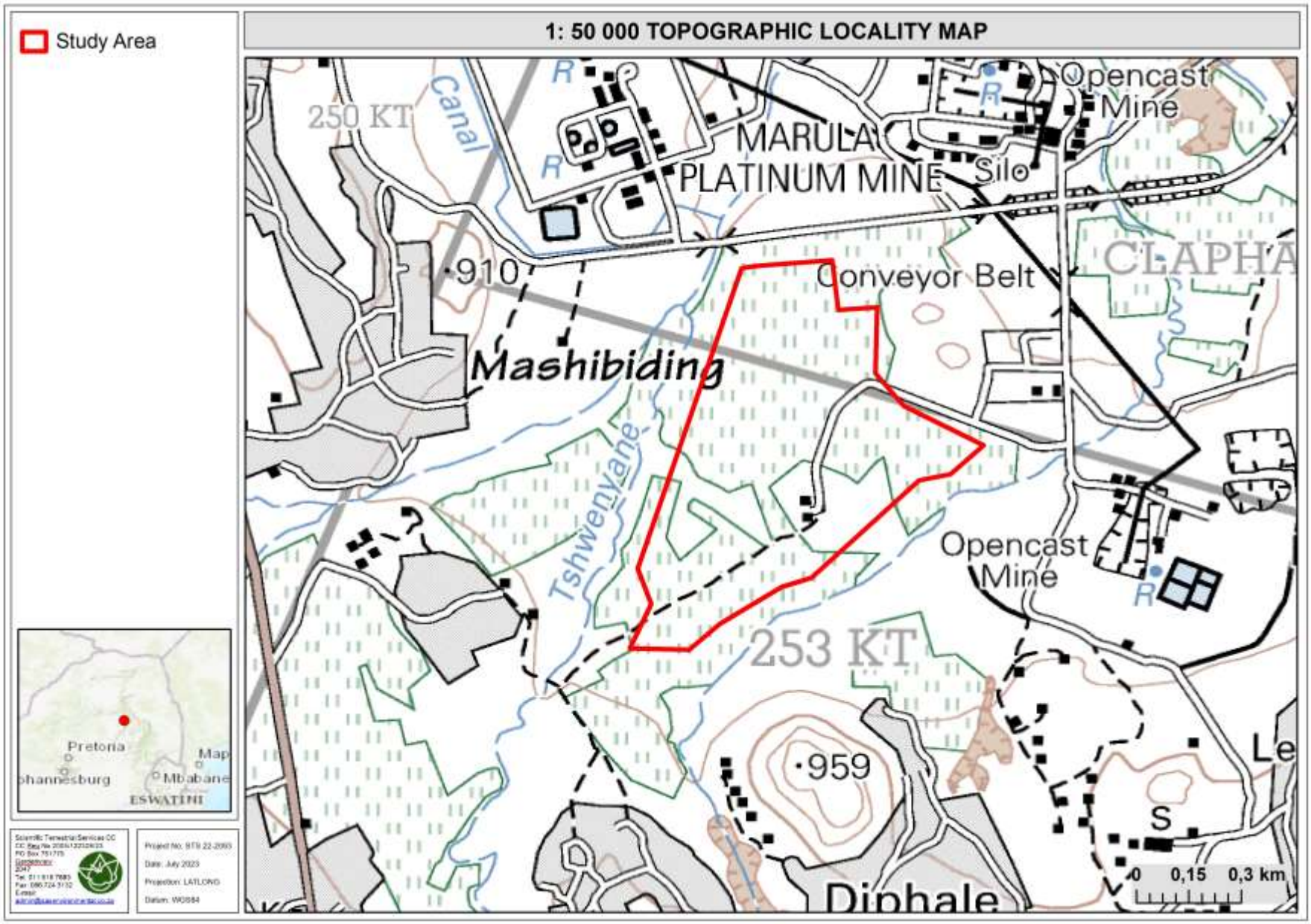

Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

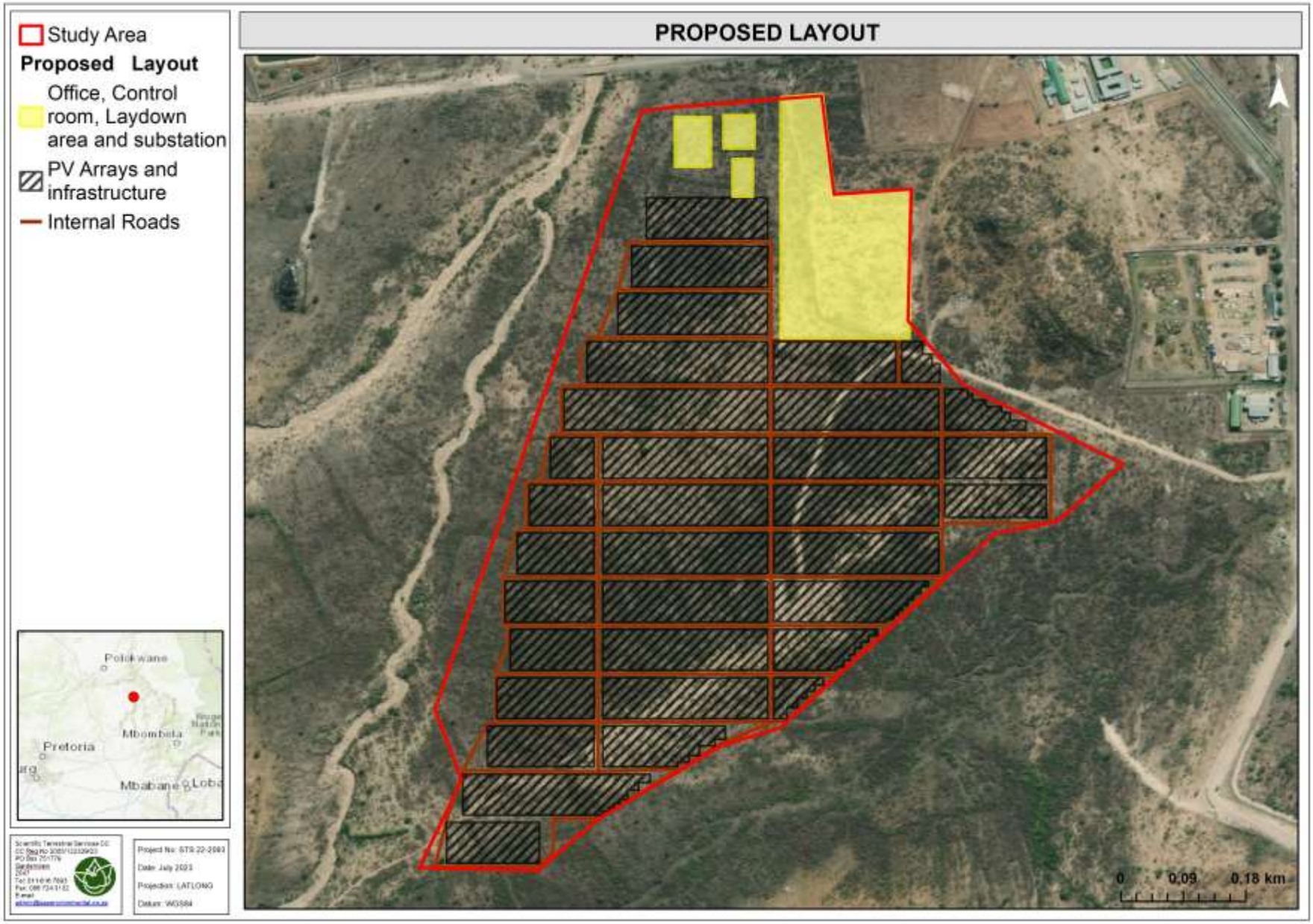

Figure 3: The layout of the development in relation to the surrounding area.

1.1 Project Scope

Specific outcomes in terms of this report are outlined below:

- To incorporate and consider all relevant information as presented by South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the National Threatened Ecosystem Database (2011), and data from the Environmental Geographical Information Systems (E-GIS) databases (https://egis.environment.gov.za/) into the assessment. Sources such as the National Environmental Management: Biodiversity Act (Act No.10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (NEMBA, Notice 389 of 2013), The International Union for Conservation of Nature (IUCN) Red List of Threatened Species; and The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland, was utilised to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To identify and consider all sensitive landscapes and possible habitat for such species; and
- To determine the environmental impacts that the proposed development may have on the ecology associated with the study area, with emphasis on avifauna species of conservation concern (SCC) and to develop mitigation and management measures in terms of avifaunal SCC for all phases of the development.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The avifaunal assessment was limited to the study area only and did not assess in detail the surrounding properties. The surrounding properties were noted on an *ad hoc* basis whilst moving to and from the study area however, with data extrapolated to these areas through the use of satellite imagery as and where necessary;
- The specialist has been requested to include Battery Energy Storage Systems (BESS) as part of the project components. The exact type of BESS technology proposed to be used has not been provided for assessment, thus technology-specific impacts have been unable to be included in the assessment of potential impacts;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most avifaunal communities have been accurately assessed and considered;

- Due to the nature and habits of most avifaunal species and their often-wide ranging habits or migration patterns, it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations were compared with literature studies and existing avifaunal databases for the site where necessary;
- It has been confirmed by the client that bifacial panels will be utilised as part of the proposed solar development, however it cannot be determined at this stage whether operational vegetation clearing under the panels will be required or not (e-mail response from Luke Colvin, Energy Group, 06 July 2023). Accordingly a recommendation has been made that low vegetation be retained or allowed to become re-established under the arrays to protect the underlying soil from erosion and to provide some form of residual natural habitat for certain avifauna in the development footprint. It is recognised that such vegetation retention in the operational phase of the development may be deemed to be technically non-feasible, however;
- The field assessment was undertaken during summer (13th December 2022). In addition to the current site assessment, a previous assessment was undertaken for other surface developments related to the mining operations, in November 2020 (STS 200060 – Part C: Faunal Assessment). The field assessment aimed to determine the ecological status of the habitat associated with the Study Area; and
- This avifaunal assessment has complied with the BirdLife South Africa Birds and Solar Energy Guidelines as far as possible (refer to Section 2.3).

1.3 Indemnity and Terms of use of this Report

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. The 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 and STS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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2 ASSESSMENT APPROACH

2.1 General Approach

A field assessment was undertaken during mid summer (13th of December 2022) in order to determine the potential presence of SCC and general habitat characteristics within the study area. The results of the previous site assessment in November 2020 were also considered. A reconnaissance 'walkabout' was undertaken on the study area and all observed avifauna were recorded. A detailed explanation of the method of assessment is provided in **Appendix B** of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered, and sensitive areas were assessed. In addition, identified locations of protected species (if recorded) were marked by means of Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map should guide the design and layout of the proposed construction and operational activities.

2.3 Conformance to the BirdLife South Africa Birds and Solar Energy - Best Practice Guideline

The solar energy industry as a renewable power generation source is expanding rapidly in southern Africa, however experiences in other parts of the world suggest that, like many other energy sources, solar power may affect birds in different ways, through the alteration of

habitat, the displacement of populations from preferred habitat, collision and burn mortality associated with elements of the solar hardware and ancillary infrastructure. It is important to note, however that the nature and implications of these effects are poorly understood.

In order to fully understand and successfully avoid and minimise the possible negative impacts of solar energy on the region's birds, it is essential that sufficient, project- and site-specific data are gathered to both inform the avifaunal impact assessment process and build the scientific birding community's understanding of the impacts and potential mitigation measures (Jenkins *et al*, 2017).

Accordingly, the Birds and Renewable Energy Specialist Group (BARESG), convened by BirdLife South Africa and the Endangered Wildlife Trust (EWT) has developed a set of guidelines and monitoring protocols for evaluating utility-scale solar energy development proposals. The guidelines are aimed at environmental assessment practitioners, avifaunal specialists, developers and regulators and propose a tiered assessment process, including a number of different tiers of assessment and monitoring (Jenkins *et al*, 2017):

- Preliminary avifaunal assessment;
- Data collection;
- Impact Assessment; and
- Monitoring.

The guidelines detail the recommended means and standards required to achieve the following aims:

- To inform the current environmental impact assessment processes;
- To develop the collective understanding of the effects of solar energy plants on southern African birds; and
- To identify the most effective means to mitigate these impacts.

A gradient of survey and monitoring requirements for avifaunal studies is recommended by the guidelines based on the proposed technology, size of footprint, the amount of available data, and the estimated sensitivity of the receiving environment (refer to Figure 4). The assessment and monitoring regime adopted is dependent on the level of sensitivity of the study area, as determined through the preliminary avifaunal assessment.

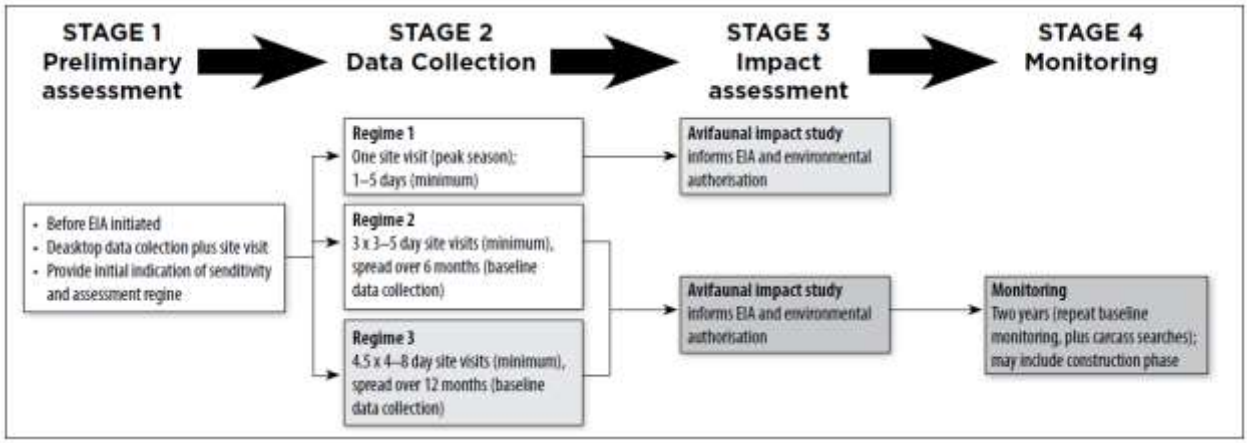

Figure 4: Recommended multi-tier process for assessing the potential and realised impacts of proposed solar energy developments in South Africa (Jenkins *et al*, 2017).

In the determination of what type of avifaunal assessment regime should be utilised for the proposed development, the size of the site and the avifaunal sensitivity of the study areas needs to be considered, as stipulated by the BLSA guidelines. The guidelines stipulate that solar development sites between 30ha and 150ha are of medium size – the study area is 92ha and thus of medium size. For such medium sites where non-CSP-type solar developments are proposed a Regime 2-level assessment is recommended to be applied unless the site has been assessed to be of low avifaunal sensitivity. The level of avifaunal sensitivity is dependent on a number of factors, detailed in Table 1.

Table 1: Criteria determining avifaunal sensitivity on the Marula Platinum development site.

Sensitivity Criterion	Applicability to the Development Site
Number of priority species present or potentially present	Low (none flagged in the DFFE web-based screening tool)
Regional, national, or global importance of the affected area for these species (both individually and collectively)	Low – (The site is not located in an IBA)
Perceived susceptibility of these species (both individually and collectively) to the anticipated impacts of development	Low – loss of habitat and collision potential associated with the proposed development could have an impact on certain larger collision-prone SCC, but these are highly unlikely to inhabit or range onto the study area
Avifaunal habitat (e.g. wetlands, nesting or roost sites) of regional or national significance	Not Present
Population of a priority species that is of regional or national significance	No
A bird movement corridor that of regional or national significance	Not present
A protected area and/or Important Bird and Biodiversity Area	Not present
Avifaunal habitat (e.g., a wetland, nesting or roost sites) of local significance	Not present – primarily due to the high level of degradation of the study area. The presence of a small koppie adjacent to the northern boundary of the study area is of higher sensitivity compared to the adjacent thornveld, but it is isolated and more suitable rocky habitat is present in the wider local area.
A locally significant population of a priority species	Not Present
A locally significant bird movement corridor	Not present

An area would be considered to be of low avifaunal sensitivity if it does not meet any of the above criteria. In the context of the development site, no such criteria, even at a local level are met. The site is highly degraded and all habitat, including freshwater habitat has been largely degraded. **The study area is thus assessed to have a low avifaunal importance.**

Where the avifaunal sensitivity is low for medium-sized sites, a regime 1 assessment process can be undertaken. For assessment regime 1, the consulting avian specialist should visit the development site at least once and spend sufficient time there to obtain first-hand knowledge of the avian habitats present, in order to predict the affected avifauna, the nature and scale of possible impacts and the best mitigation options available. This assessment should be informed substantially by the specialist's previous experience of similar habitats and bird taxa, supplemented by the existing data describing the birds likely to be present (e.g. SABAP 1 and 2 data). The specialist should endeavour to see as much of the inclusive affected area as possible, and any field data collected on site should also be used in the assessment. If there is reason to suspect an obvious and predictable seasonal peak in avian abundance or activity in the general area of the proposed development, the site visit must be timed to coincide with this peak time (e.g. soon after rain which prompts influxes of birds into dry areas, or in summer when the majority of migratory birds would be present).

Accordingly a single site visit was undertaken in December 2022. In addition to the current site visit a previous faunal assessment was undertaken as part of the assessment of surface infrastructure related to the mine in the same footprint as the current development. This assessment considered avifauna and avifaunal sensitivities and thus can be considered as part of the data gathering and assessment for the proposed development. The site visit was timed to coincide after the first summer rains on the site which can be considered to be the part of the peak period of bird occurrence on the site. As a result of the rainfall that had fallen vegetation was noted to have recovered from a dry season state and certain plant species were in flower, with a concomitant increase in insect and other invertebrate biodiversity abundance on the site. December is the time of the year when the vast majority of intra-African and Palearctic migrant species would have been present on the site. The author displays extensive experience of avifaunal assessment in the wider Burgersfort / Steelpoort / Tubatse area, having undertaken avifaunal assessments and avifaunal monitoring for other solar power developments in this area.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the study area's actual biodiversity characteristics.

Table 2: Summary of the conservation characteristics for the study area (Quarter Degree Square (QDS) 2430CA).

DETAILS OF THE STUDY AREA IN TERMS OF THE 2018 FINAL VEGETATION MAP OF SOUTH AFRICA, LESOTHO, AND SWAZILAND					
BIOME	The study area is situated within the **Savanna Biome**				
BIOREGION	The study area is located within the **Central Bushveld Bioregion**				
VEGETATION TYPE	**Sekhukhune Plains Bushveld** (SVcb 27)				
DESCRIPTION OF THE VEGETATION TYPES ASSOCIATED WITH THE STUDY AREA ACCORDING TO MUCINA & RUTHERFORD (2006)					
ALTITUDE (m)	700–1 100				
CLIMATE	Summer rainfall with very dry winters.				
	MAP (mm)	**MAT (°C)**	**MFD (Days)**	**MAPE (mm)**	**MASMS (%)**
	518	19	4	2084	79
DISTRIBUTION	Limpopo and Mpumalanga Provinces				
GEOLOGY & SOILS	Complex geology, with rocks mainly mafic and ultramafic intrusive rocks of the main to lower zones of the Rustenburg Layered Suite on the eastern lobe of the Bushveld Igneous Complex (Vaalian). The zones (subsuites) are dominated by concentric belts of norite, gabbro, anorthosite and pyroxenite, with localised protrusions of magnetite, chromatite, serpentinised harzburgite, olivine diorite, shale, dolomite, and quartzite. Most of the area consists of red apedal soils. Deep, loamy Valsrivier soils are characteristic of the plains and shallow Glenrosa soils are found on the low-lying, rocky hills. Patches of erodible black, melanic structured horizons are common around small mountains. Some Steendal soils are underlain by gypsum. Land types[2] mainly Ae, Ib, Ea and Ia.				
CONSERVATION	**Vulnerable (VU).** Target 19%. Nearly 2% statutorily conserved in Potlake, Bewaarkloof and Wolkberg Caves Nature Reserves. Approximately 25% of this area has been transformed and is mainly under dry-land subsistence cultivation. A small area is under pressure from chrome and platinum mining activities and the associated urbanisation. Depending on commodities, this threat could increase in the future. There is a high level of degradation of much of the remaining vegetation by unsustainable harvesting and utilisation. Erosion widespread at usually high to very high levels with donga formation. Alien *Agave* species, *Caesalpinia decapetala*, *Lantana camara*, *Melia azedarach*, *Nicotiana glauca*, *Opuntia* species, *Verbesina encelioides* and *Xanthium strumarium* are widespread but scattered.				
VEGETATION & LANDSCAPE FEATURES	Mainly semi-arid plains and open valleys between chains of hills and small mountains running parallel to the escarpment. Predominantly short, open to closed thornveld with an abundance of *Aloe* species and other succulents. Heavily degraded in places and overexploited by man for cultivation, mining, and urbanisation. Both man-made and natural erosion dongas occur in areas containing clays rich in heavy metals. Encroachment by indigenous microphyllous[3] trees and invasion by alien species is common throughout the area.				

[2] Land types refer to a class of land with specified characteristics. In South Africa it has been used as a unit denoting land at 1:250 000 scale, over which there is a marked uniformity of climate, terrain form and soil pattern. Land type Ae refers to Red (yellow soils <10%) that are more eutrophic than dystrophic/mesotrophic, Land type Ib refers to soil that consists largely of rock (60-80%), usually with shallow and/or rocky soils on steep slopes, Land type Fb refers to Shallow, and/or rocky, often steep, moderately leached (some lime, mainly in valleys) soils, and Land type Ea refers to dark, blocky clay topsoil (often swelling clays) and/or red, structured clays (ARC: Land Type Survey Staff. 1972 – 2006).

[3] Microphyllous - having very small leaves. From *micro* meaning small and *phyllous* referring to leaves.

CONSERVATION DETAILS PERTAINING TO THE AREA OF INTEREST (VARIOUS DATABASES)	
NATIONAL BIODIVERSITY ASSESSMENT (2018) (FIGURE 5)	Small sections of the study area are located within the remaining extent of the Sekhukhune Plains Bushveld, which is currently **endangered (EN)** and considered to be **poorly protected**. The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. Two headline indicators that are applied to both ecosystems and species are used in the NBA: threat status and protection level: i. Ecosystem threat status tells us about the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as CR, EN, VU or least concern (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds; and ii. Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected, Poorly Protected, Moderately Protected or Well Protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the NEMPAA.
RED LIST OF ECOSYSTEMS (2022) (FIGURE 6)	According to the 2022 Red List of Ecosystems, the study area is located within the remaining extent of a threatened ecosystem, namely the EN Sekhukhune Plains Bushveld ecosystem. This ecosystem is classified as a B1(i) ecosystem; B1(i) ecosystems have been classified as such because they have a restricted distribution and high rate of loss (in terms of habitat). The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value. The revised list (known as the Red List of Ecosystems 2022) is based on assessments that followed the International Union for Conservation of Nature (IUCN) Red List of Ecosystems Framework (version 1.1) and covers all 456 terrestrial ecosystem types described in South Africa (Mucina and Rutherford 2006; with updates described in Dayaram et al., 2019). The revised list identifies 120 threatened terrestrial ecosystem types (55 CR, 51 EN and 14 VU types). Following a series of consultations with conservation authorities and the public in 2020/21 the Revised list of terrestrial ecosystems that are threatened and in need of protection was the approved by the Minister for implementation in August 2022. The revised list was published in the Government Gazette (Gazette Number 47526, Notice Number 2747) and came into effect on 18 November 2022.
IBA (2015) (FIGURE 7)	Although the study area is not located directly within an IBA, it is located within a 10 km radius of an IBA (IBA, 2015) - the **Wolkberg** and the **Blyde River Canyon System IBAs** are located approximately 6 kms north and northeast (respectively) of the study area.
SAPAD (2022, Q3)[4], SACAD (2022, Q3)[5], & NPAES (2018) (FIGURE 8)	According to the SAPAD (2022_Q3), there are several protected areas within a 10 km radius of the study area, namely the Apiesboom Private Nature Reserve (PNR; ~ 4 km), Bokgobelo Protected Environment (~ 9 km), De Hoop Dam Protected Environment (~ 8 km), De Hoop PNR (~ 6 km), Glen Ore PNR (~ 7 km), Lekgalametsi Nature Reserve (NR; ~ 8 km)), Luiperdhoek PNR (~ 5 km), NR: Co-operation and Development (~ 8 km); Potlake NR (~ 6 km), Rietkom PNR (~ 9 km), Sonia Schoeman PNR (~ 8 km), and Wolkberg Wilderness Area (~ 8 km). According to the SACAD (2022_Q3), the study area is located within a 10 km radius of a conservation areas, namely the Kruger to Canyons Biosphere Reserve (~ 5 km).

[4] **SAPAD (2022):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act No. 57 of 2003) (NEMPAA). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention

[5] **SACAD (2022):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

	According to NPAES database (2018), a no protected areas are located within a 10 km radius of the study area.
DETAIL OF THE AREA OF INTEREST IN TERMS OF THE LIMPOPO CONSERVATION PLAN V2 (2018) (FIGURE 9)	
ECOLOGICAL SUPPORT AREA 1 (ESA 1)	A small section within the northeast of the study area is located within a **Category 1 ESA**. These are natural, near natural and/or degraded areas that are selected to support CBAs by maintaining ecological processes. **Land Management Recommendations:** Implement appropriate zoning and land management guidelines to avoid impacting on ecological processes. Avoid intensification of land use and fragmentation of natural landscapes. **Incompatible Land-Use**: Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). **Note**: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain the overall ecological functioning of ESAs.
ECOLOGICAL SUPPORT AREA 2 (ESA 2)	A small section within the northeast of the study area is located within a **Category 2 ESA**. Category 2 ESAs are areas no longer intact but potentially retain significant importance from a process perspective (e.g., maintaining landscape connectivity). **Land Management Recommendations:** Implement appropriate zoning and land management guidelines to avoid impacting on ecological processes. Avoid intensification of land use and fragmentation of natural landscapes. **Incompatible Land-Use**: Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). **Note**: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain the overall ecological functioning of ESAs.
OTHER NATURAL AREAS	Most of the study area is located within an area considered to be **other natural areas (ONAs)**. These are natural and intact areas but are not required to meet targets, nor have they been identified as Critical Biodiversity Areas or Ecological Support Areas. **Land Management Recommendations**: No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing "Not Natural" areas should be favoured for development before "Other natural areas".
NO NATURAL HABITAT REMAINING	Scattered sections throughout the study area are located within an area considered to have **No Natural Remaining (NNR) Habitat.** These are areas with no significant direct biodiversity value. These are either not natural areas or degraded natural areas that are not required as ESA. These areas include intensive agriculture, urban, industry, and human infrastructure. **Land Management Recommendations:** No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing "Not Natural" areas should be favoured for development before "Other natural areas".
NATIONAL WEB-BASED SCREENING TOOL	
The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below: ➢ Very high: Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 square kilometres (km^2) are considered critical habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under CR, EN, or VU D criteria of the IUCN or species listed as critically/ extremely rare under South Africa's national red list criteria. For each species reliant on a critical habitat, all remaining suitable habitat has been manually mapped at a fine scale. ➢ High: Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. ➢ Medium: Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. ➢ Low: Areas where no threatened species are known or expected to occur.	
ANIMAL SPECIES THEME (FIGURE 10)	For the animal species theme, the study area is located within an area of **medium sensitivity.** Triggering species include*:* » Mammals*: Crocidura maquassiensis* (Makwassie musk shrew (VU))*;*

	» Reptiles*: Kinixys lobatiana* (Hingeback Tortoise (VU)); and » Invertebrates*: Aroegas fuscus* (Brown False Shieldback (EN)). **It is important to note that no avifaunal species are listed as trigger species.**
TERRESTRIAL BIODIVERSITY THEME (FIGURE 11)	For the terrestrial biodiversity theme, the study area has a **low** and a **very high sensitivity.** Triggering features of the very high sensitivity included the presence of **Category 1 and Category 2 ESAs.**
RENEWABLE ENERGY: STRATEGIC TRANSMISSION CORRDIRS	
POWER CORRIDORS (FIGURE 12)	Although the study area is not located within a power corridor, it is located east of an International Power Corridor.
RENEWABLE ENERGY DEVELOPMENT ZONES (REDZ)	The study area is not located within a REDZ.

Areas Database; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply

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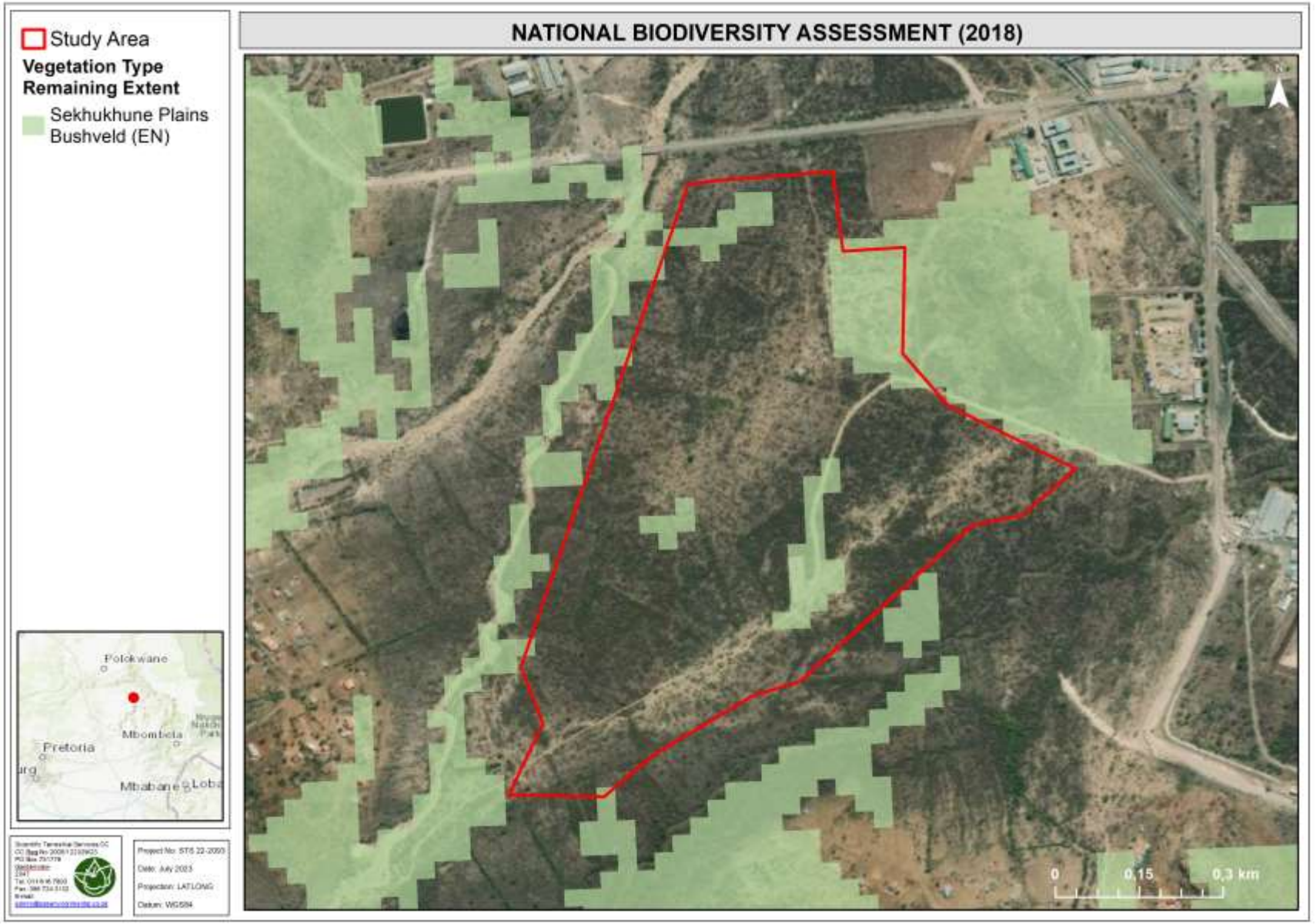

Figure 5: The remaining extent of the endangered vegetation type associated with the study area according to the National Biodiversity Assessment (2018) in relation to the study area.

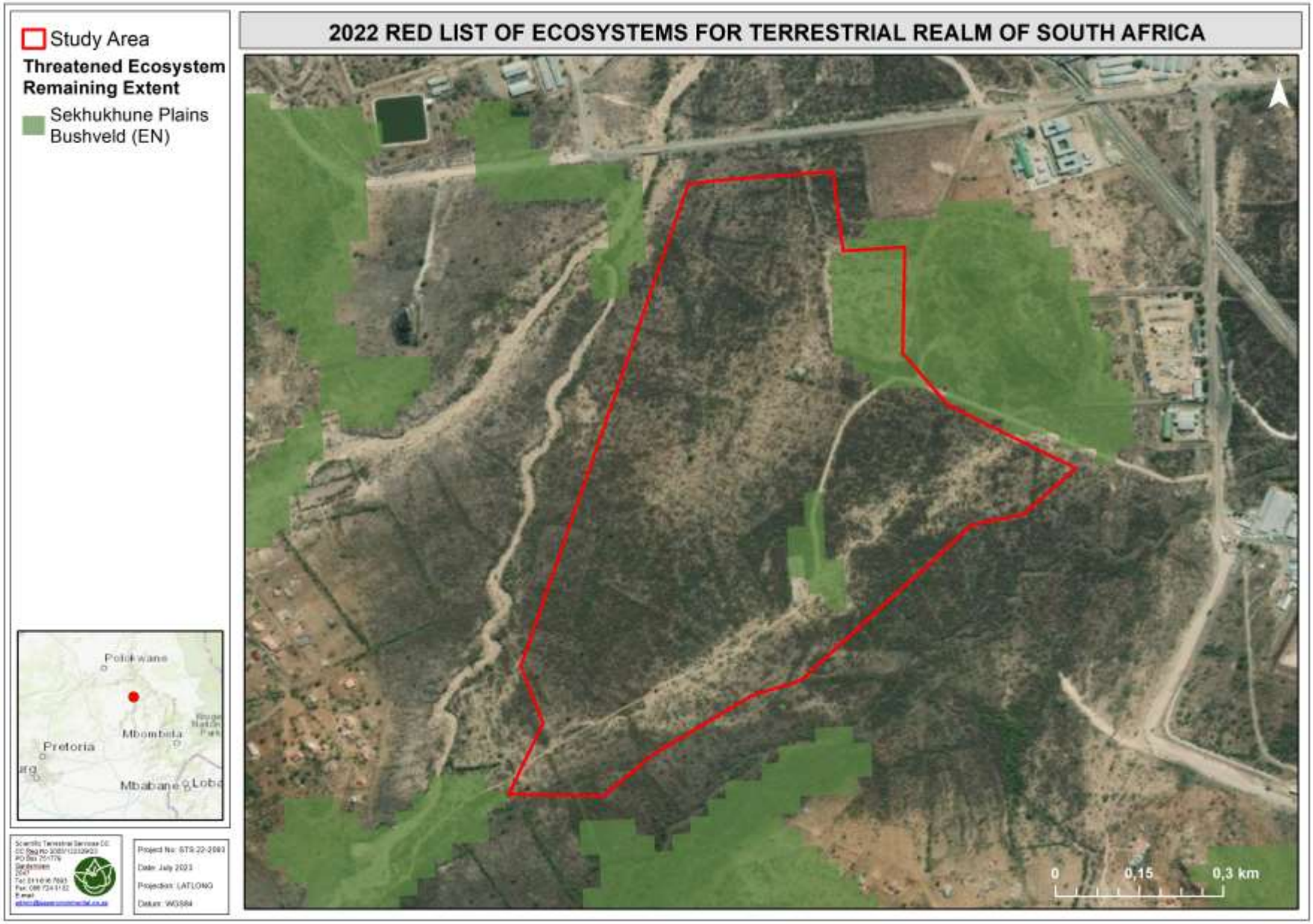

Figure 6: The remaining extent of the endangered ecosystem associated with the study area according to the 2022 Red List of Ecosystems.

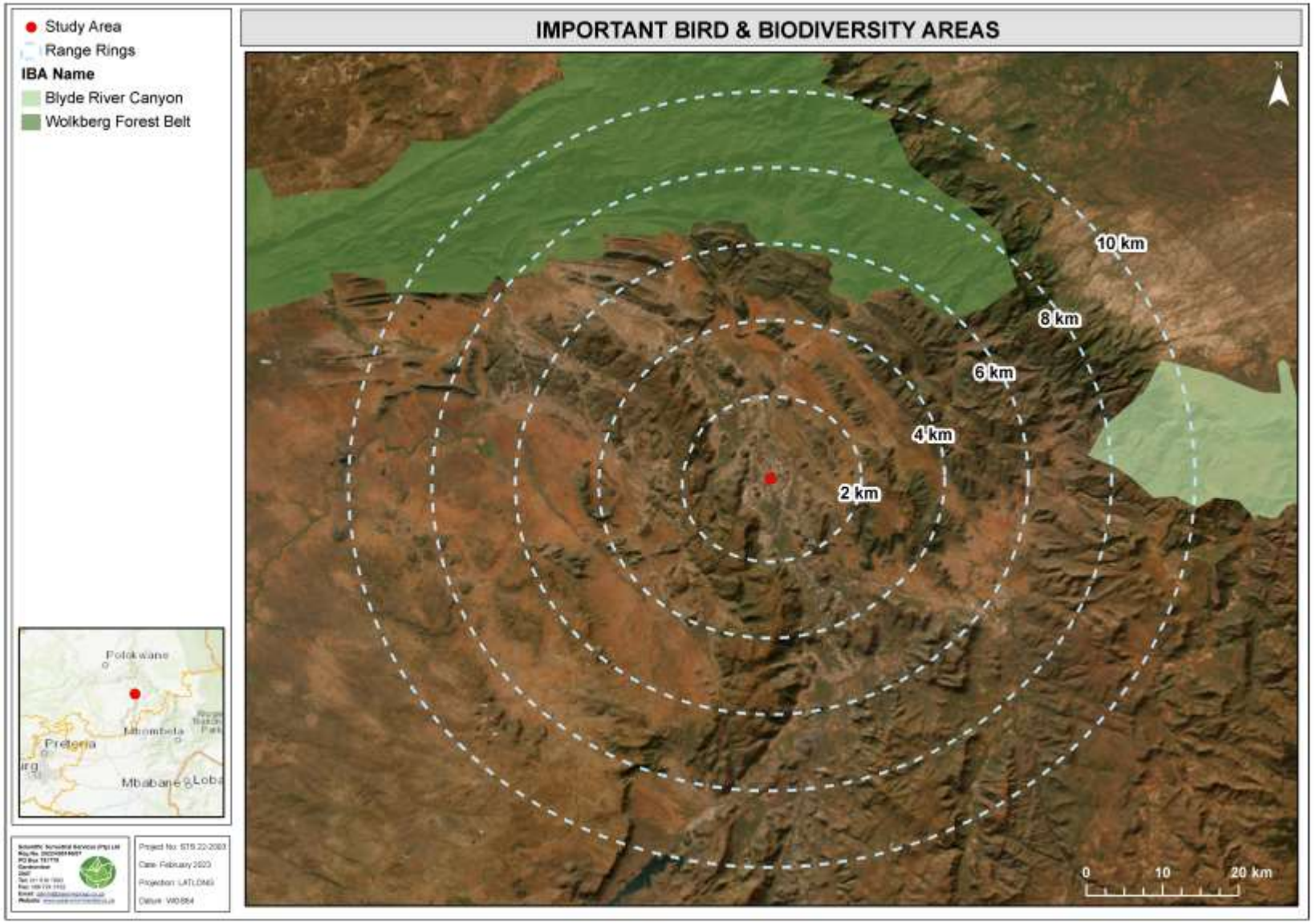

Figure 7: The study area in relation to Important Bird Areas (2015).

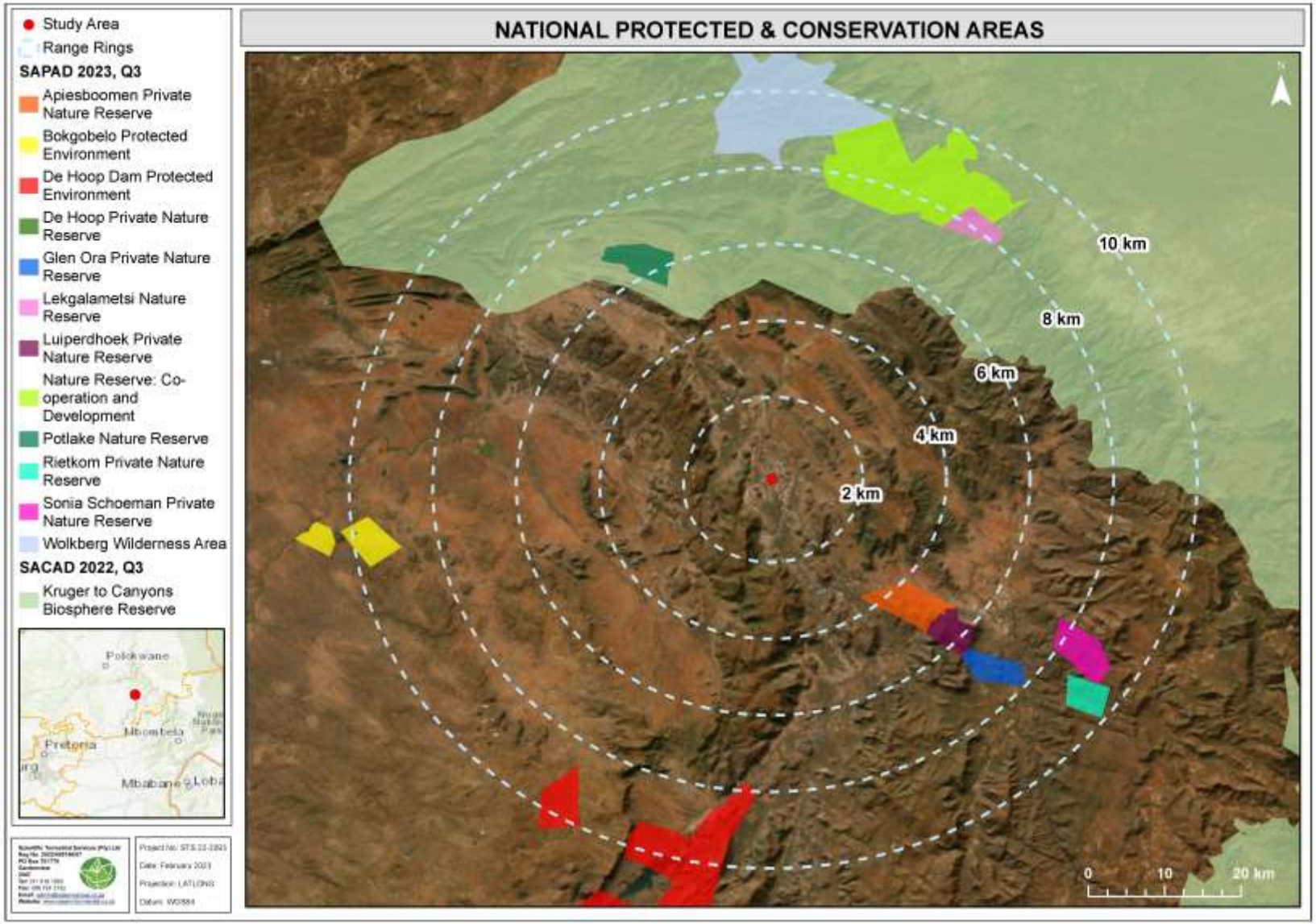

Figure 8: The study area in relation to national protected and conservation areas as per the SAPAD (2022, Q3) and the SACAD (2022, Q3).

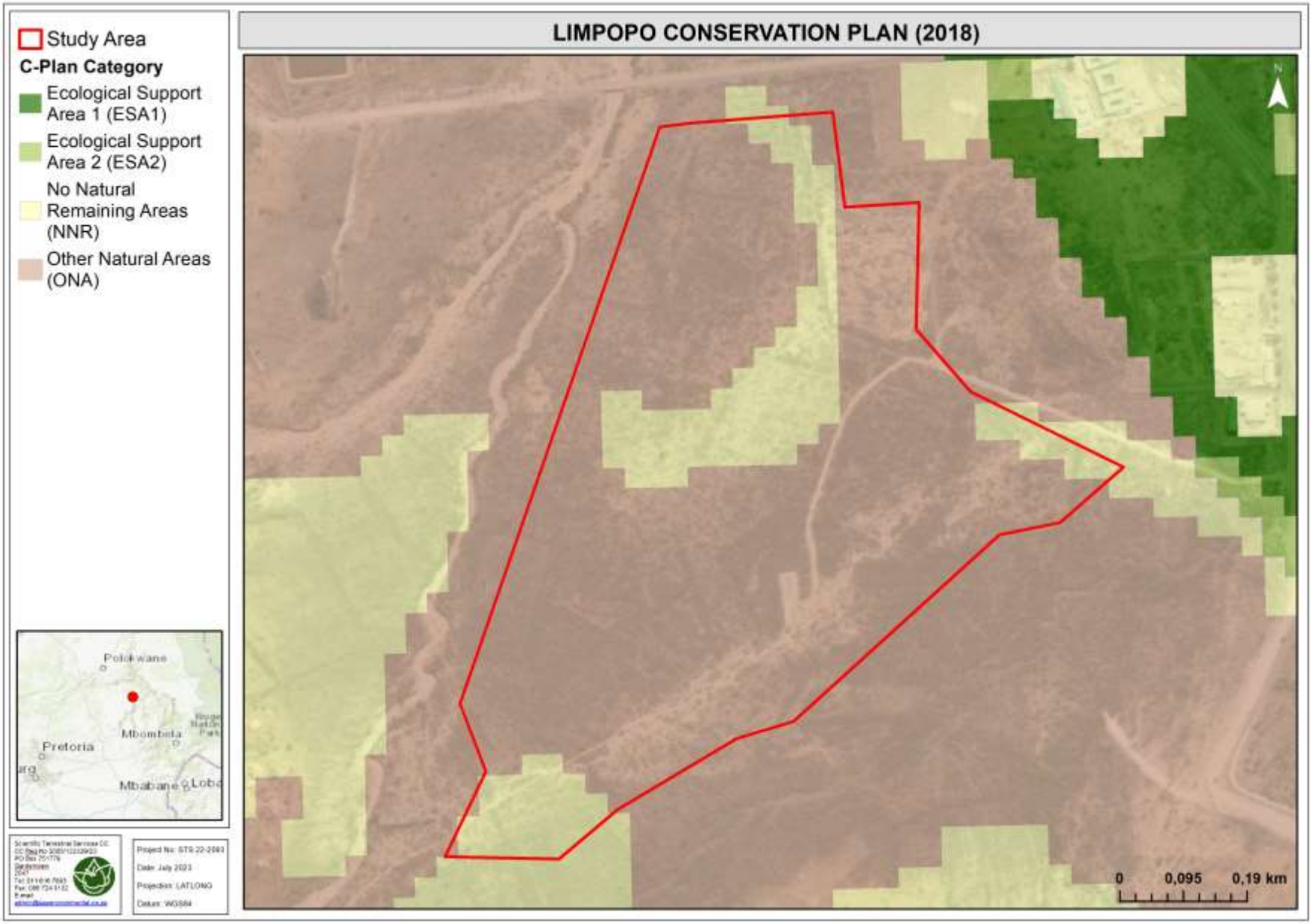

Figure 9: The study area in relation to the C-Plan categories as indicated in the Limpopo Biodiversity Conservation Plan (C-Plan; 2018).

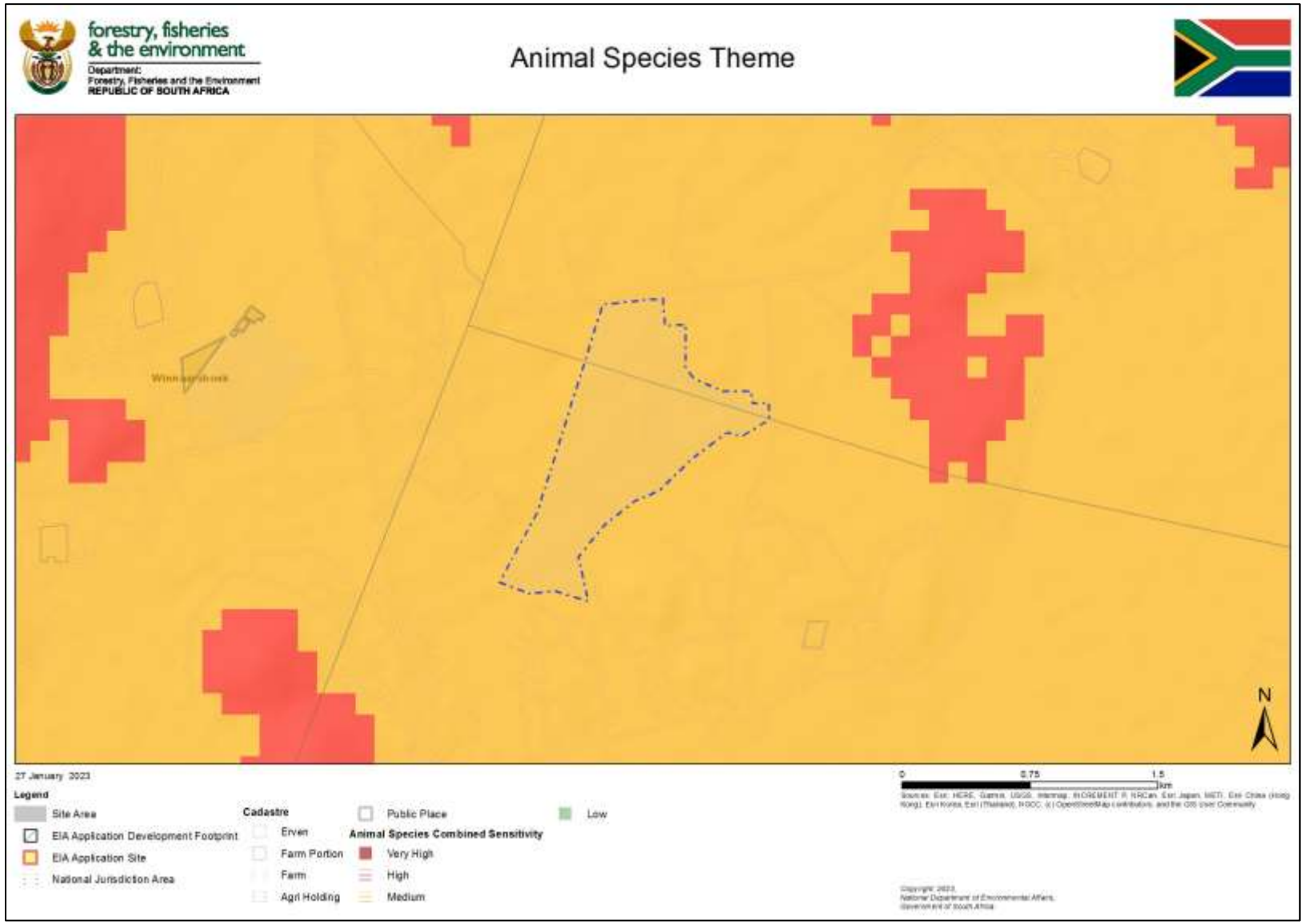

Figure 10: The Animal Species Theme sensitivity of study area as identified by the screening tool.

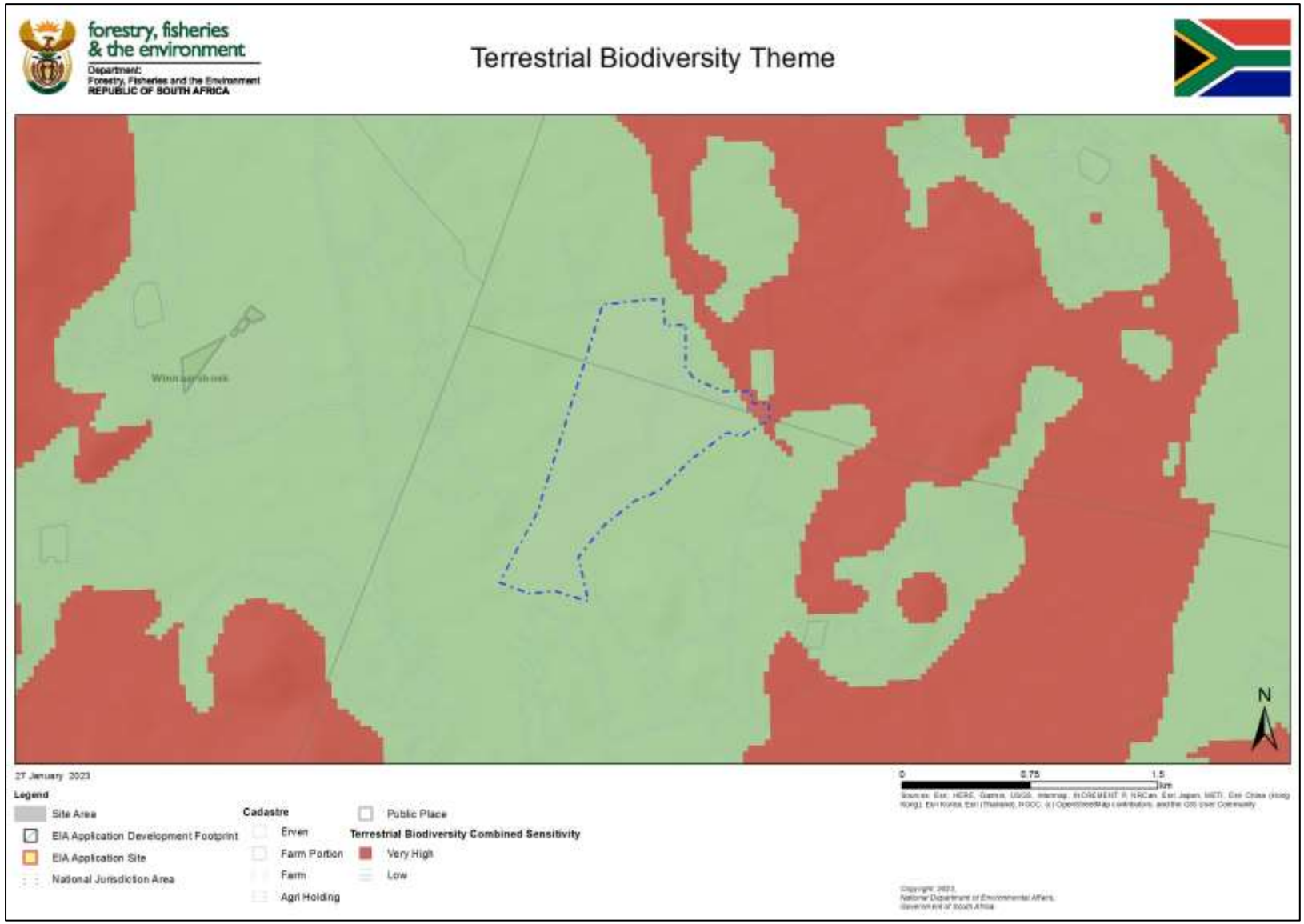

Figure 11: The Terrestrial Biodiversity Theme sensitivity of study area as identified by the screening tool.

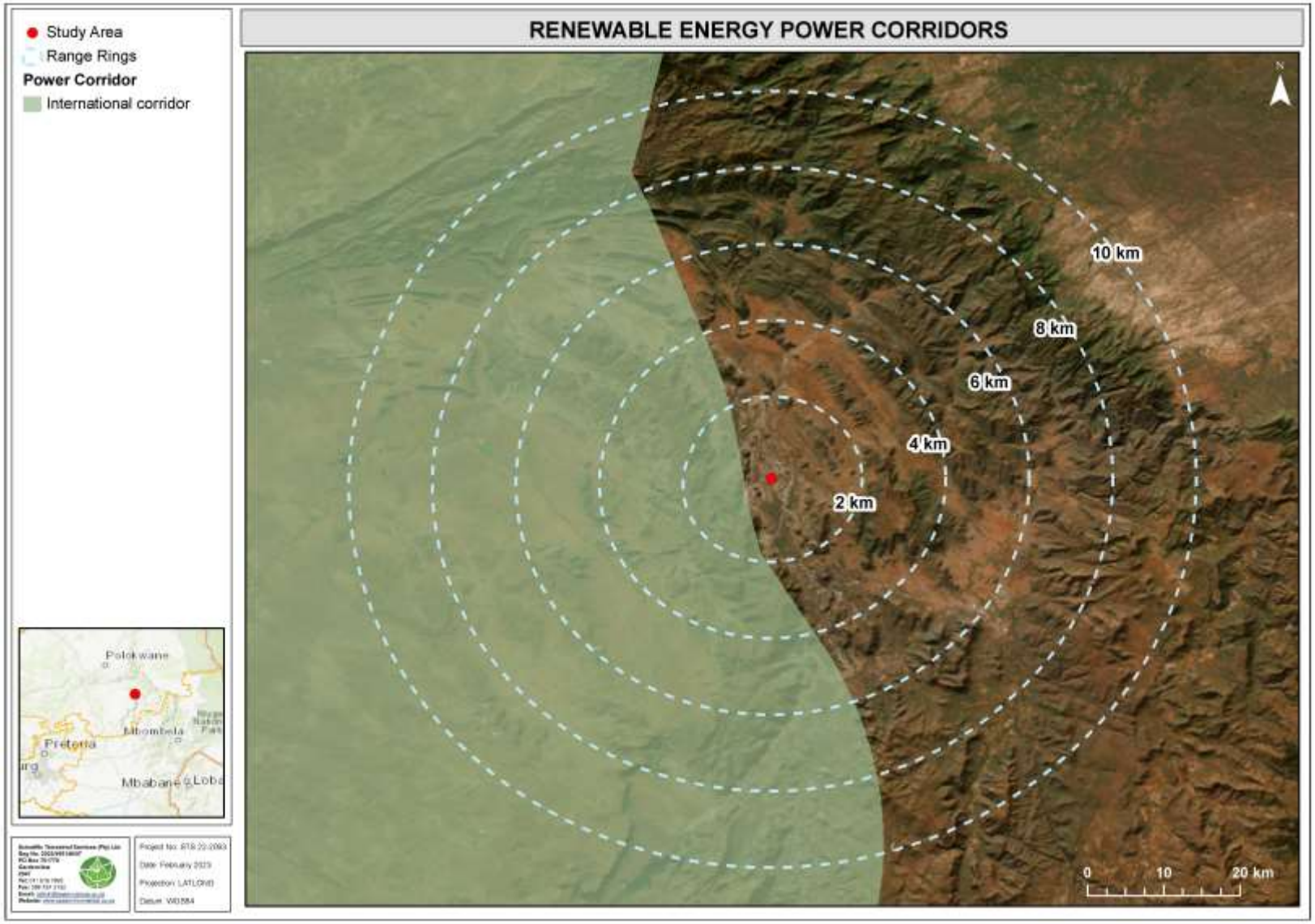

Figure 12: Strategic Transmission Power Corridors associated with the study area.

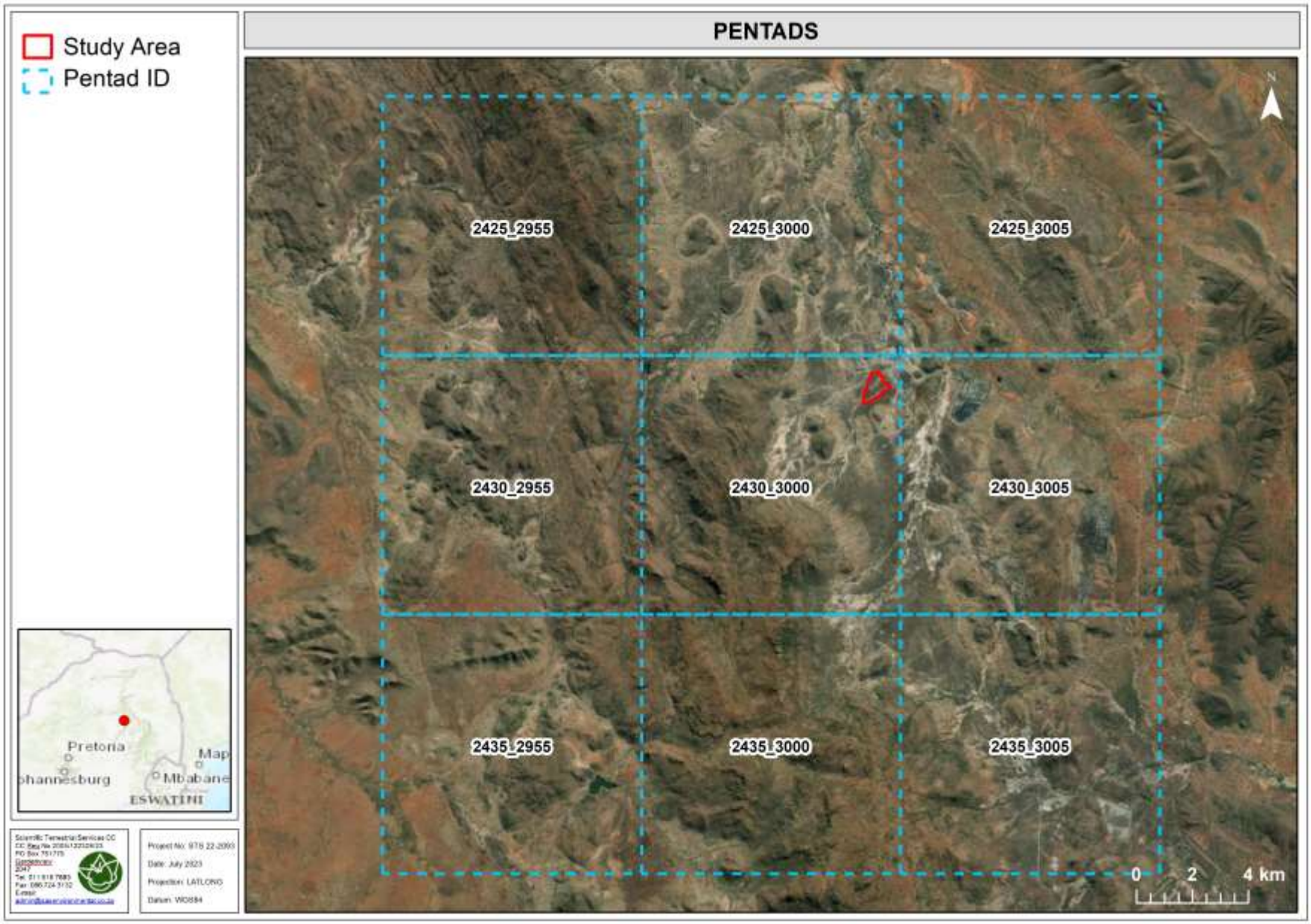

Figure 13: Pentads associated with the study area.

3.2 Results of Desktop Avifaunal SCC Assessment

The following table of avifaunal SCC include threatened/ sensitive bird species whose distribution ranges (as presented in Taylor *et al*, 2015) include the area in which the proposed development is located. Records from SABAP 2 were obtained to determine if these species were recorded in SABAP 2. The study area is located in the pentad 2430_3000, but due to the generally low coverage of atlas cards in the wider area, and the proximity of the study area to other pentads, records from the adjacent pentads have also been checked for the occurrence of SCC and the relative reporting rate for each species in these pentads. The study area pentad and the surrounding pentads are indicated in Table 3. The table below provides a brief summary of the data.

Table 3: A summary of historic and current data for SCC obtained from SABAP2 pentad 2430_3000 as well as from adjacent pentads.

Common Name	Scientific Name	Regional Status (Taylor *et al*, 2015)	Reporting Rate (%)				Recorded in Other Neigh-bouring Pentads
			SABAP 2 2430_3000 (3 FP cards)	SABAP 2 2425_3000 (4 FP cards)	SABAP 2 2425_3005 (3 FP cards)	SABAP 2 2430_3005 (38 FP cards)	
Abdim's Stork	*Ciconia abdimii*	NT	-	-	-	2.6	
Cape Vulture^	*Gyps coprotheres*	EN	-	-	-	21.1	-
White-backed Vulture	*Gyps africanus*	EN	-	16.7	-		X (2435_3005)
Verreauxs' Eagle	*Aquila verreauxii*	VU	-	-	-	-	X (2430_2955 2435_3000))
Lanner Falcon	*Falco biarmicus*	VU	33.3	25	33.3	55.3	X (2435_3005)

^A single Cape Vulture was observed soaring to the east of the study area during the November 2020 site assessment.

LC= Least Concern, NA= Not Assessed, NT= Near Threatened, VU= Vulnerable, EN= Endangered, CR= Critically Endangered, SI=Species Interest and P=Protected in Provincial or National Legislation; FP = Full Protocol

4 AVIFAUNAL ASSESSMENT RESULTS

Based on the results of the field investigations undertaken on the 13th of December 2022, three broad habitat units with were distinguished within the study area:

- **Degraded Bushveld Habitat** - low-lying habitat comprising of loose, sandy soils that support a species poor floral community that is dominated by *Dichrostachys cinerea*;
- **Freshwater Habitat** - consisting of non-perennial drainage lines in which a weakly to moderately developed and heavily degraded riparian[6] habitat was identified. Please refer to SAS 22-1161 (2023) for further information pertaining to these systems. Two drainage lines drain northwards adjacent to the study area boundaries, with small parts of their delineated extent being located within the study area boundaries; and
- **Modified Habitat** - habitat was associated with areas in which little to no vegetation structure can be assigned to the floral communities, i.e., associated with areas of historic clearing and/or excavation activities (in which habitat has subsequently started to recover, although floral communities are still largely absent and species poor), or areas of current utilisation, e.g., roads[7].

It should be noted that a further habitat unit (**rocky outcrop**) is located in very close proximity to the study area. Although located outside of the study area its close proximity to the northern boundary of the study area, due to the mobility of birds and due to its potential elevated sensitivity, it is deemed important from an avifaunal context. The habitat unit comprises of an isolated rocky outcrop (koppie) that rises above the surrounding terrain. The outcrop comprises a different vegetation composition as compared to the surrounding degraded bushveld flats and more mature trees, along with rocky habitat (large boulders) that is favoured by certain avifaunal species.

Section 4.1 summarises the field observations that were made during the site visit in December 2022, along with the earlier site visit conducted in November 2020, with regards to overall avifaunal diversity, food availability, habitat integrity, habitat availability, general

[6] National Water Act, 1998 (Act 36 of 1998) (NWA): "Riparian Habitat" includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

[7] Informal, gravel roads are present within the study area. However, these have not been mapped given the small extant thereof. Larger modified features (e.g., historic excavation areas) were however mapped.

comments and business case and conclusion. The photographs below provide a visual representation of the above-mentioned habitat units.

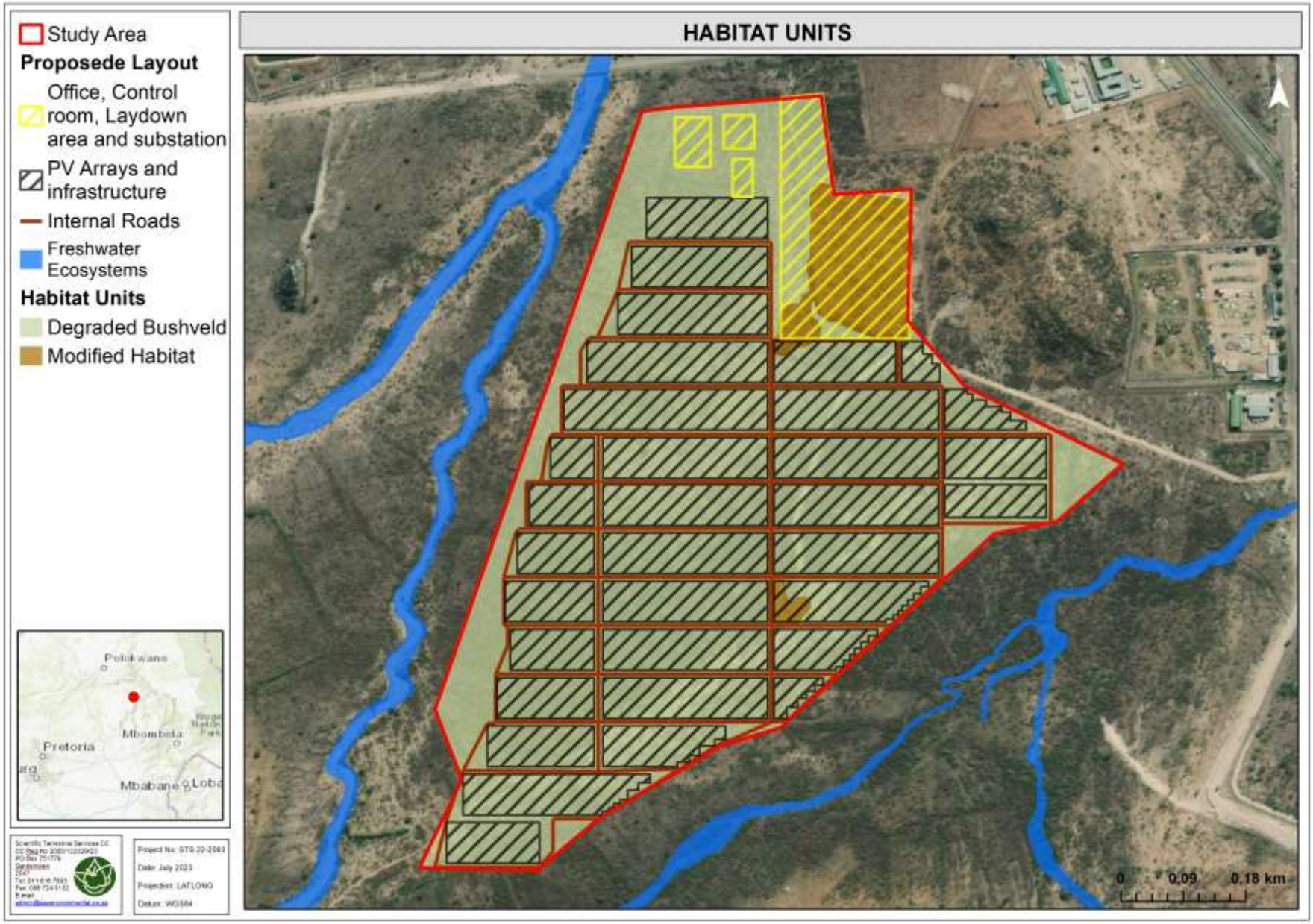

Figure 14: Habitat units encountered within study area and immediate surrounds.

4.1 Summary of results for avifaunal species

Photograph Notes:

Left Top Left – Marico Flycatcher (*Melaenornis mariquensis*) recorded in the northern part of the study area **Left Top Right** Scaly-feathered Finch (*Sporopipes squamifrons*) perched on the site. **Left Bottom Left** –Southern Masked Weaver male (*Ploceus velatus*) in transitional plumage constructing a nest along the western drainage line; **Left Bottom Right** – Red-back Shrike (*Lanius collurio*) perched.

Right Top: Left – View of the development site from the koppie located immediately to the north of the site. **Right Top Right** – Dense *Dichrostachys cinerea* thickets in the study area. **Right Bottom Left** –Power lines on the northern boundary of the study area; **Right Bottom Right** – The drainage line on the study areas western boundary.

Photographs:

Avifaunal Species of Conservation Concern (SCC)	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland indicates that several SCC have an overall distribution which encompasses the study area, entailing that these species could potentially occur in the study area; SABAP2 data for the study areas and surrounding pentads was consulted and indicates that certain of these have been recorded in the wider area. **No SCC were observed in the study area during the site assessment.** The SABAP2 database indicates that only one SCC has been recorded in the pentad in which the study area is located - the Lanner Falcon (*Falco biarmicus*) (VU) is also the most commonly-occurring SCC in the surrounding pentads, with relatively high reporting rates (around 50%) in the pentad to the east of the study area (2430_3005) that has 38 cards and the pentad to the south east (2435_3005) that has 10 cards. This species is variable in terms of its habitat preferences but is likely to roost and nest in the mountainous terrain in parts of the wider area, hunting smaller bird species in the lower-lying terrain that characterises the site and its surrounds where various passerine species, often granivores often congregate to feed in agricultural and peri-urban settings. A number of raptor species could range into the study area, the most likely of which would be the Verreaux's Eagle (*Aquila verreauxii*) (VU). The Verreaux's Eagle is strongly associated with mountainous terrain, which occupies a large area to the west of the study area. The Verreaux's Eagle preys primarily on the Rock Hyrax (*Procavia capensis*) which is limited to such rocky and mountainous habitat but can also hunt small antelope and goats. As such the species is only likely to be a very occasional visitor to the study area, flying overhead and possibly ranging around the small koppie immediately to the north of the site on an occasional basis. Cape Vultures (*Gyps coprotheres*) (EN) are similarly likely to be limited to the higher-lying mountainous terrain to the west of the study are and are likely to be associated with occasional flyovers above the site – a single bird was observed soaring to the east of the study area during the November 2020 site visit. The White-backed Vulture (*Gyps africanus*) (CR) has been recorded in a neighbouring pentad but due to the high degree of habitat fragmentation and loss along with the high human presence in the landscape, this species is deemed highly unlikely to range into the study area other than very occasionally. The possibility for the occurrence of the Tawny Eagle (*Aquila rapax*) (EN) on the site is deemed to be highly unlikely due to its very sparse reporting rate and rarity outside of large protected areas. No suitable habitat (grassland or grassy savannah) for the Secretarybird *(Sagittarius serpentarius*) (VU) or Pallid Harrier (*Circus macrourus*) (NT) is present on the site and thus the potential of occurrence of these two species is deemed to be very limited. The site occurs within the distribution ranges of a number of threatened waterbird species. Freshwater habitat on the development site and its immediate surrounds is limited to two ephemeral drainage lines that are highly degraded, thus open water or marshland habitat that would support such species is either extremely limited or absent, thus the potential for the following species to be present on site is extremely low: White-backed Night Heron (*Gorsachius leuconotus*) (VU), African Finfoot (*Podica senegalensis*) (VU), Greater Painted Snipe (*Rostratula benghalensis*) (NT), Marabou Stork (*Leptoptilos crumeniferus*) (NT) and Black Stork (*Ciconia nigra*) (VU). Abdim's Storks (*Ciconia abdimii*) (NT) typically inhabit grassland or cultivated fields, neither of which occur in the study area, thus this species is highly unlikely to range into the study area. Lastly European Roller (*Coracias garrulus*) (NT) typically occurs within grassy savannah, and as such habitat is absent from the site, it is likewise unlikely to occur.	
General Avian Discussion	Avifaunal diversity is considered to be very low within the study area. The habitat units within the study area provide few alternative landscape structures, which is often considered a primary determinant of bird assemblages, and the highly degraded nature of the woodland vegetation on the site, caused by the proliferation of *Dichrostachys cinerea* on the site that effectively prevents the growth of a grassy / herbaceous understorey, twinned with the removal (felling) of large trees and an extremely high livestock grazing presence has resulted in the prevalence of uniform and unproductive wooded habitat over most of the study area. Accordingly, despite being timed after significant rains had occurred in the local area, the site assessment revealed a relatively low species diversity in the study area. The bird species recorded were either generalists (common species tolerant of a wide variety of habitat types) or species that prefer dense woodland habitat. As detailed above, the extremely dense coverage of the indigenous encroacher species *D. cinerea* largely limits the potential for growth of a herbaceous (grassy) sub-layer that limits avian species diversity and abundance, with granivores being much less common	**Conclusion** The avifaunal habitat sensitivity for the study area was assessed to be low based on a desktop assessment and has been confirmed to be low based on the site verification. The possibility of SCC ranging into / occurring within the area on a regular basis is considered to be very low and it is considered highly unlikely that any of the SCC will breed within the study area. The strong human disturbance factor over much of the landscape of the study area is considered a very strong limiting factor for the occurrence of SCC. Clearing of vegetation for the proposed solar arrays and ancillary infrastructure will have a direct impact on habitat availability in the development footprint, leading to localised migration of many avifaunal species to adjacent habitats. The retention of similar habitat in the

	than would be expected in a bushveld habitat. The low density of seed-eaters also limits the abundance of birds in the study area, as seed-eaters often represent the largest component of avian biomass in woodland and savannah settings. The presence of two freshwater ecosystems (ephemeral drainage lines) would under normal circumstances increase avian species diversity and abundance, due to the presence of increased moisture levels and increased food availability within the riparian corridor. However the removal of much of the larger trees within the riparian corridor, along with significant erosion has severely degraded this habitat, contributing to an overall low avian species occurrence and abundance on the site. Habitat diversity is increased in the context of the adjacent koppie (rocky outcrop habitat) which is also more intact than the surrounding bushveld. Larger trees and bush clumps provide shelter and foraging opportunities for birds. Human infrastructure, primarily related to mining activities has transformed large areas of a natural habitat in the vicinity of the development site, thereby significantly reducing avian diversity in such areas. The northern part of the study area is also traversed by power lines. Such power lines are utilised by certain species as perching locations and are likely to be utilised by certain raptor species as vantage points. The study area is likely to experience seasonal variation in bird species densities, primarily related to food sources that are related to the growing and rainy seasons. During the summer months the overall food resource production of the herbaceous layer (where present) increases, especially for granivorous and nectivorous species, and a higher abundance of avifauna can be supported. The summer months will see an increase in insect abundance which provide an energy rich source of food for many avifaunal species. This increase is likely mimicked by small mammals as well as lizards and skinks which are an important food resource for raptors and some smaller bird species. Understandable reductions in insect abundance will likely occur during the winter months, and many avifaunal species will likely become more nomadic in their behaviour. The degradation and habitat-related homogeneity of the site significantly lowers the possibility for the majority of the potentially occurring SCC to range within the area.	immediate surrounds of the proposed development (especially within non-developable freshwater corridors and associated buffer areas, along with the non-development of the rocky outcrops habitat – koppie on the northern site boundary) will partially offset this by providing areas into which affected bird species can move. Avifaunal abundances within the footprint will however dramatically decrease. Species that relocate into the surrounding areas will be subject to higher levels of competition for food resources and space. Impacts to avifaunal species within the study area will result in the localised loss of habitat, diversity and avian abundance, whilst edge effects such as noise, dust and footprint creep will impact on avifaunal species in the immediate vicinity of the proposed development.

4.2 Avifaunal SCC Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of many avian species, possible low population numbers or varying habits of species, as well as the wide range of many species that entail that such species may only intermittently inhabit different parts of their range / territory. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed regional listings, whose known distribution ranges and habitat preferences include the study area were taken into consideration. Table 4 lists the SCC for the project. Of these species, none were recorded in the study area. Of the remainder of the potentially-occurring SCC, one species has been recorded in the pentad in which the study area occurs - Lanner Falcon (*Falco biarmicus*, VU). Four (4) other species were recorded in the neighbouring pentads, but only one – the Verreaux's Eagle (*Aquila verreauxii*, VU) has been assessed to be likely to visit the study area, albeit on an occasional basis.

Table 4: Avifaunal SCC that have been recorded in, and which may occur within the study area.

SCIENTIFIC AND COMMON NAME	HABITAT DESCRIPTION	REGIONAL STATUS	POC (%)
Falco biarmicus (Lanner Falcon)	**Range**: Breeding resident ranging widely across southern Africa and occurring across Africa, Arabia, and the western Palaearctic. **Major habitats**: Grassland, cultivated fields, cleared woodland. **Description**: Aerial hunter of avian prey, with birds caught on the wing in an aerial chase. **Food:** Feeds primarily on small birds. **Available habitat within the study area and immediate surrounds:** Cleared areas within degraded bushveld habitat especially along power lines; Freshwater Habitat (ephemeral drainage lines) and the small koppie. **Nature of potential impact related to the proposed development:** The transformation of habitat may exert a local impact on birds foraging in the local the area. This may be mitigated somewhat if a grassy understorey is retained under the panels, thereby still attracting small passerines to the site. The panels could pose a collision risk for such birds engaging in high speed aerial pursuits.	**VU**	**L**
Aquila verreauxii (Verreaux's Eagle)	**Range**: Breeding resident, occurring widely across southern Africa and into sub-Saharan Africa as far north as Ethiopia. **Major habitats**: Mountainous / hilly terrain, especially where its primary prey item *Procavia capensis* occurs. **Description**: Powerful raptor, often hunting in pairs, preferring to hunt along steep slopes or ridge tops, ambushing unsuspecting prey **Food:** Feeds primarily on *Procavia capensis* but is an opportunistic feeder taking smaller prey up to the size of small antelope and goats. **Available habitat with the study area and immediate surrounds:** Birds may occasionally forage over the isolated koppie to the immediate north of the study area **Nature of potential impact related to the proposed development:** Limited potential impact- birds may overfly the development site or may occasionally range in the vicinity of the site to search for prey on the isolated koppie.	**VU**	**L**

5 SENSITIVITY MAPPING

Figure 15 below conceptually illustrates the habitat units on the site in terms of the avifaunal sensitivity of each such unit. The areas are depicted according to their sensitivity in terms of the presence or potential for avifaunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 5: A summary of sensitivity of each habitat unit and implications for development.

Sensitivity	Habitat Unit	Development Implications
Low Sensitivity	➢ **Modified Habitat** Conservation Objective for areas of Low Sensitivity**:** Optimise development potential.	These habitats are deemed to be of low sensitivity for avifauna due to their altered state, absence of vegetation lack of heterogeneity and intensive anthropogenic presence – presence of mining activities and linear developments. Development within these areas is unlikely to lead to high impacts to avifaunal habitat or species diversity provided mitigation measures are implemented.
Moderately Low	➢ **Degraded Bushveld** Conservation Objective for areas of Moderately-Low Sensitivity**:** Optimise development potential while improving biodiversity intactness of surrounding natural habitat and managing edge effects.	The habitat sensitivity of this unit is considered moderately low as it has been largely degraded as a result of historic and current agricultural activities and associated land use practices which have exacerbated natural processes, in particular bush encroachment by *Dichrostachys cinerea* on the site. The unit is comprised of homogenous thornveld vegetation with limited foraging and breeding opportunities for most avifauna and this habitat is not considered important for any SCC. Development within this habitat unit is not expected to have a significant negative impact on the local or regional ecology of the area, provided mitigation measures are adhered to.
Moderate	➢ **Freshwater Habitat** Conservation Objective for areas of Moderate Sensitivity**:** Preserve the biodiversity value and functionality of the habitat unit, limit development and disturbance.	Freshwater habitat in the study area and its immediate surrounds comprises of two ephemeral drainage lines which are partly to heavily modified. This modification, especially of the riparian zone of the western drainage line which is heavily eroded and from which most larger riparian trees have been removed, significantly reduces the inherently high sensitivity associated with freshwater features. Freshwater features are also legally protected; thus these features should be excluded from development.
Moderately High	➢ **Rocky Outcrop** Conservation Objective: Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The rocky outcrop has been deemed to be sensitive due to the heterogeneity of the habitat and the protection and increased foraging opportunities offered by the larger trees associated with this small koppie, although it is located in a context of high degree of habitat fragmentation. The elevation offered by the koppie is likely to be important to certain raptor species, and the likely presence of Rock Hyraxes (*Procavia capensis*) may attract Verreaux's Eagles on an occasional basis. This habitat unit is located outside of the development footprint, making it easier to be protected from the development, although edge effects may transpire if sufficient mitigation measures are not implemented.

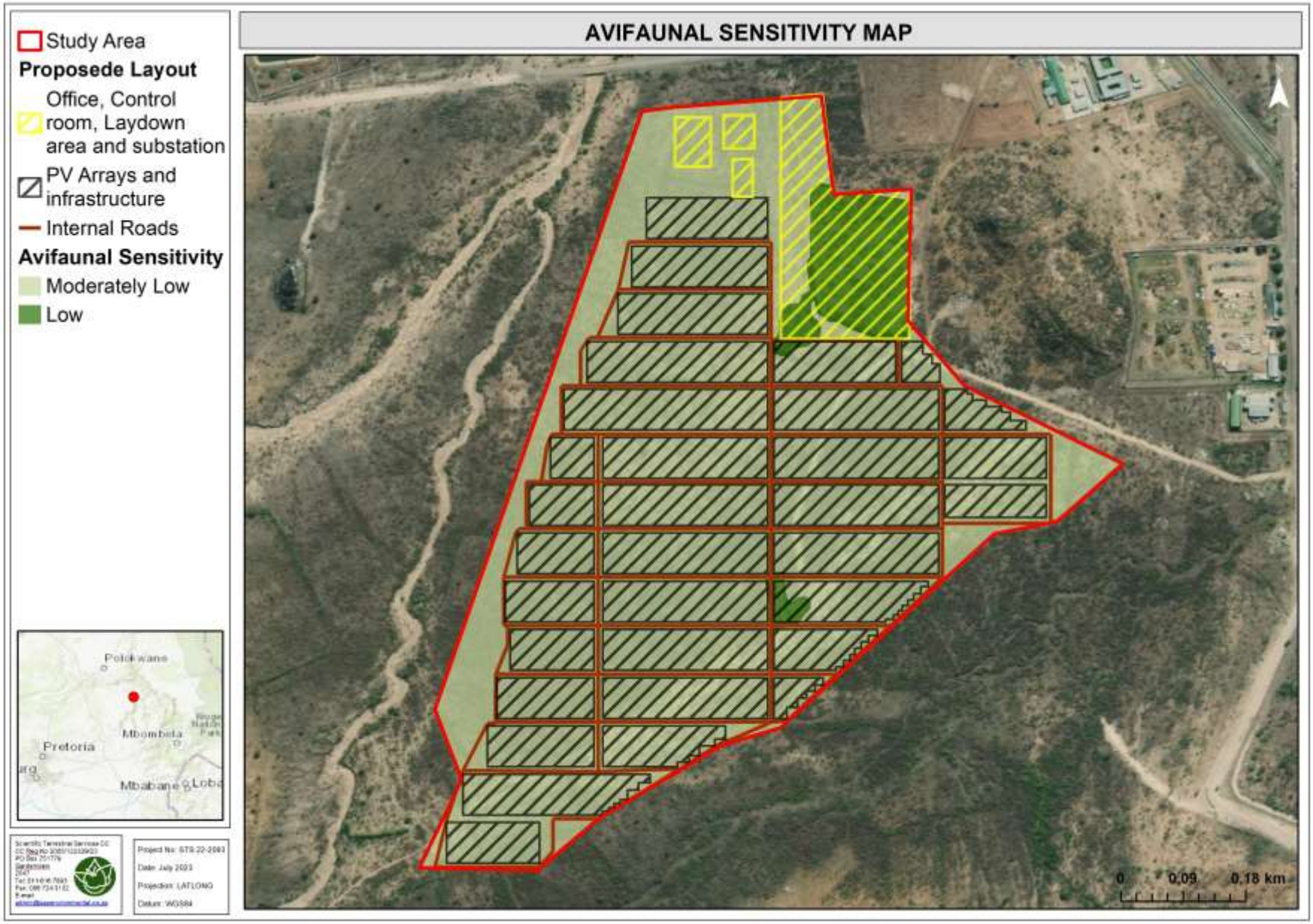

Figure 15: Avifaunal sensitivity map for the Study Area and immediate surrounds.

6 IMPACT ASSESSMENT

Table 6 below serves to summarise the nature of potential impacts on the avifaunal ecology of the study area, and Tables 7-10 have assessed these impacts in detail according to the method described in Appendix C (as provided by the EAP).

An assessment of all potential i) Construction Phase, and ii) Operational & Maintenance Phase impacts is provided in Section 6.2. For the impact assessment, it is assumed that the Solar PV Plant will not be decommissioned when the mine goes into its closure phase. All mitigatory measures required to minimise the perceived impacts are presented in Sections 6.3.4.and Sections 6.3.6.

6.1 Activities and Aspect Register

The table below indicates the perceived risks to avifaunal species associated with the activities pertaining to the proposed solar development.

Table 6: Aspects and activities register considering avifaunal resources during all phases of development.

ACTIVITIES AND ASPECTS REGISTER
Planning (Pre-construction) Phase
- Potential failure to implement the required mitigation measures before and at the commencement of construction activities, in particular with respect to exclusion of freshwater ecosystems and associated buffers from the developable area: - **Impact: Long-term or permanent degradation and modification of the receiving environment, loss of SCC and fauna habitat.**
- Potential inadequate design of PV infrastructure increasing the possibility of colliding with infrastructure. - **Impact:** Long-term collision and risks to SCC species leading to a reduction in SCC diversity.
Construction Phase
- Loss of indigenous vegetation and thus avifaunal habitat within the solar array footprint that is permanently cleared of woody vegetation. - **Impact:** Permanent loss of avifaunal habitat at a local scale affecting the typical species assemblage and thus reducing avifaunal habitat and diversity in the wider area. Further reduction of available habitat in the long-term, compounding the limiting factors to avifaunal assemblages.
- Inadequate layout optimisation, resulting in extensive (non-phased / indiscriminate) site clearing and the removal of indigenous vegetation. - **Impact:** Loss of avifaunal habitat with local impacts on avifaunal communities.
- Uncontrolled and unplanned site clearing and the removal of vegetation and destruction of avifaunal habitat and forage. - **Impact:** Loss of avifaunal habitat for species reliant on this specific habitat for survival.
- Proliferation of AIP species that colonise areas of increased disturbances and which may outcompete indigenous plant species, including further transformation of adjacent, undeveloped habitat. - **Impact:** Degradation of favourable avifaunal habitat outside of the direct construction footprint, leading to a decrease in avifaunal diversity at a localised scale and loss of land to meet biodiversity targets.

ACTIVITIES AND ASPECTS REGISTER
- Potential dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs and destroying residual natural habitat. - **Impact:** Loss of avifaunal habitat and diversity.
- Potential failure to implement stormwater controls on the construction site. - **Impact:** Potential increased erosion within vulnerable soils, especially within the ephemeral drainage lines that could lead to degradation of riparian habitat that would negatively affect is productivity for avifaunal usage.
- Additional pressure on avifaunal habitat as a result of an increased human presence associated with the proposed development, contributing to: • Potential hunting/trapping/removal/collection of avifaunal species or potential SCC; and • Increased human activity, especially loud noise associated with construction activities will lead to the displacement and/or loss of potential avifaunal SCC. - **Impact:** Loss of sensitive avifaunal habitat and the potential loss of potential avifaunal SCC.
- Potential failure to concurrently rehabilitate bare or disturbed sites as soon as the construction activities have occurred will potentially result in loss of viable soils, increasing erosion risk and/or permitting the proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for historically recorded avifaunal species. Loss of avifaunal diversity and potential SCC which will disperse into the surrounding area in search of favourable habitat. Knock-on effects on adjacent / downgradient freshwater ecosystems through increased sedimentation, and / or increased erosion of riparian zones through increased runoff velocities, thereby further degrading avifaunal habitat within adjacent freshwater ecosystems.
Operational and Maintenance Phase
- Potential failure to implement an alien floral control plan after the construction phase. - **Impact:** Potential permanent transformation of avifaunal habitat and long-term degradation of avifaunal habitat adjacent to the development site due to potential proliferation of AIPs.
- Ineffective rehabilitation of exposed and impacted areas potentially leading to vegetation succession and a possible reduction of avifaunal diversity and occurrence of potential avifaunal SCC over the long-term. - **Impact:** Permanent loss of avifaunal habitat and diversity, and a higher likelihood of edge effect impacts on adjacent and nearby natural avifaunal habitat of increased sensitivity. Further reduction of available habitat in the long-term, compounding the limiting factors to avifaunal assemblages.
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes being left fragmented, resulting in reduced migration capabilities of avifaunal species, isolation of avifaunal populations and a decrease in avifaunal diversity; • Compacted soils limiting the re-establishment of natural vegetation; and • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of avifaunal habitat and diversity.
- Increased risk of collisions with the project infrastructure. - **Impact:** Local loss of potential avifaunal SCC abundance and diversity.

6.2 Avifaunal Impact Assessment Results

The below tables indicate the perceived risks to the avian ecology of study area associated with all phases of the proposed development within the study area. Following the impact assessment methodology provided by the EAP, both direct impacts and indirect impacts have been assessed for each phase. It should be noted that due to the predominance of degraded bushveld habitat in the study area, and the very small spatial extents of other habitat units potentially affected, the habitat units have not been individually assessed but as a collective. For the habitat units that are more sensitive and located adjacent to the site (i.e. freshwater habitat and rocky outcrop HU's), potential impacts are considered through the assessment of indirect impacts. It has been assumed that neither of these habitat units would be directly transformed by the proposed development, as the koppie (rocky outcrop habitat unit) and freshwater ecosystems are located outside of the site / study area boundary, and as the freshwater ecosystems buffers have been stipulated as non-development areas in the freshwater report for the development.

It should be noted that the table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 7: Impact on AVIFAUNAL HABITAT AND DIVERSITY from the proposed development activities in the study area and immediate surrounds for the CONSTRUCTION PHASE.

Description of Impact				
Type of Impact	Direct		Indirect	
Nature of Impact	Negative		Negative	
Phases	Construction		Construction	
Criteria	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)	Moderate change (Medium)	Minor change (Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Part of Site / Property	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low	Medium	Low
Probability	Probable (High)	Probable (High)	Probable (High)	Possible / frequent (Medium)
Significance	**Medium-**	**Low -**	**Low-**	**Very Low -**
Additional Assessment Criteria				
Degree to which impact can be reversed	Irreversible: The development will result in loss of most (woody) vegetation over most of the development site which will irreversibly affect the habitat for avifauna; albeit at a limited spatial scale		Fully Reversible: Noise and Disturbance-related impacts will stop once construction has been competed; With mitigation any impacts on adjacent habitat related to stormwater can be reversed.	
Degree to which impact may cause irreplaceable loss of resources	Low: Despite the loss of a woody vegetation over most of the spatial extent of the development site, the development will be very unlikely to cause irreversible loss of resources due to the highly degraded nature of the habitat and the relatively small spatial extent of the area to be transformed.		Low: The development will be very unlikely to cause irreversible loss of resources due to the short timeframe of the construction, the ability to mitigate stormwater-related impacts, and the relatively small scale of the study area.	
Degree to which impact can be avoided	Low		Medium	
Degree to which impact can be mitigated	Low: The loss of woody habitat on the site is very difficult to mitigate due to the permanent nature of the loss. Should grassy / herbaceous vegetation be allowed to re-establish itself under the panel arrays, certain granivores would return to forage on the site. The retention of the freshwater ecosystem movement corridors on either side of the site is a mitigatory measure as bird movement corridors in the vicinity of the site will be retained		Medium: Noise and Disturbance related impacts can be mitigated to a certain degree, but due to the nature of bulk earthworks a degree of impact is still likely to materialise. Stormwater related impacts (leading to potential further degradation of habitat though initiation or worsening of erosion) can be mitigation through proper controls.	
Cumulative Impact				
Extent to which a cumulative impact may arise	Possible		Possible	

Rating of cumulative impacts	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
	Low -	Low -	Low -	Low -

Table 8: Impact on AVIFAUNAL SCC from the proposed development activities in the study area and immediate surrounds for the CONSTRUCTION PHASE.

Description of Impact				
Type of Impact	Direct		Indirect	
Nature of Impact	Negative		Negative	
Phases	Construction		Construction	
Criteria	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Minor change (Low)	Minor change (Low)	Negligible change (Very Low)	Negligible change (Very Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Part of Site / Property	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low	Low	Low
Probability	Conceivable (Low)	Conceivable (Low)	Conceivable (Low)	Unlikely / Improbable (Very low)
Significance	**Low-**	**Very Low -**	**Very Low**	**Insignificant -**
Additional Assessment Criteria				
Degree to which impact can be reversed	Irreversible: The development will result in loss of most (woody) vegetation over most of the development site which will irreversibly affect the habitat for avifauna; albeit at a limited spatial scale		Fully Reversible: Noise and Disturbance-related impacts will stop once construction has been competed; With mitigation any impacts on adjacent habitat related to stormwater can be reversed.	
Degree to which impact may cause irreplaceable loss of resources	Low: Despite the loss of a woody vegetation over most of the spatial extent of the development site, the development will be very unlikely to cause irreversible loss of resources in a SCC context due to the highly degraded nature of the habitat and the relatively small spatial extent of the area to be transformed which significantly limits the potential for SCC to exist on the site.		Low: The development will be very unlikely to cause irreversible loss of resources due to the short timeframe of the construction, the ability to mitigate stormwater-related impacts, and the low POC of SCC in the study area and surrounds.	
Degree to which impact can be avoided	High: There is a very low POC of SCC in the study area, thus the potential impact associated with vegetation clearing and habitat destruction loss would be highly unlikely to constitute an impact on these species.		Medium: Noise and disturbance-related impacts can be mitigated but not avoided in totality. Stormwater related impacts (leading to potential further degradation of habitat though initiation or worsening of erosion) can be mitigation through proper controls.	
Degree to which impact can be mitigated	Medium: Birds are able to move to similar areas of habitat in the surrounds. The retention of the freshwater ecosystem movement		Medium: Noise and Disturbance related impacts can be mitigated to a certain degree, but due to the nature of bulk earthworks a degree of	

	corridors on either side of the site is a mitigatory measure as bird movement corridors in the vicinity of the site will be retained.		impact is still likely to materialise. Stormwater related impacts can be mitigation through proper controls.	
Cumulative Impact				
Extent to which a cumulative impact may arise	Possible		Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
	Low -	**Very Low -**	**Low -**	**Very Low -**

Table 9: Impact on avifaunal HABITAT AND DIVERSITY from the proposed development activities in the study area and immediate surrounds for the OPERATIONAL AND MANAGEMENT PHASE.

Description of Impact				
Type of Impact	Direct		Indirect	
Nature of Impact	Negative		Negative	
Phases	Operational and Management		Operational and Management	
Criteria	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Minor change (Low)	Minor change (Low)	Minor change (Low)	Negligible change (Very Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Part of Site / Property	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low	Medium	Low
Probability	Possible / Frequent (Medium)	Conceivable (Low)	Conceivable (Low)	Unlikely / Improbable (Very low)
Significance	**Low-**	**Very Low -**	**Low**	**Insignificant -**
Additional Assessment Criteria				
Degree to which impact can be reversed	Fully Reversible.		Fully Reversible.	
Degree to which impact may cause irreplaceable loss of resources	Low: The development will be very unlikely to cause irreversible loss of resources due to being part of a new baseline and as the development would have a relatively small footprint, and not being likely to have a significant collision risk for general avifauna.		Low: Indirect impacts relate to stormwater controls which could degrade adjacent freshwater habitat, thereby impacting avian habitat and diversity, but due to the manageability of the impact and the already degraded nature of the freshwater resource will be unlikely to lead to irreplaceable loss of resources.	
Degree to which impact can be avoided	High: The operation and maintenance of the solar development is unlikely to result in a measurable impact on general bird diversity in the		High: The operation and maintenance of the solar development is unlikely to result in a measurable impact on general bird diversity in the	

	local area, and the possibility of collision is low due to the low degree of bird abundance and species diversity in the area.		local area due to indirect impacts, as these are easily avoided through stormwater management.	
Degree to which impact can be mitigated	Medium: The site is not located adjacent to any bird movement corridors and is within an area of low degree of bird abundance and species diversity which mitigates the impact.		High: The operation and maintenance of the solar development will be unlikely to result in a measurable impact on general bird diversity in the local area due to indirect impacts, as these are easily mitigated through stormwater management.	
Cumulative Impact				
Extent to which a cumulative impact may arise	Possible		Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
	Low -	**Very Low -**	**Low -**	**Very Low -**

Table 10: Impact on avifaunal SCC from the proposed development activities in the study area and immediate surrounds for the OPERATIONAL AND MANAGEMENT PHASE.

Description of Impact				
Type of Impact	Direct		Indirect	
Nature of Impact	Negative		Negative	
Phases	Operational and Management		Operational and Management	
Criteria	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Minor change (Low)	Minor change (Low)	Minor change (Low)	Negligible change (Very Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Part of Site / Property	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low	Medium	Low
Probability	Unlikely / improbable (Very low)	Unlikely / improbable (Very low)	Conceivable (Low)	Unlikely / Improbable (Very low)
Significance	**Very Low-**	**Insignificant -**	**Low**	**Insignificant -**
Additional Assessment Criteria				
Degree to which impact can be reversed	Fully Reversible.		Fully Reversible.	
Degree to which impact may cause irreplaceable loss of resources	Low: The development will be very unlikely to cause irreversible loss of resources due to being part of a new baseline, and not being likely to have a significant collision risk for SCC, primarily due to the very low POC of SCC in the area.		Low: Indirect impacts relate to stormwater controls which could degrade adjacent freshwater habitat, thereby impacting avian habitat and diversity, but due to the manageability of the impact and the already	

			degraded nature of the freshwater resource will be unlikely to lead to irreplaceable loss of resources.	
Degree to which impact can be avoided	High: The operation and maintenance of the solar development will be unlikely to result in a measurable impact on avifaunal SCC in the local area.		High: The operation and maintenance of the solar development will be unlikely to result in a measurable impact on SCC occurrence in the local area due to indirect impacts, as these are easily avoided through stormwater management.	
Degree to which impact can be mitigated	High: The site is not located adjacent to any bird movement corridors and is within an area of low degree of SCC POC which mitigates the impact.		High: The operation and maintenance of the solar development will be unlikely to result in a measurable impact on avifaunal SCC in the local area due to indirect impacts, as these are easily mitigated through stormwater management.	
Cumulative Impact				
Extent to which a cumulative impact may arise	Possible		Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
	Low -	**Very Low -**	**Low -**	**Very Low -**

6.3 Impact discussion

The impact significance of the proposed development (prior to mitigation) on avifaunal habitat, diversity and SCC range from medium low to insignificant (negative). Potential regional-scale impacts are highly unlikely, and if recommended mitigation measures as stipulated in the Sections 6.3.4 and 6.3.6 below are adhered to, impacts on avifaunal diversity and habitat are likely to be localised. If effective mitigation takes place at all stages of the proposed project, most of the impacts may be reduced to lower significance ratings, minor to insignificant (negative).

The most significant potential impacts are construction phase impacts that would result from the proposed destruction of habitat that would occur due to clearing for the development of the solar panel arrays. Although commencing in the construction phase this impact will extent to the full operational life of the development as cleared (woody) vegetation will not be restored and permanent transformation of the solar panel footprint will transpire. These impacts can be partially mitigated, as birds on the development site will be able to relocate to neighbouring areas of similar habitat as habitat is cleared. The non-development of two drainage lines that run parallel to the study area boundaries that have been retained as non-developable areas in the development layout will pose an additional mitigation measure in this context by retaining bird movement corridors adjacent to the developed footprint.

6.3.1 Impact on avifaunal SCC

A number of avifaunal SCC have distribution ranges which encompass the study area and may utilize it for foraging on an irregular basis. None of these species have been recorded in the study area, and only Lanner Falcon (*Falco biarmicus*) has been recorded in the pentad in which the study area is required. Of the species that have been recorded in the neighbouring pentads, only Verreaux's Eagle (*Aquila verreauxii*) has been assessed to have the potential to range into the study area, on an occasional basis.

Due the very high human activity presence in the area, twinned with the very large territories of these species, there is thus a limited chance of SCC being adversely impacted by the proposed development at a regional or population level, and the area is not considered to be a regionally important breeding, roosting or foraging habitat for any of the abovementioned species and thus no impacts on their respective populations breeding productivity are likely to occur. Mitigation measures will further reduce the impact on SCC.

6.3.2 Impact on avifaunal Diversity and Habitat

One of the primary impacts associated with the development of a PV-based solar power generation facility is its physical transformation of large areas of natural vegetation – in many cases PV facilities involve the complete removal of vegetation from the inclusive footprint of the installed PV panels, although a pioneer grass layer may subsequently develop under the panels. It is understood that such an approach would be adopted for the proposed development.

The habitat transformation associated with the clearing of all vegetation could result in a number of impacts on birds, including:

- direct habitat loss which would be particularly significant for species with restricted ranges or very specific habitat requirements;
- habitat fragmentation and/or modification; and
- disturbance / displacement of species (e.g. through construction / maintenance activities).

In this context, and at the scale of the development site, the development of the arrays will have a significant impact on the bird assemblage (abundance and species density), and most birds that currently occur in the degraded bushveld on the site will no longer be able to inhabit the site once construction (vegetation clearing) has commenced.

Only a very small number of birds (most likely to be granivores – seed eaters) such as weavers, widows, waxbills, and some gamebirds such as Helmeted Guineafowl (*Numida meleagris*) etc. would be likely to forage within the arrays if a pioneer grass layer is allowed to become established under the arrays. It is important to note that none of the affected species have restricted ranges or very specific habitat requirements; all of the commonly occurring woodland species that have been commonly recorded on the development site and more widely in the surrounds are very well-represented in the wider surrounding area where woodland habitat has been retained and will be present once the development becomes operational. As such, none of the affected species have limited distributions and the loss of habitat at the scale of the proposed development will not have a population-level impact.

At a wider study area scale (i.e. a 2km radius of the development site), the habitat transformation impact will be less significant, as parts of the study area will still be characterised by degraded bushveld habitat, and certain ecological linkages will be retained on the property on which the development is proposed and its immediate surrounds if vegetation clearing is limited to the development footprint and buffers around the freshwater

ecosystem habitat (drainage lines) are maintained. The retention of such linkages is significant, as habitat loss impacts are heightened when the site of a proposed development will directly affect important areas of ecological connectivity, or in habitat for threatened species.

6.3.3 Construction-related Disturbance and Displacement Impacts

The construction of the solar panel arrays over a relatively large area may potentially be a significant civil engineering undertaking that will involve bulk earthworks and the removal of vegetation. Construction will thus be noisy, will at times generate large volumes of dust, and will involve the use and co-ordination of large numbers of construction equipment and vehicles. Sources of loud noise are likely to have varied, but definite impacts on birds; noise from human activities (in particular from infrastructure and construction sites) has a strong impact on the physiology and behaviour of birds. This impact related to the masking of signals used for communication, breeding and for hunting (Bottalico *et al*, 2015). The presence of a noise source in an area implies a decrease in bird density. The decrease happens because birds tend to leave the areas where their signals are masked by the noise source (Bottalico *et al*, 2015).

In the context of the study area, it is important to note however that the current surrounding mining operations provide a source of noise that adds to the ambient noise levels in the area. The baseline is thus altered from a natural setting. Nonetheless, construction activities, in particular the above-mentioned high noise generating activities would be likely to lead to the displacement and disturbance of birds, even in areas not being developed that are located adjacent to the development site. This is a temporary impact that will last for the duration of the construction but may lead to the temporary displacement of birds and the abandonment of breeding efforts in adjacent areas such as on the isolated koppie immediately to the north of the study area boundary. This would be particularly significant for larger species of birds which occur in lower densities due to the occurrence of large territories. The majority of bird species breed in the summer months, and accordingly it is thus recommended that construction activities, in particular earth moving, rock removal and vegetation clearing occur in the winter months when most bird species are not breeding and there is a lower number and species diversity on the site due to the absence of migratory species.

6.3.4 Construction-related Mitigation Measures

- If permitted by approval timeframes, the bulk of construction should be timed to occur in the drier winter months when most bird species are not breeding, and when many granivores tend to become nomadic in nature and less territorial;
- No unauthorised fires are to be allowed on the site;
- An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora and therefore fauna habitat throughout the construction phase;
- In the context of construction phase environmental management, edge effect control must be implemented to ensure no further degradation and potential loss of avifaunal habitat outside of the proposed project footprint area. An on-site Environmental Control Officer (ECO) must monitor and mitigate any edge effects throughout the construction phase. Special attention must also be paid to potential increase and spread of AIPs;
- Existing roads must as far as possible be used for access purposes to the construction site;
- An AIP Management/Control Plan must be implemented by a qualified professional; and
- No collection or hunting of any fauna species is to be allowed by personnel during the construction phase, especially with regards to avifaunal SCC (if encountered and not part of a rescue/relocation plan).

6.3.5 Potential Operational Impacts associated with the development of Solar Arrays

One of the other significant direct impacts relating to the development and operation of solar panel arrays is bird trauma or mortality that is caused by collisions with PV panels, with the possible reasons for collisions being polarised light pollution and/or relating to waterbirds mistaking large arrays of PV panels as wetlands or waterbodies – the so-called “lake effect” (Walston *et al*, 2016). No evaporation ponds are proposed to be developed in association with the solar power development, and the proposed arrays are not located in close proximity to any natural or artificial waterbodies that exist in the vicinity of the development footprint. This means that there are no exacerbating factors that would be likely to attract waterbirds to the vicinity of the solar arrays. The solar development site is not located along major avian flyways (which would exist along a major river, for example, and this potential impact is thus not considered to be significant and the potential for large numbers of waterbirds or threatened species to be attracted to the solar arrays through the lake effect is expected to be low. Nonetheless as part of the proposed operational monitoring of bird-related impacts on the

development site, the solar arrays must be monitored for collision-related impacts, as discussed further in Section 7.

Night-time lighting could be a source of collisions if birds travelling at night are disoriented by lighting. Nocturnal bird species could also be at risk of collision with the arrays if attracted to insects that are themselves attracted to white lighting. It is however recognised that the wider area is likely to be characterised by a high level of night-time lighting at mining infrastructure and in surrounding settlements. Nonetheless it is recommended that lighting at the solar facility is kept to a minimum.

6.3.6 Operational Phase Mitigation Measures

- It is recommended that low vegetation be retained or allowed to become re-established under the arrays to protect the underlying soil from erosion and to aid in the control of stormwater management to prevent edge effects on residual areas of avifaunal habitat adjacent to the development site boundaries from materialising. Such retention of a low / grassy vegetation layer will also provide some form of residual, albeit highly modified habitat for avifauna, providing foraging opportunities for a limited array of mainly granivorous species. It is recognised however that such vegetation retention in the operational phase of the development may be deemed to be technically non-feasible;
- Ongoing alien and invasive vegetation monitoring and control should take place for a period after the end of construction;
- The Alien and Invasive Plant Management and Control Plan designed and implemented as part of the operational phase must include for control and eradication for a period of at least 5 years after the end of construction;
- Monitoring of the solar arrays for bird fatalities must occur at regular intervals during the operational phase of the development, in line with the BLSA Birds and Solar Energy Guideline;
- Anti roosing spikes / diverters should be fitted to the solar panels, if required;
- BESS infrastructure must be regularly checked and operated according to the relevant SANS guidelines to prevent the potential for leaks and ruptures that could pose a risk of pollution; and
- Operational lighting at the solar facility must be limited to low level security lighting and no floodlighting must be utilised.

6.3.7 Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving avifaunal ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified ***at a local scale***:

- Reduction in potential avifaunal presence and in the surrounding habitats through edge effects, and potential collisions;
- Loss of and altered avifaunal species diversity;
- Reduction of avifaunal abundance; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and loss of avifaunal habitat and species diversity may be permanent if mitigation measures are not implemented.

6.3.8 Cumulative Impacts

The development, in particular of solar arrays that will result in large-scale transformation of natural (albeit highly degraded) vegetation and habitats forms part of a wider trend of transformation of natural habitat in the wider area. The wider area is characterised by mining operations, human settlements and undeveloped land that is used for livestock grazing. As such the development, in particular the transformation of habitat associated with the solar arrays is considered part of a wider cumulative impact on avifauna in the wider area that is associated with increasing loss of habitat and resultant loss on avian diversity and abundance in the area.

7 RECOMMENDED MONITORING REGIME

The mitigation measures for each stage of the project are detailed in Section 6 above. Monitoring is a critical component of the mitigation measures for solar power plants. The development of solar power generation facilities is a relatively recent phenomenon in South Africa, and such facilities have only been in place for the last decade, concentrated in certain parts of the country. The localised impacts of such facilities are still poorly understood.

As such it is advised that monitoring be conducted in the post construction phase of the project as detailed below:

Quantifying bird mortalities – Regular searches for carcasses of any bird fatalities associated with the operational solar facility must be undertaken, by an avifaunal specialist or a suitably qualified ECO or employee of the proponent. Searches must be undertaken at the solar arrays. The methods detailed in the BLSA Birds and Solar Guidelines must be applied.

8 CONCLUSION AND RECOMMENDATIONS

Scientific Terrestrial Services (STS) was appointed to conduct an Avifaunal Assessment as part of the Environmental Assessment and Authorisation process for the proposed development of a solar power plant at the Marula Platinum Mine near Burgersfort, Limpopo Province.

Based on the findings of the avifaunal assessment it is the opinion of the ecologists that from an avifaunal perspective, the proposed components of the development can be considered acceptable. The impact of greatest significance that is anticipated to occur is the alteration of areas of natural habitat (degraded bushveld) in the development area footprint, reducing avian abundance and diversity within the study area. Impact scores are reduced as no sensitive habitat is proposed to be developed, and as there is a very low likelihood of the occurrence of sensitive species (SCC) beyond intermittent ranging and foraging into the development area. Further impacts that may result from the proposed project are as a result of potential collisions with the proposed PV facilities.

The small scale of the study area and its degraded baseline reduces the significance of the impact of the loss of woody vegetation on the development site. It is anticipated that should the proposed mitigation measures be implemented the risk of collisions can be drastically reduced. Due to the low potential of occurrence of Species of Conservation Concern, impacts to these priority species are not anticipated to be regionally significant.

It is important that all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure the ecology within the proposed construction areas as well as surrounding zone of influence is protected or adequately rehabilitated in order to minimise the deviations from the Present Ecological State as much as possible.

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APPENDIX A: Legislative Requirements

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT (NEMBA, ACT NO. 10 OF 2004)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.
Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

CONSERVATION OF AGRICULTURAL RESOURCES ACT (CARA, ACT 43 OF 1983)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

APPENDIX B: Avifaunal Method of Assessment

Avifaunal Assessment Methodology

A reconnaissance 'walk through' on foot was undertaken to determine the general habitat types found throughout the study area. Special emphasis was placed on areas that may potentially support avifaunal SCC. Sites representative of habitat units or unique niche habitats were then marked and point counts were undertaken in order to identify the occurrence of the avifaunal communities, species and habitat diversities. The presence of any avifaunal inhabitants of the study area was assessed through direct visual observation or identifying such species through calls, nests and potentially pellets.

It is important to note that avifaunal species have varied breeding patterns and are subject to seasonal fluctuations. As such, it is unlikely that all avifaunal species will have been recorded during the site assessment. However, even though some avifaunal species may not have been identified during the sight assessment, the habitat units and degree of transformation can be used to establish an accurate understanding of avifaunal species most likely associated with the study area.

Avifaunal Species of Conservational Concern Assessment

Throughout the fauna assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species. The **Probability of Occurrence (POC)** for each faunal SCC is described as:

- "**Confirmed'**: if observed during the survey.
- "**High**": if within the species' known distribution range and preferable habitat for foraging, roosting or breeding is available.
- "**Medium**": if either within the known distribution range of the species with marginal habitat that does not occur within the core of the species range or within an important foraging, roosting or breeding area; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Avifaunal Habitat Sensitivity

The sensitivity of the study area for avifauna species was determined by calculating the mean of five different parameters which influence avifaunal species and provide an indication of the overall avifaunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Avifaunal SCC:** The confirmed presence or potential for avifaunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for avifaunal species;
- **Food Availability:** The availability of food within the study area for avifaunal species;
- **Avifaunal Diversity:** The recorded avifaunal diversity compared to a suitable reference condition such as surrounding natural areas or available avifaunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for avifaunal species. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to avifaunal species. The different classes and land-use objectives are presented in the table below:

Table B1: Avifaunal habitat sensitivity rankings and associated land-use objectives.

SCORE	RATING SIGNIFICANCE	CONSERVATION OBJECTIVE
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C: Impact Assessment Methodology

Impact assessment methodology as provided by the proponent (SLR Consulting).

This assessment methodology enables the assessment of biophysical, cultural, and socio-economic impacts including cumulative impacts and impact significance through the consideration of intensity, extent, duration, and the probability of the impact occurring. Consideration is also given to the degree to which impacts may cause irreplaceable loss of resources, be avoided, reversibility of impacts and the degree to which the impacts can be mitigated.

METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF IMPACTS

Part A (Table E1) provides the definition for determining impact consequence (combining intensity, extent, and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B (Table E2) and C (Table E3). The interpretation of the impact significance is given in Part D (Table E4). This methodology is utilised to assess both the incremental and cumulative project related impacts.

Table E1: Part A – Definitions and Criteria.

PART A: DEFINITIONS AND CRITERIA		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, extent, and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance, or degradation. Associated with severe consequences. May result in severe illness, injury, or death. Targets, limits, and thresholds of concern continually exceeded. Habitats or ecosystems of high importance for maintaining the persistence of species or habitats that meet critical habitat thresholds. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance, or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits, and thresholds of concern regularly exceeded. Habitats or ecosystems which are important for meeting national/provincial conservation targets. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance, or discomfort. Associated with real but not substantial consequences. Targets, limits, and thresholds of concern may occasionally be exceeded. Habitats or ecosystems with important functional value in maintaining biotic integrity. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance, or nuisance. Associated with minor consequences or deterioration. Targets, limits, and thresholds of concern rarely exceeded. Habitats and ecosystems which are degraded and modified. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance, or nuisance. Associated with very minor consequences or deterioration. Targets, limits, and thresholds of concern never exceeded. Species or habitats with negligible importance. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.

	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**Very Short term**	Very short, always less than a year or may be intermittent (less than 1 year). Quickly reversible.
	Short term	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	Medium term	Medium-term, 5 to 10 years.
	Long term	Long term, between 10 and 20 years. Likely to cease at the end of the operational life of the activity or because of natural processes or by human intervention.
	Very long term/ permanent	Very long, permanent, +20 years. Irreversible. Beyond closure or where recovery is not possible either by natural processes or by human intervention.
Criteria for ranking the EXTENT of impacts	**Site**	A part of the site/property. Impact is limited to the immediate footprint of the activity and within a confined area.
	Whole site	Whole site. Impact is confined to within the project area and its nearby surroundings.
	Beyond site	Beyond the site boundary, affecting immediate neighbours.
	Local	Local area, extending far beyond site boundary.
	Regional/ national	Regional/National. Impact may extend beyond district or regional boundaries with national implications.

Table E2: Part B – Determining Consequence.

PART B: DETERMINING CONSEQUENCE – APPLIES TO POSITIVE OR ADVERSE IMPACTS						
		EXTENT				
		Site	**Whole site**	**Beyond the site, affecting neighbours**	**Local area, extending far beyond site**	**Regional/ National**
INTENSITY = VL						
DURATION	**Very long term /permanent**	Low	Low	Medium	Medium	Medium
	Long term	Very Low	Low	Low	Medium	Medium
	Medium term	Very Low	Low	Low	Low	Medium
	Short term	Very low	Very Low	Low	Low	Low
	Very short term	Very low	Very Low	Very Low	Very Low	Low
INTENSITY = L						
DURATION	**Very long term /permanent**	Low	Medium	Medium	High	High
	Long term	Low	Medium	Medium	Medium	High
	Medium term	Low	Low	Medium	Medium	Medium
	Short term	Very low	Low	Low	Medium	Medium
	Very short term	Very low	Very low	Low	Low	Low
INTENSITY = M						
DURATION	**Very long term /permanent**	Medium	Medium	High	High	Very High
	Long term	Low	Medium	Medium	High	High
	Medium term	Low	Medium	Medium	Medium	High
	Short term	Low	Low	Medium	Medium	Medium
	Very short term	Very low	Low	Low	Low	Medium
INTENSITY = H						
DURATION	**Very long term /permanent**	Medium	High	High	Very High	Very High
	Long term	Medium	Medium	High	High	Very High
	Medium term	Low	Medium	Medium	High	High
	Short term	Low	Medium	Medium	Medium	High

	Very short term	Very low	Low	Low	Medium	Medium
INTENSITY = VH						
DURATION	Very long term /permanent	Medium	High	Very High	Very High	Very High
	Long term	Medium	High	High	Very High	Very High
	Medium term	Medium	Medium	High	High	Very High
	Short term	Low	Medium	Medium	High	High
	Very short term	Low	Low	Medium	Medium	Medium

Table E3: Part C – Determining Significance.

PART C: DETERMINING SIGNIFICANCE - APPLIES TO POSITIVE OR ADVERSE IMPACTS							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

Table E4: Part D – Interpretation of Significance.

PART D: INTERPRETATION OF SIGNIFICANCE		
Significance		Decision guideline
Very High	Very High +	Represents a key factor in decision-making. Adverse impact would be considered a potential fatal flaw unless mitigated to lower significance.
High	High +	These beneficial or adverse impacts are considered to be very important considerations and must have an influence on the decision. In the case of adverse impacts, substantial mitigation will be required.
Medium	Medium +	These beneficial or adverse impacts may be important but are not likely to be key decision-making factors. In the case of adverse impacts, mitigation will be required.
Low	Low +	These beneficial or adverse impacts are unlikely to have a real influence on the decision. In the case of adverse impacts, limited mitigation is likely to be required.
Very Low	Very Low +	These beneficial or adverse impacts will not have an influence on the decision. In the case of adverse impacts, mitigation is not required.
Insignificant		Inconsequential, not requiring any consideration.

ADDITIONAL ASSESSMENT CRITERIA

- Additional criteria that are taken into consideration in the impact assessment process to further describe the impact and support the interpretation of significance in the impact assessment process include:
- the degree to which impacts may cause irreplaceable loss of resources;
- the degree to which impacts can be avoided;
- the degree to which impacts can be reversed;
- the degree to which the impacts can be mitigated; and
- the extent to which cumulative impacts may arise from interaction or combination from other planned activities or projects is tabulated below.

Table E5: Additional Assessment Criteria.

ADDITIONAL ASSESSMENT CRITERIA		
Criteria for DEGREE TO WHICH AN IMPACT CAN BE REVERSED	**IRREVERSIBLE**	Where the impact cannot be reversed and is permanent.
	PARTIALLY REVERSIBLE	Where the impact can be partially reversed and is temporary.
	FULLY REVERSIBLE	Where the impact can be completely reversed.
Criteria for DEGREE OF IRREPLACEABLE RESOURCE LOSS	**NONE**	Will not cause irreplaceable loss.
	LOW	Where the activity results in a marginal effect on an irreplaceable resource.
	MEDIUM	Where an impact results in a moderate loss, fragmentation or damage to an irreplaceable receptor or resource.
	HIGH	Where the activity results in an extensive or high proportion of loss, fragmentation or damage to an irreplaceable receptor or resource.
Criteria for DEGREE TO WHICH IMPACT CAN BE AVOIDED	**NONE**	Impact cannot be avoided, and consideration should be given to compensation and offsets.
	LOW	Impact cannot be avoided but can be mitigated to acceptable levels through rehabilitation and restoration.
	MEDIUM	Impact cannot be avoided, but the significance can be reduced through mitigation measures.
	HIGH	Impact can be avoided through the implementation of preventative mitigation measures.
Criteria for the DEGREE TO WHICH IMPACT CAN BE MITIGATED	**NONE**	No mitigation is possible or mitigation even if applied would not change the impact.
	LOW	Some mitigation is possible but will have marginal effect in reducing the impact significance rating.
	MEDIUM	Mitigation is feasible and will may reduce the impact significance rating.
	HIGH	Mitigation can be easily applied or is considered standard operating practice for the activity and will reduce the impact significance rating.
Criteria for POTENTIAL FOR CUMULATIVE IMPACTS	**UNLIKELY**	Low likelihood of cumulative impacts arising.
	POSSIBLE	Cumulative impacts with other activities or projects may arise.
	LIKELY	Cumulative impacts with other activities or projects either through interaction or in combination can be expected.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[8] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation, or compensation.
- Desired outcomes are defined and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[8] Mitigation measures should address both positive and negative impacts.

APPENDIX D: Species Observation List

Table D1: Avifaunal species list

Genus Common Name	Species Common Name	Genus (Scientific)	Species (Scientific)	2430_300 Record	Neighbouring Pentad Record	Regional Threat Status	Endemicity	Recorded on Site December 2022
Egret	Western Cattle	*Bubulcus*	*ibis*	Y				
Falcon	Lanner	*Falco*	*biarmicus*	Y	Y	VU		
Kite	Black	*Milvus*	*migrans*	Y				
Kite	Yellow-billed	*Milvus*	*aegyptius*	Y				
Eagle	Wahlberg's	*Hieraaetus*	*wahlbergi*	Y				
Buzzard	Jackal	*Buteo*	*rufofuscus*	Y				
Francolin	Crested	*Dendroperdix*	*sephaena*					Y
Francolin	Orange River	*Scleroptila*	*gutturalis*	Y				
Spurfowl	Natal	*Pternistis*	*natalensis*	Y			NE	
Spurfowl	Swainson's	*Pternistis*	*swainsonii*	Y				Y
Guineafowl	Helmeted	*Numida*	*meleagris*	Y				Y
Pigeon	Speckled	*Columba*	*guinea*	Y				
Dove	Red-eyed	*Streptopelia*	*semitorquata*	Y				
Dove	Cape Turtle	*Streptopelia*	*capicola*	Y				
Dove	Laughing	*Spilopelia*	*senegalensis*	Y				Y
Dove	Namaqua	*Oena*	*capensis*	Y				Y
Dove	Emerald-spotted Wood	*Turtur*	*chalcospilos*	Y				
Go-away-bird	Grey	*Crinifer*	*concolor*	Y				
Cuckoo	Great Spotted	*Clamator*	*glandarius*	Y				Y
Cuckoo	Klaas's	*Chrysococcyx*	*klaas*	Y				Y
Cuckoo	Diederik	*Chrysococcyx*	*caprius*	Y				Y

Genus Common Name	Species Common Name	Genus (Scientific)	Species (Scientific)	2430_300 Record	Neighbouring Pentad Record	Regional Threat Status	Endemicity	Recorded on Site December 2022
Swift	Horus	*Apus*	*horus*	Y				
Swift	Little	*Apus*	*affinis*	Y				Y
Mousebird	Speckled	*Colius*	*striatus*	Y				Y
Mousebird	Red-faced	*Urocolius*	*indicus*	Y				
Kingfisher	Brown-hooded	*Halcyon*	*albiventris*	Y				
Bee-eater	Little	*Merops*	*pusillus*	Y				Y
Barbet	Black-collared	*Lybius*	*torquatus*	Y				
Barbet	Acacia Pied	*Tricholaema*	*leucomelas*	Y			NE	Y
Barbet	Crested	*Trachyphonus*	*vaillantii*	Y				
Lark	Sabota	*Calendulauda*	*sabota*	Y				Y
Swallow	Barn	*Hirundo*	*rustica*	Y				Y
Swallow	Greater Striped	*Cecropis*	*cucullata*	Y				
Swallow	Lesser Striped	*Cecropis*	*abyssinica*	Y				Y
Martin	Rock	*Ptyonoprogne*	*fuligula*	Y				
Crow	Pied	*Corvus*	*albus*	Y				Y
Raven	White-necked	*Corvus*	*albicollis*	Y				
Bulbul	Dark-capped	*Pycnonotus*	*tricolor*	Y				
Greenbul	Sombre	*Andropadus*	*importunus*	Y				
Chat	Familiar	*Oenanthe*	*familiaris*					Y
Robin-Chat	White-throated	*Cossypha*	*humeralis*	Y			EN	Y
Scrub Robin	Kalahari	*Cercotrichas*	*paena*	Y			NE	Y
Scrub Robin	White-browed	*Cercotrichas*	*leucophrys*	Y				Y
Eremomela	Yellow-bellied	*Eremomela*	*icteropygialis*	Y				Y
Crombec	Long-billed	*Sylvietta*	*rufescens*	Y				
Apalis	Bar-throated	*Apalis*	*thoracica*	Y				Y
Cisticola	Rattling	*Cisticola*	*chiniana*	Y				Y

Genus Common Name	Species Common Name	Genus (Scientific)	Species (Scientific)	2430_300 Record	Neighbouring Pentad Record	Regional Threat Status	Endemicity	Recorded on Site December 2022
Cisticola	Lazy	*Cisticola*	*aberrans*	Y				
Prinia	Tawny-flanked	*Prinia*	*subflava*	Y				
Prinia	Black-chested	*Prinia*	*flavicans*	Y				Y
Flycatcher	Spotted	*Muscicapa*	*striata*	Y				
Warbler	Chestnut-vented	*Curruca*	*subcoerulea*	Y				Y
Flycatcher	Marico	*Melaenornis*	*mariquensis*	Y			NE	Y
Batis	Chinspot	*Batis*	*molitor*	Y				Y
Wagtail	Cape	*Motacilla*	*capensis*	Y				
Shrike	Lesser Grey	*Lanius*	*minor*	Y				
Fiscal	Southern	*Lanius*	*collaris*	Y				Y
Shrike	Red-backed	*Lanius*	*collurio*	Y				Y
Boubou	Southern	*Laniarius*	*ferrugineus*	Y			EN	Y
Puffback	Black-backed	*Dryoscopus*	*cubla*	Y				
Tchagra	Brown-crowned	*Tchagra*	*australis*	Y				Y
Tchagra	Black-crowned	*Tchagra*	*senegalus*	Y				
Myna	Common	*Acridotheres*	*tristis*	Y				Y
Starling	Violet-backed	*Cinnyricinclus*	*leucogaster*	Y				
Starling	Cape	*Lamprotornis*	*nitens*	Y				
Starling	Red-winged	*Onychognathus*	*morio*	Y				
Sunbird	Southern Double-collared	*Cinnyris*	*chalybeus*	Y				
Sunbird	White-bellied	*Cinnyris*	*talatala*	Y				Y
Sunbird	Amethyst	*Chalcomitra*	*Amethystina*	Y				Y
White-eye	Cape	*Zosterops*	*virens*	Y			EN	
Sparrow-Weaver	White-browed	*Plocepasser*	*mahali*	Y				Y
Sparrow	House	*Passer*	*domesticus*	Y				Y

Genus Common Name	Species Common Name	Genus (Scientific)	Species (Scientific)	2430_300 Record	Neighbouring Pentad Record	Regional Threat Status	Endemicity	Recorded on Site December 2022
Sparrow	Great	*Passer*	*motitensis*	Y			NE	
Sparrow	Cape	*Passer*	*melanurus*	Y			NE	Y
Weaver	Scaly-feathered	*Sporopipes*	*squamifrons*	Y				Y
Sparrow	Southern Grey-headed	*Passer*	*diffusus*	Y				
Masked-weaver	Lesser	*Ploceus*	*intermedius*	Y				Y
Weaver	Southern Masked	*Ploceus*	*velatus*	Y				Y
Widowbird	White-winged	*Euplectes*	*albonotatus*	Y				
Mannikin	Bronze	*Spermestes*	*cucullata*	Y				
Pytilia	Green-winged	*Pytilia*	*melba*	Y				Y
Waxbill	Blue	*Uraeginthus*	*angolensis*	Y				Y
Waxbill	Violet-eared	*Granatina*	*granatina*	Y			NE	Y
Waxbill	Common	*Estrilda*	*astrild*	Y				
	Quailfinch	*Ortygospiza*	*atricollis*	Y				
Indigobird	Dusky	*Vidua*	*Purpurascens*	Y				
Indigobird	Village	*Vidua*	*chalybeata*	Y				
Whydah	Long-tailed Paradise	*Vidua*	*paradisaea*	Y				
Canary	Yellow-fronted	*Crithagra*	*mozambica*	Y				
Canary	Black-throated	*Crithagra*	*atrogularis*	Y				
Canary	Brimstone	*Crithagra*	*sulphurata*	Y			NE	Y
Bunting	Cinnamon-breasted	*Emberiza*	*tahapisi*	Y				
Bunting	Golden-breasted	*Emberiza*	*flaviventris*	Y				

EN = Endemic. NE = Near Endemic
VU = Vulnerable

APPENDIX E: Declaration and Specialists CV's

1. (a) (i) Details of the specialist who prepared the report

Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Paul da Cruz	BA(Hons) Geography and Environmental Studies (University of the Witwatersrand)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Chris Hooton		
Postal address:	29 Arterial rd. West, Oriel Bedfordview		
Postal code:	2007	Fax:	086 724 3132
Telephone:	011 616 7893		
E-mail:	chris@sasenvgroup.co.za		
Qualifications	BTech Nature Conservation (Tshwane University of Technology) National Diploma Nature Conservation (Tshwane University of Technology)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Paul da Cruz		
Postal address:	29 Arterial rd. West, Oriel Bedfordview		
Postal code:	2007	Fax:	086 724 3132
Telephone:	011 616 7893		
E-mail:	paul@sasenvgroup.co.za		
Qualifications	BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand) BA (Geography) (University of the Witwatersrand)		
Registration / Associations	Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP) Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA) Member of the South African Wetland Society (SAWS)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Fax:	011 615 6240/ 086 724 3132
Telephone:	011 616 7893		
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Paul da Cruz, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

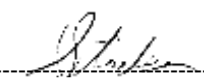
I, Christopher Hooton, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.

Specialist Signature

I, Stephen van Staden, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone, Zambia

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF PAUL DA CRUZ

PERSONAL DETAILS

Position in Company	Senior Ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP)
Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)	1998
BA (Geography) (University of the Witwatersrand)	1997

Short Courses

Taxonomy of Wetland Plants (Water Research Commission)	2017
Advanced Grass Identification (Frits van Outshoorn)	2010
Grass Identification (Frits van Outshoorn),	2009
Soil Form Classification and Wetland Delineation; (TerraSoil Science)	2008

AREAS OF WORK EXPERIENCE

South Africa – All Provinces. **Southern Africa** – Lesotho, Botswana

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy (Wind and solar)
2. Linear developments (energy transmission, telecommunication, pipelines, roads, border infrastructure)
3. Nature Conservation and Ecotourism Development
4. Commercial development
5. Residential development
6. Environmental and Development Planning and Strategic Assessment
7. Industrial/chemical; Non-renewable power Generation

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- EIA / BA Applications & Environmental Authorisation Amendments
- EMPr Compilation
- Environmental Compliance Monitoring (Environmental Auditing)
- Environmental Screening Assessments and Listing Notice 3 Trigger Identification / Mapping
- Strategic Environmental Assessments and Environmental Management Frameworks
- EIA / Specialist Study Peer Review

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Assessments in support of Environmental Screening Assessments, Precinct Planning & SEA
- Wetland Construction (Compliance) Monitoring

Biodiversity Assessments

- Avifaunal Assessments and Strategic Biodiversity Assessment

Visual Impact Assessment

- Visual Impact Assessments

GIS / Spatial Analysis

- GIS Spatial Analysis and Listing Notice 3 mapping.

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments