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TERRESTRIAL BIODIVERSITY EIA ASSESSMENT FOR THE

PROPOSED NEO 1 20MW SOLAR PV PLANT

THAT WILL BE SITUATED IN THE MAFETNG DISTRICT OF THE KINGDOM OF LESOTHO

- BOTANICAL ASSESMENT
- AVIFAUNAL ASSESMENT
- FAUNAL ASSESMENT

B E C

Bathusi Environmental Consulting

In collaboration with

Ecocheck Environmental Services cc
(Faunal Assessment)

Pachnoda Consulting cc
(Avifaunal Assessment)

this report was produced for

Royal HaskoningDHV
Enhancing Society Together

SECTION A – ADMINISTRATION, PROJECT DETAILS & INTRODUCTORY COMMENTS

This report is compartmentalised as follows:

Section A	Report navigation, project introduction and details, administrative aspects and specialist executive summaries;
Section B	Broad descriptions of the biophysical environment and background to the macro-ecological attributes;
Section C	Botanical aspects of the receiving environment, impact assessment, management and monitoring recommendations;
Section D	Mammalian, invertebrate & herpetofaunal aspects of the receiving environment, impact assessment, management and monitoring recommendations; and
Section E	Avifaunal aspects of the receiving environment, impact assessment, management and monitoring recommendations.

REPORT NAVIGATION

LIST OF FIGURES

LIST OF TABLES

1 PROJECT DETAILS

Relevant Project Details	
Client:	Royal HaskoningDHV
Report Name:	Terrestrial Biodiversity EIA Assessment for the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho
Report Type:	Biodiversity Impact Assessment Report
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Report Author:	Riaan A. J. Robbeson (Pr.Sci.Nat.) (Bathusi Environmental Consulting cc)

2 ROYAL HASKONINGDHV CONTACT MINUTIAE

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3 REPORT CITATION

When used as a reference, or included as an addendum, this report should be cited as:

Bathusi Environmental Consulting cc (2019). Terrestrial Biodiversity Scoping Assessment for the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. Reference Number RHD – NPV – 2018/26, Version 2019.11.01.07.

4 CONTRIBUTING SPECIALISTS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg. 14).

Table 2: Biodiversity specialists for this project	
Botanical Specialist:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*
Faunal Specialist:	**Dewald Kamffer (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Conservation Biology), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	*400204/05*
Avifaunal Specialist:	**Lukas Niemand (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Restoration Ecology), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	*400095/06*

5 EXECUTIVE SUMMARIES

The Lesotho Government, under the Ministry of Energy and Meteorology (MEM), has engaged NEO 1 Consortium to implement the NEO 1 20 MW Solar Photovoltaic Power (PV) Generation Development Project. Generated power will be sold to Lesotho Electric Corporation (LEC) for transmission and distribution through a proximate grid connection. The proposed site will comprise approximately 66 ha and is situated approximately 2.5 km southwest from Sepechele, geographically situated inbetween the Ha Ramarothole, Ha Lempetje and Ha Raliemere villages of the Mafeteng District of the Kingdom of Lesotho.

Royal HaskoningDHV was appointed as the Environmental Assessment Practitioners (EAP) to compile the ESIA for the proposed 20 MW Solar PV Plant. The ESIA comprised of the Scoping Study[1], this Impact Assessment and Environmental and Social Management Plan as well as Public and Stakeholder Consultation. Bathusi Environmental Consulting (BEC) was appointed by Royal HaskoningDHV to provide insight into the biological disciplines, including terrestrial vegetation, fauna and avifauna as part of the Environmental Impact Assessment phase. A suitable site investigation was conducted during October 2018.

To evaluate the cumulative impact on the biological receiving environment, the inclusive assessment of future, nearby developments were also considered. Specifically, the biodiversity report compiled for the 70 MW Ha-Ramarothole Solar Project[2], was included in the assessment of cumulative impacts.

BOTANICAL ASSESSMENT

The study area corresponds to the Grassland Biome, notably the Mesic Highveld Grassland, comprising a macro-ecological type known as the Eastern Free State Sandy Grasslands, as defined by Mucina & Rutherford (2006). With a conservation status set at Endangered, all reasonably representative portions of natural grassland would be perceived as being important for conservation purposes on a local and regional scale. However, as per the IFC PF6 definitions, habitat within the proposed development footprint is regarded "Modified".

The following key observations resulted from the floristic assessment:

⇒ Consultation of the SANBI database accounts for the presence of only 187 plant species within the corresponding ¼-degree grid (2927CD), reflecting a poor knowledge of the floristic diversity of the region in general;

⇒ The SANBI information source also indicates the **absence** of conservation important taxa from the regional, again reflecting on the high paucity of accurate and comprehensive scientific botanical data on a regional scale, rather than a true lack of plants of conservation importance from the region, notwithstanding the generally poor ecological status of much of the remaining natural grasslands;

⇒ The site investigation revealed a presence of approximately 81 plant species, reflecting a poor floristic composition caused by severe and long-term anthropogenic transformative impacts, notably from historic agricultural practices and persistent and high grazing pressure;

⇒ Although the total of 81 plant species equates to approximately 43 % of the regional diversity, there is only an approximate 8.0 % overlap in the species composition (*sensu lato*), reflecting a poor representation of the regional ecological type;

[1] *Bathusi Environmental Consulting cc (2018). Terrestrial Biodiversity Scoping Assessment for the proposed NEO 1 20 MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. Reference Number RHD – NPV – 2018/25, Version 2019.07.25.26.05.*

[2] *70 MW Ha-Ramarothole Solar Project: Environmental and Social Impact Assessment (ESIA). Mafube Consulting (Pty) Limited*

⇒ Persistence of conservation important plants within the study site is regarded highly unlikely as all habitat was found to be severely deteriorated from long-term historic and persistent agricultural efforts and severe grazing practices;

⇒ A review of aerial imagery and results obtained from a basic botanical appraisal of the site and immediate surrounds, indicated the following habitat types to be present:

- *Cynodon dactylon – Gazania krebsiana* Erosion Gulleys (low floristic sensitivity);
- *Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs (medium-high floristic sensitivity);
- *Moraea pallida– Wahlenbergia* cf. *dieterlenii* Agricultural Fields (low floristic sensitivity); and
- *Pentameris ariodes – Trifolium burchellianum* Drainage Lines and Seeps (medium-high floristic sensitivity);

A review of the proposed site alternatives indicated that none of the four alternatives exhibit highly sensitive floristic attributes as all the variants are spatially situated on deteriorated habitat types, notably agricultural fields. The spatial proximity to other sensitive habitat types, however, does indicate a slight preference for Option 1 as other options do coincide marginally with sensitive habitat types, including wetlands and ridge environs. Despite this slight preference for Option 1, floristic sensitivity is not regarded a likely driver for the selection process of the most preferable option between the proposed alternatives. In terms of the floristic receiving environment, Option 1 is therefore regarded as a suitable development footprint for the proposed development.

An appraisal of likely and potential impacts revealed the following:

⇒ Direct Impacts – No natural grassland vegetation remains on the site, also with reference to conservation important plants and associated habitat. Any expectation of significant direct impacts on natural and sensitive flora is therefore unrealistic. A moderately biodiversity sensitivity is ascribed to wetland habitat situated within the site and construction activities could potentially result in some adverse impacts within these environs. However, the wetland ecological report has indicated the potential of incorporating some infrastructure across these features, provided the application of a suitable mitigation approach. The entire exclusion of these areas is not advocated as the implementation of selected protective buffers and effective management of these areas during the construction and operational phases are expected to ameliorate the significance of direct impacts within these sensitive environs to an acceptable level. Other sensitive environs, including topographically heterogeneous habitat such as cliffs, outcrops, ledges and surface rocks, are unlikely to be subjected to direct impacts as these areas are located outside the proposed development footprint.

⇒ Indirect Impacts – Moderately significant indirect impacts are expected to result from the proposed development. Areas that exhibit either sensitive floristic habitat (ridges, ledges, cliffs, etc.) or habitat that comprise important ecosystem services and functions (drainage lines, grassland seepages, etc.) area located in the direct vicinity of the proposed development footprint are. The need to conserve and protect these habitat types from inadvertent and indirect impacts from the development is demonstrated by the near-absence of pristine and natural habitat types on a local and regional scale.

⇒ Cumulative Impacts – The expected significance of cumulative impacts ensuing from the development are of moderate significance, mainly because of the absence of expansive areas of natural, and highly sensitive areas in the direct proximity to the site. The assessment of cumulative impacts within the botanical receiving environment took into consideration the proposed development of the neighbouring 70 MW Ha-Ramarothole Solar Project. Expected cumulative impacts are not regarded particularly significant within a larger region where significant and historic anthropogenic impacts are already rife and severe, exhibiting signs of significant deterioration and decimation of the original grassland habitat. The contribution of this project on a local and regional scale, in relation to nearby developments, will unlikely result in significant exacerbation of existing and anticipated cumulative impacts.

The botanical receiving environment of the site and immediate surrounds demonstrates classic attributes of severely deteriorated and modified habitat, as defined by the IFC Performance Standard 6. Historic, long-term subsistence agricultural practices and persistent, inappropriate and high grazing pressure have decimated and transformed natural vegetation within the development footprint (and surrounds), leading to the establishment of a secondary climax vegetation and several other successional/ seral vegetatal stages that does not exhibit any characteristics of the original natural grasslands of the Sandy Eastern Free State Sandy Grasslands ecological type. Limited habitat were recognised as being moderately important in terms of the provision of ecological services, notably the wetlands towards the east of the footprint.

As could be expected, an evaluation of potential and likely impacts on the floristic receiving environment did not demonstrate any significant impacts; the significance are generally expected to range between low and moderate. The comprehensive and timeous implementation of the recommended botanical mitigation strategy is expected to ameliorate the significance of impacts to an acceptable level.

It is therefore the considered opinion of the specialist that the proposed development and operation of the NEO 1 PV Project is not expected to result in significant or severe impacts on the floristic environment on a local or regional scale; with the understanding that a complete and comprehensive mitigation approach is followed for the duration of the project, i.e. through completion of the decommissioning phase and restoration of all development areas. No significant losses of sensitive floristic attributes are expected, and the conservation status of the regional ecological types and plants are not likely to be affected adversely by the proposed development.

FAUNAL ASSESSMENT

To establish the faunal attributes and inherent sensitivity of the receiving environment, a suitable faunal assessment of the site and immediate surrounds were conducted during October 2018 through the use of ecological indicators such as tracks, dung, diggings, nests and calls and *ad hoc* observations. A total of only nineteen animal species (excluding avifauna) were recorded in the study area, including the following groups:

⇒ Four dragonflies;
⇒ three butterflies
⇒ two frogs;
⇒ five reptiles; and
⇒ three mammals.

Plant communities that were described for the study area are regarded adequately representative of the macro faunal habitat types, including:

⇒ *Cynodon dactylon – Gazania krebsiana* Erosion Gulleys (low faunal sensitivity);
⇒ *Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs (medium-high faunal sensitivity);
⇒ *Moraea pallida– Wahlenbergia* cf. *dieterlenii* Agricultural Fields (low faunal sensitivity); and
⇒ *Pentameris ariodes – Trifolium burchellianum* Drainage Lines and Seeps (medium-high faunal sensitivity).

Faunal characteristics of the four site alternatives are regarded highly similar and any significant variation in terms of faunal attributes are regarded highly unlikely. Any of the proposed site alternatives would be regarded suitable for the proposed development and no significant differences between the four site alternatives could be reasonably established. Anticipated impact significance on the faunal receiving environment will unlikely vary significantly between the site variants. Consequently, the desktop investigation, field investigation, data analyses, results, discussion and impact assessment as well as the mitigation measures proposed considered the four sites as one larger study area. Option 1 is

regarded a suitable development footprint, with generally low expected impact significance on the faunal receiving environment.

Based on the results and analyses of the literature study and field investigation of October 2018, the following key conclusions pertaining to the faunal attributes and inherent sensitivity of the receiving environment are presented:

⇒ The plant communities described for the study area are representative of the macro faunal habitat types;

⇒ No red data listed animals or any other animals of conservation concern were encountered during the field investigation; none are known to occur in the Q-grid 2927CD in which the study area is found;

⇒ The animals found to inhabit the study area and immediate surrounds are common and widespread species and not currently considered to be of any direct (species level) conservation importance;

⇒ Erosion gullies and agricultural fields of the study area exhibit low faunal sensitivities and the rocky ledges & cliffs and drainage lines and seeps exhibit medium-high faunal sensitivities;

⇒ Three direct, three indirect and two cumulative impacts associated with the proposed project are anticipated to have relevance to the faunal communities of the study area and surrounds, albeit at relative low significance levels;

⇒ All of the anticipated impacts can be effectively mitigated, reducing those with moderate, moderate-high and high significances to impacts with low significances;

⇒ The assessment of cumulative impacts within the faunal receiving environment took into consideration the proposed development of the neighbouring 70MW Ha-Ramarothole Solar Project. Expected and anticipated cumulative impacts will unlikely be exacerbated to significant impact levels as the existing impact levels within the faunal receiving environment (without considering any development activities) are already severe;

⇒ A comprehensive, annual faunal monitoring program will ensure that any changes to the faunal communities will be identified and managed with additional mitigation and management measures; and

⇒ The objectives of Performance Standards 1 and 6 of the IFC that has relevance to the conservation and protection of the fauna of the region were considered and has been satisfied by the faunal assessment.

AVIFAUNAL ASSESSMENT

Objectives of the avifaunal assessment included the description of the avifauna associations in the project area according to (a) species composition and richness prior to construction activities; (b) to provide an inventory of bird species occurring in the project area; (c) provide an impact assessment; and (d) provide an indication on the occurrence of species of concern (e.g. threatened and near threatened species).

Four broad avifaunal habitat types were identified within the proposed development footprint and immediate surrounds, ranging from agricultural fields, drainage lines and seeps, erosion gulley's to localised rocky ledges and cliffs (the latter was located adjacent to the site). Approximately 109 bird species were expected to occur, of which 51 species were observed during the early part of October 2018. This observed species richness highlights the perturbated condition and early seral stages of the dominant habitat types on the study site. However, the poor observed bird richness in the area was also contributed to the fact that the avifauna on the western part of Lesotho was poorly known and insufficiently sampled.

The observed composition included four Red listed species, namely the globally vulnerable Southern Bald Ibis (*Geronticus calvus*), the globally near threatened Blue Korhaan (*Eupodotis caerulescens*), the globally near threatened African Rock Pipit (*Anthus crenatus*) and the globally near threatened Ground Woodpecker (*Geocolaptes olivaceus*). The African Rock Pipit and Ground Woodpecker were restricted to the rocky ledges and cliffs, while the Blue Korhaan and Southern Bald Ibis were recorded on the agricultural fields and secondary grasslands in the vicinity of the study area. The two latter species occurred in low densities in the area although being widespread.

A review of the proposed four site alternatives indicate the spatial location on disturbed or degraded land; none of the four sites is therefore regarded as being either fatally flawed or highly preferable. Option 1 is probably the most suitable site when considering the spatial placement in relation to ridges and drainage lines. In comparison with the other options, Option 1 does not overlap significantly with any habitat that is considered to be of high avifaunal sensitivity, whereby the other options are either do coincide marginally with ridge habitat and /or drainage lines, or are situated in close proximity to such habitat types. Therefore, the predicted significance of impacts such as collision trauma, is likely to be slightly lower at Option 1 when compared to the other Options.

The main potential impacts associated with the proposed PV solar facility were identified as the following:

⇒ Loss of habitat and subsequent displacement of bird species due to the ecological footprint required during construction.

⇒ Direct interaction (collision trauma) by birds with the surface infrastructure (photovoltaic panels) caused by polarised light pollution and/or waterbirds colliding with the panels (as they are mistaken for waterbodies).

⇒ Collision with associated infrastructure (mainly overhead powerlines and reticulation).

The assessment of cumulative impacts within the avifaunal receiving environment took into consideration the proposed development of the neighbouring 70MW Ha-Ramarothole Solar Project. An evaluation of potential and likely impacts on the avifauna revealed that the expected impact significance was generally low to moderate, with the exception of the potential for birds to collide with the panels and associated powerlines. In the absence of sufficient information on the occurrence and densities of waterbirds, the impact related to collision trauma was regarded as high (without mitigation) unless supporting evidence is acquired by means of a follow-up survey during the peak wet season.

A comprehensive mitigation approach was recommended along with pre- and post-construction monitoring actions to confirm/ amend the mitigation approach and the EMPr for the development.

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7 INDEMNITY & LIMITATIONS OF THIS REPORT

⇒ Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as the interpretation of information available to them at the time of compiling this report.

⇒ Due care and diligence is exercised by the authors, consultants and/or specialist investigators in rendering services and preparing this document. BEC, the consultants and/or specialist investigators accepts no liability for conclusions, suggestions, limitations and recommendations made in good faith, based on available information, or based on data that was obtained from surveys of a brief nature.

⇒ The client, by accepting this document, indemnifies BEC, its members, consultants and/or specialist investigators against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from, or in connection with, services rendered, directly or indirectly by BEC and by the use of the information contained in this document.

⇒ Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area.

⇒ To obtain a comprehensive understanding of the dynamics of ecological associations in an area, as well as the status of endemic, rare or threatened species in an area, ecological surveys should always consider investigations at different time scales (across seasons/ years) and through replication.

⇒ Notably, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.

⇒ It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

⇒ Furthermore, additional information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report, including findings and recommendations, should new information may become available from ongoing research or additional work performed in the immediate region of this specific site, or any forthcoming information pertaining to this investigation after the submission of this report.

⇒ This report should always be considered in its entirety. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.

⇒ The information as presented in this document only has reference to the investigated study site boundaries and cannot be applied to any other area without prior investigation. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

8 DECLARATION OF INDEPENDENCE

We, the undersigned, acting in the capacity as specialist biodiversity consultants, declare that:

⇒ We acted as independent specialist consultants conducting these biodiversity assessments and preparing the results and reports;

⇒ As professional and active members, we consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

⇒ Neither the respective consultants, nor Bathusi Environmental Consulting cc (BEC), are subsidiaries, legally or financially, of either Mills & Otten Environmental Consultants, or the Client;

⇒ At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than fair financial compensation for work performed in a professional capacity as specified by the 2014 National Environmental Management Act (No 107 of 1998) Regulations GNR 983 and GNR 986, as amended in 2017;

⇒ Neither the respective consultants, nor BEC, shall be affected in any manner by the outcome of the environmental process of which this report and biodiversity assessments form part of, other than being part of the general public;

⇒ We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience;

⇒ We do not have any influence over decisions made by the governing authorities;

⇒ We undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2005; and

⇒ Upon request, we shall provide the competent authority with access to all information at our disposal regarding the study/ application, whether such information is favourable to the applicant or not.

Should we consider ourselves in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.

Riaan A. J. Robbeson (Pr.Sci.Nat.)
on behalf of Bathusi Environmental Consulting cc (CK1999/052182/23)

Dewald Kamffer (Pr.Sci.Nat.)
on behalf of Ecocheck Environmental Services cc

Lukas J. Niemand (Pr.Sci.Nat.)
on behalf of Pachnoda Consulting cc

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9 PROJECT SYNOPSIS

The Lesotho Government, under the Ministry of Energy and Meteorology (MEM), has engaged Neo 1 Consortium to implement the NEO 1 20 MW Solar Photovoltaic Power (PV) Generation Development Project. Generated power will be sold to Lesotho Electric Corporation (LEC) for transmission and distribution through a proximate grid connection. Specifically, the proposed project will supply the ELC Ramathole Substation located within the Mafeteng District. Contractually, it is expected that the plant will be operational for a minimum of 15 years, however, considering the quality of construction, materials, components and ongoing maintenance, the lifespan of the project could potentially exceed 25 years.

The Project will entail construction of a Photovoltaic Power Generation Plant that will include operation of the plant and generation of solar power that will be sold to Lesotho Electricity Corporation (LEC) and maintenance of the plant for up to 25 years. Approximately 70,000 solar panels will be used in construction of the generation plant. The project will also include the following infrastructures:

⇒ Construction of a 33 kV Powerline from the PV Plant to the Ramathole substation. The exact voltage and tower position will be subjected to a final design and agreement with the Lesotho Electricity Corporation. The powerline will be approximately 1.1 km in length and with a servitude corridor of approximately 22 m (11 m on each side);
⇒ Operation and Maintenance Building;
⇒ Laydown areas;
⇒ Inverter Station (internal substation) to increase ("step-up") the voltage of the electricity for transmission into the grid;
⇒ The main site entrance road is gravel, 10 m in length and 6 m wide and will be connecting from the existing access road; and
⇒ Total area to be fenced is approximately 66 ha.

As a Corporate Social Responsibility (CSR) initiative the Project will build a standalone solar PV-battery-backup generation (LPG or Diesel) mini grid in the Raliemere community. The CSR initiative will operate as a micro-utility in the village providing modern energy access to 184 Households, 1 School and 4 Small Enterprises. The electricity will be supplied via "Pay As You Go" (PAYG) prepaid, metered 220 V AC electricity through a Lesotho Grid Code compliant distribution network at the uniform retail tariff rate set by the Lesotho Electricity and Water Authority (LEWA). The village has been informed and surveyed through a consultative process. The solar farm will sell electricity to LEC. There are existing access roads leading to the project site from the main road.

9.1 PROJECT TECHNOLOGY

The power plant will use crystalline silicon PV technology to convert sunlight into electricity. This project employs tier 1 solar PV panels mounted on single axis East to West trackers. It is anticipated that Direct Current combiners will be utilized to route power to six 4 MW Inverter blocks including a step-up transformer for a medium voltage connection to the off-takers electric grid.

9.2 PROJECT CONSTRUCTION

It is anticipated that construction will commence in the fourth quarter of 2019 however, this is dependent on finalization of negotiations with the Government of Lesotho and a Lenders due diligence process.

The site would be accessed from an existing, gravel access road. A 10 m long and 6 m wide, gravel access road would be constructed from the existing access road to the site. The existing access road would need to be graded for a length of approximately 1.3 km to ensure an acceptable surface for construction traffic. Temporary access roads will only be constructed, where necessary, and rehabilitated upon completion of construction. Solar panels will be shipped to the nearest port and transported to site via road transport (flatbed trucks) as normal loads.

It is anticipated that construction traffic will consist of approximately seven vehicles per hour, of which four will be heavy duty and three will be motor vehicles.

Approximately 200 workers will be employed during the 9-11 months construction phase and this will consist of unskilled labourers from local communities who will perform general work and imported skilled labourers. Minor levelling of the site may be needed. This would entail some cutting and filling, but most likely more filling is required than cutting. Any additional fill material required will be obtained from commercial sources. Topsoil will be removed from any cut or fill areas and replaced once levelling has taken place. The grass/low vegetation on site will not be scraped clear in order to keep dust to a minimum. Small shrubs or trees may be removed, if required.

A permanent on-site Operations and Maintenance (O&M) building will be constructed for the operation of the plant and will include rainwater harvesting tanks for domestic water usage and will be powered by the plant. All buildings will be single story. Piles will be emplaced in predrilled pilot holes for anchoring the PV array structures to the subsurface, and concrete slabs will be poured for the inverters, step up transformers and switchgear, the power house (offices and control room), the parking lot, the backup LPG generator and fuel tank and the security guard house.

Crews for the solar field will mount tracking frames onto the concrete poles and completed tracking frames will have PV panels installed with mounting brackets. Wiring between panels and the inverter will be underground.

A security gate and associated guardhouse may be placed at the entrance to site. This is aimed at preventing unauthorised vehicular access to site during both construction and operation. The site will be fenced in with chain link fence or similarly visually permeable materials. If possible, water will be sourced from an onsite borehole and stored on site in JoJo style tanks alternatively water will be trucked in from a municipal source. Approximately 150 m^3/MW (or 3,000 m^3 in total) of water is required for construction.

General and hazardous construction waste will be disposed of at an appropriate, licensed landfill facility. If there are no licenced facilities in Lesotho, then waste will be disposed of at a licenced facility in South Africa such as in Bloemfontein. Temporary holding tanks will be utilized during construction to hold wastewater and waste will be disposed of in terms of relevant legislation / regulations.

9.3 PROJECT OPERATION

The project will sell power to LEC for a period of 25 years and has the option to extend this period. Activities during operation will be limited to maintenance, occasional visits by LEC, LEWA, government personnel or visitors and minimal delivery of supplies and materials.

Project traffic during operation will consist of an average of six vehicles per day of which one will be a heavy duty and five will be motor vehicles. It is anticipated that approximately 11 people will be employed for the operational phase of the project and will maintain the facilities mechanical and electrical systems and conduct routine maintenance and repairs (technical oversight, safety compliance, maintenance, reporting, site work, cleaning and security). Periodically, as indicated by visual inspection and metered output, the solar field will be cleaned with water.

Approximately 20 m^3/year of water is required during operation. Water will be sourced from onsite borehole (if possible) or trucked in from a municipal source and stored on site in JoJo style tanks. It is proposed to build septic tanks on site for wastewater and designs will comply with relevant legislation and regulations. General and hazardous waste will be disposed of at an appropriate, licensed landfill facility. Electricity during operation would be obtained from the site or from a backup generator.

9.4 PROJECT DECOMMISSIONING

Should operations not be extended past the initial 25 years then full decommissioning will occur and the land will be returned as close as reasonably possible to its original state or better. Concrete foundations, should they be required for the panels, may be removed in totality or will be broken down such that they can be covered with topsoil and revegetated. Decommissioning is likely to be of similar duration to construction namely 9-11 months.

9.5 SITE SELECTION AND LAYOUT

The site will comprise of approximately 66 ha, the design and layout of which is presented in **Figure 1**, but also could change based on specialist input during this EIA phase. The initial site selection process entailed a screening process during which the following requirements were considered:

⇒ Availability of land with suitable physical parameters and attributes, including shape, size, etc.;
⇒ Proximity to the LEC 33/ 132 kV line and substation;
⇒ Considerations of the geographical parameters, notably a suitable grade and avoidance of southward facing slopes; and
⇒ Geographical placement in Lesotho with relatively high irradiance (in kWh per m^2 per annum).

Due to the mountainous terrain and topographical nature of Lesotho and the prevalence of high irradiance in the western lowlands, the site selection focussed on areas adjacent to the existing LEC 132 kV line and substation in the Mafeteng District. Four sites were initially identified and subjected to a robust consideration process, appraising aspects such as social interaction with the local communities, elevation gradients, soils stability and erosion, access points in proximity to local villages, schools, clinics and institutions and a proposed site layout.

Anticipated benefits and environmental enhancements of the project will include (*inter alia*):

⇒ Provision of a stable source electricity to Lesotho as protection against unstable supply from SA;
⇒ Avoiding the production and emission of approximately 45 500 tonnes of CO_2 per annum from an equivalent sized coal power generation plant;
⇒ Elimination of tillage and fertilizer application, perennial grass cover, protection against overgrazing, and peripheral reforestation will have the dual effect of 1) limiting runoff from the site as drainage from the site will

be contained at contour level and allow for infiltration, and 2) reducing soil and dust/ wind erosion and the eutrophication of waterways from fertilizer runoff.

⇒ A visual screen around the site will further limit runoff, soil and dust erosion as well as providing the local communities with a resource for sustainable harvesting of biomass and wood; and

⇒ Employment opportunities will preferentially be available to the local communities, also with reference to skills development throughout the construction and operational phases.

9.6 GEOGRAPHIC LOCATION OF THE DEVELOPMENT FOOTPRINT

The proposed site will comprise approximately 60 ha of cultivated fields that are situated between the Ha Ramarothole, Ha Lempetje and Ha Raliemere villages, within the Mafeteng District. A general GPS location for the site is S29.7991° and E27.3373°. The proposed site is situated approximately 2.5 km southwest from Sepechele, immediately north of the road between Likhoele and Sepechele. The regional location of the site alternatives is illustrated in **Figure 2**. A Google Earth image of the region is presented in **Figure 3**.

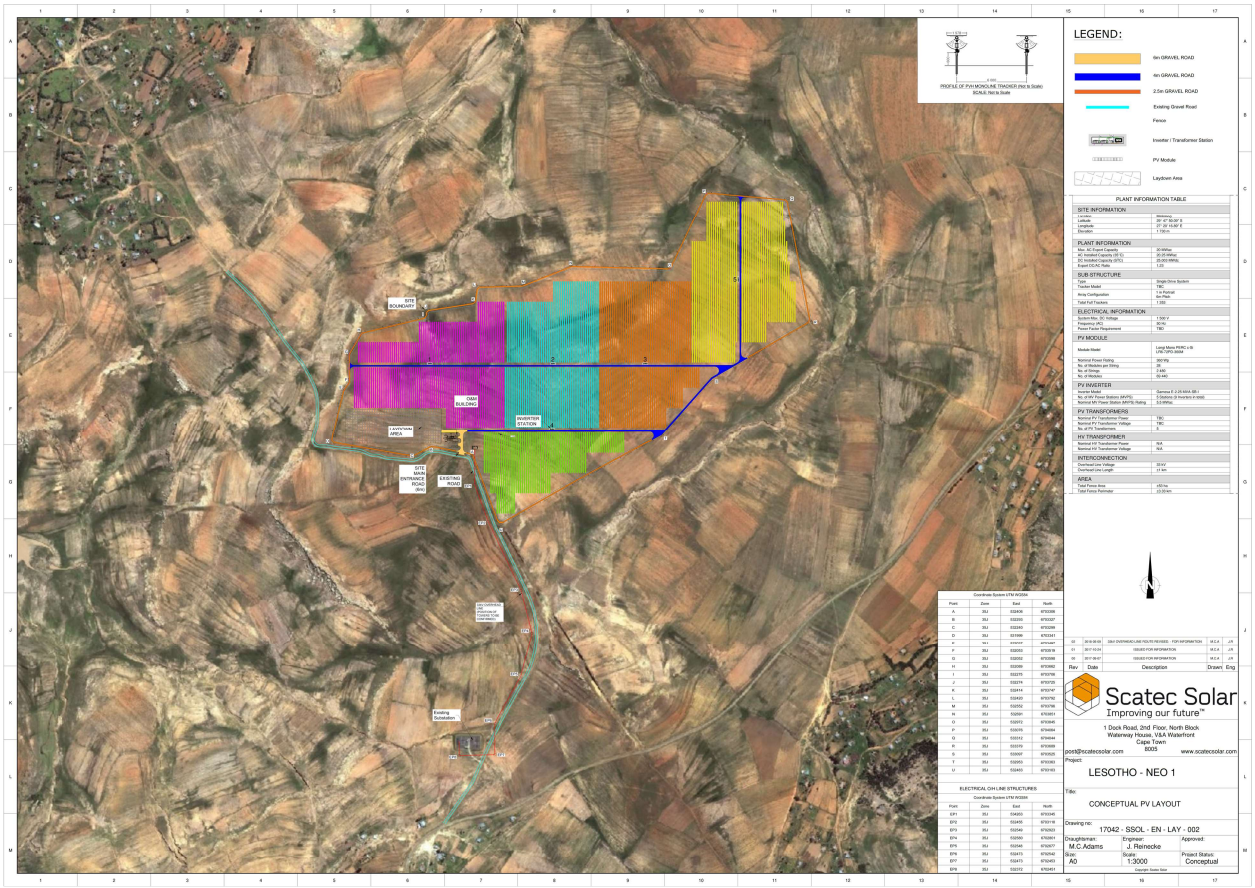

Figure 1: Illustration of the preferred site (Option 1) and project layout

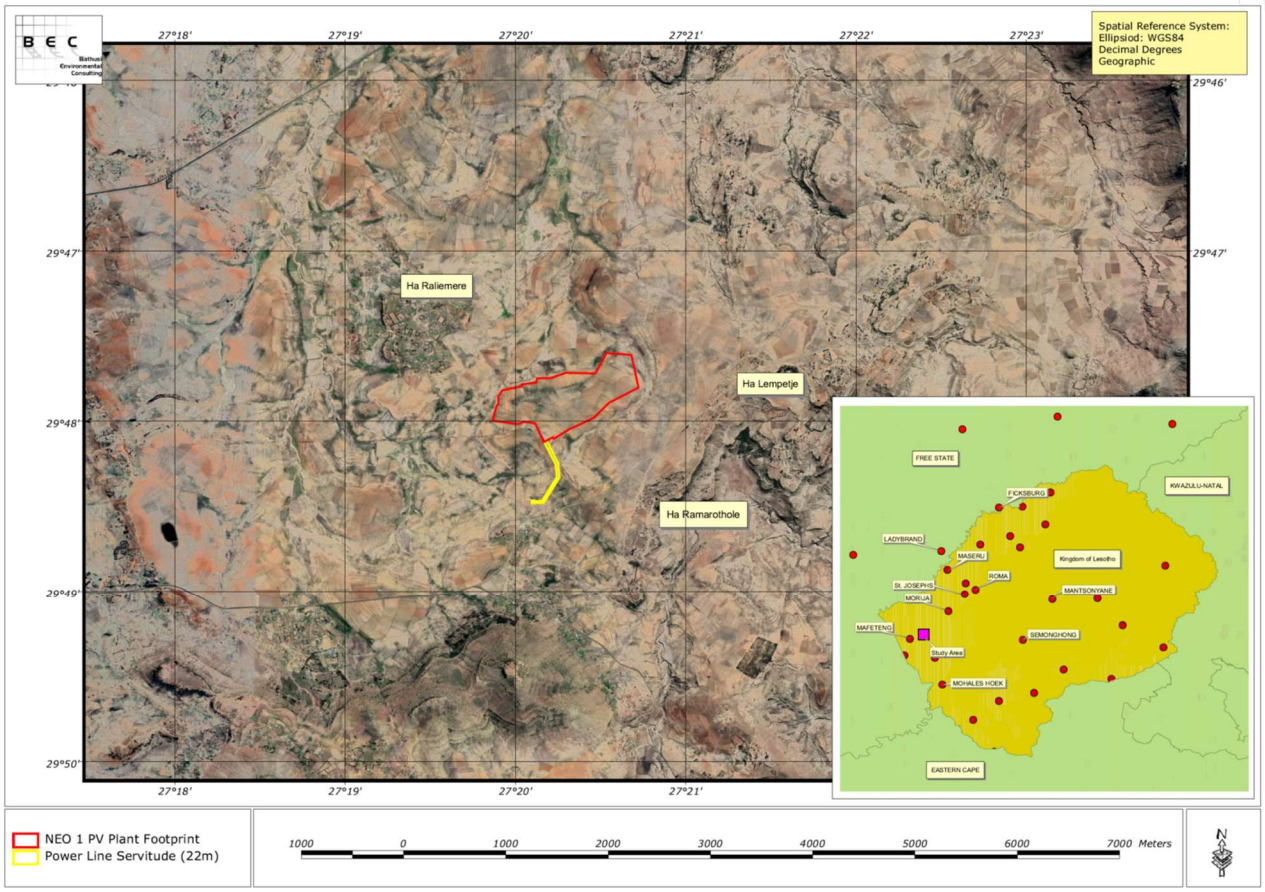

Figure 2: Regional geographic location of the proposed study site
Imagery courtesy of www.googleearth.com

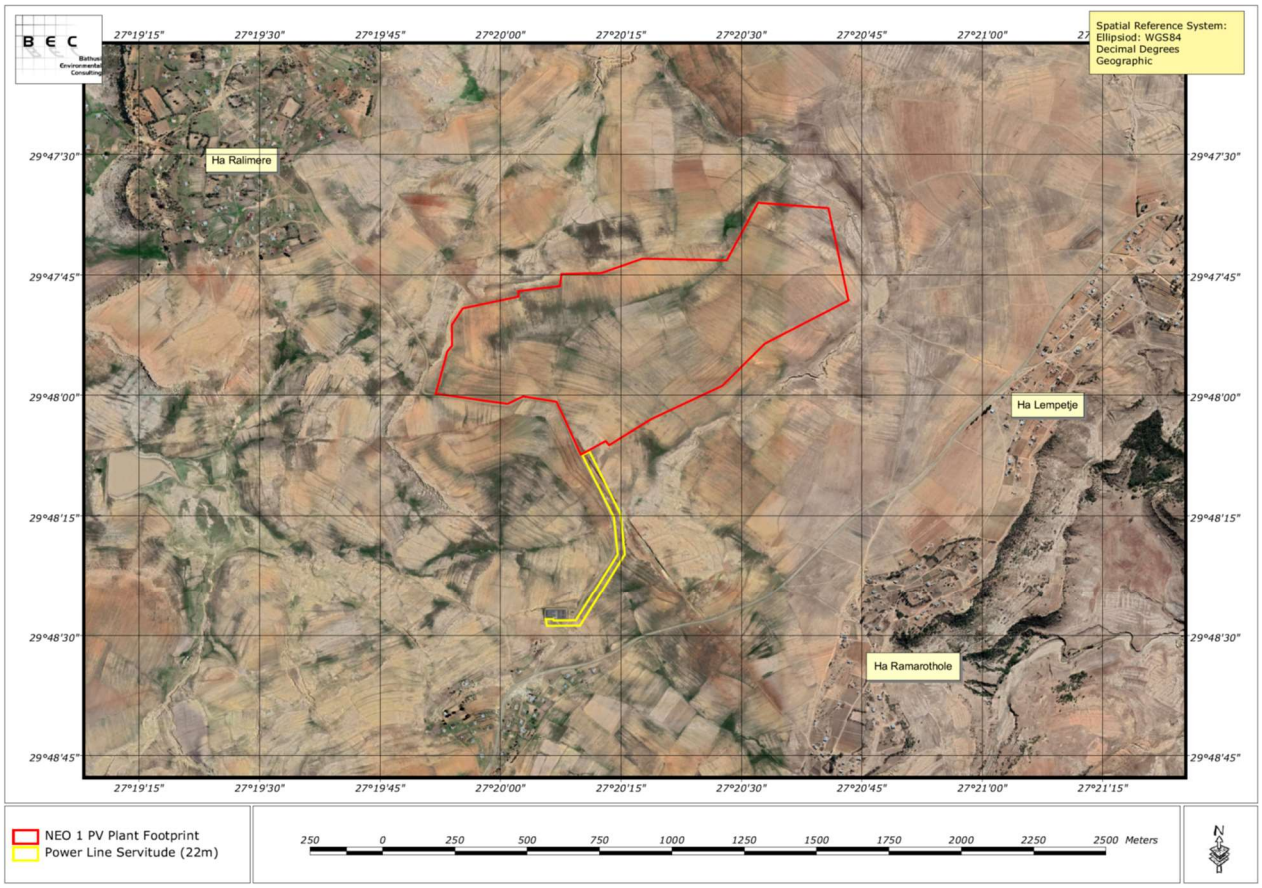

Figure 3: Aerial imagery of the immediate surrounds
Imagery courtesy of www.googleearth.com

9.7 NEIGHBOURING DEVELOPMENTS (CUMULATIVE IMPACTS)

The Government of Lesotho will also construct a 70 MW solar electricity generation facility at Ha-Ramarothole on the Mafeting District, situated immediately nearby this proposed Neo 1 PV Plant. An ESIA for the project has been carried out in accordance with the Lesotho Environmental Legislation and results are presented in the report: "*70 MW Ha-Ramarothole Solar Project: Environmental and Social Impact Assessment (ESIA) (Mafube Consulting (Pty) Limited and Citseo Consulting (Pty) Limited".*

A generalised map of the anticipated geographical extent of the footprint of the Ha-Ramarothole PV Plant development footprint, in relation to the Neo 1 PV Plant footprint, is presented in **Figure 4.**

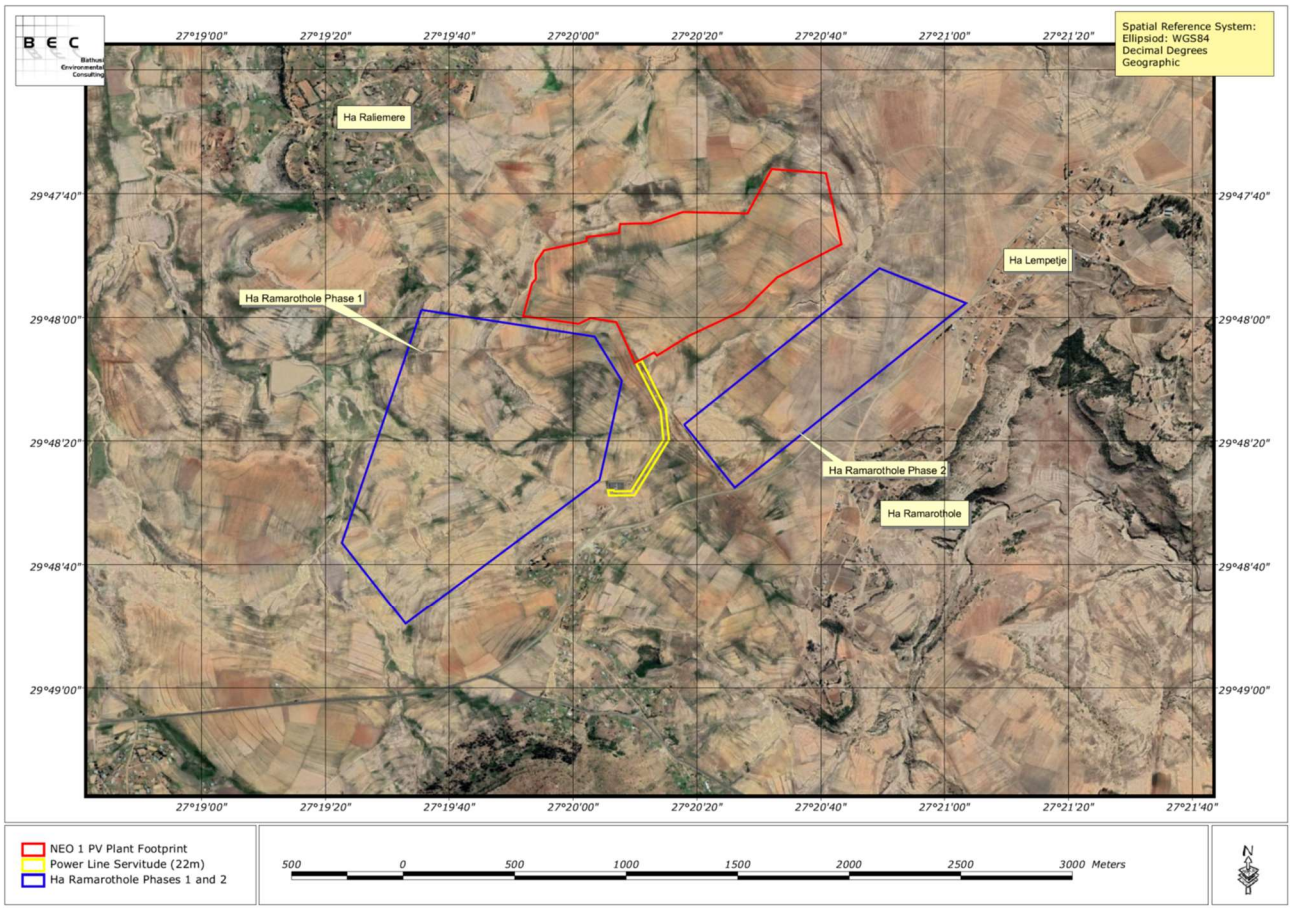

Figure 4: Schematic illustration of the proposed Ha-Ramarothole PV Plant (blue polygons) in relation to the Neo 1 PV Plant (red polygon)
Imagery courtesy of www.googleearth.com

10 ACRONYMS & ABBREVIATIONS

Table 3: Acronyms and abbreviations	
BEC	Bathusi Environmental Consulting cc
CBA	Critical Biodiversity Areas
CBD	Convention on Biological Diversity
CITES	Convention of International Trade in Endangered Species
CR	Critically Endangered
DAFF	Department of Fisheries and Forestry
DD	Data Deficient
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
End	Endemic Species
ESA	Ecological Support Areas
IBA	Important Bird Area
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
Ha/lsu	Hectares per large stock unit
LC	Least Concern
mmasl	Mean Meters Above Sea Level
NEMBA	National Environmental Management Biodiversity Act
NEnd	Near Endemic Species
NFA	National Forest Act
NT	Near Threatened
PAN	Protected Area Network
POSA	Plants of Southern Africa
Pr.Sci.Nat.	Professional Natural Scientist (registered at SACNASP)
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SEIA	Social and Environmental Impact Assessment
SSC	Species of Special Concern
TOPS	Threatened or Protected Species
VU	Vulnerable

11 GLOSSARY OF TERMS

Table 4: Glossary of Terms	
Ad hoc	Random, non-sequential, opportunistic observations
Anthropogenic	Human induced
Austral	Southern hemisphere
Avifauna	Birds
Biodiversity	Diversity among and within plant and animal species in an environment
Bovid	A mammal of the cattle family (Bovidae)
Carnivore	Flesh eating animal
Conspecific	Animals or plants belonging to the same species
Disjunct	Disjoined or distinct from one another
Diurnal	During the day
Endemic	Restricted to a certain geographic area
Granivore	Animals that eat seeds as the main part of their diet
Herbivorous	Animals that eat plants
Herpetofauna	Amphibians and Reptiles
Insectivorous	Animals that feed on insects as the main part of their diet
Lepidoptera	Butterflies
Mammal	A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young and (typically) the birth of live young
Monitoring	The collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a conservation or management objective
Passerine	Relating to or denoting birds of a large order distinguished by having feet that are adapted for perching, including all songbirds
Putative species	Species that are assumed to exist, or reputed to have existed
Red Data	A taxon included in the UICN list of threatened species
Rodent	Gnawing mammal of an order that includes rats, mice, squirrels, hamsters, porcupines, and their relatives, distinguished by strong constantly growing incisors and no canine teeth. They constitute the largest order of mammals
Solitary	Animals that spend a majority of their lives without others of their species, with possible exceptions for mating and raising their young
Subterranean	Existing, living under the earth's surface
Sympatric	Animals or plant species or populations occurring within the same or overlapping geographical areas
Territorial	The sociographical area that an animal of a particular species consistently defends against conspecifics (or, occasionally, animals of other species). Animals that defend territories in this way are referred to as territorial. Territoriality is only shown by a minority of species.
Threatened	Species (including animals, plants, fungi, etc.) that are vulnerable to endangerment in the near future. Species that are threatened are sometimes characterised by the population dynamics measure of critical dispensation, a mathematical measure of biomass related to population growth rate

12 INTRODUCTION

Biodiversity is a series of relationships in a complex web, which is also referred to as 'the web of life'. Our natural environment includes rivers, wetlands, coastlines, mountains, plains, grasslands, woodlands, forests, etc., as well as all the life on earth, such as plants, animals, reptiles, insects, and birds. South Africa is blessed with an exceptionally rich biodiversity; we have the recognition as one of the world's few 'megadiverse' countries. In addition to having an entire floral kingdom, it also includes two globally significant biodiversity 'hot spots' (the Cape and succulent Karoo regions), six Centres of Plant Diversity, two Endemic Bird Areas and the richest temperate flora in the world (Cowling, 2000).

Pressure is continually being exerted on these valuable natural resources of South Africa because of uncontrolled growth of human population. Energy consumption has increased exponentially as well as the drive to extract more economically valuable resources at ever-faster rates. Natural habitats that harbour valuable biodiversity are being lost at increasingly faster rates and over progressively wider areas, while managed lands are undergoing increasing simplification. Projections show that the extinction of species and degradation of ecosystems are likely to continue, and likely accelerate and drastic action is needed to arrest the uncontrolled extinction of species on a global scale caused by modern lifestyles. Many would argue, from spiritual and ethical points of view, that the diversity of life on Earth has intrinsic value, and that it is worth protecting for its own sake.

However, implementing 'biodiversity friendly' practices remains challenging within the entire developmental sphere, especially for smaller companies and peripheral players. This is partly because governments, while perhaps committed on paper to biodiversity, have found it difficult to create the right incentives and apply the necessary regulations in a way that could encourage all players to conserve biodiversity (ICMM, 2004). Achieving a balance while doing this requires better understanding and recognition of conservation and development imperatives by all stakeholders, including governments, business and conservation communities.

Energy is essential for sustainable development. In many countries, including South Africa, economic growth and social needs are resulting in substantially greater energy demands, even taking into account continuing and accelerated energy efficiency improvements. The need for a stable supply of energy across South Africa is one of the most hotly debated topics; from governmental institutions, industries and developers, down to the common household. Although the electricity demand:supply ration in South Africa has been stable for the recent past, government has indicated the need for new projects to prepare for future energy demands, as outlined in the country's Integrated Resource Plan (IRP). Independent Power Producers (IPP) play a crucial role in the provision of some of the energy requirements through the development and operation of power generation operations. These activities include traditional coal-fired power stations, Open Cycle Gas Turbines (OCGT) as well as hydro-electricity and pumped storage schemes, and alternative sources such as wind generation and solar power plants.

Despite the significant potential for negative impacts on biodiversity, there is a great deal that companies can do to minimize or prevent impacts on our irreplaceable natural resources. There are also many opportunities for companies to enhance biodiversity conservation within their areas of operations. Being proactive in the assessment and management of biodiversity is important not only for new operations but also for those that have been operating for many years, usually under regulatory requirements that were less focused on the protection and enhancement of biodiversity. In summary, the threats to biodiversity are compelling. Unless they are addressed in a holistic manner, which considers social and economic as well as scientific considerations, the benefits of ecosystem services will be substantially diminished for future generations. Furthermore, the next 50 years could see a further acceleration in the degradation of ecosystem services unless action is taken to reverse current trends.

13 BIODIVERSITY EIA ASSESSMENT APPROACH

Royal HaskoningDHV was appointed as the Environmental Assessment Practitioners (EAP) to conduct the ESIA for the proposed 20MW Solar PV Plant. The ESIA comprised the Scoping Study, ESIA and Environmental and Social Management Plan (of which this biodiversity Impact Assessment Report forms part of) as well as Public and Stakeholder Consultation. Bathusi Environmental Consulting (BEC) was appointed by Royal HaskoningDHV to provide insight into the biological disciplines, including vegetation, fauna and avifauna as part of the Environmental Impact Assessment phase.

A Project Brief was compiled for the project and submitted to the Lesotho Department of Environment for approval in 2016 and a Record of Decision was granted for the Project Brief in 2017. The African Development Bank will provide financial backing for the project and a major requirement is that the Environmental and Social Impact Assessment (ESIA) process needs to be undertaken according to the International Finance Corporation Standards (IFC), notably Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. The aim of this assessment will therefore be to collate and present available information of sufficient scope that will accurately characterise the broad macro-ecological characteristics of the area and assess the potential impacts on biodiversity.

1. Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems."
2. Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services.
3. Ecosystem services valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. This Performance Standard addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle.

The objectives of PS6 include:

⇒ Protection and conservation of biodiversity;
⇒ Maintaining benefits from ecosystem services; and
⇒ Promoting the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Whilst PS6 is more applicable to the Environmental Impact Assessment phase of the project, an application of the basic principles will suffice to authenticate statements and recommendations presented in this report. The following aspects, as a minimum, will be addressed during the project:

1. A review and assessment of the status of the receiving environment;
2. A broad reference to ecosystem services;
3. Collation of adequate baseline data and information to inform the decision-making process;
4. An identification and evaluation of potential and likely risks and impacts related to biodiversity;

5. The development of an informed mitigation hierarchy to manage effects in an integrated and responsible manner; and
6. Promote and advance the sustainable management of living resources.

14 LEGISLATIVE AND POLICY FRAMEWORK

A brief appraisal of relevant legislation yielded several aspects of relevance to the biological and biodiversity environment. It is emphasised that this may not necessarily be an entirely comprehensive representation of all legislative aspects pertaining to biodiversity related actions and activities, and due care is advised prior to the undertaking of any activity that may have an impact on the environment, including all biological and biophysical attributes.

The mandate on environment is derived from Section 36 of the Constitution of Lesotho[3], which states that:

Lesotho shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to ensure to all its citizens a sound and safe environment adequate for their health and well-being.

The following legislative aspects are advised:

⇒ Environment Act, 2008;
⇒ Forest Act, No 11 of 1978;
⇒ Forest Regulation LN 36 of 1980;
⇒ Game Preservation Proclamation, No 33 of 1951;
⇒ Historical Monuments, Relics, Fauna and Flora Act, No 41 of 1967;
⇒ Land Husbandry Act, 22 of 1969;
⇒ National Environmental Policy for Lesotho, 1998;
⇒ National Parks Act, 11 of 1975;
⇒ Range Management and Grazing Control Regulations, LN39 of 1980;
⇒ Section 36 of the Constitution of Lesotho; and
⇒ Weeds Eradication Act, 18 of 1969.

[3] Lesotho's Constitution of 1993 with Amendments through 1998 (www.constituteproject.org, 2018)

SECTION B – BIOPHYSICAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

Riaan A. J. Robbeson (Pr.Sci.Nat.)

15 LAND COVER & LAND USE OF THE REGION

Recent and historic anthropogenic land use often determines land cover; it is an important factor contributing to the condition of the land. Different uses have varying effects on the integrity of the land. For this assessment, land cover is loosely categorized into classes that represent natural habitat and land cover categories that originated from habitat degradation and transformation on a local or regional scale. Areas that are characterized by high levels of transformation and habitat degradation are generally more suitable for development purposes as it is unlikely that biodiversity attributes of conservation importance will be present or affected by development. Conversely, areas that are characterized by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

A brief appraisal of available aerial imagery (Google Earth©, refer **Figures 2 and 3**) indicates that the region surrounding the study area comprises widespread and extensively transformed habitat resulting from anthropogenic land use categories such as subsistence farming and small-scale agricultural practices and informal settlements, modernised human activities, such as cluster industrial developments, limited commercial agriculture, and insignificant road and railway infrastructure, etc. Remaining portions of natural shrublands and grasslands in the region are extensively utilised for grazing purposes during the both the austral summer and winter periods by cattle, goat and sheep and the ecology of the larger region has been progressively disturbed over the past decades because of this overgrazing.

A mosaical appearance of the landscape on a local and regional scale reflect the intensive nature of recent and historic anthropogenic disruptive activities. The severity (notably because of the irreversible nature) of these land uses resulted in the transformation and decimation of the natural grasslands of the region, ultimately rendering the remaining portions of natural grasslands highly sensitive and efforts to arrest the loss of biodiversity on a local scale should be prioritised, despite the apparent misalignment with rights that accompany land ownership.

16 REGIONAL CONSERVATION CONTEXT

Figure 5 provides an illustration of the geographical placement of the study site in relation to the conservation areas. No formally declared conservation areas are situated in spatial proximity to the proposed study area. The BGIS (2015) does however indicate the regional conservation context in terms of the following datasets for protected areas in southern Africa:

⇒ The study site is geographically situated within the Drakensberg Alpine Centre (DAC) (Van Wyk & Smith 2001); and

⇒ The study site is also situated within the South Eastern Escarpment priority areas (BGIS, NPAES Focus Areas).

16.1 DRAKENSBERG ALPINE CENTRE

The Drakensberg Alpine Centre (DAC) (Van Wyk & Smith 2001), although named after the Drakensberg range, occupies only the central high-lying portion of the range and forms part of the Great Escarpment which separates the marginal areas of the southern African subcontinent from the interior plateau. Topographically the DAC is mountainous with sheer cliffs up to about 1 200 m high. The vegetation of this unit can be broadly classified into alpine (± 2 800 m – 3 500 m) and subalpine (± 1 800 m – 2 800 m) belts (Killick 1963, 1978, 1990). The vegetation of the alpine belt may be designated as alpine tundra and consists of climax heath communities dominated many by low woody species, interspersed with extensive grasslands. The region is essentially treeless and most of the plants exhibit xeromorphic characters reflecting the severity of the climate. The heath constituents are evergreen shrublets with either sclerophyllous or grey-woolly leaves. Cushion plants and perennial rosette plants are common. Bogs or sponges are features of the river-heads of the Orange (Senqu) River System.

The vegetation of the subalpine belt consists of various types of grassland. Woody communities occur in sheltered situations, mostly along streambanks and in deep gullies. Protea savanna occurs in places, as well as tall shrubland.

The main Drakensberg Escarpment in KwaZulu-Natal is adequately protected in several nature reserves and protected wilderness areas. Unfortunately, very little of the high plateau of Lesotho is formally protected. Indeed, in this mountain country a single national park, Sehlabathebe, has been established on the border with KwaZulu-Natal. Vegetation of the alpine belt often suffers from extreme overstocking by domestic animals. This has resulted in deterioration of the grassland, invasion by Karoo elements and significant damage to bog vegetation. Vegetation is also threatened by subsistence cultivation of crops in areas not suitable for crop farming. Despite being protected by law, populations of *Aloe polyphylla* have been severely plundered by unscrupulous collectors who sell the plants to local people and visitors. There is a need for further research on the vegetation of the alpine/ tundra region of the DAC. This region is currently under severe pressure from overgrazing by livestock. Appropriate land use management systems should be developed and implemented to ensure the protection of the unique vegetation and flora of the region.

16.2 SOUTH EASTERN ESCARPMENT PRIORITY AREA

South Africa's first national assessment of spatial priorities for biodiversity conservation, released in 2005, aimed to identify conservation priority areas for mainstreaming into all sectors at national and provincial scales. The National Spatial Biodiversity Assessment (NSBA) was based on a planning for implementation approach in order to deliver defensible products useful to decision-makers. These analyses included the ecosystem status and protection level assessments outlined above, an irreplaceability analysis of the species and ecosystem data, and the expert mapping of important, national-scale ecological, and evolutionary processes. The nine priority areas identified across southern Africa are: North-eastern Escarpment, Bushveld- Bankenveld, Moist Grasslands, Central Grasslands, South-eastern Escarpment, Maputaland-Pondoland, Albany Thicket and Wild Coast, Cape Floristic Region, and the Succulent Karoo.

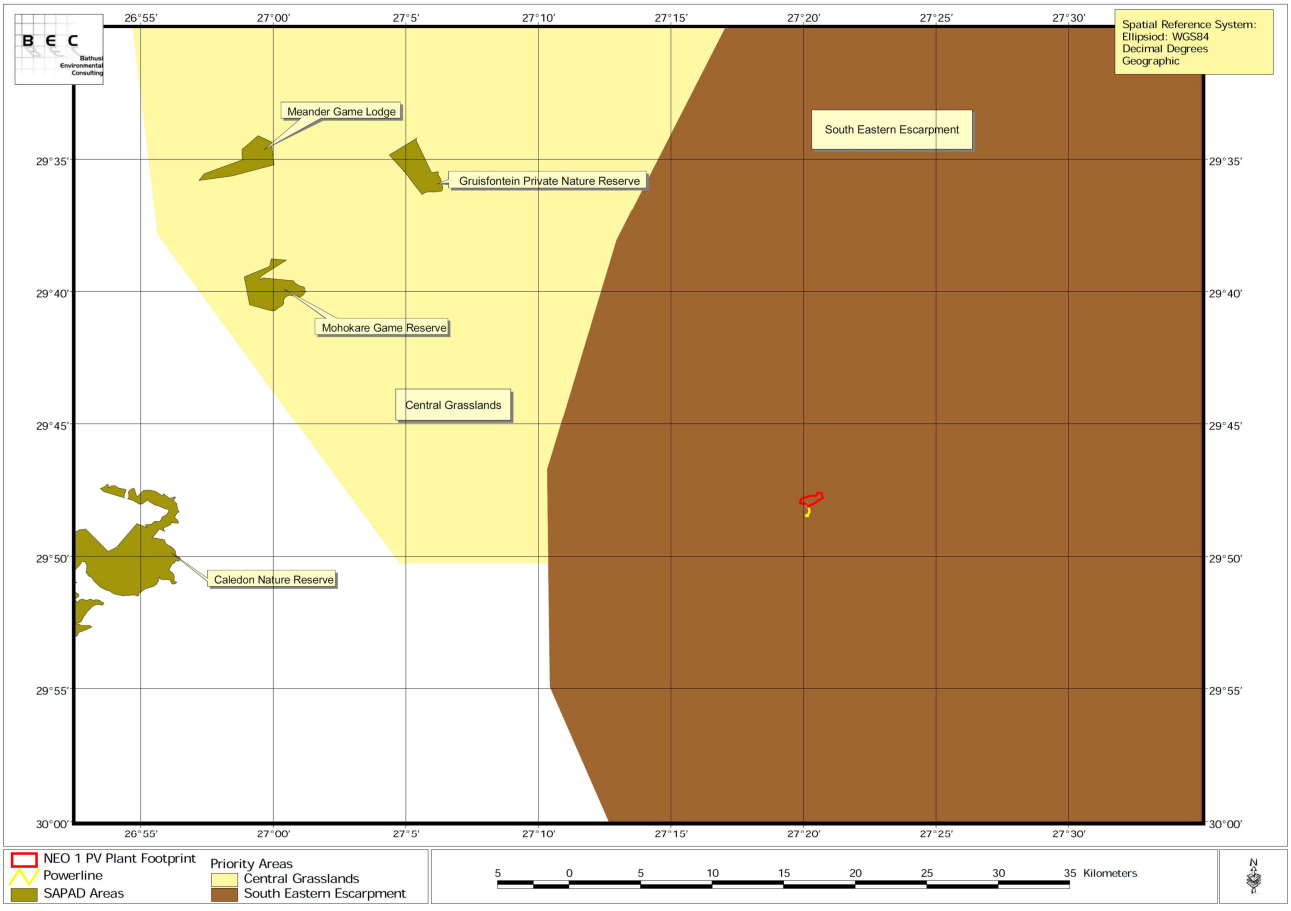

Figure 5: Land based conservation areas in the general surrounds

17 SURFACE WATER[4]

Areas of surface water contribute significantly towards the local and regional biodiversity due to atypical habitat that is present within ecotonal areas. Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats and are generally rich in species due to the confluence of habitats. In addition to daily visitors that utilize the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for numerous fauna species as well as a distribution method for plant seeds.

Due to topographically varied habitat within the immediate region, the site and surrounds exhibit various wetland types, including channelled valley bottoms, bogs, perennial and non-perennial streams, erosion gulleys and (possibly) mires. For an accurate description of the diversity and spatial presence of these wetland types, the reader is referred to the wetland ecology report (MD4071 – Neo 1 20MW Solar PV Plant, Freshwater Assessment (EIA), MD4071TPRP1812180735, Draft/V1, 2019/06/04).

In general, the status of wetland habitat in the immediate surrounds of the proposed site was found to be moderately to severely deteriorated, mainly because of some surface and gulley erosion as well as limited effects of effluents and nitrogenous substances utilised for agricultural purposes to downstream wetlands and streams. The effects of long-term and persistent use of these features for agricultural, grazing and domestic purposes resulted in a continued decline in the status, notably the floristic attributes of the drainage lines, streams and rivers. The remainder of wetland features exhibit altered and deteriorated floristic characteristics.

18 BACKGROUND TO THE GRASSLAND ECOLOGY

The regional vegetation is typified as the Drakensberg Grasslands, which primarily correspond with the Great Escarpment of the Drakensberg region that includes Lesotho and extending south-westwards into the Stormberg and Amathole Mountains. These are some of the highest elevation regions of southern Africa and the topography in these areas may be very steep. Rainfall is generally high; precipitation may occur at any time of the year and orographic mists and snow during the austral winter period supplement rainfall.

Heathlands are found either on steep slopes or in the extreme summit positions such as the highest mountain ridges, edges or flat mesas or damp, high-altitude plateaus. These are found in South Africa from the Soutpansberg to the Amathole, with larger patches occurring on the Lesotho plateau. The substrate in these localities of often leached by continuous precipitation and soils tend to be nutrient-poor.

Of the earliest classification of Lesotho vegetation was by Staples and Hudson (1938) who broadly divided Lesotho into two grassland types: *Themeda triandra* dominated grassland, occurring mainly on northern slopes at lower elevations throughout Lesotho and *Festuca caprina* grassland, occurring on slopes at high altitudes. Acocks (1975) and Killick (1978) used a similar approach in classifying the high-altitude vegetation. The Maloti-Drakensberg study identified four vegetation zones (Tainton et al 1989), which include alpine and sub-alpine grasslands (unique in Southern Africa),

[4] Please note that it is not the intention of this report to present a detailed account of the wetland and aquatic habitat types of the area; this is addressed in a separate specialist report. However, certain aspects do related to the biodiversity of the study area and general comments pertaining to this attribute are therefore included in this report.

sweetveld and disturbed grassland. Loxton, Venn and Associates (1993) identified different vegetation belts with various communities, including:

1. Temperate Alpine belt
2. Temperate/subtropical belt
3. Subtropical sub-alpine belt
4. Subtropical montane belt.

19 BROAD WEATHER STATISTICS

The climate of Lesotho is generally temperate, characterized by warm, moist summers, from November to March; and cold, dry winters from May to July; thus categorized as semi-arid to sub-humid and continental. Moderate maximum temperatures are characteristic of the region with snow and frost occurring every winter (refer **Figure 6**). Available regional information indicates that the study area receives between 630 and 650 mm precipitation per annum, mainly in the form of thunderstorms during the summer months, but also marginally supplemented by snow during the winter season. Temperatures ranges between an average high of 27°C in January and December and an average low of 0°C in June and July, but often falls below -6°C.

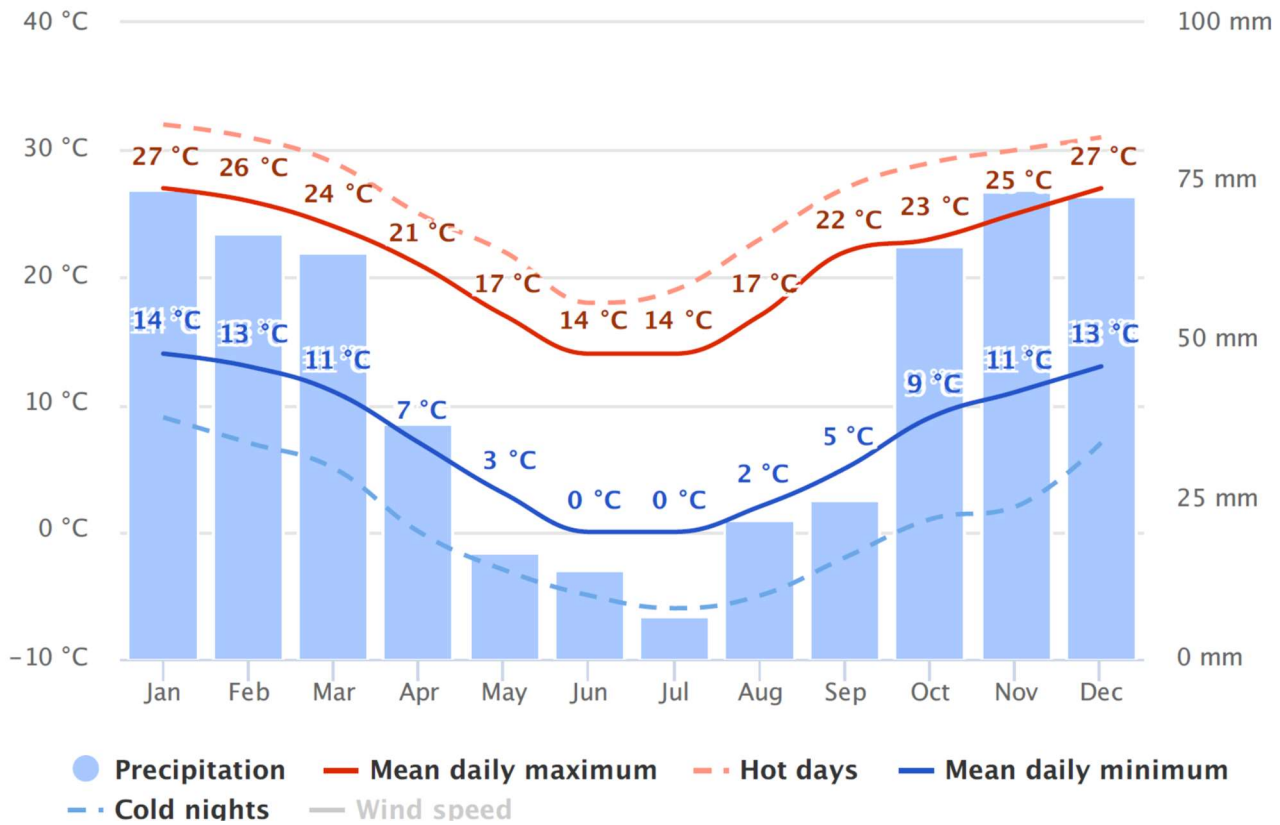

Figure 6: Average temperature and precipitation data for the nearby Sepechele
Data courtesy of www.meteoblue.com

Moderate wind speeds (refer **Figure 7**) with a high chill factor are common; light breezes are often experienced from the east (ENE), whilst stronger winds are less often encountered from the west and north.

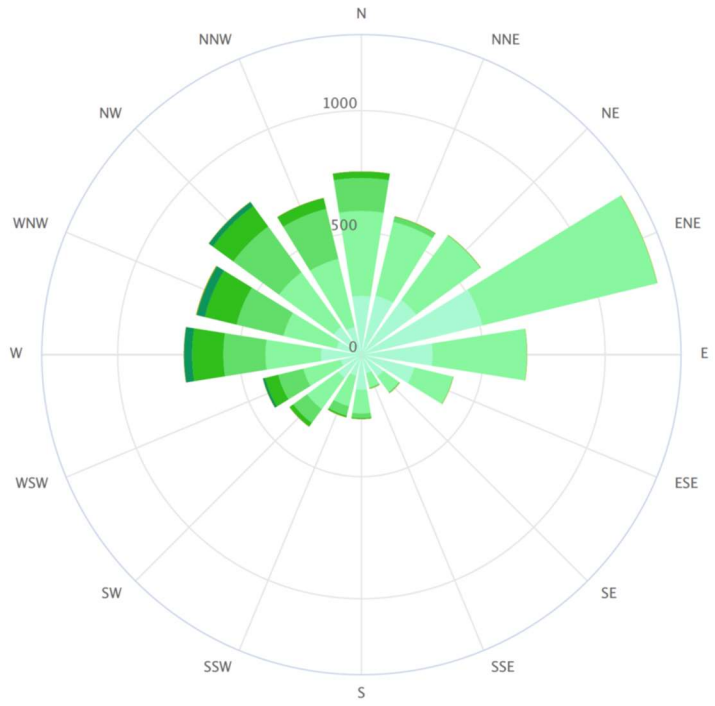

Figure 7: Wind rose for Sepechele, Lesotho

Data courtesy of www.meteoblue.com (the wind rose indicates how many hours per year the wind blows from the indicated direction).

SECTION C – BOTANICAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

Riaan A. J. Robbeson (Pr.Sci.Nat.)

20 SITE ALTERNATIVES AND DEVELOPMENT OPTIONS

A review of the proposed site alternatives indicated that none of the four alternatives exhibit highly sensitive floristic attributes as all the variants are spatially situated on deteriorated habitat types, notably agricultural fields. The spatial proximity to other sensitive habitat types, however, does indicate a slight preference for Option 1 as other options do coincide marginally with sensitive habitat types, including wetlands and ridge environs. Despite this slight preference for Option 1, floristic sensitivity is not regarded a likely driver for the selection process of the most preferable option between the proposed alternatives. In terms of the floristic receiving environment, Option 1 is therefore regarded as a suitable development footprint for the proposed development and the Impact Assessment was therefore aimed at establishing the significance of expected and likely impact within Option 1.

21 REGIONAL FLORISTIC ATTRIBUTES

21.1 REGIONAL FLORISTIC TRAITS – EASTERN FREE STATE SANDY GRASSLAND (GM 4)

The study area corresponds to the Grassland Biome, notably the Mesic Highveld Grassland, comprising a macro-ecological type known as the Eastern Free State Sandy Grasslands, as defined by Mucina & Rutherford (2006) (refer **Figure 8**). Mesic Highveld Grassland is found mainly in the eastern, precipitation-rich regions of the Highveld, extending as far as the Northern Escarpment. The division between dry and moist grassland is made on the basis of annual rainfall, with 500-700 mm rainfall marking the boundary. Above 600 mm of rainfall, sour andropogonoid grasses predominate. The 600 mm rainfall limit also corresponds to soil nutrient factors: plan growth in most grasslands with dystrophic soils is most macronutrient-limited and in dry grasslands with eutrophic soils it is mostly water-limited. Altitude also has a strong influence on most climatic variables. Generally, an increase in altitude corresponds with a decrease in temperature and an increase in rainfall. Different grassland units within the Mesic Highveld Grasslands are distinguished on the basis of geology and other substrate properties, including elevation, topography and rainfall.

The Eastern Free State Sandy Grassland is geographically situated in the Free State Province, Lesotho and marginally into KwaZulu-Natal Province, including Ladybrand (west) to the base of foothills of the Drakensberg (Maloti) and the Escarpment in the vicinity of Harrismith (east) and Mafeteng (south). Altitude ranges between 1 520 m and 1 800 m, but reaches 2 020 m in places.

The landscape is flat to slightly undulating and undulating terrain with streams and rivers that drain the foothills of the Drakensberg. Closed grassland dominated by *Eragrostis curvula*, *Tristachya leucothrix* and *Themeda triandra* is typical of these areas. Other dominant grasses include *E. capensis*, *E. racemosa*, *Cymbopogon pospischilii*, *Elionurus muticus*, *Eragrostis plana* and *Aristida junciformis*. Numerous herb species, notably of the Asteraceae family, is encountered; species of *Helichrysum*, *Hilliardiella*, and *Berkheya* increase the alpha diversity considerably. The abundance of numerous *Helichrysum* species is conspicuous. This unit is also found embedded within many hills and small mountains carrying Gm 5 Basotho Montane Shrubland. Due to wide range of grazing and fire regimes, the grassland has a patchy appearance.
The conservation status of this unit is **Endangered**; only 2 % is statutorily conserved in the Qwaqwa and Golden Gate Highlands National Parks as well as in the Sterkfontein Dam Nature Reserve. Almost half on this unit is already transformed for cultivation (maize), building of dams (e.g. Sterkfontein, Loch Athlone, Saulspoort). *Cirsium vulgare*, *Cosmos bipinnatus* (forming spectacular displays along road verges and on old fields), *Hypochaeris radicata*, *Plantago*

virginica, *Tagetes minuta*, *Verbena bonariensis*, *V. brasiliensis*, *Richardia brasiliensis*, *Guilleminea densa* and others are frequent alien invaders and diminish the agricultural and biodiversity value of these grasslands.

Important taxa within this unit include the following:

Graminoids: *Aristida junciformis* subsp. *galpinii*, *Cymbopogon pospischilii*, *Digitaria monodactyla*, *D. tricholaenoides*, *Elionurus muticus*, *Eragrostis chloromelas*, *E. curvula*, *E. plana*, *E. racemosa*, *Harpochloa falx*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Microchloa caffra*, *Monocymbium ceresiiforme*, *Setaria sphacelata*, *Themeda triandra*, *Tristachya leucothrix*, *Andropogon appendiculatus*, *A. schirensis*, *Aristida congesta*, *A. diffusa*, *Brachiaria serrata*, *Cymbopogon caesius*, *Cynodon dactylon*, *Cyperus obtusiflorus* var. *flavissimus*, *C. obtusiflorus* var. *obtusiflorus*, *Diheteropogon amplectens*, *Ehrharta capensis*, *Eragrostis capensis*, *Helictotrichon natalense*, *H. turgidulum*, *Koeleria capensis*, *Panicum gilvum*, *Setaria nigrirostris*, *Trachypogon spicatus*, and *Trichoneura grandiglumis*.

Herbs: *Barleria monticola, Berkheya onopordifolia* var. *onopordifolia*, *B. speciosa*, *Dicoma anomala*, *Helichrysum psilolepis*, *Acalypha angustata*, *A. peduncularis*, *Ajuga ophrydis*, *Anthospermum herbaceum*, *Berkheya pinnatifida*, *B. setifera*, *Crabbea acaulis*, *Cycnium racemosum*, *Dianthus basuticus*, *Haplocarpha scaposa*, *Hebenstretia dentata*, *H. dura*, *Helichrysum ammitophilum*, *H. aureonitens*, *H. caespititium*, *H. cephaloideum*, *H. herbaceum*, *H. nudifolium* var. *nudifolium*, *H. nudifolium* var. *pilosellum*, *H. oreophilum*, *H. rugulosum*, *H. spiralepis*, *Hermannia depressa*, *Hirpicium armerioides*, *Ipomoea crassipes*, *I. pellita*, *Kohautia amatymbica*, *Lactuca inermis*, *Nolletia ciliaris*, *Pelargonium luridum*, *Pentanisia prunelloides* subsp. *prunelloides*, *Selago densiflora*, *S. galpinii*, *Senecio coronatus*, *S. erubescens* var. *crepidifolius*, *S. inornatus*, *Sonchus nanus*, *Tolpis capensis*, *Trifolium burchellianum*, *Hilliardiella natalensis*, and *H. oligocephala*.

Geophytic Herbs: *Boophone disticha*, *Crinum bulbispermum*, *Cyrtanthus stenanthus*, *Drimiopsis maculata*, *Eucomis autumnalis* subsp. *autumnalis*, *Gladiolus dalenii*, *G. papilio*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*, *Watsonia lepida*, *Xysmalobium involucratum*, and *X. undulatum*.

Herbaceous Climber: *Rhynchosia totta*.

Low Shrubs: *Helichrysum melanacme*, *Anthospermum rigidum* subsp. *pumilum*, *Euphorbia striata* var. *cuspidata*, *Gnidia kraussiana*, *Helichrysum dasycephalum*, *Polygala hottentotta*, and *Tephrosia capensis* var. *acutifolia*.

A biogeographically important (endemic) taxon that often occur on the Low Escarpment is the low shrub *Heteromma krookii*.

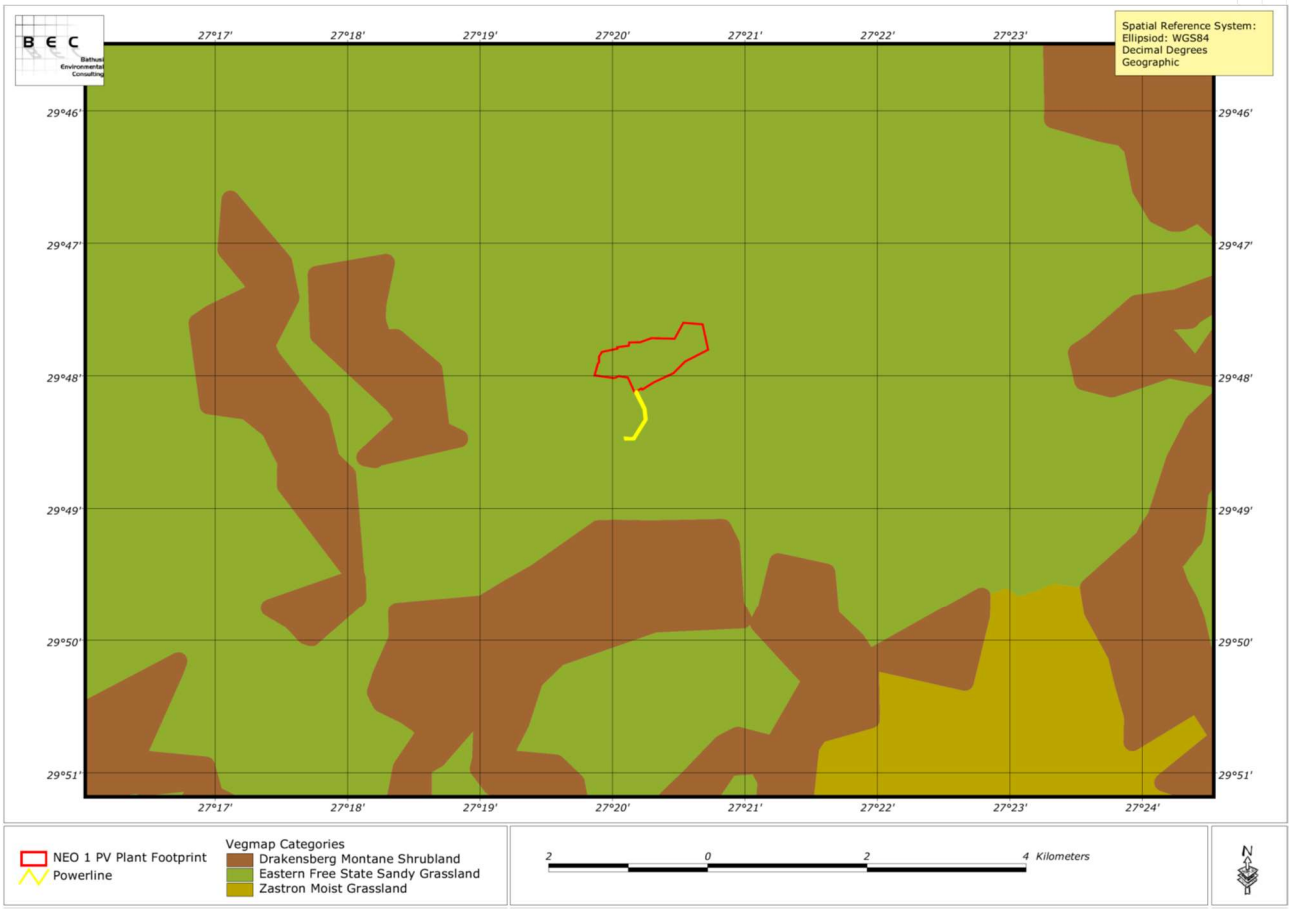

Figure 8: Vegmap categories of the region

21.2 REGIONAL PHYTODIVERSITY (SANBI)

The SANBI database was consulted to provide a brief account of the known regional phytodiversity; the presence of only 187 plant species within the corresponding ¼-degree grid (2927CD) has been recorded, reflecting a poor knowledge of the floristic diversity of the area in general (refer **Appendix 1**). Typical to the grassland landscapes, dominant growth forms of the vegetations comprises a high percentage of graminoids (33 species, 17.6 %) and herbs (50 species, 26.7 %). Moderate records of geophytes, succulents and shrubs are noted (refer **Table 5**), reflecting the paucity of comprehensive floristic data for the region.

The diversity of plants within the region is represented by 50 plant families, typically dominated by Poaceae (graminoids, 33 species, 17.6% %) and Asteraceae (25 species, 13.4 %). This fairly low diversity of plant families similarly reflect a paucity of accurate and comprehensive floristic data for the region. On closer inspection, the absence or the poor representation of plant families that are typically associated with the grassland region, does indicates the severity of anthropogenic impacts on a local and regional scale that rendered the vegetation heavily modified.

Table 5: Growth forms recorded in the region of the study area (SANBI)		
Growth Form	*Number*	*Percentage*
Climbers	4	2.1 %
Cyperoids	5	2.7 %
Dwarf shrubs	13	7.0 %
Geophytes	26	13.9 %
Graminoids	33	17.6 %
Herbs	50	26.7 %
Hydrophytes	3	1.6 %
Lithophytes	6	3.2%
Parasites	2	1.1 %
Sedges	1	0.5 %
Shrubs	19	10.2 %
Succulents	19	10.2 %
Suffrutex	4	2.1 %
Trees	2	1.1 %
Total	187	

21.3 PLANTS OF CONSERVATION IMPORTANCE – REGIONAL RECORDS

The assessment of plants of conservation concern and importance is based on the following legislative sets:

⇒ Union for Conservation of Nature;

⇒ National Forests Act of 1998; and

⇒ Lesotho Legislation/ Schedules.

IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001) was employed as the basis of conservation categories for plants. This list was amended to include additional categories to indicate species that are of local conservation concern (refer Figure 9). The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

The SANBI information source does not indicate the presence of any plant of conservation importance within the Q grid in which the study area is spatially situated. Considering the paucity of accurate and comprehensive floristic data for the region, this apparent absence of Red Data sampling records confirms the paucity of comprehensive floristic data, rather than the true absence of plants of conservation importance from the region and possibility of plant species of conservation importance persisting in the region cannot be discounted at this stage of the process.

Although not within the scope of this particular investigation, several seasonal surveys are generally required to confirm (or refute) the absence of conservation important plants from an area, particularly if the diversity and ecological status of the habitat conforms to the general habitat requirements for certain/ specific species.

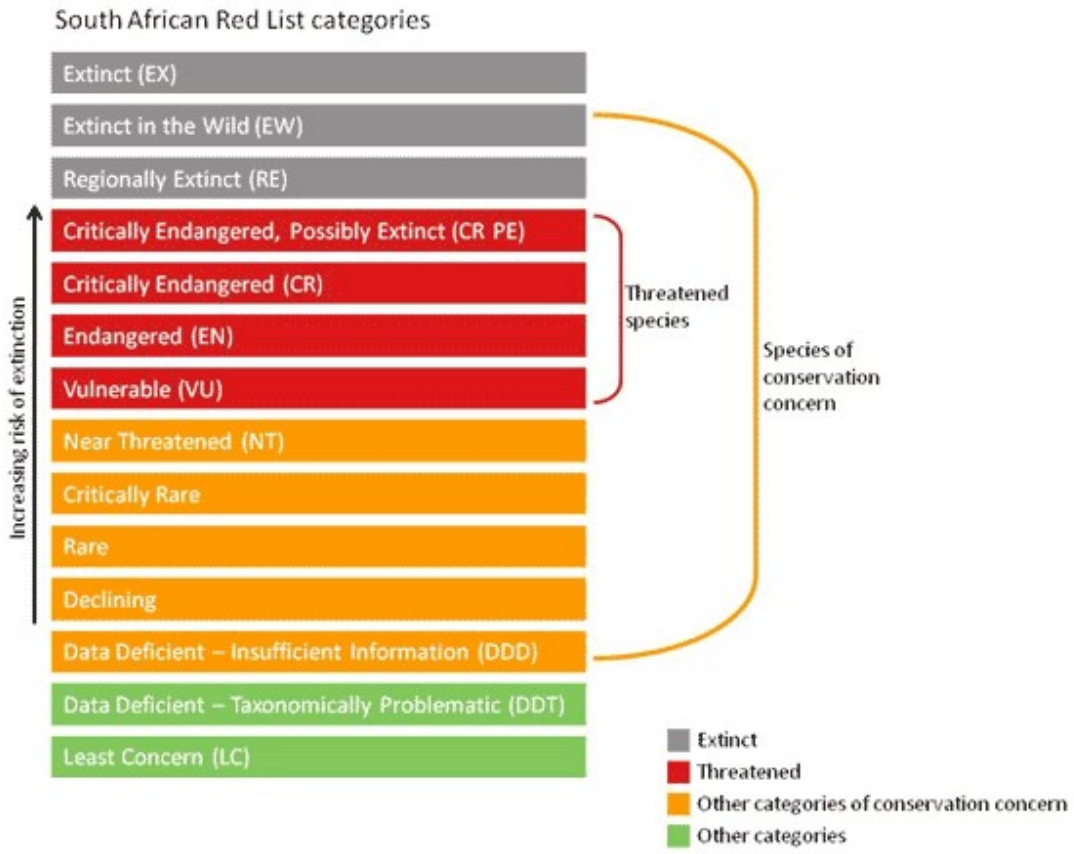

Figure 9: South African Red List Categories (courtesy of SANBI)

22 FLORISTIC DIVERSITY OF THE SITE AND IMMEDIATE SURROUNDS

22.1 ALPHA DIVERSITY

It should be noted that the site investigation was conducted during October 2018, before the advent of significant summer rains. Unequivocal identification of some species was therefore not possible, and some species (with specific reference to annuals), that will only be present in vegetative and reproductive growth during later periods, may have been overlooked. This is also of particular significance regarding the presence of conservation important plant species in relation to the proposed development.

The site investigation revealed a presence of approximately 81 plant species (refer **Appendix 2**). The recorded floristic diversity is regarded poor; not only reflecting sub-optimal survey conditions, but also the severity and long-term history of anthropogenic impacts on and the severity of impacts resulting from persistently high grazing pressure and anthropogenic transformative agricultural activities. Notably, the absence of most species that are typically associated with natural grassland ecotype (refer **Section 21.1**, **Appendix 1**) indicates the absence of habitat types that could potentially be construed as natural or pristine representations of the regional ecological type. Furthermore, the absence of a diverse composition of growth forms such as geophytes and succulents reflect the severity of habitat transformation.

The paucity of accurate and comprehensive regional floristic data, with particular reference to conservation important plants, is reflected in poor sampling records for the region (refer **Section 21.2**, **Appendix 1**). A comprehensive appraisal of the diversity of the site, and comparative assessment of survey results with the regional floristic diversity will therefore not yield confident and sensible results, apart from confirming the obvious atypical and dissimilar nature of floristic attributes of the site. Suffice to state that, although the total of 81 plant species equates to approximately 43 % of the regional diversity, there is only an approximate 8.0 % overlap in the species composition (*sensu lato*).

Apart from areas in vicinity to settlements, where exotic trees predominate against the steeper, rocky slopes, the grassland physiognomy is strongly reflected in the absence of a diverse and dominant tree layer; scattered small trees and low shrubs generally persist in sheltered habitat types, mostly associated with the topographical variable units such as outcrops, ridges, ledges and cliffs.

22.2 PLANTS OF CONSERVATION IMPORTANCE – 2018 SURVEY RESULTS

The EIA phase, although conducted during a seasonal period (early austral summer, October) which was not conducive to the location and identification of conservation important plants, afforded an opportunity to assess the ecological status and diversity of habitat types within the receiving environment and to establish the suitability in terms of general habitat requirements.

No plants of conservation importance was identified during the site survey period. Based on the appraisal of habitat types and status, the persistence of conservation important plants within the study site is regarded highly unlikely as all habitat was found to be either entirely transformed by long-term historic and persistent agricultural efforts and severe grazing practices, or severely degraded. Within the immediate surrounds, limited habitat was identified that are regarded moderately suitable as habitat for conservation important plant species.

22.3 ALIEN AND INVASIVE PLANT SPECIES – 2018 SURVEY RESULTS

Table 7 highlights the presence of common weeds, exotic and declared alien and invasive plant species[5] recorded on the site and immediate surrounds.

Because some of these species exhibit significant and aggressive invasive properties, their abundance and propagation within the site and immediate surrounds should periodically be scrutinised and the development and implementation of a dedicated Alien and Invasive Management Plan, as part of the EMP for the development is strongly advised. In particular, species indicated in **bold** (refer Table 6) are regarded a significant threat to the environmental status of the receiving environment.

Table 6: Exotic and Invasive species recorded in the site and immediate surrounds

Species Name	*Family*	*Status/ Uses*	*Common Name*
Acacia dealbata	Fabaceae	Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014), CARA 2002 – Category 1(Western Cape), Category 2 (rest of SA)	Silver Wattle (e), Silwerwattel (a)
Agave sisalana	**Agavaceae**	**Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014)**	**Sisal**
Argemone ochroleuca	Papaveraceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Mexican poppy (e), Bloudissel (a)
Berkheya discolor	Asteraceae	Common weed	Mohata-o-mosoeu (ss)
Berkheya setifera DC.	Asteraceae	Weed, widespread	Rasperdisseldoring (a)
Cirsium vulgare (Savi) Ten.	Asteraceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Scottish thistle (e), Skotse dissel (a)
Crepis hypochoeridea (DC.) Thell.	Asteraceae	Weed, indicator of disturbed areas, Naturalised exotic	--
Cupresses macrocarpa	Cupressaceae	Ornamental, non-indigenous (USA), probably sterile variety	Monterey Cypress (e), Golden Crest (e)
Echinopsis schickendantzii	**Cactaceae**	**Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)**	**Torch Cactus (e), Orrelkaktus (a)**

[5] South African legislation pertaining to Alien and Invasive plant species are utilised as a proxy for the purpose of presenting a comprehensive understanding of the threats posed by certain species

Table 6: Exotic and Invasive species recorded in the site and immediate surrounds			
Species Name	*Family*	*Status/ Uses*	*Common Name*
Eucalyptus species	Myrsinaceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014) (see act for detail)	Eucaluptus gum tree (e), Bloekomboom (a)
Moraea pallida (Baker) Goldblatt	Iridaceae	Indicates overgrazing, often in colonies. Poisonous to cattle	Yellow Tulip (e), Berkatjietee (a), Khahla-e-nye-nyane (ss)
***Opuntia ficus-indica* (L.) Mill.**	**Cactaceae**	**Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)**	**Prickley pear (e), Turksvy (a)**
Pennisetum clandestinum Chiov.	Poaceae	Declared Invader - Category 1B in protected areas and wetlands in which it does not already occur (NEM:BA, 2004. AIP, 2016)	Kikuyu Grass (e), Kikoejoegras (a)
Populus deltoidea	Salicaceae	None	Poplar (e), Populier (a)
Prunus persica (L.) Batsch var. *persica*	Rosaceae	Naturalised exotic, edible fruit	Peach (e), Perske (a)
Rosa species	Rosaceae	None	--
Rubus rigidus Sm.	Rosaceae	Invader Species	Bramble (e), Braambos (a)
Rumex species	Polygonaceae	Native to Europe, common weed	--
Salix babylonica L.	Salicaceae	Non-endemic	Weeping willow (e), Treurwilger (a)
Salix mucronata Thunb. ssp. *mucronata*	Salicaceae	Non-endemic	African Willow (e), Wildewortel (a)
Seriphium plumosum	Asteraceae	Invasive properties	Bankrupt bush (e), Bankrotbos (a)
Solanum sisymbrifolium Lam.	Solanaceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Wild tomato (e), Doringbitterappel (a)

22.4 PLANTS WITH MEDICINAL PROPERTIES AND POPULAR TRADITIONAL PRACTICES

A number of plants were recorded on the site and in the immediate surrounds that are known for being utilised as traditional medicine or used for traditional practices.

Table 7: Plants with traditional medicinal uses and popular properties			
Species Name	*Family*	*Status/ Uses*	*Common Name*
Buddleja salviifolia (L.) Lam.	Buddlejaceae	Traditional uses	Quilted Sagewood (e), Saliehout (a)
Bulbine narcissifolia	Liliaceae	Medicinal uses	Wild Kopieva (e), Wildekopieva (a)
Celtis africana Burm.f.	Celtidaceae	Timber	White Stinkwood (e), Witstinkhout (a)
Centella asiatica (L.) Urb.	Apiaceae	Edible parts, medicinal properties	Marsh pennywort (e), Varkoortjies (a)
Cupresses macrocarpa	Cupressaceae	Ornamental, non-indigenous (USA), probably sterile variety	Monterey Cypress (e), Golden Crest (e)
Diospyros lycioides	Ebenaceae	Medicinal uses, edible parts, dyes	Star Apple (e), Bloubessie (a)
Gazania krebsiana	Asteraceae	Medicinal uses, food source	Butter flower (e), Botterblom (a)
Halleria lucida L.	Scrophulariaceae	Edible fruit, traditional medicinal uses	Tree-fuschia (e), Geelhoutkop (a)
Helichrysum caespititium (DC.) Harv.	Asteraceae	Medicinal uses	Speelwonderboom (a)
Hermannia depressa N.E.Br.	Malvaceae	Medicinal uses	Rooiopslag (a)
Hyparrhenia hirta (L.) Stapf	Poaceae	Thatching & weaving	Thatch Grass (e), Dekgras (a)
Kiggelaria africana L.	Flacourtiaceae	Traditional uses, larval host for *Acrea horta* & *Cymothoe alcimeda*	Wild Peach (e), Wildeperske (a)
Kohautia amatymbica Eckl. & Zeyh.	Rubiaceae	Edible parts	Tremble tops (e)
Leonotis species	Lamiaceae	Medicinal uses, colours & dyes	Minaret Flower (e), Wildedagga (a)

Table 7: Plants with traditional medicinal uses and popular properties			
Species Name	*Family*	*Status/ Uses*	*Common Name*
Oxalis species	Oxalidaceae	Edible parts	Bobbejaanuintjie (a)
Pellaea calomelanos	Adianthaceae	Medicinal properties	Hard Fern (e), Hardevaring (a)
Prunus persica (L.) Batsch var. *persica*	Rosaceae	Naturalised exotic, edible fruit	Peach (e), Perske (a)
Rubus ludwigii Eckl. & Zeyh. subsp. *ludwigii*	Rosaceae	Edible parts, medicinal uses	Silver Bramble (e), Wildebraam (a)
Searsia erosa (Thunb.) Moffett	Anacardiaceae	Traditional and medicinal uses	Broomkarree (e), Besembos (a)

23 VEGETATION DEVELOPMENT DRIVERS OF THE SITE AND SURROUNDS

Historically, development of grassland vegetation is generally the result of complex interacting driving forces that include climatic-, geological (soil), topographical- and moisture gradients typical of the grassland regions of the Lesotho landscapes. Importantly, and on a smaller scale, anthropogenic activities have recently contributed to severe deterioration and decimation of natural grasslands by means of subsistence cultivation, extensive agricultural activities and intensive, persistent and inappropriate grazing strategies, notably within the lowland plains and wetland habitat types. The study area and the general surrounds strongly reflect these driving forces and are characterized by extremely high levels of habitat transformation that caused the sterilisation of extensive areas of natural grassland habitat, ultimately rendering the remaining grasslands as heavily modified.

In general, the proposed development footprint is situated on varying slopes and aspects, and soils are generally shallow, siliceous and grainy. These soils are also rather poor, with resulting vegetation that is often regarded as 'sourish'. On lower topographical units (floodplains and seepages) soils conform to deeper horizons that comprise of clayey soils with higher moisture retention capabilities. Conversely, vegetation in these parts tend to be 'sweeter', hence the high occupation and utilisation factors noted within these parts. A review of aerial imagery and results obtained from this basic botanical survey of the site and immediate surrounds, indicated the following habitat types to be present (refer Figure 10):

⇒ *Cynodon dactylon – Gazania krebsiana* Erosion Gulleys;
⇒ *Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs;
⇒ *Moraea pallida– Wahlenbergia* cf. *dieterlenii* Agricultural Fields; and
⇒ *Pentameris ariodes – Trifolium burchellianum* Drainage Lines and Seeps.

23.1 *CYNODON DACTYLON – GAZANIA KREBSIANA* EROSION GULLEYS

The extent of erosion gulleys in the surrounds of the development footprint provides evidence of the severity of impacts resulting from inappropriate grazing practices that caused trampling of stabilising vegetation and exposing soils to eroding effects of downpours and runoff and the persistent subsistence agricultural strategies. The duplex nature of these soils resulted in the formation of severe and deep erosion gulleys through the removal of the sandy topsoils and exposure of the lower, structured clay horizons to rapidly flowing water after raining events. These erosion gulleys are particularly prevalent, and originating in, the upper parts of the smaller catchments in areas where the slopes exceed 7 % (pers. obs.). No obvious activities were noted to combat the exacerbation of these features and further expansion is reasonably expected in future. Erosion gulleys noted in proximity to the site, although not located within the development footprint, include areas to the immediate south and north, running in an eastern direction.

As these soils are periodically subject to further erosion during raining advents, extremely little vegetation is noted within these features. Isolated and singular plants generally occur in sheltered areas and crevices. No plants of particular prominence/ abundance were recorded in these parts and soils are generally bare and exposed.

The periodic use of branches and plant materials that is harvested during trimming and pruning management activities to stabilise the lower parts of these erosion gulleys in the immediate vicinity of the development footprint is recommended. The reader is also referred to recommendations presented in the wetland ecology report pertaining to management activities combating existing erosion within gulleys and the development of new erosion advents caused by runoff from the development. Placement of plant material and branches in the lower parts of erosion gulleys will dissipate the severity of runoff, whilst also acting as a trap for soils and seeds transported by the runoff that will ultimately act as stabilising agents for the process.

23.2 *HALLERIA LUCIDA – MOSSIA INTERVIRALIS* ROCKY LEDGES AND CLIFFS

As with the previous unit, the *Halleria lucida - Mossia interviralis* ecological type is not represented within the development footprint, but since it constitutes an important and sensitive habitat types within the immediate surrounds of the development, mention is made thereof. These features are characterised by the exposed underlying geology, forming open plates of flat, exposed rocks, or crests, that terminates in steep cliffs of huge boulders, eventually connecting with the lower slopes of grassland plains. As these features are generally poor in flora and also inaccessible for most parts, the characterising vegetation has retained some measure of the original regional ecological type. Biophysical attributes of this unit that has had a direct and significant bearing on the characterising vegetation include crags, shallow and sandy soils, sheltered hollows, moisture retention in isolated pockets, etc. These biophysical features also vary significantly between representative portions of this habitat type in the region, depending on slopes, aspect, extent, etc. The nature of these features vary between relatively small and low ledges and cliffs, to areas characterised by high cliffs and huge boulders with extensive crests of exposed surface rocks.

The proximity to populated areas/ settlements is a particularly important factor determining the prevalence and ecological status of the vegetation of this habitat type. Areas in proximity to settlements are generally characterised by the presence of the invasive tree species *Acacia dealbata* and the absence/ disappearance of natural vegetation (refer Figure 10). Representative portions situated further away from populated areas, but still with access for grazing purposes, are characterised by an admixture of 'natural' species and plants that indicate a severe and persistent utilisation/ grazing factor. Only when situated significant distances from populated areas, and also when becoming inaccessible for cattle, are 'normal' vegetative factors retained.

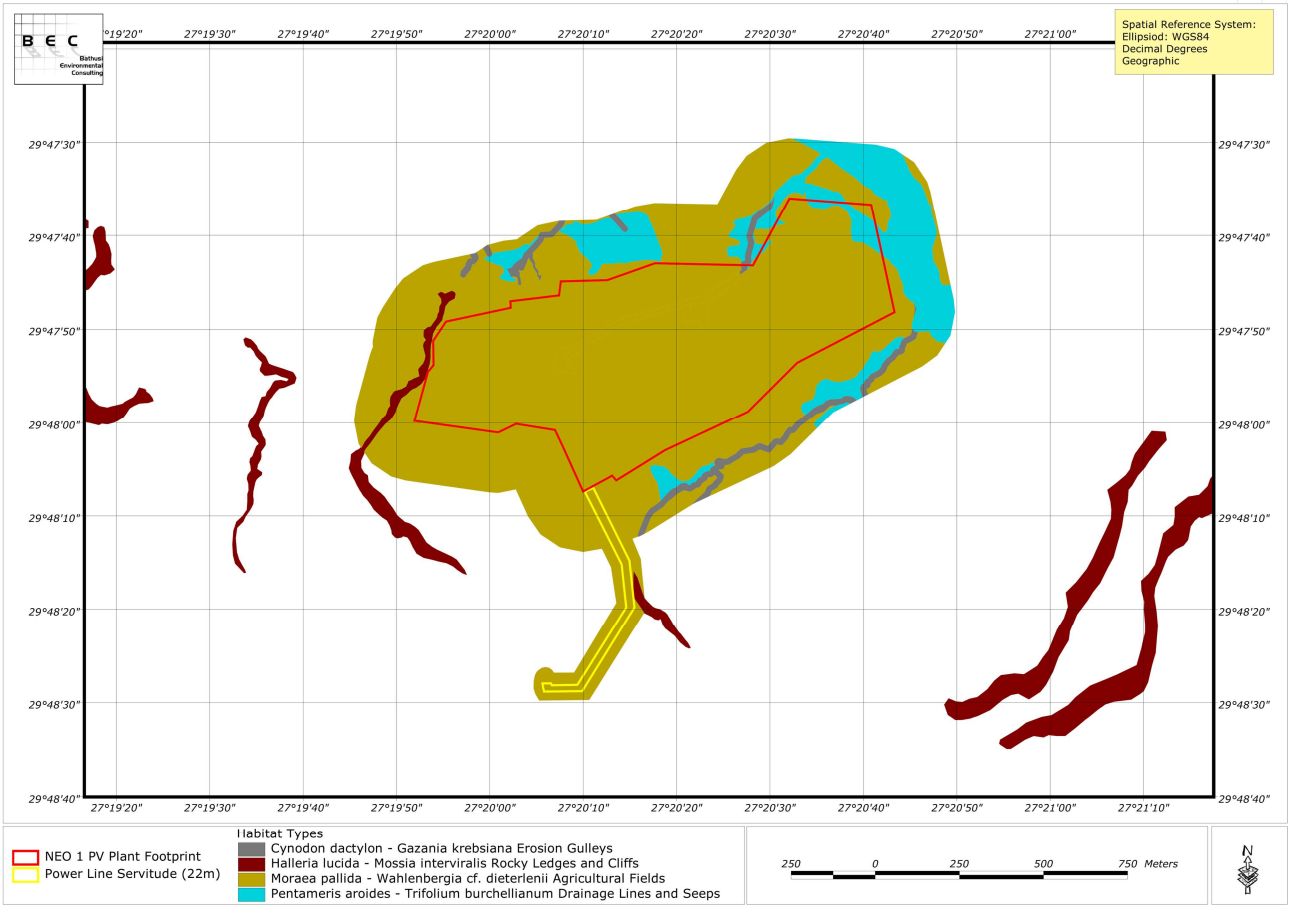

Figure 10: Botanical units of the development footprint and the immediate surrounds

Because of the highly variable biophysical attributes of these features, a high diversity of plants are noted on a local and regional scale, but the vegetation that characterises these areas are generally hardy and habitat specific, being able to survive in challenging conditions such as shallow and poor soils, heavily shaded and cool micro-climates, etc. Conversely, the absence of a dense and dominant vegetal cover and the dominating physical attributes do provide some protection against effects such as fire, severe and repetitive grazing, etc, explaining the presence of some woody shrubs and trees.

Representative portions in proximity to the development footprint are generally characterised by the presence of shrubs and low trees that are restricted to inaccessible features. The presence of a woody component is a distinguishing floristic feature that indicates the prominence and presence of surface rocks. These species include *Halleria lucida* (d), *Celtis africana, Diospyros lycioides,* and *Kiggelaria africana.* Shrubs that are often encountered include *Cliffortia linearifolia* (d), *Myrsine africana* (d), *Rubus rigidus* and *R. ludwigii* and *Searsia erosa.* A poor compliment of grasses are noted, but a diverse herbaceous layer include species such as *Argyrolobium* species, *Asclepias aurea, Cheilanthes* species, *Delosperma* species, *Gazania krebsiana, Helichrysum caespititium* (d), *H.* cf. *splendidum* (d), *Massonia* species, *Mossia interviralis* (d), and *Pellaea calemelanos.* A total of 34 plant species were recorded in this unit; because of seasonal constraints, this recorded alpha diversity is regarded low and it is highly likely that a more suitable seasonal survey (December to February) will reveal the presence of several other plant species. The presence of conservation important plants in this unit can also not be discounted at this stage.

These features, not only because they represent isolated and extremely limited remnants of the original natural vegetation, but also because they are often associated with plants of conservation importance, are regarded highly sensitive. A basic illustration of the presence of this unit in the immediate surrounds of the development footprint is presented in **Figure 11.**

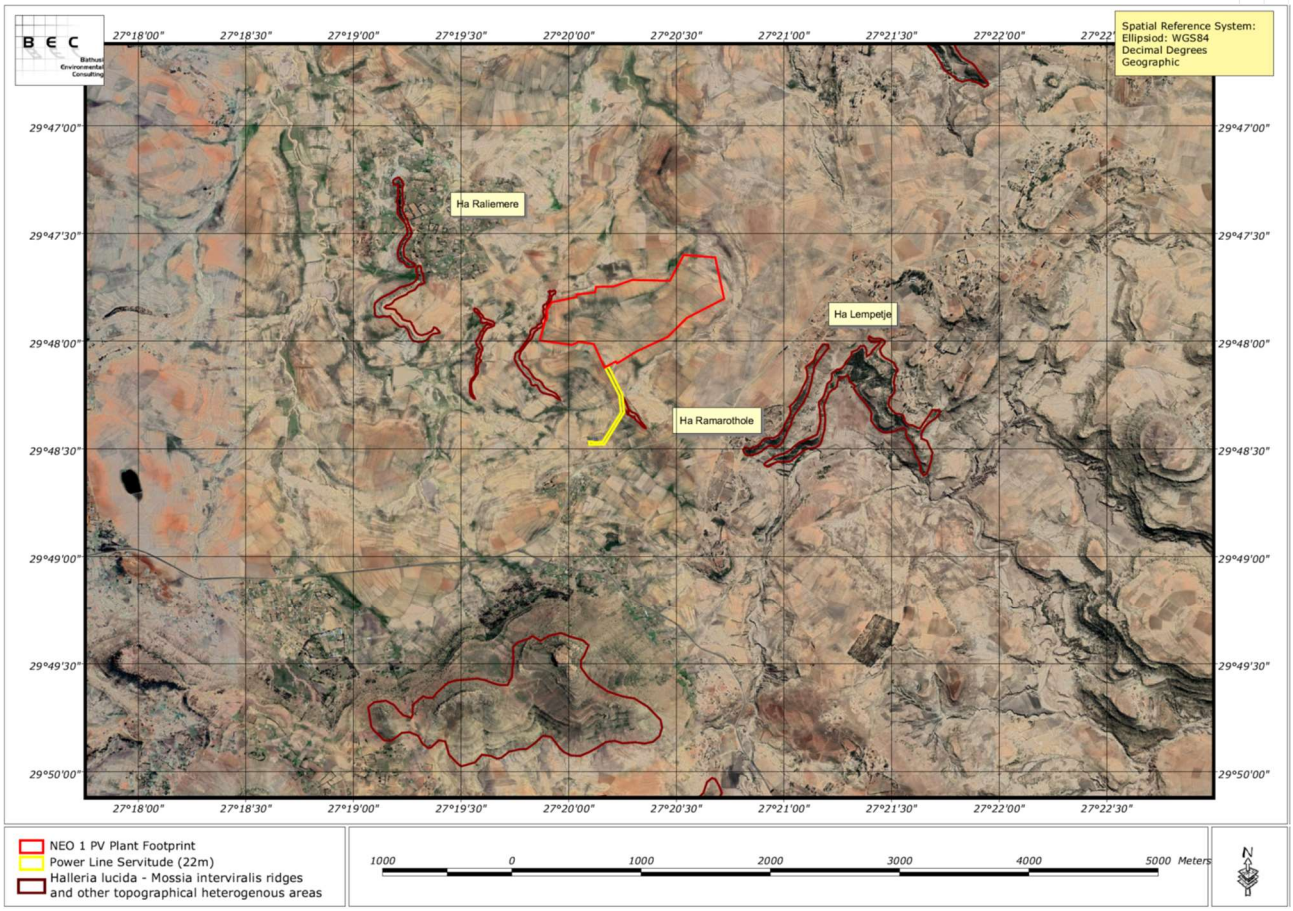

Figure 11: Geographic distribution of the *Halleria lucida* - *Mossia interviralis* ridges and other topographical heterogeneous habitat in relation to the development footprint

23.3 *MORAEA PALLIDA*– *WAHLENBERGIA* CF. *DIETERLENII* AGRICULTURAL FIELDS

This unit comprises the largest extent of the proposed development footprint, constituting old and fallow agricultural fields. Soils in these parts vary between sandy and loamy, slopes are generally less than 7 % and no surface rocks are present. The historic nature of these agricultural attempts is demonstrated as far back as aerial imagery allows, notably 2004 (GoogleEarth, refer Figure 12). The persistent and severe nature of agricultural activities dictates that no natural vegetation remains within these areas and the vegetatal cover is regarded entirely transformed; it is however unclear when agricultural activities ceased. Since the cessation of agricultural activities, the vegetation has been dominated by an admixture of grasses and forbs, the composition, dominance and presence varying depending on the seral status of the land.

From aerial imagery, it is notable that the area comprises of numerous, separate fields that were cultivated during different periods. These agricultural activities also ceased during different periods and the nature of the existing vegetation is determined by the period that these fields have been fallow, allowing the recovery/ development of vegetation into different seral stages. The 'eldest' of these fields are characterised by a prominent layer of the shrub *Felicia filifolia*, while 'younger' fields are characterised by the absence of this shrub, but are characterised by a prominent and moderately diverse herbaceous layer. The forb *Wahlenbergia* cf. *dieterlenii* is prominently encountered throughout the area, while the presence of the geophyte *Moraea pallida* generally indicates the deteriorated nature of the area, the prominence of this species also indicates the extent of time since the cessation of agricultural activities.

The cessation of cultivation resulted in the successional occupation by a composition of pioneer and opportunistic species, of which the abundance and presence continually changed (seral stages) to the present stage(s). This present

stage of the eldest areas is often described as a (late) climax status as future changes in species composition is generally minimal, remaining stable without significant anthropogenic intervention. However, 'younger' areas are characterised by sequential changes in the presence, abundance and dominance of species until a climax status is achieved where little/ few changes are resulting. This could potentially take 50 years or more to culminate into a stable, albeit, atypical, vegetation.

Pristine grassland (primary vegetation), of which no representative portions were recorded within the site or immediate surrounds, typically exhibits a relative high number of co-dominant species (grasses and forbs), which individually does not attain an exclusive dominance. Lesotho grasslands are known for a high diversity of, particularly, the herbaceous layer, comprising numerous annuals, geophytes, succulents and other types of specialised floristic growth forms. The species composition of the proposed development site is notably poor; a diversity of only 36 species were recorded. Noteworthy species recorded in this unit include the grasses *Aristida congesta* ssp. *barbicollis, Chloris virgata, Cynodon dactylon* (d), *Pentameris airoides* ssp. *jugorum* , the forbs and low shrubs, *Crepis hypochoeridea, Felicia muricata* (d), *Helichrysum caespititium* (d), *Moraea pallida* (d) and *Wahlenbergia dieterlenii* (d) and the shrub *Felicia filifolia* (d).

Structural and compositional attributes of the vegetation on the site do not conform to the regional ecological type (Eastern Free State Sandy Grassland); extremely few species that are typically associated with the regional vegetation were recorded on the site. Furthermore, no plant taxa of conservation importance was recorded during the survey period. Considering biophysical habitat conditions and the existing status of the dominant vegetation, as well as the severity of transformative anthropogenic activities, the likelihood of any conservation important species persisting on the site is regarded low. The estimated ecological status and floristic sensitivity of this habitat type is therefore estimated as low.

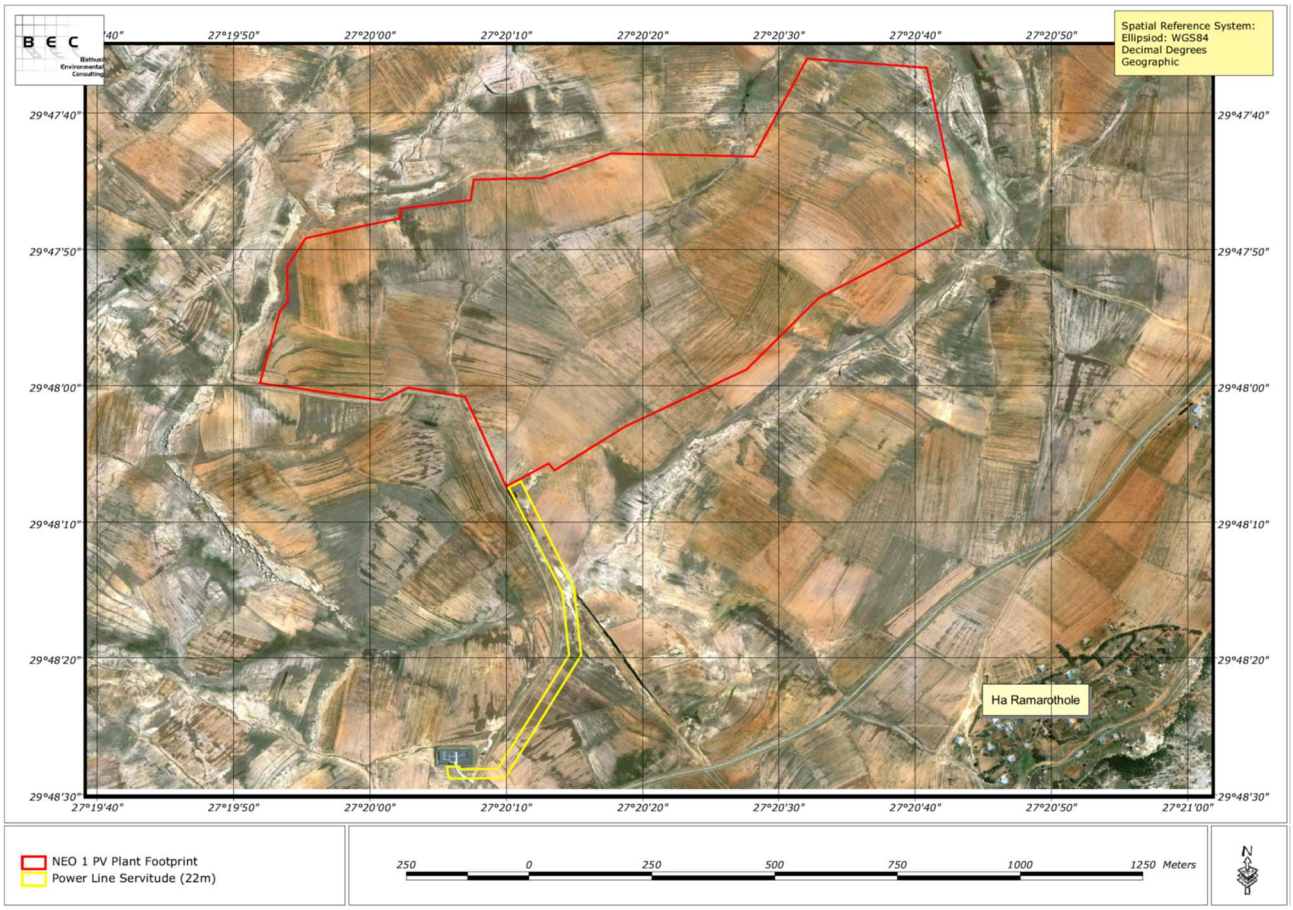

Figure 12: Historic aerial imagery (2004, GoogleEarth©) of the practice of subsistence agricultural practices within the site and immediate surrounds

23.4 *PENTAMERIS ARIODES – TRIFOLIUM BURCHELLIANUM* DRAINAGE LINES AND SEEPS[6]

Several grasslands seepages are situated within, and in proximity of the site. Notably, a natural drainage line, including a natural spring and grasslands seepages, is situated on the eastern boundary of the site. These areas, although exhibiting significant deterioration, are regarded moderately sensitive. Severe, persistent and inappropriate grazing and trampling has resulted in the development of an altered/ deteriorated vegetatal cover, the development of erosion and altered flowing patterns of the drainage lines. Soils in these areas are characterised by a comparatively high clay content, slopes are generally flat, sloping towards the east and north. As a result of the clayey conditions and relative flat slopes, moisture is retained in the soils for long periods, rendering the vegetation palatable and moist for extended periods of the year, resulting in high and persistent grazing. The formation of deep pools within the floodplain is notable and would under normal circumstances have contributed significantly to the biodiversity infrastructure of the region. However, because of the severity of anthropogenic impacts, this contribution has been minimalised.

A natural spring is situated on the northeastern border of the site and the flow of water is evident. This is a significant and sensitive biophysical feature, although no conservation important plant species has been recorded at this locality. Although not situated within the spatial boundary of the site, the proximity of this feature to the site ultimately renders it an important consideration during the planning and execution of the development.

The vegetation of these units comprises of the grasses *Eragrostis chloromelas, Pennisetum clandestinum, Pentameris airoides* subsp. *jugorum, Paspalum dilatatum* and the forbs *Centella asiatica, Marsilea* cf. *macrocarpha* and *Trifolium burchellianum.* The recorded floristic diversity in these units are generally low, reflecting on the severity of the existing impacts.

24 ESTIMATED FLORISTIC SENSITIVITY

For existing protected areas and species, the floristic importance ascribed to certain areas is obvious and simplistic. Most countries will have differentiated the biodiversity importance of their protected areas (national or local) as part of their designation. Conversely, outside of protected areas, but within areas that are clearly of value for biodiversity, the evaluation of importance is complex and often vague. It is therefore important to note that the absence of protected status should never be interpreted as low biodiversity importance; many areas of international importance for biodiversity lie outside of protected areas. The challenge is to include a suitable range of criteria to determine whether the site is of local, regional, national or international importance. Furthermore, areas that are characterised by severe and intensive disruption of the natural ecological processes and decimation of the principal floristic attributes, are generally regarded to exhibit low sensitivity attributes. It is important to note that no universal standard exist to assess or evaluate the floristic sensitivity of the receiving environment. However, some common criteria, that were employed for this particular assessment, include the following:

⇒ Keystone species, conservation important species and suitability of habitat for these species;
⇒ Rarity and fragility of the habitat;
⇒ Species/habitat richness;
⇒ Species endemism and perceived species richness;
⇒ Fragility value of ecosystem services also considering contribution to ecological infrastructure.

[6] The reader is also referred to the Wetland Ecology Report (MD4071 – Neo 1 20MW Solar PV Plant, Freshwater Assessment (EIA), MD4071TPRP1812180735, Draft/V1, 2019/06/04). Please note that differences in the mapping of wetland units are a result of interpretative differences between vegetation, which is based on floristic and biophysical attributes, and the wetland assessments, which is based on soil mapping techniques.

A basic and subjective evaluation of the receiving environment of the perceived floristic sensitivity of the receiving environment is presented in **Table 8** and illustrated in **Figure 13**.

Table 8: Flora Habitat Sensitivities for the study area

Community	RD Species	Landscape Sensitivity	Status	Species Diversity	Functionality	Total	Sensitivity Index	SENSITIVITY CLASS
Cynodon dactylon – Gazania krebsiana Erosion Gulleys	1	2	2	2	1	51	16%	low
Halleria lucida – Mossia interviralis Rocky Ledges and Cliffs	7	9	6	7	10	243	76%	medium-high
Moraea pallida– Wahlenbergia cf. *dieterlenii* Agricultural Fields	1	2	2	3	3	62	19%	low
Pentameris ariodes – Trifolium burchellianum Drainage Lines and Seeps	4	10	7	8	9	229	72%	medium-high

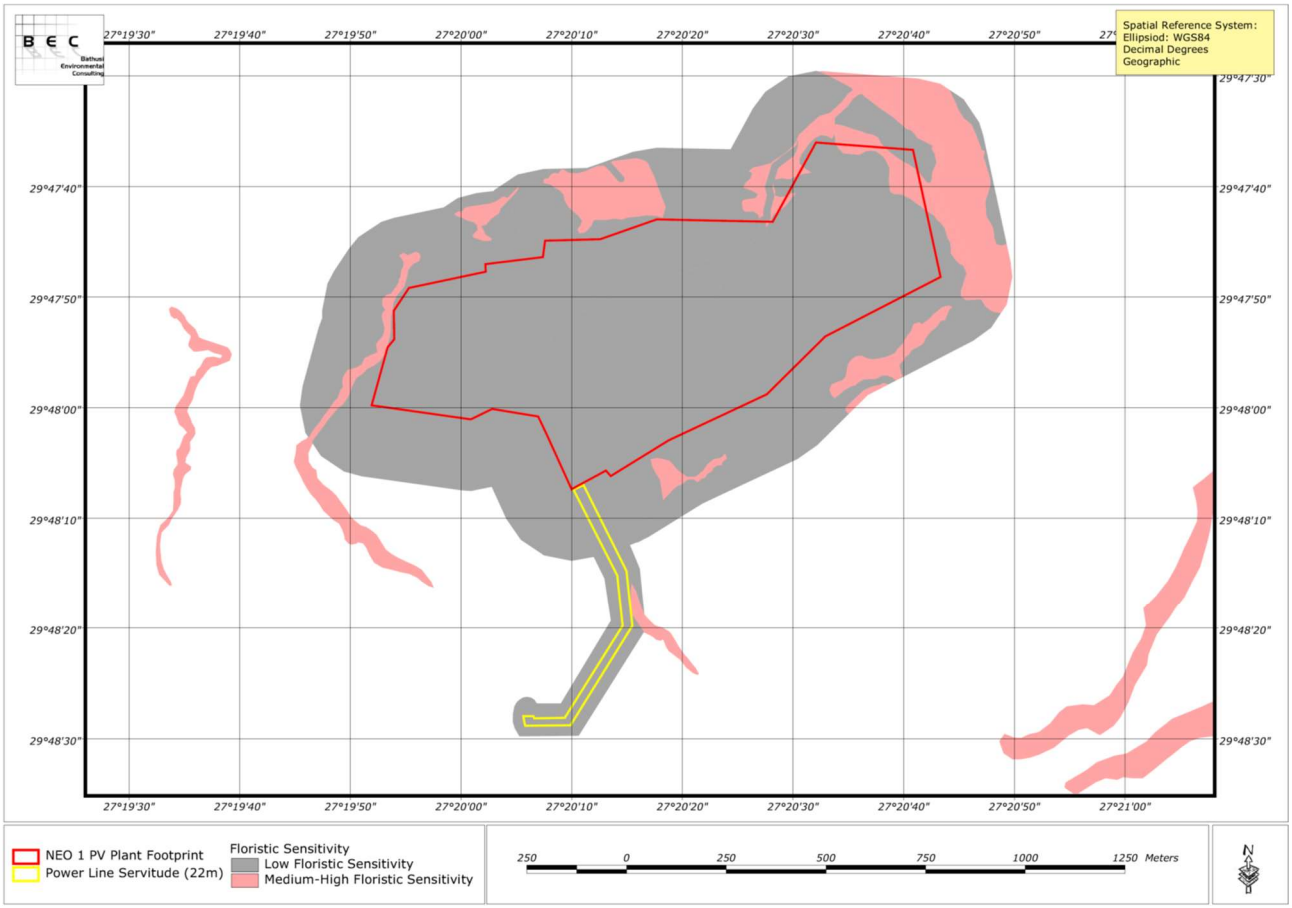

Figure 13: Estimated floristic sensitivity of the development footprint and immediate surrounds

25 POTENTIAL AND LIKELY IMPACTS ON THE FLORISTIC RECEIVING ENVIRONMENT

⇒ No impacts of a beneficial nature on the floristic environment are likely to result;

⇒ the proposed activity is unlikely to result in the loss of natural and/or floristically sensitive and important habitat; and

⇒ based on a generic list of impacts associated with this type of development, three categories of impacts are likely to result, namely:

- direct impacts;
- indirect impacts; and
- impacts of a cumulative nature.

25.1 NATURE OF IMPACTS

25.1.1 DIRECT IMPACTS

The largest extent of impacts within the biological environment is likely to result because of direct (physical) effects of land clearing activities and habitat loss. Direct impacts include any effect on the various habitat types, including locally endemic species, populations or individual species of conservation importance, as well as on overall species richness, diversity and abundance. These impacts also include effects on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. Loss of sensitive, restricted or protected habitat types are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty. Impacts of a direct nature include the following:

1. Loss of plant taxa of conservation importance/ concern;
2. Loss of habitat associated with plant taxa of conservation importance;
3. Local depletion of plant taxa and reduction of phytodiversity;
4. Loss of atypical, sensitive, conservation important habitat or ecosystems of restricted abundance; and
5. Loss and alteration of ecological processes and ecosystem services within the proposed site.

25.1.2 INDIRECT IMPACTS

In contrast, indirect impacts are not always immediately evident and can consequently not be measured at a specific moment in time; 'spill-over effects' are spatially and temporally removed from the actual activity and manifestations are typically subtle. The extent of the effect is frequently at a scale that is larger than the actual site of impact, but usually restricted to a local scale (and not regional). A measure of estimation, extrapolation, or interpretation is therefore required to evaluate the importance of these impacts and is usually a factor of the sensitivity of the receiving surrounding environment. This type of impact typically results in adverse effects or deterioration of surrounding areas due to uncontrolled, development related activities.

In addition, the ecological functionality of the immediate and surrounding area could be adversely affected by the proposed development, with reference to the ecological interaction between plants and animals. Lastly, one of the most important effects of indirect impacts is the alteration of biophysical characteristics of the surrounding areas through the introduction and proliferation of plants with an exotic nature or encroachment characteristics. Impacts of an indirect nature generally include the following:

6. Impacts on surrounding habitat types that are associated with plants of conservation importance (decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.);
7. Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat; and

8. Exacerbated encroachment of invasive, exotic and encroacher plant species.

25.1.3 CUMULATIVE IMPACTS

Cumulative impacts are generally defined as those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. Impacts of a cumulative nature place direct and indirect impacts of this projects into a regional and national perspective. Cumulative impacts typically adversely affect the local and regional conservation status of plant and animal taxa and protected habitat types as well as local and regional fragmentation levels, but also issues such as increased exploitation due to the exacerbation of anthropogenic activities on a local scale. These impacts are notoriously problematic to control or prevent, often requiring huge financial commitments to mitigate. Impacts of a cumulative nature typically include the following:

9. Increased plundering of natural resources due to increased human encroachment;
10. Exacerbation of existing levels of habitat fragmentation and isolation; and
11. Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural grassland habitat).

25.2 METHOD STATEMENT

Table 10 clarifies the applied method for assessing the significance of impacts (as supplied by the EAP).

Table 9: Categorisation of Impact Significance		
Descriptive criteria		
Nature	Category	
Extent (E)	Categories 1 – 4	
	1	Footprint / site
	2	Local (within a radius of 2 kms of site)
	3	Regional
	4	National
Duration (D)	Categories 1 – 4	
	1	Short (less than five years)
	2	Medium term (5-15 years)
	3	Long term (15-30 years)
	4	Permanent
Intensity (I)	Categories 1 – 4	
	1	Low
	2	Moderate
	3	High
	4	Very High
Probability (P)	Categories 1 – 4	
	1	Improbable
	2	Probable
	3	Highly Probable
	4	Definite

IMPACT : Cumulative		
Extent (E)		
Duration (D)		
Intensity (I)		
Probability (P)		
Significance	Significance = E + D + I + P	
	Minimum value of 4, maximum of 16	
	Status determines if positive / negative	
	Negative (13 - 16 points) NEGATIVE VERY HIGH	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
	Negative (10 - 12 points) NEGATIVE HIGH	These are impacts which individually or combined pose a significantly high negative risk to the environment. These impacts pose a high risk to the quality of the receiving environment. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
	Negative (7 - 9 points) NEGATIVE MODERATE	These are impacts which individually or combined pose a moderate negative risk to the quality of health of the receiving environment . These systems would not generally require immediate action, but the deficiencies should be rectified to avoid future problems and associated cost to rectify once in HIGH risk. Aesthetically and/or physically non-compliance can be expected over a medium term. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable. Mitigation is possible with additional design and construction inputs.
	Negative (4 - 6 points) NEGATIVE LOW	These are impacts which individually or combined pose a deleterious or adverse impact and low negative risk to the quality of the receiving environment, and may lead to potential health, safety and environmental concerns. Aesthetically and/or physical non-compliance can be expected for short periods. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	Positive (4 - 6 points) POSITIVE LOW	These are impacts which individually or combined pose a low positive impact to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance.
	Positive (7 - 9 points) POSITIVE MODERATE	These are impacts which individually or combined pose a moderate positive effect to the quality of health of the receiving environment. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable.
	Positive (10 - 12 points) POSITIVE HIGH	These are impacts which individually or combined pose a significantly high positive impact on the environment. These impacts pose a high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is longer term, greater in extent, intense in its effect and highly likely to occur. The effects of the impact may affect the broader environment.
	Positive (13 - 16 points) POSITIVE VERY HIGH	Permanent and important beneficial impacts which may arise. Individually or combined, these pose a significantly high positive impact on the environment. These impacts pose a very high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is long term, greater in extent, intense in its effect and highly likely or definite to occur. The effects of the impact may affect the broader environment.

25.3 QUANTITATIVE EVALUATION OF EXPECTED IMPACTS ON THE BOTANICAL RECEIVING ENVIRONMENT

25.3.1 IMPACT SIGNIFICANCE – DIRECT IMPACTS

Nature	1. Direct - Loss of plant taxa of conservation importance/ concern	
	Before Mitigation	After Mitigation
Extent	1 (Footprint/ Site)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	6 (NEGATIVE LOW)	5 (NEGATIVE LOW)
Nature	2. Direct - Loss of habitat associated with plant taxa of conservation importance	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)
Nature	3. Direct - Local depletion of plant taxa and reduction of phytodiversity	
	Before Mitigation	After Mitigation
Extent	1 (Footprint/ Site)	1 (Footprint/ Site)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	6 (NEGATIVE LOW)	5 (NEGATIVE LOW)
Nature	4. Direct - Loss of atypical, sensitive, conservation important habitat or ecosystems of restricted abundance	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)
Nature	5. Direct - Loss and alteration of ecological processes and ecosystem services within the proposed site	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	9 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)

25.3.2 IMPACT SIGNIFICANCE – INDIRECT IMPACTS

Nature	6. Indirect - Impacts on surrounding habitat types that are associated with plants of conservation importance	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)
Nature	7. Indirect - Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	7 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)
Nature	8. Indirect - Exacerbated encroachment of invasive, exotic and encroacher plant species	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	4 (Permanent)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	3 (Highly probable)	1 (Improbable)
Significance	11 (NEGATIVE HIGH)	5 (NEGATIVE LOW)

25.3.3 IMPACT SIGNIFICANCE – CUMULATIVE IMPACTS

Nature	9. Cumulative - Increased plundering of natural resources due to increased human encroachment	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	6 (NEGATIVE LOW)	5 (NEGATIVE LOW)
Nature	10. Cumulative - Exacerbation of existing levels of habitat fragmentation and isolation	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	4 (Permanent)	3 (Long term, 15-30 years)
Intensity	1 (Low)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	7 (NEGATIVE MODERATE)
Nature	11. Cumulative - Cumulative impacts on local/ regional and national conservation targets and obligations	
	Before Mitigation	After Mitigation
Extent	3 (Regional)	2 (Local <2 km radius)
Duration	4 (Permanent)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	10 (NEGATIVE HIGH)	6 (NEGATIVE LOW)

25.3.4 IMPACT SIGNIFICANCE – SUMMARY

Table 10: Summary of Impact Significance within the Botanical Receiving Environment		
Impact	Before Mitigation	After Mitigation
1. Direct - Loss of plant taxa of conservation importance/ concern	6	5
2. Direct - Loss of habitat associated with plant taxa of conservation importance	8	5
3. Direct - Local depletion of plant taxa and reduction of phytodiversity	6	5
4. Direct - Loss of atypical, sensitive, conservation important habitat or ecosystems of restricted abundance	8	6
5. Direct - Loss and alteration of ecological processes and ecosystem services within the proposed site	9	6
6. Indirect - Impacts on surrounding habitat types that are associated with plants of conservation importance	8	6
7. Indirect - Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat	7	6
8. Indirect - Exacerbated encroachment of invasive, exotic and encroacher plant species	11	5
9. Cumulative - Increased plundering of natural resources due to increased human encroachment	6	5
10. Cumulative - Exacerbation of existing levels of habitat fragmentation and isolation	8	7
11. Cumulative - Cumulative impacts on local/ regional and national conservation targets and obligations	10	6

25.4 BRIEF DISCUSSION OF ESTIMATED IMPACT SIGNIFICANCE

Direct Impacts – As the absence of any natural, pristine or sensitive natural grassland that could be construed as being representative of pristine grassland of the regional ecological type (Eastern Free State Sandy Grassland), notably also with reference to conservation important plants and associated habitat, have been demonstrated by this botanical assessment, the expected direct impact significance is generally regarded as low. Any significant direct impact on natural and sensitive flora is therefore unrealistic as habitat within the proposed development footprint has already been transformed through historic, long-term and persistent subsistence agricultural practices. The effective implementation of generic mitigation measures is expected to ameliorate the significance of direct impacts to an acceptable level.

It should however be noted that moderately sensitive wetland habitat is situated on the eastern border of the site and construction activities could potentially result in some impact within these environs. Despite vegetation within these parts of the site regarded as severely deteriorated because of persistent, long-term and inappropriate grazing and trampling, the contribution of these habitats to ecosystem services is regarded important and should therefore be afforded some protection from inadvertent impacts from the proposed development. The most effective manner by which this could be achieved would be the exclusion of these minor areas from the footprint and the implementation of an effective buffer zone. Recommendations presented in the wetland report is referenced in this regard to provide input for an effective buffer width. The implementation of a protective buffer and effective management of these areas during the construction and operational phases are expected to ameliorate the significance of direct impacts within these sensitive environs to an acceptable level.

Other sensitive environs, including topographically heterogeneous habitat such as cliffs, outcrops, ledges and surface rocks, are unlikely to be subjected to direct impacts as these areas are located outside the proposed development footprint. Existing impacts within these environs are therefore unlikely to be exacerbated by direct impacts from the proposed development. Other than avoidance of any inappropriate and inadvertent impacts within these areas, no specific mitigation measures are proposed.

Indirect Impacts – Moderately significant indirect impacts are expected to result from the proposed development. Located in the direct vicinity of the proposed development footprint are areas that exhibit either sensitive floristic habitat (ridges, ledges, cliffs, etc.) or habitat that comprise important ecosystem services and functions (drainage lines, grassland seepages, etc.). The need to conserve and protect these habitat types from inadvertent and indirect impacts from the development is demonstrated by the near-absence of pristine and natural habitat types on a local and regional scale. Effects of the proposed development that could potentially cause delayed impacts, such as contamination, exacerbation of erosion, increased and inappropriate exploitation, changes to the ecological functionality, exacerbation and introduction of weeds and invasive plants, etc. need to be prevented at the source and monitored as part of a dedicated biodiversity monitoring plan.

It should be noted that these indirect impacts, when not adequately and timeously addressed and mitigated, do exhibit the potential to cause severe, significant and unacceptable impacts within the surrounding receiving environment and therefore need to be corrected within short timeframes. Controlling and correcting these impacts are generally simple, effective and cost -and time efficient. The implementation of a biodiversity monitoring protocol and periodic audits will effectively highlight inappropriate effects on the surrounding environment that caused by construction and operational activities. Preventative measures generally include the clear and definite delineation of the development footprint, boundaries that determine construction and operational activities and preventing the spread and use of surrounding areas for any purpose whatsoever. Sensitive habitat types, as mentioned above, should be highlighted as being sensitive and important and are specifically mentioned in this regard.

Cumulative Impacts – The expected significance of cumulative impacts ensuing from the development are regarded only of moderate significance, mainly because of the absence of expansive areas of natural, and ecologically sensitive areas in the direct proximity to the site. Expected cumulative impacts are not regarded particularly significant within a larger region where significant and historic anthropogenic impacts are already rife and severe, exhibiting signs of significant deterioration and decimation of the original grassland habitat. The estimated moderate significance of these cumulative impacts mainly stem from increased anthropogenic presence and activities in the surrounding region (uncontrolled influx of people, jobseekers, informal business, etc.) and the associated effects (increased linear-, residential infrastructure, commercial- and industrial activities, exacerbated habitat fragmentation and exploitation of natural resources) on remaining sensitive natural habitat and ecological infrastructure. Prevention, control and reversing results of these cumulative impacts within areas of expansive natural habitat are generally outside the direct management and control of the developer and/ or operator and are also notoriously difficult and costly to control. Fortunately, it is regarded of lower importance/ significance for this project where widespread and extensive anthropogenic effects rendered the surrounding region less pristine.

While some direct and indirect impacts, such as the loss of habitat within the development footprint and unavoidable increase in landscape fragmentation and cumulative losses of natural habitat are generally unavoidable due to the nature of the development, the severity of these impacts (on a cumulative scale) are however manageable to some extent. The effective implementation of generic mitigation measures is expected to ameliorate the significance of cumulative impacts to an acceptable level.

26 RECOMMENDED BOTANICAL MITIGATION APPROACH FOR THE PROJECT

26.1 BACKGROUND

Mitigation aims to eliminate or reduce negative biodiversity impacts. Mitigation options should generally be considered in the following order of preference:

1. Avoidance of impacts altogether;
2. Reduction of impacts where unavoidable;
3. Restoration of habitats to their original state;
4. Relocation of affected species or habitats; or
5. Compensation for any residual, unavoidable damage.

The mitigation of negative impacts on biodiversity and ecosystem services is a legal requirement for authorisation purposes and must take on different forms depending on the significance of the impact and the area being affected. Mitigation requires proactive planning that is enabled by following the mitigation hierarchy, illustrated in Figure 14. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity, where:

Avoiding or preventing impacts – refers to considering options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is the best option but is not always possible if development/ construction is to take place. However, there are areas where the environmental and social constraints are too high, and development should not take place. Such areas are best identified early in the development life cycle, so that impacts can be avoided, and authorisations refused. In the case of areas where environmental constraints might be limiting, this includes some ecosystems, habitats, ecological corridors, or areas that provide essential ecosystem services and are of such significant conservation value or importance that their loss cannot be compensated for (i.e. there is no substitute). In such areas, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation hierarchy (e.g. rehabilitating or offsetting impacts) to provide effective remedy for impacts on biodiversity or ecosystem services. Information about the location of many such areas is available, often making it possible to avoid them.

Reduction of impacts where unavoidable – refers to considering alternatives in the project location, siting, scale, layout, technology and phasing that would minimise impacts on biodiversity and ecosystem services. Even in areas where the environmental and social constraints are not particularly high for development to proceed/take place every effort should still be made to minimise impacts.

Restoration of habitats to their original state – refers to the rehabilitation of areas where impacts were unavoidable, and measures are taken to return impacted areas to a condition ecologically similar to their 'pre-development natural state' or an agreed land use after closure. Although rehabilitation is important and necessary, unfortunately even with significant resources and effort, rehabilitation is a limited process that usually falls short of replicating the diversity and complexity of a natural system. Instead, rehabilitation helps to restore some resemblance of ecological functioning in an impacted landscape, to avoid on-going negative impacts, and/or to provide some sort of aesthetic fix for a landscape. Rehabilitation should occur concurrently or progressively with the proposed activity, and/or on cessation of the activity.

Relocation of affected species or habitat – refers to the physical translocation of affected individuals within the footprint, or adjacent areas, where unavoidable and devastating effects are likely to occur. The translocation of individuals is generally subject to permitting requirements and should be based on a like-for like habitat, taking cognisance of potential impacts such as genetic populations, geographic isolation, etc. The relocation of habitat is generally in severely selective events where small, isolated and biologically significant habitat can be realistically relocated

and reproduced outside the affected footprint. This approach can also be augmented by propagation of certain species.

Offset impacts/ Compensation for any residual, unavoidable damage –refers to compensating for remaining and unavoidable negative effects on biodiversity. When every effort has been made to minimise and then rehabilitate remaining impacts to a degree of no net loss of biodiversity against biodiversity targets, biodiversity offsets can provide a mechanism to compensate for significant residual negative impacts on biodiversity.

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives of project location, footprint siting, scale, layout, technology and phasing until the proposed development best 'suits' and can be accommodated without significant negative impacts in the receiving environment. In cases where the receiving environment cannot support the development (e.g. there is insufficient water) or where the project will eradicate unique biodiversity, the development may not be feasible; the earlier the developing company knows of these risks, and can plan to avoid them, the better. In cases where biodiversity impacts are likely to be severe, the guiding principle should therefore be to "anticipate and prevent" rather than "assess and repair".

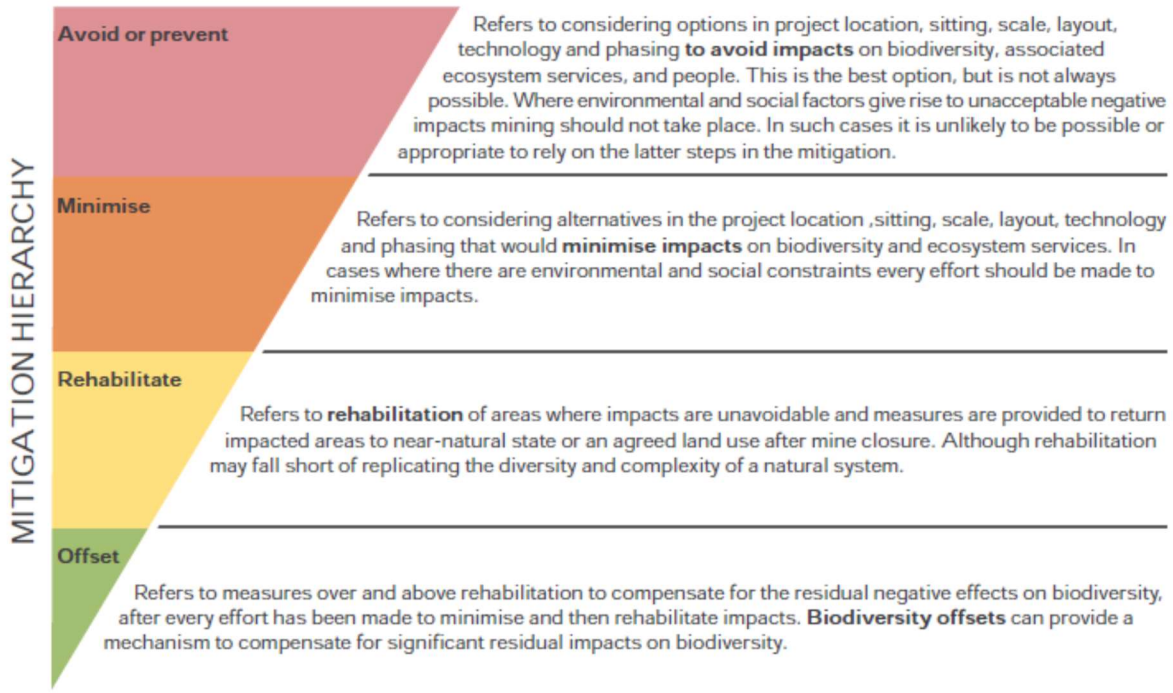

Figure 14: Mitigation hierarchy for dealing with negative impacts on biodiversity

The mitigation approach should be contained and elaborated in the Environmental Management Plan for the development and should be regarded as a 'Living Document' that will be amended and updated as new information becomes available. The following mitigation actions are recommended:

26.2 GENERAL MITIGATION RECOMMENDATIONS

Mitigation Measure 1 - Appoint an Environmental Officer (EO) with a suitable knowledge of the local ecology and biodiversity aspects of the region. This appointment should be done prior to commencement of construction activities. Responsibilities should include, but not necessarily be limited to, ensuring adherence to EMP guidelines, guidance of activities, planning, reporting;

Mitigation Measure 2 - The immediate compilation and implementation of an Alien and Invasive Management Programme for the development footprint. The aim of this programme should include (*inter alia*) the identification, control and eradication of invasive and exotic plants from the site. Introducing an aspect of social responsibility and understanding to surrounding communities is regarded pertinent;

Mitigation Measure 3 - The immediate development and implementation of a Biodiversity Monitoring Protocol, which must be based on scientific sampling methods, is strongly recommended. Monitoring efforts should, at least, include a pre-construction, construction and post construction assessment of the biological environment. As a by-product of the biodiversity monitoring programme, available data will add value to existing biological knowledge and understanding of the ecological infrastructure of the region.

Mitigation Measure 4 - Rehabilitation efforts of all areas where land has been cleared should be undertaken with the objective of establishing a vegetatal layer that approximates the pre-development environment in terms of structure and composition.

26.3 SITE SPECIFIC MITIGATION MEASURES

Mitigation Measure 5 - Implement a suitable mitigation strategy within wetland areas of the site, taking cognisance of recommendations presented in the wetland ecological report, e.g. required buffer zones and construction limitations, if any;

Mitigation Measure 6 - Prevent contamination of natural grasslands, drainage lines, grasslands seepages from the development footprint or any other source of pollution.

Mitigation Measure 7 - The use of locally indigenous plants for the purposed of the visual screen around the perimeter of the development footprint is recommended, taking cognisance of the following aspects:

- Growth form, maximum height;
- Local use characteristics, seeds, fruit, flowers, etc.
- Availability and associated costs;
- Invasive nature and propagation; and
- Maintenance requirements, trimming, pruning, water supply.

26.4 FENCES & DEMARCATION

Mitigation Measure 8 - Demarcate the approved footprint and construction areas by permanent means at the onset of construction to prevent accidental or unwarranted access to, or unwanted impacts in surrounding natural habitat and to control movement of personnel, vehicles, providing restrictive boundaries for construction and operational sites;

Mitigation Measure 9 - No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required.

26.5 FIRE

Mitigation Measure 10 - The Project team must compile a Fire Management Plan (FMP) for implementation by all Contractors;

Mitigation Measure 11 - The FMP shall include (*inter alia*) aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 1998;

Mitigation Measure 12 - Prevent all open fires on site;

Mitigation Measure 13 - Provide demarcated fire-safe zones, facilities and suitable fire control measures;

Mitigation Measure 14 - Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines;

Mitigation Measure 15 - The use of fire as a vegetation management tool should be guided and instructed by a qualified ecologist.

26.6 ROADS & ACCESS

Mitigation Measure 16 - Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. Access to development areas (beyond existing roads) will be undertaken will all due care to avoid erosion any unwanted impacts in sensitive areas; and

Mitigation Measure 17 - Dust control on all roads should be prioritised during all stages of development and operation.

26.7 WORKERS & PERSONNEL

Mitigation Measure 18 - No roads should be allowed within ecologically sensitive areas.

Mitigation Measure 19 - Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities until such time that adequate permanent and operational facilities can be provided;

Mitigation Measure 20 - Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted.

26.8 VEGETATION CLEARANCE & OPERATIONS

Mitigation Measure 21 - The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within demarcated working areas) shall be removed, damaged or tampered with;

Mitigation Measure 22 - Monitor the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa must be addressed on a continual basis, through an alien vegetation control and monitoring programme;

Mitigation Measure 23 - The developer must immediately take steps to remove alien vegetation. This should be done based on an alien invasive management strategy that should be compiled by a suitable ecologist. The plan must make reference to:

⇒ Uprooting, felling or cutting;

⇒ Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;

⇒ Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive.

⇒ Any person applying herbicide must be adequately qualified and certified as well as registered with the appropriate authority to handle and apply herbicides.

Mitigation Measure 24 - The size of areas subjected to land clearance must be kept to a minimum;

Mitigation Measure 25 - Only areas as instructed by the Site Manager must be cleared and grubbed;

Mitigation Measure 26 - Cleared vegetation and debris that has not been utilised must be collected and disposed of to a suitable waste disposal site. It may not be burned on site;

Mitigation Measure 27 - All vegetation not required to be removed must be protected against damage;

Mitigation Measure 28 - Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible, with specific reference to impacts related to soil erosion;

Mitigation Measure 29 - Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes to facilitate regrowth of species that occur naturally in the area;

Mitigation Measure 30 - Stored topsoil must be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting;

Mitigation Measure 31 - No spoil material may be dumped outside the defined site;

Mitigation Measure 32 - Disturbance of vegetation must be limited to areas of construction.

26.9 REHABILITATION AND RESTORATION

Mitigation Measure 33 - Ensure proper surface restoration and resloping to prevent erosion, taking cognisance of local contours and landscaping;

Mitigation Measure 34 - Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation;

Mitigation Measure 35 - The grass mix should consist of locally indigenous grasses adapted to the local environmental conditions;

Mitigation Measure 36 - Revegetated areas should be fenced to prevent damage by grazing animals;

Mitigation Measure 37 - Re-vegetated areas showing inadequate surface coverage (less than 30 % within eight months after re-vegetation) should be prepared and re-vegetated from scratch;

Mitigation Measure 38 - Damage to re-vegetated areas should be repaired promptly;

Mitigation Measure 39 - As far as practically possible, only indigenous plant species that are endemic to the area/region are to be used in landscaping activities on the site, as these species are adapted to the specific conditions (climatic, soil, etc) of the area and would require the least amount of irrigation, pesticides, etc;

Mitigation Measure 40 - Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the vegetation to properly establish.

Mitigation Measure 41 - As far as possible, waste should be avoided, reduced, re-used and/or recycled. Where this is not feasible, all waste (general and hazardous) generated during the construction of the power facility may only be disposed of at appropriately licensed waste disposal sites (in accordance with legal frameworks);

Mitigation Measure 42 - Erosion should be contained at all costs, existing erosion features in the immediate surrounds of the development footprint should be stabilized, and in collaboration with the local community, restored as an opportunity to provide guidance to local land users. Reference is made of mitigation presented as part of the specialist Wetland Ecology Report for this project.

26.10 WASTE

Mitigation Measure 43 - Prevent and advocate against the indiscriminate disposal of rubbish, litter or rubble;

Mitigation Measure 44 - The burning of general waste material is not to be allowed;

Mitigation Measure 45 - Waste must be sorted prior to leaving the site (i.e. the separation of tins, glass, paper etc) and disposed of at a suitable site;

Mitigation Measure 46 - A stormwater management plan must be compiled that will address, inter alia, capturing and storage of stormwater;

Mitigation Measure 47 - All runoff water from fuel deposits, workshops, vehicles washing areas and other equipment must be collected and directed through oil traps to settlement ponds. These ponds must be suitably lined and should be cleaned as soon as practicable, and the sludge disposed of at a suitable and permitted/ approved waste site;

Mitigation Measure 48 - No wastewater or water containing any chemical or pollutant should be released from, or escape as effluent, from the site.

26.11 SUGGESTED BOTANICAL MONITORING PROTOCOL

To ensure the accurate gathering of botanical data during the monitoring protocol, the following techniques and guidelines (*inter alia*) should be followed (as a minimum):

⇒ Fixed point monitoring should be applied as the preferred method of monitoring, with ad hoc investigation of potentially sensitive areas;

⇒ All data gathered should be measurable (qualitative and quantitative), with an additional aim of contribution to the local and regional knowledge of botanical scientific data;

⇒ Monitoring report should be repeatable and temporally and spatially comparable, with an emphasis on seasonality;

⇒ Data, when compared to previous sets, should show spatial and temporal trends; and

⇒ General habitat unit overviews should also be undertaken to augment quantitative data on a local and regional scale.

As part of the proposed (annual) Botanical Monitoring Programme, the following aspects are recommended for inclusion into the monitoring programme:

⇒ Temporal monitoring of development related impacts; an annual monitoring period is suggested;

⇒ Floristic diversity & compositional monitoring;

⇒ Floristic species richness monitoring;

⇒ Compositional monitoring within affected areas;

⇒ Conservation important plant monitoring programme within immediate surrounds of the site;

⇒ Plants with ethno-botanical properties monitoring programme;

⇒ Alien and invasive plant monitoring;

⇒ Structural and compositional monitoring; and

⇒ Land change/ habitat loss and transformation monitoring programme.

27 IFC PERFORMANCE STANDARD 1 & 6 - BOTANICAL ASSESSMENT

PS6 requires upfront identification of priority biodiversity features (based on the vulnerability and/or irreplaceability of species and ecosystems) at greatest risk from developments, and a rigorous application of the Mitigation Hierarchy. Where there are measurable adverse impacts for Critical Habitat qualifying features, or significant alteration of integrity or viability in Natural Habitat, PS6 respectively requires either a net gain or net balance for these features and habitats. IFC PS6 thereby provides an effective framework for improving overall biodiversity outcomes by focusing on the key issues, reducing unnecessary information and analysis often associated with contemporary ESIAs.

IFC PS1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.

As per Paragraph 6, the assessment of potential and likely impacts within the botanical receiving environment indicates Low to Moderate impact significance associated with impacts within the botanical receiving environment (as per Section 25 of the Botanical Assessment document); no significant losses of natural or critical habitat and/ or species are expected and risks are generally regarded as Low.

As per Paragraph 6, the introduction of generic mitigation measures (as per Section 26 of the Botanical Assessment document) are expected to result in successful and effective amelioration of impacts to acceptable significance levels. Residual impacts are expected to be minimal and, with the ultimate decommissioning of the development footprint (and with the understanding that comprehensive rehabilitation is undertaken), the site is expected to revert back to the agricultural uses for which it is currently used. Additionally, the introduction of a biodiversity monitoring protocol will provide the opportunity to add value to the existing level of floristic and ecological knowledge of the region.

As per Paragraph 11, the largest extent of the development footprint (>95 %) currently comprises of Modified Habitat, which is generally defined as areas that contain a large proportion of plant and/ or animal species of non-native origin, and/ or where human activity has substantially modified and area's primary ecological functions and species composition. Long term and persistent subsistence agricultural uses of the site has resulted in the total transformation of the original grasslands to secondary grassland and shrubland types that bear no resemblance (structurally and compositionally) to the original ecological type (Eastern Free State Sandy Grassland). These areas do not exhibit or include significant biodiversity value, other than fairly poor grazing for cattle. The ultimate rehabilitation of the site after decommissioning should consider the reversion of sterile land to pastures that would benefit surrounding communities for grazing purposes.

As per Paragraph 12, small portions of the site, notably in the eastern section and also bordering the site towards the east, comprises of Natural Habitat. These areas, although not exhibiting typical characteristics in terms of floristic composition, are nonetheless regarded as important on a local scale in terms of the ecological functionality that is associated with these features. Grassland seepages, drainage lines and natural springs are regarded important aspects of the ecological infrastructure, and although operating in a slightly modified manner, should be provided protection against further degradation. As per Paragraph 14, the client should implement all suggested Mitigation Measures (as per Section 26 of the Botanical Assessment document) to ensure the effective preservation of these features. Additionally, the opportunity to contribute towards available scientific, as well as local, knowledge and understanding of the flora of the immediate region can be achieved from the implementation of a Biodiversity Monitoring Protocol.

With the successful implementation of the suggested Mitigation Approach (as per Section 26 of the Botanical Assessment document), no nett loss of botanical features are expected.

As per Paragraph 16, no areas of Critical Habitat and/ or Species (considering botanical aspects) are present within the development site footprint, or immediate surrounds. Critical habitat is generally defined as areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. No Biodiversity Offset Programme is recommended for the botanical aspects of this particular project.

As per Paragraph 20, the proposed development footprint is not located within, or within reasonable proximity, to Legally Protected and Internationally Recognised Areas or an internationally recognised area. Despite the obvious deteriorated nature of the site, it was nonetheless recommended to provide scientific and consumer related improvements during and subsequent to the proposed development.

As per Paragraph 21, a list of common and declared Alien and Invasive Plants that were recorded in the site and immediate surrounds are presented as part of this Botanical Assessment document (refer Section 22.3) and aspects pertaining to the identification and management/ control/ eradication is included as part of the recommendation for the development of an Alien and Invasive Plant Management Plan (as per Section 26.11 of this Botanical Assessment document).

28 CONCLUDING STATEMENT

The botanical receiving environment of the site and immediate surrounds demonstrates classic attributes of severely deteriorated and modified habitat as defined by the IFC Performance Standard 6. Historic, long-term and persistent subsistence agricultural practices and persistent, inappropriate and high grazing pressure have decimated and transformed natural vegetation within the development footprint (and surrounds), leading to the establishment of secondary climax vegetation and several other successional vegetatal stages that does not exhibit any characteristics of the original natural grasslands of the Sandy Eastern Free State Sandy Grasslands ecological type. Limited habitat were recognised as being moderately important in terms of the provision of ecological services, notably the wetlands towards the east of the footprint.

Existing scientific floristic knowledge of the area is sparse; the regional ecological type is described as the Eastern Free State Sandy Grassland and is currently afforded an Endangered conservation status. Scientific knowledge of the floristic diversity of the immediate region indicates a high paucity of accurate and comprehensive data with only 187 species indicated in the relevant ¼ degree grid. However, the recorded diversity of only 81 species (October 2018) within the development footprint and immediate surrounds substantiates the categorisation of the vegetation of the site and surrounds as transformed and deteriorated. Considering the known high floristic diversity of the Grassland Biome in general, and the similarly diverse nature of natural grasslands in Lesotho, the poor floristic diversity of the site confirms the modified nature of the receiving environment.

Additionally, no plant species of conservation concern or -importance were recorded during this assessment, despite some seasonal constraints. Furthermore, no habitat was identified as being of particular importance for Red Data refugia or suitable for the persistence of these species within the development footprint. However, several small niches were identified within the proximity to the site that is typically affiliated with plants of conservation concern.

As could be expected, an evaluation of potential and likely impacts on the floristic receiving environment revealed that impact significance are generally low to moderate. The comprehensive and timeous implementation of the botanical mitigation strategy is expected to ameliorate the significance of impacts to an acceptable level.

It is therefore the considered opinion of the specialist that the proposed development and operation of the NEO 1 PV Project is not expected to result in significant or severe impacts on the floristic environment on a local or regional scale; with the understanding that a complete and comprehensive mitigation approach is followed for the duration of the project, i.e. through completion of the decommissioning phase and restoration of all development areas.

29 APPENDIX 1: REGIONAL FLORISTIC DIVERSITY

Appendix 1: SANBI botanical sampling records in the surrounds of the study area		
Species	*Family*	*Growth Form*
Acalypha punctata var. *punctata*	Euphorbiaceae	Dwarf shrub
Ajuga ophrydis	Lamiaceae	Herb
Albuca baurii	Hyacinthaceae	Geophyte
Albuca setosa	Hyacinthaceae	Geophyte
Albuca tortuosa	Hyacinthaceae	Geophyte
Albuca virens subsp. *virens*	Hyacinthaceae	Geophyte
Alepidea serrata var. *serrata*	Apiaceae	Herb
Aloe broomii var. *broomii*	Asphodelaceae	Succulent
Aloe ecklonis	Asphodelaceae	Succulent
Aloe ferox	Asphodelaceae	Succulent
Aloe maculata subsp. *ficksburgensis*	Asphodelaceae	Succulent
Aloe subspicata	Asphodelaceae	Succulent
Aponogeton junceus	Aponogetonaceae	Geophyte
Arctotis arctotoides	Asteraceae	Herb
Aristaloe aristata	Asphodelaceae	Succulent
Aristea abyssinica	Iridaceae	Herb
Aristida congesta subsp. *congesta*	Poaceae	Graminoid
Asclepias eminens	Apocynaceae	Herb
Asparagus asparagoides	Asparagaceae	Succulent
Asparagus denudatus	Asparagaceae	Shrub
Asparagus microraphis	Asparagaceae	Shrub
Asparagus stellatus	Asparagaceae	Dwarf Shrub
Aspidoglossum araneiferum	Apocynaceae	Succulent
Aspidoglossum lamellatum	Apocynaceae	Succulent
Asplenium adiantum-nigrum var. *adiantum-nigrum*	Aspleniaceae	Lithophyte
Asplenium aethiopicum	Aspleniaceae	Lithophyte
Berkheya buphthalmoides	Asteraceae	Herb
Berkheya discolor	Asteraceae	Herb
Bromus commutatus	Poaceae	Graminoid
Brunsvigia radulosa	Amaryllidaceae	Geophyte
Buglossoides arvensis	Boraginaceae	Herb
Carex acutiformis	Cyperaceae	Hydrophyte
Carex spartea	Cyperaceae	Sedge
Chamarea sp.	Apiaceae	Herb
Cheilanthes eckloniana	Pteridaceae	Lithophyte
Cheilanthes hirta var. brevipilosa forma *brevipilosa*	Pteridaceae	Herb
Cheilanthes quadripinnata	Pteridaceae	Lithophyte
Cheilanthes viridis var. viridis	Pteridaceae	Lithophyte
Cineraria geifolia	Asteraceae	Suffrutex
Cliffortia paucistaminea var. *paucistaminea*	Rosaceae	Shrub
Commelina africana var. *lancispatha*	Commelinaceae	Herb
Convolvulus arvensis	Convolvulaceae	Climber
Convolvulus sagittatus	Convolvulaceae	Herb
Conyza podocephala	Asteraceae	Herb
Conyza scabrida	Asteraceae	Shrub
Cotyledon orbiculata var. *oblonga*	Crassulaceae	Succulent
Crassula natans var. *natans*	Crassulaceae	Succulent
Crassula sediflora var. *sediflora*	Crassulaceae	Succulent
Crassula vaillantii	Crassulaceae	Succulent
Ctenium concinnum	Poaceae	Graminoid
Cucumis myriocarpus subsp. *myriocarpus*	Cucurbitaceae	Herb
Cymbopogon caesius	Poaceae	Graminoid

Cymbopogon dieterlenii	Poaceae	Graminoid
Cymbopogon pospischilii	Poaceae	Graminoid
Cynoglossum spelaeum	Boraginaceae	Herb
Cyperus obtusiflorus var. *obtusiflorus*	Cyperaceae	Cyperoid
Cyperus parvinux	Cyperaceae	Cyperoid
Cyperus usitatus	Cyperaceae	Cyperoid
Cyphia triphylla	Lobeliaceae	Climber
Cyrtanthus contractus	Amaryllidaceae	Geophyte
Dimorphotheca jucunda	Asteraceae	Herb
Diospyros lycioides subsp. *lycioides*	Ebenaceae	Shrub
Dipcadi viride	Hyacinthaceae	Geophyte
Dolichos pratensis	Fabaceae	Climber
Dryopteris inaequalis	Dryopteridaceae	Geophyte
Dysphania multifida	Amaranthaceae	Herb
Echinochloa stagnina	Poaceae	Graminoid
Eleocharis dregeana	Cyperaceae	Cyperoid
Elionurus muticus	Poaceae	Graminoid
Equisetum ramosissimum subsp. *ramosissimum*	Equisetaceae	Hydrophyte
Erica schlechteri	Ericaceae	Shrub
Eriocephalus eximius	Asteraceae	Shrub
Eriospermum cooperi var. cooperi	Ruscaceae	Geophyte
Eriospermum schinzii	Ruscaceae	Geophyte
Eucomis autumnalis subsp. *autumnalis*	Hyacinthaceae	Geophyte
Eucomis autumnalis subsp. *clavata*	Hyacinthaceae	Geophyte
Eulophia hians var. *hians*	Orchidaceae	Geophyte
Eulophia hians var. *nutans*	Orchidaceae	Geophyte
Eulophia ovalis var. *ovalis*	Orchidaceae	Geophyte
Fallopia convolvulus	Polygonaceae	Climber
Felicia filifolia subsp. *filifolia*	Asteraceae	Shrub
Festuca scabra	Poaceae	Graminoid
Ficinia cinnamomea	Cyperaceae	Cyperoid
Fingerhuthia africana	Poaceae	Graminoid
Fingerhuthia sesleriiformis	Poaceae	Graminoid
Garuleum woodii	Asteraceae	Suffrutex
Gladiolus dalenii subsp. *dalenii*	Iridaceae	Geophyte
Gnaphalium confine	Asteraceae	Herb
Habenaria epipactidea	Orchidaceae	Geophyte
Hebenstretia dentata	Scrophulariaceae	Herb
Hebenstretia dura	Scrophulariaceae	Shrub
Helichrysum chionosphaerum	Asteraceae	Herb
Helichrysum cooperi	Asteraceae	Herb
Helichrysum dregeanum	Asteraceae	Dwarf Shrub
Helichrysum pedunculatum	Asteraceae	Herb
Helichrysum rugulosum	Asteraceae	Herb
Helichrysum splendidum	Asteraceae	Herb
Helichrysum sutherlandii	Asteraceae	Dwarf shrub
Helictotrichon longifolium	Poaceae	Graminoid
Helictotrichon turgidulum	Poaceae	Graminoid
Heliophila suavissima	Brassicaceae	Dwarf Shrub
Hibiscus aethiopicus var. *ovatus*	Malvaceae	Herb
Hibiscus trionum	Malvaceae	Herb
Hyparrhenia dregeana	Poaceae	Graminoid
Hyparrhenia hirta	Poaceae	Graminoid
Hyparrhenia tamba	Poaceae	Graminoid
Hypericum aethiopicum subsp. *sonderi*	Hypericaceae	Herb
Hypoxis acuminata	Hypoxidaceae	Geophyte

Hypoxis argentea var. *sericea*	Hypoxidaceae	Geophyte
Hypoxis longifolia	Hypoxidaceae	Geophyte
Hypoxis rigidula var. *pilosissima*	Hypoxidaceae	Geophyte
Hypoxis species	Hypoxidaceae	Geophyte
Indigastrum fastigiatum	Fabaceae	Herb
Jamesbrittenia aurantiaca	Scrophulariaceae	Herb
Juncus dregeanus subsp. *dregeanus*	Juncaceae	Herb
Ledebouria cooperi	Hyacinthaceae	Geophyte
Lepidium trifurcum	Brassicaceae	Herb
Lessertia species	Fabaceae	Dwarf shrub
Limeum aethiopicum var. *fluviale*	Limeaceae	Herb
Limosella grandiflora	Scrophulariaceae	Hydrophyte
Lindernia parviflora	Linderniaceae	Herb
Listia heterophylla	Fabaceae	Dwarf Shrub
Lobelia laxa	Lobeliaceae	Herb
Lotononis lotononoides	Fabaceae	Shrub
Lotononis macrosepala	Fabaceae	Herb
Lotononis pulchella	Fabaceae	Shrub
Lotononis sericophylla	Fabaceae	Shrub
Lycium ferocissimum	Solanaceae	Shrub
Malva pusilla	Malvaceae	Herb
Manulea crassifolia subsp. *crassifolia*	Scrophulariaceae	Herb
Massonia jasminiflora	Hyacinthaceae	Succulent
Melolobium microphyllum	Fabaceae	Shrub
Merxmuellera drakensbergensis	Poaceae	Graminoid
Merxmuellera macowanii	Poaceae	Graminoid
Nenax microphylla	Rubiaceae	Dwarf Shrub
Nolletia ciliaris	Asteraceae	Suffrutex
Olea europaea subsp. *cuspidata*	Oleaceae	Tree
Ornithogalum flexuosum	Hyacinthaceae	Geophyte
Osteospermum scariosum var. *scariosum*	Asteraceae	Herb
Panicum schinzii	Poaceae	Graminoid
Panicum stapfianum	Poaceae	Graminoid
Passerina montana	Thymelaeaceae	Shrub
Pelargonium alchemilloides	Geraniaceae	Dwarf Shrub
Pennisetum macrourum	Poaceae	Graminoid
Pennisetum sphacelatum	Poaceae	Graminoid
Pennisetum thunbergii	Poaceae	Graminoid
Pentameris basutorum	Poaceae	Graminoid
Pentanisia angustifolia	Rubiaceae	Herb
Phalaris arundinacea	Poaceae	Graminoid
Physalis peruviana	Solanaceae	Herb
Polygala gracilenta	Polygalaceae	Herb
Polygala gymnoclada	Polygalaceae	Herb
Relhania acerosa	Asteraceae	Shrub
Salvia repens var. repens	Lamiaceae	Herb
Schizocarphus nervosus	Hyacinthaceae	Geophyte
Schizoglossum atropurpureum subsp. *atropurpureum*	Apocynaceae	Succulent
Schizoglossum linifolium var. *linifolium*	Apocynaceae	Succulent
Schkuhria pinnata	Asteraceae	Herb
Searsia divaricata	Anacardiaceae	Tree
Searsia dregeana	Anacardiaceae	Shrub
Searsia erosa	Anacardiaceae	Shrub
Selaginella caffrorum var. *caffrorum*	Selaginellaceae	Lithophyte
Selago albida	Scrophulariaceae	Dwarf Shrub
Selago saxatilis	Scrophulariaceae	Dwarf Shrub

Senecio arabidifolius	Asteraceae	Herb
Setaria italica	Poaceae	Graminoid
Setaria sphacelata var. sphacelata	Poaceae	Graminoid
Setaria sphacelata var. *torta*	Poaceae	Graminoid
Silene undulata subsp. *undulata*	Caryophyllaceae	Herb
Solanum retroflexum	Solanaceae	Herb
Sonchus dregeanus	Asteraceae	Herb
Sporobolus africanus	Poaceae	Graminoid
Sporobolus species	Poaceae	Graminoid
Stachys rugosa	Lamiaceae	Shrub
Stenostelma corniculatum	Apocynaceae	Herb
Teedia lucida	Scrophulariaceae	Dwarf shrub
Tenaxia disticha	Poaceae	Graminoid
Thesium costatum var. *costatum*	Santalaceae	Parasite
Thesium resedoides	Santalaceae	Parasite
Trachyandra asperata var. *asperata*	Asphodelaceae	Succulent
Trachyandra asperata var. *basutoensis*	Asphodelaceae	Succulent
Trachypogon spicatus	Poaceae	Graminoid
Tragus racemosus	Poaceae	Graminoid
Ursinia montana subsp. *montana*	Asteraceae	Herb
Wahlenbergia dieterlenii	Campanulaceae	Dwarf Shrub
Xysmalobium species	Apocynaceae	Suffrutex
Xysmalobium undulatum var. *undulatum*	Apocynaceae	Succulent

30 APPENDIX 2: FLORISTIC SAMPLING RECORDS OF THE OCTOBER 2018 SITE SURVEY

Appendix 2: Floristic diversity recorded on the site during October 2018				
Species Name	*Family*	*Growth Form*	*Status/ Uses*	*Common Name*
Acacia dealbata	Fabaceae	Tree	Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014), CARA 2002 – Category 1(Western Cape), Category 2 (rest of SA)	Silver Wattle (e), Silwerwattel (a)
Agave sisalana	Agavaceae	Succulent	Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014)	Sisal
Argemone ochroleuca	Papaveraceae	Perennial herb	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Mexican poppy (e), Bloudissel (a)
Aristida bipartita (Nees) Trin. & Rupr.	Poaceae	Grass	Unpalatable, indicator of degraded veld, Increaser IIC	Rolling grass (e), Grootrolgras (a)
Aristida congesta subsp. *barbicollis*	Poaceae	Grass	Poor grazing potential, Increaser IIC	Spreading Three-awn (e), Lossteekgras (a)
Asclepias aurea (Schltr.) Schltr.	Apocynaceae	Forb	None	Golden Star Drops (e)
Berkheya discolor	Asteraceae	Perennial herb	Least Concern	Mohata-o-mosoeu (ss)
Berkheya setifera DC.	Asteraceae	Forb	Weed, widespread	Rasperdisseldoring (a)
Buddleja salviifolia (L.) Lam.	Buddlejaceae	Shrub	Traditional uses	Quilted Sagewood (e), Saliehout (a)
Bulbine narcissifolia	Liliaceae	Succulent	Medicinal uses	Wild Kopieva (e), Wildekopieva (a)
Castalis spectabilis	Asteraceae	Forb	None	Bloubietou (e)
Celtis africana Burm.f.	Celtidaceae	Tree	Timber	White Stinkwood (e), Witstinkhout (a)
Centella asiatica (L.) Urb.	Apiaceae	Hydrophilic	Edible parts, medicinal properties	Marsh pennywort (e), Varkoortjies (a)
Centella species	Apiaceae	Hydrophilic		
Cheilanthes species	Sinopteridaceae	Fern	None	--
Chloris virgata Sw.	Poaceae	Grass	None	Feather-top Chloris (e), Witpluim-chloris (a)
Cirsium vulgare (Savi) Ten.	Asteraceae	Forb	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Scottish thistle (e), Skotse dissel (a)
Cliffortia linearifolia Eckl. & Zeyh.	Rosaceae	Shrub	None	--
Crepis hypochoeridea (DC.) Thell.	Asteraceae	Forb	Weed, indicator of disturbed areas, Naturalised exotic	--
Cupresses macrocarpa	Cupressaceae	Tree	Ornamental, non-indigenous (USA), probably sterile variety	Monterey Cypress (e), Golden Crest (e)
*Cynodon dactyl*on (L.) Pers.	Poaceae	Grass	Indicator of disturbed areas, grazing potential	Common Couch Grass (e), Gewone kweekgras (a)
Delosperma species	Mesembryanthemaceae	Succulent	None	--
Dimorphotheca jucunda	Asteraceae	Forb	None	
Diospyros lycioides	Ebenaceae	Small tree	Medicinal uses, edible parts, dyes	Star Apple (e), Bloubessie (a)
Echinopsis schickendantzii	Cactaceae	Succulent	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Torch Cactus (e), Orrelkaktus (a)

Eragrostis chloromelas Steud.	Poaceae	Grass	Edible parts, Increaser IIB	Curly leaf (e), Krulblaar (a)
Eragrostis plana Nees	Poaceae	Grass	Weaving, unpalatable, indicator of degraded areas, Increaser IIC	Tough love grass (e), Taai-pol eragrostis
Eriospermum species	Liliaceae	Geophyte	None	--
Eucalyptus species	Myrsinaceae	Tree	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014) (see act for detail)	Eucaluptus gum tree (e), Bloekomboom (a)
Euphorbia striata	Euphorbiaceae	Succulent	None	Milkweed (e), Melkgras (a)
Felicia filifolia	Asteraceae	Forb	None	--
Felicia muricata	Asteraceae	Forb	None	Wild Aster (e), Blouheuning (a)
Gazania krebsiana	Asteraceae	Forb	Medicinal uses, food source	Butter flower (e), Botterblom (a)
Halleria lucida L.	Scrophulariaceae	Tree	Edible fruit, traditional medicinal uses	Tree-fuschia (e), Geelhoutkop (a)
Haplocarpha scaposa Harv.	Asteraceae	Forb	None	Tonteldoosbossie (a)
Helichrysum caespititium (DC.) Harv.	Asteraceae	Prostrate herb	Medicinal uses	Speelwonderboom (a)
Helichrysum cf. *splendidum*	Asteraceae	Forb	None	--
Hermannia coccocarpha	Malvaceae	Forb	None	Moederkappie (a)
Hermannia depressa N.E.Br.	Malvaceae	Prostrate herb	Medicinal uses	Rooiopslag (a)
Hyparrhenia hirta (L.) Stapf	Poaceae	Grass	Thatching & weaving	Thatch Grass (e), Dekgras (a)
Hypoxis argentea	Hypoxidaceae	Geophyte	None	Small Yellowstar (e)
Kiggelaria africana L.	Flacourtiaceae	Shrub	Traditional uses, larval host for *Acrea horta* & *Cymothoe alcimeda*	Wild Peach (e), Wildeperske (a)
Kohautia amatymbica Eckl. & Zeyh.	Rubiaceae	Perennial herb	Edible parts	Tremble tops (e)
Ledebouria ovatifolia (Baker) Jessop	Liliaceae	Geophyte	None	--
Leonotis species	Lamiaceae	Dwarf shrub	Medicinal uses, colours & dyes	Minaret Flower (e), Wildedagga (a)
Listia heterophylla E.Mey	Fabaceae	Prostrate herb	Least Concern	Geelklawer (a)
Lobelia cf *laxa*	Lobeliaceae	Forb	None	--
Marsilea species	Marsileaceae	Hydrophilic	None	Waterklawer (a)
Massonia species	Hyacinthaceae	Geophyte	None	--
Melianthus comosus Vahl	Melianthaceae	Shrub	None	Touch-me-not (e), Kruidjie-roer-my-nie (a)
Melinis repens	Poaceae	Grass	Poor grazing potential, Increaser IIC	Natal Red Top (e), Natal-rooipluim (a)
Moraea pallida (Baker) Goldblatt	Iridaceae	Geophyte	Indicates overgrazing, often in colonies. Poisonous to cattle	Yellow Tulip (e), Berkatjietee (a), Khahla-e-nye-nyane (ss)
Mossia intervallaris (L.Bolus) N.E.Br.	Aizoaceae	Succulent	None	--
Myrsine africana L.	Myrsinaceae	Shrub	None	African Boxwood (e), Vlieëbos (a)
Nemesia fruticans	Scrophulariaceae	Forb	None	Wildeleeubekkie (a)
Opuntia ficus-indica (L.) Mill.	Cactaceae	Succulent	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016), edible parts	Prickley pear (e), Turksvy (a)
Osteospermum scariosum	Asteraceae	Dwarf shrub	None	Bietou (a), = Tripteris aghillana
Oxalis species	Oxalidaceae	Geophyte	Edible parts	Bobbejaanuintjie (a)

Paspalum dilatatum Poir.	Poaceae	Grass	Moist places, palatable, Increaser IIB	Common Paspalum (e), Gewone Paspalum (a)
Pellaea calomelanos	Adianthaceae	Fern	Medicinal properties	Hard Fern (e), Hardevaring (a)
Pennisetum clandestinum Chiov.	Poaceae	Grass	Declared Invader - Category 1B in protected areas and wetlands in which it does not already occur (NEM:BA, 2004. AIP, 2016), not listed elsewhere	Kikuyu Grass (e), Kikoejoegras (a)
Pentameris airoides Nees subsp. *jugorum* (Stapf) Galley & H.P.Linder	Poaceae	Grass	Important in stabilising trampled and disturbed veld	Common annual Pentaschistis (e), Gewone eenjarige Pentaschistis (a)
Populus deltoidea	Salicaceae	Tree	None	Poplar (e), Populier (a)
Prunus persica (L.) Batsch var. persica	Rosaceae	Tree	Naturalised exotic, edible fruit	Peach (e), Perske (a)
Rosa species	Rosaceae	Climber	None	--
Rubus ludwigii Eckl. & Zeyh. subsp. ludwigii	Rosaceae	Shrub	Edible parts, medicinal uses	Silver Bramble (e), Wildebraam (a)
Rubus rigidus Sm.	Rosaceae	Climber	Invader Species	Bramble (e), Braambos (a)
Rumex species	Polygonaceae	Forb	Native to Europe, common weed	--
Salix babylonica L.	Salicaceae	Tree	Non-endemic	Weeping willow (e), Treurwilger (a)
Salix mucronata Thunb. ssp. *mucronata*	Salicaceae	Tree	Non-endemic	African Willow (e), Wildewortel (a)
Searsia erosa (Thunb.) Moffett	Anacardiaceae	Shrub	Traditional and medicinal uses	Broomkarree (e), Besembos (a)
Searsia lancea L.f.	Anacardiaceae	Tree	Edible parts, tanning	Common Karree (e), Gewone Karree (a)
Senecio achilleifolius DC.	Asteraceae	Forb	Indicator of moist conditions	Slootopdammer (a)
Seriphium plumosum	Asteraceae	Shrub	Invasive properties	Bankrupt bush (e), Bankrotbos (a)
Solanum sisymbrifolium Lam.	Solanaceae	Dwarf shrub	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Wild tomato (e), Doringbitterappel (a) (= Solanum sisymbriifolium)
Sporobolus species	Poaceae	Grass	None	--
Trifolium burchellianum	Fabaceae	Prostrate herb	Least Concern	Wild Clover (e), Wildeklawer (a)
Ursinia alpina N.E.Br.	Asteraceae	Perennial herb	Least Concern	--
Wahlenbergia dieterlenii (E.Phillips) Lammers	Campanulaceae	Perennial herb	None	--
Wahlenbergia species	Campanulaceae	Perennial herb	None	--
Zornia capensis Pers.	Fabaceae	Forb	None	--

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32 PHOTOGRAPHIC RECORDS

Photo 1: Example of old agricultural fields

Photo 2: Example of old agricultural fields, note prominence of *Moraea pallida*

Photo 3: Example of old agricultural fields, note prominence of shrubs due to late successional stage

Photo 4: Example of seepage/ wetland in bottomlands situation

Photo 5: Example of erosion gulleys

Photo 6: Example of cliffs and outcrops in vicinity of study area

Photo 7: Example of drainage line towards the east of the study area

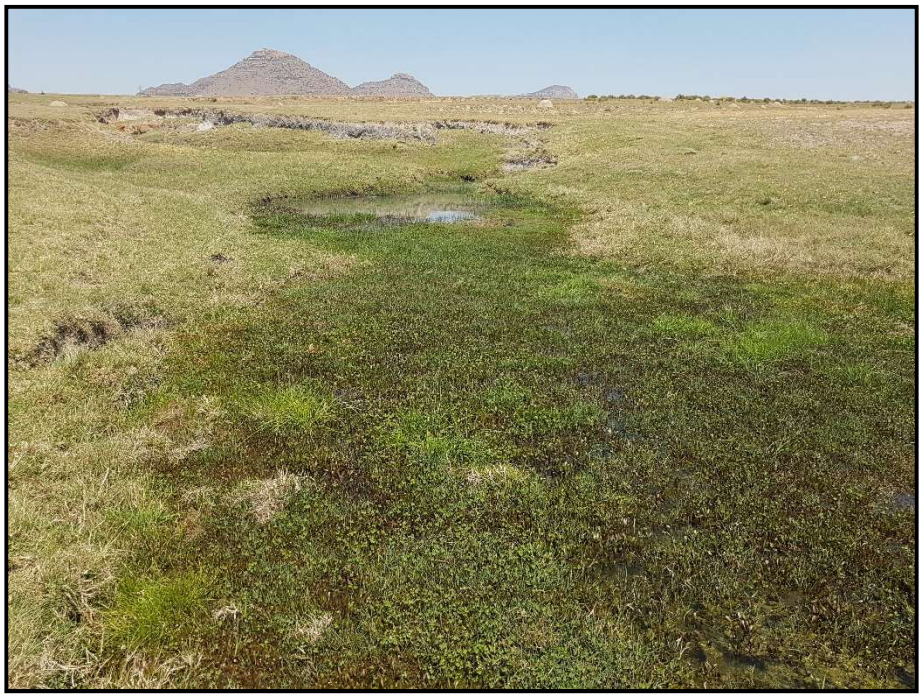

Photo 8: Example of natural spring

Photo 9: Example of prominent ridges and outcrops in the vicinity of the study area

Photo 10: Example of agricultural field, recently cultivated

SECTION D – MAMMALIAN, INVERTEBRATE & HERPETOFAUNAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

Dewald Kamffer (Pr.Sci.Nat.)

33 BACKGROUND

The Kingdom of Lesotho is heavily reliant on imported fossil fuel energy and has a growing demand for electricity and a declining wood fuel supply. An analysis of the relative merits of using photovoltaic (PV) devices over other renewable energy sources in Lesotho has been presented and the case for proper economic support and utilization of efficient renewable energy technologies argued (Taele, Gopinathan and Mokhuts'oane, 2007). Lesotho has relatively abundant renewable energy sources in the form of hydro, solar and wind. The average daily solar radiation in Lesotho varies between 4.5 and 6.5 kWh/m², with some areas in the southwest averaging more than 7 kWh/m². Both conventional and non-conventional means have been proposed to handle the challenges of rural electrification and energy provision (Taele *et al.*, 2012).

The performance of a newly installed 281 kWp first grid-connected photovoltaic solar farm in Lesotho has been shown to be satisfactory; measurements at the Moshoeshoe International Airport site indicated a high solar energy source in the range of 4.0-7.2 kWh/m²/day. Results indicate that the area is suitable for grid connected photovoltaic systems (Mpholo, Nchaba and Monese, 2015). Large-scale solar power plants are being developed at a rapid rate, and are setting up to use thousands or millions of acres of land globally. It has been shown that many of the impacts of solar power related to land use intensity, human health, plant and animal life, geo-hydrological resources and climate change are considered to be beneficial relative to traditional power generation (Turney and Fthenakis, 2013).

Even though renewable energy is a promising alternative to fossil fuel-based energy, its development can require a complex set of environmental trade-offs. After reviewing feedback between utility-scale solar energy (USSE) development and land-atmosphere interactions, it has been shown that several characteristics and development strategies of USSE systems have low environmental impacts relative to other energy systems, including other renewable energies. Increasing the environmental compatibility of USSE systems will maximise the efficacy of this key renewable energy source in mitigating climatic and global environmental change (Hernandez *et al.*, 2014).

Biodiversity conservation is critical for the continued supply of ecosystem services to secure the sustainability of livelihoods, especially for poor rural people in developing countries. Current rates of biodiversity losses need to be curbed by using effective interventions and decision-making and actions. Results of a community sustainability assessment of the Maloti-Drakensberg Transfrontier Project have indicated that the current practices are unsustainable. Consequently, there is a need to raise awareness at community level and implement action plans to realize changes that support the sustainability in the long term (Pelser and Letsela, 2012). Given that the 5 000 km long Great Escarpment of southern Africa provides most of the subcontinent's fresh water, protection and restoration of these escarpment habitat is urgently required. Key research needs include exhaustive biodiversity surveys, systematic studies to test refugia and migration hypotheses, and the effects of modern climate change. Such research results can then be consolidated into effective conservation planning and co-ordinated international efforts to protect the rich biodiversity of the escarpment and the ecological services in provides (Clark, Barker and Mucina, 2011). Through the evaluation of global environment competitiveness, it is known that the environment competitiveness index of Lesotho only ranks 132nd in 133 countries (Jianping *et al.*, 2013).

Performance Standard 6 of the International Finance Corporation (IFC) provides guidance to studies that are relevant to Biodiversity Conservation and Sustainable Management of Living Natural Resources. The performance standards are mainly directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid,

mitigate and manage risks and impacts as a way of doing business in a sustainable way. Performance Standard 6 is used as a guide to ensure IFC compliance regarding the biodiversity scoping and impact assessments. It recognizes that protecting and conserving biodiversity, maintaining ecosystem services and sustainably managing living natural resources are fundamental to sustainable development. It, in turn, has been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

34 SITE ALTERNATIVES AND DEVELOPMENT OPTIONS

Faunal characteristics of the four site alternatives are regarded highly similar and any significant variation in terms of faunal attributes are regarded highly unlikely. Any of the proposed site alternatives would be regarded suitable for the proposed development and no significant differences between the four site alternatives could reasonably be established. Anticipated impacts on the faunal receiving environment will unlikely vary significantly between the site variants. Consequently, the desktop investigation, field investigation, data analyses, results, discussion and impact assessment as well as the mitigation measures proposed considered the four sites as one larger study area. Option 1 is therefore regarded a suitable development footprint, with generally low expected impact significance on the faunal receiving environment.

35 METHOD STATEMENT

35.1 DESKTOP INVESTIGATION

During the desk-top phase of the project the study area and surrounds (approximately 5 km radius) were investigated at desktop level by means of a subjective evaluation of recent and historic aerial imagery obtained from Google Earth Pro. Assessments of potential red data faunal inhabitants and likely impacts were ultimately based on a basic appraisal of aerial imagery obtained from Google Earth Pro and the interpretation of expected habitat diversity and -status as well as consultation of available information sources, such as captured data from Animal Demography Unit (ADU) of the University of Cape Town (UCT). The ADU provides known geographical data as well as regional red data listed statuses of following animal groups in its' Virtual Museum (excluding avifauna):

⇒ Dung beetles;
⇒ Fishes;
⇒ Frogs;
⇒ Lacewings and ant-lions;
⇒ Moths and butterflies;
⇒ Mammals;
⇒ Dragonflies and damselflies;
⇒ Reptiles;
⇒ Scorpions; and
⇒ Spiders.

The location of the study area as well as likely faunal habitats present in the study area and surrounds were used as parameters in assessing the likelihood of any red data listed species of the region occurring in the study area and surrounds.

Key results obtained from the desk-top (scoping) assessment indicated the following:

⇒ A high paucity of comprehensive faunal data is indicated from available information sources;

⇒ Only six animals (all frogs) have been officially recorded from the ¼ degree grid 2927CD on the Animal Demography Unit's Virtual Museum;

⇒ Only five red data listed species (threatened or near threatened) have been confirmed for the grid 2927; only the Vlei Rat, *Otomys auratus*, and the White-tailed Rat are considered to have at least a moderate probability of occurring in the study area or immediate surrounds; and

⇒ The Sable Antelope, Vaal Rhebok and Hartmann's Mountain Zebra are considered unlikely inhabitants of the study area and the immediate surrounds.

35.2 EIA FIELD INVESTIGATION & SPECIES IDENTIFICATION

During October 2018, the study area and selected habitat types in the surrounding area (approx. 3 km radius) were surveyed for mammals, herpetofauna and invertebrates with the use of ecological indicators such as tracks, dung, diggings, nests and calls and *ad hoc* observations. Visual sightings of species were also used to identify both small and medium to large mammals as well as frogs and reptiles. Well-known flying insects such as butterflies, moths, dragonflies, bees and beetles were collected or identified in flight wherever possible. Active searches for rock dwelling species were included in the survey methods.

Animal species were identified by consultation of the following field guides:

⇒ Field Guide to Mammals of Southern Africa (Stuart and Stuart, 2000);

⇒ A Field Guide to the Tracks and Signs of East and South African Mammals (Stuart and Stuart, 1994);

⇒ Tracks and Tracking in Southern Africa (Liebenberg, 2000);

⇒ Bats of Southern Africa (Taylor, 2000);

⇒ Bats of southern and central Africa: a bio-geographic and taxonomic synthesis (Monadjem *et al.*, 2010);

⇒ Handbook of the Mammals of the World: Vol. 1 – Carnivores (Sillero-Zubiri, 2009);

⇒ Handbook of the Mammals of the World: Vol. 2 – Hoofed Animals (Zachos, 2012);

⇒ Handbook of the Mammals of the World: Vol. 3 – Primates (Mittermeier, Wilson and Rylands, 2013);

⇒ A photographic Guide to Snakes and other Reptiles of Southern Africa (Branch, 2001);

⇒ A Guide to the Reptiles of Southern Africa (Alexander and Marais, 2007);

⇒ Chameleons of Southern Africa (Tolley and Burger, 2007);

⇒ Atlas and Red Data Book of the Frogs of South Africa (Minter *et al.*, 2004);

⇒ A Complete Guide to the Frogs of Southern Africa (Du Preez and Carruthers, 2009);

⇒ Frogs and Frogging in Southern Africa (Carruthers, 2001);

⇒ Amphibians of Central and Southern Africa (Channing, 2001);

⇒ Baboon and Trapdoor Spiders of Southern Africa: An Identification Manual (Dippenaar-Schoeman, 2002);

⇒ Field Guide to the Spiders of South Africa (Dippenaar-Schoeman, 2014);

⇒ Spiders of Southern Africa (Leroy and Leroy, 2003);

⇒ African Spiders. An Identification Manual (Dippenaar-Schoeman and Jocqué, 1997);

⇒ Southern African Spiders (Filmer, 1991);

⇒ Spiders of the Savanna Biome (Dippenaar-Schoeman, Foord and Haddad, 2013);

⇒ Butterflies of Southern Africa (Swanepoel, 1953);

⇒ Field Guide to the Butterflies of South Africa (Woodhall, 2005);

⇒ Pennington's butterflies of Southern Africa (Dickson and Kroon, 1978);

⇒ Conservation Assessment of butterflies of South Africa, Lesotho and Swaziland: Red List and atlas (Mecenero *et al.*, 2013);

⇒ Guide to the Dragonflies & Damselflies of South Africa (Tarboton and Tarboton, 2015);
⇒ A Field Guide to the Dragonflies of South Africa (Tarboton and Tarboton, 2002b);
⇒ A Field Guide to the Damselflies of South Africa (Tarboton and Tarboton, 2002a);
⇒ Goggagids. Die Geleedpotiges van Suider-Afrika (Holm and Dippenaar-Schoeman, 2010);
⇒ Insects of Southern Africa (Scholtz and Holm, 2008);
⇒ Inseklopedie van Suider-Afrika (Holm, 2008);
⇒ Fruit Chafers of southern Africa (Scarabaeidae: Cetoniini) (Holm and Marais, 1992);
⇒ Alien and Invasive Animals: a South African Perspective (Picker and Griffiths, 2011);
⇒ Field Guide to insects of South Africa (Picker, Griffiths and Weaving, 2002);
⇒ Scorpions of Southern Africa (Leeming, 2003).

Species that could not be identified with the use of above-listed field guides and other online resources, were submitted to the Virtual Museum (ADU-UCT, 2017) for identification.

35.3 FAUNAL SENSITIVITY

The faunal sensitivities of the macro habitat types of the study area and surrounds were estimated using five comparable and relevant ecological characteristics:

1. Habitat Status (ST): the level of habitat transformation and degradation vs. pristine faunal habitat;
2. Habitat diversity (DV): the number and frequency of different faunal micro habitats found within each of the macro habitat types;
3. Habitat linkage (LN): the degree to which a macro habitat type is linked to other natural areas enabling movement of animals to and from the habitat found in the study area;
4. Habitat sensitivity (SN): the relative presence of elements of inherently sensitive faunal habitats such as surface rock associated with outcrops and surface and underground water found in wetlands; and
5. Red data species (RD): the degree to which suitable habitat for the red data species likely to be found in the study area is located within each macro habitat type.

The following faunal sensitivity categories were used:

⇒ Low 0-19 %;
⇒ Medium-low 20-39 %;
⇒ Medium 40-59 %;
⇒ Medium-high 60-79 %; and
⇒ High 80-99 %.

35.4 FAUNAL MACRO HABITAT TYPES

Animals do not exist in isolation within ecosystems; animals of terrestrial as well as aquatic ecosystems are influenced by plant community structure and species diversity. Many aquatic species find refuge in extensive reedbeds that are frequently found within lowland wetland ecosystems (Sychra, Adamek and Petrivalská, 2010). Furthermore, the structure and age of vegetal formation of ponds and impounds play a significant role in selecting species traits related to the population dynamics and feeding habits of species (Cereghino *et al.*, 2008). Similarly, terrestrial animals' ecological reactions depend on plant community structure; studies on species richness have indicated that for spiders, local processes are important, with assemblages in a particular patch being constrained by habitat structure (Borges and Brown, 2004).

Likewise, plant community structure is often influenced by primary consumers; herbivores are known key drivers of ecosystem function and nutrient dynamics within grazed plant communities (Duncan, 2005; Kamffer and Verreynne, 2018). Plant communities that were described for the study area (refer to **Section 23**) are regarded adequately representative of the macro faunal habitat types, including:

⇒ *Cynodon dactylon – Gazania krebsiana* Erosion Gullies;
⇒ *Halleria lucida – Mossia interviralis* Rocky Ledges & Cliffs;
⇒ *Moraea pallida – Wahlenbergia* cf. *dieterlenii* Agricultural Fields; and
⇒ *Pentameris ariodes – Trifolium burchellianum* Drainage Lines & Seeps.

36 RESULTS

36.1 DESKTOP INVESTIGATION OF REGIONAL DISTRIBUTION INFORMATION

The study area is located within the Q-grid 2927CD; an assessment of faunal disciplines revealed the listing of only 6 amphibian species for 2927CD (*www.vmus.adu.org.za*, 2018); no red data are listed species (refer **Table 11**).

Table 11: Animals listed for 2927CD on 18 October 2018

Taxonomic rank	*Group*	*# spp. recorded*
Scorpiones	Scorpions	0
Araneae	Spiders	0
Odonata	Dragonflies & Damselflies	0
Neuroptera & Megaloptera	Antlions & Allies	0
Scarabaeinae	Dung Beetles	0
Lepidoptera	Butterflies & Moths	0
Anura	Frogs	6
Reptilia	Reptiles	0
Mammalia	Mammals	0
Total # species recorded		**6**

Red data listed species historically recorded for Q-grid 2927 include animals regionally listed as (RS):

⇒ Near Threatened (NT): 1 species; and
⇒ Vulnerable (VU): 3 species.

The five red data animals have the following global statuses (GS):

⇒ Not Evaluated (NE): 1 species;
⇒ Least Concern (LC): 2 species;
⇒ Vulnerable (VU): 1 species; and
⇒ Endangered (EN): 1 species.

Based on an appraisal of available data, habitat interpretations and known habitat requirements for these species, the following probabilities of occurrence (PoO) within the study area are estimated for the five red data species:

⇒ Low: 3 species; and

⇒ Moderate: 2 species.

Results of the Red Data fauna analysis are summarised in Table 12.

Table 12: Red data animals listed for 2927

Binomial Name	*English Name*	*Regional Status*	*Global Status*	*PoO*
Artiodactyla: Bovidae				
Hippotragus niger niger	Sable Antelope	VU	LC	low
Pelea capreolus (Forster, 1790)	Vaal Rhebok	NT	LC	low
Perissodactyla: Equidae				
Equus zebra hartmannae	Hartmann's Mountain Zebra	VU	VU	low
Rodentia: Muridae				
Otomys auratus Wroughton, 1906	Vlei Rat (Grassland type)	NT	NT	moderate
Rodentia: Nesomyidae				
Mystromys albicaudatus (A. Smith, 1834)	White-tailed Rat	VU	EN	moderate

36.2 ANNOTATIONS ON LIKELY RED DATA SPECIES FOR THE AREA

36.2.1 VLEI RAT – GRASSLAND TYPE (OTOMYS AURATUS WROUGHTON, 1906)

Otomys auratus is one of three cryptic afromontane *Otomys* species that seems to be closely associated with a particular biome; *O. Irroratus* (senso stricto) is associated mostly with the Fynbos and Thicket Biomes, *O. auratus* with the Grassland Biome and *O. angoniensis* with the Savanna Biome. A loss of up to 66 % of highly suitable habitat of *O. auratus* has been predicted (Nengovhela, 2014; Taylor *et al.*, 2016). It has also been shown that small mammal diversity at high altitudes in southern Africa is relatively high (Kok, Parker and Barker, 2012). However, a review of small mammal studies from major ranges in Africa and Madagascar found that the hump-shaped altitudinal profiles in species richness common in terrestrial small mammal communities are not common in these ranges. Declines in richness with increasing altitude as well as cases of no significant altitudinal change were the most common patterns noted (Taylor *et al.*, 2015).

Otomys auratus has been shown to be a very important prey item of the wetland specialist carnivore *Leptailurus serval* (Schreber, 1776), comprising up to 57.8 % of biomass consumed (Ramesh and Downs, 2015). *Otomys auratus* is listed regionally as Near Threatened (ADU-UCT, 2017) and as Near Threatened globally (*www.iucnredlist.org*, 2018).

Figure 15: The Southern African Vlei Rat, Otomys auratus Wroughton, 1906

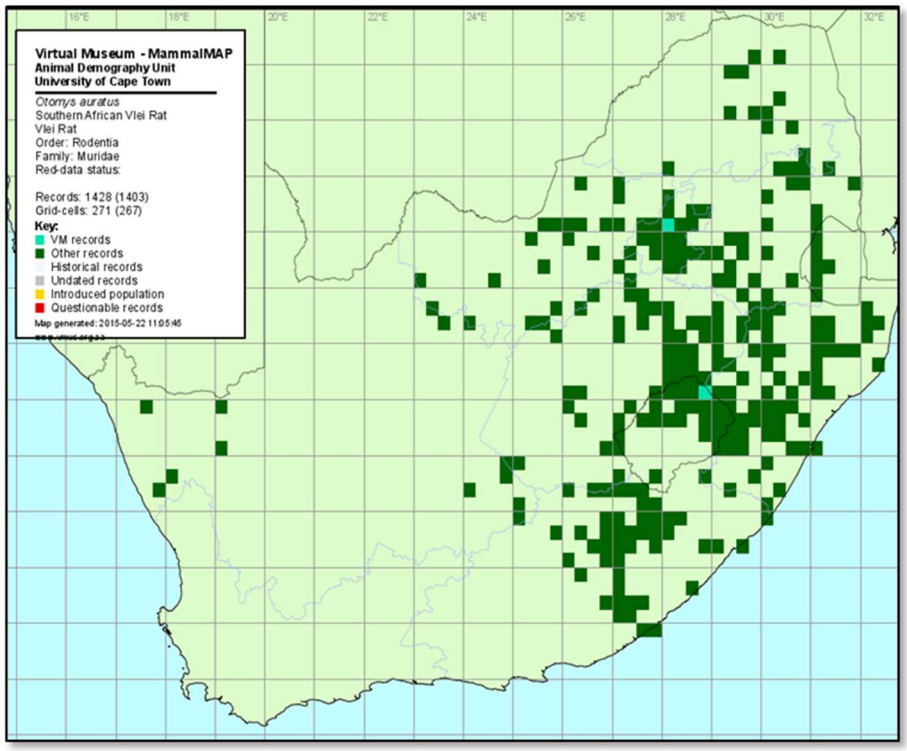

Figure 16: Distribution map of the Southern African Vlei Rat, *Otomys auratus* Wroughton, 1906

36.2.2 WHITE-TAILED RAT (MYSTROMYS ALBICAUDATUS (A. SMITH, 1834))

The White-tailed Rat, despite having been recorded in at least three nature reserves in northern South Africa, does not appear to be adequately protected in other parts of southern Africa (Dean, 1978). The species is a known prey species of Gaboon Adder, *Bitis gabonica* (A.M.C. Duméril, Bibron & A.H.A. Duméril, 1854) (Perrin and Bodbijl, 2001) and Western Barn Owl, *Tyto alba* (Scopoli, 1769) (Avery, Avery and Palmer, 2005). The White-tailed Rat is known to be associated with crests and ridges in grassland (Armstrong and van Hensbergen, 1996) and it shows a strong affinity to the Grassland Biome (Mugo *et al.*, 1995). In a study on habitat associations of small mammals in the foothills of the Drakensberg mountains, *Mystromys albicaudatus* was only found in rocky outcrops and on the mountain top in rocky situations

(Simelane, Mahlaba and Shapiro, 2017). The White-tailed Rat has been recorded from the Sehlabathebe National Park in Lesotho (Lynch and Watson, 1990) and is one of fifty-two mammal species to have been recorded from the Kingdom of Lesotho (Lynch, 1994). *M. albicaudatus* is listed regionally as Vulnerable (ADU-UCT, 2017) and as Endangered globally (*www.iucnredlist.org*, 2018).

Figure 17: Example of the White-tailed Rat, *Mystromys albicaudatus* A. Smith, 1834

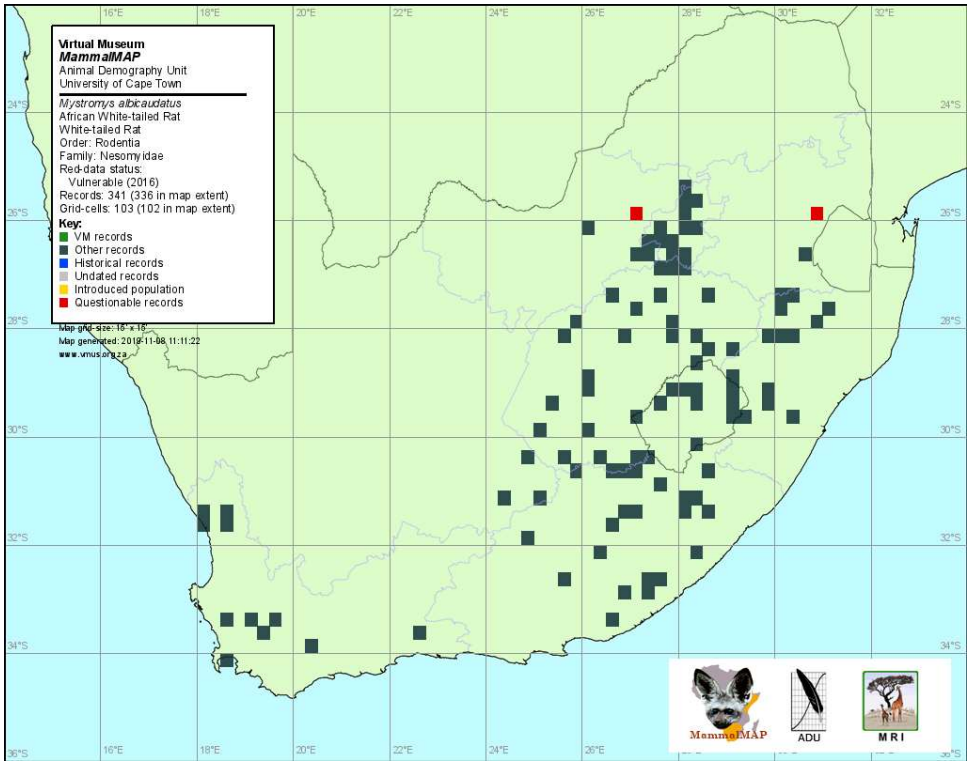

Figure 18: Distribution map of the White-tailed Rat, *Mystromys albicaudatus* A. Smith, 1834

36.3 RESULTS OF THE FIELD INVESTIGATION & SPECIES IDENTIFICATION

A total of only nineteen animal species (excluding avifauna) were recorded in the study area. This diversity represents the following (refer **Table 13**):

⇒ Eight (8) Orders; and

⇒ sixteen (16) Families.

Photographic evidence of some of these species are presented in **Figure 19**. None of the species observed in the study area during the field investigation are listed as threatened or near threatened species, they also do not have any regional (ADU-UCT, 2017) or global (*www.iucnredlist.org*, 2018) listing as Red Data listed species.

Table 13: Animals recorded in the study area (October 2018)

Binomial Name	*English Name*	*Regional Status*	*Global Status*
Odonata: Coenagrionidae			
Africallagma glaucum Burmeister, 1839	Swamp Bluet	NL	LC
Odonata: Aeshnidae			
Anax imperator Leach, 1815	Blue Emperor	NL	LC
Odonata: Libellulidae			
Crocothemis erythraea Brullé, 1832	Broad Scarlet	NL	LC
Sympetrum fonscolombii Selys, 1840	Nomad	NL	LC
Orthoptera: Pyrgomorphidae			
Phymateus viridipes Stål, 1873	Green Milkweed Locust	NL	NL
Lepidoptera: Pieridae			
Pontia helice helice (Linnaeus, 1764)	Common Meadow White	LC	LC
Lepidoptera: Nymphalidae			
Vanessa cardui (Linnaeus, 1758)	Painted Lady	LC	LC
Lepidoptera: Lycaenidae			
Aloeides maluti Pringle, 1983	Maluti Copper	LC	NL
Hymenoptera: Apidae			
Xylocopa caffra (Linnaeus, 1767)	Carpenter Bee	NL	NL
Anura: Pyxicephalidae			
Amietia delalandii (Duméril and Bibron, 1841)	Delalande's River Frog	LC	LC
Anura: Pipidae			
Xenopus laevis Daudin, 1802	Common Platanna	LC	LC
Squamata: Scincidae			
Trachylepis punctatissima Smith, 1849	Speckled Rock Skink	LC	LC
Trachylepis varia (Peters, 1867)	Variable Skink	LC	NL
Squamata: Cordylidae			
Cordylus cordylus Linnaeus, 1758	Cape Girdled Lizard	LC	LC
Squamata: Agamidae			
Agama aculeata distanti (Boulenger, 1902)	Distant's Ground Agama	LC	NL
Agama atra Daudin, 1802	Southern Rock Agama	LC	LC
Macroscelidea: Macroscelidae			
Elephantulus myurus Thomas & Schwann, 1906	Eastern Rock Sengi	LC	LC
Rodentia: Bathyergidae			
Cryptomys hottentotus (Lesson, 1826)	Southern African Mole-rat	LC	LC
Rodentia: Muridae			
Gerbilliscus brantsii (A. Smith, 1836)	Highveld Gerbil	LC	LC

Aloeides maluti Pringle, 1983

Elephantulus myurus Thomas & Schwann, 1906

Cryptomys hottentotus (Lesson, 1826) - burrows

Gerbilliscus brantsii (A. Smith, 1836) - burrows

Agama aculeata distanti (Boulenger, 1902)

Phymateus viridipes Stål, 1873

Figure 19: Photographic evidence of selected animal species recorded in the study area (October 2018)

The species inventory collated during the field investigation for the study area and immediate surrounds added significantly to existing faunal distribution data for 2927CD (*www.vmus.adu.org.za*, 2018). The recorded species include the following groups:

⇒ Four dragonflies;
⇒ three butterflies
⇒ two frogs;
⇒ five reptiles; and
⇒ three mammals.

Evidence of selected species were submitted to the Virtual Museum (ADU-UCT, 2017) to augment the database (refer Figure 20).

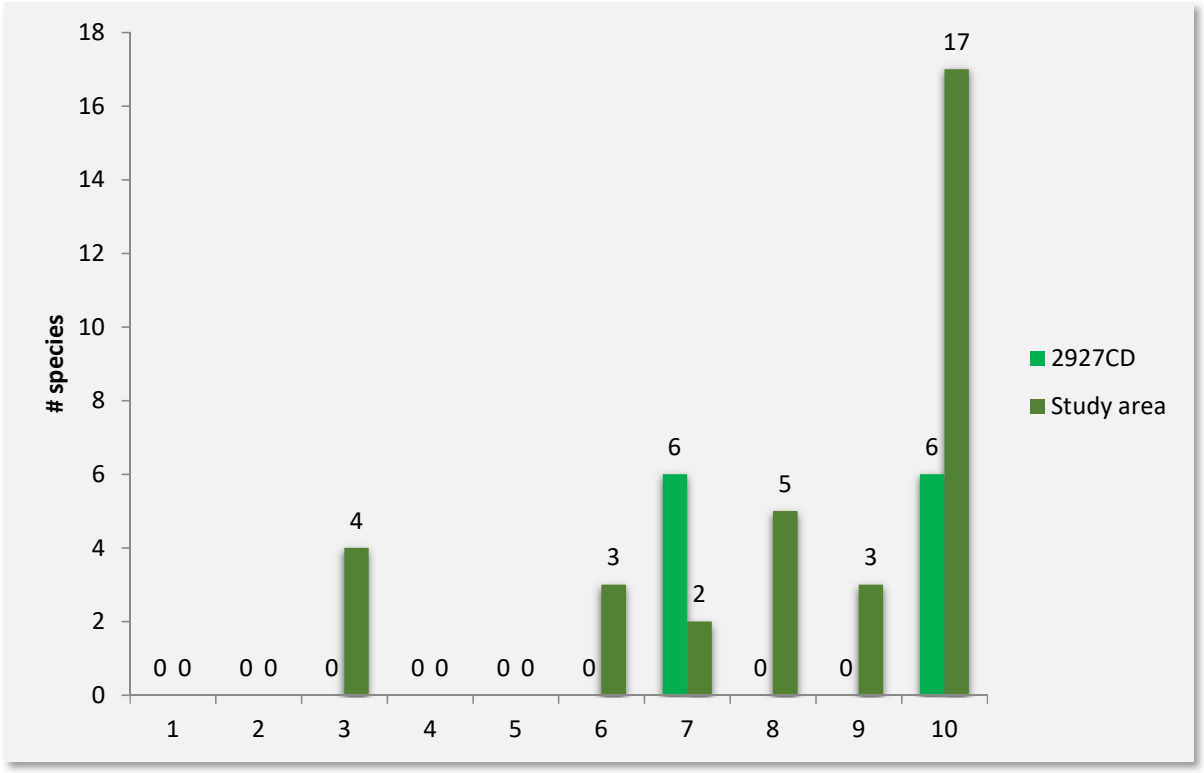

Figure 20: Comparison between 2927CD and study area listed species richness

37 FAUNAL HABITAT SENSITIVITY

37.1 FAUNAL HABITAT SENSITIVITIES

The faunal sensitivities of the macro habitat types were estimated using five comparable and relevant ecological characteristics:

1. Habitat Status (**HT**): the level of habitat transformation and degradation vs. pristine faunal habitat;
2. Habitat diversity (**DV**): the number and frequency of different faunal micro habitats found within each of the macro habitat types;
3. Habitat linkage (**LN**): the degree to which a macro habitat type is linked to other natural areas enabling movement of animals to and from the habitat found in the study area;
4. Habitat sensitivity (**SN**): the relative presence of elements of inherently sensitive faunal habitats such as surface rock associated with outcrops and surface and underground water found in wetlands; and
5. Red data species (**RD**): the degree to which suitable habitat for the red data species likely to be found in the study area is located within each macro habitat type.

The following faunal sensitivity categories were used:

- Low 0-19 %;
- Medium-low 20-39 %;
- Medium 40-59 %;
- Medium-high 60-79 %; and
- High 80-99 %.

The faunal habitat sensitivities estimated for the four faunal macro habitats described for the study area and surrounds (refer **Table 14**) are illustrated in **Figure 21**. For a detailed description of these, please refer **Section 23 (Vegetation Development Drivers of the Site)**.

Table 14: Faunal sensitivities of the habitat types of the study area

Status	*Habitat type*	*HT*	*DV*	*LN*	*SN*	*RD*	*AVERAGE*	*Sens Class*
Natural	Rocky Ledges & Cliffs	6	7	7	7	7	68 %	medium-high
	Drainage Lines & Seeps	6	7	8	6	6	66 %	medium-high
Transformed	Erosion Gullies	2	2	3	1	1	18 %	low
	Agricultural Fields	2	2	3	1	1	18 %	low

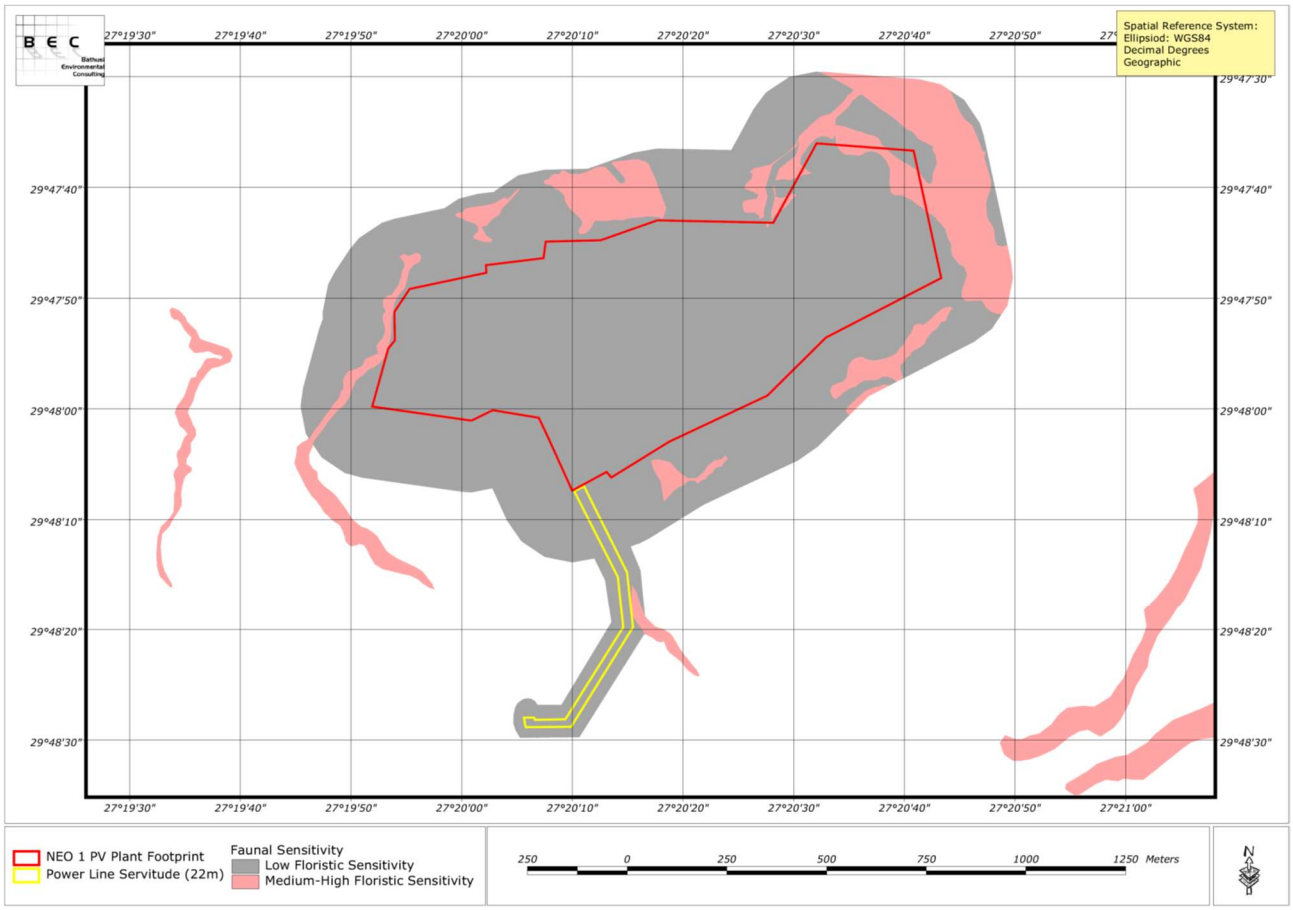

Figure 21: Estimated faunal sensitivity of the development footprint and immediate surrounds

38 ANTICIPATED IMPACTS ON THE FAUNAL ENVIRONMENT

38.1 NATURE OF IMPACTS

38.1.1 DIRECT IMPACTS

Direct impacts represent those that are indisputably a result of the proposed project and unequivocally influencing the fauna of the region. They are immediate and physical in nature and often irreversible and permanent. Anticipated direct impacts of the proposed project on the fauna of the study area include:

1. Impacts on/ losses of fauna taxa of conservation importance and habitat associated with conservation important (CI) species;
2. Loss of natural habitat, including essential habitat refugia; and
3. Depletion of faunal diversity, human/ animal conflict situations.

38.1.2 INDIRECT IMPACTS

Indirect impacts are mostly "spill-over" impacts that are removed from direct impacts by time and/or space. They might occur subsequent to the construction phase, even post closure, or in faunal habitat fragments located next to or close to the directly affected area. Indirect impacts might be immediate or delayed, they are often not easily linked to the project itself and their manifestations are often subtle. Indirect impacts might also be irreversible and permanent or rescindable and temporary. Anticipated indirect impacts of the proposed project on the fauna of the study area include:

4. Degradation of untransformed habitat in areas surrounding the project area;
5. Indirect impacts on movement/ migration patterns of animals, ecological interaction and processes, including the introduction of invasive and non-endemic species; and
6. An increase in edge effects in the ecological region in which the project is located.

38.1.3 CUMULATIVE IMPACTS

Cumulative impacts are the totality of impacts in a given area resulting from this and other projects that impact upon the fauna of a region for any reason. The exact nature, duration, significance and scale of cumulative impacts are difficult to quantify; they are in fact not always considered during impact assessments as a result. However, cumulative impacts are significant and require consideration during this process of mitigating impacts and managing the natural ecological environment of the region. Anticipated cumulative impacts of the proposed project on the fauna of the region include:

7. Cumulative losses and degradation of natural faunal habitat; and
8. Cumulative depletion of faunal taxa, assemblages and communities on a regional and local scale, with specific reference to the conservation status of certain fauna taxa.

38.2 IMPACT ASSESSMENT METHOD

Based on the information available in the literature, including digital imagery of the faunal habitats of the study area and surrounds, as well as the results of the field investigation, none of the anticipated impacts on the faunal communities of the study area and surrounds are expected to result in a "no-go" option regarding the proposed renewable energy project. It is expected that all of the impacts that might occur as consequences of the construction and operation of the proposed project potentially influencing the fauna of the area and region would be possible to mitigate in order to be considered acceptable (based on IFC and other international based standards relevant to Environmental Impact Assessments).

The method applied for assessing the significance of impacts of the fauna of the study area, as supplied by the EAP, are explained in Section 25.2

38.3 QUANTITATIVE EVALUATION OF EXPECTED IMPACTS ON THE FAUNAL RECEIVING ENVIRONMENT

38.3.1 IMPACT SIGNIFICANCE – DIRECT IMPACTS

Nature	1. Direct – Loss of conservation important species and - habitat	
	Before Mitigation	After Mitigation
Extent	1 (Footprint/ Site)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	3 (Long term, 15-30 years)
Intensity	1 (Low)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	6 (NEGATIVE LOW)	6 (NEGATIVE LOW)
Nature	2. Direct – Loss of natural habitat, including essential habitat refugia	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	3 (Long term, 15-30 years)
Intensity	2 (Moderate)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)
Nature	3. Direct - Local depletion of faunal diversity resulting from human/animal conflict	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	1 (Improbable)	1 (Improbable)
Significance	8 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)

38.3.2 IMPACT SIGNIFICANCE – INDIRECT IMPACTS

Nature	4. Indirect - Degradation of untransformed habitat in surrounding areas	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	9 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)
Nature	5. Indirect - Loss of movement corridors and migration patterns & introduction of alien/invasive species	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	4 (Permanent)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	3 (highly probable)	1 (Improbable)
Significance	11 (NEGATIVE HIGH)	5 (NEGATIVE LOW)
Nature	6. Indirect - Increase in edge effects in the ecological region of the study area	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	9 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)

38.3.3 IMPACT SIGNIFICANCE – CUMULATIVE IMPACTS

Nature	7. Cumulative – Depletion, losses and degradation of faunal habitat	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	9 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)
Nature	8. Cumulative – Depletion of animal species and communities on a regional scale	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	9 (NEGATIVE MODERATE)	5 (NEGATIVE LOW)

38.3.4 IMPACT SIGNIFICANCE – SUMMARY

Table 15: Summary of Impact Significance within the Faunal Receiving Environment

Impact	Before Mitigation	After Mitigation
1. Direct – Loss of conservation important species and habitat	6	6
2. Direct - Loss of natural faunal habitat and refugia	8	6
3. Direct – Local depletion of faunal diversity	8	5
4. Indirect – Degradation of faunal habitat in surrounding areas	9	5
5. Indirect – Loss of animal migration corridors/ routes and introduction of alien invasive species	11	5
6. Indirect – Increase in regional edge effects	9	5
7. Cumulative – Regional faunal habitat loss and degradation	9	5
8. Cumulative – Regional loss of faunal taxa and communities	9	5

38.4 DISCUSSION – ESTIMATED IMPACT SIGNIFICANCE

Direct Impacts – Faunal habitat types within the study area (and surrounds) are been significantly degraded and heavily modified through constant and long-term over-grazing and trampling of the terrestrial and wetland-associated habitats of the study area and surrounds. The original indigenous medium and large herbivores have been replaced by cattle, sheep, goats, pigs and horses, but with no natural migration patterns and the persistent and high grazing pressures, the status of the grasslands have been severely altered – structurally as well as compositionally. Direct impacts of habitat and species loss in the study area are not considered significant, even prior to the implementation of a mitigation strategy.

Indirect Impacts – Indirect impacts of the proposed activity within the study area have an estimated significance of moderately high prior to the implementation of a mitigation strategy. Some small, albeit important, natural faunal habitat refugia have been identified in parts bordering the study area; rocky ledges, cliffs and wetland seeps that have significant potential as habitat for species of conservation importance (refer **Section 23.2**). Rehabilitation of these areas could improve the habitat status of both rocky and wetland habitats, increasing their habitat potential and the potential for the reintroduction of original conservation important species to the local area. The proper mitigation and management of likely impacts of the proposed project will reduce the significance of all indirect impacts to low.

Cumulative Impacts – It is estimated that anticipated cumulative impacts for the proposed project are of moderate significance (prior to mitigation). The region, in which the study area is situated, does exhibit numerous natural faunal habitat and is likely to host many and diverse natural animal assemblages. Many of these animal taxa are heavily reliant on free movement corridors and migratory channels through the landscape and require access suitable habitat patches

for feeding, refuge and propagation purposes. The loss of certain levels of individual animals and suitable habitat patches on a regional scale, as a result of habitat destruction and an increased influx of people, has the potential to lead to regional extinctions of certain species as well as the detrimental transformation of animal communities in the region. It is however possible to manage these impacts within the proposed development to some extent.

39 RECOMMENDED FAUNAL MITIGATION APPROACH FOR THE PROJECT

39.1 BACKGROUND

The mitigation of impacts aims to eliminate or reduce biodiversity impacts. A general rule of thumb follows the following hierarchy of mitigation options:

⇒ Total impact avoidance;
⇒ When unavoidable, reduction of impact;
⇒ Habitat restoration to original state;
⇒ Species or habitat relocation; or
⇒ Compensation for any residual and unavoidable damage.

Impact mitigation regarding biodiversity is a legal requirement and requires proactive planning. The significance of an impact determines the level of mitigation required:

⇒ Avoid or prevent: when considering options in project location, scale and layout as well as technology and phasing to avoid or prevent impacts on biodiversity;
⇒ Minimise: considering alternatives that would minimise impacts to biodiversity and ecosystem services;
⇒ Rehabilitate: rehabilitation of habitats are used in case of an unavoidable impact; rehabilitation cannot fully return habitat to its original state; and
⇒ Offset: when additional measures are taken to compensate for the residual negative effects on biodiversity.

The Environmental Management Plan (EMP) should include the proposed mitigation measures and reflect the mitigation approach relevant to the specific impacts anticipated for this project.

39.2 GENERAL MITIGATION MEASURES

Mitigation Measure 1 - The appointment of a suitably qualified Environmental Control Officer (ECO) before construction commences, is critical to managing is mitigating all impacts on site; it is the duty of the ECO to ensure that the principles in the EMP is strictly adhered to; and

Mitigation Measure 2 – The implementation of the faunal monitoring programme as part of the annual Biodiversity Monitoring Program. This should include (inter alia) the monitoring and management of Alien and Invasive animal species that might establish in the region of the study area and establishing the long-term trends of impacts on the faunal component of the receiving environment and immediate surrounds. The austral summer period is regarded an optimal period for the execution of the faunal monitoring protocol.

39.3 SITE SPECIFIC MITIGATION MEASURES

Mitigation Measure 3 – Allow for limited construction activities within areas of medium-high faunal sensitivity (drainage lines & seeps), aligning with recommendations presented in the wetland ecological report;

Mitigation Measure 5 – Develop an integrated waste management plan, with specific reference to inappropriate food disposal that will lead to human-animal conflict situations created with the presence of problem animals such as rats etc.

39.4 ROADS & ACCESS

Mitigation Measure 6 – Vehicle access across natural habitat is to be restricted to one track – multiple tracks should be avoided;

Mitigation Measure 7 – The road plan for the site should take cognisance of sensitive faunal habitats; planning and actions should attempt to prevent accidental deaths of animals by vehicular collisions;

Mitigation Measure 9 – Appropriate speed limits must be enforced to protect animals and allow for sufficient safety margins.

39.5 ANIMALS

Mitigation Measure 10 – Absolutely no animals may be hunted, trapped, snared or killed for any purpose whatsoever; boundary fences should be patrolled regularly to check for and remove any snares or other animal traps;

Mitigation Measure 11 – A person that is qualified and competent to safely capture problem animals, with specific reference to snakes, must be appointed to safely handle and remove any dangerous animals from site;

Mitigation Measure 12 – The site induction should include familiarization with the potentially occurring dangerous animals of the area and the correct actions to take when encountering all species. Snakes would most likely represent the highest likelihood of encounter. Poor local knowledge of snakes often result in the indiscriminate killing of these animals, which should not be allowed;

Mitigation Measure 13 – Appoint competent personnel and ensure the presence of the proper treatment facilities for snake bites;

Mitigation Measure 14 – Have the emergency contact details for medical personnel available to assist remotely with advice and treatment actions of snakebites; and

Mitigation Measure 15 – No domestic pets, with specific reference to feral cats, of any kind should be allowed on site, near the study area or at the construction camps and permanent, new accommodation of personnel in the vicinity of the site.

39.6 PROPOSED FAUNAL MONITORING PROTOCOL

To ensure that the faunal species and communities of the study area are not affected adversely over the medium term during the construction and operational phases of the project, an annual faunal monitoring program is recommended. This will, optimally be executed on an annual basis over the construction period until (approximately) 2 years subsequent to the commencement of operation. The purpose would be to establish any potential changes to the faunal community and diversity structure of the site and, immediate surroundings, recommending additional mitigation measures if needed. The following general monitoring guidelines should be included in the faunal monitoring program (*inter alia*):

1. Fixed point sampling (annually repeated at the sample geographical points) of invertebrates and small mammals;
2. Ad hoc, random sampling of all faunal groups during the same time of year (austral summer, after the first spring rains, preferably from late November onwards);
3. Monitoring of specific animal groups such as dragonflies, butterflies and damselflies to be used as bio-indicators of local ecosystem health and ecosystem service status;
4. Specific sampling aimed at determining the presence/absence and ecology of conservation important species such as Vlei Rat and White-tailed Rat;
5. Count samples of any alien and invasive animals that might establish on site or close by;
6. Include any observational and *ad hoc* data as gathered by personnel on site during the period between monitoring bouts. Develop a sighting and register log for observations pertaining to the presence/ abundance and occurrence of animals on site; and
7. Take photographic evidence of occurrences of animals wherever possible.

40 IFC PERFORMANCE STANDARD 1 & 6 – FAUNAL ASSESSMENT

IFC Performance Standard 1 concerns the assessment and management of environmental and social risks and impacts. Performance Standard 6 has relevance to biodiversity conservation and sustainable management of living natural resources. These standards form part of the IFC's Sustainability Framework that comprises the IFC's Policy and Performance Standards on Environmental and Social Sustainability and IFC's Access to Information Policy. The Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

Performance Standard 1 has the following objectives:

⇒ To identify and evaluate environmental and social risks and impacts of the project;

⇒ To adopt a mitigation hierarchy to anticipate and void, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities and the environment;

⇒ To promote improved environmental and social performance of clients through the effective use of management systems;

⇒ To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately; and

⇒ To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Performance Standard 6 has the following objectives:

⇒ To protect and conserve biodiversity;

⇒ To maintain the benefits from ecosystem services; and

⇒ To promote the sustainable management of living natural resources through the adoption of practises that integrate conservation needs and development priorities.

The objectives of Performance Standards 1 and 6 that have direct relevance to the faunal communities and relevant aspects of this project are:

1. To identify and evaluate environmental and social risks and impacts of the project;
2. To adopt a mitigation hierarchy to anticipate and void, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities and the environment;
3. To promote improved environmental and social performance of clients through the effective use of management systems;
4. To protect and conserve biodiversity;
5. To maintain the benefits from ecosystem services; and
6. To promote the sustainable management of living natural resources through the adoption of practises that integrate conservation needs and development priorities.

These six objectives were considered and addressed during the faunal assessment of this study. Faunal impacts were identified and evaluated; a mitigation hierarchy was adopted and mitigation measures are proposed based on the significance of impacts anticipated. By adhering to these mitigation principles, the client ensures that the protection and conservation of biodiversity is considered and that the benefits from ecosystem services are maintained and potentially enhanced. The sustainable management of living natural resources (i.e. animals) is promoted by the mitigation principles as well as the proposed faunal monitoring guidelines.

41 CONCLUDING STATEMENT

Based on the results and analyses of the literature study and field investigation of October 2018, the following conclusions were reached regarding the faunal communities of the study area and surrounds and anticipated impacts of the proposed project on these faunal communities:

⇒ Biodiversity conservation is critical for the continued supply of ecosystem services to secure the sustainability of livelihoods, especially for poor rural people in developing countries;

⇒ Animals do not exist in isolation within ecosystems; animals or terrestrial as well as aquatic ecosystems are influenced by plant community structure and species diversity;

⇒ The plant communities described for the study area are representative of the macro faunal habitat types;

⇒ No red data listed animals or any other animals of conservation concern were encountered during the field investigation; none are known to occur in the Q-grid 2927CD in which the study area is found;

⇒ The animals found to inhabit the study area and immediate surrounds are common and widespread species and not currently considered to be of any direct (species level) conservation importance;

⇒ The sampling effort of the field investigation has significantly added to the species inventory list of the Q-grid 2927CD (Virtual Museum);

⇒ Erosion gullies and agricultural fields of the study area exhibit low faunal sensitivities and the rocky ledges & cliffs and drainage lines and seeps indicate medium-high faunal sensitivities;

⇒ Three direct, three indirect and two cumulative impacts associated with the proposed project are anticipated to have relevance to the faunal communities of the study area and surrounds;

⇒ All of the impacts anticipated can be effectively mitigated, reducing those with moderate, moderate-high and high significances to impacts with low significances;

⇒ A comprehensive, annual faunal monitoring program will ensure that any changes to the faunal communities will be identified and managed with additional mitigation and management measures; and

⇒ The objectives of Performance Standards 1 and 6 of the IFC that has relevance to the conservation and protection of the fauna of the region were considered and has been satisfied by the faunal assessment.

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SECTION E – AVIFAUNAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

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43 BACKGROUND

Pachnoda Consulting undertook a bird specialist study for the proposed NEO 1 20MW Solar PV Plant to be situated in the Mafeteng district in Kingdom of Lesotho.

NEO 1 Consortium aims to implement the NEO 1 20MW Solar Photovoltaic Power (PV) Generation Development Project under guidance of the Lesotho Ministry of Energy and Meteorology (MEM). Generated power will be sold to Lesotho Electric Corporation (LEC) for transmission and distribution through a proximate grid connection. The facility will occupy a footprint of approximately 66 ha and is geographically situated approximately 2.5 km southwest from Sepechele between the Ha Ramarothole, Ha Lempetje and Ha Raliemere villages of the Mafeteng District of the Kingdom of Lesotho. The project will produce approximately 48 000 MWh of electricity per year, thereby avoiding 45 500 tonnes of CO_2 emissions.

44 TERMS OF REFERENCE

A bird assessment is required as part of the Environmental Impact Assessment process to investigate the impacts of the proposed facility on the avian attributes at the study site and its immediate surroundings. The avifaunal attributes at the proposed PV facility will be determined by means of a desktop analysis of GIS based information, third-party datasets and a site visit.

The terms of reference are to:

⇒ conduct a baseline bird assessment based on available information pertinent to the ecological and avifaunal attributes on the study site and habitat units;

⇒ assess all information on an EIA level in order to present the following results:

- typify the regional and site-specific avifaunal macro-habitat parameters that will be affected by the proposed project;
- provide a shortlist of bird species present as well as highlighting dominant species and compositions;
- provide an indication on the occurrence of threatened, near threatened, endemic and conservation important bird species likely to be affected by the proposed project;
- provide an indication of sensitive areas or bird habitat types corresponding to the study site;
- highlight areas of concern or "hotspot" areas;
- identify and describe impacts that are considered pertinent to the proposed development;
- highlight gaps of information in terms of the avifaunal environment;
- provide a preliminary Critical Habitat assessment as per Performance Standard 6 (PS6) of the International Finance Corporation's guidelines (IFC, 2012); and
- recommend additional surveys and monitoring protocols (sensu Jenkins et al., 2017).

44.1 OBJECTIVES

The main objectives of the avifaunal study were to: (a) describe the avifauna associations in the project area according to species composition and richness prior to construction activities; (b) provide an inventory of bird species occurring in the project area; (c) provide an impact assessment; and (d) provide an indication on the occurrence of species of concern (e.g. threatened and near threatened species; sensu IUCN, 2017; Taylor et al., 2015; Barnes, 2001).

Please note that this report emphasises the avifaunal community as a key indicator group on the proposed project area, thereby aiming to describe the preliminary conservation significance of the habitat units in the area. Therefore, the occurrence of certain bird species and their relative abundances may have influence on the outcome of the ecological sensitivity of the area and the subsequent layout of the proposed solar facility infrastructure.

44.2 SCOPE OF WORK

The following aspects formed part of the Scope of Work:

⇒ A desktop study of expected bird species (e.g. species that could potentially be present), as well as species recorded in the past (e.g. SABAP1);
⇒ A baseline survey of observed bird species according to ad hoc observations and sampling site;
⇒ A list of bird species historically recorded within the relevant quarter degree grid in which the study site occurs;
⇒ Any protected or threatened species recorded in the past within the relevant quarter degree grid, their scientific names and colloquial names, and protected status according to IUCN red data lists; and
⇒ The potential of these protected or threatened species to persist within the study area.

The following aspects were discussed during this avifaunal assessment:

⇒ Collision-prone bird species expected to be present and or observed;
⇒ A list of the dominant bird species;
⇒ A list of observed and expected threatened and near threatened species (according to IUCN red data list);
⇒ Possible migratory or nomadic species;
⇒ Potential important flyways/ congregatory sites and/or foraging sites; and
⇒ Avian impacts associated with the PV solar facility.

44.3 METHODS & APPROACH

44.3.1 LITERATURE SURVEY AND DATABASE ACQUISITION

A desktop and literature review of the area under investigation was commissioned to collate as much information as possible prior to a baseline survey (October 2018). Literature consulted makes primarily use of small-scale datasets located at various governmental and academic institutions that were collected by citizen scientists (e.g. Animal Demography Unit & SANBI). These include (*inter alia*) the following:

⇒ Hockey et al. (2005), Harrison et al. (1997) and Del Hoyo et al. (1992-2011) for general information on bird identification and life history attributes;
⇒ Barnes (2001) was consulted for information regarding the biogeographic affinities (sensu biome-restricted bird species) of selected bird species that could occur on the study area;
⇒ The conservation status of bird species was categorised according to the global IUCN Red List of threatened species (IUCN, 2017) and the regional conservation assessment of Taylor et al. (2015);
⇒ Distributional data was sourced from the South African Bird Atlas Project (SABAP1) and verified against Harrison et al. (1997) for species corresponding to the quarter-degree grid cell (QDGC) 2927CD (known as 51 Thabana-Morema). The information was then modified according to the prevalent habitat types present on the study area.

The SABAP1 data provides a "snapshot" of the abundance and composition of species recorded within a quarter degree grid cell (QDGC) which was the sampling unit chosen (corresponding to an area of approximately 15 min latitude x 15 min longitude). It should be noted that atlas data makes use of reporting rates that were calculated from observer cards submitted by the public as well as citizen scientists. It therefore provides an indication of the thoroughness of which the QDGCs were surveyed between 1987 and 1991. QDGCs adjacent to the study site were also investigated to verify the potential occurrence of threatened or near threatened bird taxa (these include 2927CA, 2927CC, 2927DA and 2927DC);

⇒ Additional distributional data was also sourced from the SABAP2 database (http://www.sabap2.adu.org.za). The information was then modified according to the prevalent habitat types present on the study area. Since bird distributions are dynamic (based on landscape changes such as fragmentation and climate change), SABAP2 was born (and launched in 2007) from SABAP1 with the main difference being that all sampling is done at a finer scale known as pentad grids (5 min latitude x 5 min longitude, equating to 9 pentads within a QDGC). Therefore, the data is more site-specific, recent and more comparable with observations made during the site visit (due to increased standardisation of data collection). The pentad grid relevant to the current project is 2945_2720 and 2945_2715[7] (although all eight surrounding pentad grid information was also scrutinised); and

⇒ The choice of scientific nomenclature, taxonomy and common names were recommended by the International Ornithological Committee (the IOC World Bird List v. 8.2), unless otherwise specified (see www.worldbirdnames.org as specified by Gill & Donsker, 2018).

44.3.2 FIELD METHODS

The avifauna of the study area was surveyed during early October 2018 corresponding to the commencement of the austral wet season ("summer"). However, the survey preceded any major rainfall events and is therefore considered as a dry season survey. An inventory of bird species identified within the study area, along with their common and scientific names, is included (refer to Appendix 3).

The baseline avifaunal survey was informed by results obtained from the following survey techniques.

Point Counts

Bird data was collected by means of twelve (12) point counts (as per Buckland et al. 1993), where all birds observed and heard from a specific point over a set period of time is recorded. Data from the point counts will be analysed to determine dominant, indicator bird species (so-called discriminant or typical species), relative densities and to delineate the different associations present.

The use of point counts is advantageous since it is the preferred method to use for skulking or elusive species. In addition, it is the preferred method to line transect counts where access is problematic, or when the terrain appears to be complex (e.g. mountainous). It is considered to be a good method to use, and very efficient for gathering a large amount of data in a short period of time (Sutherland, 2006). The spatial position of each point count is illustrated in Figure 22. The spatial placement of the point counts was determined through a stratified random design which ensures coverage of each habitat type and/or macro-habitat (Sutherland et al., 2004).

At each point, all bird species seen/ heard within approximately 100 m from the centre of the point were recorded (c. an area of 3.14 ha) along with their respective abundance values. Each point count lasted approximately 20 - 30 minutes, while the area within the 100 m of homogenous habitat is slowly traversed to ensure that all bird species were detected

[7] Please note that both pentads have been poorly surveyed, and all previous observations pertain to ad hoc submissions (with zero full protocol submissions). The current baseline survey provided the first full protocol survey for pentad grids 2945_2720 and 2945_2715.

(according to Watson, 2003). To ensure the independence of observations, points were positioned at least 200 m apart. Observations were not truncated, and in order to standardise data collection, the following assumptions were conformed to (according to Buckland et al., 1994):

⇒ All birds on the point must be seen and correctly identified. This assumption is in practice very difficult to meet in the field as some birds in the nearby vicinity may be overlooked due to low visibility or were obscured by outcrops. Therefore, it is assumed that the portion of birds seen on the point count represents the total assemblage on the point.

⇒ All birds must be recorded at their initial location. All movements of the birds are random and therefore natural in relation to the movements of the observer. None of the birds moved in response to the presence of the observer, and birds flying past without landing were omitted from the analysis. In other words, no bird is recorded more than once.

Random (ad hoc) surveys

To obtain an inventory of bird species present (apart from those observed during the point counts), all bird species observed/detected while moving between point counts were identified and noted. Particular attention was devoted to suitable roosting, foraging and nesting habitat for species of conservation concern (e.g. threatened or near threatened species).

Playback/broadcasting and recording of bird vocalisations

The probability of detecting skulking/ elusive species or species for which the distribution ranges are insufficiently known in the area was verified by playback of bird calls/songs wherever suitable habitat was detected (e.g. pertaining to rocky ridges such as the African Rock Pipit *Anthus crenatus*). Special care was taken to keep disturbance to a minimum and not to affect the bird's natural behaviour (e.g. to prevent unnecessary habituation). In certain instances, the calls/vocalisations of species which are confusing and problematic to identify, were recorded as proof or evidence.

All observations obtained during the survey were submitted to the South African Bird Atlas Project (SABAP2).

Data generated from the point counts was analysed according to Clarke & Warwick (1994) based on the computed percentage contribution (%) of each species, including the consistency (calculated as the similarity coefficient/standard deviation) of its contribution. Hierarchical Agglomerative Clustering (a cluster analysis-based group-average linkages; Clarke & Warwick 1994) was performed on calculated Bray-Curtis coefficients derived from the data. A cluster analysis is used to assign "species associations" between samples with the aim to objectively delineate groups or assemblages. Therefore, sampling entities that group together (being more similar) are believed to have similar compositions.

The species diversity of each species association was analysed by means of rarefaction, while richness measures (such as the total number of species recorded (S) and various diversity indices) were calculated to compare the associations with each other. The advantage of rarefaction is that it adjusts the number of species expected from each sample if all were reduced to a standard size.

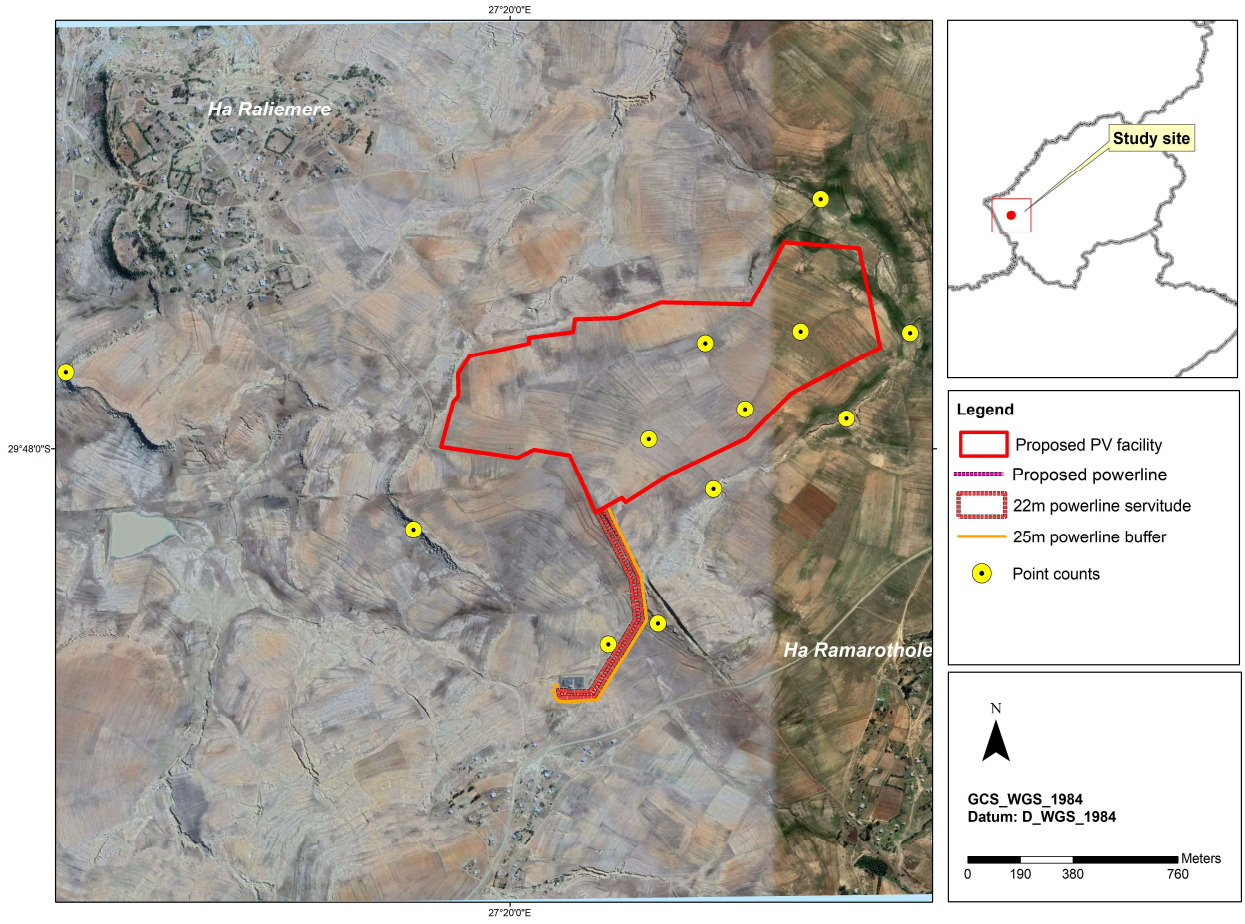


Figure 22: Spatial position of 12 bird point counts conducted within the study area

44.4 AVIFAUNAL SENSITIVITY ANALYSIS

An avifaunal sensitivity analysis was performed for each habitat type on the study site based on its inherent ecosystem service (ecological function) and the preservation of bird diversity (avifaunal importance).

44.4.1 ECOLOGICAL FUNCTION

The extent to which a habitat type is ecologically connected to the surrounding area is an important determinant of the sensitivity analysis. Habitat with a high degree of landscape connectivity or with extensive drainage systems amongst one another are perceived to be more sensitive and will be those contributing to important avifaunal flyways.

44.4.2 AVIFAUNAL IMPORTANCE

Avifaunal importance relates to species diversity, endemism and the presence of topographical features or primary habitat units with the intrinsic ability to sustain conservation important species.

44.4.3 SENSITIVITY SCALE

Very High - Sensitive habitat with either low inherent resistance or low resilience towards disturbance factors. These habitat types represent ecosystems with high connectivity and support high bird diversities while providing suitable habitat for a number of threatened or near-threatened species.

High – Highly dynamic habitat considered important for the maintenance of ecosystem integrity. These habitat types support high bird diversities and provide suitable habitat for at least one or more threatened or near-threatened species.

Medium – These are slightly modified habitat types, which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems, OR habitat types with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species.

Low –Disturbed/transformed habitat with little ecological function and is generally very poor in species diversity with a dominant composition of unspecialised and widespread species.

Very Low - Severely modified habitat where ecosystem service is arrested or non-functional. Species diversity is extremely low and often dominated by very few bird species.

44.5 LIMITATIONS AND ASSUMPTIONS

⇒ It is assumed that third party information (obtained from government, academic/research institution, non-governmental organisations) is accurate and true;

⇒ Some of the datasets are out of date and therefore extant distribution ranges may have shifted although these datasets provide insight into historical distribution ranges of relevant species.

⇒ The datasets are mainly small-scale and could not always consider azonal habitat types that may be present on the study area (e.g. small dams). In addition, these datasets encompass surface areas larger than the study area, which could include habitat types and species that are not present on the study site. Therefore, the potential to overestimate species richness is highly likely while it is also possible that certain cryptic or specialist species could have been be overlooked in the past.

⇒ Some of the datasets (e.g. SABAP2) managed by the Animal Demography Unit of the University of Cape Town were recently initiated and therefore incomplete.

⇒ The study area is incompletely surveyed and atlassed prior to the baseline survey (as evidenced by the lack of any SABAP2 full protocol card submissions). Therefore, bird richness information for the area is scant and incomplete.

⇒ To obtain a comprehensive understanding of the diversity and dynamics of the avifaunal, invertebrate and bat community on the study area, as well as the status of endemic, rare or threatened species in the area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies are not feasible and are mostly based on instantaneous sampling bouts. It should also be realised that bird distribution patterns fluctuate widely in response to environmental conditions (e.g. local rainfall patterns, nomadism, migration patterns, seasonality), meaning that a composition noted at a particular moment in time will differ during another time period at the same locality. Therefore, a comprehensive inventory, irrespective of the taxon or group of taxa could only be achieved during long-term temporal sampling.

An important limitation of the assessment is the temporal timing of the survey, which coincided with the late austral dry season. It involves three constraints that are basically all related to seasonal constraints and climate:

1. ***Lack of precipitation*** - The lack of adequate precipitation means that most of the drainage lines, pools and dams in the area are not inundated. This will result in few observations and low bird numbers of waterbirds such as waterfowl (ducks and geese), wading birds (herons, storks) and shorebirds attracted to the region. For this reason, the results of the baseline assessment will be incomplete, and impacts related to potential collision trauma will be difficult to estate without a follow-up survey after the area has received sufficient rains.
2. ***Migration and timing of arrival of Palearctic migrants*** - The survey coincides with the early part of October when many of the Palearctic migrant species has not arrived at their final wintering grounds (e.g. Barns Swallows *Hirundo rustica*). Those species that were observed are believed to be early arrivals, thereby implying that the inferred

richness index and bird abundance values are biased and may represent an underestimation to be used as benchmark/reference data during pre-construction monitoring.

3. ***Effects of livestock grazing on graminoid structure*** - During the baseline survey of October 2018 most moist, palatable grassland bordering the seeps and drainage lines was severely grazed by livestock, rendering the grassland sere superficially similar to "lawns". The shortly, heavily grazed grassland explains the absence of typical Highveld grassland birds such as Southern Red Bishop (*Euplectes orix*), Long-tailed Widowbirds (*E. progne*) and Levaillant's Cisticola (*Cisticola tinniens*). It should be noted that, should the *status quo* of the graminoid component vary on a temporal basis, the avian composition will most likely reflect these changes in terms of species composition and abundance, specifically with the progression of the wet season.

This company, the consultants and/or specialist investigators therefore do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

45 BIRD SPECIES COMPOSITION & DIVERSITY PATTERNS

45.1 AVIFAUNAL BROAD-SCALE HABITAT TYPES

45.1.1 MORAEA PALLIDA– WAHLENBERGIA CF. DIETERLENII AGRICULTURAL FIELDS

Nearly the entire study site consists of tilled agricultural and fallow land (refer Figures 23 and 24). The transformation of natural grassland into agricultural fields explains the low bird richness in the area (c. <110 species) along with the possible historical displacement of endemic and obligatory grassland specialist taxa. However, the early successional seral stage of this habitat, along with the high propensity for annual plants (and inherent seed bank thereof) attracts congregations of granivore bird species, especially when the seed bank is germinating.

This unit consists mainly of a gradient of successional seral stages, representing recently tilled land which is currently used for the production of crops (mainly *Zea mays*) and early secondary seral stage which is fallow land that was probably used for agricultural purposes during the previous season. It is characterised by shortly grazed secondary graminoids (mainly *Cynodon dactylon* and *Chloris virgata*) and early aspect forb species such as *Crepis hypochaeridea, Felicia muricata, Helichrysum caespititium* and *Wahlenbergia dieterlenii*. Some sections of this habitat showed successional progress and are characterised by the dominance of the shrub *Felicia filifolia* and an abundance of termitaria. These *Felicia filifolia*-dominated shrubland were prominent on areas where recent cultivation and agricultural practice has ceased. The presence of the geophyte *Moraea pallida* generally indicates the deteriorated nature of this habitat, and the extent of time since the cessation of agricultural activities.

Typical bird species that forage in large numbers include Red-capped Lark (*Calandrella cinerea*), Cape Sparrow (*Passer melanurus*) and the insectivorous African Pipit (*Anthus cinnamomeus*). Other species that are also present include Speckled Pigeon (*Columba guinea*), Pied Crow (*Corvus albus*), Egyptian Goose (*Alopochen aegyptiaca*) and Western Cattle Egret (*Bubulcus ibis*). Bird species prone towards collision with the proposed electrical infrastructure associated with the PV facility that may also utilise this habitat include Western Cattle Egret (*Bubulcus ibis*), Black-headed Heron (*Ardea melanocephala*), Southern Bald Ibis (*Geronticus calvus*), large-bodied anseriform species such as Egyptian Goose (*Alopochen aegyptiaca*), White Stork (*Ciconia ciconia*) and Blue Korhaan (*Eupodotis caerulescens*). The Southern Bald Ibis (*Geronticus calvus*) is the only threatened foraging bird species with a high frequency of occurrence.

45.1.2 PENTAMERIS ARIODES – TRIFOLIUM BURCHELLIANUM DRAINAGE LINES AND SEEPS[8]

This habitat is located along the edges of drainage lines and is prominent on north-eastern and south-eastern parts of the study site (refer Figures 23 and 24). It is often colonised by dense, shortly-grazed secondary grassland dominated by *Eragrostis chloromelas, Pennisetum clandestinum, Pentameris airoides subsp. jugorum, Paspalum dilatatum* and consists of a number of pools which hold surface water for extended periods. The shortly grazed moist grassland provides foraging and roosting habitat for Cape Longclaw (*Macronyx capensis*) and Cape Wagtail (*Motacilla capensis*). However, if grazing regimes are appropriately managed and the graminoid structure is restored, this habitat type will also provide habitat for Long-tailed Widowbird (*Euplectes progne*), Yellow-crowned Bishop (*E. afer*), Southern Red Bishop (*E. orix*), Zitting Cisticola (*Cisticola juncidis*) and Levaillant's Cisticola (*C. tinniens*). It is also often visited by terrestrial species such as Blacksmith Lapwing (*Vanellus armatus*), Southern Bald Ibis (*Geronticus calvus*) and Black-headed Heron (*Ardea melanocephala*). When inundated during the wet season, the numerous pools are likely to be colonised by a number of waterbirds, most

[8] Please note that the habitat types used for this assessment is based on a visual and floristic interpretation of the broach scale habitat types. For a detailed illustration of wetland habitat types that are based on soil characteristics, the reader is referred to the wetland ecological report. For the purposes of this avian assessment, the structural and compositional aspects of the flora is regarded sufficient in providing substantiating evidence of the presence and abundance associated with bird species

notably Yellow-billed Duck (*Anas undulata*) and White-faced Duck (*Dendrocygna viduata*). A natural spring is situated on the north-eastern border of the site. This spring is considered to be perennial as evidenced by the occurrence of obligate wetland plant taxa such as *Marsilea* cf. *macrocarpha*.

45.1.3 *Cynodon dactylon – Gazania krebsiana Erosion Gulleys*

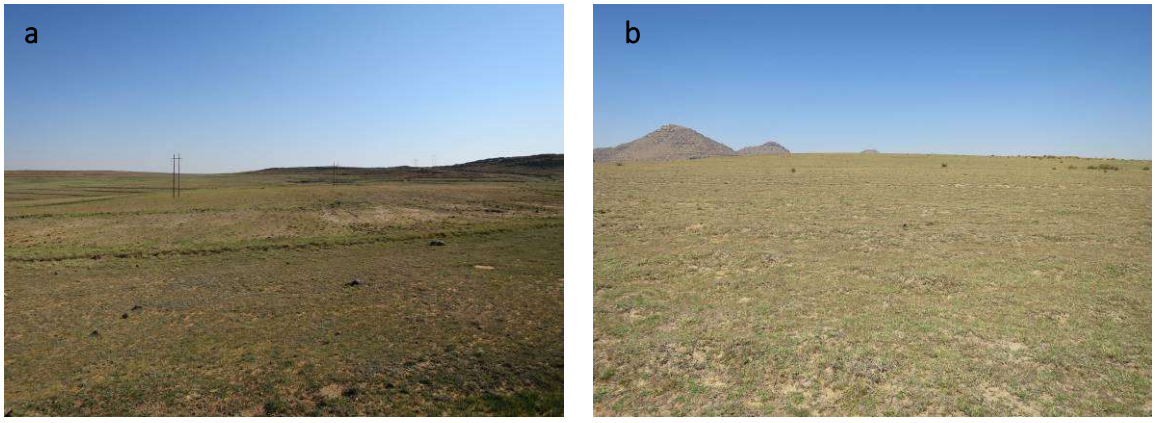
This habitat consists of deeply incised seasonal drainage lines with evidence of bank erosion occur on the northern and southern boundaries of the study site (refer Figure 24). This habitat type is often important daily flyways for waterbird species in the region while also providing ephemeral foraging habitat for waterbird and wading bird taxa when inundated during the wet season. Important bird taxa confined to this habitat when inundated with a high probability of colliding with the infrastructure include Reed Cormorant (*Microcarbo africanus*), African Black Duck (*Anas sparsa*), Yellow-billed Duck (*A. undulata*), White-faced Duck (*Dendrocygna viduata*), Red-billed Teal (A. *erythrorhyncha*), Grey Heron (*Ardea cinerea*), Little Egret (*Egretta garzetta*) and African Sacred Ibis (*Threskiornis aethiopica*).

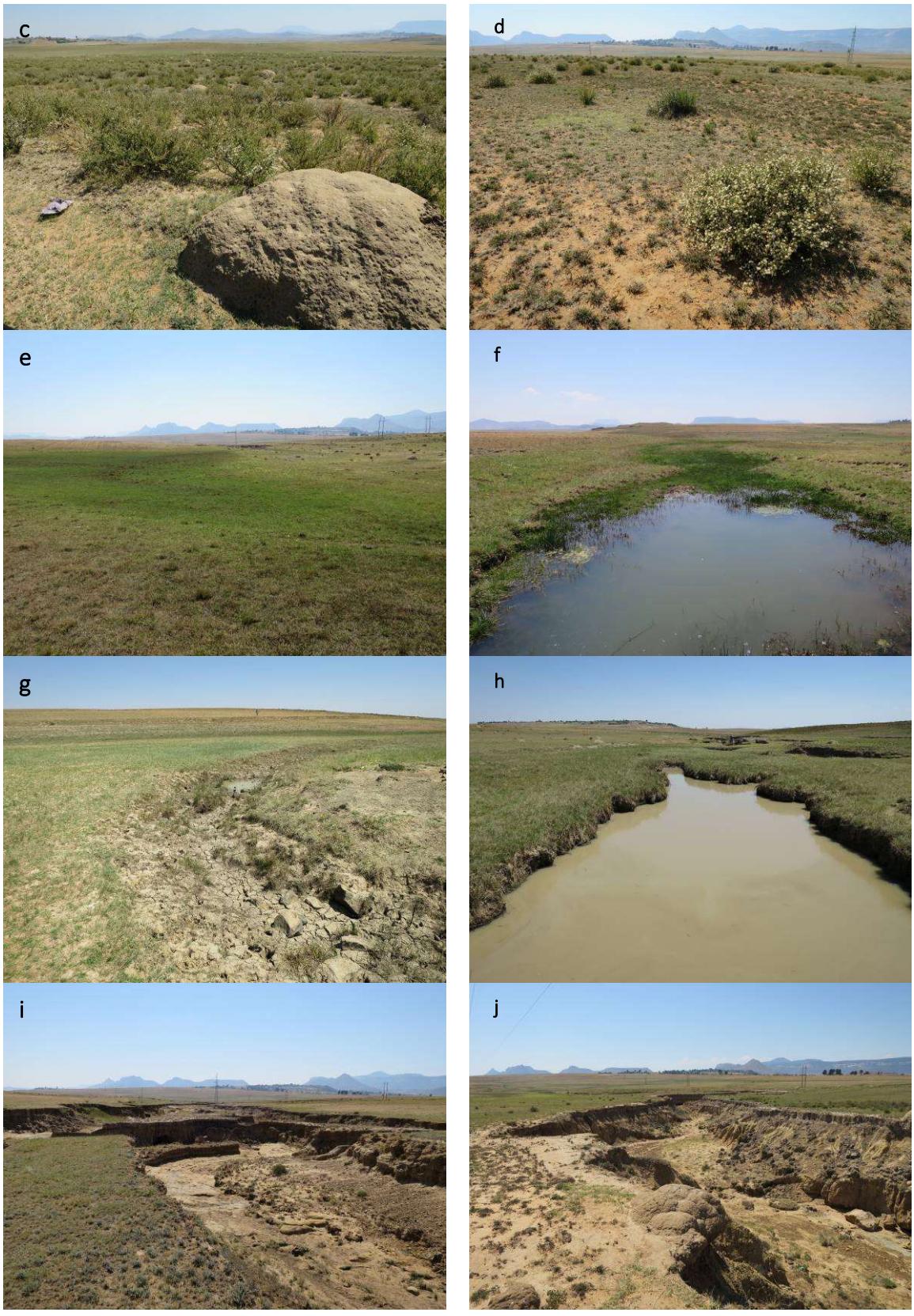
45.1.4 *Halleria lucida – Mossia interviralis Rocky Ledges And Cliffs*

This habitat includes south- and west-facing ridges consisting of exposed sandstone outcrops and cliffs. It is prominent along the proposed distribution line and also occurs to west of the study site (refer Figure 24). This habitat is characterised by the exposed localised sandstone escarpments, with flat sheetrock and exfoliating rock at the crests that gives way to steep cliffs of large boulders towards the footslope, thereby eventually connecting with the lower slopes of grassland plains. These ridges provide perching and hunting vantage points for birds of prey (e.g. Jackal Buzzard *Buteo rufofuscus*, Lanner Falcon *Falco biarmicus* and Rock Kestrel F. *rupicolus*), as well as foraging and breeding habitat for facultative rupiculous (rock-loving) bird taxa such as Cape Bunting (*Emberiza capensis*), Familiar Chat (*Oenanthe familiaris*), Mountain Wheatear (*Myrmecocichla monticola*), Eastern Long-billed Lark (*Certhilauda semitorquata*) and Long-billed Pipit (*Anthus similis*). The larger, and more prominent ridges in the region also provide habitat for the near threatened African Rock Pipit (*Anthus crenatus*), although this species was not observed from the ridges immediately adjacent to the study site.

45.1.5 *Azonal Habitat: Artificial Impoundments*

An artificial impoundment characterised by open surface water and exposed mudflats is situated approximately 900 m south-west of the study site (refer Figure 24). During the site visit bird richness was low, with only two collision-prone bird species observed, namely Egyptian Goose (*Alopochen aegyptiaca*) and Grey Heron (*Ardea cinerea*). However, the impoundment may also attract a number of Palearctic Scolopacid wader taxa (e.g. sandpipers and stints) during the summer, as well as Charadriid plovers such Three-banded Plover (*Charadrius tricollaris*).

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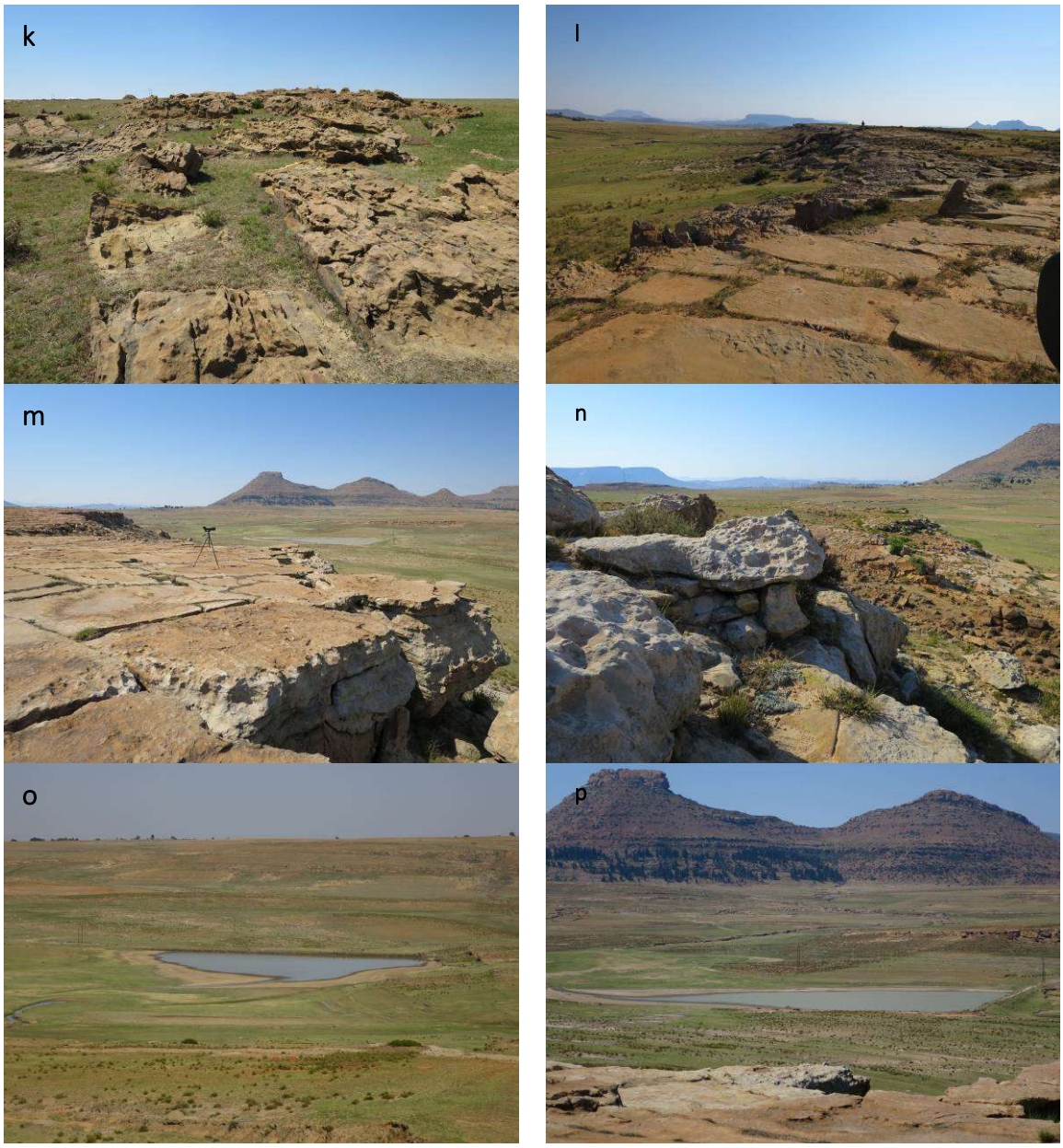

Figure 23: A collage of images illustrating the different habitat types on the study site and nearby the study site (a-d) *Moraea pallida – Wahlenbergia cf. dieterlenii* agricultural fields, (e-h) *Pentameris ariodes – Trifolium burchellianum* drainage lines and seeps, (i-j) *Cynodon dactylon – Gazania krebsiana* erosion gulleys, (k-n) *Halleria lucida – Mossia interviralis* rocky ledges and cliffs and (o-p) an artificial impoundment.

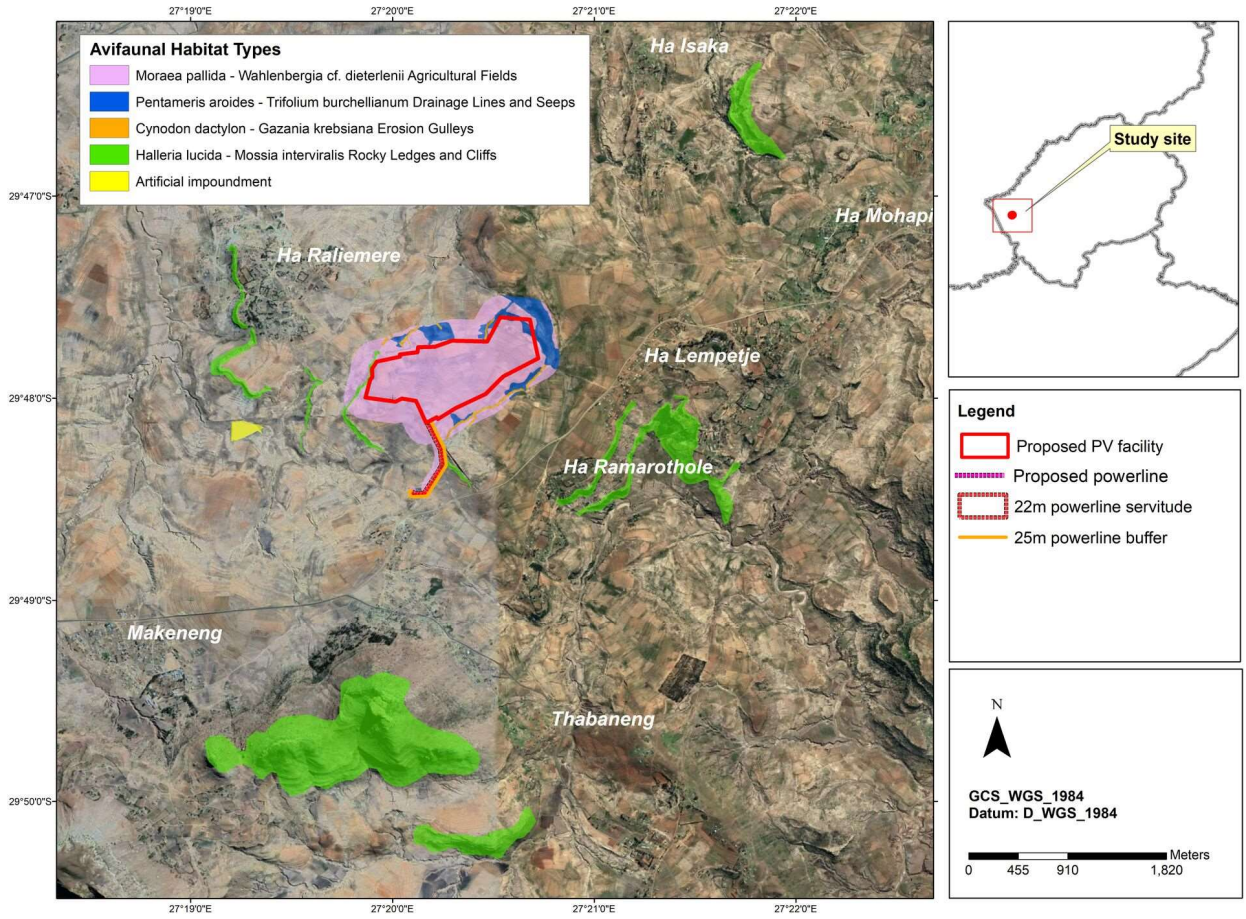

Figure 24: Avifaunal habitat types of the site and immediate surrounds

45.2 SPECIES RICHNESS AND PREDICTED SUMMARY STATISTICS

Approximately 109 bird species are expected to occur on the study site (refer **Table 18**), of which 51 species (c. 48 % of the expected number of species) was confirmed during the survey in October 2018 (**Appendix 3**). The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2)[9] (Harrison et al., 1997; www.sabap2.org). The expected and observed richness is strongly correlated with extant and historical transformation of grassland habitat, grazing pressure and the absence of any major mountain range within the immediate surroundings of the study site. The expected bird richness equates to 30 % of the approximate 361 species listed for Lesotho[10]. In addition, the expected bird richness also equates to approximately 13 % of the 855 species recorded within South Africa[11] (and 11 % of the approximate 976[12] species listed for the southern African subregion[13]). In addition, the species richness obtained from the SABAP2 pentad grids corresponding to study site (excluding SABAP1) was significantly lower with 59 bird species recorded prior to the current survey, which emphasises the poor atlas coverage of the area (refer **Figure 25**) and disrupted ecological condition of the habitat types on the study site. On a national scale, the predicted species richness per pentad

[9] The expected richness statistic was derived from QDS 2927CD (51 Thabana-Morena) and pentad grid 2945_2720 (including eight adjacent grids). Sixty (60) bird species were recorded from the QDS and 73 bird species (based on 14 *ad hoc* cards, two full protocol cards). The SABAP2 statistic was corrected by excluding erroneous submissions of species "splits", including the Clapper and Long-billed Lark complex (splits emanating from *Mirafra apiata* and *Certhilauda curvirostris*), Orange River White-eye (*Zosterops pallidus*), Olive Thrush (*Turdus olivaceus*) and Northern Grey-headed Sparrow (*Passer griseus*).

[10] *sensu* Lepage (2018).

[11] With reference to South Africa including Lesotho and Swaziland (BirdLife South Africa, 2018).

[12] sensu www.zestforbirds.co.za (Hardaker, 2018).

[13] A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).

on the study area is considered to be low (refer **Figure 26**). According to the SABAP2 database, the study area hosts between 51-75 species, which is similar to the observed richness derived during the site visit.

According to **Table 16**, the study site and immediate surroundings is poorly represented by biome-restricted species, with only one species, namely Southern Bald Ibis (*Geronticus calvus*), expected to be present. The study site is also poorly represented by endemic and near-endemic bird species, with six endemics species (to South Africa and Lesotho) recorded: Southern Bald Ibis (*G. calvus*), Blue Korhaan (*Eupodotis caerulescens*), Eastern Long-billed Lark (*Certhilauda semitorquata*), Pied Starling (*Lamprotornis bicolor*), African Rock Pipit (*Anthus crenatus*) and Ground Woodpecker (*Geocolaptes olivaceus*). Near-endemic species (shared with South Africa) observed on the site included Jackal Buzzard (*Buteo rufofuscus*), Cloud Cisticola (*Cisticola textrix*) and Large-billed Lark (*Galerida magnirostris*).

Table 16: Summary table of the total number of species, Red listed species (Taylor et al., 2015; IUCN 2017), endemics and biome-restricted species (Barnes., 2001) expected to occur and observed within the proposed study area

	Expected	*Observed*
Total number of species (*sensu* Lepage, 2018)*	109 (30 %)	51 (48 %)
Number of Red Listed species (Taylor et al., 2015 & IUCN 2017)*#	15 (50 %)	4 (27 %)
Number of biome-restricted species (Barnes., 2001 – Afrotropical Highlands)*	1 (14 %)	1 (100 %)
Number of Lesotho Highland endemics (marginally shared with South Africa)	0	0
Number of endemics (BirdLife SA, 2018)**	6 (14 %)	6 (100 %)
Number of near-endemics (BirdLife SA, 2018)**	6 (20 %)	3 (50 %)

* only species within the geographic boundaries of Lesotho were considered.
** only species within the geographic boundaries of South Africa (including Lesotho and Swaziland) were considered.
# three species were observed during SABAP1 (Southern Bald Ibis & African Rock Pipit) and SABAP2 (ad hoc observations of Lanner Falcon), although 15 species have been recorded in the wider region spanning five QDGCs.

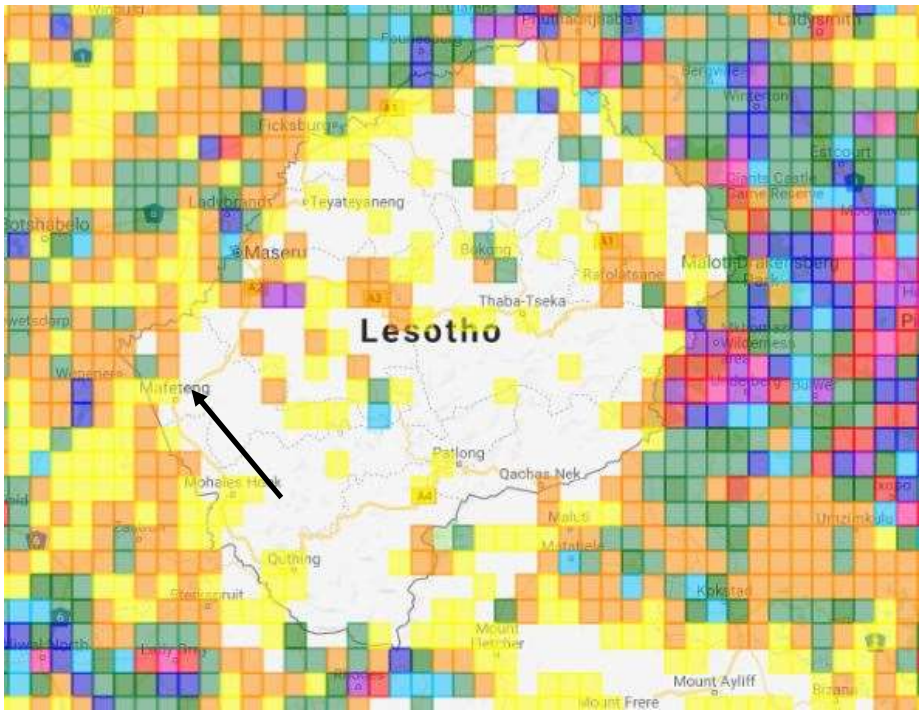

Figure 25: The atlas coverage of pentad grids in Lesotho (map courtesy of SABAP2 and the Animal Demography Unit).
The arrow indicates the approximate position of the study site.

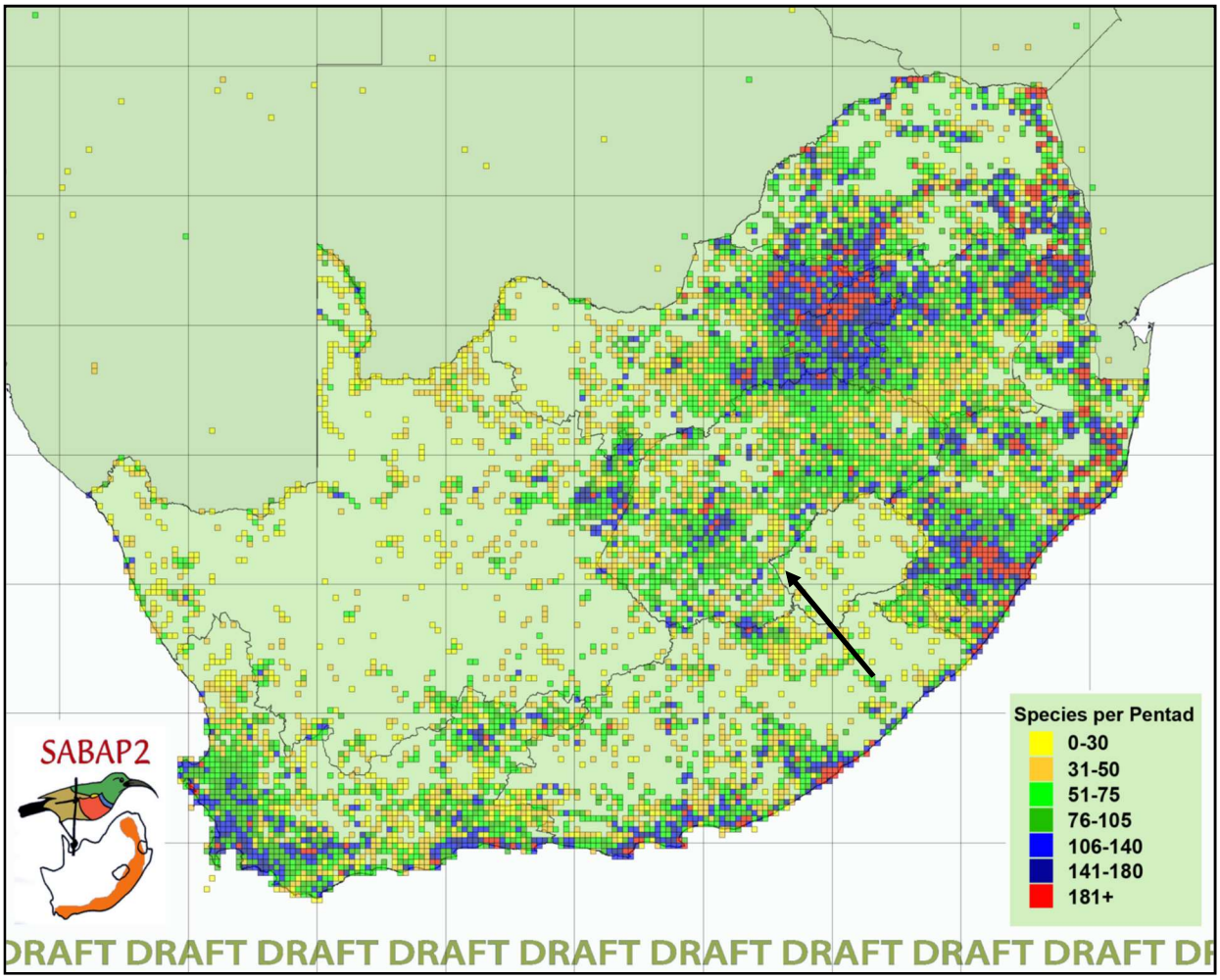

Figure 26: Bird species richness per pentad grid in comparison to the study area (see arrow)
(map courtesy of SABAP2 and the Animal Demography Unit)

45.3 IMPORTANT BIRD AND BIODIVERSITY AREAS

The avifaunal importance of a particular area is often analysed based on BirdLife International's criteria to evaluate and identify Important Bird Areas (IBAs). Criteria used are outlined by the BirdLife International Secretariat (Fishpool, 1997):

⇒ Category A1: the regular presence of significant numbers of globally threatened species. In general, only IUCN species listed as Critically Endangered, Endangered or Vulnerable are considered. The regular presence of a Critical or Endangered species, irrespective of population size, at a site may be sufficient for a site to qualify as an IBA. For Vulnerable species, the presence of more than threshold numbers at a site is necessary to trigger selection;

⇒ Category A2: the area holds a significant component of a group of species whose breeding distributions is restricted to an Endemic Bird Area (EBA) or Secondary Area. In other words, an EBA provides habitat for two or more species with restricted ranges co-occur and have global distributions of less than 50 000 km². It is noteworthy that 70 % of these species are also globally threatened. A Secondary Area (SA) holds one or more restricted-range species, but does not qualify as an EBA because less than two species are entirely confined to it. A typical SA includes a single restricted-range species which does not overlap in distribution with any other restricted-range species. For SAs, species occur where there are disjunct records of one or more restricted-range species, which are clearly geographically separate from any of the EBAs;

⇒ Category A3: the area holds significant numbers of species whose distributions are largely confined to one biome. These species have shared distributions greater than 50 000 km².

⇒ Category A4: the area may qualify on any one or more of the four criteria listed below:

- The area is known to hold on a regular basis more or less 1 % of a biogeographic population of a congregatory waterbird species.

- The area is known to hold on a regular basis more or less 1 % of the global population of a congregatory seabird or terrestrial species.
- The area is known or thought to hold on a regular basis more or less 20 000 waterbirds or more or less 10 000 pairs of seabirds of one or more species.
- The area is known or thought to exceed thresholds set for migratory species at bottleneck sites.

The study site is not located in close proximity to any Important Bird Area (Barnes, 2001) (refer **Figure 27**). Also, the prevalent habitat types on the study site have a low probability to sustain bird species that are restricted or endemic to the Lesotho Highlands (e.g. Mountain Pipit *Anthus hoeschi*, Drakensberg Rockjumper *Chaetops aurantius* and Drakensberg Siskin *Crithagra symonsi*). In addition, bird species restricted to the Namib-Karroo Biome (e.g. Layard's Warbler *Sylvia layardi* and Sickle-winged Chat *Emarginata sinuata*) are predicted to be absent or have low probabilities of occurrence on the study site. These two species have localised distribution ranges within Lesotho.

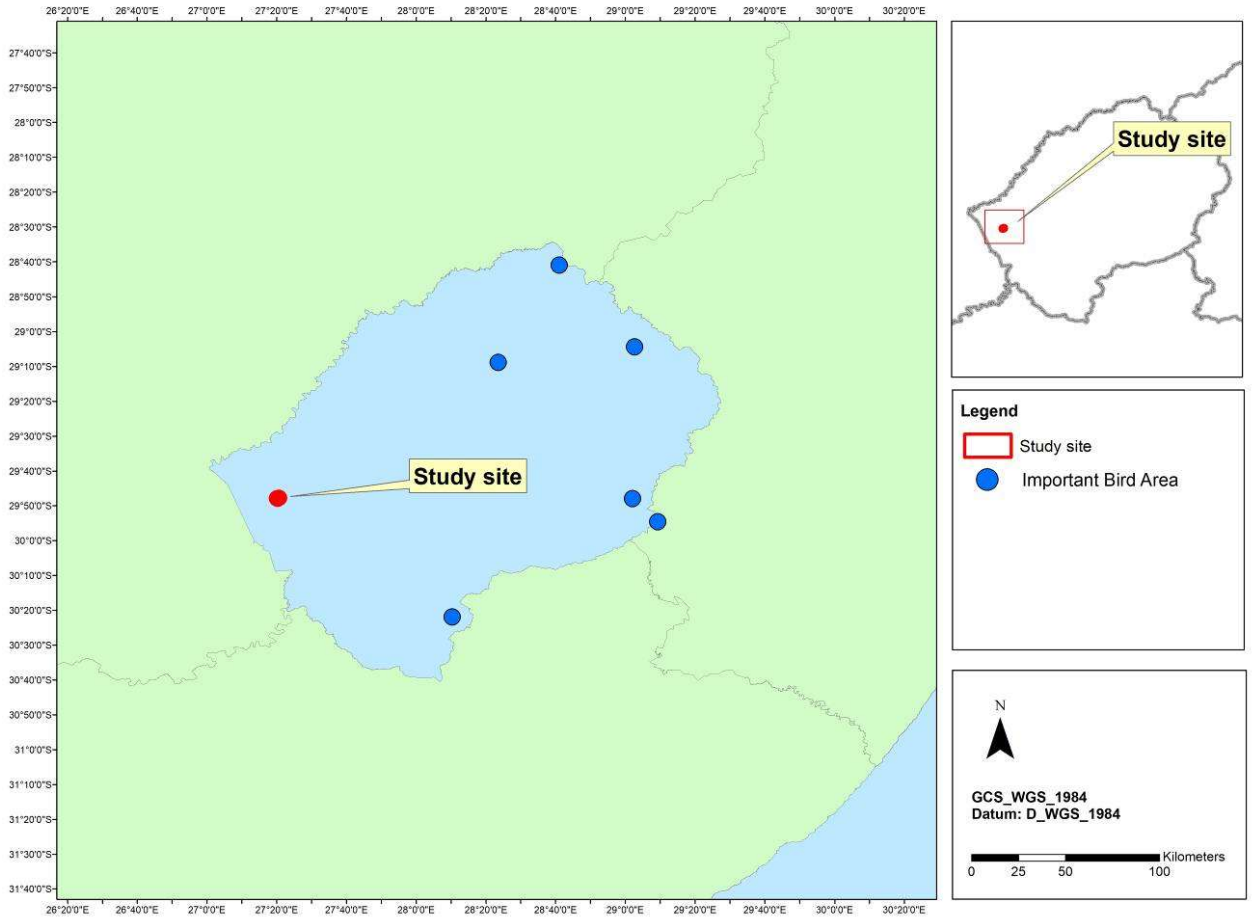

Figure 27: A map illustrating the Important Bird Areas in Lesotho with spatial reference to the study site

45.4 BIRD SPECIES OF CONSERVATION CONCERN

Table 18 provides an overview of bird species of conservation concern that could occur on the study site based on their historical distribution ranges (including observation from nearby or adjacent QDG cells) and the presence of suitable habitat. According to Table 17, a total of 15 species have been recorded in the *wider study region* which includes seven globally threatened species, four globally near threatened species, three regionally threatened species and one regionally near-threatened species.

It is evident from Table 17 that the highest reporting rates (SABAP2 = 50.00%) were observed for the globally vulnerable Southern Bald Ibis (*Geronticus calvus*), the globally near threatened African Rock Pipit (*Anthus crenatus*), the globally near threatened Blue Korhaan (*Eupodotis caerulescens*), the globally near threatened Ground Woodpecker (*Geocolaptes olivaceus*) and the regionally vulnerable Lanner Falcon (*Falco biarmicus*). These species have a high likelihood of occurrence and were indeed confirmed from the study area and immediate surroundings during the October 2018 survey.

The remaining species (as per Table 17) are regarded as irregular foraging visitors with low probabilities of occurrence. However, extensive areas of potential foraging habitat persist for some of these species (e.g. Secretarybird *Sagittarius serpentarius* and Abdim's Stork *Ciconia abdimii*) despite being absent or undetected during the survey. It is possible that the low reporting rates reflect the poor coverage of the study area by citizen scientists (e.g. birdwatchers) and the possibility exists that some of these species could occur in higher numbers during other times of the year.

Table 17: Threatened and near threatened bird species that could utilise the proposed study area based on their known and historical distribution range and the presence of suitable habitat (species highlighted in grey were confirmed from the study area)

Species	Global Conservation Status*	Regional Conservation Status**	SABAP1 reporting rate (derived)	SABAP2 reporting rate	Preferred Habitat	Occurrence Status
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near-threatened	3.65 (observed from two QDG cells adjacent to study site)	Not recently observed within the study area post 2007	Prefers open grasslands. Also forages in wetlands, pastures and agricultural land.	A highly irregular to rare foraging visitor to the study site.
Anthus crenatus (African Rock Pipit)	Near-threatened	Near-threatened	15.50	50.00 (recorded for the first time during the site visit)	Prefers boulder-strewn slopes and rocky scree - mainly associated with mountain ranges, koppies and outcrops.	Not present on site, although recorded from nearby ridges and outcrops.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	2.90 (observed from two QDG cells adjacent to study site)	Not recently observed within the study area post 2007	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	Vagrant to the study site.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	3.00 (only observed from 2927CA)	Not recently observed within the study area post 2007	Arid open lowland karroid shrubland and grassy plains.	Vagrant, considered to be absent from study site.
Calidris ferruginea (Curlew Sandpiper)	Near threatened	-	1.72 (only observed from adjacent QDG cells)	Not recently observed within the study area post 2007	Open large water bodies with exposed muddy shoreline habitat.	Unlikely to occur on study site although the nearby dam provides ephemeral foraging habitat.
Ciconia abdimii (Abdim's Stork)	-	Near-threatened	3.45	Not recently observed within the study area post 2007	Open stunted grassland, fallow land and agricultural fields.	An uncommon to fairly common summer foraging visitor to areas consisting of secondary grassland, agricultural land and pastures.
Ciconia nigra (Black Stork)	-	Vulnerable	1.72	Not recently observed within the study area post 2007	Breed in mountain terrain and prefers to forage on large ephemeral pans or wetland systems.	A rare to irregular foraging visitor to the study site.

Table 17: Threatened and near threatened bird species that could utilise the proposed study area based on their known and historical distribution range and the presence of suitable habitat (species highlighted in grey were confirmed from the study area)

Species	Global Conservation Status*	Regional Conservation Status**	SABAP1 reporting rate (derived)	SABAP2 reporting rate	Preferred Habitat	Occurrence Status
Circus maurus (Black Harrier)	Endangered	Endangered	4.00	Not recently observed within the study area post 2007	Breeds in karroid vegetation at high altitudes or in fynbos. Migrates to lower elevations in winter where it visits grassland habitat.	An irregular winter visitor to the study site.
Eupodotis caerulescens (Blue Korhaan)	Near-threatened	(delisted)	6.94	50.00 (recorded for the first time in the area)	Prefers extensive open short grassland and cultivated land.	Confirmed, regarded as a regular foraging visitor to the site.
Falco biarmicus (Lanner Falcon)	-	Vulnerable	12.50	50.00 (*sensu* seven *ad hoc* observations)	Varied, but prefers to breed in mountainous areas.	An occasional foraging visitor to the study site.
Geocolaptes olivaceus (Ground Woodpecker)	Near-threatened	-	-	50.00 (recorded for the first time during the site visit)	Boulder-strewn slopes, hills and mountain areas.	A resident to the nearby ridges.
Geronticus calvus (Southern Bald Ibis)	Vulnerable	Vulnerable	11.54	50.00	A species restricted to montane grassland (especially when burned) and breed/nest on steep cliffs.	Considered to be a regular foraging visitor to the study site.
Gyps coprotheres (Cape Vulture)	Endangered	Endangered	2.90 (from adjacent QDG cells)	It was not recently recorded from the area since 2007.	Mainly confined to mountain ranges, especially near breeding colonies. Ventures far afield in search of food.	An occasional overhead foraging visitor.
Oxyura maccoa (Maccoa Duck)	Vulnerable	Near-threatened	-	It was not recently recorded from the area since 2007, although it was recorded from pentad grids in the wider region.	Large saline pans and shallow impoundments.	Probably absent from the study site due to the absence of suitable habitat. Regarded as a rare visitor to the nearby dam.
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	6.56	It was not recently recorded from the area since 2007.	Prefers open grassland or lightly wooded habitat.	Regarded as uncommon or irregular foraging visitor - it is perhaps more regular owing to poor atlas coverage of the area.

45.5 ANNOTATIONS ON CONSERVATION IMPORTANT SPECIES

45.5.1 SOUTHERN BALD IBIS (GERONTICUS CALVUS) - GLOBALLY AND REGIONALLY VULNERABLE

The Southern Bald Ibis is endemic to the north-eastern parts of South Africa, Lesotho and western Swaziland, with the core of its distribution located in the north-eastern Free State, the Mpumalanga escarpment and the KwaZulu-Natal Drakensberg (BirdLife International, 2016). It is currently listed as Vulnerable due to its small global population size, which is believed to be declining as a result of habitat transformation and degradation. The regional population is estimated at 3 300 – 4 000 mature individuals (Henderson, 2015), with several breeding colonies located within Lesotho suggesting a population size in the low thousands (BirdLife International, 2016).

It is threatened by human interference at breeding localities, and also habitat loss due to afforestation, opencast mining activities and agricultural intensification (BirdLife International, 2016). However, a recent eminent threat to this species is climate change, with a predicted reduction of its extent of occurrence of 20 % by 2050 (Colyn et al. in prep). It prefers to breed on vertical cliffs, while high-altitude grassland, especially when recently burned, is its preferred foraging habitat. It also utilises cultivated land, pastures and tilled land during foraging bouts (pers. obs.). It will also attempt to breed on the vertical sides of old opencast void systems (pers. obs.).

G. calvus is regarded as a regular foraging visitor to study area, and is readily attracted to recently burned and shortly grazed grassland in the area. It is predicted that the Southern Bald Ibis (*G. calvus*) is a regular foraging visitor to the study site, with approximately nine individuals observed feeding approximately 4 km east of the study site *en route* to Manganeng village (Figure 30 and Figure 33). It could potentially become displaced from the site by the infrastructure, and it could collide with the panels and electrical infrastructure (e.g. pylons) when attempting to perch. It is assumed that these birds roost (and potentially breed) in the sandstone cliffs pertaining to the large mountain massifs to the east of the study area (c. 6 km east of the study site).

Figure 28: An example of a Southern Bald Ibis (*Geronticus calvus*) photographed among a feeding flock of nine individuals approximately 4 km east of the study site.

45.5.2 BLUE KORHAAN (EUPODOTIS CAERULESCENS) – GLOBALLY NEAR THREATENED

This species was recently delisted to least concern during a recent regional conservation assessment by Taylor et al. (2015) in the absence of data indicating a significant reduction in the population size and that most of the population is stable (Hofmeyer, 2012). However, it remains globally near threatened owing to its small global distribution range (Birdlife International, 2017a) and owing to projected recent declines observed from SABAP2 in the north-west of its distribution range (Lee et al., 2017). This species is endemic to South Africa, with its distribution extending into the lowlands of western Lesotho (Taylor et al, 2015).

This species frequents short grassland, usually in the vicinity of surface water and termitaria, and is more abundant in the Grassy Karroo (Harrison et al., 1997) than the grassland along the Great Escarpment. It appears to have benefited from livestock grazing (Taylor et al, 2015), and a foraging male was observed from the centre of the study site as well as a pair from similar habitat approximately 700 m north of the study area (Figure 31 and Figure 33). It is predicted to become displaced from the site by the infrastructure, and at risk of collide with the electrical infrastructure.

Figure 29: An example of a foraging Blue Korhaan (*Eupodotis caerulescens*) photographed at the centre of the study site

45.5.3 LANNER FALCON (FALCO BIARMICUS) - REGIONALLY VULNERABLE

The Lanner Falcon (*Falco biarmicus*) breeds mainly in mountainous areas and prefers deep ravines and sheer cliffs for nesting purposes. Although fairly common within its distribution range with approximately <10 000 mature individuals in South Africa and with >5 % of the global population occurring in the region (Taylor, 2015). It is at risk due to persisting loss of open habitat to make way for agricultural land, with a 40 % decline reported between 1997 and 2013. It is also susceptible to collision with powerlines.

It is regarded as an occasional foraging visitor to the area, which is assumed to represent post-breeding seasonal migratory individuals from the eastern grassland parts of Lesotho and South African. It was not observed during the October survey, although *ad hoc* observations during SABAP2 reveal that it was recorded in 2014 from a neighbouring pentad grid (*c* reporting rate of 33.33 %). It could utilise the numerous ridges and cliffs in the immediate surrounding area as vantage and hunting posts.

45.5.4 GROUND WOODPECKER (GEOCOLAPTES OLIVACEUS) - GLOBALLY NEAR THREATENED

Data obtained from the South African Bird Atlas Project (SABAP20 suggest a moderate population decline in the Ground Woodpecker (*Geocolaptes olivaceus*), although the rate of decline is unknown (BirdLife International, 2017b). The Ground Woodpecker was recently upgraded to the near threatened category (BirdLife International, 2017b). It is endemic to South Africa, but also occurs in mountainous areas of Lesotho and Swaziland. Lee et al. (2017) suggest that reporting rate of this species has declined by 51.7 % and its range has declined 43.3 % between data from SABAP1 and SABAP2. However, the projected decline by Lee et al. (2017) might be incomplete due to incomplete sampling during SABAP2 (as was evidenced by results obtained from this project). The species is sedentary, where it occurs on rocky slopes and mountainous areas. It is currently under thread from afforestation and the eminent threat from climate change (van Wilgen et al, 2016).

A pair was confirmed from rocky cliffs and ledges located approximately 300 m south-west of the study area (**Figure 28** and **Figure 31**). The observation of this pair is the first confirmed record of this species in the study area. The species is unlikely to be adversely affected by the project if the infrastructure footprint avoids encroaching into the *Halleria lucida – Mossia interviralis* rocky ledges and cliffs.

Figure 30: An example of Ground Woodpecker (*Geocolaptes olivaceus*) photographed from a rocky ridge adjacent to the study site

45.5.5 AFRICAN ROCK PIPIT (ANTHUS CRENATUS) - GLOBALLY AND REGIONALLY NEAR THREATENED

7he African Rock Pipit is considered to have a small population density, and according to reporting rates between SABAP1 and SABAP2 it may have experienced a moderate decline which placed this species in the Near threatened category (BirdLife International, 2017c; Peacock, 2015). It is endemic to South Africa and Lesotho with a global population size estimated by Taylor et al. (2015) as 3,300-8,900 mature individuals where it is restricted to rock and boulder-strewn slopes and scree. It is currently threatened by afforestation which could isolate populations from each other and genetic mixing. However, it is not affected by grazing or agricultural activities due to its specific habitat requirements, although climate change and habitat shifts could pose a future threat to this species (van Wilgen et al, 2016).

Preliminary analyses predict that this species may lose 85 % of its range by 2017-2100 due to climate change, making it an ideal indicator of climate change (Coetzee et al., 2009). Although not directly observed, a positive identification was mad from the diagnostic call[14] from the rocky ledges south of the study site near the proposed power line (**Figure 31**). The species is unlikely to be adversely affected by the project, provided the infrastructure footprint avoids encroaching into the *Halleria lucida – Mossia interviralis* rocky ledges and cliffs.

[14] The call of the African Rock Pipit (*Anthus crenatus*) is highly diagnostic and carries far. It is unlikely that the call of this species could to be mistaken for any other bird species.

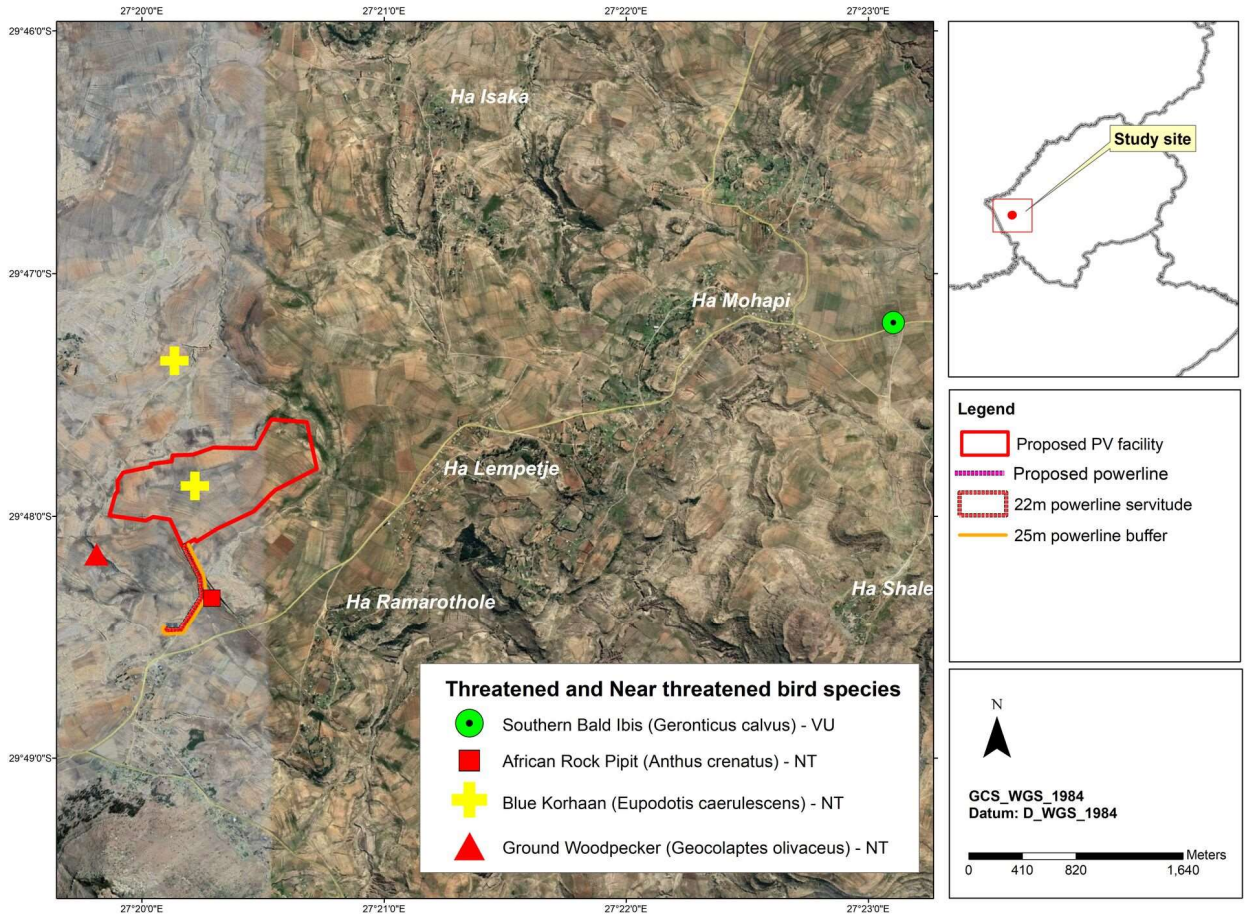

Figure 31: A map illustrating the observed localities of threatened and near threatened bird species on the study site and immediate surroundings

45.6 NOVELTIES AND "OUT OF RANGE" SPECIES

Five of the observed bird species represent new records for the study area or at least part of the study area. They are either fully or marginally out of range according to their respective known distribution ranges. Most of these species have simply not been observed in the region owing to the paucity of dedicated citizen scientists (e.g. the birding fraternity) visiting the area. However, these observations include overlooked species that were not previously recorded in the area during SABAP1 ("full out of range" species), which include the following (refer Figure 32):

⇒ Wing-snapping Cisticola (*Cisticola ayresii*) - Two independent observations from displaying males over *Moraea pallida– Wahlenbergia cf. dieterlenii* agricultural fields. The species could be confused with the similar-looking Cloud Cisticola (*C. textrix*) which also occurs on the study site, but the structure of the calls is different from each other, thereby facilitating an accurate identification of the species.

⇒ Red-breasted Swallow (*Crecopsis semirufa*) - A single observation of an adult bird flying along a powerline servitude at the north-western part of the study site.

⇒ Crested Barbet (*Trachyphonus vaillantii*) - A pair was calling from Manganeng village located to the east of the study site.

⇒ Common Myna (*Acridotheres tristis*) - Observed from villages in close proximity to the villages and human activities. Often in association with grazing cattle near villages.

The following species represent marginal out of range species that were not recorded since the inception of SABAP2 (refer Figure 32):

⇒ Ground Woodpecker (*Geocolaptes olivaceus*) - A pair was observed and photographed from a nearby ridge sytem.

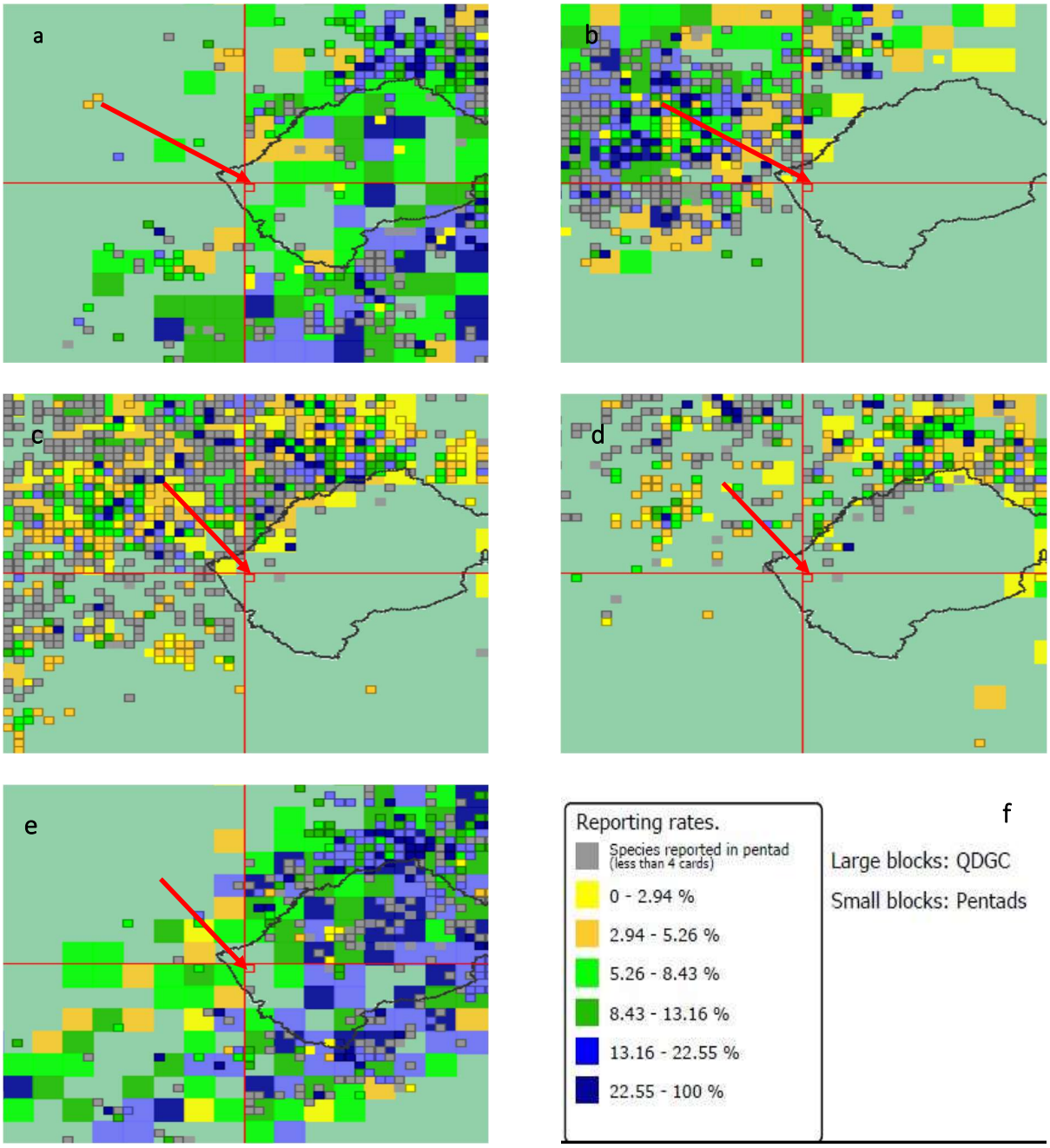

Figure 32: Example of distribution maps representing "full out of range" and "marginal out of range" bird species observed during the October 2018 survey

Large squares represent quarter degree grids (SABAP1) and small squares are pentad grids (SABAP2): (a) Wing-snapping Cisticola (Cisticola ayresii), (b) Red-breasted Swallow (Crecopsis semirufa), (c) Crested Barbet (Trachyphonus levaillantii), (d) Common Myna (Acridotheres tristis) and (e) Ground Woodpecker (Geocolaptes olivaceus). (f) represents the legend to the maps and the arrow indicates the location of the study site.

45.7 BIRD ASSEMBLAGE STRUCTURE AND COMPOSITION

45.7.1 SUMMARY OF POINT COUNTS

A total of 26 bird species and 157 individuals were recorded from 12 bird points. The data provides an estimate of the bird richness and their numbers on the study area obtained during an austral dry season. A mean of 5.8 species and 13.1 individuals were recorded per point count. The highest number of species recorded from a point count was 11 species from *Halleria lucida – Mossia interviralis* rocky ledges and cliffs and the lowest was one species from old agricultural lands. The highest number of individuals recorded per point count was 36 individuals, and the lowest was four individuals. The mean frequency of occurrence of a bird species was 22.76 % and the median was 16.76 %, while the most common value (mode) was 8.33 %. The latter represents those species that were encountered in only a single point count. One species (c. Red-capped Lark *Calandrella cinerea*) occurred in all the point counts, while three species occurred in more than 40 % of all the point counts (refer Table 18).

Table 18: Bird species (from 12 sample plots) with a frequency of occurrence greater than 20%, observed on the study area

Species	*Frequency (%)*	*Species*	*Frequency (%)*
Red-capped Lark (*Calandrella cinerea*)	100.00%	Mountain Wheatear (*Myrmecocichla monticola*)	41.67%
African Pipit (*Anthus cinnamomeus*)	83.33%	Spike-heeled Lark (*Chersomanes albofasciata*)	33.3%
Cape Sparrow (*Passer melanurus*)	41.67%	Cape Longclaw (*Macronyx capensis*)	25.00
Large-billed Lark (*Galerida magnirostris*)	41.67%	Cloud Cisticola (*Cisticola textrix*)	25.00

45.7.2 DOMINANCE AND TYPICAL BIRD SPECIES

The dominant (typical) species on the study area are presented in Table 19. Only those species that cumulatively contributed to more than 90 % to the overall similarity between the point counts are presented.

The three typical bird species on the study area include the Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*) and Spike-heeled Lark (*Chersomanes albofasciata*). The typical species forms part of nearly every bird assemblage and habitat unit on the study area, and are considered widespread species. Approximately 50 % of the typical species are insectivorous (mainly ground gleaners), while the other 50 % are small bodied granivores (consuming graminoid seeds).

Table 19: Typical bird species on the study area

Species	*Average abundance*	*Consistency*	*% Contribution*	*Primary Trophic Guild*
Red-capped Lark (*Calandrella cinerea*)	2.83	2.04	49.81	Granivore: ground gleaner
African Pipit (*Anthus cinnamomeus*)	1.75	1.30	25.78	Insectivore: ground gleaner
Spike-heeled Lark (*Chersomanes albofasciata*)	0.75	0.30	6.32	Granivore: ground gleaner
Cape Sparrow (*Passer melanurus*)	2.42	0.41	5.04	Granivore: ground gleaner
Mountain Wheatear (*Myrmecocichla monticola*)	0.83	0.41	4.67	Insectivore: ground gleaner

45.7.3 BIRD COMPOSITION AND DIVERSITY

Multidimensional scaling and hierarchical agglomerative clustering ordination of relative bird abundance values obtained from twelve (12) point counts could only find a significant difference (R=0.6, p<0.05) between the compositions on the agricultural fields and the rocky cliffs and ledges (refer Figure 33). It appears that the compositions on the drainage lines and erosion gulleys form a continuum with those assemblages pertaining to the agricultural fields and the rocky cliffs and ledges.

An attempt was made to provide a description of the composition on each habitat based on a subjective delineation which also includes those species that were observed on the drainage lines and erosion gulleys:

a b

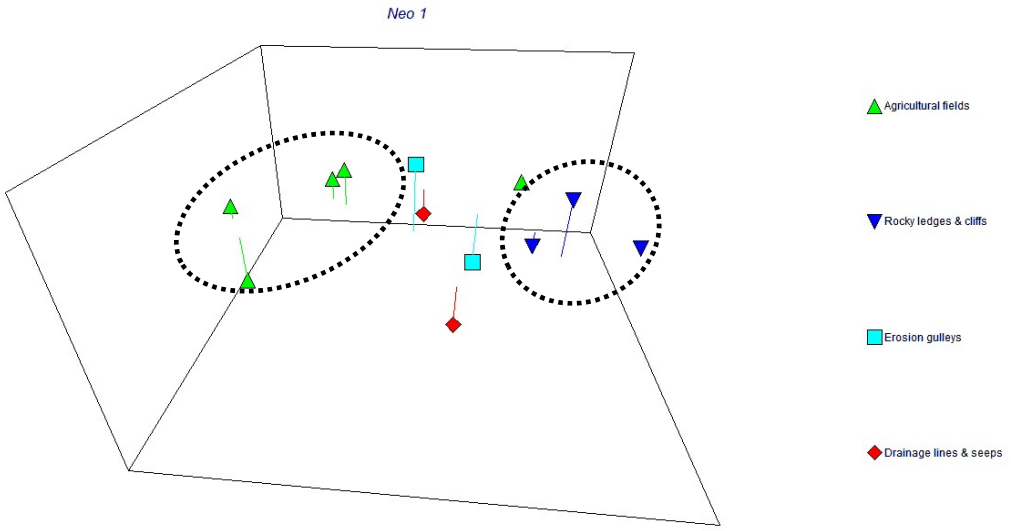

Figure 33: A three-dimensional non-metric multidimensional scaling ordination of the relative abundances of bird species based on Bray-Curtis similarities obtained from twelve (12) point counts
It differentiates between two discrete (major) bird associations on (a) agricultural fields and (b) rocky ledges and cliffs.

45.7.4 MORAEA PALLIDA – WAHLENBERGIA CF. DIETERLENII AGRICULTURAL FIELDS

Dominant species: The bird composition consists primarily of widespread grassland insectivorous and granivore taxa, including nomadic species such as Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*) and Spike-heeled Lark (*Chersomanes albofasciata*).

Indicator species with a high abundance values in this habitat (species largely restricted to this habitat on the study area) include Blue Korhaan (*Eupodotis caerulescens*), Pied Starling (*Lamprotornis bicolor*), Spike-heeled Lark (*Chersomanes albofasciata*) and Red-headed Finch (*Amadina erythrocephala*).

45.7.5 PENTAMERIS AROIDES – TRIFOLIUM BURCHELLIANUM DRAINAGE LINES AND SEEPS

Dominant species: The bird composition consists primarily of widespread grassland taxa such as Red-capped Lark (*Calandrella cinerea*) and African Pipit (*Anthus cinnamomeus*). It forms a continuum with the agricultural fields.

Indicator species with a high abundance values in this habitat (species largely restricted to this habitat on the study area) include Black-headed Heron (*Ardea melanocephala*), Western Cattle Egret (*Bubulcus ibis*) and Cape Wagtail (*Motacilla capensis*).

45.7.6 *Cynodon dactylon – Gazania krebsiana Erosion Gulleys*

Dominant species: The bird composition consists primarily of widespread grassland taxa such as Red-capped Lark (*Calandrella cinerea*) and African Pipit (*Anthus cinnamomeus*). It forms a continuum with the agricultural fields and the drainage lines.

Indicator species – None noted that exhibited a high abundance values in this habitat (species largely restricted to this habitat on the study area), although Cape Canary (*Serinus canicollis*) and Bokmakierie (*Telophorus zeylonus*) show higher abundance values at this habitat but also occurs on the rocky ledges and cliffs.

45.7.7 *Halleria lucida – Mossia interviralis Rocky Ledges and Cliffs*

Dominant species: The bird composition consists of rupicolous (rock-loving) insectivorous and granivore taxa, although it also include widespread grassland taxa that are abundant on the agricultural fields. Typical species include Mountain Wheatear (*Myrmecocichla monticola*), Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*), Large-billed Lark (*Galerida magnirostris*) and Cape Bunting (*Emberiza capensis*).

Indicator species with a high abundance values in this habitat (species largely restricted to this habitat on the study area) include Mountain Wheatear (*Myrmecocichla monticola*), Cape Bunting (*Emberiza capensis*), Eastern Long-billed Lark (*Certhilauda semitorquata*) and Ground Woodpecker (*Geocolaptes olivaceus*).

It is also evident from **Table 20** and **Figure 34** that the highest diversity of bird species and evenness (as described by rarefaction curves with high expected numbers of species) occurs on the rocky cliffs and ledges. The lowest number of bird species was recorded from the drainage lines and seeps. The low number of species from the drainage lines is probably a function of inundation since it is predicted that this habitat will host more species during the rainy season.

Table 20: Summary of the observed species richness and number of bird individuals confined to the habitat units

Habitat unit	*Number of species (S)*	*Number of individuals (N)*	*Shannon-Wiener Index H'(log_e)*
Agricultural fields	10.00	11.20	1.91
Rocky ledges & cliffs	17.00	17.67	2.56
Erosion gulley's	12.00	15.00	2.02
Drainage lines & seeps	8.00	9.00	1.83

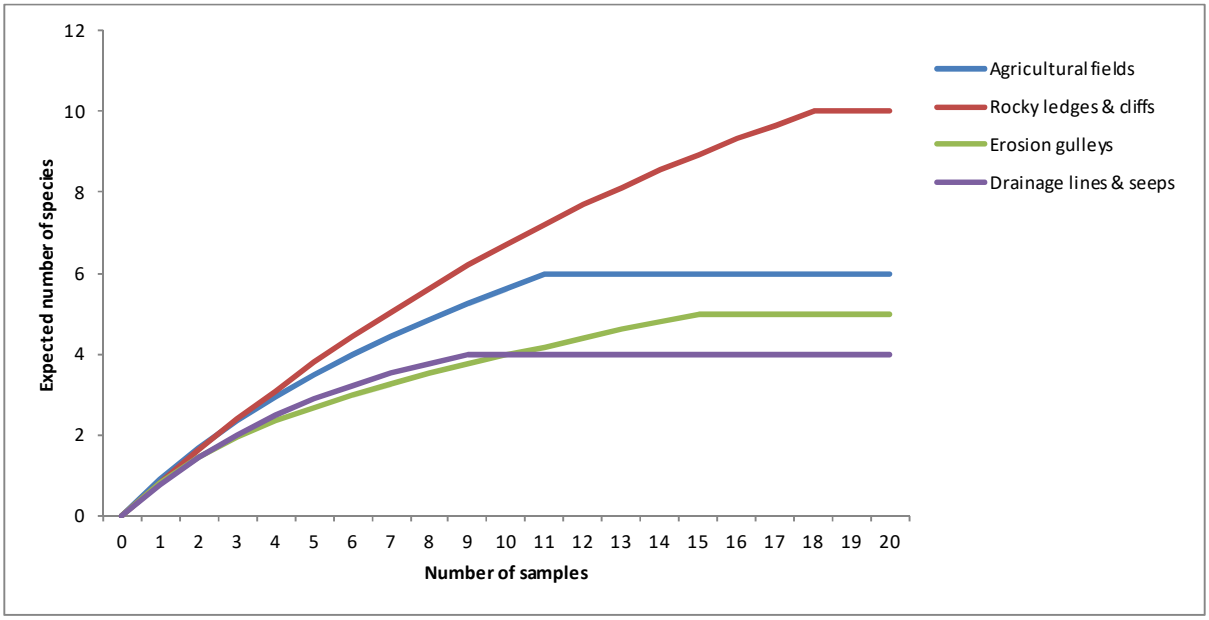

Figure 34: Rarefaction curves for the bird associations on the respective habitat units on the study site.

45.8 PASSERINE AND NON-PASSERINE DENSITIES

According to count data obtained from twelve (12) point counts, the total number of species recorded on the study area is 26 species, which is approximately 1.45 species.ha^{-1} (Table 21). The average density per hectare is considerably low with 1.77 birds.ha^{-1} and ranges between 1.40 birds.ha^{-1} on the agricultural fields to 2.39 birds .ha^{-1} on the erosion gulley's.

Table 21: Average abundance values and density estimates for 26 bird species recorded from 12 point counts and four different habitat types on the study area

Species	*Agricultural fields*	*Rocky ledges & cliffs*	*Erosion gulley's*	*Drainage lines & seeps*
Red-capped Lark	2.40	2.33	5.50	2.00
African Pipit	0.80	1.67	3.00	3.00
Cape Sparrow	3.60	2.67	1.00	0.50
Large-billed Lark	0.20	1.33	0.50	0.00
Mountain Wheatear	0.00	2.33	0.50	1.00
Spike-heeled Lark	1.40	0.00	1.00	0.00
Cape Longclaw	0.00	1.33	0.00	0.00
Cloud Cisticola	0.20	0.33	1.00	0.00
Cape Crow	0.20	0.00	0.50	0.00
Speckled Pigeon	0.40	0.33	0.00	0.00
Cape Canary	0.00	1.00	0.50	0.00
Bokmakierie	0.00	0.67	0.50	0.00
Ant-eating Chat	0.00	0.33	0.00	1.00
Cape Bunting	0.00	1.33	0.00	0.00
Red-headed Finch	1.00	0.00	0.00	0.00
Pied Starling	1.00	0.00	0.00	0.00
Wing-snapping Cisticola	0.00	0.33	0.00	0.00
Rock Kestrel	0.00	0.00	0.50	0.00
Black-headed Heron	0.00	0.00	0.50	0.00
Western Cattle Egret	0.00	0.00	0.00	0.50
Cape Wagtail	0.00	0.00	0.00	0.50
Pied Crow	0.00	0.00	0.00	0.50
Ground Woodpecker	0.00	0.67	0.00	0.00
Rufous-naped Lark	0.00	0.33	0.00	0.00
Eastern Long-billed Lark	0.00	0.33	0.00	0.00
Southern Fiscal	0.00	0.33	0.00	0.00
Sum	11.20	17.67	15.00	9.00
Density/ha	1.40	1.88	2.39	1.43

45.9 AVIFAUNAL SENSITIVITY

An assessment of the avifaunal sensitivity is presented in Figure 35.

45.9.1 AREAS WITH HIGH AVIFAUNA SENSITIVITY

Areas with High sensitivities include the rocky ledges and cliffs, as well as the drainage lines and seeps:

⇒ The rocky ledges and cliffs provide potential habitat for bird species with facultative rupicolous habits, and provide also potential foraging habitat for the globally near threatened African Rock Pipit (*Anthus crenatus*) and Ground Woodpecker (*Geocolaptes olivaceus*). This habitat contributes towards the regional avifaunal diversity in the area, and it represents one of a few habitat types that are natural and untransformed.

⇒ The rocky ledges and cliffs are often used as vantage points for foraging and/ or roosting birds of prey (it is potentially utilised by the regionally vulnerable Lanner Falcon *Falco biarmicus* and the regional endemic Jackal Buzzard *Buteo rufofuscus*).

⇒ The drainage lines and seeps support bird species which are often prone towards powerline collisions (waterbirds, wading birds etc.), while they also facilitate avian dispersal across the landscape. Despite the comparatively poor

ecological status, the presence of collision sensitive species within these habitat types ultimately renders them sensitive.

45.9.2 AREAS WITH MEDIUM AVIFAUNA SENSITIVITY

Areas with Medium sensitivities include the **moist secondary grasslands** bordering the drainage lines and seeps and the **erosion gulleys**:

⇒ These habitat units are considered to be of secondary and semi-transformed ecological condition, although it provides habitat for many bird species that are associated with wet or moist grassland habitat.

⇒ It occurs invariably along erosion gulleys, thereby is linear in spatial configuration and contributes towards ecological connectivity and avian dispersal.

45.9.3 AREAS WITH LOW AVIFAUNA SENSITIVITY

Areas with Low sensitivities include the transformed grassland and **agricultural fields**:

⇒ These habitat units are widespread in the region and sustain avifaunal species with widespread distribution ranges. The majority of the species on these habitat types are widespread or nomadic species.

45.9.4 AREAS WITH VERY LOW AVIFAUNA SENSITIVITY

Areas with Very Low sensitivities include mainly transformed areas consisting of **infrastructure and villages**: These habitat types are of small surface area and often not viable to sustain large terrestrial bird species. They are often dominated by unspecialised and generalist passerine species.

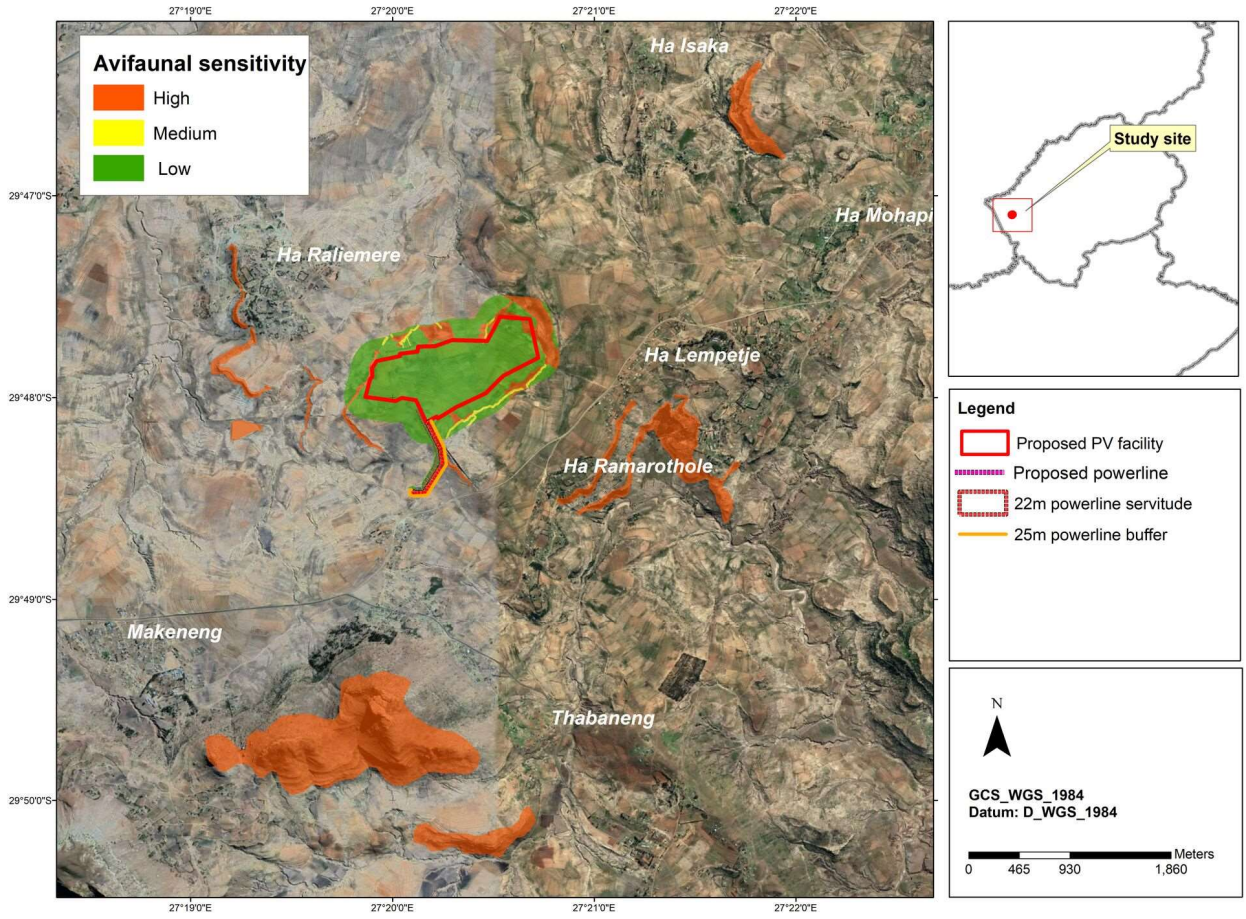

Figure 35: Avifaunal sensitivity according to the dominant habitat types on the study site and immediate surrounds

46 AVIAN IMPACTS AT SOLAR FACILITIES

46.1 BACKGROUND TO SOLAR FACILITIES AND THEIR IMPACT ON BIRDS

Birds are mobile, and are therefore also more readily affected by solar facilities than other taxonomic groups (e.g. mammals). Birds are also vulnerable to impacts caused by other types of energy facilities such as overhead power lines and wind farms. Little information is available on the avian impacts of solar energy although Gunerhan et al. (2009), McCrary et al. (1986), Tsoutsos et al. (2005) and recent investigation reports on bird fatalities in the USA by Kagen et al. (2014) and Walston et al. (2016) provide discussions thereof. These studies have shown that avian fatalities vary greatly between the geographic localities of the solar facilities and also on the type of solar facility. In addition, very few of the large solar facilities that are currently in operation are systematically monitored for avian fatalities on site, which also explains the lack of detailed information on avian impacts. According to these studies as summarised over a survey period of one to three years, avian incidental fatalities could range from 14 to over 180 birds.

As a typical example, McCrary et al. (1986) found 70 dead birds consisting of 26 species over a study period of two years. According to the Walston et al. (2016) assessment, the average annual mortality rate for known utility-scale solar facilities (the annual number of estimated bird deaths per megawatt of electrical capacity) is 2.7, and 9.9 for known and unknown fatalities (which include carcasses found on the project site of which the deaths are not known). McCrary et al. (1986) found an average rate of mortality of 1.9-2.2 birds per week, thereby affecting 0.6-0.7 % of the local bird population. However, most of the avian fatalities at these solar facilities are also probably underestimated since 10-30 % of dead birds are removed by scavengers before being noted. From these analyses (based on data obtained from facilities in the USA) it was evident that:

⇒ Approximately 81 % of all avian mortalities were caused by collisions.
⇒ Most of the mortalities were small passerines (especially swallows).
⇒ Fatalities at these solar facilities also include waterbirds (e.g. grebes, herons and gulls) which were probably attracted by the apparent "lake effect" caused by the reflective surface of the PV panels.
⇒ Approximately 10-11 % of the fatalities consists of waterbirds, but could be as high as 49 % at certain facilities.
⇒ It is unclear if the "lake effect" caused by the panels (at PV facilities) are the main cause of birds colliding or interacting with the infrastructure (since both waterbirds and other passerines are colliding with the infrastructure).
⇒ Most of the fatalities are of resident birds as opposed to migratory species.

In a different review report by Harrison et al. (2016), an attempt was made to provide evidence of the impacts caused by solar PV facilities on birds in the UK. These authors reviewed approximately 420 scientific documents, including 37 so-called "grey" literature from non-government and government organisations for any evidence relating to the ecological impacts of solar facilities. Their main findings were as follow:

⇒ The majority of the documents were not relevant and peer-reviewed documents of experimental scientific evidence on avian fatalities were non-existent.
⇒ Results based on carcass searches suggest that the bird collision risk at PV developments are low, although these studies did not take collision by overhead power lines into account.
⇒ Many of the documents recommended that PV development in close proximity to protected areas should be avoided.
⇒ The PV panels reflect polarised light, which can attract polarotactic insects with potential impact to their reproductive biology. In addition, the polarising effect of the PV panels may also induce drinking behaviour in some birds, which may mistake the panels for water.

⇒ They conclude that impact assessment reports should consider taxon-specific requirements of birds and their guilds.

46.2 IMPACTS OF PV SOLAR FACILITIES ON BIRDS

The magnitude and significance of impacts to birds caused by solar facilities will depend on the following factors:

⇒ The geographic locality of the planned solar facility;
⇒ The size or surface extent of the solar facility;
⇒ The type of solar facility (according to the technologies applied, e.g. PV or Solar Concentrator Plant); and
⇒ The occurrence of collision-prone bird species (which are often closely related to the locality of the solar facility).

Any planned solar facility corresponding to an area with threatened, range-restricted or collision-prone species will have a higher impact on these birds. In addition, any planned solar facility located in close proximity to important flyways, wetland systems or roosting/nesting sites used by the aforementioned species will have a higher impact.

The main impacts associated with PV solar facilities include (Jenkins et al., 2017):

⇒ The loss of habitat and subsequent displacement of bird species due to the ecological footprint required during construction;
⇒ Disturbances caused to birds during construction and operation;
⇒ Direct interaction (collision trauma) by birds with the surface infrastructure (photovoltaic panels) caused by polarised light pollution and/or waterbirds colliding with the panels (as they are mistaken for waterbodies);
⇒ Collision with associated infrastructure (mainly overhead powerlines and reticulation); and
⇒ Attracting novel species to the area (owing to the artificial provision of new habitat such as perches and shade) which could compete with the residing bird population.

46.3 AVIAN IMPACTS AT THE NEO 1 PV SOLAR ENERGY FACILITY

46.3.1 LOSS OF HABITAT AND DISPLACEMENT OF BIRDS

Selected portions of the proposed site will be cleared of vegetation (graded with swales to absorb and drain water into a retention pond) and to accommodate the panel arrays and associated infrastructure. Clearing of vegetation will result in the potential loss of transformed grassland, secondary moist grassland and displacement of bird species. From the results it is evident that species with widespread distribution ranges are more likely to become displaced, in particular small to medium sized non-passerines (e.g. Columbidae - doves and pigeons) and passerines (e.g. Alaudidae -larks).

In addition, approximately 1.77 birds.ha^{-1} will become displaced by the activity (as per Jenkins et al., 2017), which is considered to be low. From the results (on site observations and SABAP information), the following bird species are most likely to be impacted by the loss of habitat due to their habitat requirements, fecundity and conservation status (although not limited to):

⇒ Southern Bald Ibis (*Geronticus calvus*);
⇒ White Stork (*Ciconia ciconia*);
⇒ Blue Korhaan (*Eupodotis caerulescens*) and potentially also
⇒ Secretarybird (*Sagittarius serpentarius*); and
⇒ Abdim's Stork (*Ciconia abdimii*).

Considering the existing transformed nature of the dominant habitat types on the study site and their widespread occurrence in the region, including the general occupancy of widespread and unspecialised bird species, it is evident that the predicted impact due to the overall displacement and habitat loss is moderate without mitigation measures.

Threatened and near-threatened birds such as Blue Korhaan (*Eupodotis caerulescens*) and Southern Bald Ibis (*Geronticus calvus*) will also become displaced. However, these species occur at low densities on the study site and when considering the widespread occurrence of similar foraging habitat adjacent to the study site, the impact is regarded as moderate without mitigation.

46.3.2 CREATION OF "NEW" AVIAN HABITAT AND BIRD POLLUTION

It is also possible that the infrastructure (during operation) could attract a number of species which may occupy the site or interact with the local bird assemblages in the wider region. These include mainly alien and cosmopolitan species and aggressive omnivorous passerines which could displace other bird species from the area:

⇒ House Sparrow (*Passer domesticus*);
⇒ Common Myna (*Acridotheres tristis*);
⇒ Cape Crow (*Corvus capensis*)
⇒ Pied Crow (*Corvus albus*); and
⇒ White-necked Raven (*Corvus albicollis*).

The infrastructure could attract large numbers of roosting columbid taxa, especially Speckled Pigeons (*Columba guinea*), which could result in avian "pollution" through excreta, thereby fouling the panel surfaces. The impact could be managed and will result in a low significance.

46.3.3 COLLISION TRAUMA CAUSED BY PHOTOVOLTAIC PANELS (THE "LAKE-EFFECT")

The study site is located in close proximity several drainage lines and an artificial impoundment is also situated to the north of the site. These habitat types are often utilised by waterbirds, which could accidentally mistake the reflective panels for waterbodies, causing bird collisions with the panel surfaces. As most of the wetland features were dry during the October 2018 site visit, accurate predictions regarding the occurrence of waterbird species and their numbers (e.g. density) in the area could not be established. Predicted impacts are therefore (mostly) based on specialist experience as well as a review of relevant data of similar developments and on a best available knowledge scenario. Results of the avian monitoring programme will provide further data to inform the project on ways to effectively manage activities during the construction and/ or operational phases without affecting the feasibility of the project.

Desktop results and site observations indicate that the following species could potentially interact with the panel infrastructure:

⇒ Red-knobbed Coot (*Fulica cristata*);
⇒ Reed Cormorant (*Microcarbo a*fricanus);
⇒ African Black Duck (*Anas sparsa*);
⇒ Yellow-billed Duck (*Anas undulata*);
⇒ White-faced Duck (*Dendrocygna viduata*);
⇒ Red-billed Teal (*Anas erythrorhyncha*);
⇒ Little Egret (*Egretta garzetta*);
⇒ Purple Heron (*Ardea purpurea*);
⇒ Black-headed Heron (*Ardea melanocephala*)and
⇒ Grey Heron (*Ardea cinerea*).

The precautionary principle was therefore applied in absence of sufficient information on the occurrence of waterbird taxa in the area as well as the lack of data on bird mortalities caused by collisions, which results in an impact of high significance in the absence of any mitigation measures.

46.3.4 INTERACTION WITH OVERHEAD POWERLINES AND RETICULATION

An overhead powerline (33 kV) is proposed of approximately 1 km in length. Birds are impacted in three ways means of overhead powerlines. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines. These include the following:

Electrocution

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera *Gyps* and *Torgos*) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity in the area. Other types of electrocutions happen by means of so-called "bird-streamers". This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999).

Large transmission lines (from 220 kV to 765 kV) are seldom a risk of electrocution, although smaller distribution lines (88 – 132 kV) pose a higher risk. However, for this project, the design of the pylon is an important consideration in preventing bird electrocutions.

Collision

Collisions with earth wires have probably accounted for most bird-powerline interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as bustards, korhaans, storks and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. most species of storks) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires.

Areas where bird collisions are likely to be high could be ameliorated by marking the lines with appropriate bird deterrent devices such as "bird diverters" and "flappers" to increase the visibility of the lines.

Physical disturbances and habitat destruction caused during construction and maintenance

It is anticipated that access along the powerline servitude needs to be established through an informal (4x4) track, although no clearing of vegetation will take place. Furthermore, construction activities are likely to be accompanied by high ambient noise levels. Although construction is considered temporary, many species will vacate the area during the construction phase and will become temporarily displaced.

A rocky ledge system occurs in close proximity to the powerline servitude which deserves special consideration since this habitat feature often attracts birds of prey (the latter often include falconiform taxa which hunt small passerines). Construction activities in close proximity to these features could possibly displace these individuals from the area or increase the risk of collision with the powerlines.

46.3.5 POWERLINE COLLISION-PRONE BIRD SPECIES

A total of 33 collision-prone bird species have been recorded from the study site, of which 13 species were observed during the site visit (c. 40 % of the predicted species). In addition, eight species are birds of prey (Table 22). Species with a high risk of colliding with overhead powerlines include the Blue Korhaan (*Eupodotis caerulescens*), White Stork (*Ciconia ciconia*), Jackal Buzzard (*Buteo rufofuscus*) and Southern Bald Ibis (*Geronticus calvus*).

Table 22: Collision-prone bird species and Red listed species (in red) expected to be present on the study site inferred from the South African Atlas Project (SABAP1 & SABAP2) and personal observations

Common Name	*Scientific Name*	*Observed on site (October 2018)*	*SABAP2 Rep. Rate (Full Protocol)*	*SABAP2 Rep. Rate (Ad hoc)*	*SABAP1 Rep Rate.*
Buzzard, Jackal	*Buteo rufofuscus*	1|	50.00	7.14	$0.00
Buzzard, Steppe	*Buteo buteo vulpinus*				22.22
Coot, Red-knobbed	*Fulica cristata*				19.23
Cormorant, Reed	*Microcarbo africanus*				5.56
Cormorant, White-breasted	*Phalacrocorax lucidus*				11.11
Crow, Cape	*Corvus capensis*	1	100.00	42.86	15.38
Crow, Pied	*Corvus albus*	1	100.00	28.57	61.54
Duck, African Black	*Anas sparsa*				11.11
Duck, White-faced	*Dendrocygna viduata*			7.14	$0.00
Duck, Yellow-billed	*Anas undulata*			7.14	11.11
Egret, Western Cattle	*Bubulcus ibis*	1	100.00	21.43	46.15
Egret, Little	*Egretta garzetta*				5.56
Falcon, Amur	*Falco amurensis*			50.00	12.50
Falcon, Lanner	*Falco biarmicus*			7.14	5.56
Fish-eagle, African	*Haliaeetus vocifer*				11.11
Goose, Egyptian	*Alopochen aegyptiacus*	1	100.00	7.14	16.67
Goose, Spur-winged	*Plectropterus gambensis*	1	50.00		$0.00
Grebe, Little	*Tachybaptus ruficollis*				12.50
Hamerkop	*Scopus umbretta*				23.08
Heron, Black-headed	*Ardea melanocephala*	1	50.00	7.14	15.38
Heron, Grey	*Ardea cinerea*	1	50.00		19.23
Heron, Purple	*Ardea purpurea*				5.56
Ibis, African Sacred	*Threskiornis aethiopicus*				12.50
Ibis, Hadeda	*Bostrychia hagedash*	1	50.00	7.14	11.54
Ibis, Southern Bald	*Geronticus calvus*	1	50.00	7.14	11.54
Kestrel, Lesser	*Falco naumanni*			7.14	$0.00
Kestrel, Rock	*Falco rupicolus*	1	50.00		57.69
Kite, Black-winged	*Elanus caeruleus*				11.54
Korhaan, Blue	*Eupodotis caerulescens*	1	50.00		$0.00
Night-Heron, Black-crowned	*Nycticorax nycticorax*				11.11
Pigeon, Speckled	*Columba guinea*	1	100.00	57.14	22.22
Stork, White	*Ciconia ciconia*				19.23
Teal, Red-billed	*Anas erythrorhyncha*				12.50

46.3.6 CUMULATIVE IMPACTS

Cumulative impacts are defined as impacts that result from additional or incremental activities caused by past or present actions together with the current project. Therefore, cumulative impacts are those that will affect the general avifaunal community on the study area due to other solar farms and electrical infrastructure.

The Neo 1 PV facility will form part of several solar facilities to be constructed in the study area; refer Section 9.4, and the cumulative exacerbation of adverse effects on bird communities in the area are anticipated to be minimal, when viewed in collective interpretation of the effects of anticipated developments on a local and regional scale.

46.4 QUANTITATIVE EVALUATION OF EXPECTED AND LIKELY IMPACTS ON THE AVIFAUNA

Nature	1. Loss of habitat and displacement of birds	
	Before Mitigation	After Mitigation
Extent	1 (Footprint/ Site)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	2 (Probable)	2 (Probable)
Significance	7 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)
Nature	2. Loss and displacement of threatened and near threatened bird species	
	Before Mitigation	After Mitigation
Extent	2 (within a radius of 2 kms of site)	1 (Footprint/ Site)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	2 (Moderate)	1 (Low)
Probability	2 (Probable)	2 (Probable)
Significance	9 (NEGATIVE MODERATE)	6 (NEGATIVE LOW)
Nature	3. Creation of "new" avian habitat and bird pollution	
	Before Mitigation	After Mitigation
Extent	1 (Footprint/ Site)	1 (Footprint/ Site)
Duration	2 (Medium term, 5-15 years)	2 (Medium term, 5-15 years)
Intensity	1 (Low)	1 (Low)
Probability	2 (Probable)	1 (Improbable)
Significance	6 (NEGATIVE LOW)	5 (NEGATIVE LOW)
Nature	4. Collision trauma caused by photovoltaic panels (the "lake-effect")	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	3 (High)	2 (Moderate)
Probability	2 (Probable)	2 (Probable)
Significance	10 (NEGATIVE HIGH)	8 (NEGATIVE MODERATE)
Nature	5. Power line interaction: Collision with powerlines	
	Before Mitigation	After Mitigation
Extent	2 (Local <2 km radius)	2 (Local <2 km radius)
Duration	3 (Long term, 15-30 years)	2 (Medium term, 5-15 years)
Intensity	3 (High)	2 (Moderate)
Probability	3 (Highly Probable)	2 (Probable)
Significance	11 (NEGATIVE HIGH)	8 (NEGATIVE MODERATE)

46.4.1 AVIAN IMPACT SIGNIFICANCE – SUMMARY

Table 23: Summary of Impact Significance within the Avian Receiving Environment		
Impact	Before Mitigation	After Mitigation
1. Loss of habitat and displacement of birds	7	6
2. Loss and displacement of threatened and near threatened bird species	9	6
3. Creation of "new" avian habitat and bird pollution	6	5
4. Collision trauma caused by photovoltaic panels (the "lake-effect")	10	8
5. Power line interaction: Collision with powerlines	11	8

47 RECOMMENDED AVIFAUNAL MITIGATION APPROACH FOR THE PROJECT

47.1 LOSS OF HABITAT AND DISPLACEMENT BIRD TAXA (INCLUDING THREATENED AND NEAR THREATENED BIRDS)

It is difficult to mitigate against the loss of habitat when fixed infrastructure is applied to the entire study site. However, proper siting of the facility is key to reducing the predicted impacts.

The following mitigation measures are proposed:

Mitigation Measure 1 - Guide surface infrastructure towards habitat of low avifaunal sensitivity. Technical requirements of the project requires the use of a portion of wetland habitat (c. 0.8 ha) habitat within the northeastern part of the study area. While this minor loss of wetland is not anticipated to have a significant effect on the functionality of the habitat type on a large scale, caution is advised as it implies development within a sensitive environment that exhibit important avian habitat characteristics;

Mitigation Measure 2 - Prevent an overspill of construction activities into areas of high avifaunal sensitivity;

Mitigation Measure 3 - Care should be exercised during the placement of infrastructure at the north-eastern extremity (containing drainage lines) and western extremity (containing rocky ledges) of the site (powerline servitude).

Mitigation Measure 4 - Use indigenous plant species native to the study area (as far as practically possible) during landscaping and rehabilitation.

Mitigation Measure 5 - The proposed powerline should avoid crossing of drainage lines, seeps and erosion gulleys. Alignment of the powerline should be alongside the dirt road leading to the substation.

47.2 CREATION OF "NEW" AVIAN HABITAT AND BIRD POLLUTION

The following mitigation measures are proposed:

Mitigation Measure 6 - Apply bird deterrent devices to the panel structures to discourage birds from colonising the infrastructure or constructing nests. These could include visual or bio-acoustic deterrents such as highly reflective rotating devices, anti-perching devices such as bird guards, scaring or chasing activities involving the use of trained dogs or raptors and/or netting. Nests should be removed when early nest-building attempts are noticed.

Mitigation Measure 7 - Reduce or minimise the use of outdoor lighting to avoid attracting birds to the lights or to reduce potential disorientation to migrating birds.

Mitigation Measure 8 - Avoid the placement of infrastructure near rocky ledges. Placement of infrastructure should take note of recommendations provided by the wetland report, but with reference to the potential impacts on the avian component.

Mitigation Measure 9 - Use indigenous plant species native to the study area during landscaping and rehabilitation.

47.3 COLLISION TRAUMA CAUSED BY PHOTOVOLTAIC PANELS (THE "LAKE-EFFECT")

The following mitigation measures are proposed:

Mitigation Measure 10 - Implement additional bird surveys (pre-construction surveys, if timelines allow, please refer to monitoring recommendations) during the peak wet season (when inundation is prominent) to obtain quantified data on the waterbird richness and waterbird numbers. The data will enable more informed decisions regarding the use of deterrent devices or the siting of the infrastructure.

Mitigation Measure 11 - Apply bird deterrent devices to the panel structures to discourage birds from colonising/colliding with the infrastructure. These could include visual or bio-acoustic deterrents such as highly

reflective rotating devices, anti-perching devices such as bird guards, scaring or chasing activities involving the use of trained dogs or raptors and/or netting.

Mitigation Measure 12 - Apply systematic reflective/dynamic markers to the boundary fence to increase the visibility of the fence for approaching birds and to avoid potential bird collisions with the fence structure.

Mitigation Measure 13 - Reduce or minimise the use of outdoor lighting to avoid attracting birds to the lights or to reduce potential disorientation to migrating birds.

Mitigation Measure 14 - During operation it is recommended that bird mortalities be recorded by installing remote video cameras above some of the panels. The information can be used during post-construction monitoring.

47.4 POWER LINE INTERACTION: COLLISION WITH POWERLINES

The following mitigation measures are proposed:

Mitigation Measure 15 - The proposed powerline alignment should be placed adjacent to the existing dirt road leading to the substation.

Mitigation Measure 16 - The powerline should avoid spanning of rocky ledges, drainage lines, seeps and erosion gulleys.

Mitigation Measure 17 - The proposed pylon design must incorporate the following design parameters:

- ⇒ The clearances between the live components should exceed the wingspan of any bird species.
- ⇒ The height of the tower should allow for unrestricted movement of terrestrial birds between successive pylons.
- ⇒ The live components should be "bundled" to increase the visibility for approaching birds.
- ⇒ "Bird streamers" should be eliminated by discouraging birds from perching above the conductors. In addition, conductors should be strung below pole to avoid bridging the air gap by perching birds of prey.

It is therefore recommended that the pylon design incorporates "features as illustrated by **Figure 36**[15]. From **Figure 38** it is evident that perching of birds is discouraged by the addition of diagonal crossbars or by doing away with the crossbars that holds the conductors in place. Bird "streamers" are also eliminated by fitting the poles with bird guards/spikes above the conductors. However, safe perching is facilitated by the fitment of a horizontal bar on top of the pole structure without the risk of electrocution (due to the perpendicular orientation of the bar relative to the conductors).

Mitigation Measure 18 - All new and planned power lines should be fitted with bird flight diverters (see **Figure 37**).

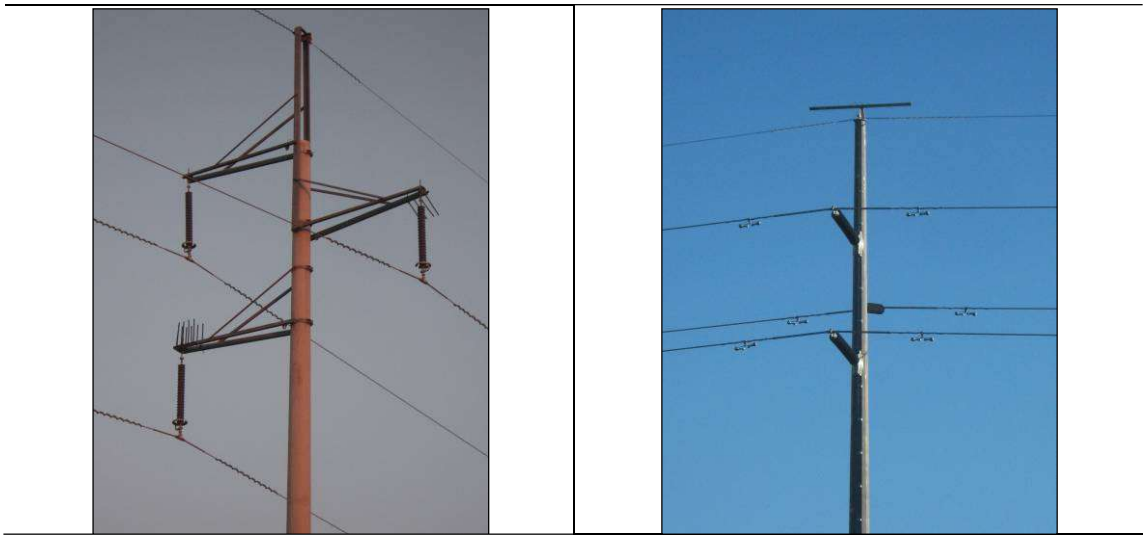

Figure 36: Two bird-friendly tower designs that could be used for the current project

[15] Please note that these are examples of recommended pylon designs. These are taken from steel monopole pylons.

Figure 37: Examples of bird flight diverters to be used on the powerlines: Double loop bird flight diverter (left) and Viper live bird flapper (right)

47.5 GENERAL MITIGATION MEASURES

Mitigation Measure 19 - All construction site camps must be confined to disturbed areas or those identified with low conservation importance. All construction site camps must be demarcated on site layout plans (preferably), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction sites that are not part of the demarcated development area should be considered as "no-go" areas for employees, machinery or even visitors.

Mitigation Measure 20 - All road networks must be planned with care to minimize dissection or fragmentation of important avifaunal habitat type as far as possible. Where possible, the use of existing roads is encouraged.

Mitigation Measure 21 - The breeding and roosting status of threatened and near threatened species corresponding to the site and powerline servitude, in particular birds of prey and blue korhaan, should be evaluated at least 30 days prior to construction. If breeding is confirmed, the nest site must be barricaded and appropriately buffered (at least 150 m, or as recommended by the avifaunal specialist as part of the pre-construction monitoring cycle). Construction activities shall only commence once the fledglings are successfully reared and has left the nesting area.

Mitigation Measure 22 - Open fires is strictly prohibited and only allowed at designated areas.

Mitigation Measure 23 - Killing or poaching of any bird species should be avoided by means of awareness programs presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the bird taxa occurring on the study area. Any person found deliberately harassing any bird species in any way should face disciplinary measures, following the possible dismissal from the site.

Mitigation Measure 24 - Checks must be carried out at regular intervals to identify areas where erosion is occurring. Appropriate remedial action, including the rehabilitation of eroded areas should be undertaken.

47.6 SUGGESTED AVIFAUNAL MONITORING PROTOCOL

There is a general lack on accurate Information on collision trauma (bird mortalities) and the displacement of birds caused by PV solar facilities. Therefore, as per the guidelines of Jenkins et al. (2017), pre- and post-construction monitoring is highly recommended:

⇒ At least two pre-construction surveys are recommended, each consisting of a minimum of 2-5 days (should time allow). At least one of the surveys should coincide with the peak wet season when most of the drainage lines and wetland features are inundated. This will enable the observer to obtain quantified data on waterbird richness and waterbird numbers, which will contribute towards the understanding of impacts related to collision trauma with

the panels. Such data was not available during the October 2018 survey which was commissioned prior to any major bout of precipitation in the area.

⇒ A post-construction survey during operation with a minimum of 2 x 2-5 days over a six-month period (including the peak wet season). The survey aims to obtain mortality data from bird colliding with the panels and will advise on appropriate mitigation measures to be implemented to reduce potential bird mortalities. The surveys should be conducted in a regular and systematic manner by means of direct observation (and the use of installed video cameras) and carcass searches.

⇒ It is possible that mortalities due to collision will occur at the powerlines even after mitigation. The post-construction monitoring should therefore also aim to quantify mortalities caused by the powerline network. A management programme must be compiled to assess the efficacy of applied mitigation measures and consult or change measures to reduce on-going mortalities when detected. Additional mitigation measures should be tested or applied, especially if mortalities include birds of prey and/ or species of conservation concern.

48 IFC PERFORMANCE STANDARD 6 - A PRELIMINARY CRITICAL BIRD HABITAT ASSESSMENT

Apart from providing a Project-specific sensitivity analysis, a critical habitat analysis was conducted to determine if the Project is situated in critical habitat. Critical habitat identification is required by IFC PS6 to determine risks, and to avoid or mitigate impacts on areas with high biodiversity value. Five major criteria must be evaluated in order to assess critical habitat (IFC PS6, 2012):

⇒ Criterion 1 - Habitat that is of significant importance to Critically Endangered (CR) and/or Endangered (EN) species (IUCN, 2015) that are wide-ranging and/or whose population distributions are not well understood. The loss of such a habitat could potentially impact the long-term survivability of the species. It also refers to habitat containing national/regional important concentrations of CR and/or EN species (<10 % of the global population) where that habitat could be considered a discrete management unit for that species.

⇒ Criterion 2 - Habitat that is of significant importance to endemic and/or restricted-range species.

⇒ Criterion 3 - Habitat supporting globally significant concentrations of migratory species and/or congregatory species.

⇒ Criterion 4 - Highly threatened and/or unique ecosystems that are at risk of significantly decreasing in area and quality, with small spatial extent or contain unique assemblages of species.

⇒ Criterion 5 - Areas associated with key evolutionary processes. These include the physical features of a landscape that might be associated with particular evolutionary processes and/or subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history.

Numerical thresholds are used to assign Criteria 1 to 3 and these thresholds form the basis of a tiered approach, in that a Tier 1 or a Tier 2 Critical Habitat designation should be determined as per **Table 24**:

Table 24: Tier 1 and Tier 2 criteria for Critical Habitat assessment

Criteria	*Tier 1*	*Tier 2*
1. Critically Endangered (CR)/ Endangered (EN) Species	(A) Habitat required to sustain ≥10% of the global population of a CR or EN Species/Subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.	(C) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a red-listed Endangered species where that habitat could be considered a discrete management unit for that species/subspecies.
	(B) Habitat with known, regular occurrences of CR or EN species where that habitat is one	(D) Habitat of significant importance to CR or EN species that are wide-ranging and/or

Table 24: Tier 1 and Tier 2 criteria for Critical Habitat assessment		
Criteria	*Tier 1*	*Tier 2*
	of 10 or fewer discrete management sites globally for that species.	whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. (E) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.
2. Endemic/Restricted Range Species	(A) Habitat known to sustain ≥95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g. a single-site endemic).	(B) Habitat known to sustain ≥1% but <95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data is available and/or based on expert judgment.
3. Migratory/ Congregatory Species	(A) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥95% of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(B) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥1% but <95% of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data is available and/or based on expert judgment. (C) For species with large but clumped distributions, a provisional threshold is set at ≥5% of the global population for both terrestrial and marine species. (D) Source sites that contribute ≥1% of the global population of recruits.

All the habitat types are classified as modified (see below), with the exception of the rocky ledges and cliffs and part of the seeps which are regarded as natural habitat (see below). *None of these habitat types are regarded as critical habitat* (in the absence of Criteria 3 - see below) under the auspices of PSs from the IFC (IFC, 2012):

⇒ *Cynodon dactylon – Gazania krebsiana* Erosion Gulleys - modified

⇒ *Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs - natural

⇒ *Moraea pallida– Wahlenbergia* cf. *dieterlenii* Agricultural Fields - modified; and

⇒ *Pentameris ariodes – Trifolium burchellianum* Drainage Lines and Seeps - both natural and modified.

A summary of the critical habitat analysis is provided below:

Criterion 1: Deals with habitat which supports critically endangered or endangered species. No critically endangered or endangered bird species were observed or recorded during SABAP2, and none are regarded to be regular in occurrence on the study site.

Criterion 1 also makes reference to nationally or regionally-listed species with conservation categories which do not respond well to those of the IUCN. However, none of these species are restricted to the project area.

Criterion 2: Deals with habitat that supports endemic and restricted range species. The bird community contains only 14 % of the endemic bird species shared with South Africa and Lesotho. Also, none of the habitat types sustain any species with >95 % or ≥1 % but <95 % of its global population restricted to the study area. In addition, none of the observed bird taxa are restricted-range species with an extent of occurrence of 50 000 km^2 or less.

Criterion 3: Criterion 3 deals with migratory or congregatory species and these taxa are known to occur in the study area. **Criteria 3 could not be sufficiently assessed due to the timing of the site visit which was not optimal for the occurrence of waterbirds or congregatory species**. It is recommended that monitoring surveys incorporate a survey during the peak wet season in order to quantify the requirements set out by Criteria 3.

Criterion 4: Has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species. Biome-restricted species applies to a group of species with a shared distribution of greater than 50 000 km^2, which occurs mostly or wholly within a particular biome and are therefore of global importance. Only one bird species (Southern Bald Ibis *Geronticus calvus*) is restricted to the Afrotropical Highlands, although it is not restricted to the project area. Therefore, the study site does not contain any highly threatened or unique ecosystem.

Criterion 5: Has relevance to areas associated with key evolutionary processes. None of the habitat types on the study area are considered to hold important landscape level features for birds, albeit at a local scale, which allows for key evolutionary processes to take place.

49 CONCLUDING SATEMENT

The avifaunal community on the site and immediate surrounds consists mainly of widespread species, and was found with a low richness of species with low occupied densities. This illustrates the overall modified habitat condition of the habitat types on the study site. Only the rocky ledges and some of the drainage lines located to the east of the site are recognised as being important in terms of bird richness and dispersal.

A total of 109 bird species are expected to occur, with a richness of 51 species that was recorded during the survey (October 2018) within the development footprint and immediate surrounds. It highlights the pertubated condition and early seral stages of the dominant habitat types on the study site. However, the poor bird richness in the area also exemplifies the fact that the avifauna on the western part of Lesotho is poorly known and insufficiently sampled.

Nevertheless, four bird species of conservation concern were recorded during this assessment, with two (African Rock Pipit *Anthus crenatus* and Ground Woodpecker *Geocolaptes olivaceus*) being restricted to the rocky ledges and cliffs and another two species (Blue Korhaan *Eupodotis caerulescens* and Southern Bald Ibis *Geronticus calvus*) occurred on the agricultural fields and secondary grasslands . The latter species occurred in low densities in the area although being widespread in the area.

As could be expected, an evaluation of potential and likely impacts on the avifauna revealed that the impact significance are generally low to moderate, with the exception of the potential for birds to collide with the panels and associated powerlines. In the absence of sufficient information on the occurrence and densities of waterbirds, the impact related to collision trauma is regarded as high (without mitigation) unless supporting evidence is acquired by means of a follow-up survey during the peak wet season.

Apart from the above, it is the opinion of the specialist that the proposed development and operation of the NEO 1 PV Project is not expected to result in any highly significant or severe impacts at a local scale; with the understanding that a complete and comprehensive mitigation approach is followed along with pre- and post-construction monitoring.

50 APPENDIX 3: SHORTLIST OF EXPECTED AND OBSERVED BIRD SPECIES

A shortlist of bird species expected and observed on the study area. # refers to IOC numbers. Scientific names and common names were used according to Gill & Donsker (2018). Also provided is the global and regional conservation status of each species (IUCN, 2017; Taylor et al., 2015). (VU - Vulnerable, NT - Near threatened).

#	Common Name	Scientific Name	Observed (October 2018)	Global Conservation Status	Regional Conservation Status	SABAP2 Reporting Rate (%)						SABAP1 Reporting Rate (%)
						Full protocol			*Ad hoc* protocol			
						%	n	Latest	%	n	Latest	
432	Barbet, Acacia Pied	*Tricholaema leucomelas*										11.11
439	Barbet, Crested	*Trachyphonus vaillantii*	1			50.00	1	10/10/2018				$0.00
808	Bishop, Southern Red	*Euplectes orix*							7.14	1	11/10/2014	19.23
812	Bishop, Yellow-crowned	*Euplectes afer*										15.38
722	Bokmakierie	*Telophorus zeylonus*	1			100.00	2	10/9/2018	7.14	1	11/10/2014	5.56
544	Bulbul, African Red-eyed	*Pycnonotus nigricans*	1			50.00	1	10/9/2018	7.14	1	3/23/2015	27.78
873	Bunting, Cape	*Emberiza capensis*	1			100.00	2	10/9/2018				12.50
872	Bunting, Cinnamon-breasted	*Emberiza tahapisi*							7.14	1	3/23/2015	26.92
152	Buzzard, Jackal	*Buteo rufofuscus*	1			50.00	1	10/9/2018	7.14	1	2/10/2015	$0.00
154	Buzzard, Steppe	*Buteo buteo vulpinus*										22.22
860	Canary, Black-throated	*Crithagra atrogularis*	1			50.00	1	10/9/2018	42.86	6	2/10/2015	5.56
857	Canary, Cape	*Serinus canicollis*	1			100.00	2	10/9/2018				11.54
866	Canary, Yellow	*Crithagra flaviventris*										12.50
575	Chat, Anteating	*Myrmecocichla formicivora*	1			100.00	2	10/9/2018				$0.00
570	Chat, Familiar	*Oenanthe familiaris*	1			50.00	1	10/9/2018	7.14	1	11/10/2014	5.56
631	Cisticola, Cloud	*Cisticola textrix*	1			100.00	2	10/9/2018	28.57	4	2/10/2015	11.54
630	Cisticola, Desert	*Cisticola aridulus*										11.54
634	Cisticola, Wing-snapping	*Cisticola ayresii*	1			100.00	2	10/9/2018				$0.00
646	Cisticola, Levaillant's	*Cisticola tinniens*										12.50
629	Cisticola, Zitting	*Cisticola juncidis*										11.54
212	Coot, Red-knobbed	*Fulica cristata*										19.23
50	Cormorant, Reed	*Microcarbo africanus*										5.56
47	Cormorant, White-breasted	*Phalacrocorax lucidus*										11.11
523	Crow, Cape	*Corvus capensis*	1			100.00	2	10/9/2018	42.86	6	3/23/2015	15.38
522	Crow, Pied	*Corvus albus*	1			100.00	2	10/9/2018	28.57	4	2/10/2015	61.54
317	Dove, Laughing	*Spilopelia senegalensis*							21.43	3	3/23/2015	46.15
314	Dove, Red-eyed	*Streptopelia semitorquata*							7.14	1	2/10/2015	23.08
95	Duck, African Black	*Anas sparsa*										11.11
100	Duck, White-faced	*Dendrocygna viduata*							7.14	1	11/10/2014	$0.00
96	Duck, Yellow-billed	*Anas undulata*							7.14	1	11/10/2014	11.11
61	Egret, Western Cattle	*Bubulcus ibis*	1			100.00	2	10/9/2018	21.43	3	2/10/2015	46.15

#	Common Name	Scientific Name	Observed (October 2018)	Global Conservation Status	Regional Conservation Status	SABAP2 Reporting Rate (%)						SABAP1 Reporting Rate (%)
						Full protocol			*Ad hoc* protocol			
						%	n	Latest	%	n	Latest	
59	Egret, Little	*Egretta garzetta*										5.56
119	Falcon, Amur	*Falco amurensis*							50.00	7	2/10/2015	12.50
114	Falcon, Lanner	*Falco biarmicus*			VU				7.14	1	11/10/2014	5.56
820	Finch, Red-headed	*Amadina erythrocephala*	1			50.00	1	10/9/2018				11.54
707	Fiscal, Southern	*Lanius collaris*	1			100.00	2	10/9/2018	28.57	4	2/10/2015	38.46
149	Fish-eagle, African	*Haliaeetus vocifer*										11.11
89	Goose, Egyptian	*Alopochen aegyptiacus*	1			100.00	2	10/9/2018	7.14	1	2/10/2015	16.67
88	Goose, Spur-winged	*Plectropterus gambensis*	1			50.00	1	10/9/2018				$0.00
6	Grebe, Little	*Tachybaptus ruficollis*										12.50
72	Hamerkop	*Scopus umbretta*										23.08
55	Heron, Black-headed	*Ardea melanocephala*	1			50.00	1	10/9/2018	7.14	1	3/23/2015	15.38
54	Heron, Grey	*Ardea cinerea*	1			50.00	1	10/9/2018				19.23
57	Heron, Purple	*Ardea purpurea*										5.56
507	House-martin, Common	*Delichon urbicum*							7.14	1	2/10/2015	$0.00
81	Ibis, African Sacred	*Threskiornis aethiopicus*										12.50
84	Ibis, Hadeda	*Bostrychia hagedash*	1			50.00	1	10/9/2018	7.14	1	11/10/2014	11.54
82	Ibis, Southern Bald	*Geronticus calvus*	1	VU	VU	50.00	1	10/9/2018	7.14	1	3/22/2012	11.54
125	Kestrel, Lesser	*Falco naumanni*							7.14	1	2/10/2015	$0.00
123	Kestrel, Rock	*Falco rupicolus*	1			50.00	1	10/9/2018				57.69
130	Kite, Black-winged	*Elanus caeruleus*										11.54
223	Korhaan, Blue	*Eupodotis caerulescens*	1	NT		50.00	1	10/9/2018				$0.00
245	Lapwing, Blacksmith	*Vanellus armatus*							21.43	3	11/10/2014	26.92
1183	Lark, Eastern Clapper	*Mirafra fasciolata*										11.54
4126	Lark, Eastern Long-billed	*Certhilauda semitorquata*	1			50.00	1	10/9/2018				12.50
463	Lark, Large-billed	*Galerida magnirostris*	1			100.00	2	10/9/2018	7.14	1	3/23/2015	7.69
490	Lark, Pink-billed	*Spizocorys conirostris*							42.86	6	3/23/2015	$0.00
488	Lark, Red-capped	*Calandrella cinerea*	1			100.00	2	10/9/2018	42.86	6	3/23/2015	7.69
458	Lark, Rufous-naped	*Mirafra africana*	1			50.00	1	10/9/2018				11.54
474	Lark, Spike-heeled	*Chersomanes albofasciata*	1			50.00	1	10/9/2018				$0.00
703	Longclaw, Cape	*Macronyx capensis*	1			100.00	2	10/9/2018	7.14	1	11/10/2014	16.67
509	Martin, Brown-throated	*Riparia paludicola*	1			50.00	1	10/9/2018				11.11
506	Martin, Rock	*Ptyonoprogne fuligula*										19.23
803	Masked-weaver, Southern	*Ploceus velatus*	1			50.00	1	10/9/2018	21.43	3	2/10/2015	11.54
210	Moorhen, Common	*Gallinula chloropus*							7.14	1	11/10/2014	11.11
390	Mousebird, Speckled	*Colius striatus*										5.56
734	Myna, Common	*Acridotheres tristis*	1						21.43	3	2/10/2015	$0.00
637	Neddicky	*Cisticola fulvicapilla*							14.29	2	3/23/2015	12.50

#	Common Name	Scientific Name	Observed (October 2018)	Global Conservation Status	Regional Conservation Status	SABAP2 Reporting Rate (%)						SABAP1 Reporting Rate (%)
						Full protocol			*Ad hoc* protocol			
						%	n	Latest	%	n	Latest	
69	Night-Heron, Black-crowned	*Nycticorax nycticorax*										11.11
311	Pigeon, Speckled	*Columba guinea*	1			100.00	2	10/9/2018	57.14	8	3/23/2015	22.22
692	Pipit, African	*Anthus cinnamomeus*	1			100.00	2	10/9/2018	28.57	4	2/10/2015	23.08
697	Pipit, African Rock	*Anthus crenatus*	1	NT	NT	50.00	1	10/9/2018				12.50
693	Pipit, Long-billed	*Anthus similis*	1			50.00	1	10/9/2018				12.50
238	Plover, Three-banded	*Charadrius tricollaris*										22.22
189	Quail, Common	*Coturnix coturnix*							7.14	1	3/23/2015	11.54
844	Quailfinch	*Ortygospiza atricollis*	1			50.00	1	10/9/2018	28.57	4	3/23/2015	15.38
805	Quelea, Red-billed	*Quelea quelea*							14.29	2	11/10/2014	$0.00
524	Raven, White-necked	*Corvus albicollis*	1			50.00	1	10/9/2018	7.14	1	11/10/2014	16.67
606	Reed-warbler, African*	*Acrocephalus baeticatus**										7.69
581	Robin-chat, Cape	*Cossypha caffra*										19.23
867	Seedeater, Streaky-headed	*Crithagra gularis*										12.50
786	Sparrow, Cape	*Passer melanurus*	1			100.00	2	10/9/2018	50.00	7	3/23/2015	46.15
784	Sparrow, House	*Passer domesticus*	1			100.00	2	10/9/2018	42.86	6	3/23/2015	19.23
4142	Sparrow, Southern Grey-headed	*Passer diffusus*							42.86	6	3/23/2015	15.38
484	Sparrowlark, Chestnut-backed	*Eremopterix leucotis*							21.43	3	3/23/2015	5.56
737	Starling, Cape Glossy	*Lamprotornis nitens*							7.14	1	2/10/2015	$0.00
733	Starling, Common	*Sturnus vulgaris*							7.14	1	11/10/2014	$0.00
746	Starling, Pied	*Lamprotornis bicolor*	1			100.00	2	10/9/2018	14.29	2	11/10/2014	34.62
745	Starling, Red-winged	*Onychognathus morio*	1			50.00	1	10/9/2018	21.43	3	3/23/2015	19.23
80	Stork, White	*Ciconia ciconia*										19.23
493	Swallow, Barn	*Hirundo rustica*							21.43	3	3/23/2015	5.56
501	Swallow, Red-breasted	*Cecropis semirufa*	1			50.00	1	10/10/2018				$0.00
502	Swallow, Greater Striped	*Cecropis cucullata*	1			100.00	2	10/9/2018	28.57	4	3/23/2015	23.08
495	Swallow, White-throated	*Hirundo albigularis*							7.14	1	11/10/2014	$0.00
380	Swift, African Black	*Apus barbatus*	1			100.00	2	10/9/2018	7.14	1	2/10/2015	15.38
386	Swift, Alpine	*Tachymarptis melba*	1			50.00	1	10/9/2018	7.14	1	2/10/2015	15.38
384	Swift, Horus	*Apus horus*							14.29	2	3/23/2015	$0.00
385	Swift, Little	*Apus affinis*										12.50
383	Swift, White-rumped	*Apus caffer*							14.29	2	3/23/2015	$0.00
97	Teal, Red-billed	*Anas erythrorhyncha*										12.50
1104	Thrush, Karoo	*Turdus smithi*										11.11
316	Turtle-dove, Cape	*Streptopelia capicola*	1			100.00	2	10/9/2018	35.71	5	3/23/2015	42.31
686	Wagtail, Cape	*Motacilla capensis*	1			50.00	1	10/9/2018	14.29	2	3/23/2015	11.11
799	Weaver, Cape	*Ploceus capensis*										5.56
564	Wheatear, Mountain	*Myrmecocichla monticola*	1			100.00	2	10/9/2018	14.29	2	11/10/2014	22.22

#	Common Name	Scientific Name	Observed (October 2018)	Global Conservation Status	Regional Conservation Status	SABAP2 Reporting Rate (%)						SABAP1 Reporting Rate (%)
						Full protocol			*Ad hoc* protocol			
						%	n	Latest	%	n	Latest	
1172	White-eye, Cape	*Zosterops virens*										11.11
846	Whydah, Pin-tailed	*Vidua macroura*							7.14	1	11/10/2014	11.11
818	Widowbird, Long-tailed	*Euplectes progne*							7.14	1	2/10/2015	26.92
445	Woodpecker, Ground	*Geocolaptes olivaceus*	1	NT		50.00	1	10/10/2018				$0.00

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