

**FAUNAL, AVIFAUNAL, FLORAL AND WETLAND ECOLOGICAL
ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT
ASSESSMENT AND AUTHORISATION PROCESS FOR THE
PROPOSED SOLAR PHOTOVOLTAIC POWER PLANT WITH
ASSOCIATED INFRASTRUCTURE AT THE ARNOT COAL FIRED
POWER STATION, MPUMALANGA PROVINCE**

Prepared for

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SECTION C

Faunal Assessment

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TABLE OF CONTENTS

TABLE OF CONTENTS	ii
LIST OF FIGURES	iii
LIST OF TABLES	iii
1 INTRODUCTION	1
1.1 Background	1
2 METHOD OF ASSESSMENT	1
2.1 General Site Survey	1
2.2 Desktop Study	1
2.3 Literature Review	2
2.4 Field Assessment	2
2.4.1 Mammals	2
2.4.2 Avifauna	2
2.4.3 Reptiles	3
2.4.4 Amphibians	3
2.4.5 Invertebrates	3
2.4.6 Spiders and Scorpions	3
2.5 Species of Conservational Concern Assessment	4
2.5.1 Species of Conservational Concern Sensitivity Index Score (SCCSIS).....	4
3 FAUNAL RESULTS	6
3.1 Mammals	7
3.2 Avifauna	8
3.3 Amphibians	10
3.4 Reptiles	11
3.5 Invertebrates	11
3.6 Arachnids and Scorpions	12
4 SPECIES OF CONSERVATIONAL CONCERN ASSESSMENT	12
5 IMPACT ASSESSMENT	14
5.1 Impact 1: Loss of Faunal Habitat and Ecological Structure	15
5.2 Impact 2: Loss of Faunal Diversity and Ecological Integrity	17
5.3 Impact 3: Impact on important faunal species of conservational concern (Mpumalanga Province)	19
5.4 Impact Summary	21
6 RECOMMENDATIONS	22
7 REFERENCES	23
FAUNAL APPENDICES	25



LIST OF FIGURES

Figure 1: Open grassland habitat typical of all assessed sites	7
Figure 2: <i>Rhabdomys pumilio</i> (Four-striped Grass Mouse) observed within the study area	8

LIST OF TABLES

Table 1: SCCSIS value interpretation with regards to RDL faunal species importance on the study area	6
Table 2: Avifaunal species recorded during the field surveys as well as their 2015 IUCN status	9
Table 3: RDL bird species with a POC of more than 60%	10
Table 4: Invertebrate species recorded during the site survey	11
Table 5: RDL bird species with a POC of more than 60%	13
Table 6: SCCSIS scoring	13
Table 7: A summary of the impact significance of the construction phase	21
Table 8: A summary of the impact significance of the operational/ maintenance phase	21



1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a faunal, avifaunal, floral and wetland assessment as part of environmental impact assessment for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot Coal Fired Power Station, Mpumalanga Province (hereafter referred to as “study area”). The study area is situated within the Arnot Power Station that is located in Arnot suburb in the Middelburg District in Mpumalanga.

2 METHOD OF ASSESSMENT

2.1 General Site Survey

A single site visit was undertaken during November and December 2014 to determine the ecological status of the study area and the surrounding areas. A reconnaissance ‘drive around’ followed by a thorough ‘walk through’ on foot was undertaken to determine the general habitat types found throughout the study area and, following this, specific study sites or areas were selected that were considered to be representative of the habitats found within the study area. Special emphasis was placed on areas that may potentially support Red Data Listed (RDL) faunal species. Sites were investigated on foot in order to identify the occurrence of the dominant faunal communities, species and habitat diversities. The presence of any faunal inhabitants of the study area was also assessed through direct visual observation or identifying such species through calls, tracks, scats, burrows and other methods as described in the methodology.

The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general invertebrates, spiders and scorpions.

2.2 Desktop Study

Initially a desktop study was undertaken to gather background information regarding the study area and its surrounding areas. All relevant National Environmental Management: Biodiversity Act (NEMBA, 2007) as well as regional authorities (MP SoER, 2003) were consulted regarding conservational species lists, and all the latest available literature was utilised to gain a thorough understanding of the area and its surrounding habitats. This



information was then used to determine the potential biodiversity lists, expected RDL lists and anticipated Species of Conservational Concern Sensitivity Index Score (SCCSIS) list of faunal species for the proposed photovoltaic power plant development and surrounding areas. This information incorporated (amongst others) data on vegetation types, habitat suitability and biodiversity potential coupled to this information.

2.3 Literature Review

Threatened or RDL faunal species which have been recorded in the Mpumalanga Province are listed in Appendices A – G (MpSoER 2003). This information was cross-referenced with information from the International Union for the Conservation of Nature (IUCN) Red Data list for 2015 (<http://www.iucnredlist.org>).

2.4 Field Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. In addition, the levels of anthropogenic and agricultural activity within the study area and surrounding area may determine whether species will be observed.

Although all species may not have been identified during the field assessment the results obtained are still adequate to gain a thorough understanding of the available habitat and foraging potential within the study area.

2.4.1 Mammals

Faunal species were recorded during the field assessment with the use of visual identification through random transect walks as well as by means of spoor, call and dung. Possible burrows in the vicinity of the study area were visually inspected for any inhabitants.

2.4.2 Avifauna

The Southern African Bird Atlas Project 2 species list (<http://sabap2.adu.org.za>) for the Quarter Degree Square (QDS) 2529DD (Appendix C) was compared with the recent field survey database of birds identified on the study area during the January 2015 surveys.



Field surveys were undertaken utilising a pair of Vespa 7x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species.

2.4.3 Reptiles

Reptiles were physically identified during the field survey. Where possible, rocks were overturned and inspected and any reptiles encountered were identified. Other habitat areas where reptiles were likely to reside were also investigated. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area.

2.4.4 Amphibians

All adult amphibian species encountered within the study area were recorded during the field assessment with the use of direct searching and visual identification along with other identification aids such as call identification. Amphibian species flourish in and around wetland and riparian areas. It is in these areas that specific attention was paid to when searching for amphibian species. However, it is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment.

2.4.5 Invertebrates

A list of visually identified and observed invertebrate species was compiled during the field surveys which were captured by means of sweep netting and active searching. However, due to their cryptic nature and habits, varied stages of life cycles, seasonal and temporal fluctuations within the environment, it is unlikely that all invertebrate species will have been recorded during the site assessment period. Nevertheless, the data gathered during the general invertebrate assessment along with the habitat analysis provided an accurate indication of which invertebrate species are likely to occur on the study area.

2.4.6 Spiders and Scorpions

Suitable habitats, such as natural vegetation and rocky outcrop areas, where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential RDL scorpions within the study area.



2.5 Species of Conservational Concern Assessment

2.5.1 Species of Conservational Concern Sensitivity Index Score (SCCSIS)

The term SCC in the context of this report refers to all RD (Red Data) and IUCN (International Union for the Conservation of Nature) listed faunal species, as well as protected species of relevance to the project. Lists below are all specified in legislation except for IUCN which is the oldest and largest global environmental organisation and helps the world to find pragmatic solutions to our most pressing environment and development challenges. It should be noted that some species or families considered threatened on a national level may not be considered threatened on a provincial level due to various factors such as stable local population trends; for these species provincial status took precedence.

The following legislations and international listings were used during the SCC consideration:

- **Provincial conservation:** protected species listed in the Mpumalanga State of the Environment Report (2003) (MP SoER 2003),
- **National conservation:** National Environmental Management Act (Act 107 of 1998) (NEMA) and National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA), and
- **Global conservation:** protected species under International Union for the Conservation of Nature (IUCN). Organisms that fall into the *Extinct in the Wild (EW)*, *critically endangered (CR)*, *Endangered (EN)*, *Vulnerable (VU)* *Least Concern (LC)*, and *Data deficient (DD)* categories of ecological status.

Given the restrictions of field assessments to identify all the faunal species that possibly occur on a particular property, the SCCSIS has been developed to provide an indication of the potential faunal SCC that could reside in the area, while simultaneously providing a quantitative measure of the study area's value in terms of conserving faunal diversity. The SCCSIS is based on the principles that when the knowledge of a species' historical distribution is combined with a field assessment that identifies the degree to which the property supports a species' habitat and food requirements, interpretations can be made about the probability of that particular species residing within the study area. Repeating this procedure for all the potential faunal SCC of the area and collating this information then provides a sensitivity measure of the property that has been investigated. The detailed methodology to determine the SCCSIS of the property is presented below:



Probability of Occurrence (POC): Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site were determined for each of the species. Each of these variables is expressed as a percentage (where 100% is a perfect score). The average of these scores provided a POC score for each species. The POC value was categorised as follows:

- **0-20%** = **Low;**
- **21-40%** = **Low to Medium;**
- **41-60%** = **Medium;**
- **61-80%** = **Medium to High and**
- **81-100%** = **High**
- POC** = **$(D+H+F)/3$**

Total Species Score (TSS): Species with POC of more than 60% (High-medium) were considered when applying the SCCSIS. A weighting factor was assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor was then multiplied with the POC to calculate the TSS for each species. The weighting as assigned to the various categories is as follows:

- **Data Deficient** = **0.2;**
- **Rare** = **0.5;**
- **Near Threatened** = **0.7;**
- **Vulnerable** = **1.2;**
- **Endangered** = **1.7 and**
- **Critically Endangered** = **2.0.**
- TSS** = **$(\text{IUCN weighting} * \text{POC})$ where $\text{POC} > 60\%$**

Average Total Species (Ave TSS) and Threatened Taxa Score (Ave TT): The average of all TSS potentially occurring on the site is calculated. The average of all the Threatened taxa (TT) (Near threatened, Vulnerable, Endangered and Critically Endangered) TSS scores are also calculated. The average of these two scores (Ave TSS and Ave TT) was then calculated in order to add more weight to threatened taxa with POC higher than 60%.

$$\text{Ave} = \text{Ave TSS} [\text{TSS}/\text{No of Spp}] + \text{Ave TT} [\text{TT TSS}/\text{No of Spp}]/2$$

SCCSIS: The average score obtained above and the sum of the percentage of species with a POC of 60% or higher of the total number of SCC species listed for the area



was then calculated. The average of these two scores, expressed as a percentage, gives the SCCSIS for the area investigated.

$$\text{SCCSIS} = \text{Ave} + [\text{Spp with POC} > 60\% / \text{Total no Of Spp} * 100] / 2$$

RDSIS interpretation:

Table 1: SCCSIS value interpretation with regards to RDL faunal species importance on the study area.

SCCSIS Score	SCC importance
0-20%	Low
21-40%	Low-Medium
41-60%	Medium
60-80%	High-Medium
81-100%	High

3 FAUNAL RESULTS

All alternatives were similar in terms of faunal habitat and were thus assessed together. The vegetation found within the study area can be described as an open grassland system, which has been disturbed through anthropogenic activities as well as grazing activities from local herds of goats and cattle. The figure below represents the typical views of the habitat associated with the study area.

With respect to faunal diversity and habitat intactness, Alternative 1 presents the best option for the construction of the photovoltaic power plant. Although Alternative 3 does not present a higher level of faunal habitat intactness or diversity, the presence of wetlands in close proximity may mean that faunal species utilising the wetlands may be affected by the proposed development if this alternative is pursued.





Figure 1: Open grassland habitat typical of all assessed sites

3.1 Mammals

No mammal SCC were observed during the site survey. Due to the disturbed nature of the habitat and the proximity to human habitation and development, the probability of any mammal SCC as listed by the Mpumalanga Province State of Environment Report (MP SoER, 2003) being observed within the study area is deemed to be very low. During the site survey, the only mammal observed was that of *Rhabdomys pumilio* (Four-striped Grass Mouse). This is a common species within the province, generally found in open grassland areas and is capable of living in close proximity to human habitation. Due to the transformed nature of the study area, and specifically the transformed grassland areas, it is likely that only the more common mammal species may be encountered within the study area at varying times of the year. Species most likely to be encountered within the study area may include *Galerella sanguinea* (Slender Mongoose), *Lepus saxatilis* (Scrub Hare) and *Ictonyx striatus* (Striped Polecat).

All of the above mentioned species are listed as Least Concern by the International Union for Conservation of Nature (IUCN, 2015), and as a result the development of the

Photovoltaic Power Plant and associated structure is unlikely to have a negative impact on mammal SCC or their associated habitat within the study area.



Figure 2: *Rhabdomys pumilio* (Four-striped Grass Mouse) observed within the study area.

3.2 Avifauna

According to Birdlife South Africa (BLSA), the study area does not fall within any Important Bird Areas (IBA), which has been highlighted as important conservation areas within South Africa (Birdlife South Africa, 2015). All avifaunal species seen or heard during the time of the assessment were recorded. Surveys were conducted across the entire study area and in the immediate surroundings. It must be noted that some migratory birds may not have been identified during the site survey period.

The majority of the study area comprises of habitat suitable for grassland birds. Birds occurring in the area have already adapted to the historical anthropogenic activities, and at this stage more common species are present. Several bird species were identified, primarily throughout the transformed habitat areas and in and around the wetland areas located in the study area.

The avifaunal species found in the study area are all commonly occurring species, which are well adapted to the already transformed habitat and are presented in the table below.

Table 2: Avifaunal species recorded during the field surveys as well as their 2015 IUCN status.

Scientific Name	Common Name	IUCN
<i>Upupa africana</i>	African Hoopoe	LC
<i>Cypsiurus parvus</i>	African Palm Swift	LC
<i>Anthus cinnamomeus</i>	African Pipit	NYBA
<i>Threskiornis aethiopicus</i>	African Sacred Ibis	LC
<i>Saxicola torquatus</i>	African StoneChat	LC
<i>Myrmecocichla formicivora</i>	Ant-eating Chat	LC
<i>Hirundo rustica</i>	Barn Swallow	LC
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC
<i>Crithagra atrogularis</i>	Black-throated Canary	LC
<i>Anthus vaalensis</i>	Buffy Pipit	LC
<i>Passer melanurus</i>	Cape Sparrow	LC
<i>Streptopelia capicola</i>	Cape Turtle Dove	LC
<i>Motacilla capensis</i>	Cape Wagtail	LC
<i>Zosterops capensis</i>	Cape White-eye	NYBA
<i>Cisticola textrix</i>	Cloud Cisticola	LC
<i>Lanius collaris</i>	Common Fiscal	LC
<i>Acridotheres tristis</i>	Common Myna	LC
<i>Vanellus coronatus</i>	Crowned Lapwing	LC
<i>Pycnonotus tricolor</i>	Dark-capped Bulbul	LC
<i>Cisticola aridulus</i>	Desert Cisticola	LC
<i>Mirafra fasciolata</i>	Eastern clapper Lark	NYBA
<i>Cecropis cucullata</i>	Greater Striped Swallow	LC
<i>Bostrychia hagedash</i>	Hadedda Ibis	LC
<i>Numida meleagris</i>	Helmeted Guineafowl	LC
<i>Passer domesticus</i>	House Sparrow	NYBA
<i>Streptopelia senegalensis</i>	Laughing Dove	LC
<i>Apus affinis</i>	Little Swift	LC
<i>Cisticola fulvicapilla</i>	Neddicky	LC
<i>Turdus olivaceus</i>	Olive Thrush	LC
<i>Streptopelia semitorquata</i>	Red-eyed Dove	LC
<i>Urocolius indicus</i>	Red-faced Mousebird	LC
<i>Columba livia</i>	Rock Dove	LC
<i>Euplectes orix</i>	Southern Red Bishop	LC
<i>Prinia subflava</i>	Tawny-flanked Prinia	LC
<i>Ploceus cucullatus</i>	Village Weaver	LC
<i>Bubulcus ibis</i>	Western Cattle Egret	LC
<i>Crithagra mozambica</i>	Yellow-fronted Canary	LC

LC = Least concern

NYBA = Not Yet Been Assessed



No avifaunal SCC were identified during the site survey (MP SoER, 2003). There is however a high probability that *Circus ranivorus* (African Marsh Harrier), *Tyto capensis* (African Grass Owl), and *Geronticus calvus* (Bald Ibis), may possibly utilise the study area specifically for foraging purposes.

Table 3: RDL bird species with a POC of more than 60%

Common Name	Scientific Name	Mpumalanga RDL status	IUCN Status	POC %
African Grass Owl	<i>Tyto capensis</i>	VU	LC	68
Southern Bald Ibis	<i>Geronticus calvus</i>	VU	VU	72
African Marsh Harrier	<i>Circus ranivorus</i>	VU	LC	65

VU = Vulnerable, LC = Least Concern, NT = Near Threatened, NYBA = Not yet been assessed by the IUCN

The proposed solar photovoltaic power plant with associated infrastructure is unlikely to pose a threat to avifaunal SCC, provided that the sensitivity map (Section A) and buffer zones are adhered to and no infringement of possible surface infrastructure occurs within the identified sensitive habitat areas of the study area.

3.3 Amphibians

Species that are known to occur within the Mpumalanga Province are listed in the MP SoER (2003) in Appendix 3.

During the site visit, no amphibian species were identified within the study area, nor was there any ideal amphibian habitat present. The areas surrounding the study area however, are more suited to the habitation of amphibian species. Common amphibian species which may inhabit surrounding areas may include the Plain Grass Frog (*Ptychadena anchietae*), Common Caco (*Cacosternum boettgeri*), Red toad (*Schismaderma carens*), Tremolo sand frog (*Tomopterna cryptotis*) and the Guttural toad (*Amietophrynus gutturalis*). The above mentioned amphibians are all considered not threatened in Mpumalanga Province (MP SoER, 2003) and Least Concern by the IUCN.

The only amphibian species listed as being of conservation concern is the Giant Bullfrog (*Pyxicephalus adspersus*) (Appendix 3, MP SoER, 2003). No Giant Bullfrogs were identified on or within or in the vicinity of the study area, although the study area falls within the distribution range of this species. Giant Bullfrogs are known to occur within and nearby riparian and wetland zones, where they remain in cocoons submerged underground during the winter periods, preferably in sandy soils, and only emerge at the start of the rainy season. They breed in shallow waters and can occupy temporary floodplains and rapidly drying pool areas. Giant bullfrogs are also known to travel vast distances and may utilise



wetlands as migratory corridors. As there was no viable habitat for this species within the study area, it is unlikely that it will be negatively affected by the proposed project.

3.4 Reptiles

No reptile species or signs thereof were observed during the site visit. The study area did not contain any rocky areas or structures that may be favoured by reptiles for shelter and refuge, and as such it is deemed highly unlikely that any species listed in the MP SoER (2003) will occur within the study area. The prevalence of better suited habitat in the surrounding areas, not just for reptile species but also for their preferred prey items, is a good indication that the study area will not be favoured by many reptile species as a permanent habitat zone. As such, any development occurring within the study area is likely to have a very minimal impact on reptile species within the area.

3.5 Invertebrates

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the study area. As such, the invertebrate assessment will not be an indication of the complete invertebrate diversity potential of the proposed development site and surrounding area. No invertebrates SCC were found during the faunal survey. Invertebrate SCC species are listed in Appendix 5. A representation of commonly encountered families in the Insecta class that were observed during the assessment is listed in the table below.

Table 4: Invertebrate species recorded during the site survey.

Order	Family	Scientific Name	Common Name	IUCN 2015
Lepidoptera	Pieridae	<i>Belenois aurota</i>	Brown-veined White	NYBA
		<i>Eurema hecabe</i>	Common grass Yellow	NYBA
	Geometridae	<i>Rhodometra sacraria</i>	Vestal	NYBA
	Nymphalidae	<i>Junonia hierta</i>	Yellow pansy	LC
		<i>Danaus chrysippus</i>	African monarch	NYBA
Isoptera	Termitidae	<i>Odontotermes latericus</i>	Harvester Termites	NYBA
Diptera	Calliphoridae	<i>Musca domestica</i>	House fly	NYBA
Orthoptera	Acrididae	<i>Ancanthacris ruficornis</i>	Garden locust	NYBA
Hymenoptera	Apidae	<i>Apis mellifera scutellata</i>	African honey bee	NYBA
	Vespidae	<i>Belanogaster junceus</i>	Paper wasp	NYBA
	Formicidae	<i>Anoplolepis custodiens</i>	Pugnacious Ant	NYBA
	Pompilidae	<i>Batozonellus fuliginosus</i>	N/A	NYBA
Odonata	Libellulidae	<i>Pantala flavescens</i>	Wandering Glider	LC

LC = Least Concern, NYBA = Not yet been assessed by the IUCN



Metisella meninx, commonly known as the Marsh Sylph (Butterfly) is an invertebrate which is listed as Vulnerable in the MP SoER, 2003 report and is not yet listed on the IUCN listings. The study area falls within the distribution range noted for the *M. meninx* however, no populations of this species were identified during the site assessments. Its preferred habitat comprises of wetlands where marsh grass (*Leersia hexandra*) are dominant. No suitable habitat for *M. menixi* is present within the study area, and as such the likelihood that this species will occur within the study area is highly unlikely.

As such, the development of the photovoltaic power plant within the study area is unlikely to have negative impact of invertebrate SCC within the study area.

3.6 Arachnids and Scorpions

No threatened spider or scorpion species lists for the Mpumalanga Province are as yet available (MP SoER, 2003). Therefore, a record of threatened spiders and scorpions was acquired from the most recent RDL spider and scorpion data available for South Africa using the SANBI threatened species database (<http://www.speciesstatus.sanbi.org>).

Trapdoor and Baboon spiders are listed as threatened throughout South Africa (Dippenaar-Schoeman, 2002). All baboon spider species form the genus; *Ceratgyrus*, *Harpactira* and *Pterinochilus* are protected under the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA) for South Africa. All scorpion species from the genus; *Hadogenes*, *Opisthacanthus* and *Opisththalmus* are also protected under NEMBA for South Africa.

During the assessment, specific attention was paid to the identification of suitable habitat for spiders and scorpions. After thoroughly searching, no scorpion or spider species were observed within the study area.

As such, it is highly unlikely that the Photovoltaic power plant will impact negatively upon any spider or scorpion species within the study area.

4 SPECIES OF CONSERVATIONAL CONCERN ASSESSMENT

The SCCIS provides a quantitative measure of the study area's value in terms of conserving faunal diversity. The SCCIS is based on the principles that when the knowledge of a species' historical distribution as well as RDL status, in this case for Mpumalanga province



(MPSoER 2003), is combined with a field assessment that identifies the degree to which the study area is able to support a species in terms of a species' habitat and food requirements. Interpretations can then be made about the probability of that particular species residing within the study area. Repeating this procedure for all the potential faunal SCC of the area and collating this information then provides a sensitivity measure of the study area that has been investigated.

Although no SCC were observed within the study or surrounding areas, there remains the possibility that some avifaunal SCC may utilise the study area for foraging purposes from time to time. Table 5 below lists the avifaunal SCC that have a POC>60% that may occur in the study area, whilst Table 6 indicates the overall SCCIS score of the study area.

Table 5: RDL bird species with a POC of more than 60%

Common Name	Scientific Name	Mpumalanga RDL status	IUCN Status	POC %
African Grass Owl	<i>Tyto capensis</i>	VU	LC	68
Southern Bald Ibis	<i>Geronticus calvus</i>	VU	VU	72
African Marsh Harrier	<i>Circus ranivorus</i>	VU	LC	65

VU = Vulnerable, LC = Least Concern, NT = Near Threatened, NYBA = Not yet been assessed by the IUCN

Table 6: SCCSIS scoring

Species of Conservational Concern Sensitivity Index Score			
Average Total Species Score			80
Average Threatened Taxa Score			80
Average (Ave TSS + Ave TT/2)			80
% Species greater than 60% POC			5%
SCCSIS of Site			43%

The SCCSIS assessment of the study areas potential faunal SCC yielded a score of 43%, indicating a medium importance with regards to faunal SCC within the region. All species with a POC of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area. The species listed in table 5 are the only species that attained a POC of greater than 60%. These species will most likely only utilise the study area for foraging purposes, however, due to the surrounding areas being more suitable for foraging purposes, these avifaunal species will most likely predominate in these areas and not within the study area.



5 IMPACT ASSESSMENT

The tables below serve to summarise the significance of potential impacts on faunal habitat that may result due to the proposed activities. A summary of all potential construction and Operational/ Maintenance impacts is provided after the impact discussion. The sections below present the impact assessment according to the method described in Section A. In addition, it also indicates the required mitigatory and management measures needed to minimise potential ecological impacts and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures, assuming that they are fully implemented.

Latent and general everyday impacts which may impact on faunal ecosystems will include any activities taking place within the study area that impact upon the receiving environment. Activities which are likely to negatively affect the faunal habitat integrity of the study area include, but are not limited to, the following:

- No fires whatsoever should be allowed on the study or surrounding areas.
- No trapping or collecting of fauna is to be allowed.
- No dumping of waste or construction material is to occur within the study or surrounding areas.
- Destruction of additional faunal habitat outside of the study area through incorrect demarcation of the construction footprint.



5.1 Impact 1: Loss of Faunal Habitat and Ecological Structure

The faunal habitat in the study area has already been disturbed through anthropogenic activities, as well as by the use of the grassland areas for grazing purposes. The study area exhibited a low diversity in terms of habitat for a variety of faunal species, resulting in only the more common and diverse faunal species being observed within the study area. Should construction and all related maintenance impacts be contained within the study area, and edge effects correctly managed, the construction of the photovoltaic power plant will have a minimal impact on viable faunal impact within the region.

Activities and aspect registry

Pre-Construction	Construction	Operational/Maintenance
Poor planning of infrastructure placement and design	Site clearing and the removal of faunal habitat leading to increased habitat loss	On-going disturbance of faunal habitat within surrounding areas due to human activities associated with maintenance activities
Inadequate design of infrastructure	Invasion of alien plants in disturbed area will reduce the natural faunal habitat	Invasion of alien plants in disturbed area will reduce the natural faunal habitat
	Risk of introduction of alien plant species and further transformation of natural faunal habitat	Risk of introduction of alien plant species and further transformation of natural faunal habitat
	Fire hazards leads to loss of habitat due to increased personnel	Fire hazards leads to loss of habitat due to increased personnel



Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	2	2	2	3	6	7	42 (Low)
Operational/ Maintenance phase	2	2	2	1	4	4	7	28 (Low)

Essential construction phase mitigation measures:

- Demarcate the construction footprint, and ensure that all construction activities remain within this footprint.
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- No trapping or hunting of fauna is to take place.
- Manage edge effects so as to ensure further loss of faunal habitat does not occur in the surrounding areas.
- Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the development area.

Recommended construction phase mitigation measures:

- Fence footprint areas so as to ensure that all activities are contained within the demarcated areas.

Essential operational phase mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint.
- Alien and invasive vegetation control should take place throughout the operational / maintenance phase of the development.
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil.
- No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place.
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

Recommended operational phase mitigation measures:

- Fence footprint areas so as to ensure that all activities are contained within the demarcated areas.

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	2	1	2	3	6	6	36 (Low)
Operational/ Maintenance phase	1	2	1	1	4	3	6	18 (Very low)

Probable latent impacts

- Improperly managed edge effects will result in the loss of faunal habitat in the surrounding areas.



5.2 Impact 2: Loss of Faunal Diversity and Ecological Integrity

Due to past agricultural activities, as well as the current grazing practices in the study area, the herbaceous layer is short and does not contain many faunal species. Due to the disturbed nature of the faunal habitat, faunal diversity was low as expected within such an area due to anthropogenic activities. The surrounding areas, most notably to the south of the study area where a wetland system is present, will provide more suitable habitat for faunal species in the area, and as such species will naturally congregate in these preferred areas. As the study area typically will fall out of the preferred habitat category, the development of the photovoltaic power plant will have a low impact on faunal diversity in the area.

Activities and aspect registry

Pre-Construction	Construction	Operational/Maintenance
Poor planning of infrastructure placement and design	Decline in faunal diversity due to disturbance in study area, vegetation clearance and alteration of natural food webs	Collision of operational vehicles with faunal species
Inadequate design of infrastructure	Collision of construction vehicles with faunal species	Collision of operational vehicles with faunal species
	Loss of faunal habitat through invasion of alien plant species in disturbed areas resulting in altered faunal diversity	Loss of faunal habitat through invasion of alien plant species in disturbed areas resulting in altered faunal diversity
	Fire hazards leads to loss of habitat due to increased personnel	Fire hazards leads to loss of habitat due to increased personnel



Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	2	2	2	3	6	7	42 (Low)
Operational/ Maintenance phase	2	2	2	1	4	4	7	28 (Low)

Essential construction mitigation measures:

- Keep all development infrastructures within designated areas within the study area, whilst minimising the construction as far as possible.
- Planning of temporary roads and access routes should take the site sensitivity plan into consideration. As far as possible pre-existing roads are to be used, whilst new roads must avoid any wetland and water systems.
- No trapping or hunting of fauna is to take place.
- Ensure that no proliferation of alien plant species occurs within the study area.

Recommended construction mitigation measures:

- It is recommended that a speed limit of 40km/h is implemented on all roads running through and accessing the study area, so as to minimise the risk of vehicle collisions with faunal species.

Essential operation mitigation measures:

- No trapping or hunting of fauna is to take place.
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- No dumping or waste disposal is to occur within the study area.
- Alien plant species must be correctly controlled and eradicated within the study area

Recommended operational mitigation measures:

- N/A

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	2	1	2	3	6	5	30 (Very Low)
Operational/ Maintenance phase	1	2	1	1	4	3	6	18 (Very low)

Probable latent impacts

- Decrease in faunal species diversity may lead to loss of species richness in the region over time.



5.3 Impact 3: Impact on important faunal species of conservational concern (Mpumalanga Province)

The proposed photovoltaic power plant is unlikely to have any impact on faunal SCC that occur within both within the Mpumalanga Province as well as on a national scale. This is mainly attributed to the already disturbed nature of the study area, as well as the pre-existing anthropogenic activities and human infrastructure that already impose and restrict the habitation of sensitive faunal species within the study area.

Activities and aspect registry

Pre-Construction	Construction	Operational/Maintenance
Poor planning of infrastructure placement and design	Increased poaching risk and fire hazards due to increased personnel on potential faunal SCC	Increased poaching and fire hazard which would lead to potential loss of SCC as well as the SCC habitat due to increased personnel
Inadequate design of infrastructure	Vehicles accessing the mine area through sensitive habitat areas	Vehicles accessing site through sensitive potential faunal SCC habitat areas
	Collision of vehicles with faunal species.	Collision of vehicles with faunal species.



Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	2	2	2	3	4	7	28 (Low)
Operational/ Maintenance phase	2	2	1	1	4	4	6	24 (Very low)

Essential construction mitigation measures:

- No trapping or hunting of fauna is to take place.
- Ensure that as far as possible all development infrastructure is placed outside of sensitive areas.
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil.

Recommended construction mitigation measures:

- N/A

Essential operational phase mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint.
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place.

Recommended operational mitigation measures:

- N/A

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	1	2	1	1	3	3	5	15 (Very low)
Operational/ Maintenance phase	1	2	1	1	4	3	6	18 (Very low)

Probable latent impacts

- Decrease in potential faunal SCC diversity may lead to loss of species richness overtime within the region.



5.4 Impact Summary

Based on the above assessment it is evident that there are three possible impacts on the faunal ecology within the study area. The table below summarises the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. Table 7 present the summary for the construction phase of the project whilst Table 8 presents the summary for the operational/ maintenance phase impacts.

Table 7: A summary of the impact significance of the construction phase.

Impact	Unmanaged	Managed
1: Loss of faunal habitat and ecological structure	Low	Low
2: Loss of faunal diversity and ecological integrity	Low	Very Low
3: Target related impacts on red data list (RDL) faunal species	Low	Very Low

Table 8: A summary of the impact significance of the operational/ maintenance phase.

Impact	Unmanaged	Managed
1: Loss of faunal habitat and ecological structure	Low	Very Low
2: Loss of faunal diversity and ecological integrity	Low	Very Low
3: Target related impacts on red data list (RDL) faunal species	Very Low	Very Low

From the impact assessment it is evident that impact significance throughout all the phases low to very low significance throughout the life of the project. The development therefore is deemed to have a very limited impact on faunal species in the region, as the area has already been disturbed and the faunal species are already exhibiting a preference for more suitable habitat in the surrounding areas, where persecution from anthropogenic activities is reduced and availability of resources is greater.



6 RECOMMENDATIONS

After the conclusion of this assessment, it is the opinion of the ecologists that the proposed activities on the study area be considered favourably, provided that the recommendations below are adhered to:

- With respect to faunal diversity and habitat intactness, Alternative 1 presents the best option for the construction of the photovoltaic power plant. Although Alternative 3 does not present a higher level of faunal habitat intactness or diversity, the presence of wetlands in close proximity may mean that faunal species utilising the wetlands may be affected by the proposed development if this alternative is pursued.
- It must be ensured that, as far as possible, any proposed surface infrastructure is placed outside of sensitive faunal habitat areas such as wetlands and associated buffer zone.
- Areas of increased ecological importance and sensitivity, such as the wetlands along with the associated buffer zone, should be considered during all phases of planning and construction activities.
- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat, need to be strictly managed in all areas of increased ecological sensitivity.
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.
- No trapping or hunting of fauna is to take place.
- All informal fires in the vicinity of operations and new construction areas should be prohibited.



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- MP SOER?



FAUNAL APPENDICES



Appendix 1: RDL Mammalian species that occur in the Mpumalanga Province (MP SoER, 2003).

English Name	Species	Status
Cape mole rat	<i>Georchus capensis yatesi</i>	EN
Sclater's golden mole	<i>Chlorotalpa sclateri montana</i>	CR
Highveld golden mole	<i>Amblysomus septentrionalis</i>	VU
Rough-haired golden mole	<i>Chrysothalpa villosus rufopallidus</i>	CR
Rough-haired golden mole	<i>Chrysothalpa villosus rufus</i>	EN
Juliana's golden mole	<i>Neamblysomus julianae</i>	EN
Robust golden mole	<i>Amblysomus robustus</i>	VU
Meester's golden mole	<i>Amblysomus hottentotus meesteri</i>	VU
Laminate vlei rat	<i>Otomys laminatus</i>	VU
Peak-saddle horseshoe bat	<i>Rhinolophus blasii empusa</i>	EN
Lesser long-fingered bat	<i>Miniopterus fraterculus</i>	VU
Welwitsch's hairy bat	<i>Myotis welwitschii</i>	EN
Short-eared trident bat	<i>Cloeotis percivali australis</i>	EN
Antbear	<i>Orycteropus afer</i>	NE
Oribi	<i>Ourebia ourebi</i>	VU
African striped weasel	<i>Poecilogale albinucha</i>	NE
Wild dog	<i>Lycaon pictus</i>	EN
Pangolin	<i>Manis temminckii</i>	VU
Aardwolf	<i>Proteles cristatus</i>	NE
African Leopard	<i>Panthera pardus</i>	NE
Natal red rock rabbit	<i>Pronolagus crassicaudatus ruddi</i>	NE

LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN.

Appendix 2: List threatened bird species which occur in Mpumalanga (MP SoER, 2003).

English Name	Species	Status
Whitewinged Flufftail	<i>Sarothrura ayresi</i>	CR
Rudd's Lark	<i>Heteromirafra ruddi</i>	CR
Yellowbreasted Pipit	<i>Hemimacronyx chloris</i>	VU
Bald Ibis	<i>Geronticus calvus</i>	VU
Botha's Lark	<i>Spizocorys fringillaris</i>	EN
Wattled Crane	<i>Bugeranus carunculatus</i>	CR
Blue Crane	<i>Anthropoides paradiseus</i>	VU
Grey Crowned Crane	<i>Balearica reguloru,</i>	VU
Blue Swallow	<i>Hirundo atrocaerulea</i>	CR
Pinkthroated Twinspot	<i>Hypargos margaritatus</i>	NT
Chestnutbanded Plover	<i>Charadrius pallidus</i>	NT
Striped Flufftail	<i>Sarothrura affinis</i>	VU
Southern Ground Hornbill	<i>Bucorvus leadbeateri</i>	VU
Blackrumped Buttonquail	<i>Turnix hottentotta nana</i>	EN
Blue Korhaan	<i>Eupodotis caerulescens</i>	VU
Stanley's Bustard	<i>Neotis denhami</i>	VU
African Marsh Harrier	<i>Circus ranivorus</i>	VU
Grass Owl	<i>Tyto capensis</i>	VU
Whitebellied Korhaan	<i>Eupodotis cafra</i>	VU
Saddlebilled Stork	<i>Ephippiorhynchus senegalensis</i>	CR
Lappetfaced Vulture	<i>Torgos tracheliotos</i>	EN
Whiteheaded Vulture	<i>Trigonoceps occipitalis</i>	EN
Bateleur	<i>Terathopius ecaudatus</i>	VU
Cape Vulture	<i>Gyps coprotheres</i>	VU
Martial Eagle	<i>Polemaetus bellicosus</i>	VU
Peregrine Falcon	<i>Falco peregrinus minor</i>	VU
Taita Falcon	<i>Falco fasciinucha</i>	NT

LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province.



Appendix 3: Threatened amphibian species of Mpumalanga (SoER, 2003).

English Name	Species	Status
Karoo Toad	<i>Bufo gariopensis nubicolus</i>	VU
Natal Ghost Frog	<i>Heleophryne natalensis</i>	VU
Spotted Shovel-Nosed Frog	<i>Hemisus guttatus</i>	VU
Yellow Striped Reed Frog	<i>Hyperolius semidiscus</i>	VU
Plain Stream Frog	<i>Strongylopus wageri</i>	VU
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	VU
Greater Leaf-Folding Frog	<i>Africalus fornasinii</i>	VU
Whistling Rain Frog	<i>Breviceps sp.</i>	VU

LC = concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN. Least

Appendix 4: Threatened reptile species of Mpumalanga (MP SoER, 2003).

English Name	Species	Status
Haacke's flat gecko	<i>Afroedura haackei</i>	EN
Abel Erasmus Pass flat gecko	<i>Afroedura sp.</i>	EN
Mariepskop flat gecko	<i>Afroedura sp.</i>	EN
Rondavels flat gecko	<i>Afroedura sp.</i>	EN
Forest/Natal purpleglossed snake	<i>Amblyodipsas concolor</i>	VU
Lowveld shieldnosed snake	<i>Aspidelaps scutatus intermedius</i>	VU
Dwarf chameleon	<i>Bradypodion transvaalense complex</i>	VU
Sungazer/ Giant girdled lizard	<i>Cordylus giganteus</i>	VU
Barberton girdled lizard	<i>Cordylus warreni barbertonensis</i>	VU
Lebombo girdled lizard	<i>Cordylus warreni warreni</i>	VU
Swazi rock snake	<i>Lamprophis swazicus</i>	VU
Transvaal flat lizard	<i>Platysaurus orientalis orientalis</i>	NT
Wilhelm's flat lizard	<i>Platysaurus wilhelmi</i>	VU
Montane burrowing skink	<i>Scelotes mirus</i>	LC
Breyer's longtailed seps	<i>Tetradactylus breyeri</i>	VU

R = Rare, DD = Data Deficient, LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Appendix 5: Threatened invertebrate species of Mpumalanga (SoER, 2003).

English Name	Species	Status
Barbara's Copper	<i>Aloeides barbarae</i>	EN
Cloud Copper	<i>Aloeides nubilis</i>	VU
Rossouw's Copper	<i>Aloeides rossouwi</i>	EN
Stoffberg Widow	<i>Dingana fraterna</i>	EN
Irving's Blue	<i>Lepidochrysops irvingi</i>	VU
Swanepoel's Blue	<i>Lepidochrysops swanepoeli</i>	EN
Jeffery's Blue	<i>Lepidochrysops jefferyi</i>	EN
Rossouw's Blue	<i>Lepidochrysops rossouwi</i>	VU
Marsh Sylph*	<i>Metisella meninx</i>	VU

R = Rare, DD = Data Deficient, LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province. * Very little detailed or general information exists on terrestrial invertebrates in the Limpopo Province, thus in general there is very little consolidated information regarding invertebrates (Limpopo DFED, 2004).

