Biodiversity Baseline & Impact Assessment – Xhariep Export Programme (XEP) Agricultural Development and associated infrastructure

Xhariep District Municipality, Free State

Report Date: August 2022

CLIENT

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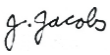
Report Writer	**Jan Jacobs** 
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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

List of Acronyms

Acronym	Definition
ADU	Animal Demography Unit
AOO	Area of Occupancy
BI	Biodiversity Importance
CBA	Critical Biodiversity Area
CI	Conservation Importance
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries, and the Environment
EOO	Extent of Occurrence
EN	Endangered
ESA	Ecological Support Area
FI	Functional Integrity
GBIF	Global Biodiversity Information Facility
IAP	Invasive Alien Plant
IBA	Important Bird and Biodiversity Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
MP	Moderately Protected
NBA	National Biodiversity Assessment
NEMBA	National Environmental Management Biodiversity Act
NP	Not Protected
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
ONA	Other Natural Area
POSA	Plants of Southern Africa
PP	Poorly Protected
SACAD	South Africa Conservation Areas Database
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Areas Database
SCC	Species of Conservation
SEI	Site Ecological Importance
SWSA	Strategic Water Source Area
VU	Vulnerable
WP	Well Protected

Executive Summary

JN Venter Beleggings Trust is proposing the development of an expansion of a centre pivot irrigation farm on a site located Southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754. The total area on all three portions is 4 800 ha, however only 2 690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality (Figure 1-1). The agricultural development will entail the following at a minimum:

- Developmental of centre pivot areas (cultivation and irrigation) which is planned to take approximately 2 154 ha or more within the project site;
- Two irrigation water storage dams, with a combined surface area of 82 ha in extent;
- Establishment of an irrigation pipeline network from the irrigation dams to the centre pivot areas;
- A new pump station taking a total surface area of 549 m^2;
- A 5 MW solar PV facility occupying an area of 9 ha, and an associated overhead power line of ~6.9 km in length; and
- A Battery Energy Storage System covering a surface area of 0.36ha.

This assessment describes the composition of the floral and faunal community within the area affected by the proposed development, and the possible impacts on the local biota. In order to achieve this, a review of available desktop information and a field survey for the Project Area of Influence (PAOI) was undertaken. The PAOI comprised of a 500 m buffer around the development boundary.

The vegetation condition of the PAOI was regarded as degraded due to the dominance of the graminoid assemblage by Indicator II species and the dominance in certain areas by *Rhigozum trichotomum*. Nevertheless, the PAOI was observed to support a diversity of fauna species including SCC.

Class	Family	Scientific Name	Common Name	Conservation Status	
				Regional	Global
Aves	Accipitridae	*Aquila rapax rapax*	Southern Tawny Eagle	EN	VU
Aves	Accipitridae	*Aquila verreauxii*	Eagle, Verreaux's	VU	LC
Aves	Falconidae	*Faclo biarmicus*	Lanner Falcon	VU	LC
Aves	Otididae	*Ardeotis kori kori*	Southern Kori Bustard	NT	NT
Aves	Sagittariidae	*Sagittarius serpentarius*	Secretarybird	VU	EN
Mammalia	Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	NT	NT

In addition to these SCC, the PAOI also supports species that are regarded as keystone fauna, within the Nama Karoo Biome. These keystone fauna, which comprise of ecosystem engineers such as *Orycteropus afer afer* (Southern Aardvark), *Geosciurus inauris* (South African Ground Squirrel) and *Messor capensis*, as well as seed dispersers such as *Stigmochelys pardalis* (Leopard Tortoise), are vital in maintaining ecosystem structure and functioning. In addition to supporting keystone fauna, the PAOI overlaps with a National Protected Areas Expansion Strategy (NPAES) Focus Area, Critical Biodiversity Areas and Ecological Support Areas. The PAOI is also traversed by numerous ephemeral drainage systems that are connected to the Lemoenspruit, with the latter categorised as an Upstream Management Area.

The Site Ecological Importance (SEI) is summarised in the table below.

Ecological Features (Area [ha])	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Critical Biodiversity Area 1, Calcrete Outcrop and Lotic Systems including Buffer Zones (3 209)	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2.	Very High Very large (> 100 ha) intact area for any conservation status of ecosystem type. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.	Very High	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	Very High
Critical Biodiversity Area 2 and Ecological Support Areas (5 138)	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2.	Very High Very large (> 100 ha) intact area for any conservation status of ecosystem type. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.	Very High	High Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.	High
Modified Areas (207)	Very Low No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.	Low Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area.	Very Low	Very High Habitat that can recover rapidly (~ less than 5 years) to restore > 75%28 of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.	Very Low

The expected impacts of the proposed development will include the following:

- habitat loss and fragmentation;
- degradation of surrounding habitat; and
- pesticide use during the operational phase.

In order to reduce the significance of the impacts several mitigation measures can be implemented during the construction and operational phase of the proposed developed. All areas identified as possessing a 'Very High' SEI and riparian buffers must be avoided. During the construction phase, displacement and disturbance of fauna can be reduced by restricting habitat loss and disturbance to within the footprint of the development area. All personnel should undergo environmental induction with regards to the local fauna and in particular awareness about not harming, collecting or hunting terrestrial species.

Rehabilitation of disturbed areas must occur to mitigate against erosion and the encroachment of invasive plants as this will lead to a negative shift in the wellbeing of the biotic community within the landscape. It is important to ensure that regular monitoring for invasive plant encroachment occurs during the operation phase. This should be undertaken quarterly during the first two years of the operation phase and annually for the life of the project. This is to ensure that the area is not degraded further.

Certain species may be highly susceptible to the pesticide use, especially in which the breeding season coincides with the most important application of pesticides. Exposure to pesticides during reproductive stages affects hatching success and fledgling survival. Alteration of feeding behaviour compromises the immune system, and increased predation further reduces the ability of these avifauna species to maintain vigorous populations, including SCC. This negative shift in avifauna populations will lead to detrimental trophic cascade effects. Intensive pesticide applications have been documented in causing increased pest resistance. The lack of a healthy predator population density will lead to greater population explosions of pest species, especially considering the latter can recover at a faster rate due to the faster reproductive rate. This impact not only applies to the avifauna species assemblage, but to the herpetofauna and mammal species assemblage as well. In addition, reduction of population density, or complete loss of, the mesocarnivore community will lead to considerable increase in potential pest species, such as rodents. Pesticides should not be used to control pest species due to the high negative impact associated with it. Only if deemed to be absolutely necessary, an appropriate organic biocide must be the only option considered. If any pesticide, including organic biocides, is to be used, the density and composition of the avifauna community must be monitored within the PAOI and proximal landscape. This is especially pertinent to SCC.

Based on the outcomes of the SEI determination, the PAOI possesses areas of 'Very High' SEI and 'High' SEI. Cumulative impacts within the region are a concern and based on the extent of land-use change within the surrounding landscape, it was rated as 'High'. The main expected impacts of the proposed development will be the loss of habitat and mortality of fauna.

The 'High' SEI denotes that "avoidance mitigation wherever possible must be implemented. This includes changes to project infrastructure design to limit the amount of habitat impacted." (SANBI, 2020). Considering that the area has been zoned for agriculture, development may proceed in the 'High' SEI Areas, as long as the 'Very High' SEI areas are avoided and actively managed. Where pivots overlap minor drainage lines, activity adjacent to these is possible, albeit only if the channel is rehabilitated and actively managed. In addition, all of the mitigation measures and Biodiversity Impact Management Actions provided in this report must be implemented if the proposed development is authorised. This is especially pertinent to avifauna monitoring as prescribed below.

Management Outcome: Avifauna				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Pesticides should not be used to control pest species due to the high negative impact associated with it. Only if deemed to be absolutely necessary, an appropriate organic biocide must be the only option considered.	Operational	Project Manager	Pesticide Use	Ongoing
The avifauna species assemblage within the PAOI must be monitored bi-annually (twice a year) during the wet and dry season. The feathers of any carcasses found must be used for pesticide analysis.	Operational	Project Manager	Avifauna	Bi-annually (twice a year)

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1 Introduction

1.1 Background

JN Venter Beleggings Trust is proposing the agricultural development and associated infrastructure on a site located Southwest of Luckhoff and Koffiesfontein in the Letsemeng Local Municipality of the Xhariep District Municipality in the Free State Province (Figure 1-1).

The full extent of the development area is ~2690 ha and is located across the following 10 interlinked properties (farm portions):

- Farm Diepdraai 754;
- Farm Weltevreden 755;
- Farm Lemoen- spruit 667; and
- Portion of the Farm Grootpoort 168.

The site is accessible via the R48 road which pass directly through the centre of the proposed site. The R369 links to R48 south-west of the proposed site. It is proposed that ~2 690 ha will be transformed across the property for the establishment of the agricultural development.

The Biodiversity Company (TBC) was appointed to undertake a Biodiversity Impact Assessment for the proposed Agricultural Development and Associated Infrastructure. The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). See Appendix A for the Protocol Checklist and where the checklist items are located in the report.

1.2 Project Description

The project site is proposed to accommodate agricultural development (cultivation), as well as the associated infrastructure, which is required for such development, and this will include:

- Developmental of centre pivot areas (cultivation and irrigation) which is planned to take approximately 2 154 ha or more within the project site;
- Two irrigation water storage dams, with a combined surface area of 82 ha in extent;
- Establishment of an irrigation pipeline network from the irrigation dams to the centre pivot areas;
- A new pump station taking a total surface area of 549 m^2;
- A 5 MW solar PV facility occupying an area of 9ha, and an associated overhead power line of ~6.9 km in length; and
- A Battery Energy Storage System covering a surface area of 0.36ha.

The proposed development will require the following infrastructure (Figure 1-2):

Infrastructure	Purpose
Centre Pivot (Cultivation and Irrigation System)	2 154 ha for cultivation
Irrigation Pipeline Network	Irrigation pipeline network to take water from the dams to the various centre pivot areas for irrigation
Two Water Storage Systems	Two main storage dams are proposed for utilization on the agricultural development. Dam 1 – 3.1 million m^3 Dam 2 – 1 million m^3
Pump station	A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams. Total surface area of 549 m^2
Solar PV area and overhead power line	Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams. 9 ha surface area with three alternative sites being considered.
Battery Energy Storage System	A battery system will be used to collect any additional power generated by the PV facility for use as and when required.

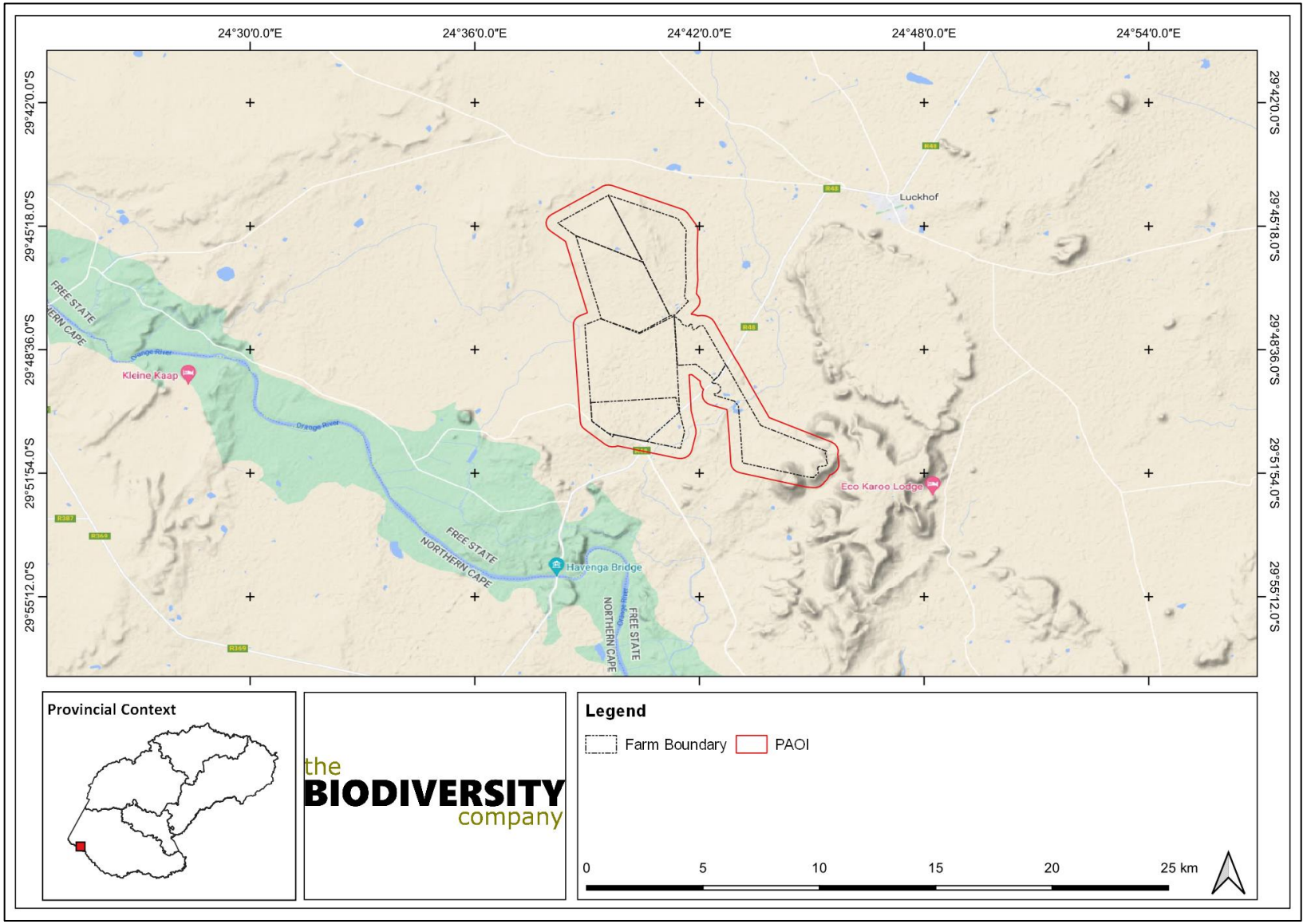


Figure 1-1 Map illustrating the location of the proposed Xhariep Export Programme Agricultural Development PAOI, Free State

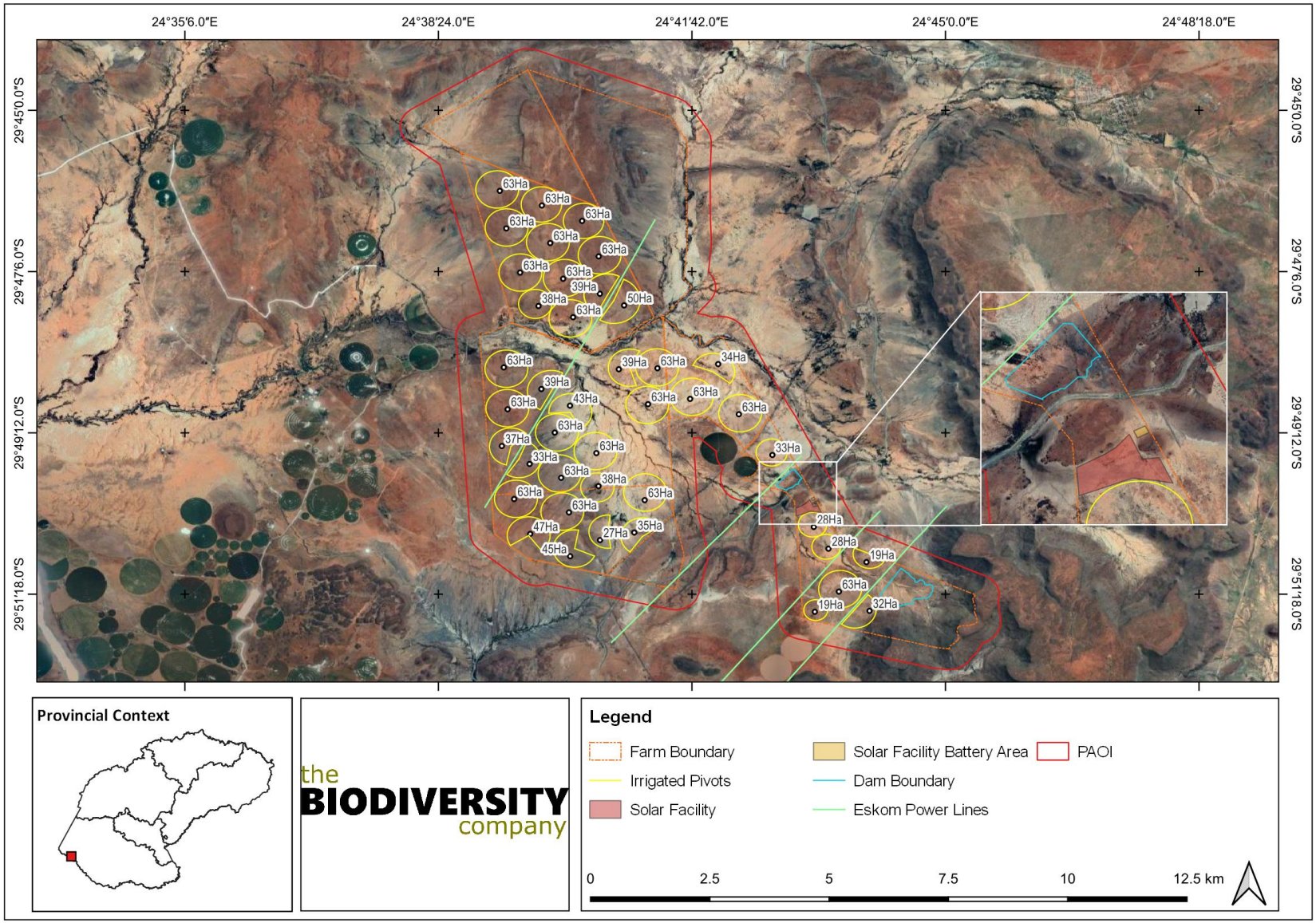


Figure 1-2 Map illustrating the layout design of the proposed Xhariep Export Programme Agricultural Development

1.3 Scope of Work

The principal aim of the assessment was to provide information to guide the risk of the proposed development to the flora and fauna communities of the ecosystems associated with the project area. The scope of work for the assessment comprises of the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape;
- Desktop assessment to compile an expected species list and possible flora and fauna Species of Conservation Concern (SCC) (Figure 1-3) that potentially occur within the proposed PAOI;
- Field survey to ascertain the species composition of the present flora and fauna community within the PAOI;
- Delineate the Site Ecological Importance (SEI) within the PAOI;
- Identify the manner that the proposed development impacts the flora and fauna community and evaluate the level of risk of these potential impacts; and
- The prescription of mitigation measures and recommendations for identified risks.

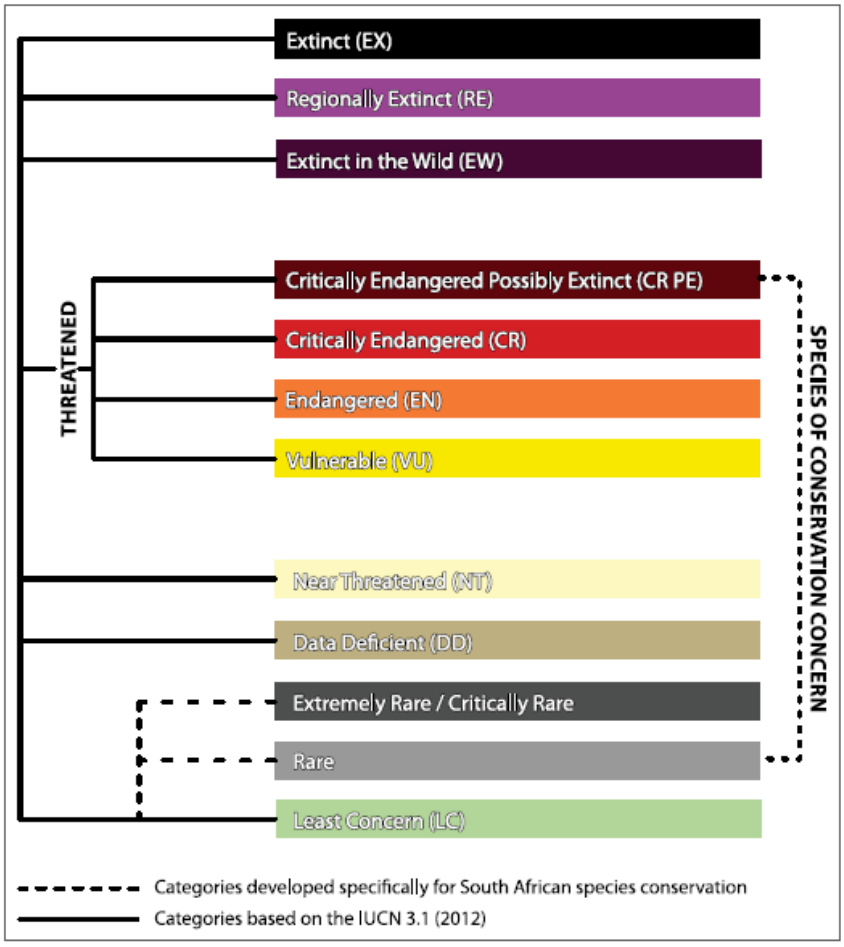


Figure 1-3 The different categories of Species of Conservation Concern modified from the IUCN's extinction risk categories. Source: SANBI (2020)

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The Project Area of Influence (PAOI) was a 500 m buffer around the farm boundary. Any alterations to the area and/or missing GIS information pertaining to the development layout would have affected the area surveyed;
- Whilst every effort was made to cover as much of the site as possible, it is possible that some flora and fauna species that are present on site were not recorded during the field survey, especially secretive or rare species;
- Only a single survey was undertaken in June (winter) and hence there is a high probability that not all species of fauna and flora will be recorded. This is due to the dormancy of certain taxa during this season;
- Due to accessibility and time constraints the meandering track only covered a minor portion of the PAOI. Nevertheless, effort was focused on those features that were representative of the habitats present, as well as those areas deemed to be of ecological importance; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by 5 m.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements relevant to biodiversity and conservation in the Free State

Region	Legislation
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on Wetlands (RAMSAR Convention, 1971)
	The United Nations Framework Convention on Climate Change (UNFCC,1994)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
National	Constitution of the Republic of South Africa (Act No. 108 of 2006)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 42946 (January 2020)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 43110 (March 2020)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations
	National Protected Areas Expansion Strategy (NPAES)
	Environmental Conservation Act (Act No. 73 of 1983)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Spatial Biodiversity Assessment (NSBA)
	World Heritage Convention Act (Act No. 49 of 1999)
	National Heritage Resources Act, 1999 (Act 25 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations, 2014
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
	Sustainable Utilisation of Agricultural Resources (Draft Legislation).
	White Paper on Biodiversity
Provincial	Boputhatswana Nature Conservation Act 3 of 1973

2 Methods

This section details the methods used in the assessment and is divided into the desktop and field components.

2.1 Project Area

According to the land type database (Land Type Survey Staff, 1972 - 2006), the PAOI is characterised by the Ae 278, Ag150, Ag151,Da 24, Da103 and Ib 207 land types. The Ae and Ag land types are characterised with Hutton and Clovelly soil forms which are red-yellow apedal and freely drained soils according to the Soil Classification Working Group, (1991) with the possibility of other soils and bare rocks also occurring. The Da land types commonly have duplex soils like the Swartland, Valsrivier as well as other associated soils that includes, Oakleaf, Mispah and Glenrosa soil forms. The Ib land types are characterised with Mispah and Swartland soil forms associated with other miscellaneous soils and bare rocks in the terrains. Red mesotrophic and eutrophic soils also occur in the area, associated with shallow and rocky profiles in the upper terrains. Lime is mostly absent in the upper areas and can occur in the lower areas. The cross-sectional profile of the aforementioned land types are illustrated in Figure 2-1 to Figure 2-6.

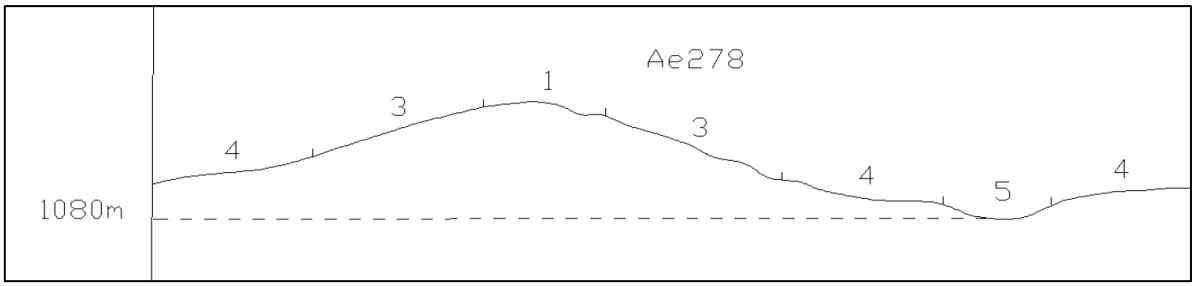


Figure 2-1 Illustration of land type Ae 278 terrain unit (Land Type Survey Staff, 1972 - 2006)

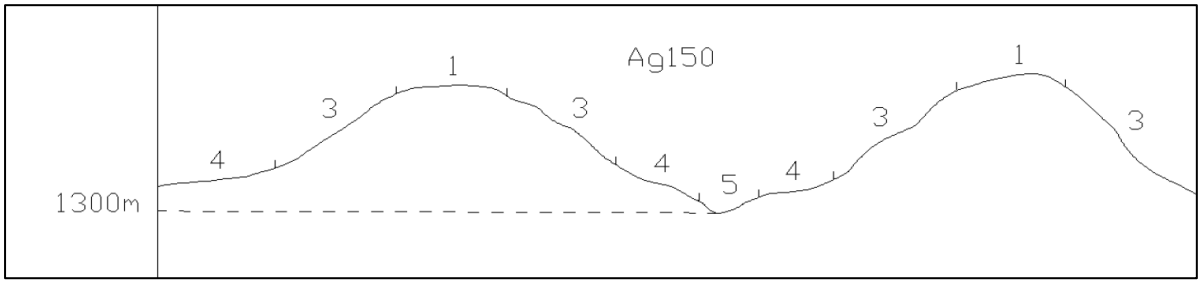


Figure 2-2 Illustration of land type Ag 150 terrain unit (Land Type Survey Staff, 1972 - 2006)

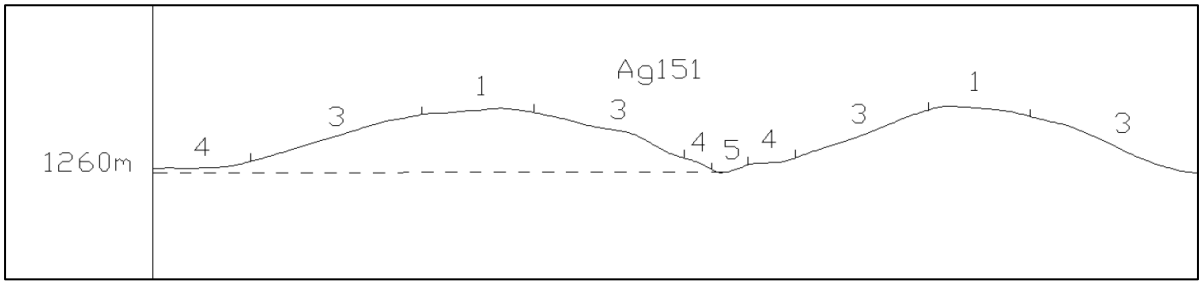


Figure 2-3 Illustration of land type Ag 151 terrain unit (Land Type Survey Staff, 1972 - 2006)

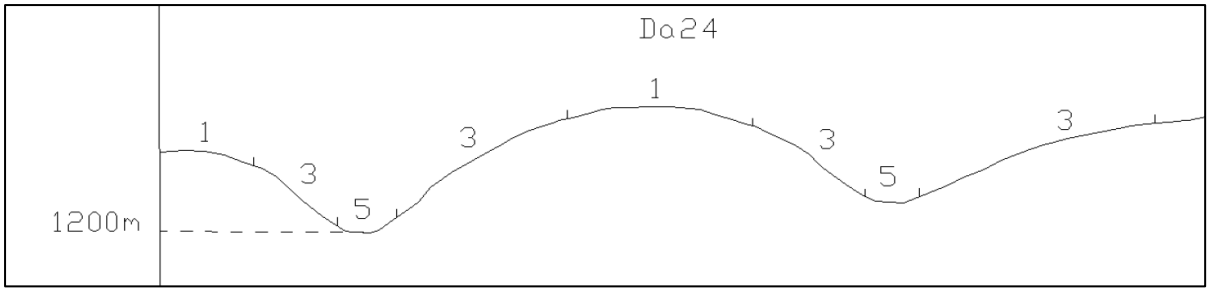


Figure 2-4 Illustration of land type Da 24 terrain unit (Land Type Survey Staff, 1972 - 2006)

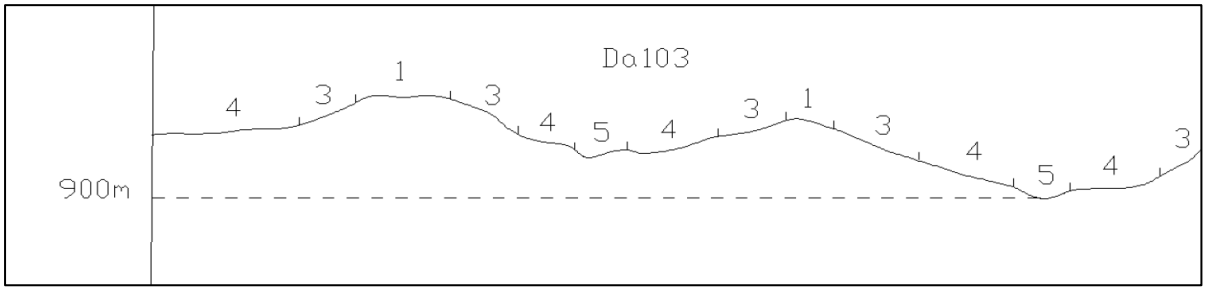


Figure 2-5 Illustration of land type Da 103 terrain unit (Land Type Survey Staff, 1972 - 2006)

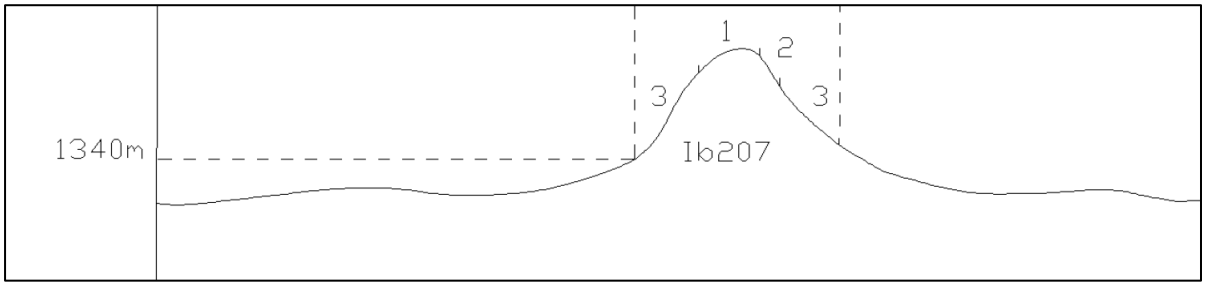


Figure 2-6 Illustration of land type Ib 207 terrain unit (Land Type Survey Staff, 1972 - 2006)

Climate data for the project area was obtained from https://en.climate-data.org/. This climate is considered to be a Hot semi-arid climate (BSh) according to the Köppen-Geiger climate classification. Hot semi-arid climates (type "BSh") tend to be located in the 20s and 30s latitudes of the tropics and subtropics, typically in proximity to regions with a tropical savanna or a humid subtropical climate. These climates tend to have hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. Hot semi-arid climates are most commonly found around the fringes of subtropical deserts.

January is the hottest month of the year with a mean temperature of 24.9 °C. The lowest mean temperature is recorded in July, at 9.8 °C. Most precipitation occurs during January (mid-Summer), with an average of 67 mm. Precipitation is the lowest in July, with an average of 9 mm.

The latest available landcover dataset indicates that the PAOI overlaps landcover features classified as shrubland, natural grassland, herbaceous wetlands, and pivot irrigated commercial annuals, with patches of eroded areas.

2.2 Desktop Assessment

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets in order to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

2.2.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- National Biodiversity Assessment 2018 (Skowno *et al*, 2019) - The purpose of the National Biodiversity Assessment (NBA) is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:
    - Ecosystem Threat Status – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition.
    - Ecosystem Protection Level – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems.
- Protected areas:
    - South Africa Protected Areas Database (SAPAD) (DFFE, 2021a) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
    - National Protected Areas Expansion Strategy (NPAES) (DFFE, 2021b) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.

- Important Bird and Biodiversity Areas (BirdLife South Africa, 2015) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;

- Free State Biodiversity Sector Plan (DESTEA, 2015) – A key objective of the Free State Provincial Spatial Development Plan is to integrate and standardize planning at all spheres of government in the province with specific reference to amongst others facilitating land-use classification of the entire land surface of the province. To this extent a set of dedicated Spatial Planning Categories (SPCs) were developed which provide a spatial framework to guide decision-making regarding land-use at all levels of planning. The SPCs represent a classification system that indicates the most suitable, or a range of, land use options for a certain piece of land. Associated with each SPC category is land use guidelines which when implemented ensures a balance between development and conservation. Mainstreaming of the biodiversity plan into spatial planning process will be achieved by aligning the biodiversity plan categories with those of the SPCs so that planning according to SPC will then automatically also adopt the biodiversity plan categories and their associated land use guidelines; and

- Hydrological Context

    - South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al.,* 2018) – A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Assessment of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types as well as pressures on these systems.

    - National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.,* 2011) – The NFEPA database provides strategic spatial priorities for conserving the country's freshwater ecosystems and associated biodiversity as well as supporting sustainable use of water resources.

2.2.2 Desktop Flora Assessment

The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) was used in order to identify the vegetation type that would have occurred under natural or pre-anthropogenically altered conditions. Furthermore, the Plants of Southern Africa (POSA) database was accessed to compile a list of expected flora species within the proposed development area and surrounding landscape (Figure 2-7). The Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2020) was utilized to provide the most current national conservation status of flora species.

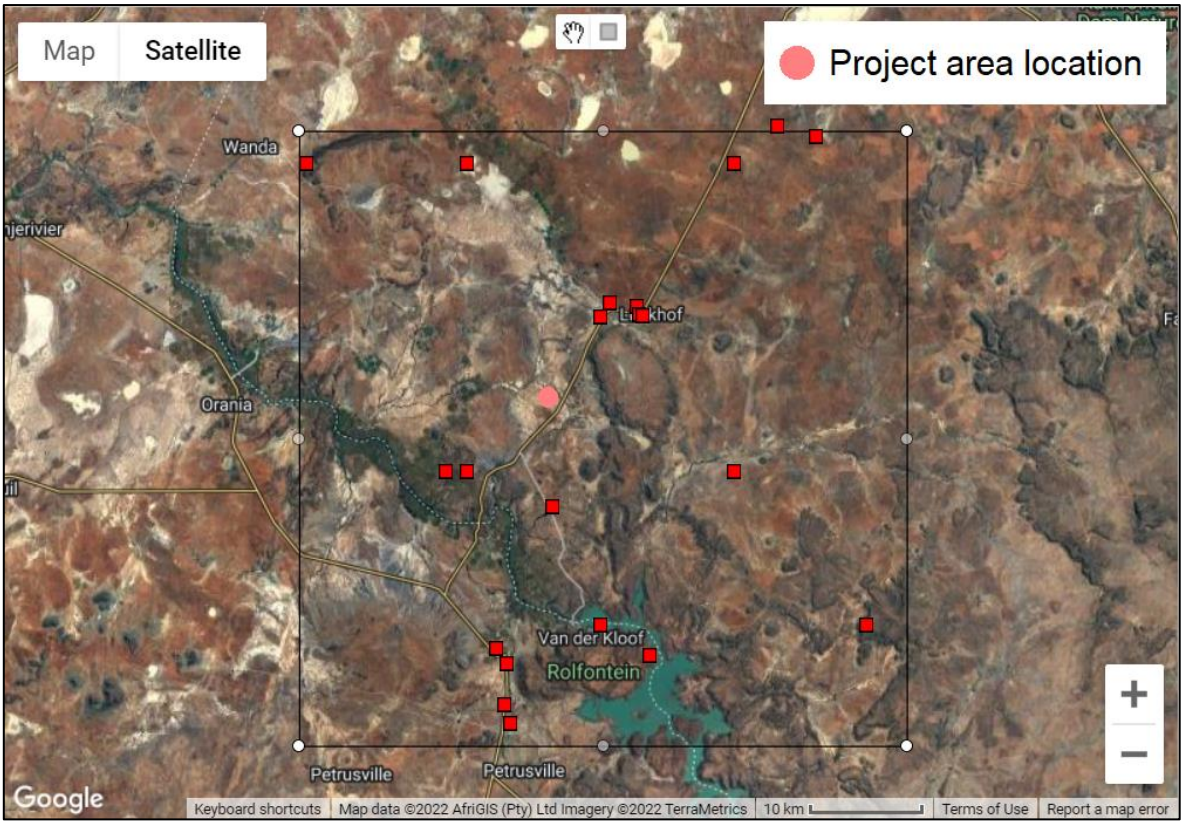


Figure 2-7 Map illustrating extent of area used to obtain the expected flora species list for the proposed Xhariep Export Programme PAOI from the Plants of South Africa (POSA) database

2.2.3 Desktop Fauna Assessment

The faunal desktop assessment comprised of the following:

- Compiling an expected herpetofauna (amphibians and reptiles) list generated from the IUCN spatial dataset (2017) and the Animal Demography Unit (FitzPatrick Institute of African Ornithology, 2022a; FitzPatrick Institute of African Ornithology, 2022b) using the 2924 quarter degree square;
- Compiling an expected avifauna list, generated from the South African Bird Atlas Project 2 (SABAP2) dataset using the 2945_2435, 2945_2440, 2945_2445, 2950_2435, 2950_2440, 2950_2445, 2955_2440 and 2955_2445 pentads; and
- Compiling an expected mammal list generated from the IUCN spatial dataset (2017) and the Animal Demography Unit (FitzPatrick Institute of African Ornithology, 2022c) using the 2924 quarter degree square.

2.3 Field Assessment

A single field survey was undertaken during the 6th – 10th of June 2022 (Winter), which constitutes a dry-season survey, to determine the presence of Species of Conservation Concern (SCC) and to ascertain an overview of the ecological condition of the PAOI. Effort was made to cover the different habitat types within the limits of time and access. The fieldwork was placed within targeted areas perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. Fauna species observed adjacent to, but not necessarily within, the PAOI were also

recorded as species occupying open habitats or arid regions exhibit larger home ranges than those inhabiting wooded or high rainfall areas (Ofstad *et al*, 2016).

2.3.1 Flora Survey

The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting flora SCC and maximising floristic coverage (Goff *et al*, 1982). In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity.

Homogenous vegetation units were subjectively identified using satellite imagery and existing land cover maps. The floristic diversity and search for flora SCC was conducted through meanders within representative habitat units.

During the survey, notes were made regarding current impacts, subjective recording of dominant vegetation species and any sensitive features (e.g., wetlands, outcrops etc.).

Relevant field guides and texts consulted for identification purposes in the field during the survey included the following:

- Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions (Fish *et al,* 2015);
- iNaturalist;
- Flowering Plants of the Southern Kalahari (Van Rooyen and Van Rooyen, 2019);
- Problem Plants and Alien Weeds of South Africa (Bromilow, 2010);
- Field Guide to Succulents in Southern Africa (Smith *et al,* 2017);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Medicinal Plants of South Africa (Van Wyk *et al.,* 2013).

2.3.2 Fauna Survey

The faunal field survey comprised of the following active and passive techniques:

- Active hand-searches - are used for species that shelter in or under particular micro-habitats (typically in dense shrubs, under rocks and coarse woody debris);
- Visual and auditory searches - This typically comprised of traversing the PAOI and using a camera to view species from a distance without them being disturbed as well as listening to species calls. Due to the climatic and habitat characteristics of the project area, the use of signs and tracks was vital in recording species (Figure 2-8A);
- Camera Traps (Figure 2-8B) – Four camera traps were deployed within the PAOI for 60 hours, accounting for a total of 280 trapping hours. The camera traps were baited with tinned sardines to improve sampling efficacy;
- Sherman Traps (Figure 2-8B) – Five Sherman traps were deployed within the PAOI for 72 hours, accounting for a total of 360 trapping hours. Sherman traps were baited with a mixture of peanut butter, oats and honey to improve sampling efficacy; and
- Utilisation of local knowledge – Property owners and farm staff were asked what species they have seen within the PAOI.

Diagnostic features of the individuals that were captured were photographed at site and released (Figure 2-8D).

Relevant field guides and texts consulted for identification purposes included the following:

- Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- A Complete Guide to the Snakes of Southern Africa (Marais, 2004);
- Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates *et al,* 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez and Carruthers, 2009);
- Stuarts' Field Guide to Mammals of Southern Africa including Angola, Zambia & Malawi (Stuart and Stuart, 2015); and
- Mammals of Southern Africa and their Tracks & Signs (Gutteridge & Liebenberg, 2021).

The location and extent of the meandering track and passive sampling points is illustrated in Figure 2-9 below. It is important to note that the Sherman traps were placed external to the PAOI due to accessibility and time constraints. Sherman traps must be serviced daily in order to ensure that the risk of mortality of any captured individuals is impeded and that the traps are reset. This area provided easy access and was on en route to the PAOI.

Figure 2-8 ***Photographs illustrating sampling methods utilised in the biodiversity impact assessment for the proposed Xhariep Export Programme Agricultural Development. A) Recording tracks and other signs such as scat, B) Camera traps placed within drainage lines and adjacent to burrows which are imperative for recording fauna in arid or semi-arid regions, C) Sherman trap placed within dense plant growth and D) Photographing diagnostic features of specimens captured***

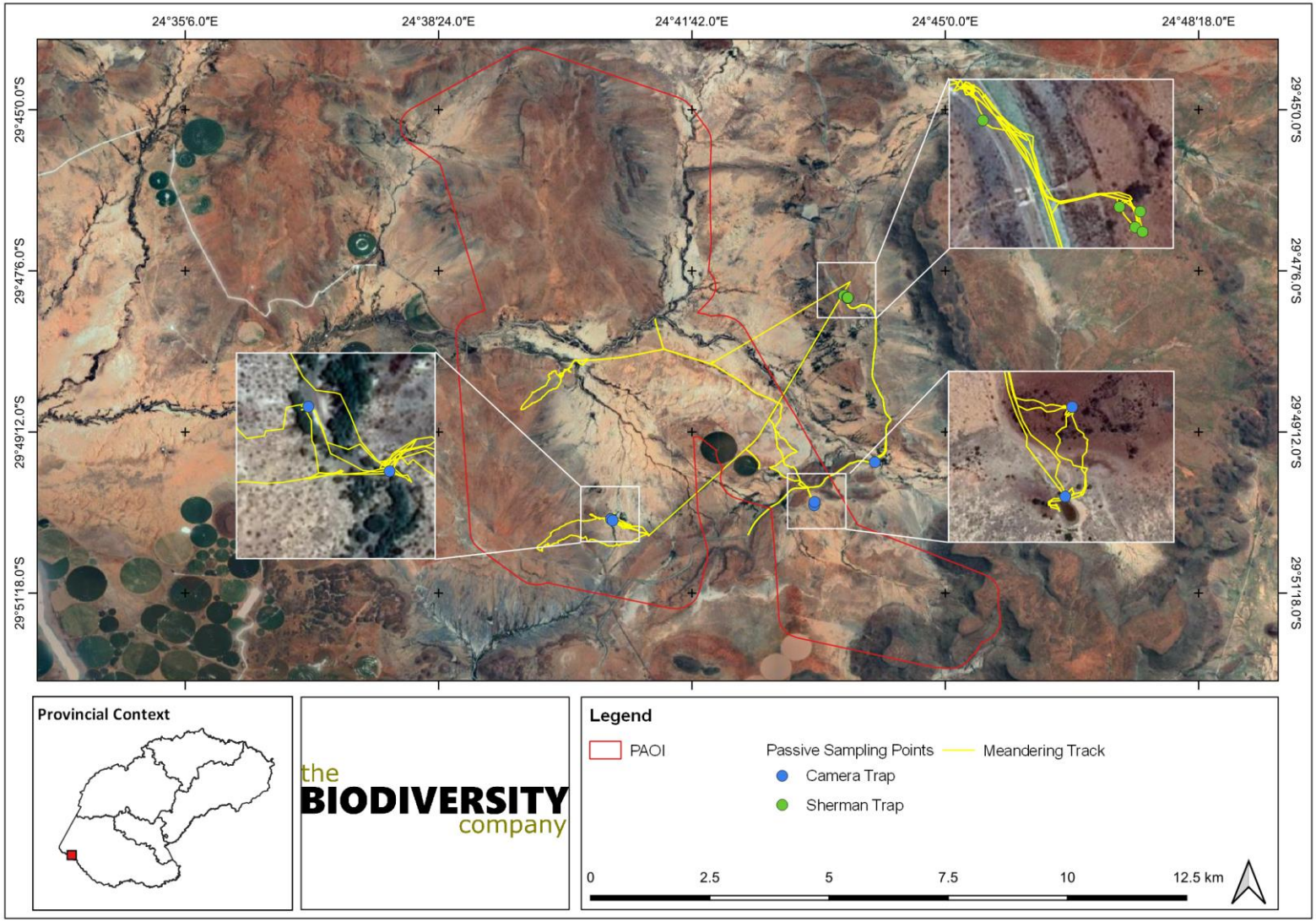


Figure 2-9 ***Map illustrating location and extent of meandering track and passive sampling points utilised in the biodiversity impact assessment for the proposed Xhariep Export Programme Agricultural Development***

2.4 Site Ecological Importance

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as available satellite imagery. These habitat types were assigned Site Ecological Importance (SEI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes. The determination of the SEI was in accordance with the method described in the Species Environmental Assessment Guideline (SANBI, 2020).

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts).

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 2-1 and Table 2-2, respectively.

Table 2-1 Summary of Conservation Importance (CI) criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global extent of occurrence (EOO) of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 2-2 Summary of Functional Integrity (FI) criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.

Functional Integrity	Fulfilling Criteria
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 2-3

Table 2-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very high	High	Medium	Low	Very low
Functional Integrity (FI)	Very high	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very low	Medium	Low	Very Low	Very Low	Very Low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 2-4.

Table 2-4 Summary of Resource Resilience (RR) criteria

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in

Table 2-5.

Table 2-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		Biodiversity Importance (BI)				
		Very High	High	Medium	Low	Very Low
Receptor Resilience (RR)	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Interpretation of the SEI in the context of the proposed development activities is provided in Table 2-6.

Table 2-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities (SANBI, 2020)

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.

3 Results & Discussion

This section provides the results of the assessment and is divided into the desktop and field assessment components.

3.1 Desktop Assessment

3.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed development to ecologically important landscape features are summarised in Table 3-1.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features.

Ecological Feature	Relevance	Section
Ecosystem Threat Status	Irrelevant – Overlaps with Least Concern ecosystems	3.1.1.1
Ecosystem Protection Level	Relevant – Overlaps with Not Protected and Poorly Protected ecosystems	3.1.1.2
Protected Areas	Relevant – Located within the 5 km Protected Area Buffer Zones of the Tuinhoek Reserve and Grasberg Reserve	3.1.1.3
National Protected Areas Expansion Strategy	Relevant – Overlaps with a NPAES priority focus area.	3.1.1.3
Important Bird and Biodiversity Area	Relevant – Located 3.25 km northeast from the Platberg-Karoo Conservancy	3.1.1.3
Free State Biodiversity Plan	Relevant – Overlaps with CBA1, CBA2, ESA1, and ESA2 features	3.1.1.4
Hydrological Context	Relevant – Drainage lines connect to a Freshwater Ecosystem Priority Area	3.1.1.5

3.1.1.1 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the PAOI overlaps with LC ecosystems (Figure 3-1).

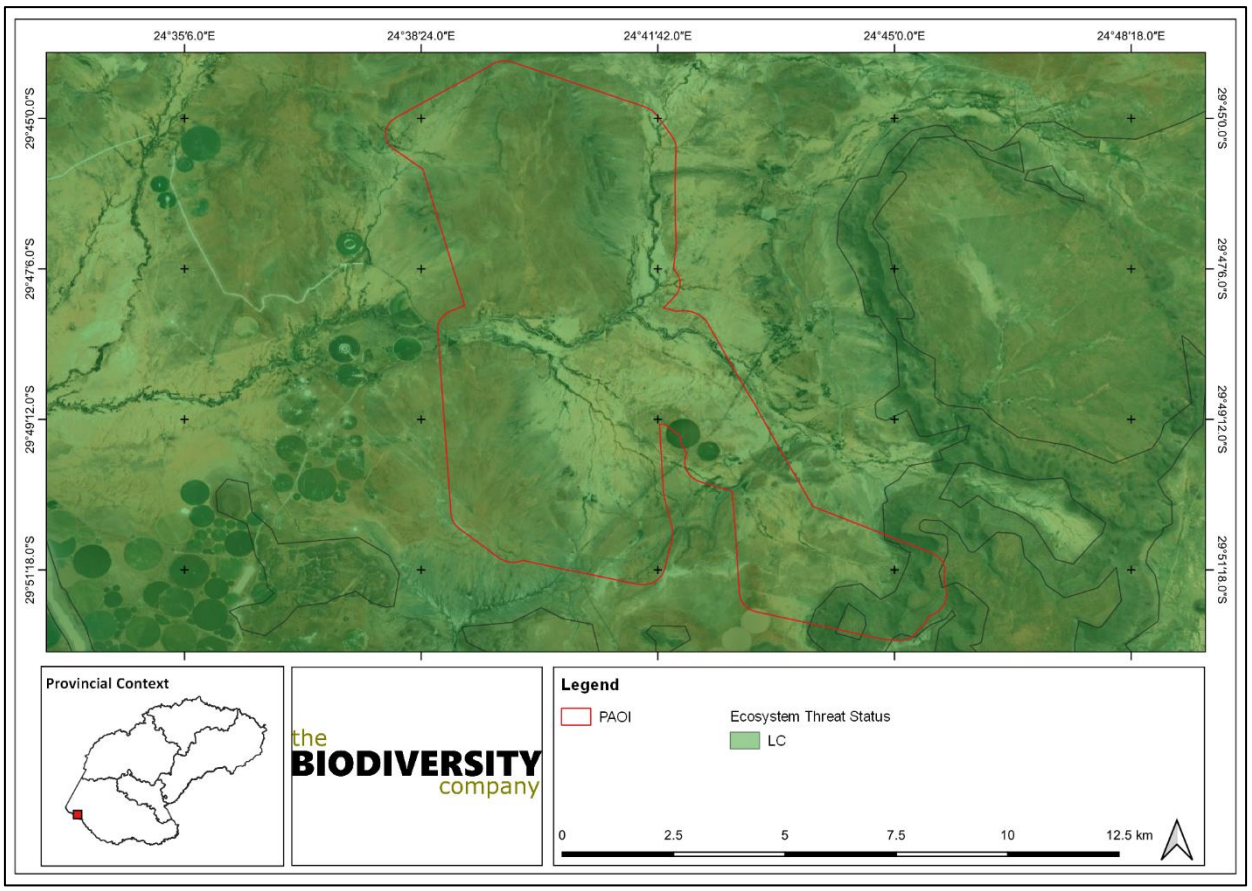


Figure 3-1 Map illustrating the ecosystem threat status associated with the proposed Xhariep Export Programme Agricultural Development PAOI

3.1.1.2 Ecosystem Protection Level

Indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems. The PAOI overlaps predominantly with a NP ecosystem and marginally overlaps with a PP ecosystem (Figure 3-2).

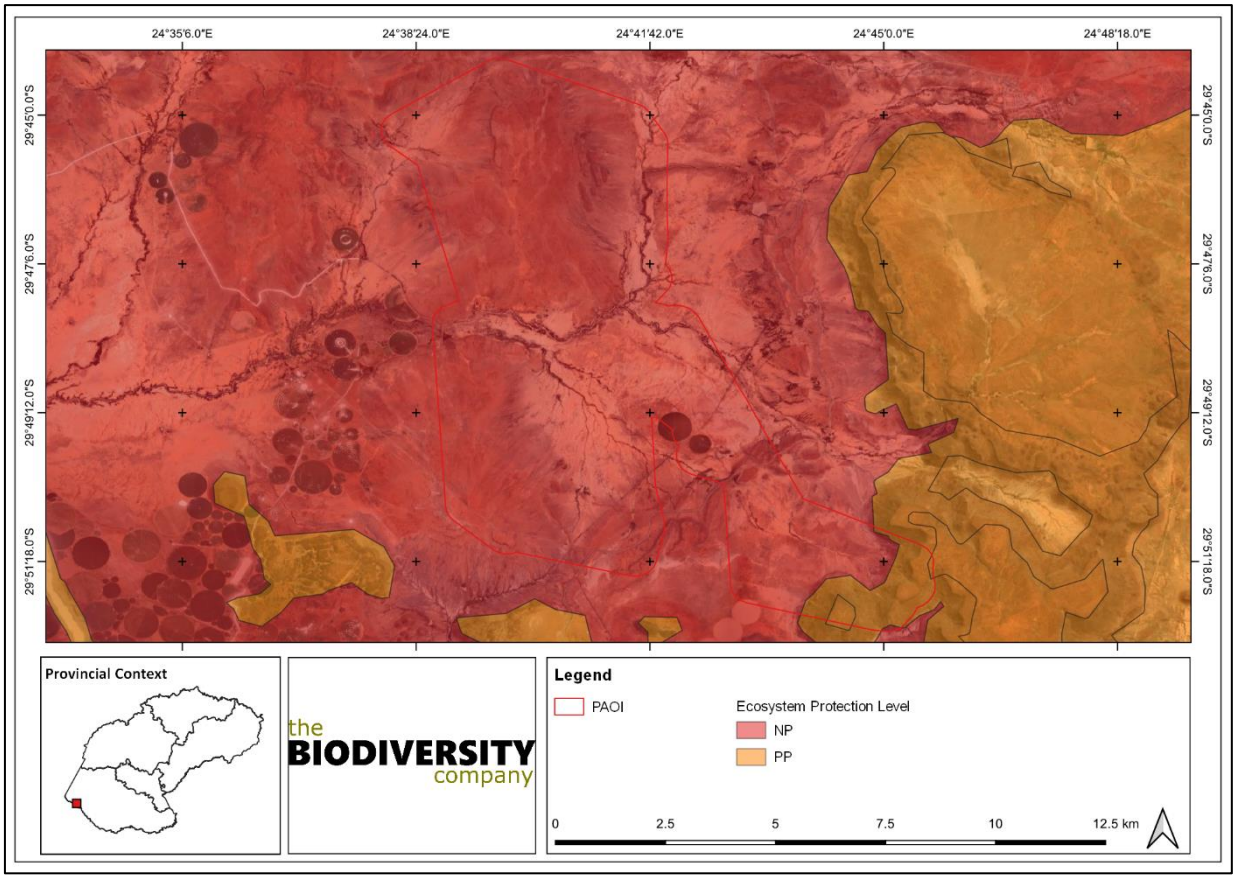


Figure 3-2 Map illustrating the ecosystem protection level associated with the proposed Xhariep Export Programme Agricultural Development PAOI

3.1.1.3 Protected Areas

According to the SAPAD (DFFE, 2022) and SACAD (DFEE, 2022) spatial datasets, the PAOI does not overlap with any formally protected areas or conservation areas. However, the project area is located approximately 2 km northwest from the overlapping Tuinhoek Reserve and Grasberg Reserve (Figure 3-3). Thus, the project area is located within the 5 km Protected Area Buffer Zones of two protected areas. However, as illustrated in Figure 3-3, the PAOI overlaps with an NPAES Focus Area.

The PAOI is located 3.25 km northeast from the Platberg-Karoo Conservancy. The Platberg–Karoo Conservancy IBA covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns, and consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. It is used mainly for grazing and agriculture (Birdlife South Africa, 2015).

This IBA is important because it contributes significantly to the conservation of large terrestrial birds as well as raptors. These birds include Blue Crane (*Anthropoides paradiseus*), Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*), Blue Korhaan (*Eupodotis caerulescens*), Black Stork (*Ciconia nigra*), Secretarybird (*Sagittarius serpentarius*), Martial Eagle (*Polemaetus bellicosus*), Verreaux's Eagle (*Aquila verreauxii*) and Tawny Eagle (*A. rapax*) (Birdlife South Africa, 2015).

Globally threatened species are the Blue Crane, Ludwig's Bustard, Kori Bustard, Secretarybird, Martial Eagle, Blue Korhaan, Black Harrier (*Circus maurus*) and Denham's Bustard (*Neotis denhami*) (Birdlife South Africa, 2015).

Regionally threatened species include the Black Stork, Lanner Falcon (*Falco biarmicus*), Tawny Eagle, Karoo Korhaan (*Eupodotis vigorsii*) and Verreaux's Eagle (Birdlife South Africa, 2015).

Biome-restricted species include Karoo Lark (*Calendulauda albescens*), Karoo Long-billed Lark (*Certhilauda subcoronata*), Karoo Chat (*Cercomela schlegelii*), Tractrac Chat (*C. tractrac*), Sickle-winged Chat (*C. sinuata*), Namaqua Warbler (*Phragmacia substriata*), Layard's Tit-Babbler (*Sylvia layardi*), Pale-winged Starling (*Onychognathus nabouroup*) and Black-headed Canary (*Serinus alario*) (Birdlife South Africa, 2015).

Congregatory species include the Lesser Kestrel and Amur Falcon (*Falco amurensis*) (Birdlife South Africa, 2015).

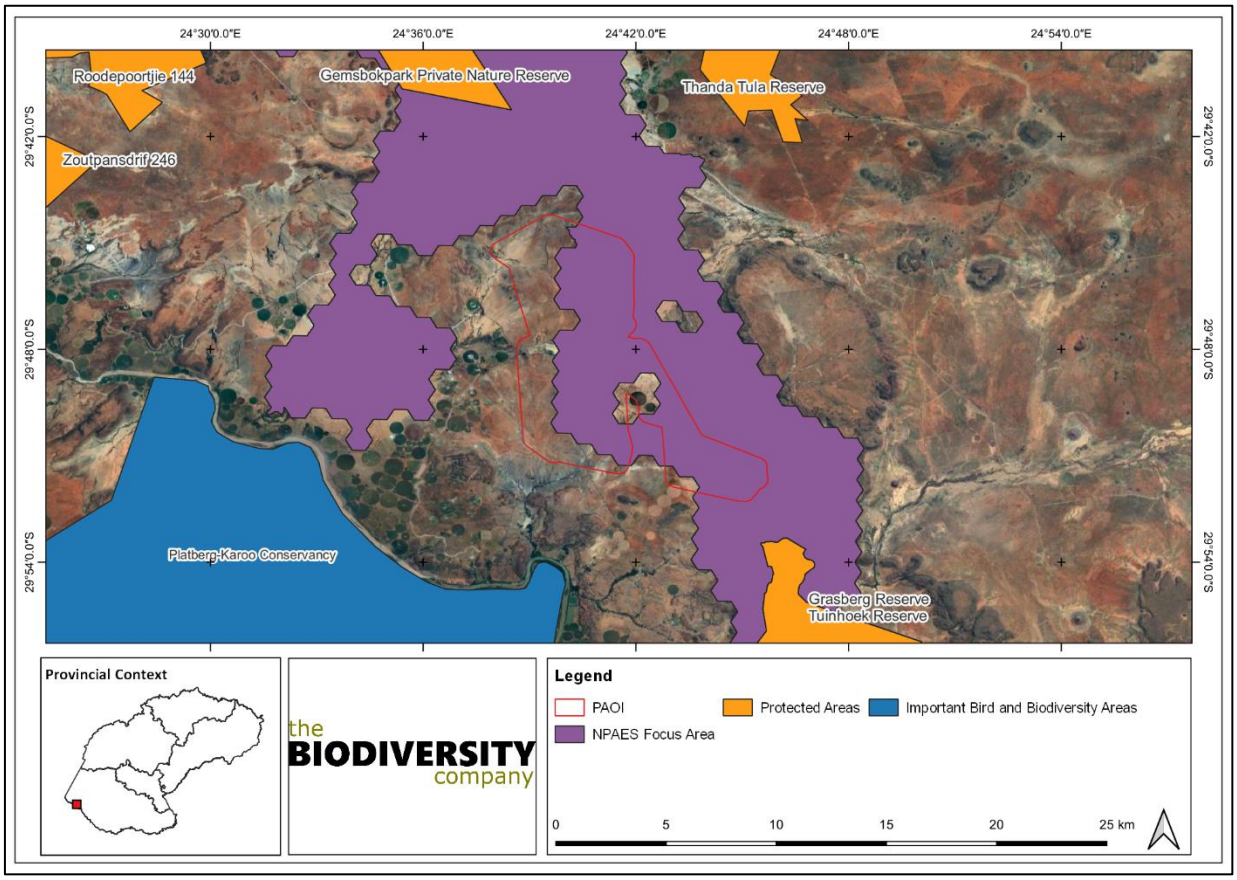


Figure 3-3 Map illustrating the location of protected areas proximal to the proposed Xhariep Export Programme Agricultural Development PAOI

3.1.1.4 Free State Biodiversity Sector Plan

The purpose of the Free State Biodiversity Sector Plan (2016) is to inform land-use planning and development on a provincial scale and to aid in natural resource management. One of the outputs is a map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These are classified into different categories, namely Protected Areas, CBA1 areas, CBA2 areas, ESA1 areas, ESA2 areas, Other Natural Areas (ONAs) and areas with No Natural Habitat Remaining (NNR) based on biodiversity characteristics, spatial configuration, and requirements for meeting targets for both biodiversity patterns and ecological processes.

Figure 3-4 illustrates that the proposed development overlaps with Critical Biodiversity Area 1 (CBA1), Critical Biodiversity Area 2 (CBA2), Ecological Support Area 1 (ESA1) and Ecological Support Area 2 (ESA2) features.

CBAs are areas that must be maintained in a good ecological condition (natural or near-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types as well as for species and ecological processes that depend on natural or near-natural habitat, that have not already been met in the protected area network (SANBI, 2016).

ESAs area that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or no necessary to meet them in natural or near-natural areas (SANBI, 2016).

Any alteration to these aforementioned features through landuse change and other anthropogenic activities will result in the loss of biodiversity targets and ecosystem functioning.

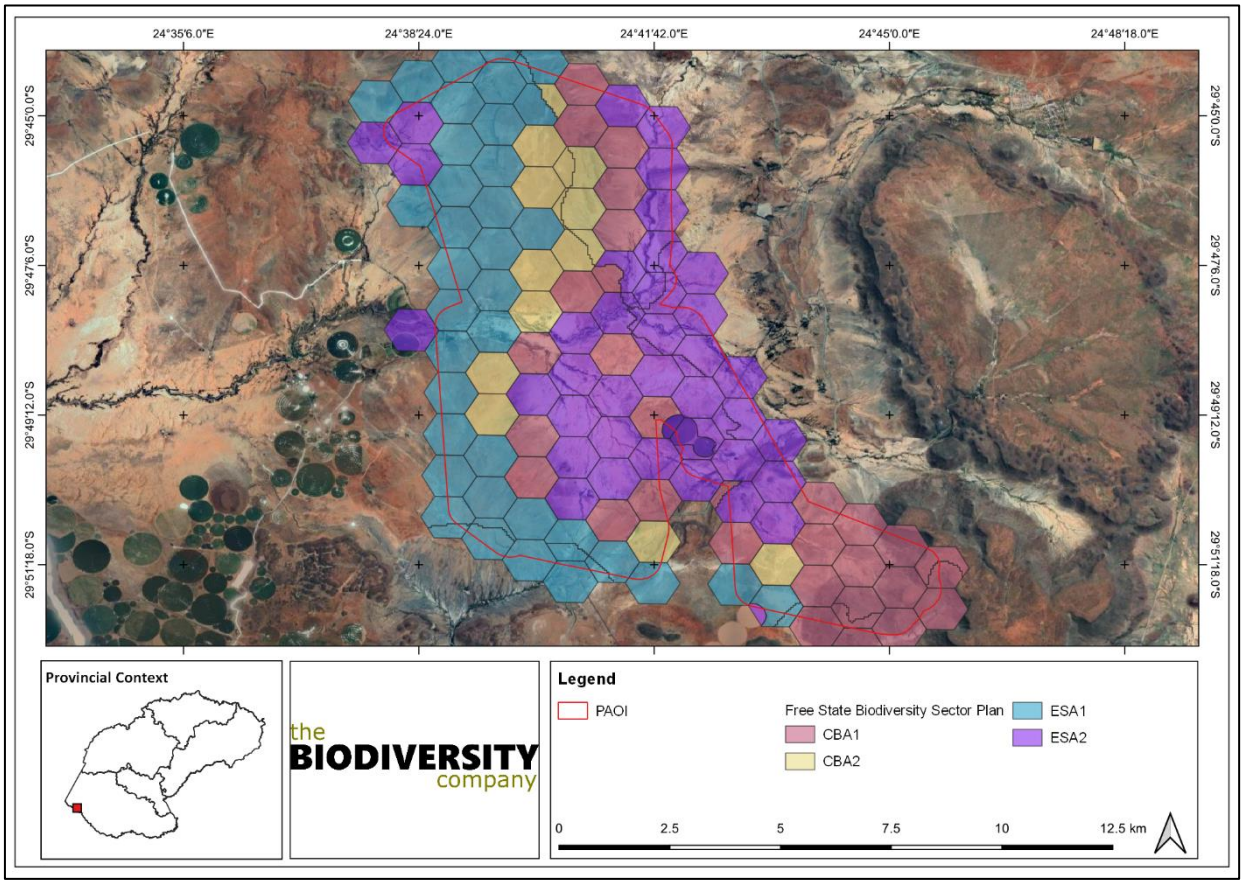


Figure 3-4 Map illustrating the proposed Xhariep Export Programme Agricultural Development PAOI overlaid onto the Free State Biodiversity Sector Plan

3.1.1.5 Hydrological Context

The PAOI is located within the Orange River Catchment, specifically quaternary catchments D33C and D33A (Figure 3-5).

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the National Biodiversity Assessment (NBA) 2018. Ecosystem threat status (ETS) of ecosystem types is based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT. Critically Endangered, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The Lemoenspruit, which was assessed as part of the SAIIAE, traverses the PAOI and is classified as EN (Figure 3-5). There are also numerous ephemeral drainage lines that drain into the Lemoenspruit, as well as directly into the Orange River mainstem (Figure 3-5). The associated reach of the Orange River is classified as CR (Figure 3-5). In addition, according to the SAIIAE, the wetland ecosystems within the PAOI are classified as CR, and those in the surrounding landscape are classified as CR and VU. Considering the threatened status of these ecosystems, any further degradation arising from the proposed development will have a considerable negative impact to their functioning.

The National Freshwater Ecosystem Priority Areas (NFEPAs) (Driver *et al*, 2011) spatial data has been incorporated in the above mentioned SAIIAE spatial data set. They are included here as the database is intended to be conservation support tools and are envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel *et al,* 2011). The NFEPA spatial layer indicates that the Lemoenspruit is regarded as an Upstream Management Area and the associated reach of the Orange River is classified as a Fish Support Area. Negative impacts arising from the proposed development will alter the functioning of these systems and therefore, will limit the capacity of these systems to provide these ecosystem services.

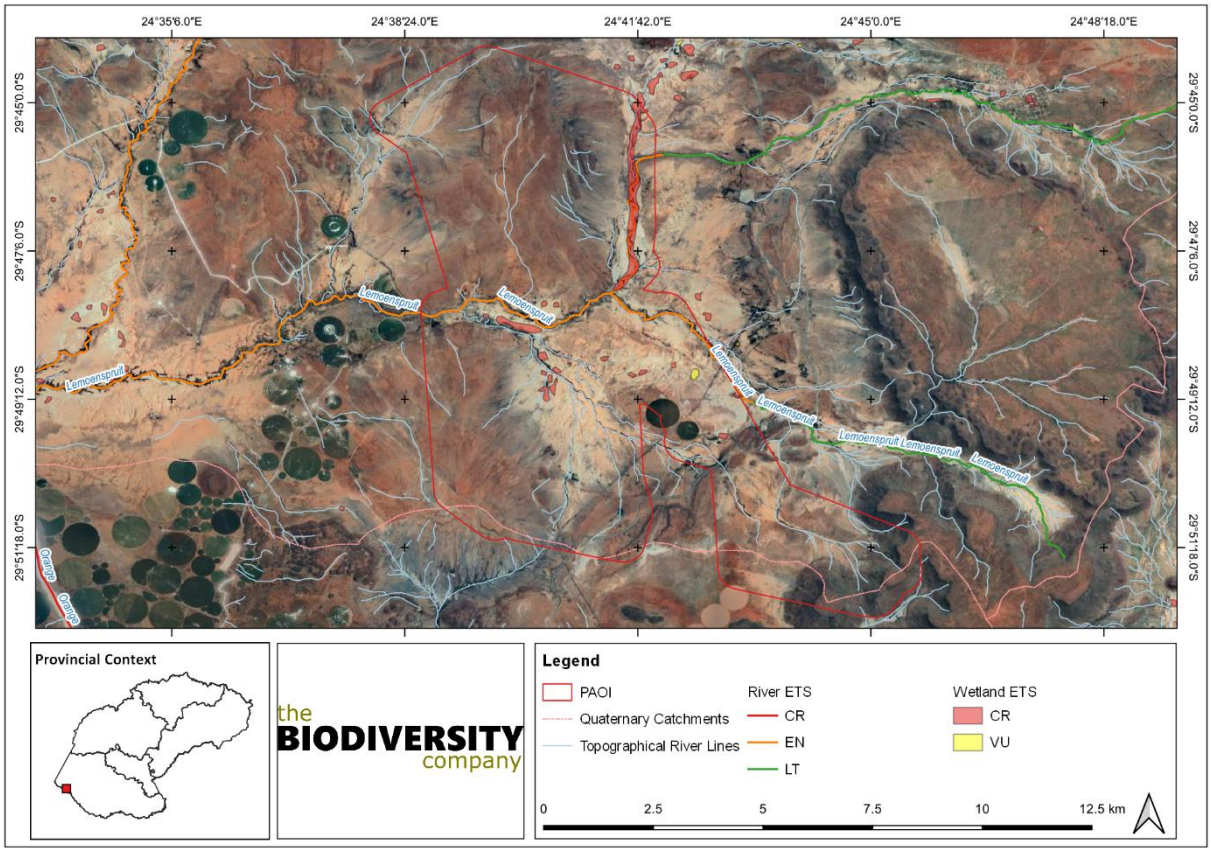


Figure 3-5 Map illustrating the hydrological context of the proposed Xhariep Export Programme Agricultural Development PAOI

3.1.2 Flora Assessment

This section is divided into a description of the vegetation type expected under natural conditions and the expected flora species.

3.1.2.1 Vegetation Type

The project area is located within the Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism. Despite relatively low floristic diversity, the Nama-Karoo vegetation has a high diversity of plant life forms. These include co-

occurring ephemerals, annuals, geophytes, C3 and C4 grasses, succulents, deciduous and evergreen chamaephytes and trees. This is probably a consequence of an ecotonal and climatically unstable nature of the region.

Scattered rocky hills, mesas and inselbergs are distinctive features of an otherwise relatively homogeneous landscape. These features are either capped by or wholly comprised of dolerite, which is a fine- to medium-grained dark, intrusive igneous rock. The surrounding plains and lowland habitats are dominated by shale and sandstone, which is a fine- to medium-grained sedimentary rock. Due to their structure, these features provide greater heterogeneity in habitat and microclimate than the surrounding plains and therefore, support higher species richness and diversity (Petersen *et al*, 2020). Species richness and relative cover of the varying plant growth forms are driven by gradients of a combination soil, environmental and climatic parameters.

On a fine-scale vegetation type, the project area overlaps with three vegetation types, mainly the Northern Upper Karoo, followed by the Besemkaree Koppies Shrubland and marginally with the Xhariep Karroid Grassland **(Figure 3-6**).

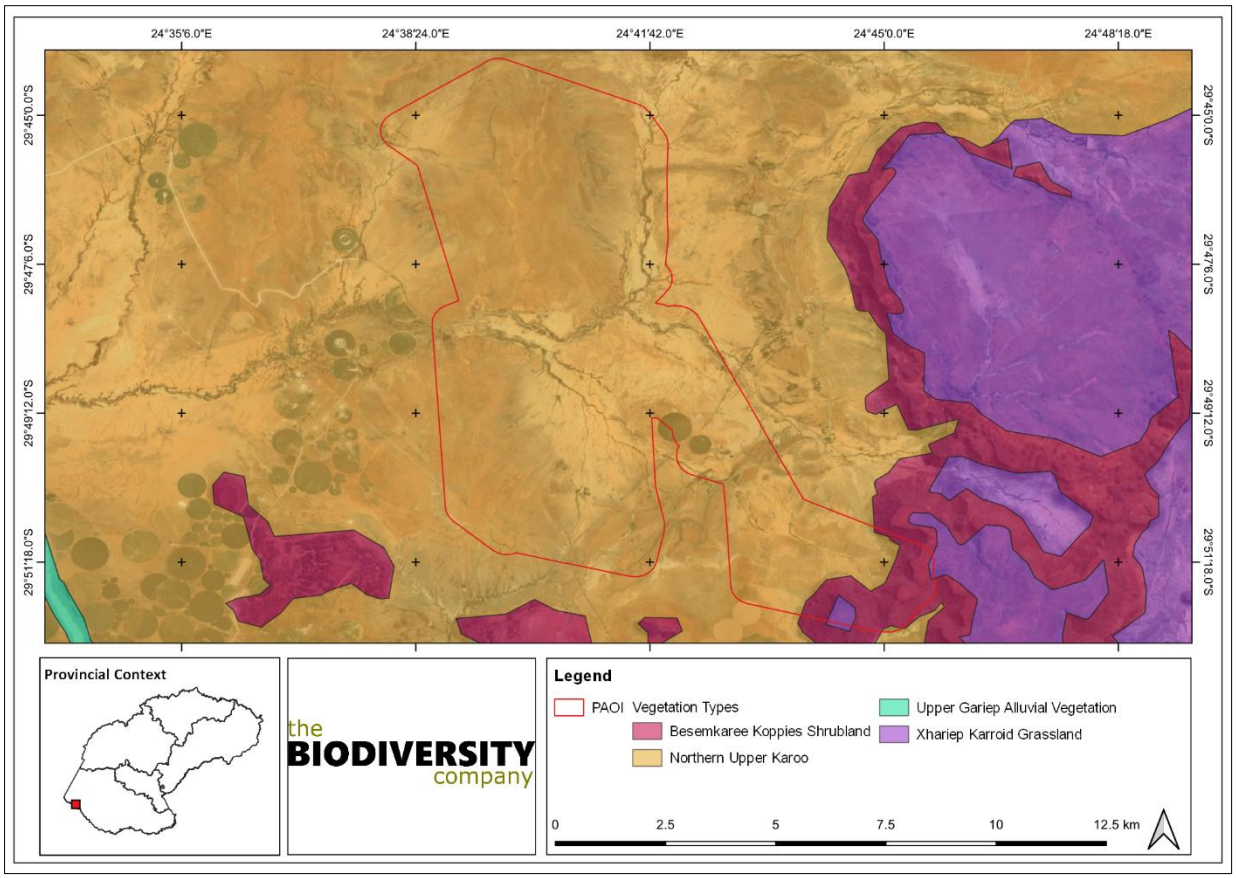


Figure 3-6 ***Map illustrating the vegetation types within the proposed Xhariep Export Programme Agricultural Development PAOI***

3.1.2.1.1 Northern Upper Karoo

The Northern Upper Karoo is restricted to the Northern Cape and Free State Provinces, specifically in the northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. In the north, it is bordered by the towns of Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. Additionally, there are a few patches in Griqualand West. Altitude varies mostly from 1000 to 1500 m (Mucina & Rutherford, 2006).

Its main vegetation feature is a shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera* subsp. *detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). In terms of landscape features, it is flat to gently sloping, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford, 2006).

Important Plant Taxa in Northern Upper Karoo

Based on Mucina and Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note that the following species are important taxa in the Northern Upper Karoo vegetation type:

Small Trees: *Senegalia mellifera* subsp. *detinens*, *Boscia albitrunca*.

Tall Shrubs: *Lycium cinereum*, *L. horridum*, *L. oxycarpum*, *L. schizocalyx*, *Rhigozum trichotomum*.

Low Shrubs: *Chrysocoma ciliata*, *Gnidia polycephala*, *Pentzia calcarea*, *P. globosa*, *P. incana*, *P. spinescens*, *Rosenia humilis*, *Amphiglossa triflora*, *Aptosimum marlothii*, *A. spinescens*, *Asparagus glaucus*, *Barleria rigida*, *Berkheya annectens*, *Eriocephalus ericoides* subsp. *ericoides*, *E. glandulosus*, *E. spinescens*, *Euryops asparagoides*, *Felicia muricata*, *Helichrysum lucilioides*, *Hermannia spinosa*, *Leucas capensis*, *Limeum aethiopicum*, *Melolobium candicans*, *Microloma armatum*, *Osteospermum leptolobum*, *O. spinescens*, *Pegolettia retrofracta*, *Pentzia lanata*, *Phyllanthus maderaspatensis*, *Plinthus karooicus*, *Pteronia glauca*, *P. sordida*, *Selago geniculata*, *S. saxatilis*, *Tetragonia arbuscula*, *Zygophyllum lichtensteinianum*.

Succulent Shrubs: *Hertia pallens*, *Salsola calluna*, *S. glabrescens*, *S. rabieana*, *S. tuberculata*, *Zygophyllum flexuosum*.

Semiparasitic Shrub: *Thesium hystrix*.

Herbs: *Chamaesyce inaequilatera*, *Convolvulus sagittatus*, *Dicoma capensis*, *Gazania krebsiana*, *Hermannia comosa*, *Indigofera alternans*, *Lessertia pauciflora*, *Radyera urens*, *Sesamum capense*, *Sutera pinnatifida*, *Tribulus terrestris*, *Vahlia capensis*.

Succulent Herb: *Psilocaulon coriarium*.

Geophytic Herb: *Moraea pallida*.

Graminoids: *Aristida adscensionis*, *A. congesta*, *A. diffusa*, *Enneapogon desvauxii*, *Eragrostis lehmanniana*, *E. obtusa*, *E. truncata*, *Sporobolus fimbriatus*, *Stipagrostis obtusa, Eragrostis bicolor*, *E. porosa*, *Fingerhuthia africana*, *Heteropogon contortus*, *Stipagrostis ciliata*, *Themeda triandra*, *Tragus berteronianus*, *T. koelerioides*, *T. racemosus*.

Conservation Status

The conservation target is 21%, with none being conserved in statutory conservation areas and about 4% has already been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams (Houwater, Kalkfontein and Smart Syndicate Dams). *Prosopis glandulosa*, one of the 12 agriculturally most important invasive alien plants in South Africa, is widely distributed in this vegetation type. Erosion ranges from very low to moderate.

3.1.2.1.2 Besemkaree Koppies Shrubland

The Besemkaree Koppies Shrubland is restricted to the Northern Cape, Free State and Eastern Cape Provinces. Within these provinces, it can be found on plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Additionally, there area also extensive dolerite-dominated landscapes along the upper Orange River that belong to this unit as well. It extends northwards to around Fauresmith in the northwest

and to the Wepener District in the northeast. Altitude varies from 1120 to 1680 m (Mucina & Rutherford, 2006).

In terms of vegetation and landscape features, this vegetation type is characterised by slopes of koppies, butts and tafelbergs covered with two-layered karroid shrublands. The lower closed-canopy layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper loose canopy layer is dominated by tall shrubs, including several *Rhus* species, *Euclea crispa* subsp. *ovata*, *Diospyros austro-africana* and *Olea europaea* subsp. *africana* (Mucina & Rutherford, 2006).

Important Plant Taxa in Besemkaree Koppies Shrubland

Mucina and Rutherford (2006) note that the following species are important taxa in the Besemkaree Koppies Shrubland:

Small Trees: *Cussonia paniculata*, *Ziziphus mucronata*.

Tall Shrubs: *Diospyros austro-africana*, *Euclea crispa* subsp. *ovata*, *Olea europaea* subsp. *africana*, *Rhus burchellii*, *R. ciliata*, *R. erosa*, *Buddleja saligna*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Grewia occidentalis*, *Gymnosporia polyacantha*, *Tarchonanthus minor*.

Low Shrubs: *Asparagus suaveolens*, *Chrysocoma ciliata*, *Amphiglossa triflora*, *Aptosimum elongatum*, *Asparagus striatus*, *Diospyros pallens*, *Eriocephalus ericoides*, *E. spinescens*, *Euryops empetrifolius*, *Felicia filifolia* subsp. *filifolia*, *F. muricata*, *Helichrysum dregeanum*, *H. lucilioides*, *Hermannia multiflora*, *H. vestita*, *Lantana rugosa*, *Limeum aethiopicum*, *Lycium cinereum*, *Melolobium candicans*, *M. microphyllum*, *Nenax microphylla*, *Pegolettia retrofracta*, *Pentzia globosa*, *Rhigozum obovatum*, *Selago saxatilis*, *Stachys linearis*, *S. rugosa*, *Sutera halimifolia*, *Wahlenbergia albens*.

Succulent Shrubs: *Aloe broomii*, *Chasmatophyllum musculinum*, *C. verdoorniae*, *Cotyledon orbiculata* var. *dactylopsis*, *Pachypodium succulentum*.

Graminoids: *Aristida adscensionis*, *A. congesta*, *A. diffusa*, *Cenchrus ciliaris*, *Cymbopogon caesius*, *Cynodon incompletus*, *Digitaria eriantha*, *Eragrostis curvula*, *E. lehmanniana*, *Heteropogon contortus*, *Setaria lindenbergiana*, *Themeda triandra*, *Tragus koelerioides*, *Cymbopogon pospischilii*, *Enneapogon scoparius*, *Eragrostis chloromelas*, *E. obtusa*, *Eustachys paspaloides*, *Fingerhuthia africana*, *Hyparrhenia hirta*, *Sporobolus fimbriatus*.

Herbs: *Convolvulus sagittatus*, *Dianthus caespitosus* subsp. *caespitosus*, *Gazania krebsiana* subsp. *krebsiana*, *Hibiscus pusillus*, *Indigofera alternans*, *I. rhytidocarpa*, *Lepidium africanum* subsp. *africanum*, *Pollichia campestris*.

Herbaceous Climber: *Argyrolobium lanceolatum*.

Geophytic Herbs: *Albuca setosa*, *Asplenium cordatum*, *Cheilanthes bergiana*, *C. eckloniana*, *Freesia andersoniae*, *Haemanthus humilis* subsp. *humilis*, *Oxalis depressa*, *Pellaea calomelanos*.

Succulent Herbs: *Aloe grandidentata*, *Crassula nudicaulis*, *Duvalia caespitosa*, *Euphorbia pulvinata*, *Huernia piersii*, *Stapelia grandiflora*, *S. olivacea*, *Tridentea gemmiflora*.

Conservation Status

The conservation target is 28% and about 5% statutorily conserved in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. Additionally, there is a small patch that is protected in the private Vulture Conservation Area. About 3% of the area has been transformed due to dams building. Erosion varies from low to high (Mucina & Rutherford, 2006).

3.1.2.1.3 Xhariep Karroid Grassland

The Xhariep Karroid Grassland is found in the Free State Province and very slightly into the Northern Cape Province: Southern regions including the vicinity of Luckhoff (west), Edenburg (north), Gariep Dam (south) and Smithfield (east). Altitude 1 260–1 560 m.

In terms of vegetation and landscape features, it consists of extensive, even or slightly undulating bottomland flats forming a matrix of large landscape patches interrupted by high dolerite sills, koppies and conspicuous ring dykes (bearing Gh 4 Besemkaree Koppies Shrubland) and supporting low- to medium-height, open grassland intermingled with small patches of dwarf karroid shrubs.

Important Plant Taxa in Xhariep Karroid Grassland

Mucina and Rutherford (2006) note that the following species are important taxa in the Xhariep Karroid Grassland:

Low Shrubs: *Chrysocoma ciliate*, *Eriocephalus ericoides*, *E. spinescens, Felicia filifolia subsp. filifolia , F. muricata , Pentzia globosa , P. incana, Amphiglossa triflora, Aptosimum elongatum, Atriplex semibaccata var. appendiculata, Berkheya annectens, Gnidia polycephala, Helichrysum asperum var. albidulum, H. dregeanum, H. lucilioides, Lycium cinereum, Melolobium candicans, Nenax microphylla, Oligomeris dregeana, Osteospermum spinescens, Rosenia humilis, Selago saxatilis, Wahlenbergia albens, W. nodosa.*

Succulent Shrubs: *Euphorbia clavarioides var. clavarioides, Hertia pallens, Ruschia hamata, R. rigida, Salsola calluna, S. glabrescens.*

Graminoids: *Aristida adscensionis, A. canescens, A. congesta, Chloris virgata, Cynodon incompletus, Eragrostis chloromelas, E. lehmanniana, E. obtusa, Fingerhuthia africana, Panicum coloratum, P. stapfianum, Themeda triandra, Tragus koelerioides, Aristida diffusa, Cymbopogon pospischilii, Digitaria eriantha, Eragrostis curvula, Sporobolus fimbriatus.*

Herbs: *Gazania krebsiana subsp. krebsiana, Convolvulus boedeckerianus, Dimorphotheca zeyheri, Hermannia coccocarpa, Indigofera alternans, Lepidium africanum subsp. africanum, Lessertia pauciflora, Rumex lanceolatus, Salvia stenophylla, Selago densiflora.*

Herbaceous Climber: *Argyrolobium lanceolatum*.

Geophytic Herbs: *Moraea pallida, Oxalis depressa*

Succulent Herbs: *Tripteris aghillana var. integrifolia*.

Conservation Status

Target 24%. About 2.5% statutorily conserved in Gariep Dam, Tussen Die Riviere, Kalkfontein Dam, Oviston, Wurasdam and Rolfontein Nature Reserves. Some 4% already transformed by cultivation and dam-building (Bethulie, Gariep, Kalkfontein, Straussfontein and Tierpoort Dams). This dry grassland is prone to encroachment of low, unpalatable karroid shrubs when exposed to heavy grazing. Erosion moderate (71%) and low (19%).

3.1.2.2 Expected Flora Species of Conservation Concern

The POSA database indicates that 329 species of indigenous plant species are expected to occur within the PAOI and surrounding landscape (Appendix B). One SCC based on their conservation status could be expected to occur within the PAOI and is provided in Table 3-2 below.

Table 3-2 Summary of flora species of conservation concern expected to occur within the Xhariep Export Programme Agricultural Development. VU = Vulnerable

Family	Species Name	Conservation Status	Habitat	Likelihood of Occurrence
Aizoaceae	*Drosanthemum pulchrum*	VU	Shale renosterveld. EOO 296 km², less than 10 remaining locations	Low

Family	Species Name	Conservation Status	Habitat	Likelihood of Occurrence
			continue to decline due to ongoing habitat loss, fragmentation and degradation.	

3.1.3 Fauna Assessment

This section provides the list of threatened fauna species expected to occur within the PAOI. N.B. the likelihood of occurrence that is provided refers to the development footprints and not the surrounding landscape.

3.1.3.1 Expected Amphibian Species of Conservation Concern

Based on the IUCN Red List Spatial Data and FrogMap database, 13 amphibian species are expected to occur within the PAOI (Appendix C). One of these expected is regarded as a SCC (Table 3-3).

Table 3-3 Amphibian species of conservation concern that are expected to occur within the Xhariep Export Programme Agricultural Development PAOI. LC = Least Concern and NT= Near Threatened

Family	Species	Common Name	Conservation Status		Likelihood of occurrence
			Regional	IUCN	
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	NT	LC	High

Giant Bull Frog (*Pyxicephalus adspersus*) is widely distributed in South Africa, Swaziland, Namibia, Botswana, and Zimbabwe, extending north to southern Angola, Zambia, Malawi, Mozambique, Tanzania, and Kenya. The species is listed as NT on a regional scale. It is a species of drier savannas where it is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary waters in pools, pans and ditches (IUCN SSC Amphibian Specialist Group, 2013). The major threat through most of its range is harvesting for local consumption, which is believed to be responsible for some population declines. In South Africa, breeding habitat has been lost due to urbanization (IUCN SSC Amphibian Specialist Group, 2013). This species is sometimes found in the international pet trade but at levels that do not currently constitute a major threat.

3.1.3.2 Expected Reptile Species of Conservation Concern

Based on the IUCN Red List Spatial Data and the ReptileMAP database, 40 reptile species are expected to occur within the PAOI and surrounding landscape (Appendix D) with one of these species regarded as threatened (Table 3-4).

Table 3-4 Reptile species of conservation concern that are expected to occur within the Xhariep Export Programme Agricultural Development PAOI. NT= Near Threatened

Family	Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
			Regional	Global	
Testudinae	*Psammobates tentorius veroxii*	Tent Tortoise	NT	NT	Moderate

Psammobates tentorius (Tent Tortoise) is restricted to South Africa and Namibia and of the three subspecies, *P. tentorius veroxii* has a wide distribution throughout the Nama Karoo in the Northern Cape and penetrates the Western Cape and possibly the Eastern Cape peripherally. Its range extends across the Orange River into Namibia. Although the species is widespread, population density is generally low throughout its range, and populations appear to be declining slowly (Hofmeyr *et al*, 2018). There is no estimate on the total global population. Threats include road mortality, veld fires, electrocution by livestock/game fences, and overgrazing from domestic livestock. Available information indicates that Pied

Crow (*Corvus albus*) predation on this is increasingly severe, with anthropogenic facilitation of Pied Crow range expansion having led to increased predation rates (Hofmeyr *et al*, 2018).

3.1.3.3 Expected Avifauna Species of Conservation Concern

The SABAP2 Data lists 191 avifauna species that could be expected to occur within the PAOI. Eight of these expected species are regarded as SCC (Table 3-5). There are only two species that have a low likelihood of occurrence due to lack of suitable habitat and food sources in the PAOI.

Table 3-5 Avifauna species of conservation concern that are expected to occur within the Xhariep Export Programme Agricultural Development PAOI. EN = Endangered, LC = Least Concern, NT= Near Threatened and VU = Vulnerable

Family	Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
			Regional	Global	
Accipitridae	*Aquila verreauxii*	Eagle, Verreaux's	VU	LC	Confirmed
Ciconiidae	*Ciconia abdimii*	Stork, Abdim's	NT	LC	High
Glareolidae	*Glareola nordmanni*	Pratincole, Black-winged	NT	NT	Low
Laridae	*Hydroprogne caspia*	Tern, Caspian	VU	LC	Low
Motacillidae	*Anthus crenatus*	Pipit, African Rock	NT	NT	High
Otididae	*Eupodotis caerulescens*	Korhaan, Blue	LC	NT	High
Otididae	*Neotis ludwigii*	Bustard, Ludwig's	EN	EN	High
Sagittariidae	*Sagittarius serpentarius*	Secretarybird	VU	EN	Confirmed

Anthus crenatus (African Rock Pipit) is endemic to southern Africa, occurring in South Africa, Lesotho and possibly Eswatini. This species is closely associated with steep rocky habitats, associated with scattered shrubs or grassy areas, occurring up to 3 000 m (Taylor *et al*, 2015). The global population size is estimated to be 3 300-8 900 mature individuals with a 34% decline in area of occupancy over the past 10 years (BirdLife International, 2021). Threats include afforestation and climate change. The species appears to benefit from pastoral agriculture and erosion.

Aquila verreauxii (Verreaux's Eagle) is listed globally as LC but VU on a regional scale (Taylor *et al*, 2015). The species occupies mountainous areas including savannah and semi-desert, where there is a relatively high abundance of *Procavia capensis* (Rock Hyrax) (BirdLife International, 2016a). More than 60% of its prey are Rock Hyraxes but it will occasionally also take other mammals, birds, tortoises and rarely, other reptiles. The population is estimated to be in the tens of thousands. The principal threat in in southern Africa is persecution where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Furthermore, numbers have declined in areas where Rock Hyraxes have been intensely hunted. Its presence within the PAOI was confirmed by a property owner within the area.

Ciconia abdimii (Abdim's Stork) is listed globally as LC but NT on a regional scale (Taylor *et al*, 2015). The species occupies savanna, grassland, inland wetlands, inland cliffs and mountain peaks and is an intra-African trans-equatorial migrant, making seasonal movements to coincide with rainfall (BirdLife International, 2016b). It arrives in the southern tropics early in the wet season and remains in this southern range until March (when the rains decrease), after which it moves north again through East Africa at the beginning of the long rains (March-April), arriving back in the breeding grounds in April and May before or on the onset of the heavy rains. The species is primarily insectivorous, its diet consisting almost entirely of large grassland insects such as swarming locusts, grasshoppers and crickets. The species is threatened by habitat degradation through urban development and agricultural activities (such as maize farming) which have reduced the available area of natural grassland.

Eupodotis caerulescens (Blue Korhaan) is endemic to South Africa and Lesotho and occurs in grassveld usually over 1500 m above sea level, preferring open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few or no trees (BirdLife

International, 2017). The total global population is estimated to number between 12 000-15 000 individuals, equivalent to 8 000-10 000 mature individuals, with a decreasing population trend. The main threat is intensive agriculture, especially within the east of its range.

Neotis ludwigii (Ludwig's Bustard) is listed as EN on a global scale (BirdLife International, 2018). The species has a large range centred on the dry biomes of the Karoo and Namib in southern Africa, being found in the extreme south-west of Angola, western Namibia and South Africa. This species inhabits open lowland and upland plains with grass and light thornbush, sandy open shrub-veld and semi-desert in the arid and semi-arid Namib and Karoo biomes. Ludwig's Bustard is nomadic and a partial migrant, moving to the western winter-rainfall part of its range in winter. The diet includes invertebrates, small vertebrates and vegetable matter. The global population is estimated to be 100 000 – 499 999 individuals. The primary threat to the species is collisions with overhead power lines, with potentially thousands of individuals involved in such collisions each. Collision rates on high voltage transmission lines in the Karoo may exceed one Ludwig's Bustard per kilometre per year. Bustards have limited frontal vision so may not see power lines, even if they are marked.

Sagittarius serpentarius (Secretarybird) is listed as EN on a global scale (BirdLife International, 2020). The species has a wide distribution across sub-Saharan Africa but surveyed densities suggest that the total population size does not exceed a five-figure number. Ad-hoc records, localised surveys and anecdotal observations indicate apparent declines in many parts of the species' range, especially in South Africa where reporting rates decreased by at least 60% of quarter degree grid cells used in Southern African Bird Atlas Projects. Threats include excessive burning of grasslands that may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans is likely to negatively affect breeding. The species is captured and traded; however, it is unknown how many deaths occur in captivity and transit. Direct hunting and nest-raiding for other uses and indiscriminate poisoning at waterholes are also further threats. A proposed conservation action is that landowners of suitable properties should join biodiversity stewardship initiatives and to manage their properties in a sustainable way for the species' populations. Its presence within the PAOI was confirmed by a property owner within the area. Furthermore, the property owner suggested that there were six pairs resident within the landscape.

The mean monthly reporting rates obtained from the SABAP 2 database for the aforementioned avifauna SCC are illustrated in Figure 3-7. Only the reporting rate for those species that were considered having a 'High' likelihood of occurrence are illustrated. The reporting rate exhibits considerable temporal variation, with all of the species not being recorded throughout the annual cycle. This is typically expected within semi-arid regions, with the movement of avifauna species linked to availability of resources. However, it is important to note that the region is very under surveyed and therefore, the temporal dynamics of the reporting rate must be interpreted with caution, with certain species, such as raptors, likely utilising the area as a permanent territory. This is especially relevant to *A. verreauxii*, as the main prey species *P. capensis* is active throughout the year.

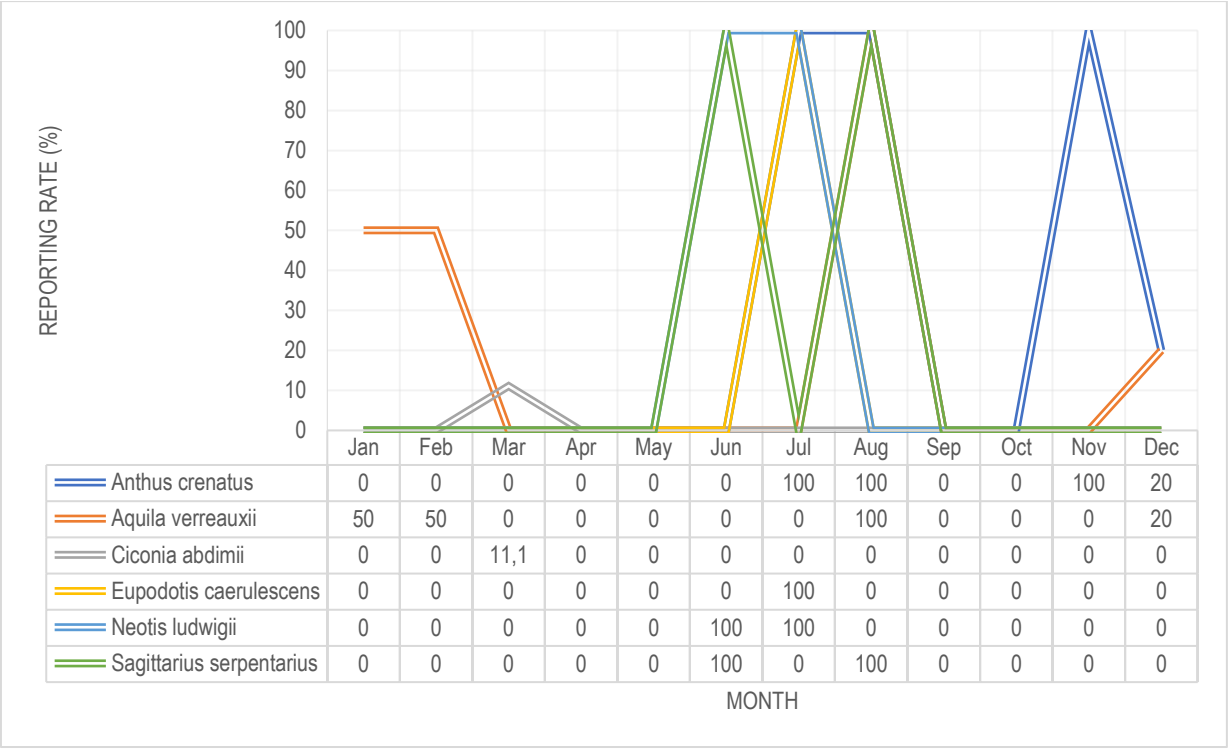


Figure 3-7 ***Line plot illustrating mean monthly reporting rate for avifauna species of conservation concern with high likelihood of occurrences within the project area of influence. The mean monthly reporting rate was calculated using the SABAP 2 reporting rates for each pentad considered in this assessment***

3.1.3.4 Expected Mammal Species of Conservation Concern

The IUCN Red List Spatial Data and MammalMAP database indicates that 59 mammal species are expected to occur within the PAOI. This list excludes larger mammal species that are generally restricted to protected areas. Nine of these expected species are of conservation concern (Table 3-6).

Table 3-6 ***Mammal species of conservation concern that are expected to occur within the Xhariep Export Programme Agricultural Development PAOI. EN = Endangered, LC = Least Concern, NT= Near Threatened and VU = Vulnerable***

Family	Scientific Name	Common Name	Conservation		Likelihood of Occurrence
			Regional	Global	
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	EN	LC	High
Erinaceidae	*Atelerix frontalis*	South African Hedgehog	NT	LC	High
Felidae	*Felis nigripes*	Black-footed Cat	VU	VU	Low
Felidae	*Leptailurus serval*	Serval	NT	LC	High
Felidae	*Panthera pardus*	Leopard	VU	VU	Moderate
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	NT	NT	Confirmed
Mustelidae	*Hydrictis maculicollis*	Spotted-necked Otter	VU	NT	Low
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	NT	LC	Moderate
Pteropodidae	*Eidolon helvum*	African Straw-colored Fruit Bat	LC	NT	Low

Atelerix frontalis (South African Hedgehog) ranges from southwestern Angola in the west, through northwestern and central Namibia, eastern Botswana, much of South Africa (throughout Gauteng and North West Province, western Limpopo Province and Mpumalanga, and throughout Free State; in the Northern Cape they occur in the northeast and southwards towards the Grahamstown district in Eastern Cape), western Zimbabwe, and may marginally occur in Lesotho. It is found in a wide variety of semi-arid and subtemperate habitats and have been recorded in scrub brush, western Karoo, grassland and

suburban gardens (Cassola, 2016). They require ample ground cover, for cover, nesting and insect food sources. The global population has not been estimated albeit there is a suspected continuing decline in the population. From 1980 to 2014, there has been an estimated 5% loss in extent of occurrence and 11-16% loss in area of occupancy (based on quarter degree grid cells) due to agricultural, industrial and urban expansion.

Leptailurus serval serval (Southern Serval) is widely distributed throughout sub-Saharan Africa but has specific habitat requirements and therefore restricted to certain areas. Thy typically favour savanna long-grass environments in high rainfall areas and are particularly associated with reedbeds and other riparian vegetation types (Thiel, 2019). The global population number is unknown. *L. serval* specializes in preying on small mammals, particularly rodents. The major threat is wetland habitat loss and degradation. Wetlands harbour comparatively high rodent densities compared with other habitat types and form the core areas of *L. serval* home ranges (Thiel, 2019). Degradation of grasslands through annual burning followed by over-grazing by domestic livestock, leading to reduced abundance of small mammals is a further threat. This species is protected by provincial legislation.

Panthera pardus (Leopard) has a wide distributional range across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range (Stein *et al*, 2020). There are few reliable data on changes in the status (distribution or abundance) throughout Africa over the last three generations, although there is compelling evidence that subpopulations have likely declined considerably. Impacts that have contributed to the decline in populations of this species include continued persecution by farmers, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting (Stein *et al*, 2020).

Parahyaena brunnea (Brown Hyaena) is endemic to southern Africa. This species occurs in dry areas, generally with annual rainfall less than 100 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna. The total population size has been estimated between 5 000-8 000 individuals with a continuing decline in mature individuals (Wiesel, 2015). Outside protected areas, the Brown Hyaena may come into conflict with humans, and they are often shot, poisoned, trapped, and hunted with dogs in predator eradication or control programmes, or inadvertently killed in non-selective control programs (Wiesel, 2015). The species is regarded as a threat to livestock in some areas, despite the finding that they very seldom prey on livestock. Their body parts are also used in traditional medicine.

3.2 Field Assessment

The following sections provides the results from the field survey for the proposed development that was undertaken during June 2022.

3.2.1 Flora Assessment

3.2.1.1 Indigenous Flora

A total of 57 species, representing 25 families were recorded within the PAOI during the survey period (Table 3-7, Figure 3-12 and Figure 3-14). Six of these species are endemic to South Africa, accounting for 11% of the total number of recorded species. None of the species recorded are regarded as SCC. Nevertheless, five species are protected by legislation and if granted authorisation, it is imperative that a Plant Search and Rescue Plan be developed prior to clearing and development. A permit from the relevant authority, Department of Economic Development, Tourism and Environmental Affairs, must be obtained to remove and relocate individuals of these species to surrounding natural areas. The locations of the protected flora species are illustrated in Figure 3-10 below. N.B. due to time constraints not all of the individuals were geotagged and the extent of occurrence of these species is considerably under-represented in the map. This is especially pertaining to the calcrete outcrop within which *Titanopsis calcarea* was ubiquitous.

Table 3-7 Summary of indigenous flora recorded within the Xhariep Export Programme Agricultural Development PAOI during the survey period. Protected species are highlighted in bold. LC = Least Concern

Family	Species Name	Growth Form	Conservation Status	Endemism
Acanthaceae	*Justicia divaricata*	Herb	LC	
Aizoaceae	*Aizoon canariense*	Succulent herb	LC	
Aizoaceae	*Malephora smithii*	Succulent herb	LC	Endemic
Aizoaceae	*Ruschia spinosa*	Succulent herb	LC	
Aizoaceae	***Titanopsis calcarea***	**Succulent herb**	**LC**	**Endemic**
Amaranthaceae	*Salsola aphylla*	Succulent herb	LC	
Anacardiaceae	*Searsia burchellii*	Small tree	LC	
Anacardiaceae	*Searsia lancea*	Tree	LC	
Apocynaceae	*Gomphocarpus fruticosus*	Herb	LC	
Asparagaceae	*Asparagus cooperi*	Herb	LC	
Asparagaceae	*Eriospermum sp.*	Geophytic herb		
Asphodelaceae	***Aloe claviflora***	**Succulent herb**	**LC**	
Asteraceae	*Berkheya multijuga*	Herb	LC	
Asteraceae	*Cineraria lyratiformis*	Herb	LC	
Asteraceae	*Crassothonna patula*	Succulent herb	LC	Endemic
Asteraceae	*Felicia filifolia subsp. filifolia*	Herb	LC	
Asteraceae	*Helichrysum luteoalbum*	Herb	LC	
Asteraceae	*Kleinia longiflora*	Succulent herb	LC	
Asteraceae	*Pentzia globosa*	Herb	LC	
Asteraceae	*Tarchonanthus camphoratus*	Small tree	LC	
Bignoniaceae	*Rhigozum trichotomum*	Small tree	LC	
Brassicaceae	*Heliophila minima*	Succulent herb	LC	
Colchicaceae	***Colchicum melanthoides***	**Geophytic herb**	**LC**	
Cyperaceae	*Afroscirpoides dioeca*	Graminoid	NE	
Cyperaceae	*Cyperus sp.*	Graminoid		
Cyperaceae	*Isolepis sp.*	Graminoid		
Euphorbiaceae	***Euphorbia crassipes***	**Succulent herb**	**LC**	
Fabaceae	*Lotononis laxa*	Herb	LC	
Fabaceae	*Melolobium microphyllum*	Herbaceous shrub	LC	
Fabaceae	*Senegalia mellifera* subsp. *detinens*	Small tree	LC	
Fabaceae	*Vachellia karoo*	Small tree	LC	
Geraniaceae	*Pelargonium* sp.	Succulent herb		
Iridaceae	***Moraea polystachya***	**Geophytic herb**	**LC**	
Oxalidaceae	*Oxalis sp.*	Geophytic herb		
Poaceae	*Aristida adscensionis*	Graminoid	LC	
Poaceae	*Aristida congesta subsp. barbicollis*	Graminoid	LC	
Poaceae	*Aristida congesta subsp. congesta*	Graminoid	LC	
Poaceae	*Chloris virgata*	Graminoid	LC	
Poaceae	*Digitaria eriantha*	Graminoid	LC	
Poaceae	*Enneapogon scoparius*	Graminoid	LC	
Poaceae	*Eragrostis capensis*	Graminoid	LC	
Poaceae	*Eragrostis lehmanniana var. lehmanniana*	Graminoid	LC	
Poaceae	*Eragrostis superba*	Graminoid	LC	

Family	Species Name	Growth Form	Conservation Status	Endemism
Poaceae	*Hyparrhenia hirta*	Graminoid	LC	
Poaceae	*Stipagrostis obtusa*	Graminoid	LC	
Poaceae	*Themeda triandra*	Graminoid	LC	
Polygalaceae	*Polygala pungens*	Succulent herb	LC	Endemic
Ranunculaceae	*Clematis brachiata*	Herbaceous climber	LC	
Rhamnaceae	*Ziziphus mucronata* subsp. *mucronata*	Large tree	LC	
Santalaceae	*Viscum continuum*	Semiparasitic epiphyte	LC	Endemic
Santalaceae	*Viscum rotundifolium*	Semiparasitic epiphyte	LC	
Scrophulariaceae	*Diclis petiolaris*	Herb	LC	
Scrophulariaceae	*Nemesia rupicola*	Herb	LC	
Solanaceae	*Lycium cinereum*	Woody shrub	LC	
Solanaceae	*Lycium hirsutum*	Small tree	LC	
Zygophyllaceae	*Sisyndite spartea*	Succulent herb	LC	
Zygophyllaceae	*Zygophyllum incrustatum*	Small tree	LC	Endemic

Figure 3-8 ***Photographs illustrating a portion of the indigenous flora recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. A) Justicia divaricata, B) Titanopsis calcarea, C) Melolobium microphyllum, D) Colchicum melanthoides, E) Malephora smithii and F) Polygala pungens***

Figure 3-9 ***Photographs illustrating a portion of the indigenous flora recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period continued. A) Cineraria lyratiformis, B) Lessertia frutescens, C) Aloe claviflora, D) Euphorbia crassipes, E) Malephora smithii and F) Moraea polystachya***

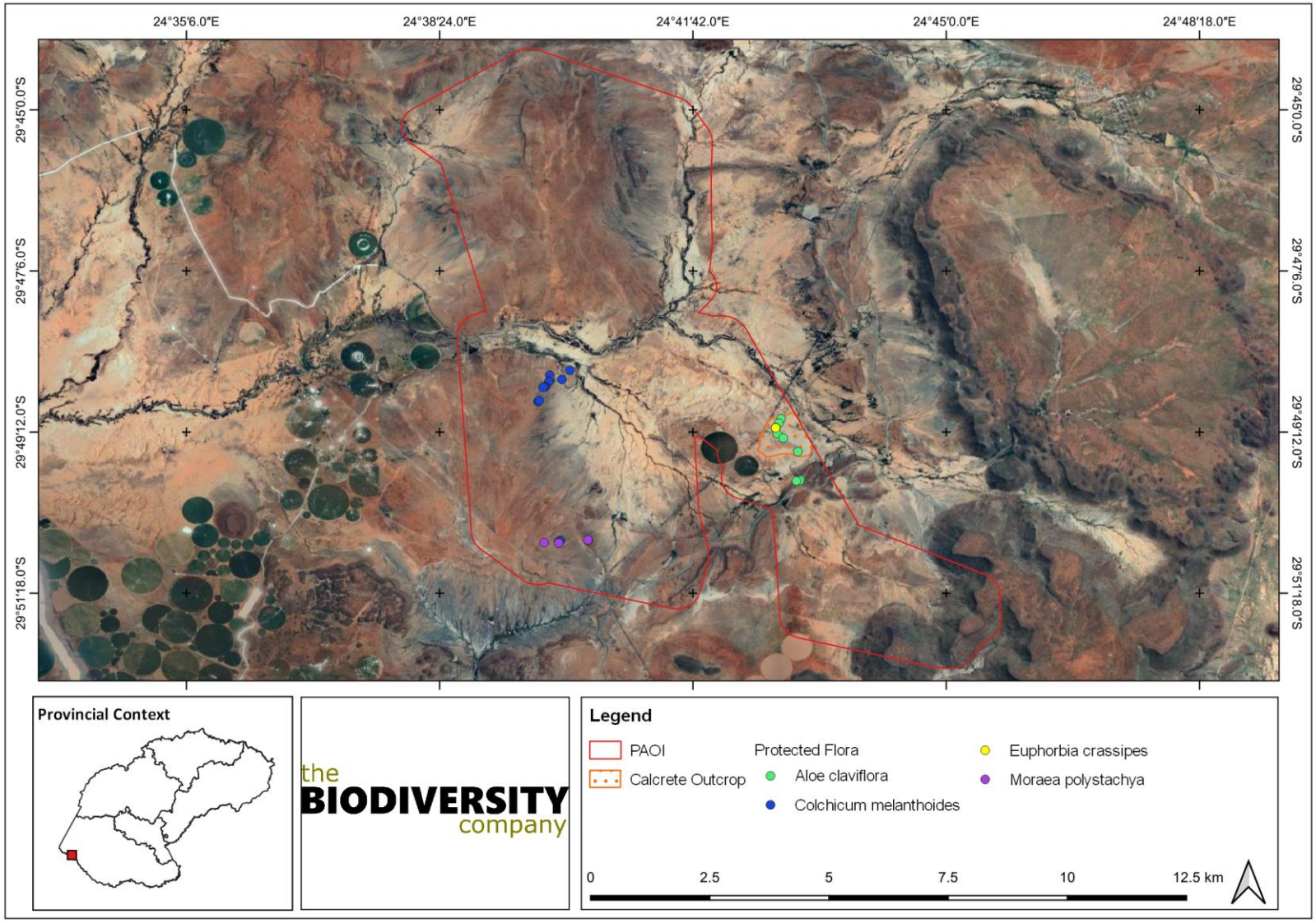


Figure 3-10 Map illustrating the location of protected flora within the proposed Xhariep Export Programme Agricultural Development PAOI

The ecological state of grasses (Poaceae) refers to the grouping of grasses according to their reaction to different levels of grazing (Oudsthoorn, 2020) The dominant graminoid species, in terms of cover, are classified as increaser II species. These grasses are abundant in overgrazed veld and are generally common in semi-arid to arid regions. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and sub-climax species.

Notably, there are likely more flora species within the PAOI, including protected species, but these were not recorded as the ideal survey period would have been from December to March as indicated by the Species Environmental Assessment Guideline (SANBI, 2020) (Figure 3-11). This would have ensured that flora species are correctly identified, and a true representative sample of the species community structure is obtained.

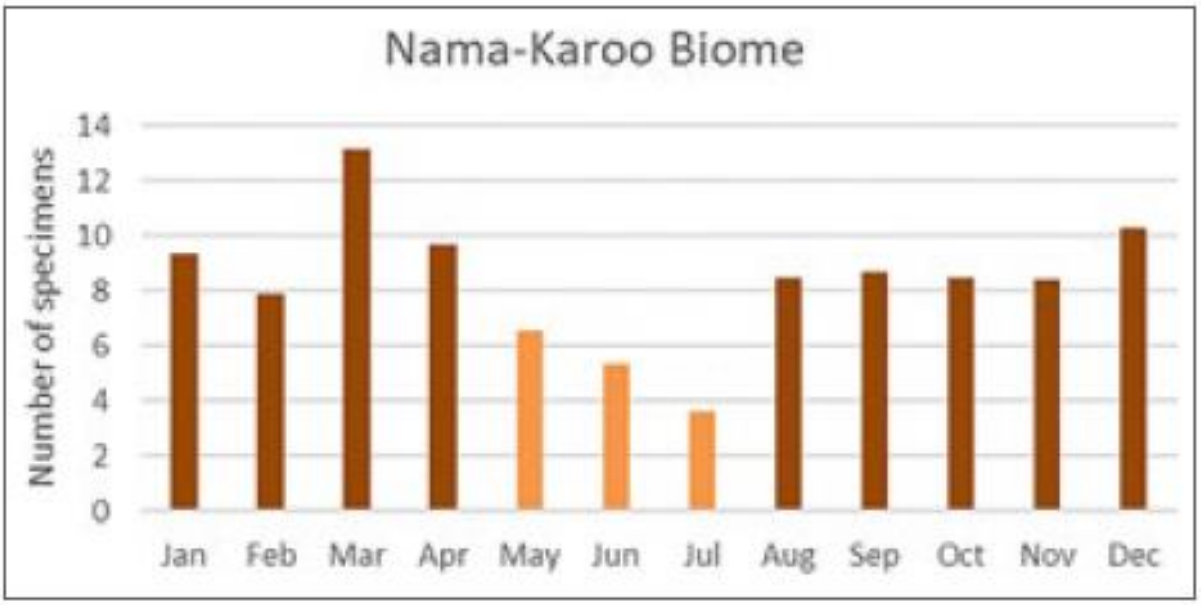


Figure 3-11 Plant collection month summary of the Nama Karoo Biome to indicate optimal survey periods. Source: SANBI (2020)

3.2.1.2 Invasive Alien Plants

Invasive Alien Plants (IAPs) tend to dominate or replace indigenous flora, thereby transforming the structure, composition and functioning of ecosystems. Therefore, it is important that these plants are controlled by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

NEMBA is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the NEMBA. The Alien and Invasive Species Regulations were published in the Government Gazette No. 44182, 24th of February 2021. The legislation calls for the removal and / or control of IAP species. In addition, unless authorised thereto in terms of the NWA, no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the NEMBA:

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive

potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the Act;
    - The relevant invasive species management programme developed in terms of regulation 4; and
    - Any directive issued in terms of section 73(3) of the Act.

Three (3) species of invasive plants that are categorised as 1b were observed within the PAOI and surrounding area (Table 3-8). Disturbance of areas due to the activities of the proposed development may enable encroachment of the invasive species into these areas. Accordingly, invasive species must be controlled by developing and implementing an Invasive Alien Plant Control Programme, should the proposed development be granted authorisation.

Table 3-8 Summary of Invasive Alien Plants recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period

Species Name	NEMBA Category	Control	Photograph
Arundo donax	1b	Difficult to control. Plants should be cut down and regrowth sprayed with a herbicide. All slash material must be burnt. Physical removal is only possible by complete removal of the rhizome.	

Species Name	NEMBA Category	Control	Photograph
Cylindropuntia imbricata	1b	Hand-spraying with Monosodium Methyl Arsenate (MSMA). Biological control is the most effective.	
Opuntia cespitosa	1b	Stem injection with herbicide. Biological control is the most effective.	

3.2.2 Fauna Assessment

3.2.2.1 Amphibians

No amphibian species were recorded within the PAOI due to the seasonal period of the survey. Based on the presence of endorheic, riverine and wetland ecosystems within the PAOI the species richness is expected to be high. It is postulated that majority, if not all, of the expected species in Appendix C occur within the PAOI.

3.2.2.2 Reptiles

Ten (10) species of reptile were recorded within the assessment area during the survey period, accounting for 25% of the expected species (Table 3-9, Figure 3-12). None of the species recorded are regarded as SCC. The lack of species diversity recorded within the PAOI is due to the secretive behaviour of many reptile species and therefore, extensive survey periods are required to obtain an accurate representative sample. Considering the heterogenous structure of the PAOI in terms of habitat structure, it is likely to support a highly diverse species assemblage.

Table 3-9 Summary of reptile species recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. LC = Least Concern

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Agamidae	*Agama aculeata aculeatea*	Western Ground Agama	LC	LC
Elapidae	*Hemachatus haemachatus**	Rinkhals	LC	LC
Elapidae	*Naja nivea**	Cape Cobra	LC	LC
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC	LC
Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	LC	LC
Scincidae	*Trachylepis capensis*	Cape Skink	LC	LC
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	LC	LC
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC	LC
Varanidae	*Varanus niloticus*	Water Monitor	LC	LC
Viperidae	*Bitis arietans arietans**	Puff Adder	LC	LC

*As indicated by farm staff

Notably, *Stigmochelys pardalis* (Leopard Tortoise), is regarded as a keystone species within the Nama Karoo biome. The species possesses a relatively large home range between 40.53 and 258.52 ha and therefore, are vital seed dispersers.

Figure 3-12 ***Photograph illustrating individuals of the reptile species recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. A) Stigmochelys pardalis (Leopard Tortoise), B) Pachydactylus capensis (Cape Thick-toed Gecko), C) Acontias gracilicauda (Thin-tailed Legless Skink) and D) Trachylepis sulcata sulcata (Western Rock Skink)***

3.2.2.3 Avifauna

Fifty (51) species, representing 31 families of indigenous avifauna were recorded within the PAOI during the survey period (Table 3-10, Figure 3-13). This accounts for approximately 26% of the species expected to occur within the PAOI. Based on the variation of the habitat structure within the PAOI, a high diversity of species is expected with more species likely to be recorded with additional surveys. Of critical importance is the recording of three SCC within the PAOI that were not provided in section 3.1.3.3 of this report. *Aquila rapax rapax* (Southern Tawny Eagle) and *Ardeotis kori kori* (Southern Kori Bustard) are listed as SCC on a regional and global scale, and *Falco biarmicus* (Lanner Falcon) is listed as a SCC on a regional scale.

Aquila rapax is listed as VU on a global scale (BirdLife International, 2021) and EN on a regional scale (Taylor *et al*, 2015). This is a widespread raptor occurring over large areas of Sub-Saharan Africa, with isolated populations in North Africa, the Middle East and South Asia, albeit the African population is now becoming increasingly dependent on protected areas (BirdLife International, 2021). The species occupies dry open habitats from sea level to 3000 m and will occupy both woodland and wooded savannah. *Aquila rapax rapax* predates on mammals, birds, reptiles, insects, and occasionally fish and amphibians. It will also regularly consume carrion and pirate other raptors' prey. The African population is estimated at 73 860 pairs with a severely declining population at a rate of decline as > 60% over the past 50 years within South Africa, Lesotho and eSwatini. The main threats are secondary poisoning, direct persecution and collisions with powerlines (BirdLife International, 2021).

Ardeotis kori is listed as NT on a regional and global scale (BirdLife International, 2016c). This species has a large but disjunct range in sub-Saharan Africa, occurring from Ethiopia and Somalia south to Tanzania, and from southern Angola and Zimbabwe south to South Africa. The species occupies flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. The diet includes a wide range of plants and animals including insects, reptiles, small rodents, birds, carrion, seeds, berries and roots. It is largely sedentary but does undertake local movements. The global population size has not been quantified, but the population in South Africa has been estimated at 2 000-5 000 birds individuals (BirdLife International, 2016c). A major threat is collision with overhead power lines, but the causes of population declines and range losses in many parts of the distribution are unknown. These have been hypothesised to include persecution, rangeland degradation and bush encroachment.

Falco biarmicus (Lanner Falcon) is listed as LC on a global scale (BirdLife International, 2016d) but VU on a regional scale. They may occur in groups up to 20 individuals or individually. Their diet is mainly composed of small birds such as pigeons and francolins. Threats include trapping, persecution, pesticide use and habitat loss.

Table 3-10 Summary of avifauna species recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. Species of conservation concern are highlighted in bold. EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Accipitridae	***Aquila rapax rapax***	**Southern Tawny Eagle**	**EN**	**VU**
Accipitridae	*Elanus caeruleus caeruleus*	African Black-shouldered Kite	LC	LC
Accipitridae	*Melierax canorus canorus*	Southern Pale Chanting Goshawk	LC	LC
Alaudidae	*Calendulauda africanoides africanoides*	Fawn-coloured Lark	LC	LC
Alaudidae	*Chersomanes albofasciata albofasciata*	Central Spike-heeled Lark	LC	LC
Alaudidae	*Mirafra fasciolata*	Eastern Clapper Lark	LC	LC
Anatidae	*Tadorna cana*	South African Shelduck	LC	LC
Ardeidae	*Ardea melanocephala*	Black-headed Heron	LC	LC
Cisticolidae	*Cisticola juncidis terrestris*	Southern African Zitting Cisticola	LC	LC
Cisticolidae	*Malcorus pectoralis*	Rufous-eared Warbler	LC	LC
Cisticolidae	*Prinia flavicans flavicans*	Black-chested Prinia	LC	LC
Coliidae	*Colius colius*	White-backed Mousebird	LC	LC
Coliidae	*Urocolius indicus*	Red-faced Mousebird	LC	LC
Columbidae	*Spilopelia senegalensis*	Laughing Dove	LC	LC
Columbidae	*Streptopelia capicola*	Cape Turtle Dove	LC	LC
Columbidae	*Streptopelia semitorquata*	Red-eyed Dove	LC	LC
Emberizidae	*Emberiza capensis cinnamomea*	Karoo Cape Bunting	LC	LC
Estrildidae	*Amadina erythrocephala*	Red-headed Finch	LC	LC
Estrildidae	*Lagonosticta senegala rendalli*	Red-billed Firefinch	LC	LC
Falconidae	***Falco biarmicus***	**Lanner Falcon**	**VU**	**LC**
Falconidae	*Falco rupicolus*	Rock Kestrel	LC	LC
Glareolidae	*Smutsornis africanus*	Double-banded Courser	LC	LC
Hirundinidae	*Ptyonoprogne fuligula*	Rock Martin	LC	LC
Laniidae	*Lanius collaris collaris*	Southern Fiscal	LC	LC
Lybiidae	*Tricholaema leucomelas*	Acacia Pied Barbet	LC	LC
Malaconotidae	*Tchagra australis*	Brown-crowned Tchagra	LC	LC
Malaconotidae	*Telophorus zeylonus zeylonus*	Southern Bokmakierie	LC	LC
Meropidae	*Merops bullockoides*	White-fronted Bee-eater	LC	LC
Motacillidae	*Motacilla capensis*	Cape Wagtail	LC	LC
Muscicapidae	*Cercotrichas coryphoeus coryphoeus*	Common Karoo Scrub Robin	LC	LC
Muscicapidae	*Cercotrichas paena*	Kalahari Scrub Robin	LC	LC
Muscicapidae	*Cossypha caffra caffa*	Southern Cape Robin-Chat	LC	LC
Muscicapidae	*Myrmecocichla formicivora*	Ant-eating Chat	LC	LC
Muscicapidae	*Oenanthe familiaris*	Familiar Chat	LC	LC

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Muscicapidae	*Turdus smithi*	Karoo Thrush	LC	LC
Nectariniidae	*Cinnyris fuscus fuscus*	Common Dusky Sunbird	LC	LC
Numididae	*Numida meleagris*	Helmeted Guineafowl	LC	LC
Otididae	***Ardeotis kori kori***	**Southern Kori Bustard**	**NT**	**NT**
Otididae	*Eupodotis afraoides afraoides*	South African Black Korhaan	LC	LC
Passeridae	*Plocepasser mahali*	White-browed Sparrow-Weaver	LC	LC
Phoeniculidae	*Rhinopomastus cyanomelas*	Common Scimitarbill	LC	LC
Ploceidae	*Ploceus velatus*	Southern Masked Weaver	LC	LC
Ploceidae	*Quelea quelea lathamii*	South African Red-billed Quelea	LC	LC
Ploceidae	*Sporopipes squamifrons*	Scaly-feathered Weaver	LC	LC
Pycnonotidae	*Pycnonotus nigricans*	African Red-eyed Bulbul	LC	LC
Remizidae	*Anthoscopus minutus*	Southern Penduline Tit	LC	LC
Scopidae	*Scopus umbretta umbretta*	Common Hamerkop	LC	LC
Strigidae	*Tyto alba affinis*	African Barn Owl	LC	LC
Sturnidae	*Lamprotornis nitens*	Cape Starling	LC	LC
Sylviidae	*Curruca subcoerulea subcoerulea*	Chestnut-vented Warbler	LC	LC
Threskiornithidae	*Bostrychia hagedash*	Hadeda Ibis	LC	LC

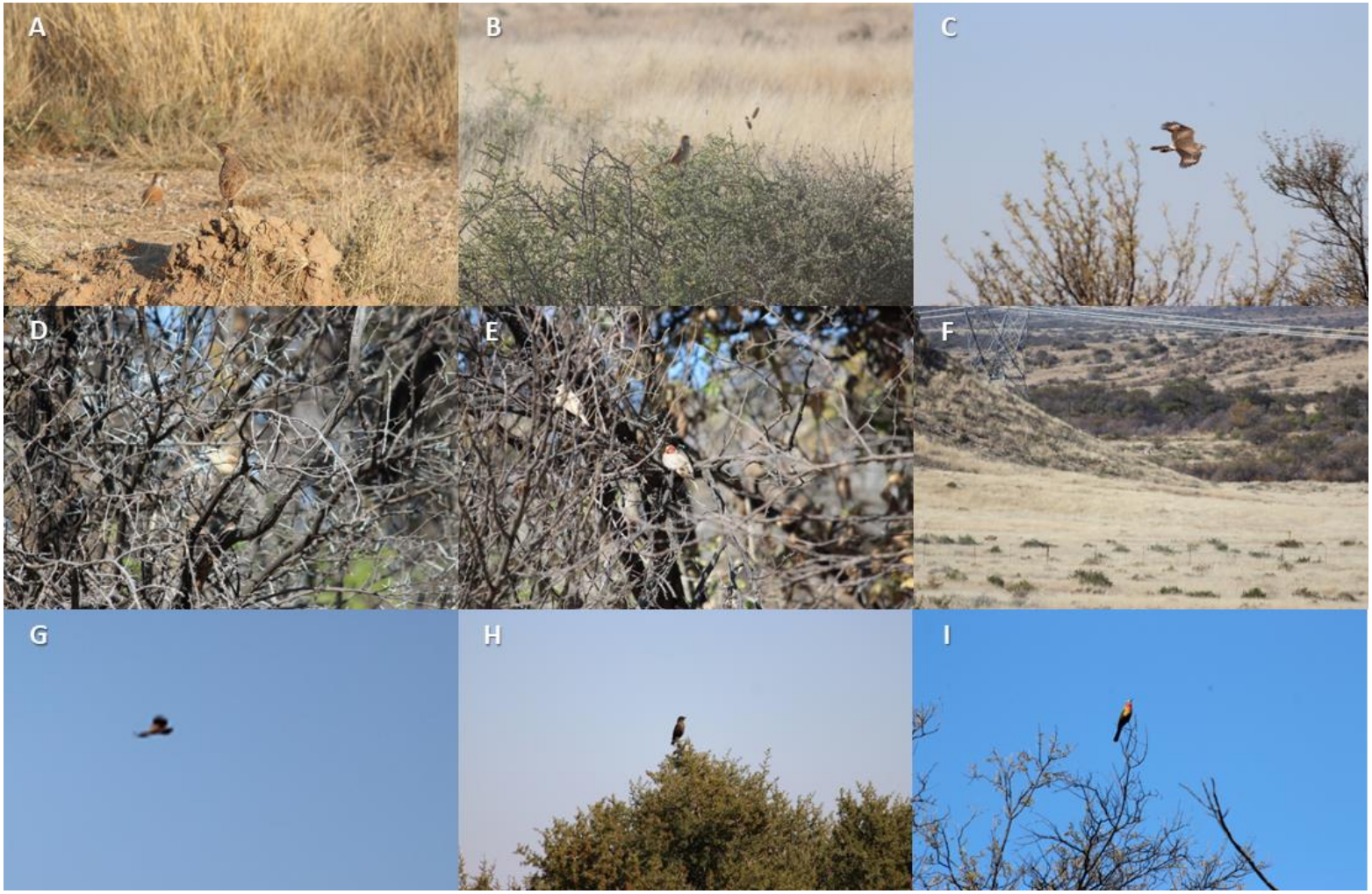


Figure 3-13 ***Photographs illustrating a portion of the avifauna species recorded within the proposed Agricultural Development and Associated Infrastructure PAOI during the survey period. A) Chersomanes albofasciata albofasciata (Central Spike-heeled Lark), B) Malcorus pectoralis (Rufous-eared Warbler), C) Melierax canorus canorus (Southern Pale Chanting Goshawk), D) Tchagra australis (Brown-crowned Tchagra), E) Amadina erythrocephala (Red-headed Finch), F) Ardeotis kori kori (Southern Kori Bustard), G) Aquila rapax rapax (Southern Tawny Eagle), H) Myrmecocichla formicivore (Ant-eating Chat) and I) Merops bullockoides (White-fronted Bee-eater)***

3.2.2.4 Mammals

Seventeen (17) mammal species were recorded during the survey based on either direct observation, capture of specimens by passive sampling techniques or the presence of visual tracks and signs (Table 3-11, Figure 3-14). This accounts for approximately 35% of the expected species. One of the expected SCC described in section 3.1.3.4 of this report was confirmed to occur within the PAOI. *Parahyaena brunnea* is classified as NT on a regional and global scale (Wiesel, 2015). Moreover, due to the diversity of habitats on a broad and fine scale, there is a high likelihood of occurrence of other select mammal SCC occurring within the PAOI (see section 3.1.3.4 of this report).

Several of the species recorded are considered important in maintaining biodiversity and ecosystem functioning. Species such as *Orycteropus afer afer* (Southern Aardvark) and *Geosciurus inauris* (South African Ground Squirrel) are regarded as ecosystem engineers and the burrows they create are also utilised as shelter by an array of faunal species, which is pertinent in the thermally variable and semi-arid environment of the PAOI and surrounding landscape. In addition, the foraging behaviour of the former species plays a role in vegetation dynamics. *Orycteropus afer* feed on the Formicidae species, *Messor capensis*, which is a major seed predator within the Karoo bioregion. During foraging by *O.afer afer*, the nests are damaged but usually not destroyed, and the seed stores are frequently distributed with the mound soils over a larger area. The seeds are usually buried within the mound soil and germinate during favourable conditions. A portion of the seeds may also be ingested by *O. afer afer* while feeding on the ants and these are distributed with the faeces. Consequently, the species inadvertently also plays a role in seed dispersal and germination.

While it is acknowledged that *O. afer afer* is regarded as keystone species within the landscape, *G. inauris* could also be regarded as such, as herbivorous mammal burrows are usually associated with higher levels of soil nutrients and greater degree of water infiltration and can result in elevated foliar nutrient concentrations and greater plant biomass surrounding their burrows (Davidson *et al*, 2012). Therefore, the areas around the burrows are utilised by many species and can result in a highly diverse arthropod community, which consequently drives a higher diversity in higher trophic levels.

The PAOI and surrounding landscape also supports a species rich assemblage of mesocarnivores. Mesocarnivores have strong effects on their prey species, and this especially so in simple ecological communities or in regions where apex predators are lacking (Roemer *et al*, 2009). Consequently, shifts in the population or diversity of the mesocarnivore community may lead to trophic cascade effects. This may result in the population explosion of lower trophic organisms, including groups that reach pest proportions such as rodents.

Table 3-11 Summary of mammal species recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. Species of conservation concern are highlighted in bold. LC = Least Concern and NT = Near Threatened

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Bathyergidae	*Cryptomys hottentotus*	Common Molerat	LC	LC
Bovidae	*Antidorcas marsupialis marsupialis*	Karoo Sprinbok	LC	LC
Bovidae	*Raphicerus campestris campestris*	Southern Steenbok	LC	LC
Bovidae	*Tragelaphus strepsiceros strepsiceros*	Southern Greater Kudu	LC	LC
Canidae	*Lupulella mesomelas mesomelas*	Southern Black-backed Jackal	LC	LC
Felidae	*Caracal caracal caracal*	Southern and Eastern African Caracal	LC	LC
Felidae	*Felis lybica cafra*	Southern African Wildcat	LC	LC
Herpestidae	*Cynictis penicillata penicillata*	Southern Yellow Mongoose	LC	LC
Herpestidae	*Herpestes pulverulentus*	Cape Grey Mongoose	LC	LC
Hyaenidae	***Parahyaena brunnea***	**Brown Hyaena**	**NT**	**NT**
Hystricidae	*Hystrix africaeaustralis africaeaustralis*	Southern Porcupine	LC	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC	LC
Macroscelididae	*Elephantulus myurus*	Eastern Rock Sengi	LC	LC
Muridae	*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC
Orycteropodidae	*Orycteropus afer afer*	Southern Aardvark	LC	LC
Suidae	*Phacochoerus africanus sundevallii*	Southern Warthog	LC	LC
Viverridae	*Genetta felina*	Southern Small-spotted Genet	LC	LC

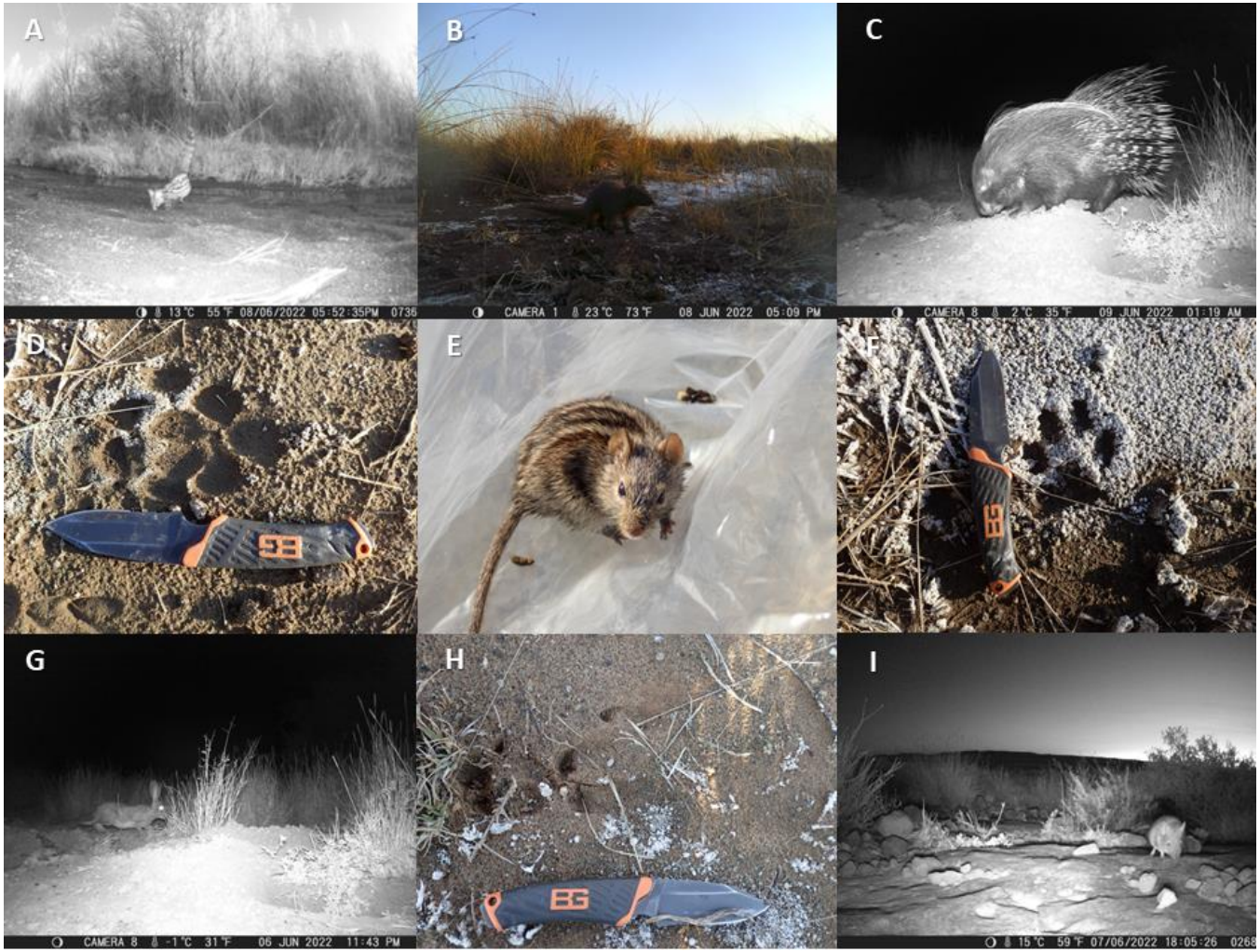


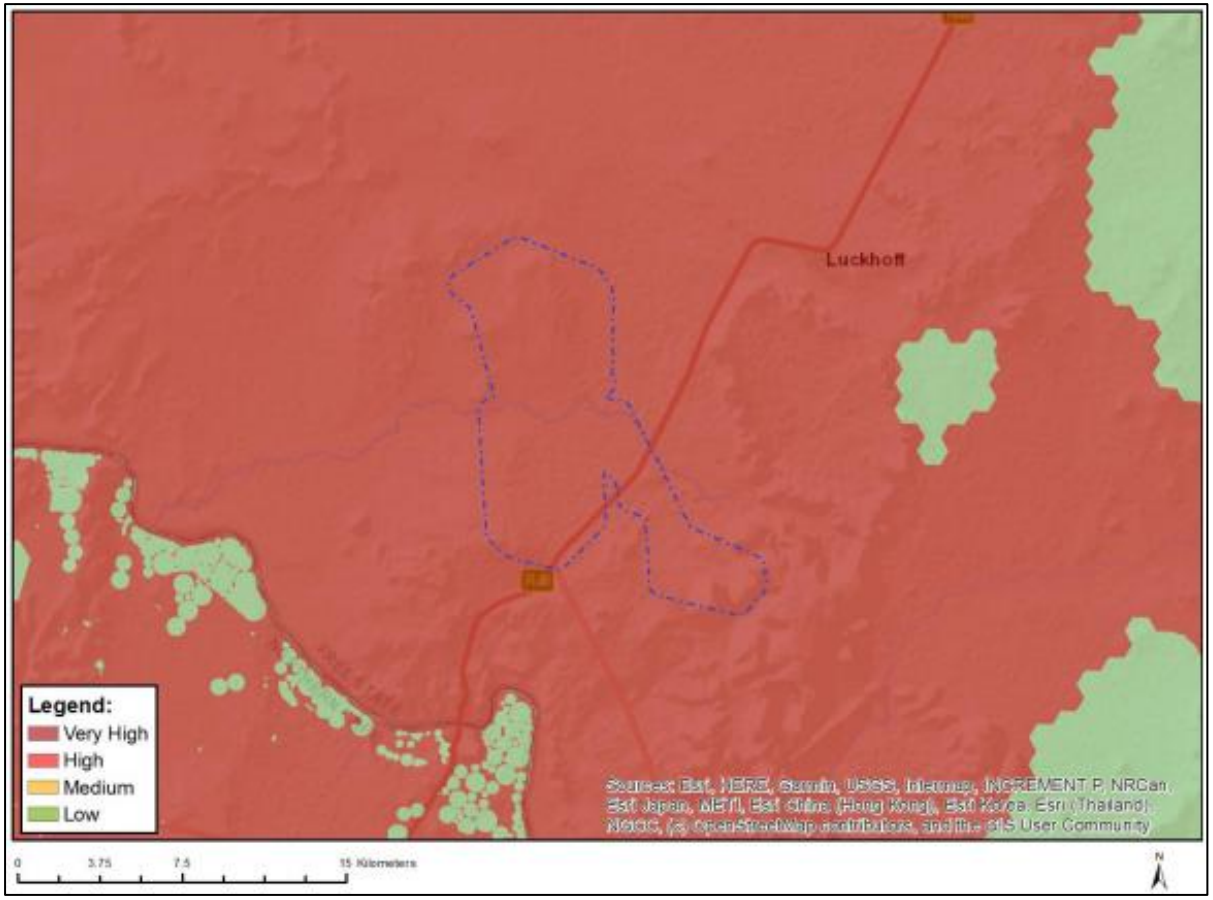
Figure 3-14 ***Photographs illustrating a portion of the mammal species recorded within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period. A) Genetta felina (Southern Small-spotted Genet), B) Herpestes pulverulentus (Cape Grey Mongoose), C) Hystrix africaeaustralis africaeaustralis (Southern Porcupine), D) Parahyaena brunnea (Brown Hyaena), E) Rhabdomys pumilio (Four-striped Grass Mouse), F) Caracal caracal caracal (Southern and Eastern African Caracal), G) Lepus saxatilis (Scrub Hare), H) Orycteropus afer afer (Southern Aardvark) and I) Elephantulus myurus (Eastern Rock Sengi)***

4 Site Ecological Importance (SEI) and Ecosystem Processes

4.1 Environmental Screening Tool

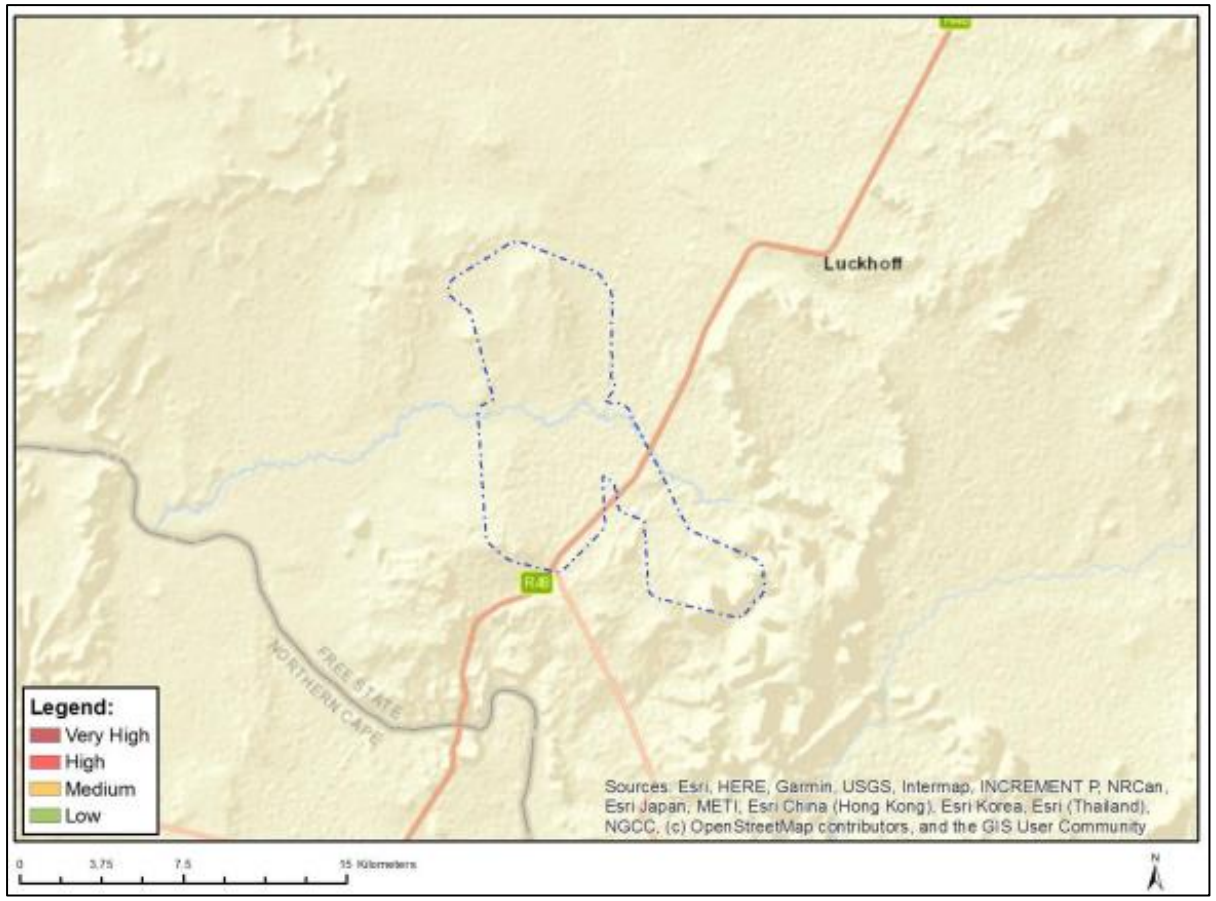
According to the Screening Tool Report generated (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended), the following sensitivity classifications were extracted from the National Web-based Environmental Screening Tool (Figure 4-1 to Figure 4-2):

- Combined Terrestrial Biodiversity Theme is Very High, due to overlap with CBA1, CBA2, ESA1, ESA2 and Protected Areas Expansion Strategy areas;
- Plant Species Theme is Medium; and
- Animal Species Theme is High, due to the overlap with *Redunca fulvorufula* (EN), *Hydrictis maculicollis* (NT) *Neotis ludwigii* (EN) and *Aquila verreauxii* (LC) (screening tool was unable to obtain a map image at the time of reporting).



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Figure 4-1 Relative Terrestrial Biodiversity Theme Sensitivity for the proposed Xhariep Export Programme Agricultural Development PAOI



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Figure 4-2 Relative Plant Species Theme Sensitivity for the proposed Xhariep Export Programme Agricultural Development PAOI

4.2 Site Ecological Importance

Based on the criteria provided in section 2.4 of this report, all habitats within the PAOI were assigned a sensitivity category, i.e., a SEI category. The PAOI was categorised as possessing habitats possessing areas of 'Very Low', 'High' and 'Very High' SEI. (Table 4-1). This indicates that the findings of this assessment are congruent with the Screening Tool with respect to the Combined Terrestrial and Animal Species Theme sensitivity.

The SEI of the PAOI as well as lotic system buffers are illustrated in Figure 4-3. Based on the buffer recommendations as provided in Macfarlane *et al* (2009) the Lemoenspruit mainstem was allocated a 100 m buffer and its associated tributaries a 50 m buffer. This is because these lotic systems play a critical role in maintaining connectivity within the landscape and support a diversity of fauna species.

Photographs illustrating the habitat structure of the PAOI is provided in Figure 4-4. The guidelines for interpreting the SEI category within the context of the proposed development are provided in

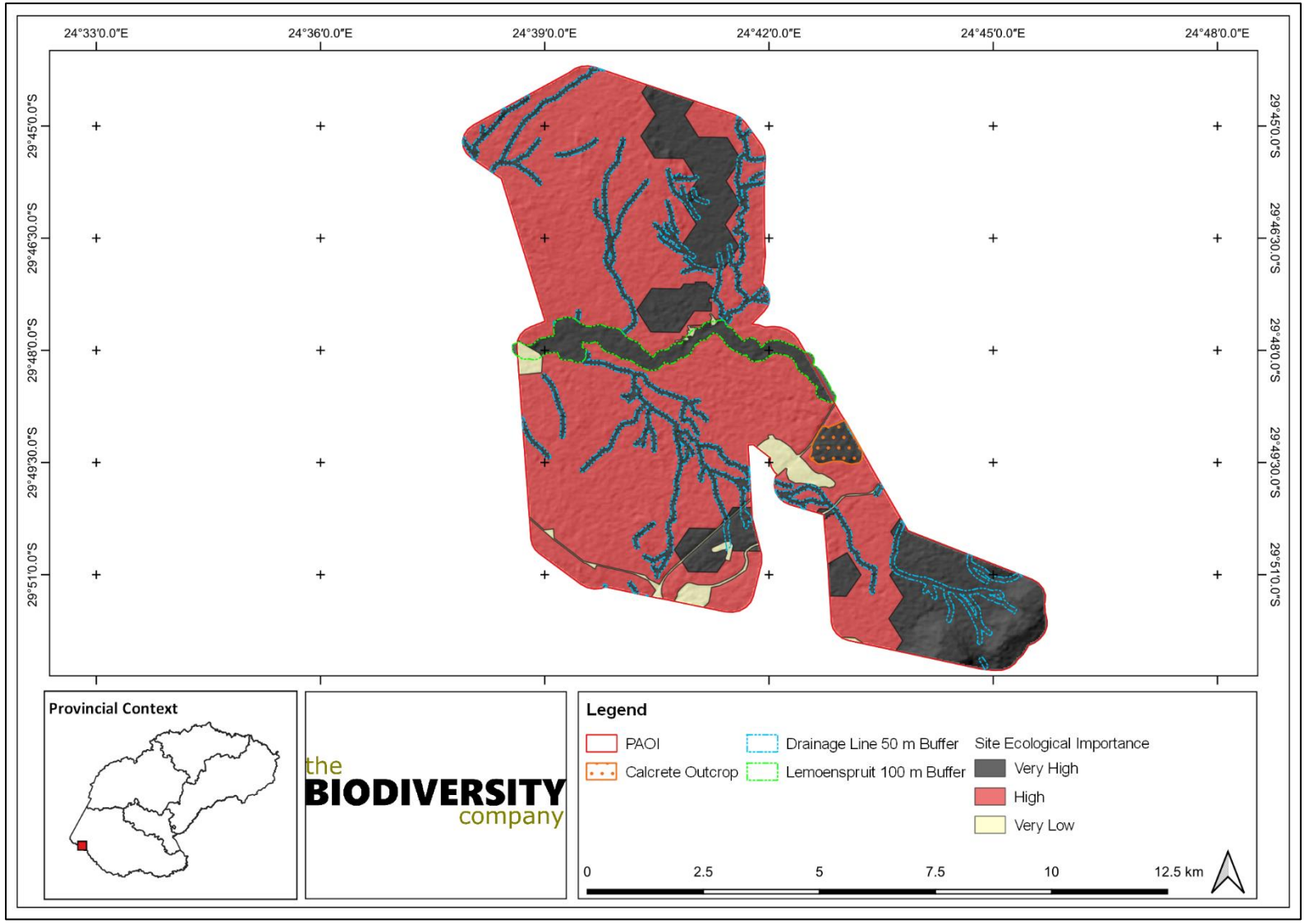


Figure 4-3 Map illustrating the Site Ecological Importance of the proposed Xhariep Agricultural Development PAOI

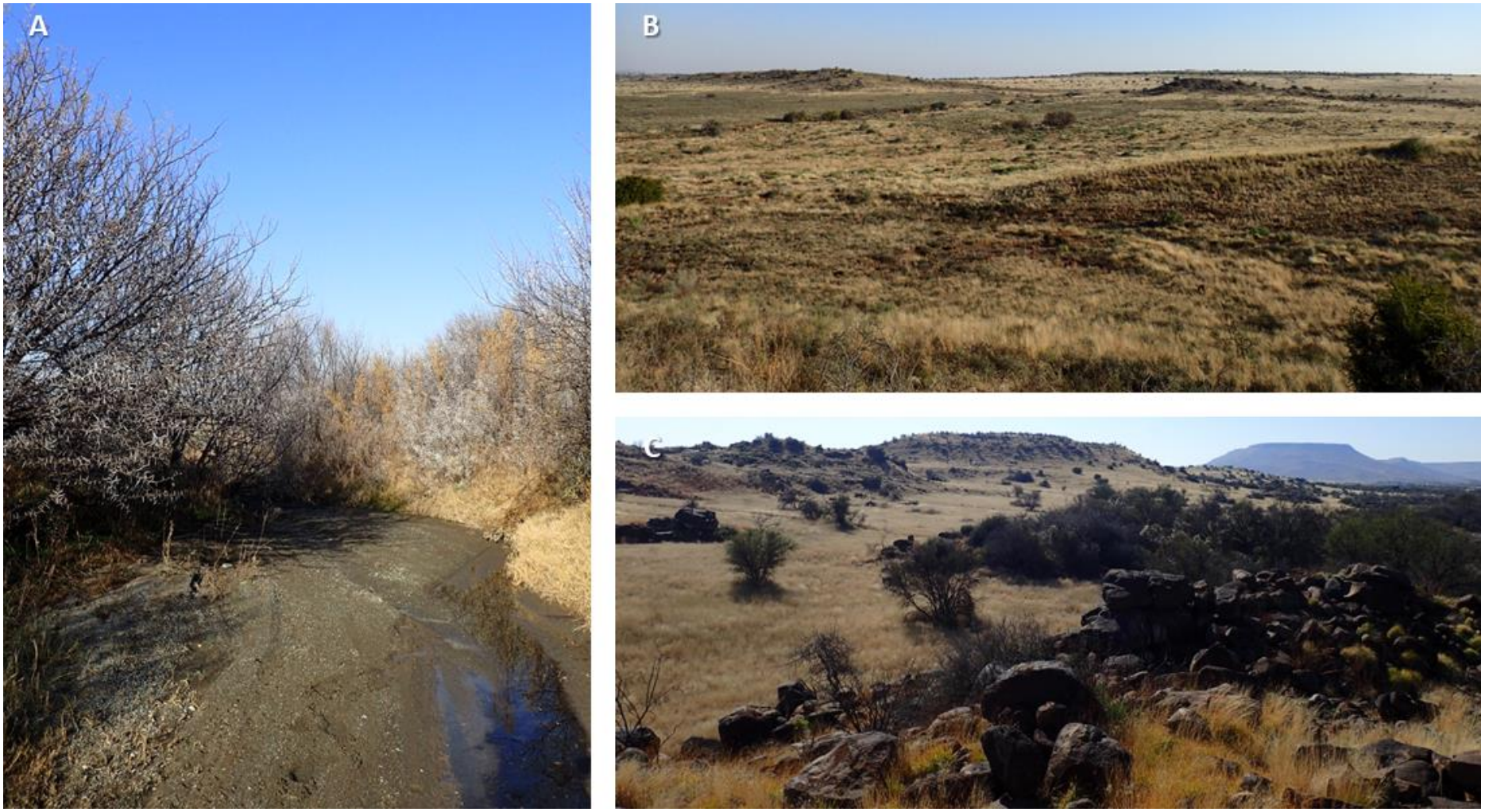


Figure 4-4 ***Photographs illustrating an overview of the physiognomy of the habitats present within the proposed Xhariep Export Programme Agricultural Development PAOI. A) Drainage lines, both perennial and ephemeral, B) Plains and gentle slopes interspersed with dolerite extrusions and C) Close-up view of a dolerite extrusion with larger mountain ranges in the background***

Table 4-2 below.

Table 4-1 Summary of the proposed Xhariep Export Programme Agricultural Development PAOI Site Ecological Importance

Ecological Features (Area [ha])	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Critical Biodiversity Area 1, Calcrete Outcrop and Lotic Systems including Buffer Zones (5 673)	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2.	Very High Very large (> 100 ha) intact area for any conservation status of ecosystem type. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.	Very High	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	Very High
Critical Biodiversity Area 2 and Ecological Support Areas (2 733)	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2.	Very High Very large (> 100 ha) intact area for any conservation status of ecosystem type. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.	Very High	High Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.	High
Modified Areas (207)	Very Low No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.	Low Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area.	Very Low	Very High Habitat that can recover rapidly (~ less than 5 years) to restore > 75%28 of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.	Very Low

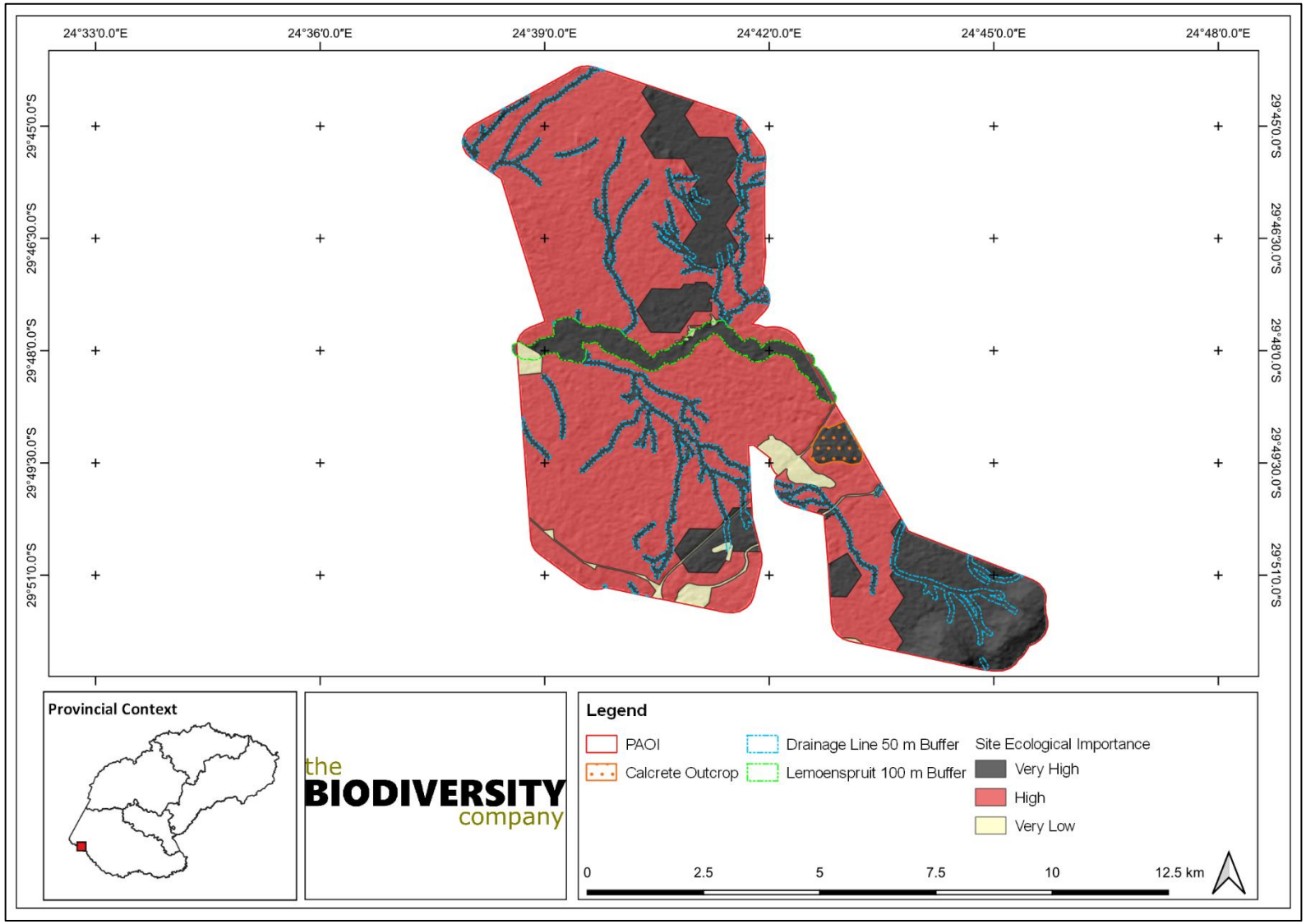


Figure 4-3 Map illustrating the Site Ecological Importance of the proposed Xhariep Agricultural Development PAOI

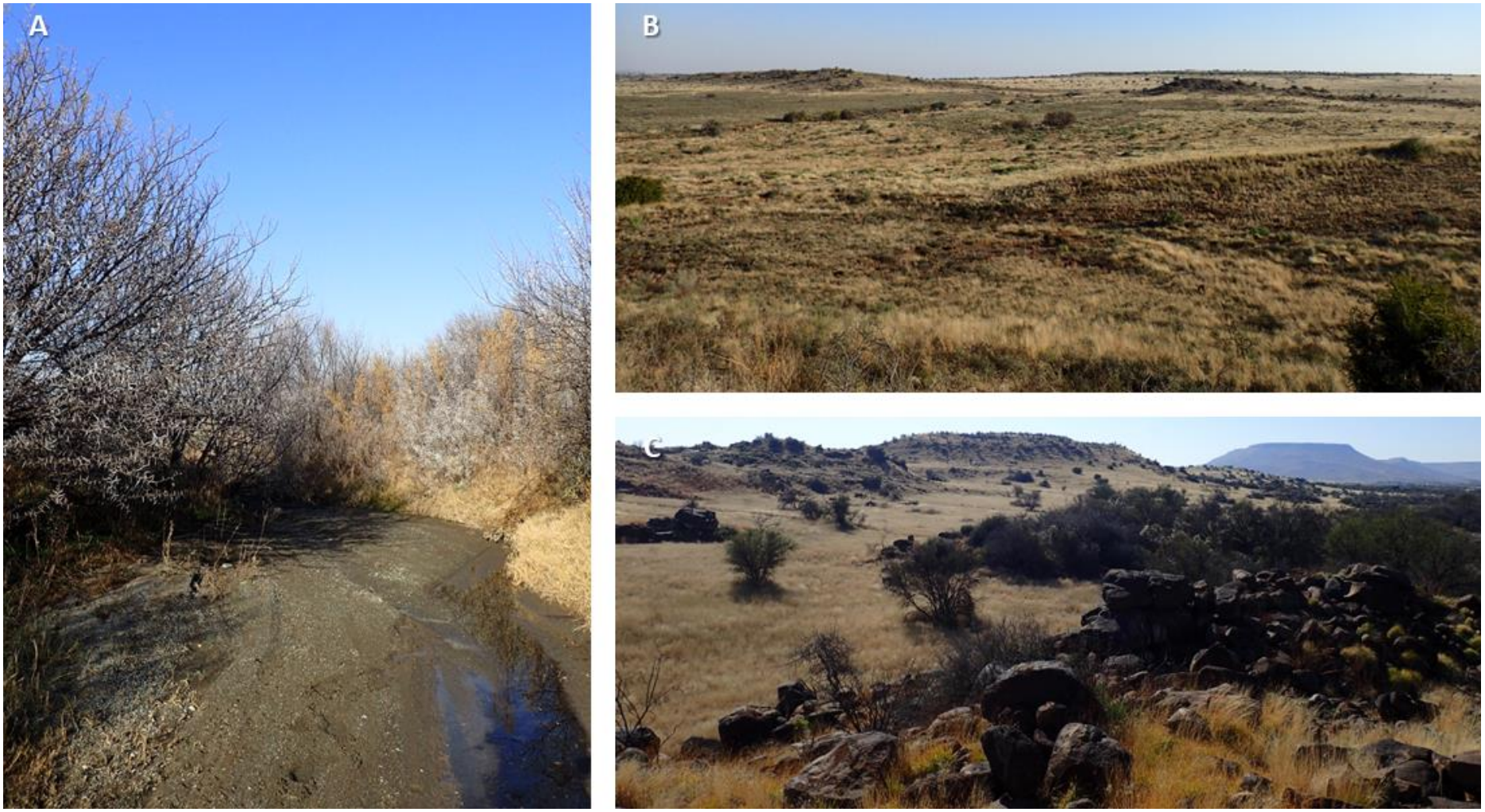


Figure 4-4 ***Photographs illustrating an overview of the physiognomy of the habitats present within the proposed Xhariep Export Programme Agricultural Development PAOI. A) Drainage lines, both perennial and ephemeral, B) Plains and gentle slopes interspersed with dolerite extrusions and C) Close-up view of a dolerite extrusion with larger mountain ranges in the background***

Table 4-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

4.3 Ecosystem Processes

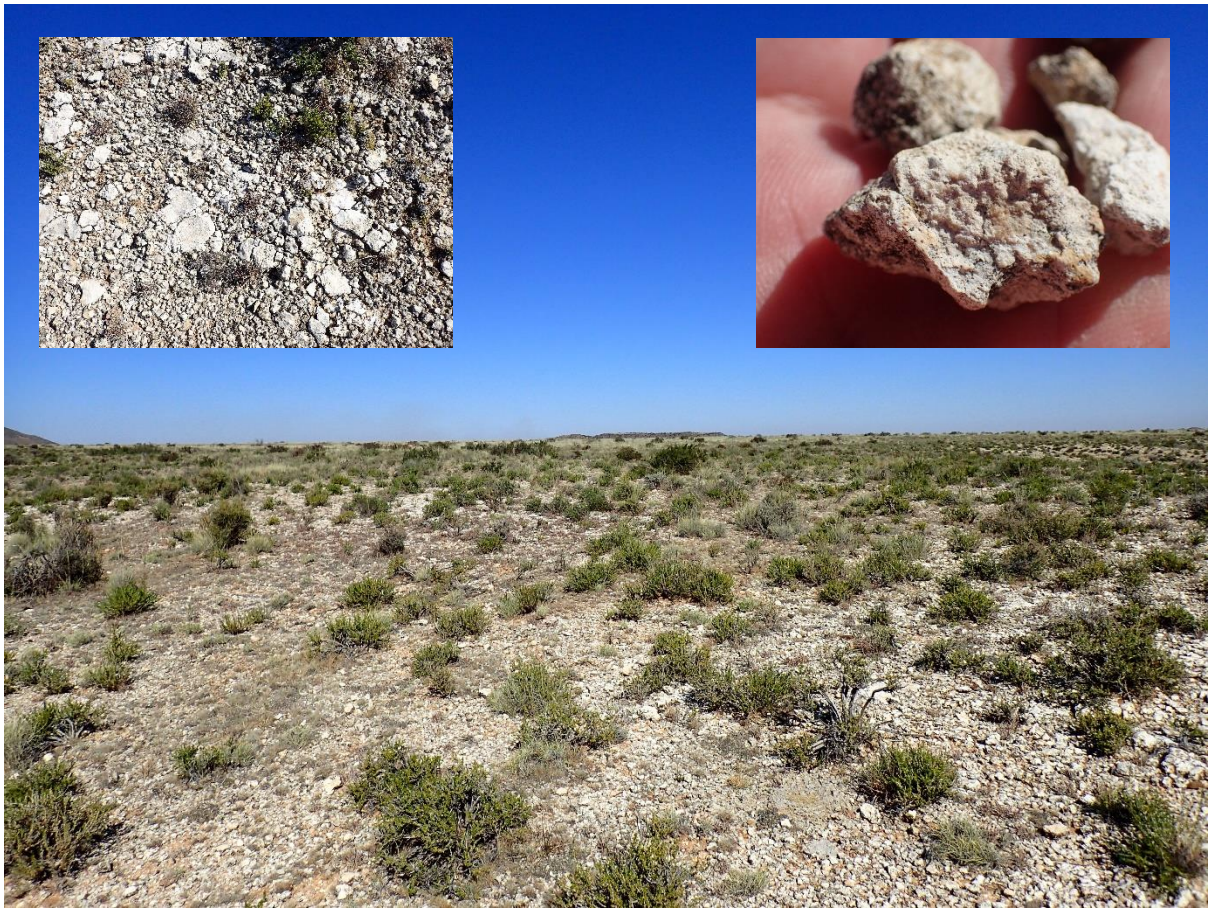
Apart from the Medium to High Conservation Importance of the PAOI, the area provides an array of ecosystem services due to its inherent processes from its biotic components as well as its high level of functional integrity. In addition to the aforementioned hydrological provisioning services (as mentioned in section 3.1.1.5 the area is an NFEPA Upstream Management Area), additional ecosystem processes and concomitant services observed during the field survey are described below.

The Formicidae species *Messor capensis* influences soil characteristics and plant growth via its tunnelling activity. The major physical change to the soils is the drier mound than inter-mound spaces, as although they permit greater water infiltration, they dry out faster due to less compaction and higher organic content. The chemical properties between mounds and inter-mound spaces also differ significantly, with mounds containing approximately 50% more phosphorous, potassium and nitrogen. This spatial discrepancy in soil physico-chemical properties therefore influences vegetation heterogeneity.

Mounds are also not static, with new mounds being developed around replacement entrances after disturbance by rainfall or feeding *O. afer afer*, thereby affecting wide areas. As aforementioned, the foraging activity of *O. afer afer* inadvertently distributes the nest seed stores with mound soil and considering that the mound soil possesses elevated nutrient content, it is likely to provide an improved germination material.

Pollination, especially by *Apis mellifera scutellata* and Lepidoptera species, was observed within the PAOI. Effective pollination is required for the necessary recruitment levels of flora in order to maintain diversity and its concomitant ecosystem functioning.

A unique feature within the PAOI, as well as the broader surrounding landscape, was a calcrete ridge and slope (see Figure 3-10 in section 3.2.1.1 of this report for location and extent). Calcrete is a sedimentary rock, a hardened deposit of calcium carbonate (calcite) in semi-arid and arid regions. This calcium carbonate cements together other materials, including gravel, sand, clay, and silt. Rainwater saturated with carbon dioxide acts as an acid and also dissolves calcite and then re-deposits it as a precipitate on the surfaces of the soil particles; as the interstitial soil spaces are filled, an impermeable crust is formed. Although exhibiting signs of degradation due to the presence of livestock, this geological feature supported unique floral and associated invertebrate communities.



As aforementioned the PAOI supports a species rich assemblage of avifauna due to the diversity of habitats present, this is especially pertaining to invertivore and raptor species. Avifauna populations have been acknowledged to provide an array of ecosystem services (Whelan *et al*, 2015, 2008). Within the geographical context of the PAOI, a key service is the population control of invertebrates. During favourable weather conditions within the Nama Karoo biome, accelerated and elevated plant growth leads to the substantial increases in the abundance of 'outbreak' herbivorous insects. This population explosion of herbivorous insects, particularly Orthopterans and *Loxostele frustalis* (Lepidoptera: Crambidae), can lead to extensive areas of vegetation being defoliated. Studies of Orthopteran outbreaks revealed that they are cyclical, with peak outbreaks occurring at 17.3 years increments. Peak swarm irruptions are correlated with warm El Niño/Southern Oscillation (ENSO) climate events, which drives wet and dry cycles within southern Africa. Swarm outbreaks was linked to the amount of precipitation over the 12 months prior to the outbreak.

Owing to their mobility, avifauna species can respond to temporally and/or spatially variable outbreaks of invertebrates. There are many studies of avifauna species that have examined the predation effects of avifauna on invertebrates, in an array of natural and agro-ecosystems (Whelan *et al*, 2015, 2008). Majority of these studies had recorded that avifauna populations significantly reduce population densities of invertebrates that cascade to the level of the plants. This control of pest species extends to the control of mammals as well. However, the potential roles of birds of prey as pest control agents of small mammals such as rodents and lagomorphs, and granivorous avifauna as pest control agents of agricultural weeds are not well studied (Whelan *et al*, 2015). Nevertheless, there is still evidence that raptors affect population dynamics of various rodent and other small mammal s in a variety of ecosystems, including agricultural areas (Whelan *et al*, 2015). Given the dominance of rodents in the diets of many raptors, it is postulated that these avifauna species benefit agriculture. Moreover, the presence of small mammal feeding Serpentes species within the PAOI also provides a means of rodent control.

5 Impact Assessment

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

This section provides the impact assessment of the proposed development, which is an agricultural and pivot expansion with the following infrastructure:

Infrastructure	Purpose
Centre Pivot (Cultivation and Irrigation System)	2 154 ha for cultivation
Irrigation Pipeline Network	Irrigation pipeline network to take water from the dams to the various centre pivot areas for irrigation
Two Water Storage Systems	Two main storage dams are proposed for utilization on the agricultural development. Dam 1 – 3.1 million m^3 Dam 2 – 1 million m^3
Pump station	A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams. Total surface area of 549 m^2
Solar PV area and overhead power line	Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams. 9 ha surface area with three alternative sites being considered.
Battery Energy Storage System	A battery system will be used to collect any additional power generated by the PV facility for use as and when required.

5.1 Present Impacts to Biodiversity

Considering the anthropogenic activities and influences within the landscape, several negative impacts to biodiversity were observed within the PAOI and the broader surrounding landscape (Figure 5-1). Note that these impacts were not necessarily within the PAOI but within the surrounding area and may still nevertheless influence species occupancy. These include:

- Crop agriculture and livestock grazing land-use;
- Overhead powerlines;
- Persecution, secondary and accidental poisoning;
- Roads and associated vehicle traffic and road kills; and
- Jackal-proof and game fences.

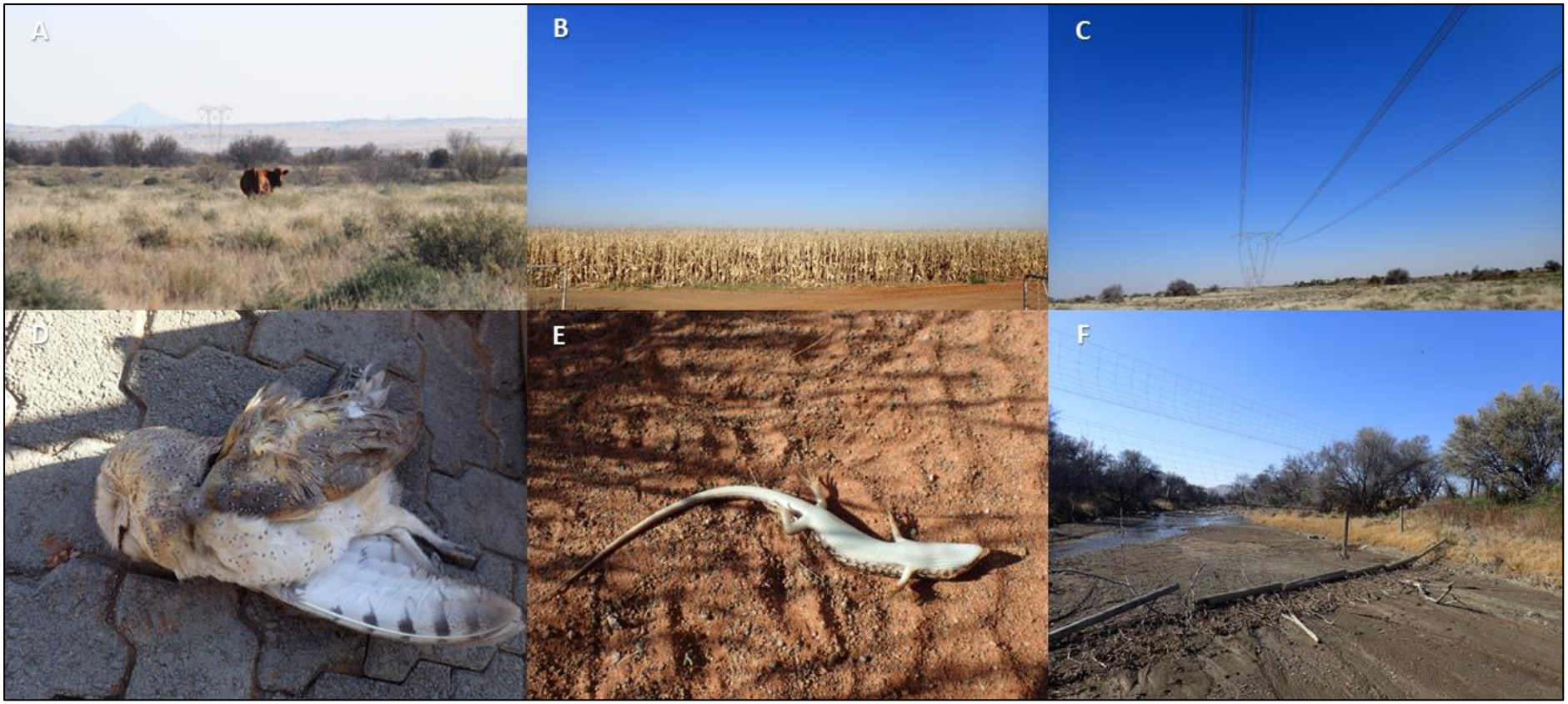


Figure 5-1 ***Photographs illustrating impacts to biodiversity within the surrounding area of the proposed Xhariep Export Programme Agricultural Development PAOI. A) Livestock/pastoral agriculture, B) Crop agriculture, C) Overhead powerlines, D) Secondary poisoning, E) Roadkill and F) Game fencing across drainage line***

5.2 Alternatives Considered

No alternatives were considered for the proposed development.

5.3 Irreplaceable Loss

The current proposed layout of the development may result in the irreplaceable loss of:

- Critical Biodiversity Areas;
- Ecological Support Areas; and
- National Freshwater Ecosystem Priority Areas.

5.4 Identification of Additional Potential Impacts

Bennun *et al* (2021) describes three broad types of impacts associated with solar energy development:

- Direct impacts – Impacts that result from project activities or operational decisions that can be predicted based on planned activities and knowledge of local biodiversity, such as habitat loss under the project footprint, habitat frag- mentation as a result of project infrastructure and species disturbance or mortality as a result of project operations;
- Indirect impacts – Impacts induced by, or 'by-products' of, project activities within a project's area of influence; and
- Cumulative impacts – Impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts.

The biotic components influencing vegetation heterogeneity and wellbeing have been described in sections 3.2.2.3 and 4 of this report. The proposed development will lead to a loss in habitat for these biotic components and therefore, cause a negative shift in the wellbeing of the vegetation within the development footprint and proximal surrounding landscape.

Within southern Africa, a proportion of biomes, and the associated vegetation types, are dependent on the dynamics of fire to maintain ecosystem functioning and wellbeing. In contrast, fire in the western arid region of the Nama Karoo is extremely rare. Occasional fires may occur after successive years of good rainfall in combination with light grazing, resulting in an increased fuel load. Fire is potentially more common in the east along the southwestern edge of the Grassland Biome including the interface with this biome on the eastern mountains. The grasslands bordering the Nama Karoo biome are regarded as Dry Highveld Grassland. Inappropriate burning regimes are likely to have detrimental consequences to ecosystem structure and functioning. An appropriate fire management plant must therefore be developed and implemented. As rainfall and productivity are unpredictable, it is difficult to set out burning frequency rules for Dry Highveld Grassland; in general, and in the absence of more specific information, the following guidelines can be applied (SANBI, 2013):

- These semi-arid systems should only be burnt when the build-up of the grass sward reaches a predetermined point, as measured with apasture disk meter, and when there is a clear reason for burning;
- A burning interval of approximately 10 years should be applied; and

- Burning should take place in late winter, and only in seasons that have been wet enough to ensure enough biomass to support an intense fire.

Pesticide use is common within South African crop agriculture areas in order to control pest species, including the Orange River Basin (Simmons and Allan, 2002). Communication with a local farmer indicated that organophosphate-based pesticides are used within the agricultural fields to control invertebrates. Organophosphates are chemical substances produced by the process of esterification between phosphoric acid and alcohol. It inhibits acetylcholinesterase (AChE) at the postsynaptic membrane of cholinergic synapses within the central and peripheral nervous systems of all vertebrate species. The following toxicity is recorded for avifauna species (Arya *et al*, 2019):

- Effect on feeding behaviours – intoxication are usually related to anorexia and symptoms of gastrointestinal stress;

- Effect on the endocrine system and reproductive behaviour – Alteration in the reproductive behaviour and gonadal development have been noticed following acute sublethal exposure;

- Effect on thermoregulation – Acute sublethal exposure results in pronounced, short-lived hypothermia; and

- Effect on the hematological system and immune system response - Exposure to high doses will cause direct injury to cells and organs of the immune system and reduce the immune function.

Considering the above information, it can be concluded that the organophosphate pesticides cause serious sub-lethal effects during the reproductive stages of avifauna. In addition, certain species may be highly susceptible to the pesticide in which the breeding season coincides with the most important application of pesticides. Exposure to pesticides during reproductive stages affects hatching success and fledgling survival. Alteration of feeding behaviour compromises the immune system, and increased predation further reduces the ability of these avifauna species to maintain vigorous populations, including SCC. This negative shift in avifauna populations will lead to detrimental trophic cascade effects. Intensive pesticide applications have been documented in causing increased pest resistance. The lack of a healthy predator population density will lead to greater population explosions of pest species, especially considering the latter can recover at a faster rate due to the faster reproductive rate. This impact not only applies to the avifauna species assemblage, but to the herpetofauna and mammal species assemblage as well. In addition, reduction of population density, or complete loss of, the mesocarnivore community will lead to considerable increase in potential pest species, such as rodents.

Information on the influence of habitat fragmentation on the pollinator community within the Nama Karoo Biome is lacking. However, it is known that fragmentation of other shrub- or graminoid-dominated vegetation communities leads to a loss in pollinator diversity and change in behaviour (Donaldson *et al*, 2002; Rusterholz & Baur, 2010; Zschokke *et al*, 2000). This leads to negative alterations in the reproductive success in terms of fruit set of particular plant species, or a group of plant species, thereby causing a negative shift in the flora species composition and diversity. Therefore, it is postulated that if the proposed development drives habitat fragmentation, it will lead to a negative shift in the diversity of the pollinator community. In addition, the use of pesticides will lead to substantial declines in the diversity of the pollinator community, leading to a considerable negative shift in the levels of flora recruitment and overall ecosystem functioning.

The potential impacts during the life of operation of the proposed development are summarised in Table 5-1.

Table 5-1 Potential impacts to biodiversity associated with the proposed Xhariep Export Programme Agricultural Development

Main Impact	Project activities that can cause loss of habitat	Secondary impacts anticipated
Habitat Destruction	Physical removal of vegetation	• Displacement/loss of flora & fauna (including SCC) • Habitat fragmentation • Increased potential for establishment of alien & invasive vegetation
Main Impact	**Project activities that can cause the spread and/or establishment of alien and/or invasive species**	**Secondary impacts anticipated**
Spread and/or establishment of alien and/or invasive species into disturbed areas	Vegetation removal	• Habitat loss for indigenous flora & fauna (including potential SCC) • Spreading of potentially dangerous diseases due to invasive and pest species • Increased potential for soil erosion • Alteration of fauna assemblages due to habitat modification
	Vehicles potentially spreading seed	
	Unsanitary conditions surrounding infrastructure promoting the establishment of pest rodents	
Main Impact	**Project activities that can cause the direct mortality of fauna**	**Secondary impacts anticipated**
Direct mortality of fauna	Roadkill due to vehicle collision	• Loss of ecosystem services
	Intentional killing of fauna for food (hunting and persecution)	
	Pesticide application	
Main Impact	**Project activities that can cause reduced dispersal/migration of fauna**	**Secondary impacts anticipated**
Reduced dispersal/migration of fauna	Loss of landscape used as corridor	• Loss of ecosystem services • Reduced plant seed dispersal • Reduced gene flow
	Removal of vegetation	
Main Impact	**Project activities that can cause emigration of fauna**	**Secondary impacts anticipated**
Reduction in population vigour	Pesticide application	

5.5 Assessment of Impact Significance

The assessment of impact significance was undertaken in consideration of the following:

- Extent of impact;
- Duration of impact;
- Magnitude of impact;
- Probability of impact; and
- Reversibility.

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Three phases were considered for the impact assessment:

- Construction Phase;
- Operational Phase; and
- Closure/Rehabilitation Phase.

5.5.1 Construction Phase

Impact Nature: Loss of habitat within development footprint		
There will be a loss of natural vegetation and habitat due to construction of centre pivots and associated infrastructure. This impact was considered for both the construction and operational phases.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Very High (10)
Probability	Definite (5)	Definite (5)
Significance	High	High
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes, albeit to a limited extent.	
Mitigation:		
• Vegetation clearing to commence only after the necessary permits have been obtained. • Avoid 'Very High' SEI areas. • Avoid dolerite extrusions. • Riparian buffer zones must be avoided.		
Residual Impacts:		
The loss of indigenous vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would be moderate.		

Impact Nature: Degradation and loss of surrounding natural habitat		
Degradation and loss of surrounding natural vegetation arising from construction activities if these are allowed to penetrate into the surrounding area.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Permanent (5)	Very short term (1)
Magnitude	Very High (10)	None (0)
Probability	Highly Probable (4)	Improbable (2)
Significance	High	Low
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
• Avoidance of 'Very High' SEI habitats and riparian buffers. • Pre-construction environmental induction for all staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, remaining within demarcated construction areas etc. • All construction activity to be within the clearly defined and demarcated areas. • Temporary laydown areas should be clearly demarcated and rehabilitated subsequent to end of use. • Suitable sanitary facilities to be provided for construction staff as per the guidelines in Health and Safety Act. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner.		

Impact Nature: Degradation and loss of surrounding natural habitat
Residual Impacts:
It is unlikely that residual impacts are expected if the appropriate mitigation measures are implemented. However, there may still be minimal degradation due to dust precipitation.

Impact Nature: Direct mortality of fauna		
Construction activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions, accidental hazardous chemical spills and persecution.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	MIinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium	Low
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, vehicle collisions, poaching, and persecution can be mitigated.	
Mitigation:		
• All personnel should undergo environmental induction with regards to fauna and awareness about not harming or collecting species. • Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified removal specialist. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner. • Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter.		
Residual Impacts:		
It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.		

Impact Nature: Emigration of fauna due to noise pollution		
Construction activity will likely lead to the emigration of fauna due to noise pollution.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Moderate (3)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium	Medium
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes, but only to a limited extent. The mitigation of noise pollution during construction is difficult to mitigate against
Mitigation:	
• Noise pollution within the context of the project is difficult to mitigate against. No construction activity is to occur at night to limit impacts to nocturnal species that tend to be more reliant on sound for behavioural processes.	
Residual Impacts:	
It is probable that some individuals of susceptible species will emigrate due to the noise generated from the construction activity. However, this is not likely to impact the viability of the local population of any fauna species.	

5.5.2 Operational Phase

Impact Nature: Loss of habitat within development footprint		
There will be a loss of natural vegetation and habitat due to construction of centre pivots and associated infrastructure. This impact was considered for both the construction and operational phases.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Very High (10)
Probability	Definite (5)	Definite (5)
Significance	High	High
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes, albeit to a limited extent.	
Mitigation:		
• Vegetation clearing to commence only after the necessary permits have been obtained. • Avoid 'Very High' SEI areas. • Avoid dolerite extrusions. • Riparian buffer zones must be avoided.		
Residual Impacts:		
The loss of indigenous vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would be moderate.		

Impact Nature: Encroachment of Invasive Alien Plants into disturbed areas		
Invasive Alien Plants (IAPs) tend to encroach into disturbed areas and can outcompete/displace indigenous vegetation.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Moderate (3)
Duration	Permanent (5)	Very short term (1)
Magnitude	High (8)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	High	Low
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No

Impact Nature: Encroachment of Invasive Alien Plants into disturbed areas	
Can impacts be mitigated?	Yes
Mitigation:	
• An IAP Management Plan must be written for the proposed development. • Regular monitoring for IAP encroachment during the operation phase to ensure that no alien invasion problems have developed as result of the disturbance. This should be every 3 months during the first two years of the operation phase and every six months for the life of the project. • All IAP species must be removed/controlled using the appropriate techniques as indicated in the IAP management plan.	
Residual Impacts:	
Based on the lack of IAPs within the development area and the implementation of an IAP Management Plan there are unlikely to be residual impacts	

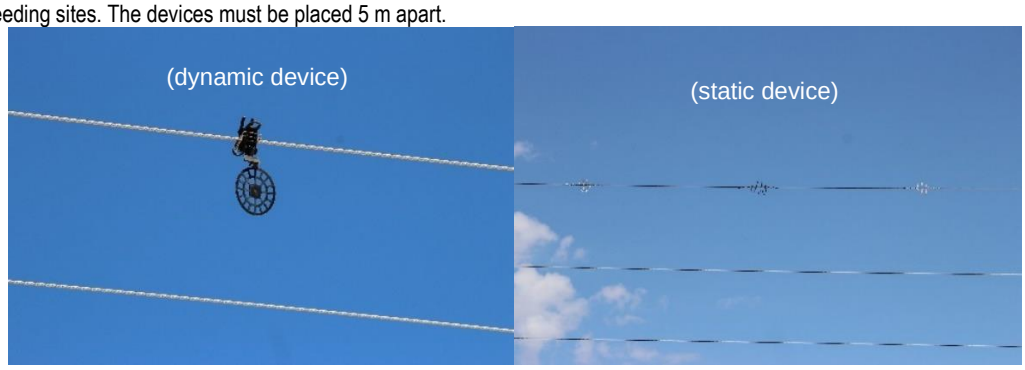
Impact Nature: Application of pesticides		
Pesticide application within the agricultural fields will lead to direct mortality, secondary poisoning, and accidental poisoning of fauna. This will lead to detrimental trophic cascade effects within the landscape. In addition, irrigation and rainfall will lead to transfer of the pesticide into surrounding areas.		
	Without Mitigation	**With Mitigation**
Extent	High (4)	Very Low (1)
Duration	Long Term (4)	Very Short Term (1)
Magnitude	Very High (10)	None (0)
Probability	Highly Probable (4)	Very Improbable (3)
Significance	High	Low
Status	Negative	Neutral
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	No	
Mitigation:		
• The optimum mitigation measure would be to ensure that no pesticides are used for the proposed development. • Should it be deemed absolutely necessary for the control of pests, then appropriate organic biocides must be investigated for use as an alternative.		
Residual Impacts	There is still the potential for reflection impacts but would have a low impact.	

Impact Nature: Application of pesticides		
Pesticide application within the agricultural fields will lead to direct mortality, secondary poisoning, and accidental poisoning of fauna. This will lead to detrimental trophic cascade effects within the landscape. In addition, irrigation and rainfall will lead to transfer of the pesticide into surrounding areas.		
	Without Mitigation	**With Mitigation**
Extent	High (4)	Very Low (1)
Duration	Long Term (4)	Very Short Term (1)
Magnitude	Very High (10)	None (0)
Probability	Highly Probable (4)	Very Improbable (3)
Significance	High	Low
Status	Negative	Neutral
Reversibility	Low	High

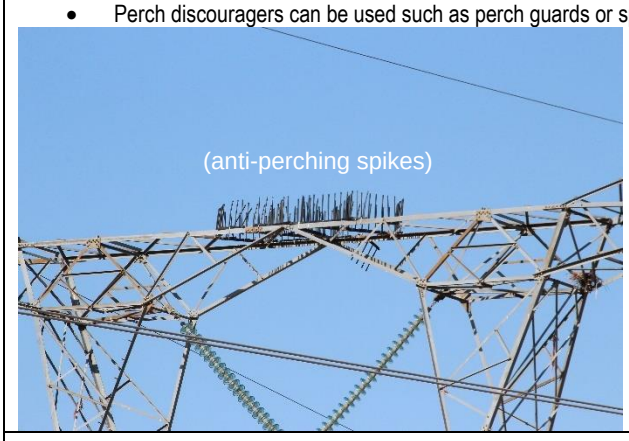
Impact Nature: Application of pesticides		
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	No	
Mitigation:		
• The optimum mitigation measure would be to ensure that no pesticides are used for the proposed development. • Should it be deemed absolutely necessary for the control of pests, then appropriate organic biocides must be investigated for use as an alternative.		
Residual Impacts	There is still the potential for reflection impacts but would have a low impact.	

Impact Nature: Avifauna collisions with powerlines		
This impact is considered pertinent as there are several species that occur within the area that exhibit a high probability of colliding with powerlines. These include SCC.		
	Without mitigation	**With mitigation**
Extent	High (4)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Very High (10)	Minor (2)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		

- The design of the proposed power line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa.
- Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used. This would involve using existing/approved pylons and associated infrastructure for different lines.
- The power line should be marked with bird diverters along all high-priority sections in order to make the lines as visible as possible to collision-susceptible species. Shaw *et al* (2021) demonstrated that Blue Crane mortality was reduced by 92% (95% confidence interval [CI]: 77–97%) and all large birds by 51% (95% CI: 23–68%). Recommended bird diverters such as flapping devices (dynamic device) and thickened wire spirals (static device) that increase the visibility of the lines should be fitted along the entire length of the OHL due to its proximity to the Voëlvlei Dam and Klein Berg River. The Inotec BFD88 bird diverter is highly recommended due to its visibility under low light conditions when most species move from roosting to feeding sites. The devices must be placed 5 m apart.



Impact Nature: Avifauna collisions with powerlines
This impact is considered pertinent as there are several species that occur within the area that exhibit a high probability of colliding with powerlines. These include SCC.
 Inotec BFD800 (source: https://migratorysoaringbirds.birdlife.org/)
Residual Impacts:
There is still the risk of large-bodied species colliding but the level of impact will be minimsed.

Impact Nature: Electrocution with powerlines		
Several species potentially occur within the area that exhibit a high probability of electrocution by powerlines. These are typically the raptor species that use the powerlines as perching spots.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• The design of the proposed power line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa. • Insulation where energised parts and/or grounded parts are covered with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered. • Perch discouragers can be used such as perch guards or spikes.		
 (anti-perching spikes)		
Residual Impacts:		

Impact Nature: Electrocution with powerlines
Several species potentially occur within the area that exhibit a high probability of electrocution by powerlines. These are typically the raptor species that use the powerlines as perching spots.
There may still be the possibility of electrocution although the severity of the impact is mimised if the appropriate mitigation measures are implemented.

5.5.3 Decommissioning/Rehabilitation Phase

Impact Nature: Direct mortality of fauna		
Decommissioning activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions and persecution.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium	Low
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, vehicle collisions, poaching, and persecution can be mitigated.	
Mitigation:		
• All personnel should undergo environmental induction with regards to fauna and awareness about not harming or collecting species. • Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist. • All construction vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions. Appropriate speed control measures and signs must be erected. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner. • Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter.		
Residual Impacts:		
It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.		

Impact Nature: Continued habitat degradation		
Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.		
	Without Mitigation	**With Mitigation**
Extent	Moderate (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (3)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Medium	Low

Impact Nature: Continued habitat degradation		
Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.		
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation:		
• Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase. • Monitoring of the rehabilitated area must be undertaken at quarterly intervals for 3 years after the decommissioning phase. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.		
Residual Impacts:		
No significant residual risks are expected, although IAP encroachment and erosion might still occur but would have a negligible impact if effectively managed.		

5.6 Cumulative Impacts

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system.

This section describes the cumulative potential impacts of the project on biodiversity. Cumulative impacts are assessed in context of the extent of the proposed development area, other developments in the area, as well as general habitat loss and transformation resulting from other activities in the area.

Presently, the surrounding immediate and broader landscape consists of natural vegetation used for supporting livestock, protected areas, intensive crop agriculture, renewable energy developments, and to a lesser extent game farms. The proposed development exacerbates habitat loss and operational impacts may lead to a highly significant level of fauna mortality, including SCC. Accordingly, the significance of the cumulative impact of the proposed development was determined to be 'High'.

Impact Nature: Cumulative habitat loss within the region		
The development of the proposed Agricultural Development and Associated Infrastructure will contribute to cumulative habitat loss within the Northern Upper Karoo, Critical Biodiversity Areas and Ecological Support Areas		
	Overall impact of the proposed development considered in isolation	**Cumulative impact of the project and other land-use in the area**
Extent	Very low (1)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Very High (10)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium	High
Status	Negative	Negative
Reversibility	High	High

Impact Nature: Cumulative habitat loss within the region		
The development of the proposed Agricultural Development and Associated Infrastructure will contribute to cumulative habitat loss within the Northern Upper Karoo, Critical Biodiversity Areas and Ecological Support Areas		
Irreplaceable loss of resources	Yes, in certain scenarios	Yes, in certain cases
Can impacts be mitigated	Yes, to some degree.	
Mitigation: Ensure that all 'Very High' SEI areas and riparian buffers are avoided. A Biodiversity, Rehabilitation and Invasive Alien Plant Management Plan must be developed and implemented. The use of pesticides should not be considered and unless absolutely necessary, organic biocides must be investigated as an alternative.		

5.7 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management.

Table 5-2 is a summary of the findings of an unplanned event assessment from a terrestrial ecology perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 5-2 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment from heavy machinery during the construction phase	Contamination of soil leading to mortality of flora and fauna.	A spill response kit must always be available. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to surrounding natural habitats that result in habitat destruction and fauna mortality.	Appropriate/Adequate fire management plan needs to be implemented.

5.8 Biodiversity Impact Management Actions

The purpose of the Biodiversity Impact Management Actions to inform on the mitigations required to lower the risk of the impacts associated with the proposed activity, provide measures for improving the conservation value of the property and to be able to be inserted into the Environmental Management Programme (EMPr). The mitigation actions required to reduce the significance of the impacts associated with the development are provided in Table 5-3.

Table 5-3 The Biodiversity Impact Management Actions for the proposed Xhariep Export Programme Agricultural Development

Management Outcome: Vegetation and Habitats				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All development areas must be clearly demarcated. Only the areas that have been authorised for development should be intruded into.	Life of operation	Project Manager	Infringement into these areas	Ongoing
Areas of indigenous vegetation outside of the direct project footprint, should under no circumstances be fragmented or disturbed further.	Life of operation	Project Manager	Grassland Areas	Ongoing
All activities must make use of existing roads and tracks where possible.	Life of operation	Project Manager	Roads and paths used	Ongoing
Apply for a permit to relocate protected plant species into the surrounding natural areas.	Construction	Project Manager	Relocation/destruction of protected plant species	Ongoing
All laydown areas, chemical toilets etc. should be restricted to 'Very Low' SEI areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction phase has been concluded. Use of re-usable/recyclable materials are recommended.	Construction	Project Manager Foreman	Laydown areas and material storage & placement.	Ongoing
Progressive rehabilitation of areas that have been cleared will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.	Life of operation	Project Manager	Rehabilitated areas	Ongoing
A spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use.	Life of operation	Project Manager Contractors Foreman	Spill events, Vehicles dripping.	Ongoing
No livestock should be permitted into recently rehabilitated areas. This is to ensure that suitable basal cover needs to be developed in order to prevent soil erosion.	Operational/Closure	Project Manager	Rehabilitated areas	Ongoing
A Fire Management Plan must be developed should unplanned fires occur. It is recommended that the appropriate fire regime provided in SANBI (2013) be adhered to. A burning interval of approximately 10 years should be applied. Burning should take place in late winter, and only in seasons that have been wet enough to ensure enough biomass to support an intense fire.	Operational	Project Manager	Fire Management	Per season

Management Outcome: Fauna				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Pesticides should not be used to control pest species due to the high negative impact associated with it. Only if deemed to be absolutely necessary, an appropriate organic biocide must be the only option considered.	Operational	Project Manager	Pesticide Use	Ongoing
The avifauna species assemblage within the PAOI must be monitored bi-annually (twice a year) during the wet and dry season. The feathers of any carcasses found must be used for pesticide analysis.	Operational	Project Manager	Avifauna	Bi-annually (twice a year)

Management Outcome: Invasive Alien Plants				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas thereby causing further encroachment of invasive species.	Construction	Project Manager	Footprint Area	Bi-annually (twice a year)
An Invasive Alien Plant control programme must be implemented to control the encroachment of invasive plant species. It is essential that invasives be removed from wetland ecosystems and areas that have been categorised as possessing a 'High' or 'Very High' SEI.	Life of Operation	Project Manager	Footprint Area	Bi-annually (twice a year)

Management Outcome: Waste Management				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Waste management must be a priority and all waste must be collected and stored effectively. All solid waste collected shall be disposed of at a licensed disposal facility	Life of operation	Project Manager	Waste Removal	Weekly
Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.	Life of operation	Foreman	Number of toilets per staff member. Waste levels	Daily
Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste	Life of operation	Project Manager	Collection/handling of the waste.	Ongoing

Management Outcome: Waste Management				
management. Under no circumstances may domestic waste be burned on site.				
Refuse bins will be emptied and secured. Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days. Recycling is encouraged.	Life of operation	Project Manager	Management of bins and collection of waste	Ongoing

Management Outcome: Environmental Awareness Training				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All staff should undergo Environmental Awareness Training. Discussions are required on sensitive environmental receptors within the project area to inform contractors and site staff of the presence of species, their identification, conservation status and importance, biology, habitat requirements and management requirements within the Environmental Authorisation and the EMPr.	Life of operation	Project Manager	Compliance to the training.	As needed

6 Conclusion and Impact Statement

6.1 Conclusion

The aim of this Biodiversity Impact Assessment was to provide information to guide the risk of the proposed Xhariep Export Programme Agricultural Development to the ecosystems affected by its development and their inherent fauna and flora.

Based on the latest available ecologically relevant spatial data the following information is pertinent to the PAOI:

- It is recognised as a Critical Biodiversity Area and Ecological Support Area, as per the Free State Biodiversity Plan;
- It overlaps with a National Protected Areas Expansion Strategy Focus Area;
- The Ecosystem Protection Level for the vegetation types associated with the development footprint is regarded as Poorly Protected; and
- The Lemoenspruit is classified as an Upper Management Area according to the NFEPA database. The Lemoenspruit drains into a reach of the Orange River that is categorised as a 'Fish Support Area'.

The Nama Karoo Biome is acknowledged to not possess a high diversity of flora species, with a total of 57 species, representing 25 families, recorded within the PAOI during the survey period. Dominant graminoid species, with respect to cover, indicates overgrazing. Nevertheless, the PAOI supports a diversity of fauna species including SCC.

Based on the fauna components recorded within the PAOI, the area provides important ecosystem services, particularly with regards to the maintenance of dynamic soil properties, biocontrol of pest species and pollination. The SEI of the PAOI was determined to vary from 'Very Low' to 'Very High'. The areas possessing a 'Very High' SEI were allocated as such were based on the confirmation or high likelihood of occurrence of fauna SCC, the extent of the area considered and its connectivity to natural areas within the landscape, as well as the low resilience of the vegetation types. The fauna SCC confirmed to occupy the PAOI include globally threatened species (Table 6-1).

Table 6-1 Fauna species of conservation concern confirmed within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period

Class	Family	Scientific Name	Common Name	Conservation Status	
				Regional	Global
Aves	Accipitridae	*Aquila rapax rapax*	Southern Tawny Eagle	EN	VU
Aves	Accipitridae	*Aquila verreauxii*	Eagle, Verreaux's	VU	LC
Aves	Falconidae	*Faclo biarmicus*	Lanner Falcon	VU	LC
Aves	Otididae	*Ardeotis kori kori*	Southern Kori Bustard	NT	NT
Aves	Sagittariidae	*Sagittarius serpentarius*	Secretarybird	VU	EN
Mammalia	Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	NT	NT

SCC that a 'high' likelihood of occurrence within the PAOI are summarised in Table 6-2. These species were not recorded during the field survey due to either seasonality constraints or because of the secretive behaviour of the species.

Table 6-2 Fauna species of conservation concern with a 'high' likelihood of occurrence within the proposed Xhariep Export Programme Agricultural Development PAOI during the survey period

Class	Family	Species	Common Name	Conservation Status	
				Regional	IUCN
Amphibia	*Pyxicephalidae*	*Pyxicephalus adspersus*	Giant Bullfrog	NT	LC
Aves	Ciconiidae	*Ciconia abdimii*	Stork, Abdim's	NT	LC
Aves	Motacillidae	*Anthus crenatus*	Pipit, African Rock	NT	NT
Aves	Otididae	*Eupodotis caerulescens*	Korhaan, Blue	LC	NT
Aves	Otididae	*Neotis ludwigii*	Bustard, Ludwig's	EN	EN
Mammalia	Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	EN	LC
Mammalia	Erinaceidae	*Atelerix frontalis*	South African Hedgehog	NT	LC
Mammalia	Felidae	*Leptailurus serval*	Serval	NT	LC

A high proportion (62%) of the SCC are avifauna and this is attributed to the proximity of the PAOI to the Platberg-Karoo Conservancy IBA. These avifauna SCC although not observed to nest within the PAOI, utilise it for foraging, which is still nevertheless important in maintaining the local populations.

6.2 Impact Statement

The main expected impacts of the proposed development will be the loss of habitat and mortality of fauna. Based on the outcomes of the SEI determination, the PAOI possesses areas of 'Very High' SEI and 'High' SEI. Figure 6-1 illustrates the components of the proposed development onto the SEI of the PAOI.

The 'High' SEI denotes that "avoidance mitigation wherever possible must be implemented. This includes changes to project infrastructure design to limit the amount of habitat impacted." (SANBI, 2020). Considering that the area has been zoned for agriculture, development may proceed in the 'High' SEI Areas, as long as the 'Very High' SEI areas are avoided and actively managed. Where pivots overlap minor drainage lines (also with Very High SEI), activity adjacent to these system is permissible, albeit only if the remaining channel extent is rehabilitated and actively managed. In addition, all of the mitigation measures and Biodiversity Impact Management Actions provided in this report must be implemented if the proposed development is authorised. This is especially pertinent to avifauna monitoring as prescribed below.

Management Outcome: Avifauna				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Pesticides should not be used to control pest species due to the high negative impact associated with it. Only if deemed to be absolutely necessary, an appropriate organic biocide must be the only option considered.	Operational	Project Manager	Pesticide Use	Ongoing
The avifauna species assemblage within the PAOI must be monitored bi-annually (twice a year) during the wet and dry season. The feathers of any carcasses found must be used for pesticide analysis.	Operational	Project Manager	Avifauna	Bi-annually (twice a year)

Figure 6-1 ***Map illustrating the proposed Xhariep Export Programme Agricultural Development and associated infrastructure components overlaid onto the Site Ecological Importance***

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8 Appendix Items

8.1 Appendix A – Protocol Checklist

"Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity" gazetted 20 March 2020, published in Government Notice No. 320

Paragraph	Item	Pages	Comment
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	i	
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	3-5, 12	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these.	26, 50, 59-62, 65-67	
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site	26, 50, 59-62	
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna.	23-24	
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments.	23-24	
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: (a) main vegetation types; (b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified.	20-22, 27-30	
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification.	-	No "low" sensitivity areas were identified for development due to the ecological condition of the site.
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: (a) the reasons why an area has been identified as a CBA; (b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation; (c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s); (d) the impact on ecosystem threat status; (e) the impact on explicit subtypes in the vegetation; (f) the impact on overall species and ecosystem diversity of the site; and (g) the impact on any changes to threat status of populations of species of conservation concern in the CBA.	23-24	
2.3.7.2	Terrestrial ecological support areas (ESAs), including: (a) the impact on the ecological processes that operate within or across the site; (b) the extent the proposed development will impact on the functionality of the ESA; and (c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna.	23-24	
2.3.7.3	Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including- (a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan.	22-23	
2.3.7.4	Priority areas for protected area expansion, including-	22-23	

	(a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network.		
2.3.7.5	SWSAs including: (a) the impact(s) on the terrestrial habitat of a SWSA; and (b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses)	-	Does not overlap a SWSA
2.3.7.6	FEPA sub catchments, including- (a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment	25	
2.3.7.7	indigenous forests, including: (a) impact on the ecological integrity of the forest; and (b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.	-	No forest habitats within the area
3.1.1.	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Cover page i	
3.1.2	A signed statement of independence by the specialist.	105	
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	6, 12	
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	12-16	
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations.	6	
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant).	57	
3.1.7	Additional environmental impacts expected from the proposed development.	65-76	
3.1.8	Any direct, indirect and cumulative impacts of the proposed development.	65-76	
3.1.9	The degree to which impacts and risks can be mitigated.	65-76	
3.1.10	The degree to which the impacts and risks can be reversed.	65-76	
3.1.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	65-76	
3.1.12	Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr).	76-79	
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate.	-	N/A
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not;	80-81	
3.1.15	any conditions to which this statement is subjected	80-81	

8.2 Appendix B – Flora species expected to occur in the project area

Family	Scientific Name	Conservation Status	Endemism
Acanthaceae	*Barleria rigida var. rigida*		
Acanthaceae	*Justicia divaricata*		
Aizoaceae	*Deilanthe peersii*	LC	Endemic
Aizoaceae	*Drosanthemum hispidum*	LC	
Aizoaceae	*Drosanthemum pulchrum*	VU	Endemic
Aizoaceae	*Galenia namaensis*	LC	
Aizoaceae	*Galenia pubescens*	LC	Endemic
Aizoaceae	*Galenia sarcophylla*	LC	
Aizoaceae	*Malephora smithii*	LC	Endemic
Aizoaceae	*Mesembryanthemum coriarium*		
Aizoaceae	*Mesembryanthemum geniculiflorum*		
Aizoaceae	*Mesembryanthemum guerichianum*	LC	
Aizoaceae	*Mesembryanthemum noctiflorum subsp. stramineum*		
Aizoaceae	*Mesembryanthemum splendens subsp. pentagonum*		Endemic
Aizoaceae	*Mesembryanthemum stenandrum*	LC	Endemic
Aizoaceae	*Mesembryanthemum tetragonum*		
Aizoaceae	*Mestoklema tuberosum*	LC	Endemic
Aizoaceae	*Plinthus cryptocarpus*	LC	
Aizoaceae	*Rhombophyllum dolabriforme*	LC	Endemic
Aizoaceae	*Ruschia cradockensis*		Endemic
Aizoaceae	*Ruschia semidentata*	LC	Endemic
Aizoaceae	*Tetragonia arbuscula*	LC	
Aizoaceae	*Tetragonia calycina*	LC	
Aizoaceae	*Tetragonia fruticosa*	LC	
Aizoaceae	*Tetragonia robusta*	LC	Endemic
Aizoaceae	*Titanopsis calcarea*	LC	Endemic
Aizoaceae	*Trianthema salsoloides var. salsoloides*	LC	
Amaranthaceae	*Atriplex vestita var. appendiculata*	LC	
Amaranthaceae	*Atriplex vestita var. inappendiculata*	LC	Endemic
Amaranthaceae	*Salsola aphylla*	LC	
Amaranthaceae	*Salsola calluna*	LC	Endemic
Amaranthaceae	*Salsola exalata*	LC	Endemic
Amaranthaceae	*Salsola geminiflora*	LC	Endemic
Amaranthaceae	*Salsola glabrescens*	LC	
Amaranthaceae	*Salsola henriciae*	LC	Endemic
Amaranthaceae	*Salsola kalaharica*	LC	Endemic
Amaranthaceae	*Salsola rabieana*	LC	
Amaranthaceae	*Salsola smithii*	LC	Endemic
Amaranthaceae	*Suaeda fruticosa*	LC	
Amaryllidaceae	*Ammocharis coranica*	LC	
Amaryllidaceae	*Nerine laticoma*	LC	
Anacardiaceae	*Searsia burchellii*	LC	
Anacardiaceae	*Searsia ciliata*	LC	
Anacardiaceae	*Searsia erosa*	LC	

Family	Scientific Name	Conservation Status	Endemism
Anacardiaceae	*Searsia lancea*	LC	
Anacardiaceae	*Searsia pyroides var. pyroides*	LC	
Apocynaceae	*Ceropegia circinata*		
Apocynaceae	*Ceropegia filiformis*	LC	
Apocynaceae	*Fockea sinuata*	LC	
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*	LC	
Apocynaceae	*Microloma armatum var. armatum*	LC	
Apocynaceae	*Orbea cooperi*	LC	
Apocynaceae	*Pachypodium succulentum*	LC	Endemic
Apocynaceae	*Stenostelma capense*	LC	
Apocynaceae	*Tridentea jucunda*	LC	
Apocynaceae	*Xysmalobium gomphocarpoides var. gomphocarpoides*	LC	Endemic
Araliaceae	*Cussonia paniculata subsp. sinuata*	LC	
Asparagaceae	*Asparagus cooperi*	LC	
Asparagaceae	*Asparagus exuvialis forma exuvialis*	NE	
Asparagaceae	*Asparagus glaucus*	LC	
Asparagaceae	*Asparagus suaveolens*	LC	
Asphodelaceae	*Aloe broomii var. broomii*	LC	
Asphodelaceae	*Aloe claviflora*	LC	
Asphodelaceae	*Bulbine narcissifolia*	LC	
Asphodelaceae	*Gonialoe variegata*	LC	
Asphodelaceae	*Trachyandra saltii var. saltii*	LC	
Aspleniaceae	*Asplenium cordatum*	LC	
Asteraceae	*Amellus tridactylus subsp. tridactylus*	LC	Endemic
Asteraceae	*Arctotis arctotoides*	LC	
Asteraceae	*Chrysocoma ciliata*	LC	
Asteraceae	*Crassothonna protecta*	LC	
Asteraceae	*Dicoma capensis*	LC	
Asteraceae	*Eriocephalus ambiguus*	LC	
Asteraceae	*Eriocephalus ericoides subsp. ericoides*	LC	
Asteraceae	*Euryops asparagoides*	LC	
Asteraceae	*Euryops subcarnosus subsp. vulgaris*	LC	
Asteraceae	*Felicia burkei*	LC	
Asteraceae	*Felicia filifolia subsp. filifolia*	LC	
Asteraceae	*Felicia muricata subsp. muricata*	LC	
Asteraceae	*Felicia zeyheri subsp. linifolia*	LC	Endemic
Asteraceae	*Gazania krebsiana subsp. arctotoides*	LC	
Asteraceae	*Helichrysum lineare*	LC	
Asteraceae	*Helichrysum lucilioides*	LC	
Asteraceae	*Helichrysum obtusum*	LC	
Asteraceae	*Lactuca dregeana*	LC	Endemic
Asteraceae	*Nidorella resedifolia subsp. resedifolia*	LC	
Asteraceae	*Oedera humilis*		
Asteraceae	*Osteospermum spinescens*	LC	
Asteraceae	*Pegolettia retrofracta*	LC	

Family	Scientific Name	Conservation Status	Endemism
Asteraceae	*Pentzia calcarea*	LC	
Asteraceae	*Pentzia calva*	LC	
Asteraceae	*Pentzia globosa*	LC	
Asteraceae	*Pentzia incana*	LC	
Asteraceae	*Pentzia lanata*	LC	
Asteraceae	*Pentzia punctata*	LC	
Asteraceae	*Pteronia acuta*	LC	
Asteraceae	*Pteronia erythrochaeta*	LC	Endemic
Asteraceae	*Pteronia glauca*	LC	
Asteraceae	*Senecio harveianus*	LC	
Asteraceae	*Senecio reptans*	LC	Endemic
Asteraceae	*Tarchonanthus camphoratus*	LC	
Asteraceae	*Ursinia nana subsp. nana*	LC	
Aytoniaceae	*Plagiochasma rupestre var. rupestre*		
Bignoniaceae	*Rhigozum obovatum*	LC	
Bignoniaceae	*Rhigozum trichotomum*	LC	
Boraginaceae	*Ehretia alba*	LC	
Boraginaceae	*Heliotropium ciliatum*	LC	
Boraginaceae	*Heliotropium lineare*	LC	
Boraginaceae	*Lithospermum cinereum*	LC	
Brassicaceae	*Lepidium desertorum*	LC	
Brassicaceae	*Lepidium englerianum*		
Bryaceae	*Bryum pycnophyllum*		
Campanulaceae	*Wahlenbergia albens*	LC	
Campanulaceae	*Wahlenbergia nodosa*	LC	Endemic
Capparaceae	*Boscia albitrunca*	LC	
Capparaceae	*Cadaba aphylla*	LC	
Caryophyllaceae	*Dianthus micropetalus*	LC	
Caryophyllaceae	*Pollichia campestris*	LC	
Cleomaceae	*Cleome angustifolia subsp. diandra*	LC	
Cleomaceae	*Cleome gynandra*	LC	
Colchicaceae	*Colchicum asteroides*	LC	Endemic
Colchicaceae	*Ornithoglossum vulgare*	LC	
Combretaceae	*Combretum erythrophyllum*	LC	
Commelinaceae	*Commelina africana var. barberae*	LC	
Commelinaceae	*Commelina africana var. krebsiana*	LC	
Convolvulaceae	*Convolvulus sagittatus*	LC	
Convolvulaceae	*Ipomoea oenotheroides*	LC	
Crassulaceae	*Cotyledon orbiculata var. dactylopsis*	LC	Endemic
Cucurbitaceae	*Cucumis myriocarpus subsp. leptodermis*	LC	
Cyperaceae	*Afroscirpoides dioeca*		
Cyperaceae	*Cyperus atriceps*	LC	
Cyperaceae	*Cyperus bellus*	LC	
Cyperaceae	*Cyperus decurvatus*	LC	
Cyperaceae	*Cyperus laevigatus*	LC	

Family	Scientific Name	Conservation Status	Endemism
Cyperaceae	*Isolepis setacea*	LC	
Cyperaceae	*Schoenoplectus muricinux*	LC	
Dipsacaceae	*Scabiosa columbaria*	LC	
Ebenaceae	*Diospyros austroafricana var. microphylla*	LC	
Ebenaceae	*Diospyros lycioides subsp. lycioides*	LC	
Euphorbiaceae	*Euphorbia arida*	LC	Endemic
Euphorbiaceae	*Euphorbia juttae*	LC	
Euphorbiaceae	*Euphorbia mauritanica*	LC	
Euphorbiaceae	*Euphorbia rhombifolia*	LC	
Euphorbiaceae	*Euphorbia spartaria*	LC	
Fabaceae	*Argyrolobium argenteum*	LC	Endemic
Fabaceae	*Argyrolobium pauciflorum*	LC	
Fabaceae	*Cullen tomentosum*	LC	
Fabaceae	*Indigastrum niveum*		
Fabaceae	*Indigofera alternans var. alternans*	LC	
Fabaceae	*Indigofera rhytidocarpa subsp. rhytidocarpa*	LC	
Fabaceae	*Indigofera sessilifolia*	LC	
Fabaceae	*Leobordea divaricata*	LC	
Fabaceae	*Lessertia depressa*	LC	
Fabaceae	*Lessertia frutescens subsp. frutescens*	LC	
Fabaceae	*Melolobium macrocalyx var. macrocalyx*	LC	
Fabaceae	*Senegalia mellifera subsp. detinens*	LC	
Fabaceae	*Senna italica subsp. arachoides*	LC	
Fabaceae	*Vachellia karroo*	LC	
Fabaceae	*Vachellia tortilis subsp. heteracantha*	LC	
Geraniaceae	*Monsonia patersonii*	LC	
Geraniaceae	*Monsonia salmoniflora*	LC	
Gisekiaceae	*Gisekia pharnaceoides var. pharnaceoides*	LC	
Grimmiaceae	*Grimmia pulvinata*		
Hyacinthaceae	*Albuca collina*	LC	Endemic
Hyacinthaceae	*Albuca longipes*	LC	
Hyacinthaceae	*Albuca prasina*		
Hyacinthaceae	*Albuca seineri*	LC	
Hyacinthaceae	*Albuca tortuosa*	LC	Endemic
Hyacinthaceae	*Dipcadi glaucum*	LC	
Hyacinthaceae	*Dipcadi viride*	LC	
Hyacinthaceae	*Drimia depressa*	LC	
Hyacinthaceae	*Drimia physodes*	LC	
Hyacinthaceae	*Ledebouria undulata*	LC	
Hyacinthaceae	*Ornithogalum flexuosum*	LC	
Hyacinthaceae	*Ornithogalum juncifolium var. juncifolium*	NE	
Hyacinthaceae	*Schizocarphus nervosus*	LC	
Hydrocharitaceae	*Lagarosiphon muscoides*	LC	
Iridaceae	*Freesia andersoniae*	LC	Endemic
Iridaceae	*Gladiolus orchidiflorus*	LC	

Family	Scientific Name	Conservation Status	Endemism
Iridaceae	*Gladiolus permeabilis subsp. edulis*	LC	
Iridaceae	*Moraea polystachya*	LC	
Juncaceae	*Juncus rigidus*	LC	
Lamiaceae	*Acrotome inflata*	LC	
Lamiaceae	*Leonotis pentadentata*	LC	
Lamiaceae	*Salvia namaensis*	LC	
Lamiaceae	*Salvia runcinata*	LC	
Lamiaceae	*Salvia stenophylla*		
Lamiaceae	*Stachys hyssopoides*	LC	
Lamiaceae	*Stachys linearis*	LC	
Limeaceae	*Limeum aethiopicum var. intermedium*	NE	Endemic
Limeaceae	*Limeum aethiopicum var. lanceolatum*	NE	
Limeaceae	*Limeum viscosum subsp. viscosum var. viscosum*	NE	
Lobeliaceae	*Lobelia thermalis*	LC	
Malvaceae	*Corchorus schimperi*	LC	
Malvaceae	*Hermannia bicolor*	LC	
Malvaceae	*Hermannia bryoniifolia*	LC	Endemic
Malvaceae	*Hermannia comosa*	LC	
Malvaceae	*Hermannia linearifolia*	LC	Endemic
Malvaceae	*Hermannia modesta*	LC	
Malvaceae	*Hermannia pulchella*	LC	
Malvaceae	*Hermannia pulverata*	LC	Endemic
Malvaceae	*Hermannia spinosa*	LC	
Malvaceae	*Hibiscus pusillus*	LC	
Marsileaceae	*Marsilea burchellii*	LC	
Melianthaceae	*Melianthus comosus*	LC	
Molluginaceae	*Hypertelis cerviana*		
Nyctaginaceae	*Phaeoptilum spinosum*	LC	
Ophioglossaceae	*Ophioglossum polyphyllum var. polyphyllum*	LC	
Oxalidaceae	*Oxalis depressa*	LC	
Oxalidaceae	*Oxalis haedulipes*	LC	
Oxalidaceae	*Oxalis lawsonii*	LC	
Oxalidaceae	*Oxalis smithiana*	LC	
Pedaliaceae	*Harpagophytum procumbens subsp. procumbens*	NE	
Pedaliaceae	*Pterodiscus speciosus*	LC	
Pedaliaceae	*Sesamum capense*	LC	
Phyllanthaceae	*Phyllanthus parvulus var. parvulus*	LC	
Poaceae	*Aristida adscensionis*	LC	
Poaceae	*Aristida congesta subsp. barbicollis*	LC	
Poaceae	*Aristida congesta subsp. congesta*	LC	
Poaceae	*Aristida vestita*	LC	
Poaceae	*Brachiaria eruciformis*	LC	
Poaceae	*Brachiaria marlothii*	LC	
Poaceae	*Cenchrus ciliaris*	LC	
Poaceae	*Chloris virgata*	LC	

Family	Scientific Name	Conservation Status	Endemism
Poaceae	*Cymbopogon pospischilii*	NE	
Poaceae	*Cynodon incompletus*	LC	Endemic
Poaceae	*Digitaria eriantha*	LC	
Poaceae	*Eleusine coracana subsp. africana*	LC	
Poaceae	*Enneapogon cenchroides*	LC	
Poaceae	*Enneapogon desvauxii*	LC	
Poaceae	*Enneapogon scaber*	LC	
Poaceae	*Enneapogon scoparius*	LC	
Poaceae	*Eragrostis bicolor*	LC	
Poaceae	*Eragrostis chloromelas*	LC	
Poaceae	*Eragrostis cilianensis*	LC	
Poaceae	*Eragrostis curvula*	LC	
Poaceae	*Eragrostis echinochloidea*	LC	
Poaceae	*Eragrostis homomalla*	LC	
Poaceae	*Eragrostis lehmanniana var. lehmanniana*	LC	
Poaceae	*Eragrostis nindensis*	LC	
Poaceae	*Eragrostis obtusa*	LC	
Poaceae	*Eragrostis pallens*	LC	
Poaceae	*Eragrostis porosa*	LC	
Poaceae	*Eragrostis pseudobtusa*	NE	Endemic
Poaceae	*Eragrostis superba*	LC	
Poaceae	*Eragrostis truncata*	LC	
Poaceae	*Eriochloa fatmensis*	LC	
Poaceae	*Eustachys paspaloides*	LC	
Poaceae	*Fingerhuthia africana*	LC	
Poaceae	*Heteropogon contortus*	LC	
Poaceae	*Hyparrhenia hirta*	LC	
Poaceae	*Leptochloa fusca*	LC	
Poaceae	*Melinis repens subsp. grandiflora*	LC	
Poaceae	*Melinis repens subsp. repens*	LC	
Poaceae	*Miscanthus ecklonii*	LC	
Poaceae	*Oropetium capense*	LC	
Poaceae	*Panicum coloratum*	LC	
Poaceae	*Panicum impeditum*	LC	
Poaceae	*Panicum maximum*	LC	
Poaceae	*Panicum stapfianum*	LC	
Poaceae	*Pogonarthria squarrosa*	LC	
Poaceae	*Puccinellia acroxantha*	LC	
Poaceae	*Schismus barbatus*	LC	
Poaceae	*Schmidtia pappophoroides*	LC	
Poaceae	*Setaria lindenbergiana*	LC	
Poaceae	*Setaria verticillata*	LC	
Poaceae	*Sporobolus albicans*	LC	
Poaceae	*Sporobolus coromandelianus*	LC	
Poaceae	*Sporobolus fimbriatus*	LC	

Family	Scientific Name	Conservation Status	Endemism
Poaceae	*Sporobolus ioclados*	LC	
Poaceae	*Sporobolus ludwigii*	LC	
Poaceae	*Sporobolus tenellus*	LC	
Poaceae	*Stipagrostis ciliata var. capensis*	LC	
Poaceae	*Stipagrostis namaquensis*	LC	
Poaceae	*Stipagrostis obtusa*	LC	
Poaceae	*Stipagrostis uniplumis var. uniplumis*	LC	
Poaceae	*Themeda triandra*	LC	
Poaceae	*Tragus berteronianus*	LC	
Poaceae	*Tragus koelerioides*	LC	
Poaceae	*Tragus racemosus*	LC	
Poaceae	*Urochloa panicoides*	LC	
Polygalaceae	*Polygala asbestina*	LC	Endemic
Polygalaceae	*Polygala leptophylla var. leptophylla*	LC	
Polygalaceae	*Polygala pungens*	LC	Endemic
Polygalaceae	*Polygala seminuda*	LC	
Portulacaceae	*Portulaca hereroensis*	LC	
Portulacaceae	*Portulaca quadrifida*	LC	
Pottiaceae	*Trichostomum brachydontium*		
Pteridaceae	*Cheilanthes eckloniana*	LC	
Ptychomitriaceae	*Ptychomitrium cucullatifolium*		
Resedaceae	*Oligomeris dipetala var. dipetala*	LC	
Rhamnaceae	*Ziziphus mucronata subsp. mucronata*	LC	
Rubiaceae	*Anthospermum rigidum subsp. rigidum*	LC	
Rubiaceae	*Kohautia cynanchica*	LC	
Ruscaceae	*Eriospermum corymbosum*	LC	
Ruscaceae	*Sansevieria aethiopica*	LC	
Santalaceae	*Osyris lanceolata*	LC	
Santalaceae	*Thesium hystrix*	LC	
Santalaceae	*Viscum hoolei*	LC	
Scrophulariaceae	*Aptosimum marlothii*	LC	
Scrophulariaceae	*Aptosimum procumbens*	LC	
Scrophulariaceae	*Aptosimum spinescens*	LC	
Scrophulariaceae	*Chaenostoma halimifolium*	LC	
Scrophulariaceae	*Diascia cuneata*	LC	Endemic
Scrophulariaceae	*Jamesbrittenia albiflora*	LC	Endemic
Scrophulariaceae	*Jamesbrittenia atropurpurea subsp. atropurpurea*	LC	
Scrophulariaceae	*Jamesbrittenia aurantiaca*	LC	
Scrophulariaceae	*Peliostomum leucorrhizum*	LC	
Scrophulariaceae	*Peliostomum origanoides*	LC	Endemic
Scrophulariaceae	*Selago albida*	LC	
Scrophulariaceae	*Selago paniculata*	LC	Endemic
Scrophulariaceae	*Selago saxatilis*	LC	
Solanaceae	*Lycium cinereum*	LC	
Solanaceae	*Lycium hirsutum*	LC	

Family	Scientific Name	Conservation Status	Endemism
Solanaceae	*Lycium oxycarpum*	LC	Endemic
Solanaceae	*Lycium pumilum*	LC	
Solanaceae	*Solanum burchellii*	LC	
Solanaceae	*Solanum lichtensteinii*	LC	
Solanaceae	*Withania somnifera*	LC	
Talinaceae	*Talinum arnotii*	LC	
Talinaceae	*Talinum caffrum*	LC	
Thymelaeaceae	*Lasiosiphon polycephalus*	LC	
Verbenaceae	*Chascanum pinnatifidum var. pinnatifidum*	LC	
Verbenaceae	*Lantana rugosa*	LC	
Zygophyllaceae	*Roepera incrustata*		
Zygophyllaceae	*Roepera lichtensteiniana*		
Zygophyllaceae	*Tetraena microcarpa*		
Zygophyllaceae	*Tetraena simplex*		
Zygophyllaceae	*Tribulus terrestris*	LC	

8.3 Appendix C – Amphibian species expected to occur in the project area

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC	LC
Pyxicephalidae	*Amietia poyntoni*	Poynton's River Frog	LC	LC
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	LC	LC
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	LC	LC
Bufonidae	*Poyntonophrynus vertebralis*	Southern Pygmy Toad	LC	LC
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bull Frog	NT	LC
Bufonidae	*Sclerophrys capensis*	Raucous Toad	LC	LC
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	LC	LC
Pyxicephalidae	*Tomopterna cryptotis*	Common Sand Frog	LC	LC
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand Frog	LC	LC
Bufonidae	*Vandijkophrynus gariepensis*	Karoo Toad	LC	LC
Pipidae	*Xenopus laevis*	African Clawed Frog	LC	LC

8.4 Appendix D – Reptile species expected to occur in the project area

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Agamidae	*Agama aculeata*	Ground Agama	LC	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC	LC
Amphisbaenidae	*Monopeltis infuscata*	Dusky Worm Lizard	LC	LC
Amphisbaenidae	*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	LC	LC
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	LC	LC
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC	LC
Colubridae	*Telescopus beetzi*	Beetz's Tiger Snake	LC	LC
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	LC	LC
Elapidae	*Hemachatus haemachatus*	Rinkhals	LC	LC
Elapidae	*Naja nivea*	Cape Cobra	LC	LC
Gekkonidae	*Afroedura nivaria*	Drakensberg Rock Gecko	LC	LC
Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	LC	LC
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC	LC
Gekkonidae	*Pachydactylus mariquensis*	Marico Gecko	LC	LC
Gekkonidae	*Ptenopus garrulus*	Common Barking Gecko	LC	LC
Lacertidae	*Pedioplanis laticeps*	Karoo Sand Lizard	LC	LC
Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard	LC	LC
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC	LC
Lamprophiidae	*Boaedon capensis*	Brown House Snake	LC	LC
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	LC	LC
Lamprophiidae	*Psammophis notostictus*	Karoo Sand Snake	LC	LC
Lamprophiidae	*Pseudaspis cana*	Mole Snake	LC	LC
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	LC	LC
Prosymnidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	LC	LC
Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	LC	LC
Scincidae	*Acontias lineatus*	Striped Legless Skink	LC	LC
Scincidae	*Trachylepis capensis*	Cape Skink	LC	LC
Scincidae	*Trachylepis occidentalis*	Western Three-striped Skink	LC	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC	LC
Scincidae	*Trachylepis spilogaster*	Kalahari Tree Skink	LC	LC

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Scincidae	*Trachylepis sulcata*	Western Rock Skink	LC	LC
Scincidae	*Trachylepis variegata*	Variegated Skink	LC	LC
Testudinidae	*Homopus femoralis*	Greater Padloper	LC	LC
Testudinidae	*Psammobates oculifer*	Serrated Tent Tortoise	LC	LC
Testudinidae	*Psammobates tentorius*	Tent Tortoise	NT	NT
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC	LC
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC	LC
Varanidae	*Varanus albigularis*	Rock Monitor	LC	LC
Varanidae	*Varanus niloticus*	Water Monitor	LC	LC
Viperidae	*Bitis arietans*	Puff Adder	LC	LC

8.5 Appendix E – Avifauna species expected to occur within the project area

Common Name	Scientific Name	Conservation Status	
		Regional	Global
Avocet, Pied	*Recurvirostra avosetta*	LC	LC
Barbet, Acacia Pied	*Tricholaema leucomelas*	LC	LC
Barbet, Crested	*Trachyphonus vaillantii*	LC	LC
Batis, Pririt	*Batis pririt*	LC	LC
Bee-eater, European	*Merops apiaster*	LC	LC
Bee-eater, Swallow-tailed	*Merops hirundineus*	LC	LC
Bee-eater, White-fronted	*Merops bullockoides*	LC	LC
Bishop, Southern Red	*Euplectes orix*	LC	LC
Bishop, Yellow-crowned	*Euplectes afer*	LC	LC
Bokmakierie	*Telophorus zeylonus*	LC	LC
Brubru	*Nilaus afer*	LC	LC
Bulbul, African Red-eyed	*Pycnonotus nigricans*	LC	LC
Bunting, Cape	*Emberiza capensis*	LC	LC
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	LC	LC
Bunting, Lark-like	*Emberiza impetuani*	LC	LC
Bustard, Ludwig's	*Neotis ludwigii*	EN	EN
Buttonquail, Common	*Turnix sylvaticus*	LC	LC
Buzzard, Common	*Buteo buteo*	LC	LC
Buzzard, Jackal	*Buteo rufofuscus*	LC	LC
Canary, Black-throated	*Crithagra atrogularis*	LC	LC
Canary, White-throated	*Crithagra albogularis*	LC	LC
Canary, Yellow	*Crithagra flaviventris*	LC	LC
Chat, Ant-eating	*Myrmecocichla formicivora*	LC	LC
Chat, Familiar	*Oenanthe familiaris*	LC	LC
Chat, Sickle-winged	*Emarginata sinuata*	LC	LC
Cisticola, Desert	*Cisticola aridulus*	LC	LC
Cisticola, Grey-backed	*Cisticola subruficapilla*	LC	LC
Cisticola, Levaillant's	*Cisticola tinniens*	LC	LC
Cisticola, Zitting	*Cisticola juncidis*	LC	LC
Coot, Red-knobbed	*Fulica cristata*	LC	LC
Cormorant, Reed	*Microcarbo africanus*	LC	LC
Cormorant, White-breasted	*Phalacrocorax lucidus*	LC	LC
Courser, Double-banded	*Rhinoptilus africanus*	LC	LC
Crombec, Long-billed	*Sylvietta rufescens*	LC	LC
Crow, Pied	*Corvus albus*	LC	LC
Cuckoo, Diederik	*Chrysococcyx caprius*	LC	LC
Darter, African	*Anhinga rufa*	LC	LC
Dove, Cape Turtle	*Streptopelia capicola*	LC	LC
Dove, Laughing	*Spilopelia senegalensis*	LC	LC
Dove, Namaqua	*Oena capensis*	LC	LC
Dove, Red-eyed	*Streptopelia semitorquata*	LC	LC
Drongo, Fork-tailed	*Dicrurus adsimilis*	LC	LC
Duck, African Black	*Anas sparsa*	LC	LC

Common Name	Scientific Name	Conservation Status	
		Regional	Global
Duck, Maccoa	*Oxyura maccoa*	LC	LC
Duck, White-faced Whistling	*Dendrocygna viduata*	LC	LC
Duck, Yellow-billed	*Anas undulata*	LC	LC
Eagle, African Fish	*Haliaeetus vocifer*	LC	LC
Eagle, Booted	*Hieraaetus pennatus*	LC	LC
Eagle, Verreaux's	*Aquila verreauxii*	VU	LC
Eagle-Owl, Spotted	*Bubo africanus*	LC	LC
Egret, Little	*Egretta garzetta*	LC	LC
Egret, Western Cattle	*Bubulcus ibis*	LC	LC
Eremomela, Yellow-bellied	*Eremomela icteropygialis*	LC	LC
Falcon, Peregrine	*Falco peregrinus*	LC	LC
Finch, Red-headed	*Amadina erythrocephala*	LC	LC
Firefinch, Red-billed	*Lagonosticta senegala*	LC	LC
Fiscal, Southern	*Lanius collaris*	LC	LC
Flycatcher, Chat	*Melaenornis infuscatus*	LC	LC
Flycatcher, Fairy	*Stenostira scita*	LC	LC
Flycatcher, Fiscal	*Melaenornis silens*	LC	LC
Flycatcher, Spotted	*Muscicapa striata*	LC	LC
Goose, Egyptian	*Alopochen aegyptiaca*	LC	LC
Goose, Spur-winged	*Plectropterus gambensis*	LC	LC
Goshawk, Gabar	*Micronisus gabar*	LC	LC
Goshawk, Pale Chanting	*Melierax canorus*	LC	LC
Grebe, Little	*Tachybaptus ruficollis*	LC	LC
Greenshank, Common	*Tringa nebularia*	LC	LC
Guineafowl, Helmeted	*Numida meleagris*	LC	LC
Hamerkop	*Scopus umbretta*	LC	LC
Harrier-Hawk, African	*Polyboroides typus*	LC	LC
Heron, Black-crowned Night	*Nycticorax nycticorax*	LC	LC
Heron, Black-headed	*Ardea melanocephala*	LC	LC
Heron, Goliath	*Ardea goliath*	LC	LC
Heron, Grey	*Ardea cinerea*	LC	LC
Hoopoe, African	*Upupa africana*	LC	LC
Ibis, African Sacred	*Threskiornis aethiopicus*	LC	LC
Ibis, Hadada	*Bostrychia hagedash*	LC	LC
Kestrel, Greater	*Falco rupicoloides*	LC	LC
Kestrel, Lesser	*Falco naumanni*	LC	LC
Kestrel, Rock	*Falco rupicolus*	LC	LC
Kingfisher, Brown-hooded	*Halcyon albiventris*	LC	LC
Kingfisher, Giant	*Megaceryle maxima*	LC	LC
Kingfisher, Malachite	*Corythornis cristatus*	LC	LC
Kingfisher, Pied	*Ceryle rudis*	LC	LC
Kite, Black-winged	*Elanus caeruleus*	LC	LC
Korhaan, Blue	*Eupodotis caerulescens*	LC	NT
Korhaan, Northern Black	*Afrotis afraoides*	LC	LC

Common Name	Scientific Name	Conservation Status	
		Regional	Global
Lapwing, Blacksmith	*Vanellus armatus*	LC	LC
Lapwing, Crowned	*Vanellus coronatus*	LC	LC
Lark, Eastern Clapper	*Mirafra fasciolata*	LC	LC
Lark, Eastern Long-billed	*Certhilauda semitorquata*	LC	LC
Lark, Fawn-colored	*Calendulauda africanoides*	LC	LC
Lark, Large-billed	*Galerida magnirostris*	LC	LC
Lark, Red-capped	*Calandrella cinerea*	LC	LC
Lark, Rufous-naped	*Mirafra africana*	LC	LC
Lark, Sabota	*Calendulauda sabota*	LC	LC
Lark, Spike-heeled	*Chersomanes albofasciata*	LC	LC
Martin, Brown-throated	*Riparia paludicola*	LC	LC
Martin, Common House	*Delichon urbicum*	LC	LC
Martin, Rock	*Ptyonoprogne fuligula*	LC	LC
Mousebird, Red-faced	*Urocolius indicus*	LC	LC
Mousebird, Speckled	*Colius striatus*	LC	LC
Mousebird, White-backed	*Colius colius*	LC	LC
Neddicky	*Cisticola fulvicapilla*	LC	LC
Osprey, Western	*Pandion haliaetus*	LC	LC
Ostrich, Common	*Struthio camelus*	LC	LC
Pigeon, Speckled	*Columba guinea*	LC	LC
Pipit, African	*Anthus cinnamomeus*	LC	LC
Pipit, African Rock	*Anthus crenatus*	NT	NT
Pipit, Nicholson's	*Anthus nicholsoni*	LC	LC
Pipit, Plain-backed	*Anthus leucophrys*	LC	LC
Plover, Three-banded	*Charadrius tricollaris*	LC	LC
Pratincole, Black-winged	*Glareola nordmanni*	NT	NT
Prinia, Black-chested	*Prinia flavicans*	LC	LC
Prinia, Karoo	*Prinia maculosa*	LC	LC
Quail, Common	*Coturnix coturnix*	LC	LC
Quailfinch	*Ortygospiza atricollis*	LC	LC
Quelea, Red-billed	*Quelea quelea*	LC	LC
Robin-Chat, Cape	*Cossypha caffra*	LC	LC
Sandgrouse, Namaqua	*Pterocles namaqua*	LC	LC
Scimitarbill, Common	*Rhinopomastus cyanomelas*	LC	LC
Scrub Robin, Kalahari	*Cercotrichas paena*	LC	LC
Scrub Robin, Karoo	*Cercotrichas coryphoeus*	LC	LC
Secretarybird	*Sagittarius serpentarius*	VU	EN
Shelduck, South African	*Tadorna cana*	LC	LC
Shrike, Crimson-breasted	*Laniarius atrococcineus*	LC	LC
Shrike, Lesser Grey	*Lanius minor*	LC	LC
Shrike, Red-backed	*Lanius collurio*	LC	LC
Sparrow, Cape	*Passer melanurus*	LC	LC
Sparrow, Southern Grey-headed	*Passer diffusus*	LC	LC
Sparrow-Lark, Grey-backed	*Eremopterix verticalis*	LC	LC

Common Name	Scientific Name	Conservation Status	
		Regional	Global
Sparrow-Weaver, White-browed	*Plocepasser mahali*	LC	LC
Spurfowl, Swainson's	*Pternistis swainsonii*	LC	LC
Starling, Cape	*Lamprotornis nitens*	LC	LC
Starling, Common	*Sturnus vulgaris*	LC	LC
Starling, Pale-winged	*Onychognathus nabouroup*	LC	LC
Starling, Pied	*Lamprotornis bicolor*	LC	LC
Starling, Red-winged	*Onychognathus morio*	LC	LC
Starling, Wattled	*Creatophora cinerea*	LC	LC
Stilt, Black-winged	*Himantopus himantopus*	LC	LC
Stonechat, African	*Saxicola torquatus*	LC	LC
Stork, Abdim's	*Ciconia abdimii*	NT	LC
Stork, White	*Ciconia ciconia*	LC	LC
Sunbird, Dusky	*Cinnyris fuscus*	LC	LC
Sunbird, Malachite	*Nectarinia famosa*	LC	LC
Swallow, Barn	*Hirundo rustica*	LC	LC
Swallow, Greater Striped	*Cecropis cucullata*	LC	LC
Swallow, Pearl-breasted	*Hirundo dimidiata*	LC	LC
Swallow, Red-breasted	*Cecropis semirufa*	LC	LC
Swallow, South African Cliff	*Petrochelidon spilodera*	LC	LC
Swallow, White-throated	*Hirundo albigularis*	LC	LC
Swift, African Black	*Apus barbatus*	LC	LC
Swift, African Palm	*Cypsiurus parvus*	LC	LC
Swift, Alpine	*Tachymarptis melba*	LC	LC
Swift, Bradfield's	*Apus bradfieldi*	LC	LC
Swift, Common	*Apus apus*	LC	LC
Swift, Horus	*Apus horus*	LC	LC
Swift, Little	*Apus affinis*	LC	LC
Swift, White-rumped	*Apus caffer*	LC	LC
Tchagra, Brown-crowned	*Tchagra australis*	LC	LC
Teal, Cape	*Anas capensis*	LC	LC
Teal, Red-billed	*Anas erythrorhyncha*	LC	LC
Tern, Caspian	*Hydroprogne caspia*	VU	LC
Thick-knee, Spotted	*Burhinus capensis*	LC	LC
Thrush, Karoo	*Turdus smithi*	LC	LC
Thrush, Short-toed Rock	*Monticola brevipes*	LC	LC
Tit, Ashy	*Melaniparus cinerascens*	LC	LC
Tit, Cape Penduline	*Anthoscopus minutus*	LC	LC
Tit, Grey	*Melaniparus afer*	LC	LC
Wagtail, African Pied	*Motacilla aguimp*	LC	LC
Wagtail, Cape	*Motacilla capensis*	LC	LC
Warbler, African Reed	*Acrocephalus baeticatus*	LC	LC
Warbler, Chestnut-vented	*Curruca subcoerulea*	LC	LC
Warbler, Great Reed	*Acrocephalus arundinaceus*	LC	LC
Warbler, Layard's	*Curruca layardi*	LC	LC

Common Name	Scientific Name	Conservation Status	
		Regional	Global
Warbler, Lesser Swamp	*Acrocephalus gracilirostris*	LC	LC
Warbler, Namaqua	*Phragmacia substriata*	LC	LC
Warbler, Rufous-eared	*Malcorus pectoralis*	LC	LC
Warbler, Sedge	*Acrocephalus schoenobaenus*	LC	LC
Warbler, Willow	*Phylloscopus trochilus*	LC	LC
Waxbill, Black-faced	*Brunhilda erythronotos*	LC	LC
Waxbill, Common	*Estrilda astrild*	LC	LC
Weaver, Scaly-feathered	*Sporopipes squamifrons*	LC	LC
Weaver, Southern Masked	*Ploceus velatus*	LC	LC
Wheatear, Capped	*Oenanthe pileata*	LC	LC
Wheatear, Mountain	*Myrmecocichla monticola*	LC	LC
White-eye, Cape	*Zosterops virens*	LC	LC
White-eye, Orange River	*Zosterops pallidus*	LC	LC
Whydah, Pin-tailed	*Vidua macroura*	LC	LC
Woodpecker, Cardinal	*Dendropicos fuscescens*	LC	LC
Woodpecker, Golden-tailed	*Campethera abingoni*	LC	LC

8.6 Appendix F – Mammal species expected to occur within the project area

Scientific Name	Common Name	Conservation Status	
		Regional	Global
Aethomys ineptus	Tete Veld Rat	LC	LC
Aethomys namaquensis	Namaqua rock rat	LC	LC
Alcelaphus buselaphus	Sclater's Shrew	LC	LC
Antidorcas marsupialis	Springbok	LC	LC
Atilax paludinosus	South African Hedgehog	NT	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Caracal caracal	Caracal	LC	LC
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Cryptomys hottentotus	Common Mole-rat	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Desmodillus auricularis	Cape Short-eared Gerbil	LC	LC
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT
Elephantulus myurus	Eastern Rock Sengi	LC	LC
Eptesicus hottentotus	Long-tailed Serotine Bat	LC	LC
Felis nigripes	Black-footed Cat	VU	VU
Felis silvestris	African Wildcat	LC	LC
Genetta genetta	Small-spotted Genet	LC	LC
Gerbilliscus brantsii	Highveld Gerbil	LC	LC
Gerbilliscus leucogaster	Bushveld Gerbil	LC	LC
Gerbillurus paeba	Hairy-footed Gerbil	LC	LC
Herpestes pulverulentus	Cape Grey Mongoose	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hydrictis maculicollis	Spotted-necked Otter	VU	NT
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC
Leptailurus serval	Serval	NT	LC

Scientific Name	Common Name	Conservation Status	
		Regional	Global
Lepus capensis	Cape Hare	Not listed	LC
Lepus saxatilis	Scrub Hare	LC	LC
Malacothrix typica	Gerbil Mouse	LC	LC
Mastomys coucha	Multimammate Mouse	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mus musculus	House Mouse	Not listed	LC
Neoromicia capensis	Cape Serotine Bat	LC	LC
Neoromicia zuluensis	Zulu Pipistrelle Bat	LC	LC
Orycteropus afer	Aardvark	LC	LC
Otocyon megalotis	Bat-eared Fox	LC	LC
Otomys unisulcatus	Bush Vlei Rat	LC	LC
Panthera pardus	Leopard	VU	VU
Papio ursinus	Chacma Baboon	LC	LC
Parahyaena brunnea	Brown Hyaena	NT	NT
Parotomys brantsii	Brants's Whistling Rat	LC	LC
Parotomys littledalei	Littledale's Whistling Rat	LC	LC
Pedetes capensis	Springhare	LC	LC
Phacochoerus africanus	Common Warthog	LC	LC
Poecilogale albinucha	African Striped Weasel	NT	LC
Procavia capensis	Rock Hyrax	LC	LC
Proteles cristata	Aardwolf	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rattus rattus	House Rat	Not listed	LC
Redunca fulvorufula	Mountain Reedbuck	EN	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Rhinolophus darlingi	Geoffroy's Horseshoe Bat	LC	LC
Saccostomus campestris	Pouched Mouse	LC	LC
Suncus varilla	Lesser Dwarf Shrew	LC	LC
Suricata suricatta	Meerkat	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC
Vulpes chama	Cape Fox	LC	LC
Xerus inauris	South African Ground Squirrel	LC	LC

8.7 Appendix G – Specialists Declarations

I, Mahomed Desai, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Mahomed Desai

Biodiversity Specialist

The Biodiversity Company

August 2022