



The Terrestrial Biodiversity Search and Rescue Report for the proposed Sannaspos Solar PV Development Project

Sannaspos, Free State Province

January 2022

CLIENT

savannah
environmental

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com






Report Name	The Terrestrial Biodiversity Search and Rescue Report for the proposed Sannaspos Solar PV Development Project
Submitted to	
Report Writer and Fieldwork	<p>Michael Schrenk </p> <p>Michael completed his professional Civil and Environmental engineering degree at the University of the Witwatersrand in 2016. He has been working in the fields of project management, biodiversity and habitat assessment and ecological restoration for over 3 years.</p>
Report Reviewer	<p>Andrew Husted </p> <p>Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.</p>
Declaration	<p>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.</p>

Table of Contents

1	Introduction.....	1
2	Project Area.....	2
3	Terms of Reference.....	5
4	Key Legislative Requirements	6
5	Definitions.....	7
5.1	Species of Conservation Concern	7
5.2	Protected Species	7
6	Methods.....	8
6.1	Geographic Information Systems (GIS) Mapping.....	8
6.2	Desktop Vegetation and Botanical Assessment.....	8
6.3	Floristic Fieldwork Survey and Analysis.....	8
6.4	Faunal Assessment.....	11
6.4.1	Desktop Assessment.....	11
6.4.2	Field Survey	11
7	Limitations and Assumptions	12
8	Results and Discussion	12
8.1	Desktop Spatial Assessment	12
8.1.1	Free State Biodiversity Sector Plan	12
8.2	Ecological Desktop Assessments	15
8.2.1	Botanical Assessment	15
8.2.2	Faunal Assessment.....	16
8.3	Field Survey	16
8.3.1	Flora.....	17
8.3.2	Fauna.....	25
9	Recommendations for the Translocation/Search and Rescue Protocol.....	27
9.1	Recommended Actions for the Translocation of Protected Flora	28
9.1.1	Flora Removal for Translocation.....	28
9.1.2	Monitoring	30
9.1.3	Permitting	30
9.2	Recommended Actions for the Translocation of Protected and Important Fauna.....	30

9.2.1	Important Actions and Considerations	31
9.2.2	General Considerations and Mitigation Actions	33
9.2.3	Permitting	34
10	Conclusion.....	35
11	References.....	36
12	Appendices.....	41

Tables

Table 4-1	A list of key legislative requirements relevant to these studies in the Free State Province	6
Table 8-1	Desktop spatial features examined.....	12
Table 8-2	Provincially protected plants potentially occurring in the project area.....	15
Table 8-3	The potential SCC mammal species present within the project area	16
Table 8-4	The potential SCC reptile species present within the project area	16
Table 8-5	The potential SCC amphibian species present within the project area.....	16
Table 8-6	The protected floral species, and proportions, observed within the project area	17

Figures

Figure 2-1	Project Area.....	3
Figure 2-2	Regional overview of the project area.....	4
Figure 5-1	Threatened species and Species of Conservation Concern (SANBI, 2016)	7
Figure 6-1	The specialist track followed during the field survey	10
Figure 8-1	The project area superimposed on the Free State Biodiversity Plan (Collins, 2015)	14
Figure 8-2	<i>Ammocharis coranica</i> , or Karroo Lily, found in 25 locations across the project area. A large pink flower sphere is typically displayed between Sept and March	18
Figure 8-3	<i>Boophone disticha</i> , or Poison Bulb, found in 60 locations across the project area. A large round headed pink/red flower sphere is usually displayed between July & Oct	18
Figure 8-4	Map of the recorded <i>Ammocharis coranica</i> locations within the project area	19
Figure 8-5	Map of the recorded <i>Boophone disticha</i> locations within the project area	20
Figure 8-6	<i>Eucomis autumnalis</i> , the Pineapple Lily, was found in only 13 locations.....	21

Figure 8-7 Olea europaea subsp. africana, the African Olive, was found in 3 locations, all along the project area boundary. The trees were between 4 and 10 m tall 22

Figure 8-8 Hypoxis hemerocallidea, the Star Flower, is not protected but does face serious threat due to over harvesting in some regions 22

Figure 8-9 Map of the recorded Eucomis autumnalis and Olea europaea subsp. africana locations within the project area..... 23

Figure 8-10 Opuntia humifusa, the most dominant category 1b AIP within the project area 24

Figure 8-11 The Secretarybird was observed during both days of the field survey 26

Figure 8-12 A pair of Secretary birds performing a courtship display over the project area 26

Figure 8-13 A single Leopard tortoise was observed foraging within the project area 27

Figure 9-1 Typical Secretarybird nests (© Awie Badenhorst) 32

Figure 9-2 Typical Aardvark burrow (© Louise Joubert) 32

1 Introduction

The Biodiversity Company was commissioned to compile a terrestrial biodiversity search and rescue (S&R) plan for the proposed solar photovoltaic (PV) development project near the town of Sannaspos in the Free State province. The plan will supplement any necessary permitting requirements for the project with regards to the *in-situ* conservation, translocation, or destruction of protected species or Species of Conservation Concern (SCC) found within the project area.

A recent full specialist terrestrial ecology and wetland assessment was completed for the project by The Biodiversity Company in December 2021 (TBC, 2021), which recorded the presence of three protected plant species and one threatened avifaunal species. As this assessment was recent and covered areas in close proximity to this search and rescue area, the findings have been used to supplement this report. This search and rescue report however focuses on the originally proposed development layout, as covered in the extensive ecological report by Strohbach (2012) and refers to this section as the 'project area'.

The facility is planned to have a contracted capacity of 75MW and will include the following infrastructure (Strohbach, 2012):

- PV arrays and inverters;
- Cabling between project components, laid underground as far as possible;
- Internal access roads;
- An overhead power line feeding into the Eskom electricity network at Sannaspos Rural Substation that is located near the site; and
- Workshop area for maintenance and storage.

In order to assess the project area for SCC, and protected biodiversity, as well as habitat conducive to the supporting of SCC and protected biodiversity, both a desktop assessment as well as a field survey were conducted during January 2022.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations, 2014 (No. 326, 7 April 2017) of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998). The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020 as well as the Government Notice 1150 in terms of NEMA dated 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". The National Web based Environmental Screening Tool (National Environmental Screening Tool, 2021) has characterised the terrestrial biodiversity for the project area as 'Very High' sensitivity.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP), field consultants and contractors, and regulatory authorities, enabling informed decision making with regards to the proposed project and the management of important terrestrial biodiversity.

2 Project Area

The project area is located 6.5 km southeast from the town of Sannaspos and 35 km east of the city of Bloemfontein in the Free State province. The size of the project area is approximately 200 ha.

The land within the project area has historically been used for agriculture as well as grazing land, and this remains the current land use. Surrounding properties are used for grazing land and agriculture, with portions of open veld and rocky ridges. Numerous dams and wetlands surround the area, and the large Modder River runs along the north-eastern boundary, 300 m from the project area.

The project area assessed is presented in Figure 2-1 below, and the regional overview is illustrated in Figure 2-2.

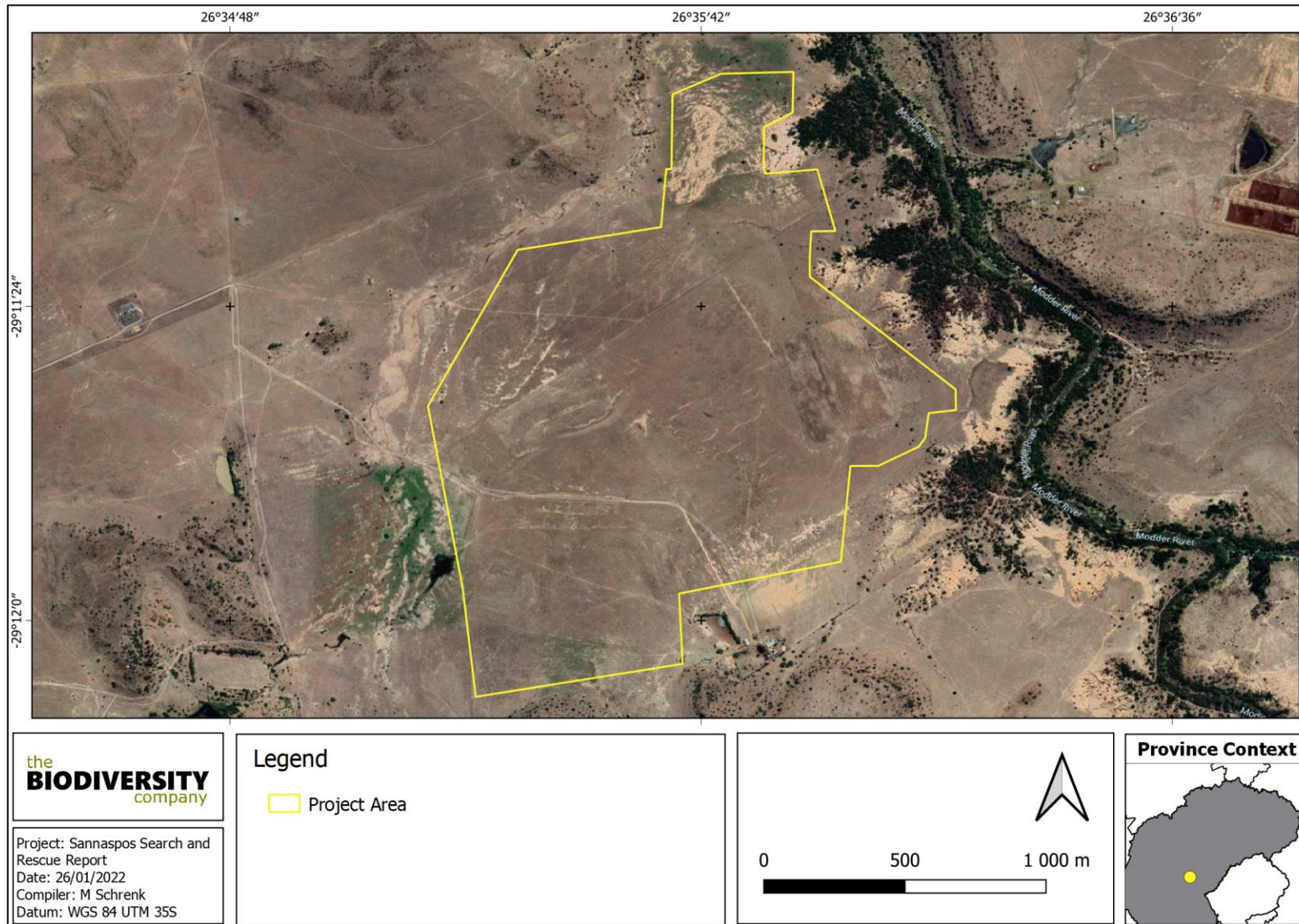


Figure 2-1 Project Area

info@thebiodiversitycompany.com

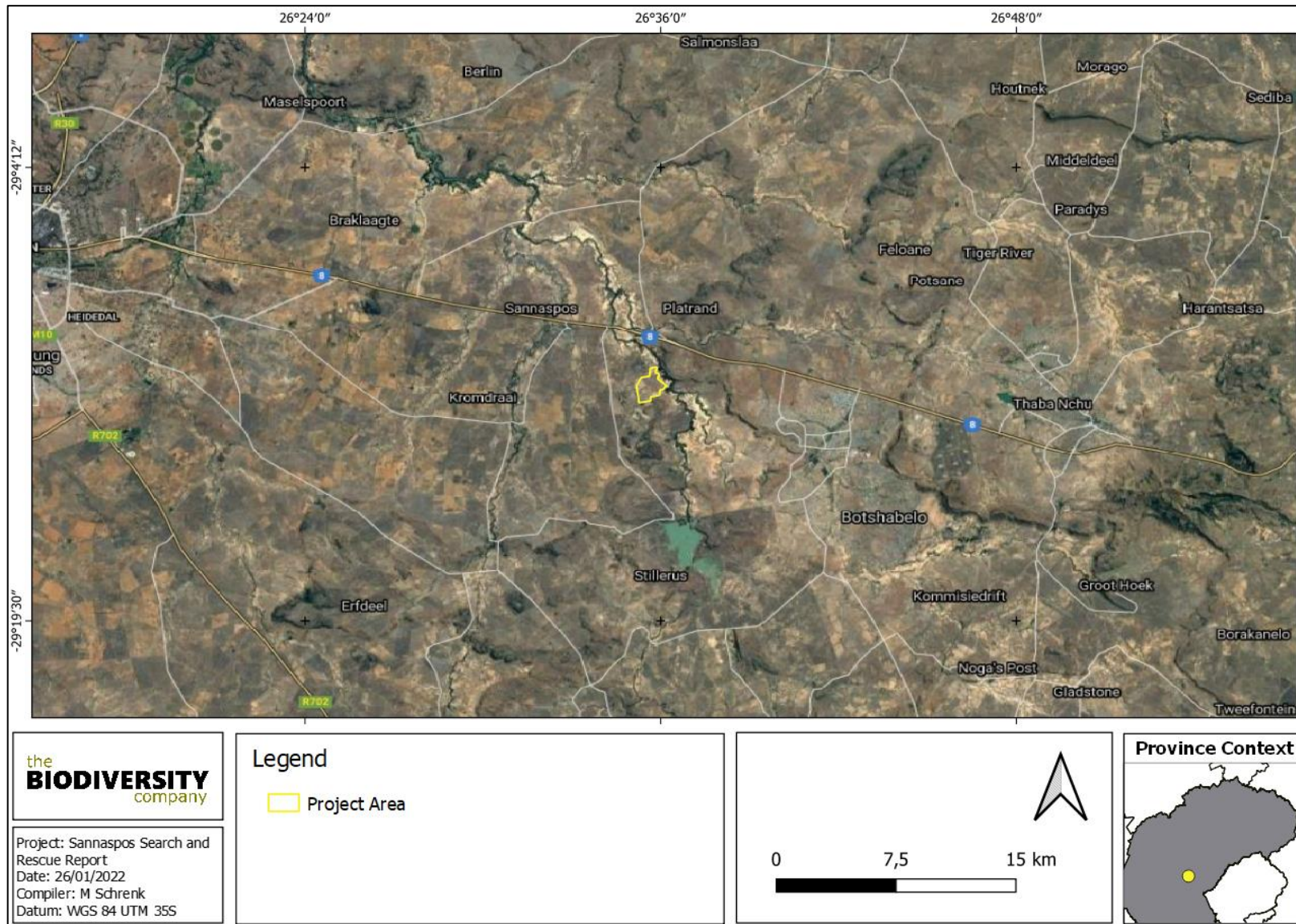


Figure 2-2 Regional overview of the project area

info@thebiodiversitycompany.com

3 Terms of Reference

The principle aim of the assessment was to inform on the translocation of select flora and fauna, especially SCC. This term includes those species regarded as red-listed or red-data species by the latest South African National Biodiversity Institute (SANBI) and International Union for Conservation of Nature (IUCN) reports. The following are the Terms of Reference that guide this search and rescue report:

a. Field survey

- Recording of the location and approximate densities of all nationally and provincially protected plant species, and plant SCC, to be affected by the development;
- The diversity and quantities of alien vegetation required to be eradicated from the area will also be recorded; and
- The location of habitats (i.e., nests, burrows) occupied by protected faunal species and/or fauna SCC will be identified.

b. Plan Compilation

A search and rescue plan will be compiled for the development, which will be submitted as a supporting document for a permit application. The plan will include the following:

- Details of the field survey findings;
- Maps and plans with respect to protected flora and fauna species;
- A plan of action for the rescue and relocation of selected species;
- Recommendations for the avoidance of selected species, if possible; and
- Recommendations for the removal or destruction of selected plant species.

4 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 4-1).

Table 4-1 A list of key legislative requirements relevant to these studies in the Free State Province

Region	Legislation
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on Wetlands (RAMSAR Convention, 1971)
	The United Nations Framework Convention on Climate Change (UNFCCC, 1994)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2013)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
	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 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 Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	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 Environmental Management Air Quality Act (No. 39 of 2004)
	National Protected Areas Expansion Strategy (NPAES)
National	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 No. 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
	National Water Act (NWA, 1998)
	Provincial
Free State Nature Conservation Ordinance 8 of 1969	

5 Definitions

5.1 Species of Conservation Concern

In accordance with the National Red List of South African Plants website, managed and maintained by SANBI, a SCC is species that has a high conservation importance in terms of preserving South Africa's rich biodiversity. This classification covers a range of red list categories as illustrated in Figure 5-1 below.

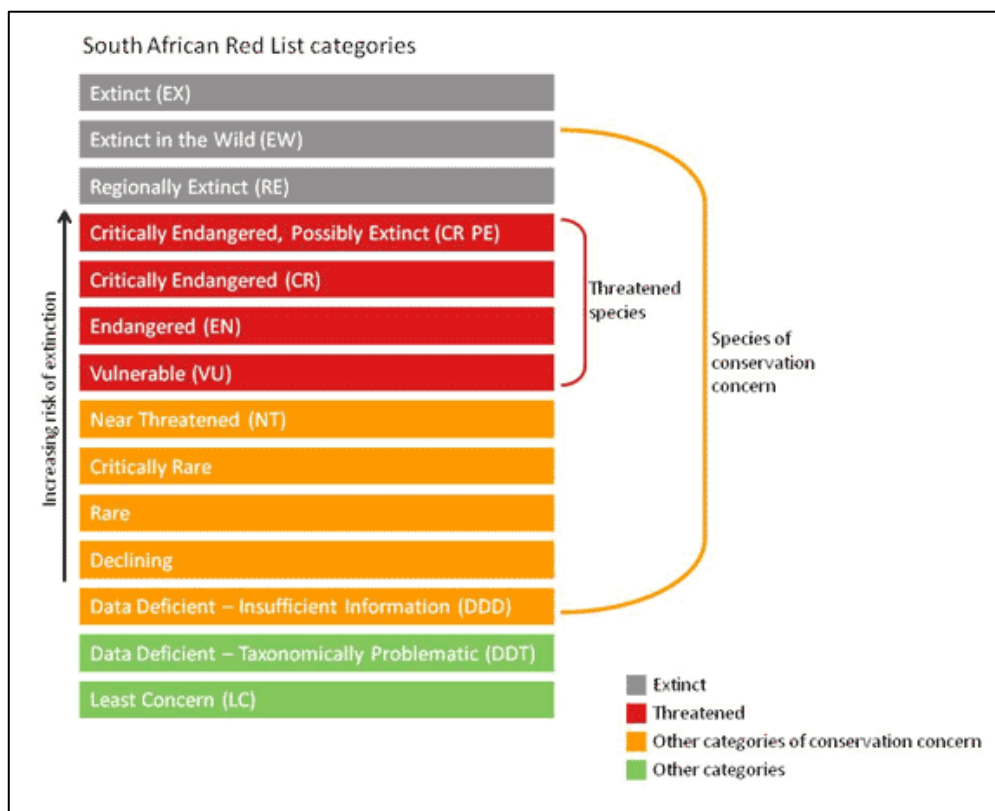


Figure 5-1 Threatened species and Species of Conservation Concern (SANBI, 2016)

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria (IUCN, 2012). This scientific system is designed to measure species' risk of extinction and its purpose is to highlight those species that are in need of critical conservation action. As this system has been adopted from the IUCN, the definition of an SCC as described and categorised above is extended to all red list classifications relevant to fauna as well as the IUCN categories, for the purposes of this report.

5.2 Protected Species

Protected species include both floral and faunal species that are protected according to some form of relevant legislation, be it provincial, national, or international. Provincial legislation may include that published in the form of a provincial ordinance or a bill, national legislation includes that which is published in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) or the National Forest Act (Act No. 84 of 1998). Relevant national legislation includes the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2013).

6 Methods

6.1 Geographic Information Systems (GIS) Mapping

Existing data layers were incorporated into GIS software to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial dataset:

- Free State Biodiversity Sector Plan of 2015 (Collins, 2015).

Brief descriptions of the standardised methodologies applied are provided below. More detailed descriptions of survey methodologies are available upon request.

6.2 Desktop Vegetation and Botanical Assessment

The desktop vegetation and botanical assessment focused on the identification of any red-data and protected species that may occur within the known distribution of the project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA-POSA, 2019), which was used to access distribution records on Southern African plants and generate an expected species list. This new database replaces the old Plants of Southern Africa (POSA) database which provided distribution data of flora at the quarter degree square (QDS) resolution. The Red List of South African Plants website (SANBI, 2016) was utilized to provide the most current account of the national conservation status of flora.

Additional information regarding ecosystems, vegetation types, protected flora and SCC was obtained from the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2012);
- Red List of South African Plants (Raimondo *et al.*, 2009; SANBI, 2016);
- Provincially Protected Plant Species (Free State Nature Conservation Ordinance 8 of 1969); and
- List of Protected Tree Species (DEFF-2, 2021).

6.3 Floristic Fieldwork Survey and Analysis

The wet season fieldwork (completed over two days during January 2022) and sample sites were placed within targeted areas (i.e., target sites) 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. The focus of the fieldwork was therefore to maximise coverage and navigate to each target site in the field, with a focus on sensitive areas, to perform a floristic assessment at each sample site.

The floristic diversity and search for protected plants and flora SCC were conducted through timed meanders. The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting protected plants and flora SCC and maximising floristic coverage. The search was performed based on the original technique described by Goff *et al.* (1982). Suitable habitat for SCC were identified according to Raimondo *et al.* (2009) and targeted as part of the timed meanders.

As the field survey was conducted for a search and rescue report the specialist worked to traverse extensive portions of the project area in the search for SCC and protected species, so as to record the observed numbers and geotag the locations of observed species. During the course of the field survey the specialist covered a distance of over 37 km within the project area, the specialist track is provided as a map in Figure 6-1 below.

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

- A field guide to Wild flowers (Pooley, 1998);
- Orchids of South Africa (Johnson & Bytebier, 2015);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Mesembs of the World (Smith *et al.*, 1998);
- Medicinal Plants of South Africa (Van Wyk *et al.*, 2013);
- Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016);
- Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions (Fish *et al.*, 2015); and
- Field guide to trees of Southern Africa, Struik Publishers (Van Wyk & Van Wyk, 1997).

The field work methodology included the following survey techniques:

- Timed meanders;
- Sensitivity analysis based on structural and species diversity;
- Identification and recording of protected floral species; and
- Identification and recording of floral red-data or red-listed species (Species of Conservation Concern).

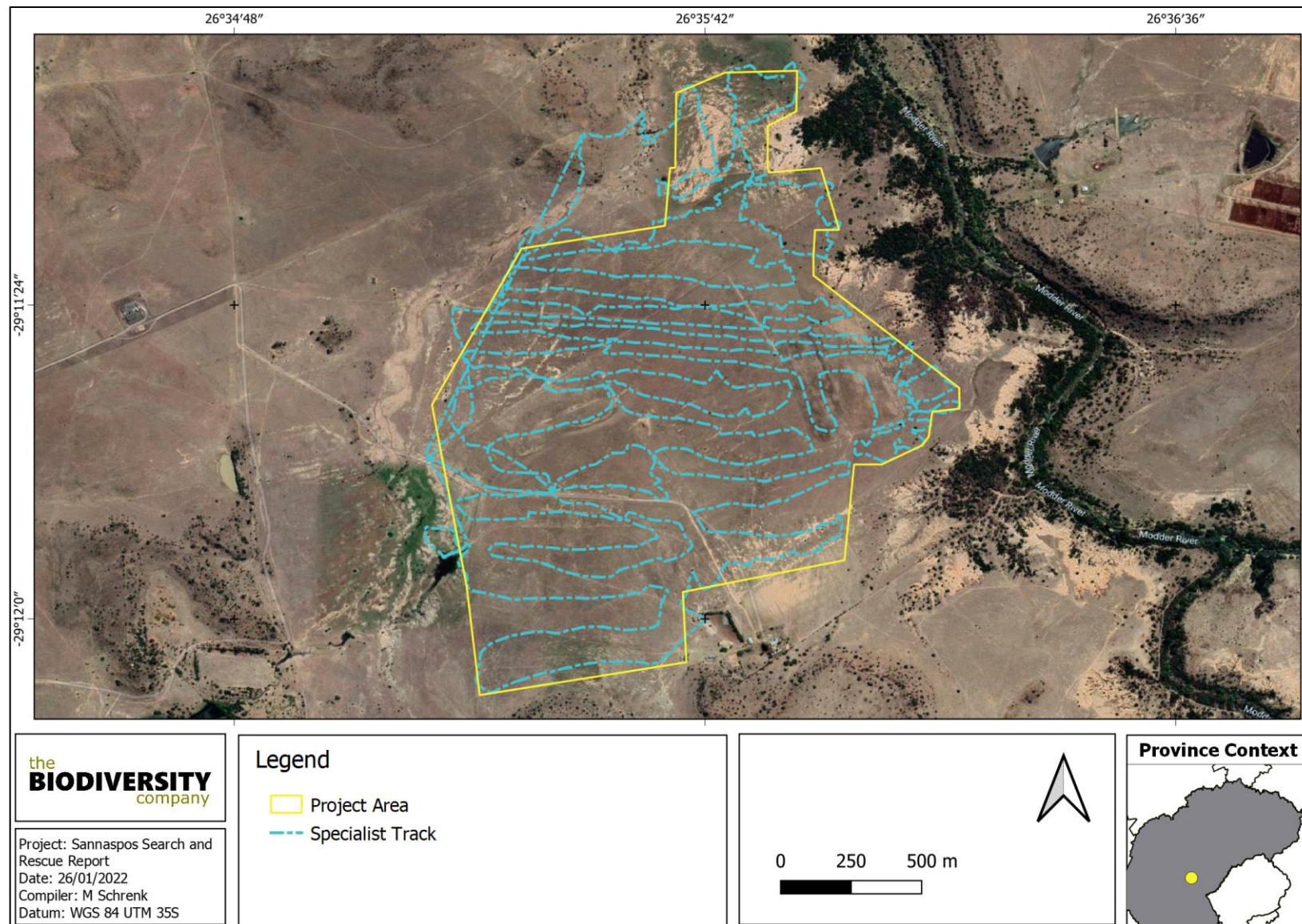


Figure 6-1 The specialist track followed during the field survey

info@thebiodiversitycompany.com

6.4 Faunal Assessment

6.4.1 Desktop Assessment

The faunal desktop assessment involved the following:

- Compilation of expected species lists for avifauna, mammals, reptiles and amphibians;
- Identification of any Red Data species or Species of Conservation Concern (SCC) potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance.

Distribution and SCC data was obtained from the following information sources:

- Animal Demography Unit (ADU, 2020);
- Southern African Bird Atlas Project 2 (SABAP2, 2019);
- South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates *et al.*, 2014);
- Checklist of Birds (Birdlife South Africa, 2015);
- Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner *et al.*, 2004);
- South Africa's official site for Species Information and National Red Lists (SANBI, 2022);
- The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za) (EWT, 2016); and
- The International Union for Conservation of Nature's Red List of Threatened Species. Version 2021-3 (IUCN, 2021).

6.4.2 Field Survey

The field survey component of the assessment utilised a variety of sampling techniques including, but not limited to, the following:

- Visual observations (involving the use of binoculars and specialist camera equipment);
- Active hand-searches, used for species that shelter in or under particular micro-habitats (typically rocks, exfoliating rock outcrops, fallen trees, leaf litter, bark etc.);
- Identification of tracks and signs; and
- Utilization of local knowledge.

The specialist track navigated during the field survey may be referred to in Figure 6-1 above.

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

- Roberts Bird Guide, Second Edition (Chittenden *et al.*, 2016);

- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005); and
- Bats of Southern and Central Africa (Monadjem *et al.*, 2010).

7 Limitations and Assumptions

The following limitations and assumptions should be noted for the assessment:

- It is assumed that all information and data received from the client is accurate;
- All datasets accessed and utilised for this assessment are considered to be representative of the most recent and suitable data for the intended purposes;
- Only a single season survey was conducted for this assessment, this would constitute a wet season survey;
- The assessment was conducted on those portions of the project area that have been allocated for development. The area surveyed was as defined by the client, and any changes in the project boundary subsequent to this may negatively impact the robustness of this report;
- A detailed biodiversity report and vegetation assessment was compiled by The Biodiversity Company (TBC, 2021) for the project region and thus this was not undertaken for this report. Only SCC and protected species are recorded and discussed for the purposes of this report; and
- The GPS used in the assessment had an accuracy of 5 m, and consequently any spatial features may be offset by 5 m.

8 Results and Discussion

8.1 Desktop Spatial Assessment

Table 8-1 below has been produced as a result of the spatial data collected and analysed (as provided by the national and provincial environmental authorities). It presents a summative breakdown of the ecological boundary considered and the associated relevance that it has to the project area.

Table 8-1 Desktop spatial features examined

Desktop Information Considered	Relevant/Not relevant	Section
Free State Biodiversity Sector Plan of 2015	Relevant: The project area overlaps with Ecological Support Areas (ESA) 1 and ESA2 areas	8.1.1

8.1.1 Free State Biodiversity Sector Plan

The Free State Province Biodiversity Plan classifies areas within the province on the basis of their contributions to reaching the conservation targets within the province. These areas are

primarily classified as either Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs).

Critical Biodiversity Areas (CBAs) are terrestrial areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and healthy functioning of important species and ecosystems and the delivery of ecosystem services. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met (SANBI, 2017).

Ecological Support Areas (ESAs) are areas that are not essential for meeting biodiversity representation targets but play an important role in supporting the ecological functioning of ecosystems as well as adjacent Critical Biodiversity Areas, and/or in delivering ecosystem services that support socio-economic development (SANBI, 2017).

As shown in Figure 8-1 and according to the Free State Province Biodiversity Plan, the project area is situated mostly within an ESA2 area, with a small portion towards the south overlapping with ESA1 area.

According to SANBI (2017), an ESA1 area is a portion of land currently either in a good or fair ecological condition and the objective is to maintain it in at least a fair ecological condition; while an ESA2 area is likely in a modified condition where the objective is to avoid further deterioration in ecological condition.

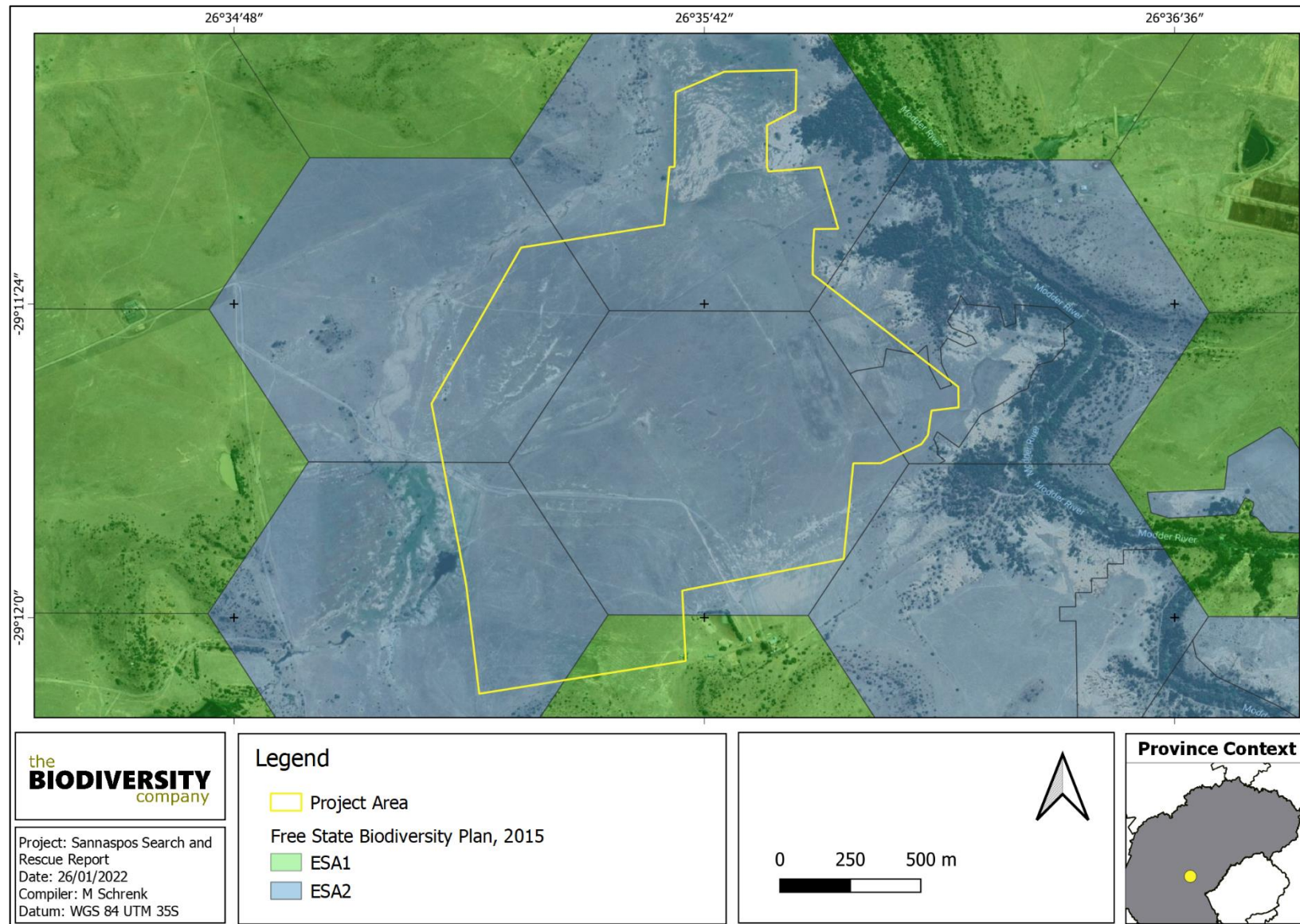


Figure 8-1 The project area superimposed on the Free State Biodiversity Plan (Collins, 2015)

info@thebiodiversitycompany.com

8.2 Ecological Desktop Assessments

8.2.1 Botanical Assessment

Based on the Plants of Southern Africa (BODATSA-POSA, 2019) database, over 400 plant species have the potential to occur within the project area and its surroundings. Of these plant species no species are listed as being SCC and 24 are listed as provincially protected plants (Table 8-2).

Table 8-2 Provincially protected plants potentially occurring in the project area

Family	Taxon	Author	SANBI	IUCN	Ecology
Amaryllidaceae	<i>Brunsvigia radulosa</i>	Herb.		LC	Indigenous
Amaryllidaceae	<i>Boophone disticha</i>	(L.f.) Herb.	LC	LC	Indigenous
Amaryllidaceae	<i>Haemanthus humilis</i> subsp. <i>humilis</i>	Jacq.	LC	LC	Indigenous; Endemic
Anacampserotaceae	<i>Anacampseros rufescens</i>	(Haw.) Sweet		LC	Indigenous
Araliaceae	<i>Cussonia paniculata</i> subsp. <i>sinuata</i>	Eckl. & Zeyh. (Reyneke & Kok) De Winter		LC	Indigenous
Asphodelaceae	<i>Aloe grandidentata</i>	Salm-Dyck		LC	Indigenous
Asphodelaceae	<i>Kniphofia ritualis</i>	Codd		LC	Indigenous
Asteraceae	<i>Helichrysum nudifolium</i> var. <i>pilosellum</i>	(L.) Less. (L.f.) Beentje		LC	Indigenous
Asteraceae	<i>Helichrysum rugulosum</i>	Less.	LC	LC	Indigenous
Asteraceae	<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	(L.) Less.	LC	LC	Indigenous
Asteraceae	<i>Helichrysum dregeanum</i>	Sond. & Harv.		LC	Indigenous
Asteraceae	<i>Helichrysum aureum</i> var. <i>monocephalum</i>	(Houtt.) Merr. (DC.) Hilliard		NE	Indigenous
Asteraceae	<i>Helichrysum melanacme</i>	DC.		LC	Indigenous
Asteraceae	<i>Helichrysum argyrosphaerum</i>	DC.		LC	Indigenous
Asteraceae	<i>Helichrysum zeyheri</i>	Less.		LC	Indigenous
Asteraceae	<i>Helichrysum chionosphaerum</i>	DC.	LC	LC	Indigenous
Asteraceae	<i>Helichrysum odoratissimum</i> var. <i>odoratissimum</i>	(L.) Sweet			Indigenous
Ericaceae	<i>Erica maesta</i> var. <i>maesta</i>	Bolus		LC	Indigenous
Euphorbiaceae	<i>Euphorbia rhombifolia</i>	Boiss.		LC	Indigenous
Euphorbiaceae	<i>Euphorbia pulvinata</i>	Marloth		LC	Indigenous
Euphorbiaceae	<i>Euphorbia clavarioides</i>	Boiss.		LC	Indigenous
Iridaceae	<i>Gladiolus permeabilis</i> subsp. <i>edulis</i>	D.Delaroche (Burch. ex Ker Gawl.) Oberm.		LC	Indigenous
Iridaceae	<i>Dierama robustum</i>	N.E.Br.		LC	Indigenous
Oleaceae	<i>Olea europaea</i> L. subsp. <i>africana</i>	(Mill.) P.S.Green	LC		Indigenous

Provincially protected plants are legally protected by the Free State Nature Conservation Ordinance 8 of 1969 and Red Listed plants (SCC) are those that are threatened to some degree with extinction and must be protected to ensure their survival in the wild.

8.2.2 Faunal Assessment

Largely based on the South African Bird Atlas Project Version 2 (SABAP2, 2017), IUCN Digital Distribution Maps (IUCN, 2016), and the Animal Demography Unit (ADU, 2020) databases, Table 8-3, Table 8-4, and Table 8-5 below each summarises the SCC faunal species that have the potential to occur in or around the project area. According to the databases, over 120 avifaunal species, over 60 mammal species, and over 60 herpetofauna (amphibian and reptile) species may occur within the project area. The desktop avifaunal assessment did not detect any potential avifaunal SCC within the project area.

Table 8-3 The potential SCC mammal species present within the project area

Species	Common Name	SANBI	IUCN	Likelihood of Occurrence
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT	Moderate
<i>Atelerix frontalis</i>	South Africa Hedgehog	NT	LC	Low
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	LC	NT	Low
<i>Felis nigripes</i>	Black-footed Cat	VU	VU	Moderate
<i>Hydrictis maculicollis</i>	Spotted-necked Otter	VU	NT	Low
<i>Leptailurus serval</i>	Serval	NT	LC	Moderate
<i>Mystromys albicaudatus</i>	White-tailed Rat	VU	EN	Low
<i>Panthera pardus</i>	Leopard	VU	VU	Low
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT	Low
<i>Poecilogale albinucha</i>	African Striped Weasel	NT	LC	Low
<i>Redunca fulvorufula</i>	Mountain Reedbuck	EN	LC	Low

Table 8-4 The potential SCC reptile species present within the project area

Species	Common Name	SANBI	IUCN	Likelihood of Occurrence
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	NT	LC	Low

Table 8-5 The potential SCC amphibian species present within the project area

Species	Common Name	SANBI	IUCN	Likelihood of Occurrence
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	NT	LC	Moderate

These numbers and records exclude any animals that typically only occur within nature reserves and private reserves.

It is noted that during the field survey completed as per the 2021 specialist studies (TBC, 2021), *Sagittarius serpentarius* (Secretarybird) carcass was recorded, and *Orycteropus afer* (Aardvark) was observed. Therefore, these species are likely to occur within the project area.

8.3 Field Survey

This section details the observations recorded during a two-day on-site field survey conducted to ground truth the floral and faunal SCC and protected species nature of the project area. These observations pertain to the current state of the area as of January 2022.

During the terrestrial survey the floral and faunal communities within the project area were assessed and photographs were captured, some of which are provided in this section of the report. The core purpose of the survey was to identify and locate all SCC and protected species occurring within the project area, which may be used in any permit application processes and to advise on conservation and/or relocation measures.

For ease of reading, the observations and discussions pertaining to both the floral species and faunal species recorded are separated below.

8.3.1 Flora

Four provincially protected plant species were recorded within the project area during the field survey, with a total of 101 individual specimens observed and recorded. The distribution of the protected floral species within the project area may be regarded as natural, with *Boophone disticha* being the most abundant and widespread species across the area. Table 8-6 below lists the recorded species. The number of specimens recorded (No. recorded) represents the minimum number of individuals present and there are likely to be more within the project area.

Table 8-6 The protected floral species, and proportions, observed within the project area

Species	Common Name	Author	SANBI	Ecology	No. recorded
<i>Ammocharis coranica</i>	Karoo Lily	(Ker Gawl.) Herb.	LC	Indigenous	25
<i>Boophone disticha</i>	Poison Bulb	(L.f.) Herb.	LC, decreasing	Indigenous	60
<i>Eucomis autumnalis</i>	Pineapple Lily	(Mill.) Chitt.	LC, decreasing	Indigenous	13
<i>Olea europaea subsp. africana</i>	African Olive	(Mill.) P.S.Green	LC	Indigenous	3

Several individual plants were observed immediately outside of the project area, but for the purposes of considering a project buffer they were included above. It is also noted that over 10 *Hypoxis hemerocallidea* (Star-flower) specimens were recorded, and although these species are not protected nor SCC, they were listed as 'Declining' in 2009 and face significant threat due to their overexploitation for harvesting and trading.

Ammocharis coranica (Figure 8-2) is listed as 'Least Concern' (LC) according to the red list of South African plants website (SANBI, 2016), but it is a protected plant as per Free State legislation. This indigenous species is found in all nine provinces, and it grows in a variety of soils, ranging from sand to clay types. It does however prefer sandy soils, open flat areas and full sun. This bulb species thrives in dry areas and can stay alive though long periods of drought. Refer to the map in Figure 8-4 below for the recorded locations of this species.

Boophone disticha (Figure 8-3) is currently listed as 'Least Concern' (LC) according to the red list of South African plants website (SANBI, 2016), however in 2009 it was listed as Declining, and its population trend is currently noted as Decreasing. It is a protected plant as per Free State legislation. Poison Bulb is widely distributed in all provinces of South Africa, and it occurs in dry grassland as well as on rocky slopes and occurs mainly in summer rainfall regions. Although the species is widespread and long-lived it faces significant habitat loss in KwaZulu-Natal and Gauteng, it is also traded extensively to the point that trade volumes suggest unsustainable harvesting. Refer to the map in Figure 8-5 below for the recorded locations of this species.



Figure 8-2 *Ammocharis coranica*, or Karroo Lily, found in 25 locations across the project area. A large pink flower sphere is typically displayed between Sept and March



Figure 8-3 *Boophone disticha*, or Poison Bulb, found in 60 locations across the project area. A large round headed pink/red flower sphere is usually displayed between July & Oct

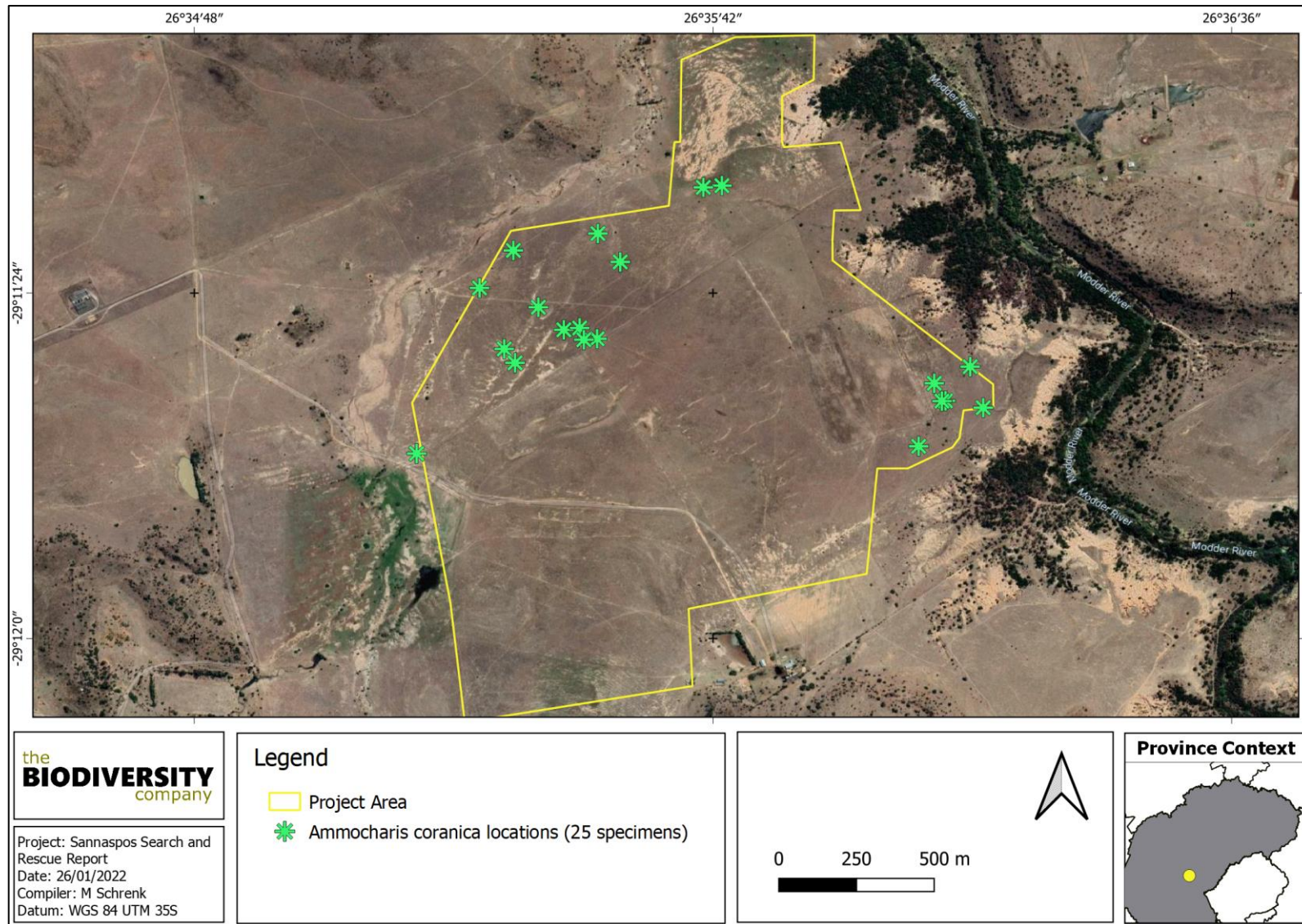


Figure 8-4 Map of the recorded *Ammocharis coranica* locations within the project area

info@thebiodiversitycompany.com

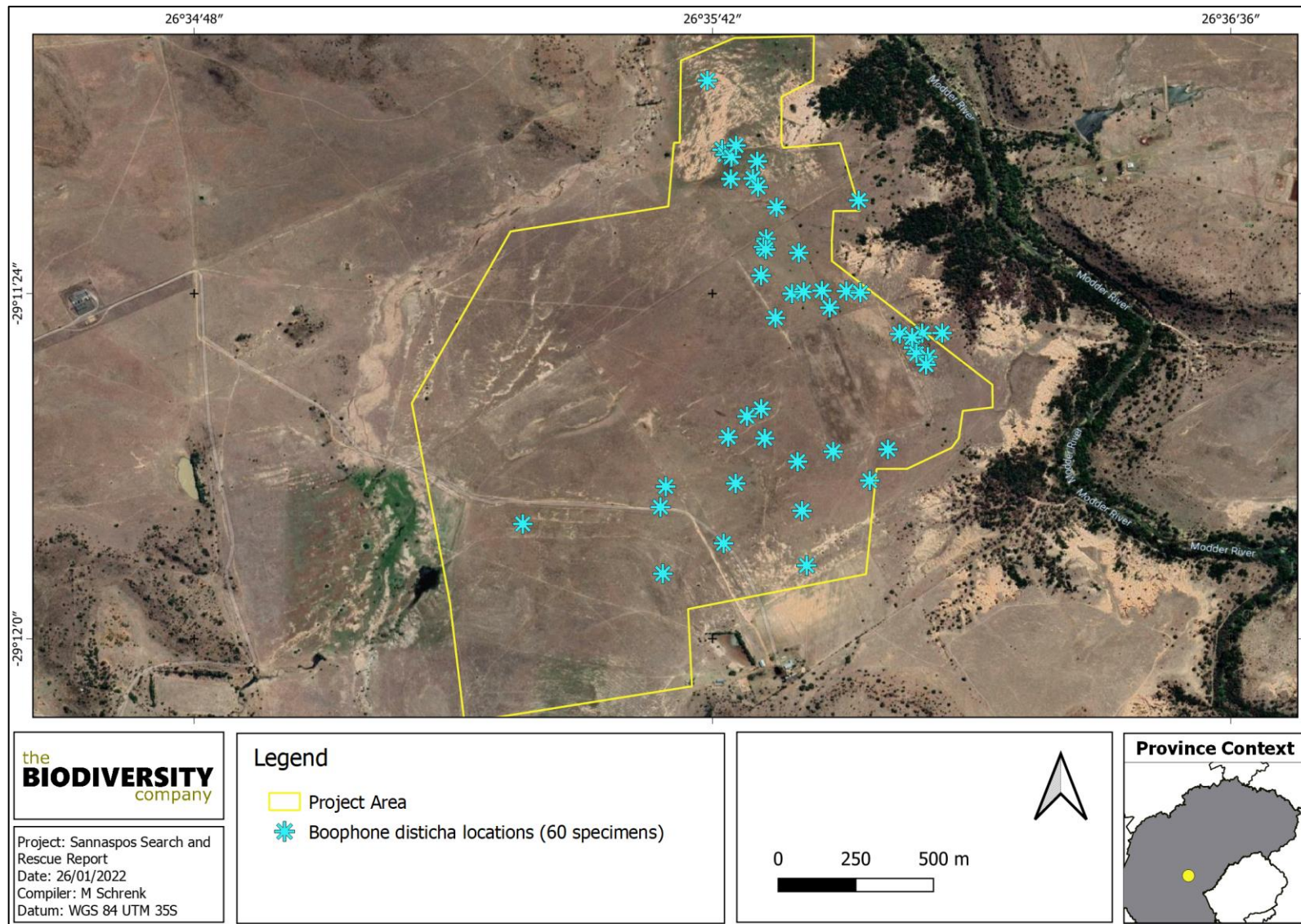


Figure 8-5 Map of the recorded *Boophone disticha* locations within the project area

info@thebiodiversitycompany.com

Eucomis autumnalis (Figure 8-6) is a bulbous plant that is currently listed as 'Least Concern' (LC) according to the red list of South African plants website (SANBI, 2016), however in 1999 it was listed as Vulnerable, and it was listed as Declining in 2009. Its population trend is currently noted as decreasing and it is a protected plant as per Free State legislation. The indigenous Pineapple Lily is distributed across all provinces of South Africa except the Western Cape, and it grows in open grassland and marshes. Although the species is widespread it faces significant threat due to large population declines as it is a highly popular medicinal plant. Refer to the map in Figure 8-9 below for the recorded locations of this species.

Olea europaea subsp. africana (Figure 8-7) is currently listed as 'Least Concern' (LC) according to the red list of South African plants website (SANBI, 2016), however it is a protected plant as per Free State legislation. The African Olive or Wild Olive tree is widely distributed across all nine provinces of South Africa, and it is found in a variety of habitats, often near water, e.g. On rocky hillsides, on stream banks and in woodland (where it can reach over 12 m). Refer to the map in Figure 8-9 below for the recorded locations of this species.

Hypoxis hemerocallidea (Figure 8-8) occurs in open grassland and woodland and is widespread in South Africa in the six eastern summer rainfall provinces. The species is not protected but does face significant threat in Gauteng due to urban sprawl and extensive commercial exploitation. The plants do not re-seed easily and so the demand for the tubers may cause the plants in the wild to decline.



Figure 8-6 *Eucomis autumnalis*, the Pineapple Lily, was found in only 13 locations



Figure 8-7 *Olea europaea subsp. africana*, the African Olive, was found in 3 locations, all along the project area boundary. The trees were between 4 and 10 m tall



Figure 8-8 *Hypoxis hemerocallidea*, the Star Flower, is not protected but does face serious threat due to over harvesting in some regions

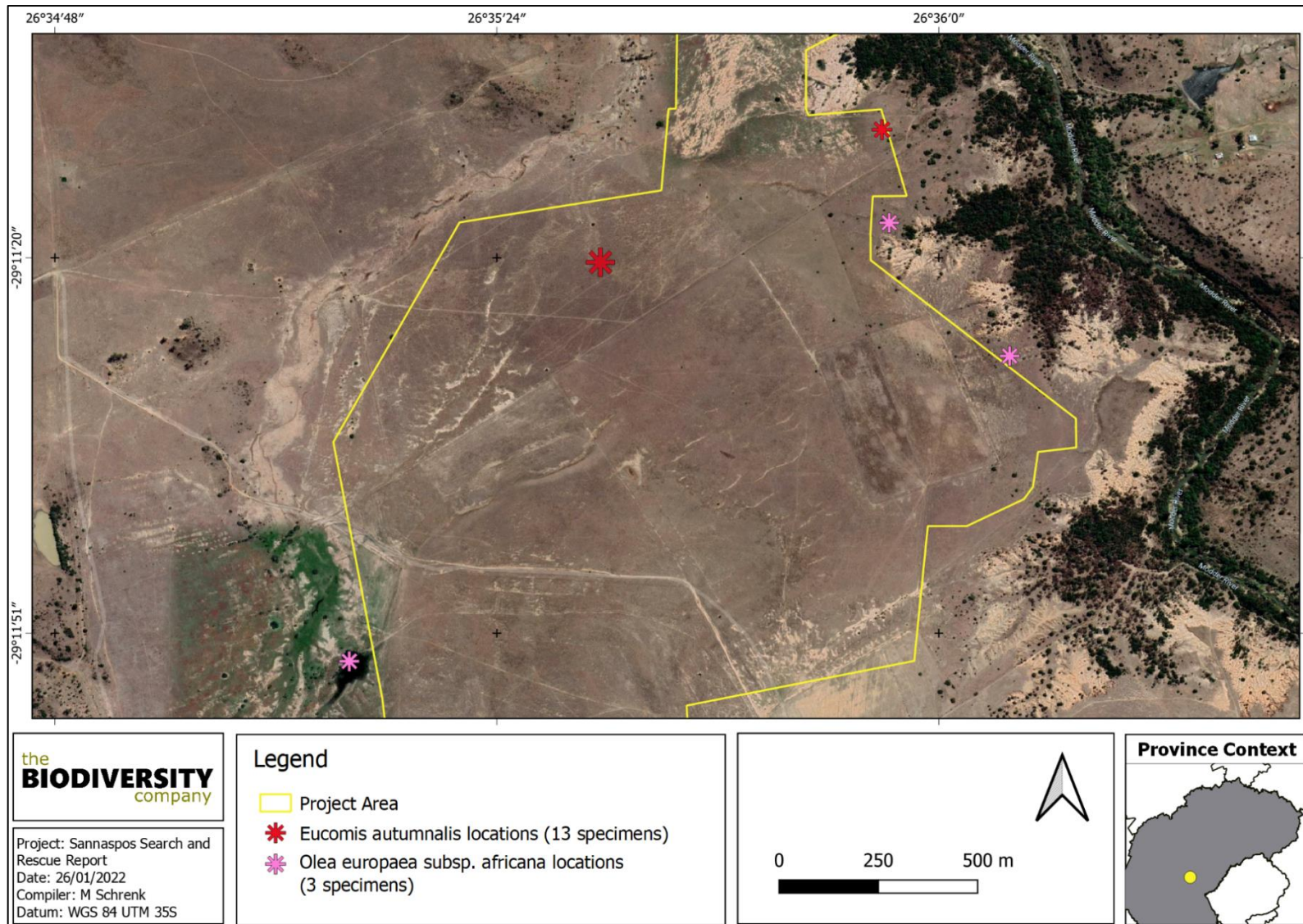


Figure 8-9 Map of the recorded *Eucomis autumnalis* and *Olea europaea* subsp. *africana* locations within the project area

info@thebiodiversitycompany.com

8.3.1.1 Alien Invasive Plants

The most dominant Alien Invasive Plant (AIP) recorded across the project area was the *Opuntia humifusa* (Low/Eastern/Large Flowered Prickly Pear), listed as a category 1b invasive as per the latest national NEM:BA legislation (Figure 8-10). The species was widespread, particularly occurring within the central portions of the project area where it was observed forming dominant large clusters. *Opuntia humifusa* competes with and replaces indigenous species. Dense infestations reduce the grazing potential and hence the carrying capacity of the land and the very spiny cladodes adhere to passing animals, and the barbed spines can cause severe injuries.

The Alien and Invasive Species Regulations were published in the Government Gazette No. 44182, 24th of February 2021 and the legislation calls for the removal and / or control of AIP species (Category 1 species). Category 1b species require 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.

Additional AIPs were observed, in accordance with the 2021 specialist report (TBC, 2021), and in line with this report as well as the national regulations it is required that the landowner immediately notify the competent authority in writing, and take steps to manage the species in compliance with:

- Section 75 of the NEM:BA;
- The relevant invasive species management programme developed for the property in terms of regulation 4; and
- Any directive issued in terms of section 73(3) of the NEMBA.



Figure 8-10 *Opuntia humifusa*, the most dominant category 1b AIP within the project area

8.3.2 Fauna

One SCC and protected avifaunal species, *Sagittarius serpentarius* (the Secretarybird), and one protected reptile species, *Stigmochelys pardalis* (the Leopard tortoise), was observed within the project area.

Secretary birds were observed flying over the project area on both days of the field survey (Figure 8-11), and a Secretarybird carcass was recorded during the field survey in 2021 (TBC, 2021). It is thus considered highly likely that these birds occur frequently within the project area and surrounds. During the first day of the survey two Secretary birds were observed circling the project area in an undulating pattern which is typical of their mating or courtship display (Figure 8-12). On the second day a young Secretarybird was observed passing through the area.

The bird uses a variety of habitats across its range in sub-Saharan Africa and it occurs in all nine provinces in South Africa, preferring open areas of grassland and savanna. They spend most of their time on the ground and are often recorded foraging in agricultural fields. Secretary birds face serious threat due to extensive habitat loss and from collisions with fences and powerlines, exposure to secondary pesticide poisoning is also a major concern.

The Secretarybird is an important avifaunal species in South Africa, the relevant conservation datasets and legislation that applies to this bird is listed below:

- Provincially protected by the Free State Nature Conservation Ordinance 8 of 1969, where it is listed as 'Protected Game';
- Nationally Red-listed as 'Vulnerable' based on the 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland;
- Globally Red-listed as 'Endangered' based on the 2020 assessment as per the IUCN Red List of Threatened Species; and
- Internationally protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) where it is listed under Appendix II.

It is noted that numerous additional provincially protected avifaunal species were observed within the project area, such as *Anas undulata* (the Yellow-billed duck) and *Ardea cinerea* (the Grey heron). The provincial legislation lists extensive species of wild birds as protected game, including commonly observed species such as lapwings and egrets. It is thus important to refer to the recommendations sections below which cover general mitigation measures that must be followed during site preparation and construction.



Figure 8-11 The Secretarybird was observed during both days of the field survey



Figure 8-12 A pair of Secretary birds performing a courtship display over the project area

info@thebiodiversitycompany.com

A single juvenile *Stigmochelys pardalis* (Leopard tortoise) was recorded foraging within the project area during the first day of the survey (Figure 8-13). The species is widespread, preferring savanna, nama-karoo, succulent karoo, fynbos, Albany thicket and dry highveld grassland habitats with sweet and palatable grasses. The tortoises are regarded as important seed dispersers. The main threats to this species include habitat degradation and exploitation for the pet trade.

As the Leopard tortoise faces mounting threat from over trading it is listed under Appendix II of CITES. It is also listed as 'Protected Game' according to the Free State Nature Conservation Ordinance 8 of 1969.



Figure 8-13 A single Leopard tortoise was observed foraging within the project area

9 Recommendations for the Translocation/Search and Rescue Protocol

It is important to note that *in-situ* conservation (conserving a species within its original range) is strongly preferred over search and rescue operations, which have associated risks and can result in the erosion of the inherent genetic diversity and characteristics of that species (SANBI, 2016). *In-situ* conservation must be guided by an Ecological Management Plan.

If *in-situ* conservation is impossible, due to the nature of the development and associated activities, then translocation may be seen as an important tool in biological conservation (Griffith et al, 1989). However, it is critical to ensure that the practices followed are conducted responsibly and by suitably qualified and permitted specialists.

The focus of the biodiversity translocation within the area of the proposed activity is to:

- Prevent the unnecessary destruction of select flora including those of conservation concern; and
- Prevent the loss of the faunal community including those of conservation concern.

Accordingly, the sections below provide the protocol through which the translocation process should occur, as pertaining to the flora and fauna within the project area.

For the purposes of this report, and according to the Threatened or Protected Species (TOPS) Regulations, the term “Translocation” refers to the process of capturing a specimen of a protected species or a Species of Conservation Concern at a particular location, the conveying or transporting of such specimen and the release of the specimen in another location.

9.1 Recommended Actions for the Translocation of Protected Flora

Four plants observed within the project area are listed as protected plants according to schedule 6 of the Free State Nature Conservation Ordinance 8 of 1969, see section 8.3.1 above. Section 30 of the ordinance declares that: “Except under authority of a permit which may be issued by the Administrator, no person shall pick any protected plant: Provided that - the unavoidable damaging or destruction of a protected plant in the course of any agricultural or development activity which is being lawfully carried out on land shall not be prohibited.” The definition of ‘pick’ is given as: “Gather, cut, chop off, uproot, damage or destroy”.

Due to their protected status and past listing as ‘declining’ according to the national red-list, as many species of *Boophone disticha* and *Eucomis autumnalis* should be responsibly collected and redistributed as possible.

9.1.1 Flora Removal for Translocation

Removal of flora must occur prior to the change in land-use from current conditions to cleared land within the demarcated zone/project area. The removal of flora is likely to be a systematic process as earthworks takes place. The following are the recommended actions that need to be implemented in order to achieve the desired effect of the removal process:

- Appoint an experienced horticulturalist or landscaping contractor to undertake the rescue operation, manage the rescued plant material and operate the nursery;
- The establishment of a nursery will be essential in order to safely keep/store rescued plants that may be used for various purposes: either for rehabilitation of the site post-construction, or for a contribution to the public for education (by providing native plants for public gardens and nature centres), or until a decision can be made with regards to the removed plants (in principle rescued plants should be utilized for public benefit, which include replanting in rehabilitated areas, providing stock for propagation and providing plant material for a scientific project):
 - Nursery facilities should be established where additional natural habitat will not be affected and where there is access to water;
 - The nursery must be fenced off, demarcated and inaccessible to livestock and natural herbivores to avoid the loss of species; and

- The nursery will house removed plants and should be located in an area with easy access for transport and logistical purposes.
- If large portions of natural land surrounding the project area are guaranteed to remain undeveloped, removed plants may be transplanted within these areas subject to landowner permission and guidance from the appointed horticulturalist;
- Three of the protected plants, *Ammocharis coranica*, *Boophone disticha*, and *Eucomis autumnalis* are bulbous and thus considered relatively easy to remove and propagate. Collection and transplantation of these plants must involve the following:
 - Removal of the bulb and intact root system as far as possible (digging as deep below the plant as possible), and then kept in moistened clear plastic bags until they can be replanted (this time period should be as short as possible); and
 - Bulbs should be planted with their tops at or just below ground level.
- Some plants may be difficult and cumbersome to transplant, such as the large *Olea europaea subsp. africana* trees, and the most practical measure would be to collect seeds and avoid the trees as far as possible. Since all three observed specimens occurred just outside of the project area, it should be easy to achieve this. Collected seeds should be germinated, and stored seeds must be protected from boring insects;
- All plants relocated must be counted and the numbers kept, for monitoring purposes and relocation success estimates;
- All assessment area clearing should be monitored as it proceeds to ensure that as many SSC and protected plants are rescued as possible;
- Collecting of plants should be strictly prohibited unless specifically required and under the supervision of the Environmental Control Officer (ECO), horticulturalist, or person in charge:
 - Signage should indicate the prohibition of the collecting of indigenous species.
- Habitats that are currently disturbed/transformed and that are outside of the development zone are potential sites for rehabilitation where a positive biodiversity outcome can be locally achieved;
- Experienced horticulturalists and/or specialist consultants should be used to advise on the final location of all removed plants. Plants must not be planted as ornamentals within private gardens as this limits their ability to effectively disperse seeds and exposes them to risks from domestic pets and disease from exotic garden flora. A preferable option would be to translocate all flora to the nearest protected area:
 - The Rustfontein Nature Reserve is 7 km south of the project area and likely to contain ideal soil conditions for all locally protected flora.
- Any SCC or protected plants close to the development zone that will remain in place may not be damaged, disturbed, destroyed or removed. These plants should be marked and the areas cordoned off as no-go areas; and
- All *Vachellia* tree species (thorn trees) near to the project area must be left undisturbed, due to their potential usage as nesting sites for the local Secretary birds.

9.1.2 Monitoring

Post-search and rescue monitoring of plants within the nursery should be undertaken on a monthly basis until a decision has been made regarding the final use/location of the plants. Post-relocation monitoring of plants that have been relocated to a different area or habitat during the search and rescue process should occur on a quarterly basis, so as to evaluate whether the intervention was successful or not. Post-relocation monitoring should take place for at least two years after the process has been completed.

A detailed record/report, including photographs, indicating the success of the plant rescue operation (including the condition of plants in the nursery) must be kept.

9.1.3 Permitting

The areas that are planned to be directly impacted by the proposed activity need to be cleared of any SSC and protected plants. Permits are generally required by law before any SSC or protected plants are removed, cleared, or transplanted. Permits to collect, relocate, and propagate plant material as well as to collect seed or cuttings for the proposed activity must be obtained from the relevant authorities. This should be an individual permit application that covers all components of the project.

The generally accepted permit application includes a list of the plants that fall under each piece of legislation; some with GPS coordinates. A permit application must then be completed, and the relevant authority may require a site visit before issuing a permit.

Rescuing plants listed as protected under national or provincial legislation is subject to requirements that include the collection/use of whole plants, seedlings/saplings, and plant parts. A permit may be required to possess, transport, or propagate such species.

In this instance the relevant authority to be contacted is the Free State Department of Economic, Small Business Development, Tourism, and Environmental Affairs (DESTEA). The appropriate website is: <http://www.destea.gov.za/>. Additional contact options are provided in section 9.2.3 below.

9.2 Recommended Actions for the Translocation of Protected and Important Fauna

The most sensitive species observed within the project area was *Sagittarius serpentarius* (Secretarybird). The species is listed as 'Vulnerable' nationally and 'Endangered' internationally. This means that the bird faces a very high risk of extinction in the wild (IUCN, 2012) and it is recommended that there be no further loss of habitat, any nesting site observed would constitute critical habitat and must not be disturbed.

The Secretarybird is also listed and protected under appendix II according to international CITES legislation, as is the observed *Stigmochelys pardalis* (Leopard tortoise). Both species, as well as numerous wild bird species, are listed as protected game under schedule 1 of the Free State Nature Conservation Ordinance 8 of 1969. According to section 2 (3) of the ordinance: "No person shall hunt protected game, except under authority of a permit which may be issued by the Administrator", where the term 'hunt' is defined as: "In any manner whatsoever to kill or capture or to attempt to kill or capture; to shoot at; to search for, follow or lie in wait with intent to kill, shoot at or capture; or wilfully to disturb."

Translocation of fauna must occur prior to the change in land-use from current conditions to conditions to the respective uses within the demarcated zone/project area. Nevertheless, translocation is likely to be a continuous process and during the earthworks and/or planting phase, any vertebrate species (birds, mammals, and herpetofauna) found, that do not move out of the project area on their own, must be translocated. The following are the recommended actions that need to be implemented to achieve the desired effect of the translocation process.

9.2.1 Important Actions and Considerations

- Any avifaunal species observed have the advantage of being able to easily move off in the case of clearing activities, provided that no nests are found. No Secretarybird nests were observed within the project area, however, should any nests be observed anywhere within the project area or region it is critical that these remain undisturbed, and their location reported to melissa.whitecross@birdlife.org.za. Secretary birds typically nest in large flat stick structures on the tops of flat thorn trees or dense bushes, between 3 and 6 m above the ground (Figure 9-1):
 - All thorn trees surrounding the project area should remain undisturbed; and
 - Due to the sensitive nature of the Secretarybird species and the likelihood of nests occurring within the project region, it is recommended that a specialist pre-construction Secretarybird nest survey be conducted. This survey should cover the project area as well as all areas within a 5 km radius of the project area.
- The protected Leopard tortoise was observed within the project area and these species are at high risk due to their illegal exploitation in the pet trade. It is thus recommended that the relevant permit be obtained and any observed tortoises within the project area or surrounds be relocated to the nearest protected area (the Rustfontein Nature Reserve is 7 km south of the project area):
 - As these species are small and move slowly, they are at high risk of being illegally collected or accidentally killed during construction activities, they can also move in and out of the project area over long periods of time as the project commences;
 - Tortoise species that are to be relocated can be captured easily by hand and placed in a large and secure pet carry box. The box must be lined with a soft natural medium (such as hay) and water is to be provided; and
 - Any captured species must not be kept in captivity for extended periods of time due to risk of stress, dehydration, and malnutrition. The time between capture and release should not be more than 48 hours, subject to permit conditions.
- No *Orycteropus afer* (Aardvark) were observed, and neither were their burrows. The species is protected by provincial legislation and as such any observed species or burrows (Figure 9-2) must not be disturbed without the relevant permit:
 - In order to mitigate risk of disturbance or accidental killing, all site clearing should be done in a progressive manner, from one section of the project area to the other and over a period of several days, allowing any burrowing mammals such as Aardvark sufficient time to move off; and

- Should any Aardvark be observed that do not move out of the project area on their own, it is important to contact an experienced relocation or capture expert in order to consult on the capture, holding, and release process.



Figure 9-1 Typical Secretarybird nests (© Awie Badenhorst)



Figure 9-2 Typical Aardvark burrow (© Louise Joubert)

9.2.2 General Considerations and Mitigation Actions

- All clearing should be done in a progressive manner, starting at the most disturbed areas and moving to the more natural areas;
- Should any avifaunal, mammal, reptile, or amphibian species be observed within the project area that does not move off on its own, activities should temporarily cease and an appropriate specialist should be consulted in order to advise on the most suitable course of action;
- The success of faunal translocation depends on the number of individuals and the habitat quality of the area that they are released into (Germano & Bishop, 2009). Poor habitat quality can ultimately cause a translocation initiative to fail, as individuals migrate away from the release site, leading to deaths. Furthermore, the distance from the original habitat also determines the success of translocation (Villaseñor et al., 2013);
- It is recommended that the monitoring of select taxa be considered to ascertain the success of the translocation (Pickett et al., 2013). This should be conducted at least a month after the specimens have been released in order to minimise stress. Any relocated Leopard tortoises should be monitored for at least 6 months.
- It is recommended that no clearing be undertaken during the Spring-Summer season as this is the breeding season for a majority of the local fauna;
- Any use of illegal trapping techniques or poisons must be strictly prohibited;
- The process of translocation is a very stressful process for the animal and even short holding periods can cause acute stress responses, which may exist for up to a month (Germano & Bishop, 2009). Therefore, any handling, transport and time to release should be as minimised as much as possible;
- Any open trenches that are left open for more than two hours should be covered with a suitable hard material or have at least one end that is sloped/tapered, in order to allow animals that fall in to escape. If this is not possible, then branches should be placed inside the trenches so that small animals may climb out of the trenches;
- Prior and during vegetation clearance any larger fauna species present should be given the opportunity to move away from the construction machinery safely;
- All staff and contractors need to be consulted on a day-to-day basis regarding observations of fauna or faunal nests/burrows, or a format needs to be implemented where staff can submit observations as they occur, in case these observations may assist in prevention of faunal casualties;
- Waste management must be a priority and all waste must be collected, stored adequately, and disposed of at a suitable facility. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests from entering the site. Under no circumstances may domestic waste be burned or stored in an open pit on site;

- All staff should be educated about the sensitivity of local faunal species and measures should be put in place to responsibly deal with any species that are encountered during the construction process;
- Construction activities and vehicles could cause spillages of lubricants, fuels and waste material, potentially negatively affecting the functioning of the ecosystem. All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the project area;
- Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided and an emergency spill kit must always be available on site;
- Liquid must be stored in leak-proof, sealable containers or packaging;
- No storage of vehicles or equipment must be allowed outside of the designated area;
- All activities and access must make use of the existing roads;
- Drip trays, or any form of oil absorbent material, must be placed underneath vehicles/machinery and equipment when not in use;
- No servicing of equipment should take place on site;
- Leaking equipment shall be repaired immediately or be removed from site to facilitate repair;
- Relevant health and safety action plans must be in place on site, and there must be training for contactors and employees in the management of sewage spills, leaks and other impacts that may occur to the surrounding environment; and
- A specialist Contractor shall be used for the bioremediation of contaminated soil where the required remediation material and expertise is not available on site.

9.2.3 Permitting

- Any activity involving the translocation of protected fauna (such as the Leopard tortoise and Aardvark) must be conducted only after the relevant permit is obtained from the relevant authority;
- In this instance the relevant authority to be contacted is the Free State Department of Economic, Small Business Development, Tourism, and Environmental Affairs (DESTEA). The appropriate website is: <http://www.destea.gov.za/>; and
- Alternatively, this 2015 document developed by SANBI lists all relevant national and provincial contacts for permitting authorities: [CONTACT DETAILS FOR PERMITTING ISSUING AUTHORITIES – updated July 2015](#). This website by the Professional Hunters' Association of South Africa (PHASA) also provides a list of national and provincial contacts for permit queries: <https://phasa.co.za/nature-conservation-contact-list/>.

10 Conclusion

Upon completion of the field survey the specialist identified four protected flora species and two protected fauna species within the project area. One of the observed fauna species, *Sagittarius serpentarius* (Secretarybird), is also considered an SCC as it is nationally and internationally red-listed as 'Threatened'. Both fauna species are also listed under appendix II of the CITES convention and are thus afforded international protection.

All six of these species must be afforded special consideration as per the recommendations provided, particularly due to the fact that the development will have an impact on the biodiversity within and surrounding the project area. This includes the fact that a specialist nest survey should be conducted for the sensitive Secretarybird species, as a mating pair was observed within the project area.

All location-based data that is shared as part of this report must be considered sensitive and confidential due to the nature and statuses of the species concerned. Spatial data files containing species location data may be provided upon request, subject to strict privacy policies.

11 References

ADU (Animal Demography Unit). (2020). Virtual Museum. <https://vmus.adu.org.za/> (Accessed: Dec 2021).

Alexander, G. & Marais, J. (2007). A guide to the Reptiles of Southern Africa. Struik, Cape Town.

Alexander, G.J., Tolley, K., Bates, M.F. & Mouton, P.L.F.N. 2018. *Smaug giganteus*. The IUCN Red List of Threatened Species 2018: e.T5336A115650269. <https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T5336A115650269.en>. Downloaded on 10 November 2021.

Awuah, A. 2018. NBA 2018 Rivers and NBA 2018 National Wetland Map 5. South African National Biodiversity Institute (SANBI), Newlands, Cape Town.

Barbour, M.T., Gerritsen, J. & White, J.S. 1996. Development of a stream condition index (SCI) for Florida. Prepared for Florida Department of Environmental Protection: Tallahassee, Florida.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J & de Villiers, M.S. (Eds). (2014). Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African Biodiversity Institute, Pretoria.

BGIS (Biodiversity GIS). (2018). <http://bgis.sanbi.org/> (Accessed: Jan 2022).

Birdlife South Africa. (2015). Checklist of Birds - List of Threatened Species. <https://www.birdlife.org.za/publications> (Accessed: Jan 2021).

BirdLife South Africa. (2017). Important Bird Areas Factsheet. <http://www.birdlife.org> (Accessed: Jan 2021).

BODATSA-POSA. (2019). South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]. <http://newposa.sanbi.org/>. (Accessed: Dec 2021).

Collins, N.B. 2015. Free State Province Biodiversity Plan: CBA map. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

Branch, W.R. (1998). Field Guide to Snakes and Other Reptiles of Southern Africa. Struik, Cape Town.

Chittenden, H., Davies, G., and Weiersbye, I. (2016). Roberts Bird Guide Second Edition. The John Voelcker Bird Book Fund, Cape Town.

CITES. UNEP-WCMC (Comps.) 2021. Checklist of CITES species. CITES Secretariat, Geneva, Switzerland and UNEP-WCMC, Cambridge, United Kingdom. Accessed: Jan 2022.

Dallas, H.F. 2007. River Health Programme: South African Scoring System (SASS) Data Interpretation Guidelines. Report produced for the Department of Water Affairs and Forestry (Resource Quality Services) and the Institute of Natural Resources.

Department of Environment, Forestry and Fisheries (DEFF), 2021. Screening Report for an Environmental Authorization or for a Part Two Amendment of an Environmental Authorisation as Required by the 2014 EIA Regulations – Proposed Site Environmental Sensitivity.

Department of Environment, Forestry and Fisheries (DEFF-2), 2021. Notice of the list of protected tree species under the National Forests Act, 1998 (Act no. 84 of 1998). National Gazettes, No. 44204 of 01 March 2021.

Department of Environmental Affairs (DEA) (2016) National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.

Department of Forestry, Fisheries and the Environment (DFFE), 2021. South Africa Protected Areas Database (SAPAD_OR_2021_Q3). Published 2021/12/17. Available at: <http://egis.environment.gov.za>

Department of Forestry, Fisheries and the Environment (DFFE-2), 2021. South Africa Conservation Areas Database (SACAD_OR_2021_Q3). Published 2021/12/17. Available at: <http://egis.environment.gov.za>

Department of Water and Sanitation (DWS). 2021. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Draft. Compiled by RQS-RDM.

Del Hoyo, J., Collar, N.J., Christie, D.A., Elliott, A., Fishpool, L.D.C., Boesman, P. & Kirwan, G.M. (1996). HBW and BirdLife International Illustrated Checklist of the Birds of the World. Volume 2: Passerines. Lynx Editions and BirdLife International, Barcelona, Spain and Cambridge, UK.

Du Preez, L. & Carruthers, V. (2009) A Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town.

Eskom. (2015). Taylor, M.R., Peacock, F. & Wanless, R.M. (Eds). The 2015 Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

EWT. (2016). Mammal Red List 2016. www.ewt.org.za (Accessed: Dec Jan 2021).

EWT (Endangered Wildlife Trust). (2017). Threatened Amphibian Programme. (2015). The Southern African Frog Atlas Project <https://www.ewt.org.za/TAP/reference.html> (SAFAP, now FrogMAP). <http://vmus.adu.org.za> (Accessed: Dec Jan 2021).

Eyssell, A. (2017). Vegetation Assessment and Management Input Report for G&W Base and Industrial Minerals, Koppies Bentonite Mine. Dimela Eco Consulting, Pretoria.

Fish, L., Mashau, A.C., Moeaha, M.J. & Nembudani, M.T. (2015). Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions. SANBI, Pretoria.

FrogMap. (2017). The Southern African Frog Atlas Project (SAFAP, now FrogMAP). <http://vmus.adu.org.za> (Accessed: Jan 2021).

GDARD (2014): Technical Report for the Gauteng Conservation Plan (Gauteng C-Plan v3.3). Gauteng Department of Agriculture and Rural Development: Nature Conservation Directorate. 60 pages.

- Germano, J. M., & Bishop, P. J. 2009. Suitability of amphibians and reptiles for translocation. *Conservation Biology*, 23: 7–15.
- Goff, F., Dawson, G., & Rochow, J. (1982). Site examination for threatened and endangered plant species. *Environmental Management*, 6(4), 307-316.
- Griffith, B., Scott, J. M., Carpenter, J. W., & Reed, C. 1989. Translocation as a species conservation tool: Status and strategy. *Science*, 245: 477–480.
- Griffiths, C., Day, J. & Picker, M. (2016). *Freshwater Life: A Field Guide to the Plants and Animals of Southern Africa*. Struik Nature, Cape Town.
- Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (Eds). (2005). *Roberts – Birds of Southern Africa*, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.
- IUCN. (2012). *IUCN Red List Categories and Criteria: Version 3.1. Second edition*. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32pp.
- IUCN 2016. *The IUCN Red List of Threatened Species. Version 2016-1*. <http://www.iucnredlist.org>. Downloaded on <January 2022>.
- International Union for Conservation of Nature (IUCN) 2021. *The IUCN Red List of Threatened Species. Version 2021-3*. <https://www.iucnredlist.org>. Accessed Dec 2021
- Johnson, S. & Bytebier, B. (2015). *Orchids of South Africa: A Field Guide*. Struik publishers, Cape Town.
- Kasl, B. (2017). *Assessment of faunal species richness, with focus on vertebrate species, within the mineral boundary of koppies bentonite mine near koppies, free state province, for G&W Base Minerals (Pty) Ltd. Commissioned by Dimela Eco Consulting, Pretoria.*
- Lötter, M.C. & Le Maitre, D. (2021) *Fine-scale delineation of Strategic Water Source Areas for surface water in South Africa using Empirical Bayesian Kriging Regression Prediction: Technical report*. Prepared for the South African National Biodiversity Institute (SANBI), Pretoria. 33 pages.
- Macfarlane., D and Bredin., I. 2017. *Buffer zone Guidelines for Wetlands, River and Estuaries Part 1: Technical Manual*
- Macfarlane, D.M., Dickens J., Von Hase F. 2009. *Development of a methodology to determine the appropriate buffer zone width and type for developments associated with wetlands, watercourses and estuaries. Final literature review. Report produced for the Department of Water Affairs and Forestry. Submitted to: Water Research Commission. INR Report No:400/09*
- MammalMap. (2017). <http://mammalmap.adu.org.za/> (Accessed: Dec 2021).
- Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. *Important Bird and Biodiversity Areas of South Africa*. Johannesburg: BirdLife South Africa.
- Measey, G.J. (2011). *Ensuring a Future for South Africa's Frogs: A Strategy for Conservation Research*. South African National Biodiversity Institute, Pretoria.

Minter, L., Burger, M., Harrison, J.A. & Kloepfer, D. (2004). Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute Avian Demography Unit, Washington; Cape Town.

Monadjem, A., Taylor, P.J., Cotterill, F.D.P. & Schoeman, C. (2010). Bats of southern and central Africa: a biogeographic and taxonomic synthesis. Wits University Press, Johannesburg.

Mucina, L. & Rutherford, M.C. (Eds.). (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria, South African.

National Environmental Screening Tool, 2021. Available from Department of Environmental Affairs website:

<https://screening.environment.gov.za/screeningtool/index.html#/pages/welcome>

NBA. (2018). Terrestrial Ecosystem Threat Status 2018. <http://bgis.sanbi.org/>. (Accessed: Jan 2021).

Nel, J. L., Driver, A., Strydom, W. F., Maherry, A. M., Petersen, C. P., Hill, L., Roux, D. J., Nienaber, S., van Deventer, H., Swartz, E. R. & Smith-Adao, L. B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, WRC Report No. TT 500/11. Water Research Commission, Pretoria.

NPAES. (2011). National Protected Areas Expansion Strategy. www.environment.gov.za (Accessed: Jan 2021).

Pickett, E. J., Stockwell, M. P., Bower, D. S., Garnham, J. I., Pollard, C. J., Clulow, J., & Mahony, M. J. 2013. Achieving no net loss in habitat offset of a threatened frog required high offset ratio and intensive monitoring. *Biological Conservation*, 157: 156–162.

Pooley, E. (1998). A Field Guide to Wild Flowers: KwaZulu-Natal and Eastern Region. The Flora Publications Trust; ABC Bookshop, Durban.

Raimondo, Domitilla & von Staden, Lize & Foden, Wendy & Victor, Janine & Helme, N.A. & Turner, R.C. & Kamundi, D.A. & Manyama, P.A.. (2009). Red list of South African plants 2009. *Strelitzia*. 25.

SABAP2 (Bird Atlas Project). (2017). <http://vmus.adu.org.za/>. (Accessed: Dec 2021).

SACAD (South Africa Conservation Areas Database) and SADAP (South Africa Protected Areas Database) (2019). <http://egis.environment.gov.za>

SANBI. 2013. Grasslands Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and D. McCulloch. South African National Biodiversity Institute, Pretoria. 139 pages.

SANBI. (2016). Red List of South African Plants version 2020. South African National Biodiversity Institute. <http://redlist.sanbi.org> (Accessed: Jan 2022).

SANBI. (2017). Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning. Driver, A., Holness, S. & Daniels, F. (Eds). 1st Edition. South African National Biodiversity Institute, Pretoria.

South African National Biodiversity Institute (SANBI). 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria. pp. 1–214.

South African National Biodiversity Institute (SANBI). 2022. South Africa's official site for Species Information and National Red Lists. <http://speciesstatus.sanbi.org/> (Accessed: Jan 2022).

Skinner, J.D. & Chimimba, C.T. (2005). The Mammals of the Southern African Subregion (New Edition). Cambridge University Press, South Africa.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). (2019). South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria.

Smith, G.F., Chesselet, P., van Jaarsveld, E.J., Hartmann, H., Hammer, S., van Wyk, B., Burgoyne, P., Klak, C. & Kurzweil, H. (1998). Mesembs of the world. Briza Publishers, Pretoria.

Strohbach, M. (2012). EIA Report: Ecology, Proposed Sannaspos 75 MW Solar Energy Facility, Free State. Savannah Environmental (Pty) Ltd, Sandton.

Taylor, M.R., Peacock, F. & Wanless, R.M. (Eds). (2015). The 2015 Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

The Biodiversity Company (TBC). (2021). The biodiversity and wetland assessments for the proposed Sannaspos solar PV development. The Biodiversity Company, Johannesburg.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. 2018. South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 October 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number <http://hdl.handle.net/20.500.12143/5847>.

Van Oudtshoorn, F. (2004). Guide to the Grasses of Southern Africa. Second Edition. Briza Publikasies, Pretoria.

Van Wyk, B. & Van Wyk, P. (1997). Field guide to trees of Southern Africa. Struik Publishers, Cape Town.

Van Wyk, B. & Malan, S. (1997). Field Guide to the Wild Flowers of the Highveld: Also Useful in Adjacent Grassland and Bushveld, Struik Publishers, Cape Town.

Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. (2013). Medicinal Plants of South Africa. Briza Publications, Pretoria.

Villaseñor, N. R., Escobar, M. A. H., & Estades, C. F. 2013. There is no place like home: High homing rate and increased mortality after translocation of a small mammal. European Journal of Wildlife Research, 59: 749–760

12 Appendices

Appendix A Specialist declarations

DECLARATION

I, Michael Schrenk, 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.



Michael Schrenk

Environmental Consultant

The Biodiversity Company

January 2022

DECLARATION

I, Andrew Husted, 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.



Andrew Husted

Terrestrial Ecologist

The Biodiversity Company

January 2022

Appendix B Specialist CVs

Michael Schrenk

B.Sc Civil and Environmental Engineering

Cell: +27 76 529 2652

Email: mike@thebiodiversitycompany.com

Identity Number: 9204165023085

Date of birth: 16 April 1992



Profile Summary

Extensive project management experience

Experience with green engineering, ecological evaluation, terrestrial biodiversity, and conservation

Expertise include terrestrial biodiversity assessment and ecological restoration

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services
Infrastructure Development, Farming, Land contamination, Sustainability and Conservation

Key Experience

- Environmental Impact Assessments (EIA)
- Environmental Management Programmes (EMP)
- Ecological assessments
- Rehabilitation Plans and Monitoring
- Veld management and Veld condition
- Terrestrial biodiversity management

Country Experience

South Africa

Nationality

South African

Languages

English – Proficient

Qualifications

- BSc (University of the Witwatersrand) – Civil and environmental engineering
- Cand Sci Nat (Pending)

SELECTED PROJECT EXPERIENCE

Project Name: Olivedale Retirement Village Erf1250 rehabilitation

Personal position / role on project: Project manager and assistant terrestrial ecologist

Location: Olivedale, Gauteng, South Africa

Main project features: Assist in the securing of environmental authorisation and general authorisation for the rehabilitation of Erf 1250. Assist/Manage the terrestrial and ecological assessment and rehabilitation process.

Project Name: Golden Harvest Park ecological assessments

Personal position / role on project: Assistant terrestrial ecologist and engineer

Location: Hunters Hill AH, Gauteng, South Africa

Main project features: To plan and conduct various assessments with regards to the management and rehabilitation of the natural areas within the Golden Harvest Park.

Project Name: Wild Serve terrestrial biodiversity management plan

Personal position / role on project: Project manager and terrestrial ecologist

Location: North Riding AH, Gauteng, South Africa

Main project features: Develop and implement a provincial terrestrial biodiversity management plan for Gauteng, with a focus on the habitat requirements for urban and fringe dwelling fauna.

OVERVIEW

An overview of the specialist technical expertise include the following:

- Project management
- Ecological assessments and management plans
- Terrestrial biodiversity management
- Rehabilitation plans
- Low-level green engineering design and construct

TRAINING

Some of the more pertinent training undergone includes the following:

- Tree Identification and Analysis; University of the Witwatersrand
- Ecological management and Assessment; GDARD and Department of Environmental Affairs

EMPLOYMENT EXPERIENCE

Project manager at Wild Serve NPC (March 2016 – January 2021)

Managed various terrestrial biodiversity and ecological related projects throughout Gauteng, involving ecological restoration, biodiversity management and conservation, education, and community engagement.

Project Lead for the National Geographic Society funded project: "Creating Innovative and Sustainable Environmental Solutions for Modern, Urban-based Communities" (March 2019 – April 2020)

Manage a team to conduct an urban sustainability project involving the youth.

Project manager and engineer for Breed Life Farms (June 2018 – June 2019)

Lead the planning, design, and construction of urban agriculture related solutions.

ACADEMIC QUALIFICATIONS

University of the Witwatersrand, Johannesburg (2016): Bachelor of Science (BSc) in Civil and Environmental Engineering (with honours).

Andrew Husted

M.Sc Aquatic Health (*Pr Sci Nat*)

Cell: +27 81 319 1225

Email: andrew@thebiodiversitycompany.com

Identity Number: 7904195054081

Date of birth: 19 April 1979



Profile Summary

Working experience throughout South Africa, West and Central Africa and also Armenia.

Specialist experience in exploration, mining, engineering, hydropower, private sector and renewable energy.

Experience with project management for national and international multi-disciplinary projects.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise include Instream Flow and Ecological Water Requirements, Freshwater Ecology, Terrestrial Ecology and also Ecosystem Services.

Areas of Interest

Sustainability and Conservation.

Instream Flow and Ecological Water Requirements.

Publication of scientific journals and articles.

Key Experience

- Familiar with World Bank, Equator Principles and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Fish population structure assessments
- The use of macroinvertebrates to determine water quality
- Aquatic Ecological Assessments
- Aquaculture

Country Experience

Botswana, Cameroon
Democratic Republic of Congo
Ghana, Ivory Coast, Lesotho
Liberia, Mali, Mozambique
Nigeria, Republic of Armenia,
Senegal, Sierra Leone, South Africa
Tanzania

Nationality

South African

Languages

English – Proficient

Afrikaans – Conversational

German - Basic

Qualifications

- MSc (University of Johannesburg) – Aquatic Health.
- BSc Honours (Rand Afrikaans University) – Aquatic Health
- BSc Natural Science
- Pr Sci Nat (400213/11)
- Certificate of Competence: Mondli Wetland Assessments
- Certificate of Competence: Wetland WET-Management
- SASS 5 (Expired) – Department of Water Affairs and Forestry for the River Health Programme
- EcoStatus application for rivers and streams

CURRICULUM VITAE: Andrew Husted

EMPLOYMENT EXPERIENCE

The Biodiversity Company (January 2015 – Present)

Director / Ecologist.

Digby Wells Environmental (August 2008 – December 2014)

Freshwater & Terrestrial Ecologist

PREVIOUS EMPLOYMENT: Econ@UJ (University of Johannesburg)

Freshwater Ecologist

ACADEMIC QUALIFICATIONS

University of Johannesburg, Johannesburg, South Africa (2009): MAGISTER SCIENTIAE (MSc) - Aquatic Health:

Title: *Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations.*

Rand Afrikaans University (RAU), Johannesburg, South Africa (2004): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Rand Afrikaans University (RAU), Johannesburg, South Africa (2001 - 2004): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

PUBLICATIONS

Desai M., Husted A., Fry C., Downs C.T., & O'Brien G.C. 2019. Spatial shifts and habitat partitioning of ichthyofauna within the middle–lower region of the Pungwe Basin, Mozambique. *Journal of Freshwater Ecology*, 34(1), 685–702. doi: 10.1080/02705060.2019.1673221

Tate R.B. and Husted, A. 2015. Aquatic Biomonitoring in the upper reaches of the Boesmanspruit, Carolina, Mpumalanga, South Africa. *African Journal of Aquatic Science*.

Tate R.B. and Husted A. 2013. Bioaccumulation of metals in *Tilapia zillii* (Gervai, 1848) from an impoundment on the Badeni River, Cote D'Ivoire. *African Journal of Aquatic Science*.

O'Brien G.C., Bulfin J.B., Husted A. and Smit N.J. 2012. Comparative behavioural assessment of an established and new Tigerfish (*Hydrocynus vittatus*) population in two manmade lakes in the Limpopo catchment, Southern Africa. *African Journal of Aquatic Science*.

Tomschi H., Husted A., O'Brien G.C., Cloete Y., Van Dyk C., Pieterse G.M., Wepener V., Nel A. and Reisinger U. 2009. Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam near Selebi Phikwe, Botswana. EC Multiple Framework Contract Beneficiaries.8 ACP BT 13 – Mining Sector (EDMS). Specific Contract N° 2008/166788. Beneficiary Country: Botswana. By: HPC HARRESS PICKEL CONSULT AG

Husted A. 2009. Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations. The University of Johannesburg (Thesis).
