LOXTON WIND ENERGY FACILITY 3: Site Sensitivity Verification and Terrestrial Animal Species Specialist Assessment for the Karoo Dwarf Tortoise

Applicant: Loxton Wind 3 (Pty) Ltd

Report compiled by: Marius Burger, trading as Sungazer Faunal Surveys

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An adult Leopard Tortoise (*Stigmochelys pardalis*) that was observed within the Loxton WEF 3 study area during the October 2022 survey. Details at: https://www.inaturalist.org/observations/141672487.

Contents

ABBREVIATIONS

3FBS	3Foxes Biodiversity Solutions
DFFE	Department of Forestry, Fisheries and the Environment
DTC	Dwarf Tortoise Conservation
ECO	Environmental Control Officer
EGI	Electrical Grid Infrastructure
EIA	Environmental Impact Assessment
EOO	Extent of Occurrence
EWT	Endangered Wildlife Trust
IUCN	International Union for Conservation of Nature
NEMA	National Environmental Management Act
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African Biodiversity Institute
SCC	Species of Conservation Concern
SSV	Site Sensitivity Verification
STR	Screening Tool Report
TASSA	Terrestrial Animal Species Specialist Assessment

DECLARATION OF INDEPENDENCE & CV OF SPECIALIST CONSULTANT

DECLARATION OF INDEPENDENCE

I, **Marius Burger**, hereby declare that I have no conflicts of interest related to the work of this report. Specifically, I declare that I have no personal financial interests in the property and/or development being assessed in this report, and that I have no personal or financial connections to the relevant property owners, developers, planners, financiers or consultants of the development, other than fair remuneration. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise.

ABRIDGED CURRICULUM VITAE

Marius Burger holds a National Diploma in Nature Conservation with Cape Technicon (aka Cape Peninsula University of Technology). He worked as a research assistant with Eastern Cape Nature Conservation (1987-1997), and subsequently took up employment with the Animal Demography Unit (University of Cape Town) as National Coordinator of the Southern African Frog Atlas Project (1997-2003) and as Project Herpetologist of the Southern African Reptile Conservation Assessment (2005-2009). Burger's EIA activities as a faunal specialist started in 1996. He established a sole-proprietor business *Sungazer Faunal Surveys* in 1998 and has since participated in about 130 different projects in collaboration with a variety of EIA consultancies. His experience and achievements as a faunal specialist are summarised below:

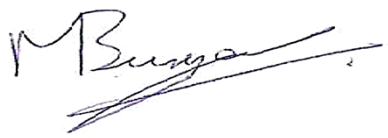
- Registered with SACNASP as a Professional Natural Scientist for the fields of Ecological Science and Zoological Science (Reg. no. 130600) – see certificate below.
- Member of IUCN SSC Snake and Lizard Red List Authority 2017-2020: 2017 – present.
- Member of IUCN SSC Amphibian Specialist Group: Sub-Saharan Africa (2009 – present).
- Member of Herpetological Association of Africa: 1988 – present.
- Extraordinary Lecturer with the Unit for Environmental Sciences and Management, North-West University: 2015 – present.
- Associate consultant with FLORA FAUNA & MAN, Ecological Services Ltd.: 2011 – present.
- Research collaborator with the Smithsonian Institute: 2002 – 2004.
- Research collaborator with the South African Museum: 2000 – 2002.
- Country liaison for the journal *Amphibian and Reptile Conservation*: 2000 – 2004.
- Chairman of the Port Elizabeth Herpetological Club: 1992 – 1996.
- Compiled about 170 specialists and EIA reports for various consultancies and projects.
- Published about 120 scientific, semi-scientific and popular articles, and authored/edited three books and 35 chapters/accounts in books.
- Presented 53 papers/posters at national/international symposia.

WORK EXPERIENCE IN AFRICAN COUNTRIES

Biodiversity surveys & environmental assessments: Central African Republic, Ethiopia, Gabon, Kenya, Liberia, Mozambique, Republic of the Congo, South Africa, South Sudan, Zambia.

RECENT WORK EXPERIENCE IN THE VICINITY OF THE LOXTON PROJECT AREA

Nuweveld Wind Farms and Hoogland Wind Farms (see References section).



Marius Burger – trading as *Sungazer Faunal Surveys* – April 2023

Registered with SACNASP as a Professional Natural Scientist for the fields of Ecological Science and Zoological Science (Reg. no. 130600)

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Marius Burger

Registration Number: 130600

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Zoological Science (Professional Natural Scientist)
Ecological Science (Professional Natural Scientist)

Effective **5 May 2021** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

SACNASP certificate for Marius Burger, valid until 31 March 2024.

TERRESTRIAL ANIMAL SPECIES SPECIALIST ASSESSMENT CHECKLIST

NEMA GN No 1150 of 30 October 2022: Terrestrial Animal Species: Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species.

1	**General Information**	
1.1	An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "very high" or "high" sensitivity for terrestrial animal species must submit a Terrestrial Animal Species Specialist Assessment Report.	MEDIUM sensitivity: Terrestrial Animal Species Specialist Assessment Report (i.e. this report)
1.2	An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of "medium sensitivity" for terrestrial animal species must submit either a Terrestrial Animal Species Specialist Assessment Report or a Terrestrial Animal Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.	
1.3	An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of "low" sensitivity for terrestrial animal species must submit a Terrestrial Animal Species Compliance Statement.	NA
1.4	Where the information gathered from the site sensitivity verification differs from the screening tool designation of "very high" or "high", for terrestrial animal species sensitivity and it is found to be of a "low" sensitivity, then a Terrestrial Animal Species Compliance Statement must be submitted.	NA
1.5	Where the information gathered from the site sensitivity verification differs from the screening tool designation of "low" terrestrial animal species sensitivity and it is found to be of a "very high" or "high" terrestrial animal species sensitivity, a Terrestrial Animal Species Specialist Assessment must be conducted.	NA
1.6	If any part of the development falls within an area of confirmed "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol means, the area on which the proposed development will take place and includes the area that will be disturbed or impacted.	NA
1.7	The Terrestrial Animal Species Specialist Assessment and the Terrestrial Animal Species Compliance Statement must be undertaken within the study area.	Sections 4 to 6
1.8	Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site	
1.9	Where the nature of the activity is expected to have an impact on SCC beyond the boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.	Section 7.4
2	**Terrestrial Animal Species Specialist Assessment**	
2.1	The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP) with a field of practice relevant to the taxonomic group ("taxa") for which the assessment is being undertaken.	Pages 4 & 5
2.2	The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline; and must;	This report

2.2.1	identify the SCC which were found, observed or are likely to occur within the study area;	Sections 3 to 5
2.2.2	provide evidence (photographs or sound recordings) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility, immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);	Sections 4 & 5
2.2.3	identify the distribution, location, viability and provide a detailed description of population size of the SCC, identified within the study area;	Section 5
2.2.4	identify the nature and the extent of the potential impact of the proposed development on the population of the SCC located within the study area;	Section 8
2.2.5	determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases, including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;	Section 6
2.2.6	determine the potential impact of the proposed development on the habitat of the SCC located within the study area;	Section 8
2.2.7	include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, include a motivation for the deviation;	Sections 3 to 7
2.2.8	identify any dynamic ecological processes occurring within the broader landscape that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;	Sections 3 to 6
2.2.9	identify any potential impact of ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long-term viability;	Sections 3 to 6
2.2.10	determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC;	Section 7
2.2.11	discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity; and	Section 9
2.2.12	identify any alternative development footprints within the preferred site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification.	Section 8
2.3	The findings of the assessment must be written up in a Terrestrial Animal Species Specialist Assessment Report.	This report
3	**Terrestrial Animal Species Specialist Assessment Report**	
3.1	This report must include as a minimum the following information:	Pages 4 & 5
3.1.1	contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae.	
3.1.2	a signed statement of independence by the specialist;	
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;	Sections 3.6 & 4.2
3.1.4	a description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 4
3.1.5	a description of the mean density of observations/number of sample sites per unit area and the site inspection observations.	Section 4.2

3.1.6	a description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 4.3
3.1.7	details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	Section 9; Table 7
3.1.8	the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	Table 7
3.1.9	the location of areas not suitable for development and to be avoided during construction where relevant;	Section 7.4
3.1.10	a discussion on the cumulative impacts;	Section 8.5.4
3.1.11	impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 8.3
3.1.12	a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	Section 9
3.1.13	a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	N/A
3.2	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	This report

1 INTRODUCTION

1.1 Project background

The applicant **Loxton Wind Facility 3** (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 15 km east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

Two additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Loxton WEF 1 and Loxton WEF 2 (see Figure 1).

A preferred project site with an extent of approximately 58 000 ha has been identified as a technically suitable area for the development of the three WEF projects. Loxton WEF 1 will comprise of up to 42 turbines, Loxton WEF 2 up to 61 turbines and Loxton WEF 3 up to 39 turbines. Loxton WEF 1 and Loxton WEF 3 will each have a contracted capacity of up to 240 MW with a permanent footprint of up to 65 ha, whereas Loxton WEF 2 will comprise of up to 61 turbines with a contracted capacity of up to 480 MW and permeant footprint of up to 110 ha.

The Loxton WEF 3 project site covers approximately 12 500 ha and comprises the following farm portions:

- Remaining Extent of the Farm Yzervarkspoort No. 139
- Portion 1 of the Farm Yzervarkspoort No. 139
- Remaining Extent of Farm 273
- Remaining Extent of the Farm No. 262
- Remaining Extent of the Farm Erasmuskraal No. 269

The Loxton WEF 3 project site (Figures 7 & 14) is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 240 MW:

- Up to 39 wind turbines with a maximum hub height of 160 m and a rotor diameter of up to 200 m.
- A transformer at the base of each turbine.
- Collective concrete turbine foundations with a permanent footprint of 6 ha.
- Each turbine will have a crane hardstand of 70 m x 45 m. The collective permanent footprint for turbine hardstands will be up to approximately 13 ha.
- Each turbine will have a temporary blade hardstand of 80 m x 45 m. The collective temporary footprint for blade hardstands will be up to approximately 15 ha.
- Temporary laydown areas (with a combined footprint of up to 25 ha) which will accommodate the boom erection, storage and assembly area.
- Battery Energy Storage System (with a footprint of up to 5 ha).
- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where feasible.
- One on-site substation of up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid.
- Construction period laydown areas (temporary) up to 6 ha.
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 15 m road corridor may be temporarily impacted upon during construction and rehabilitated to 6 m wide after construction. The WEF will have a total road network of up to 50 km.
- A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2 ha).
- Operation and Maintenance buildings (with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, parking bays, a workshop and a storage area.

The Electrical Grid Infrastructure (EGI) associated with the Loxton WEF considers a 300 m wide corridor route from the Loxton Switching Station/Collector Station to the Gamma MTS. The EGI is located within the Central Strategic Powerline Corridor and is therefore subject to a Basic Assessment process in accordance with GN 113 of 16 February 2018 listed under NEMA, 1998.

The following report is comprised of site sensitivity verification (SSV), Terrestrial Animal Species Specialist Assessment (TASSA) and impact assessment components, specifically in the contexts of the potential occurrence of the Karoo Dwarf Tortoise (*Chersobius boulengeri*) within the Loxton WEF 3 site. Although this is a stand-alone report, it should be read in conjunction with the Loxton WEF 1 (Burger 2023a) and the Loxton WEF 2 (Burger 2023b) reports.

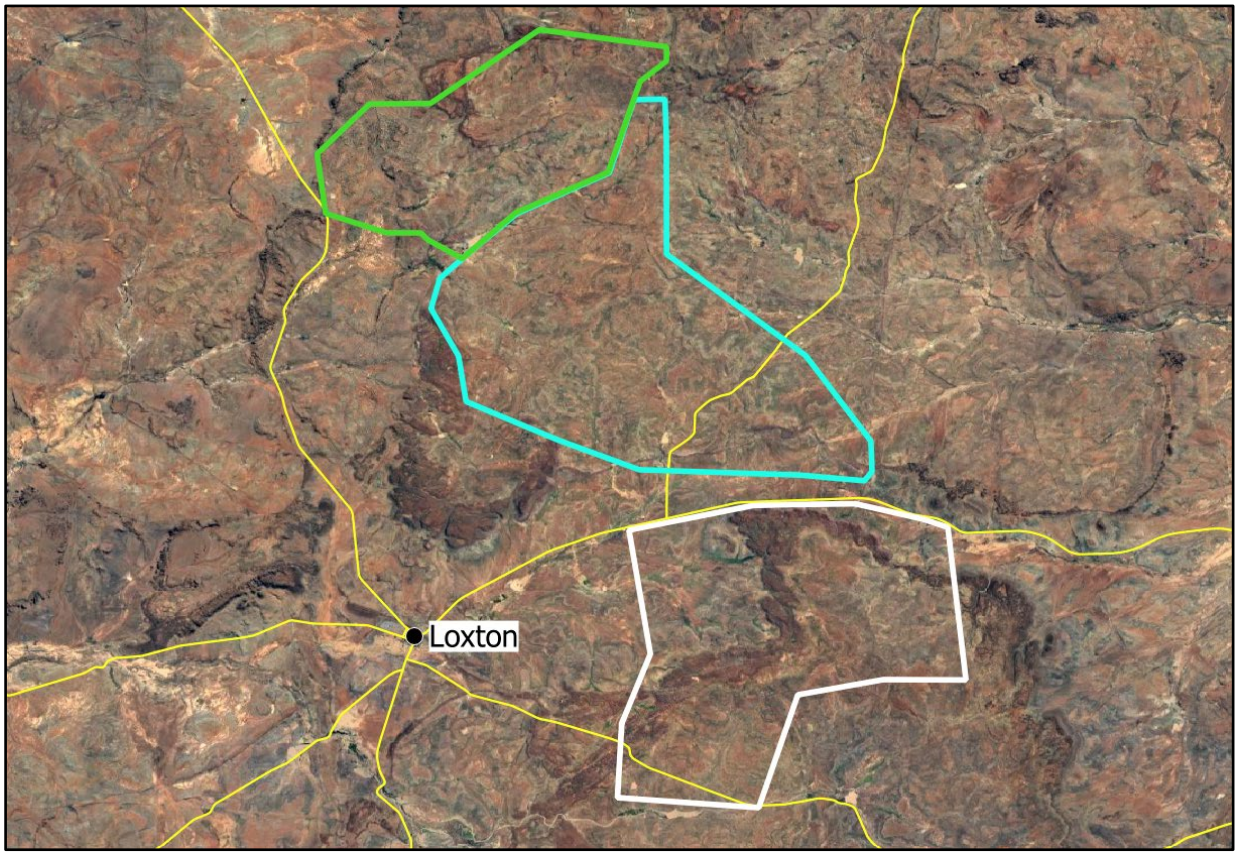


Figure1: The approximate boundaries of the three proposed WEFs in the Loxton region: Loxton WEF 1 in the north (green polygon) is the focus of the current SSV report. The other two sites, i.e. Loxton WEF 2 (blue polygon) and Loxton WEF 3 (white polygon) were also visited during the SSV ground-truthing stint to check for the potential occurrence of Karoo Dwarf Tortoises at the respective sites.

1.2 The Karoo Dwarf Tortoise

One of the specialist investigations that was commissioned as part of the Loxton WEF projects deals specifically with the potential occurrence of the Karoo Dwarf Tortoise within the respective study areas. The National web-based Environmental Screening Tool Reports (STR) that were produced for the Loxton WEF 1, 2 and 3 farms listed this species as being of MEDIUM[1] sensitivity within the Animal Species Theme. The current IUCN listing of this species is *Endangered*, and thus it is considered as a species of conservation concern (SCC). Background information about the Karoo Dwarf Tortoise is presented in Section 3.

[1] Model-derived suitable habitat areas for threatened and/or rare species. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed.

2 TERMS OF REFERENCE

In terms of the requirements of the National Environmental Management Act (NEMA; Act 107 of 1998, as amended) Environmental Impact Assessment (EIA) Regulations (4 December 2014, Government Notice R982, R983, R984 and R985, as amended), various aspects of the proposed developments may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority, namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. In accordance with GN 320 and GN 1150 (20 March 2020)[2] of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the Screening Tool. Marius Burger – trading as Sungazer Faunal Surveys – was commissioned as the herpetofaunal specialist to verify the sensitivity of Loxton WEF 3 (i.e. this report), and also of Loxton WEF 1 (Burger 2023a) and Loxton WEF 2 (Burger 2023b).

The specialist is requested to compile the following reports, in line with Appendix 6 of the EIA Regulations, 2014 (as amended), as well as any specific Gazetted specialist protocols (if required or applicable):

1. Site Sensitivity Verification (SSV); and
2. Terrestrial Animal Species Specialist Assessment (TASSA); or if applicable
3. Terrestrial Animal Species Compliance Statement (TASCS).

The following report for the Loxton WEF 3 site provides a combination of the SSV, TASSA and impact assessment components.

3 KAROO DWARF TORTOISE SPECIES ACCOUNT

3.1 Karoo Dwarf Tortoise species account

The following section provides general background on the conservation status, morphology, distribution, habitat, activity patterns and population trends of the Karoo Dwarf Tortoise – also known as Karoo Padloper and Boulenger's Padloper. These components were considered in preparing the SSV reports for the three Loxton WEFs. The bulk of this information was gleaned from the forthcoming revised conservation status of the reptiles of South Africa, Eswatini and Lesotho (Tolley *et al.* in press), and also from various other sources (e.g. Hofmeyr *et al.* 2018, Juvik and Hofmeyr 2015, Loehr 2018, Loehr and Keswick 2022, Loehr *et al.* 2021).

3.2 Conservation status

The current IUCN conservation status of the Karoo Dwarf Tortoise is *Endangered* (A4ace). This is because most localities (30 of 35) no longer harbour viable populations and nearly 50% of the species' range is moderately or severely degraded with changes from a shrubby to a grassy landscape (Stevens *et al.* 2015). The species is thought to be in decline based on an estimate of a reduction in population size of approximately 30% over the past 25 years (one generation) and a projected reduction of at least another 30% over the next 50 years (two generations), for a total reduction over three generations of approximately 60% (Hofmeyr *et al.* 2018, Tolley *et al.* in press).

3.3 Morphological characters

The Karoo Dwarf Tortoise is small (max. 110 mm in length) and cryptically coloured, and it is often difficult to detect specimens in stony habitat. The Greater Padloper which also occurs within the Loxton region is

[2] GN 320 (20 March 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

similar in general appearance to the Karoo Dwarf Tortoise, and it may sometimes be difficult to distinguish shell remains of the two species. The easiest way to tell the two species apart is to count the number of claws on the front limbs, with the Karoo Dwarf Tortoise having five front claws and the Greater Padloper four front claws.


Figures 2 & 3: An example of an adult Karoo Dwarf Tortoise in life. The presence of five claws (top right photo) on the front limbs is a diagnostic character to distinguish the genus *Chersobius* from the similar genus *Homopus* that has four claws on the front limbs. Photographs by Bonnie Schumann, Nama Karoo Coordinator (EWT) as per https://www.inaturalist.org/observations/118892553.

3.4 Distribution

The Karoo Dwarf Tortoise is a South African endemic that is distributed throughout much of the south-western Great Karoo and along the region of the Great Escarpment, eastwards to Cradock in the Eastern Cape Province (see Figures 4 & 5). This species' EOO is 144,000 km^2.

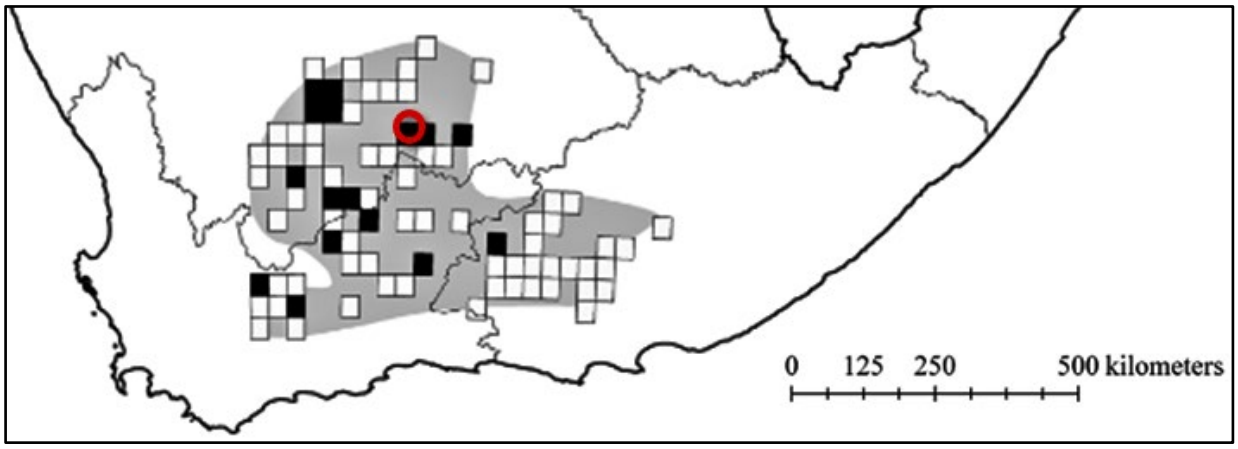


Figure 4: The distribution range of the Karoo Dwarf Tortoise, presented as quarter-degree grid cells and a shaded polygon (map modified from Loehr and Keswick 2022). The white cells denote observations of live and dead individuals recorded during the period 1881–2000, whereas the black cells denote observations of 24 live individuals recorded during the period 2001–2017. The red circle indicates the general region of the three Loxton WEFs.

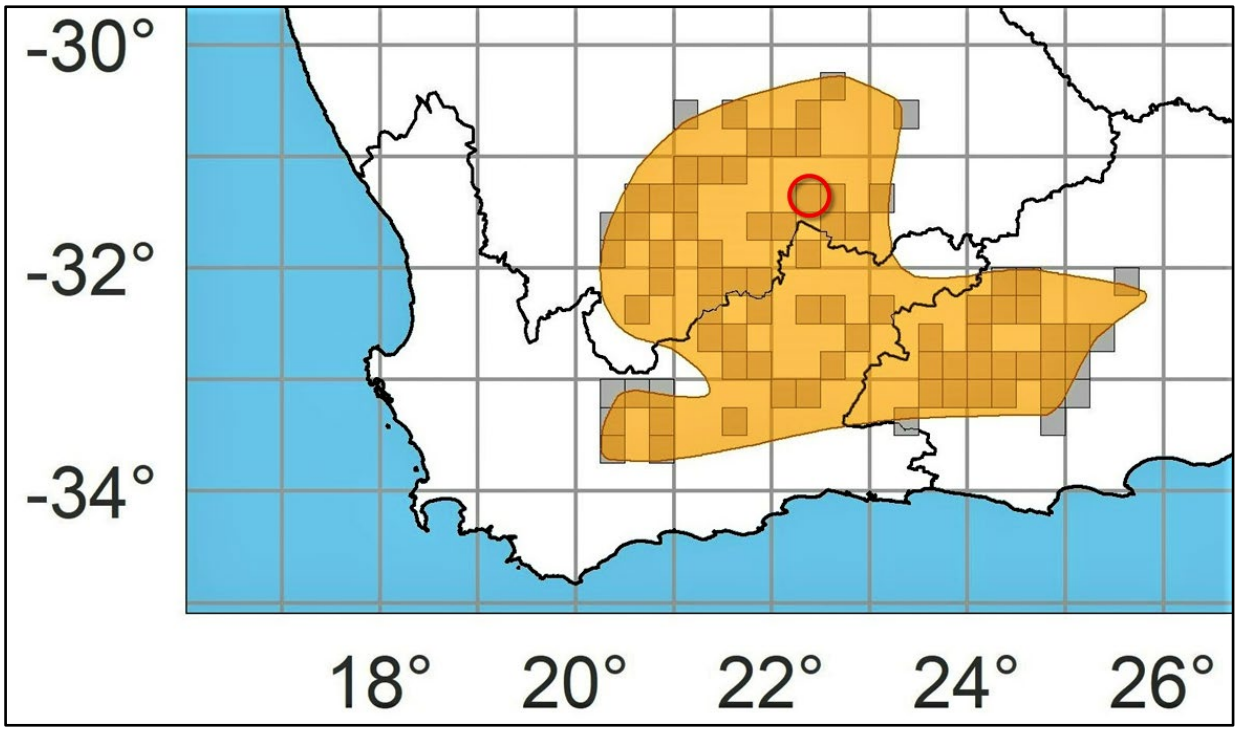


Figure 5: The distribution range of the Karoo Dwarf Tortoise, presented as quarter-degree grid cells and a shaded polygon as per the forthcoming revised conservation status of the reptiles of South Africa, Eswatini and Lesotho (Tolley *et al.* in press). The red circle indicates the general region of the three Loxton WEFs.

3.5 Habitat

The Karoo Dwarf Tortoise occurs mainly in the southern regions of the Succulent and Nama Karoo biomes and peripherally in the Albany Thicket biome in the southeast of its range, at elevations of approximately 800–1,500 m a.s.l. This species is generally associated with dolerite ridges, but it also inhabits various other rocky outcrops such as sandstone and shale formations. The rocky components serve as shelter for this small tortoise (Figure 6).

Figure 6: A pair of Karoo Dwarf Tortoises emerging from the shelter of a large rock, photographed by Courtney Hundermark at a DTC research site in the Williston region.

The vegetation of the Loxton WEF 3 site was described by Todd (2022), approximately as follow:

- The whole of the Loxton WEF 3 site is classified as falling within the *Eastern Upper Karoo* vegetation type.
- This is an oversimplification of the vegetation present on site. The on-site field assessment for Loxton WEF 3 indicates that there are also some extensive tracts of *Upper Karoo Hardeveld* present, as well as a few areas of riparian vegetation which would currently fall into the *Bushmanland Vloere* vegetation type but are more-closely allied to the *Southern Karoo Riviere* vegetation type.

3.6 Activity patterns

The following details are from a field study by Loehr *et al.* (2021):

- Karoo Dwarf Tortoises inhabit an arid region in South Africa where most rains fall around austral summer (October–May).
- Karoo Dwarf Tortoises spend approximately 80–90% of their time in retreats.
- Activity (behaviour outside retreats) in the spring seems to be unrelated to time of the day.
- Activity in the summer appears to be restricted to the afternoon and evening.
- The recorded summer-time period of daily activity for this species is very low, i.e. about 11 minutes per day.
- The study concluded that Karoo Dwarf Tortoises might be mitigating predation risks by maintaining a low level of activity and thermoregulating within retreats.
- The short feeding time of Karoo Dwarf Tortoises compared to other tortoise taxa may result in slow growth and reproductive rates, which might in turn affect population resilience and conservation needs of this SCC.

3.7 Population trends within global distribution

The Karoo Dwarf Tortoise occurs at low densities (Loehr and Keswick 2022) and it appears to have a low dispersal capability (Loehr 2015). Repeated surveys at 40 sites (2005–2021) covering 50% of the distribution where the species had been previously documented confirmed only one occupied site with a population that is in apparent decline (Loehr and Keswick 2022), and a few individuals were observed at four other sites. Tortoises were however absent from the remainder of sites. Recent records of live individuals are few, and the population is therefore considered to be in decline.

4 SITE SENSITIVITY VERIFICATION METHODOLOGY

4.1 Distribution records

Various literature (see References section) and electronic data sources were examined to gather Karoo Dwarf Tortoise locality records. The distribution records obtained from these sources were pooled and plotted on a map (Figures 8 & 9) so that it can be viewed in the context of the proposed development areas:

- SANBI: A re-assessment of the conservation status of southern African reptiles. This project is currently in progress. It is based on a dataset of about 190,000 reptile records which include data from several of the most important museum collections and a wide variety of transcribed literature records. A manuscript of the results of this project is scheduled to be published in 2023 (Tolley at al. in press). A subset of this data was extracted (scrutinised and cleaned) for Karoo Dwarf Tortoise locality records.
- ReptileMAP: http://vmus.adu.org.za/.
- iNaturalist: https://www.inaturalist.org/home.

4.2 Site visits by faunal specialists

The appointed herpetologist spent a total of four days (15 to 18 October 2022) visiting various sites within the three Loxton WEF sites. The main aims of the site investigations were to 1) specifically search for

evidence of actual occurrence of the Karoo Dwarf Tortoises by means of observations of live specimens or shell remains, and to 2) assess the suitability (or not) of the terrain as habitat for this species. The timing (early summer) of the site visit was appropriate for the surveying of Karoo Dwarf Tortoises, as per the Species Environmental Assessment Guideline (SANBI 2020). In addition to the field surveying efforts of the project herpetologist, the faunal specialist (Simon Todd of 3FBS) has spent about 14 days exploring the Loxton WEF sites (Todd 2022). In doing so he would have been on the lookout for evidence of Karoo Dwarf Tortoises in the general region.

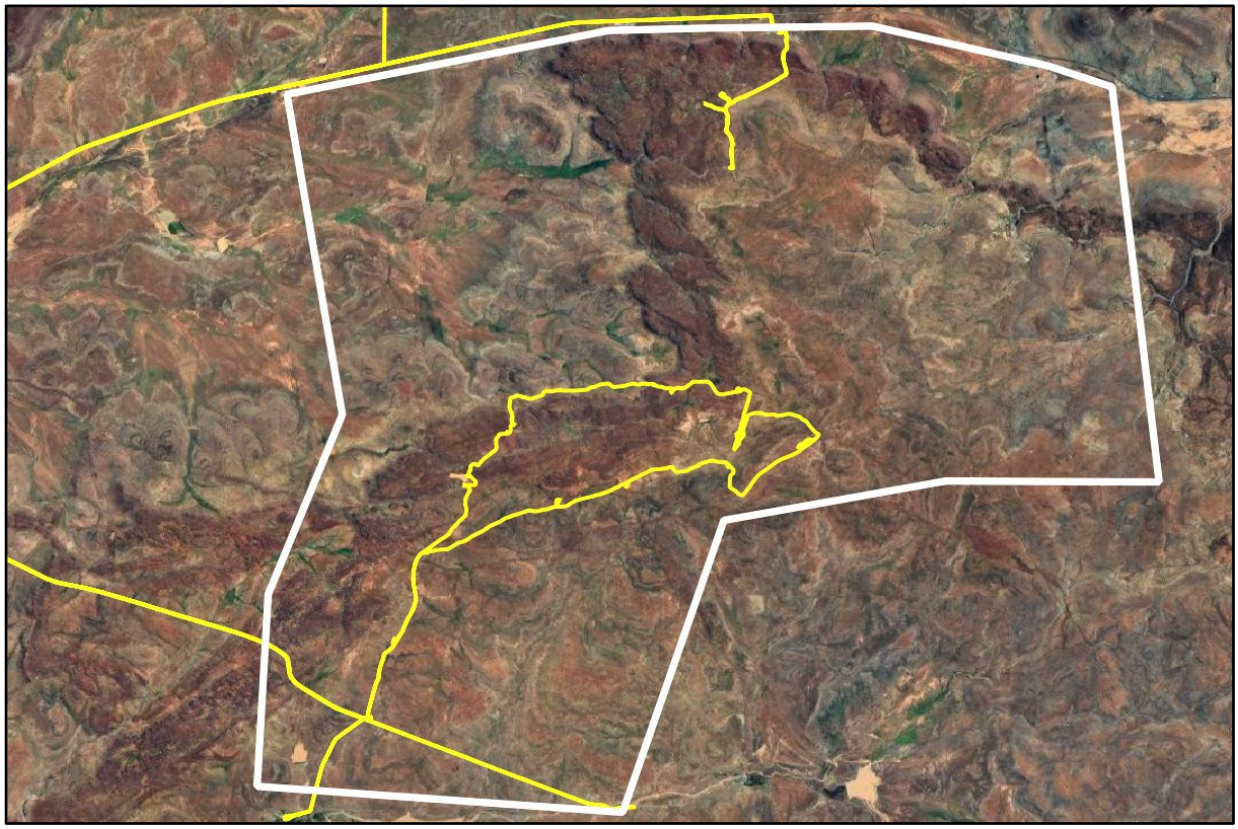


Figure 7: The tracks (yellow lines) of the surveying effort (17 & 18 October 2022) to search for evidence of the occurrence of Karoo Dwarf Tortoises within the Loxton WEF 3 site and general surroundings.

4.3 Site visit limitations

Surveys of the Karoo Dwarf Tortoise is hampered by the fact that the species has low detectability in the field, and it is thus difficult to determine its occurrence or actual absence at a particular site. To selectively quote from Loehr and Keswick (2022): "*Inconspicuous, secretive, or sparsely distributed species receive relatively little research attention, potentially leading to uncertainty about their status and lack of efforts to conserve them. Karoo dwarf tortoises spend most of the time in retreats at remote arid locations, and are seldom seen*."

4.4 Consultation with other experts and landowners

Discussions were held with two tortoise specialists and a few landowners about the potential occurrence of the Karoo Dwarf Tortoise within the proposed development areas:

- **Victor Loehr** of Dwarf Tortoise Conservation (DTC; formerly Homopus Research Foundation) is the world expert on dwarf and padloper tortoises, with years of field experience in South Africa: https://www.researchgate.net/profile/Victor-Loehr/research
- **Courtney Hundermark**, research associate with DTC: http://home.caiway.nl/~loehr/index.html.

5 OUTCOME OF SITE SENSITIVITY VERIFICATION

5.1 Historical distribution records

The general distribution pattern of the Karoo Dwarf Tortoise as per the map of all known records plotted (Figures 8 & 9) shows that the Loxton WEF 3 site falls well within the distribution of this species. The 20 nearest Karoo Dwarf Tortoise observation records to the Loxton WEF 3 site are almost all historical records from several decades ago (i.e., 1969 and 1975) or undated (these are also old). One record (1975) plots within the Loxton WEF 3 study area (Figure 9). The only recent records are three 2021//22 records between Loxton/Beaufort West, and two 2016 records from about 14 km NNW of Loxton. The general impression gained from these distribution records is thus that the species does indeed occur within the Loxton WEF 3 site, as per the projections of the STR.

5.2 Recent distribution records

Despite the four days of active searching at the three Loxton WEF sites in areas of seemingly suitable habitat (as described in Section 5.5 below), the appointed herpetologist encountered no live or dead Karoo Dwarf Tortoises during the October 2022 survey.

Farm owners and their workers were interviewed and shown photos of chelonians from the general region. These persons confirmed the occurrence of Leopard Tortoise (*Stigmochelys pardalis*), Southern Tent Tortoise (*Psammobates tentorius)* and South African Helmeted Terrapin (*Pelomedusa galeata*), but none of them recognised the Karoo Dwarf Tortoise or Greater Padloper (*Homopus femoralis*). A few observations of Leopard Tortoises (e.g. https://www.inaturalist.org/observations/141678815) and Southern Tent Tortoises (e.g. https://www.inaturalist.org/observations/141678699) were recorded within the Loxton WEF 3 site during the October 2022 survey. See also Table 7 for additional herpetofaunal observations recorded from the three Loxton WEF sites during this survey.

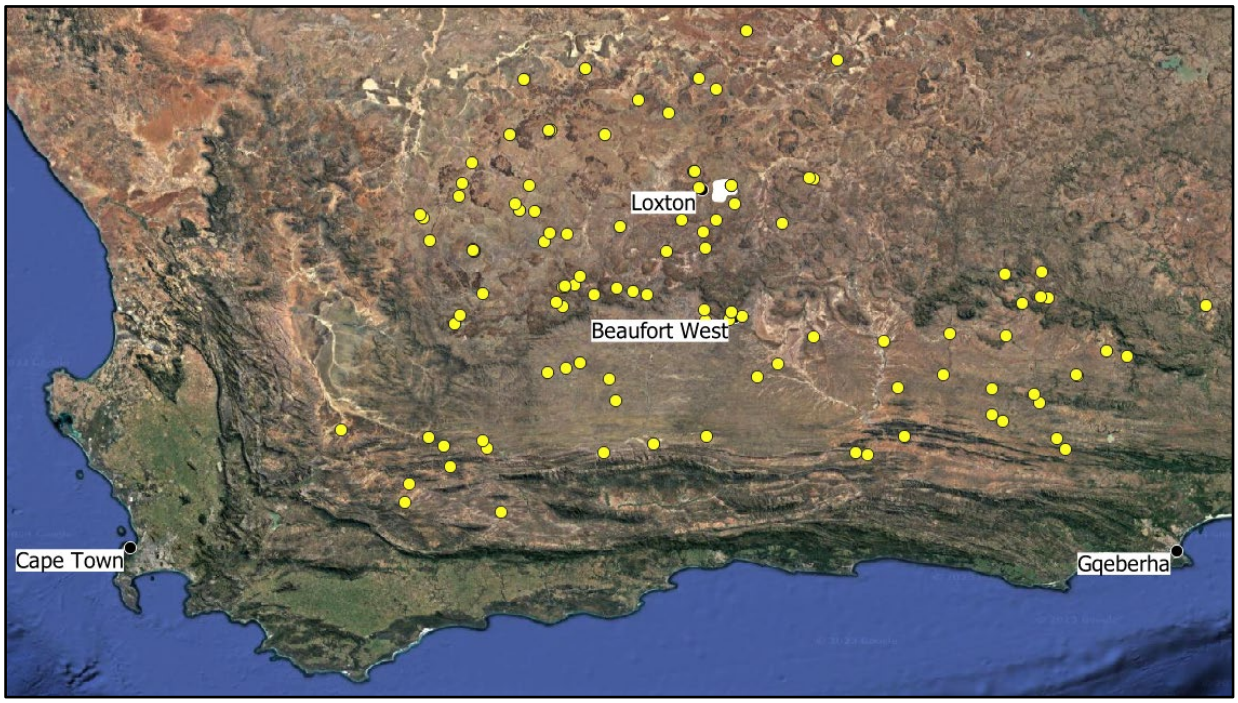


Figure 8: The total extent of Karoo Dwarf Tortoise distribution, with all known locality records (yellow dots) plotted in relation to the Loxton WEF 3 site (white polygon).

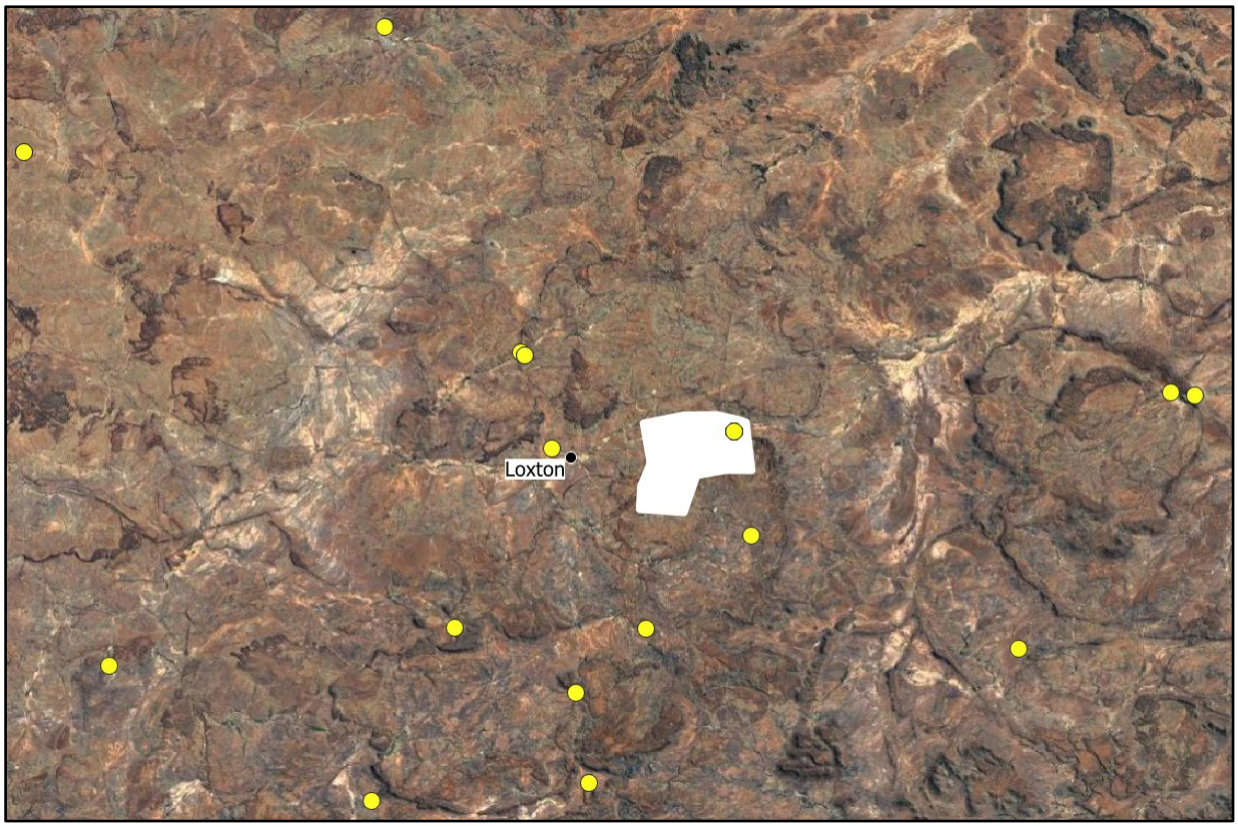


Figure 9: A zoomed-in perspective of Figure 8 to show all known distribution records of Karoo Dwarf Tortoises (yellow dots) in the general region of the Loxton WEF 3 site (white polygon), including one within the WEF 3 study area.

5.3 Population trends within Loxton WEF 3

No observations of Karoo Dwarf Tortoises at the Loxton WEF 3 site were made during the October 2022 survey, nor during the various visits by Todd (2022). It is not realistically feasible to make definite statements about the population size of this SCC within this study area, but the general impression is that it is extremely rare within this region. This conclusion is based on the fact that:

- Regardless of the more than two weeks of field studies that were conducted by the appointed faunal specialist (3FBS) and herpetologist within the study area, no evidence (live or dead) of this species were made.
- A few historical records from 1975 are known from one locality within the study area (Figure 9).
- Interviewed landowners and their staff are unfamiliar with this species, i.e., they do not encounter specimens during farming activities.

5.4 Importance of the Loxton WEF 3 population of Karoo Dwarf Tortoises

Based on the current evidence that Karoo Dwarf Tortoises are seemingly very rare within the study area, it can be argued that the Loxton WEF 3 population is not of particularly high conservation importance for this species. Although this may be true to some extent if viewed in the context of the species' global distribution (EOO = 144 000 km^2), it must be kept in mind that this is an *Endangered* species that is currently experiencing global decline (Section 3.2). As such, all existing populations of this species should be regarded as being of conservation importance to some degree. Although the Loxton WEF 3 site does not appear to be a stronghold site for Karoo Dwarf Tortoises, it nevertheless contributes to the overall population viability of this species. This site contains units of habitat that are suited to the species' ecological needs, and these specific nodes should be regarded as being of HIGH conservation importance.

However, due to the seemingly low population size of Karoo Dwarf Tortoises within the study area, the overall conservation importance of the Loxton WEF site is MODERATE at a global scale.

5.5 Habitat suitability

Due to specimen detectability limitations of the Karoo Dwarf Tortoise, an alternative surveying approach is to assess the habitat suitability of the site in terms of its potential to be inhabited by this species. These tortoises frequent specific habitat types and thus individuals are not spread evenly within the landscape. The two most relevant physical habitat attributes are geological and vegetation components that respectively cater for the species' shelter and dietary needs. The species has a strong affinity with dolerite ridges (Figures 10 & 11), but it also inhabits other types of rocky features such as shale/mudstone and sandstone (Figures 12 & 13) outcrops. Here they utilise holes or cavities under rocks as shelter (e.g., Figure 6), and they feed on shrubs and geophytes. Although much of the Loxton WEF 3 landscape is flat terrain, several zones of rocky slopes and ridges are present. These rocky features must be taken into consideration when conducting the site sensitivity mapping of the study area. The general approach should be to concentrate the layout design to the areas where tortoises would likely be absent or scarce within the landscape.

Figure 10: A dolerite outcrop within Loxton WEF 3. No evidence of Karoo Dwarf Tortoises was found at this site, but the habitat seems suitable.

Figure 11: Dolerite terrain within Loxton WEF 3. No evidence of Karoo Dwarf Tortoises was found at this site, but the habitat seems suitable.

Figure 12: Rocky terrain within Loxton WEF 3. No evidence of Karoo Dwarf Tortoises was found at this site, but the habitat seems semi-suitable.

Figure 13: A rocky ridge within Loxton WEF 3. No evidence of Karoo Dwarf Tortoises was found at this site, but the habitat seems semi-suitable.

6 CONCLUSIONS OF THE SITE SENSITIVITY VERIFICATION

As per the above SSV assessment, it is concluded that the Karoo Dwarf Tortoise is indeed likely to occur within the Loxton WEF 3 site. The STR Animal Species Theme rating of MEDIUM sensitivity for this area is thus appropriate. It is therefore necessary to compile a TASSA for this species in the context of the proposed wind energy developments for this area (see below). This is done in conjunction with the impact assessment components for this project. Comprehensive information about the population demographics of Karoo Dwarf Tortoises within Loxton WEF 3 site is not currently available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

7 TERRESTRIAL ANIMAL SPECIES SPECIALIST ASSESSMENT

7.1 Assessment rationale

The occurrence of the Karoo Dwarf Tortoise within the Loxton WEF 3 study area was confirmed by means of a SSV process (see above for details of the SSV component). The STR Animal Species Theme rating of MEDIUM sensitivity for this area is therefore appropriate. Accordingly, a TASSA is presented below in the context of the proposed wind energy developments for this area. Note that several aspects required for the TASSA were already presented in the SSV section and, for the most, these will not be repeated in the following TASSA section.

7.2 SANBI 2020 buffer recommendations

The Species Environmental Assessment Guideline (SANBI 2020) provides buffer recommendations for SCC to be applied for activities that may result in loss or major degradation of habitat, as well as direct impact on the SCC. The recommended buffer applications for Karoo Dwarf Tortoise are 500 m away from rocky habitats, or a minimum buffer of 300 m away from rocky habitats. The guideline also specifically prescribes that "*If connectivity to other suitable rocky habitats (with 300 m buffer) is not possible, then the recommended buffer (i.e. 500 m) must be applied*". The justification for these relatively large buffers follows that 1) foraging habitats are not exclusively confined to the rocky habitats, and 2) rocky habitats tend to occur patchily in the landscape and therefore large buffers are needed to provide habitat connectivity.

7.3 Sensitivity mapping

An ecological sensitivity map of the Loxton WEF 3 site was produced as part of the fauna and flora specialist screening study (Todd 2022). This entailed the mapping of sensitive features such as wetlands, drainage lines, rocky hills and pans, with buffering applied to comply with legislative requirements or ecological considerations. In keeping with the sensitivity grading of the specialist screening study, the same categories of sensitivity are also used here for the assessment of the Karoo Dwarf Tortoise. These are LOW, MEDIUM, HIGH and VERY HIGH (= NO-GO).

In developing the ecological sensitivity mapping for the Karoo Dwarf Tortoise, the dolerite features within the Loxton WEF 3 site were rated as being NO-GO areas. Other rocky outcrops such as sandstone and shale/mudstone that are potentially also inhabited by Karoo Dwarf Tortoises were also considered. For these, a Digital Elevation Model (DEM) was used to project the extent of elevation within the landscape. Angle was calculated from the variation in the altitude of the landscape derived from this DEM slope (as per Horn 1981). The slope angle presented varied between 1 and 38 degrees, which is indicative of the relative dominance of flat areas within the landscape and the presence of steeper slopes forming ridgelines and plateaus. Shapefiles were created which visualised different categories slope angle in the landscape including, areas where the angle lay between 5 and 38 degrees and areas where the angle lay between 10 and 38 degrees. These features were rated as being of HIGH and MEDIUM sensitivity respectively. Note

that the DEM does not distinguish between slopes that are rocky or without rocks. Rocky terrain is generally more suitable for Karoo Dwarf Tortoises than areas without rocks.

- **LOW:** The LOW sensitivity areas are deemed to be generally suboptimal for supporting Karoo Dwarf Tortoise populations. Such areas are generally flat with natural or transformed habitat, and mostly devoid of rocky or stony habitat. These areas may still be inhabited by Karoo Dwarf Tortoises, but in proportionally lower numbers compared to the higher sensitivity areas. These areas thus form part of the species' Extent of Occurrence, but less so of its Area of Occupancy. Most types of development can proceed within these areas with LOW expected impact on the region's Karoo Dwarf Tortoises.
- **MEDIUM:** The MEDIUM sensitivity areas comprise very gentle slopes as per the DEM projections. The DEM range for this particular layer is 5 to 38 degree slopes, but in its projection (Figure 14) it displays as 5 to 9 degrees units due to being overlaid by the HIGH (10 to 38 degrees) layer. For the most these slopes are covered with natural (untransformed) habitat, and often also contains rocky/stony components. A degree of development activities is acceptable within the MEDIUM zones, but it is preferable to side-step these areas where practically feasible.
- **HIGH:** The HIGH sensitivity areas comprise slopes of 10 to 38 degrees, as per the DEM projections (Figure 14). For the most these slopes are covered with natural (untransformed) habitat, and often also contains rocky/stony components. Development within the HIGH sensitivity areas is undesirable and may only take place minimally.
- **VERY HIGH (NO-GO):** Dolerite outcrops are regarded as being the most important of Karoo Dwarf Tortoise habitat within the Loxton WEF 3 landscape. Accordingly, these outcrops were rated as VERY HIGH sensitivity NO-GO zones from which all forms of development activities should be avoided.

The Species Environmental Assessment Guideline (SANBI 2020) buffer recommendations for the Karoo Dwarf Tortoise are 500 m away from suitable rocky habitats or 300 m away as a minimum. Such liberal buffering would be appropriate for a known stronghold population of Karoo Dwarf Tortoises such as the DTC research site in the Williston region. However, it appears as though the Loxton WEF 3 site is only of MODERATE (or perhaps even LOW) significance in terms of being inhabited by Karoo Dwarf Tortoises. Instead of applying the SANBI 2020 buffer recommendations, it was deemed appropriate to rather use the DEM approach whereby dolerite outcrops and slope categories serve as the indicators of where these tortoises are likely to be most prevalent within the landscape. This approach was implemented for the current Loxton WEF 3 layout design (Figure 14) so that roads, turbines, laydowns and other units of associated infrastructure are predominantly positioned in areas of LOW and MEDIUM sensitivity. This sensitivity assessment approach of demarcating dolerite outcrops and rocky slopes is deemed to be an appropriate alternative buffering system to adequately safeguard the Karoo Dwarf Tortoise populations within the Loxton WEF 3 site.

The outcomes of the sensitivity mapping based on the DEM assessment as well as the terrestrial ecology studies (Todd 2022) were applied to minimise the potential impacts on ecological connectivity in relation to the broader landscape, thereby also minimising the impacts on the Karoo Dwarf Tortoise and promoting its long-term viability in this region. A combination of these two sensitivity approaches is presented in Figure 14, together with the proposed placements of turbines, roads and various infrastructure. The selection of these development nodes was done as per the various denoted sensitivity constraints.

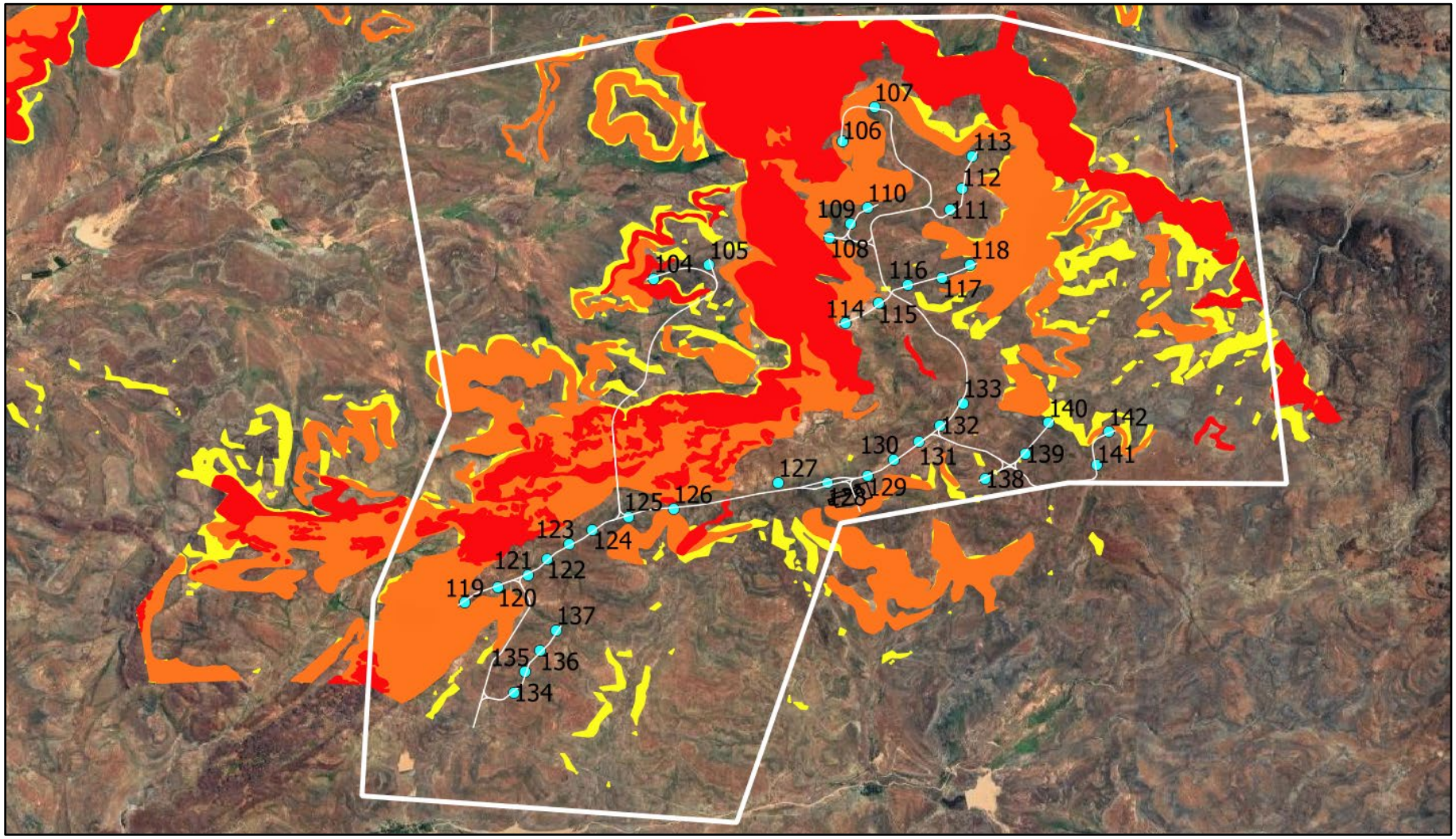


Figure 14: Sensitivity map of the Loxton WEF 3 site depicting the various categories of sensitive zones, i.e. VERY HIGH/NO-GO (red), HIGH (orange) and MEDIUM (yellow). These delimitations are based on the sensitivity assessment of the fauna and flora specialist screening study (Todd 2022) wherein sensitive or important habitats such as rocky outcrops (including dolerite features), wetlands, drainage lines, and pans were flagged as sensitive. The yellow polygons represent the 5 to 9 degrees slopes of the DEM, to indicate gentle slopes that are of MEDIUM sensitivity for Karoo Dwarf Tortoises. The proposed placement of 39 turbines (blue dots 104–142), roads (white lines) and other infrastructure were selected within the context of the sensitivity constraints.

7.4 Project area of influence (PAOI)

- The direct (primary) influence from the proposed development is the actual project footprints. The total development footprint for the Loxton WEF 3 project has temporary development footprint of approximately 110 ha and a permanent footprint of up to 65 ha.
- An indirect (secondary) influence from the proposed development may potentially be the scenario whereby the addition of powerline pylons within the study area may be utilised as additional nesting sites by crows, which in turn may result in an increase of the local crow population and consequently cause an increase of predation on tortoises. Since the Loxton WEF 3 on-site powerlines between the wind turbines to the facility substations will follow existing/proposed access roads and will for the most be buried, this particular scenario is not relevant to this project. However, this scenario will be applicable in the assessment of the powerline grid connection infrastructure.

In summary, the PAOI for this project does not extend beyond the boundaries of the Loxton WEF 3 study area.

8 IMPACT ASSESSMENT

8.1 General impacts of wind farms on tortoises

A number of studies have investigated the effects of wind energy operation on tortoise ecology, behaviour and survival (e.g. Agha *et al.* 2015, Lovich *et al.* 2011, 2018). The general findings of these studies were that for tortoises, the negative impacts associated with wind energy facilities during the operation phase are typically of low significance or severity. In some cases such facilities also offer positive prospects that may safeguard or boost local tortoise populations.

8.2 Impact components relevant to Karoo Dwarf Tortoises

The main categories of negative impacts that have been recorded for the Karoo Dwarf Tortoise are as follow (see Tolley *et al.* in press):

- **Degradation and loss of habitat:** The main past and current threat appears to be habitat degradation and loss, stemming mostly from crop and stock-farming activities. The diet of this tortoise consists of varied shrubs and geophytes, but some areas of its range have undergone a vegetation shift to an increasing grass component in the shrublands (Masubelele *et al.* 2014, du Toit *et al.* 2015).
- **Climate change:** Climate change predictions are that savanna and desert vegetation will expand into large portions of the current biome (Driver *et al.* 2012), which would likely intensify grazing pressure by livestock and reduce food and cover for tortoises (Hofmeyr *et al.* 2018).
- **Predation:** It appears as though the increased predation by White-necked Ravens and Pied Crows in recent years may be one of the most significant causes for the apparent decline of Karoo Dwarf Tortoises (Loehr and Keswick 2022).

In summary, the main ecological components and processes that are of relevance to the population viability of the Karoo Dwarf Tortoise within the landscape are 1) the presence of habitat elements that cater for shelter and dietary needs, 2) climatic events (i.e., drought vs periods of good rainfall), and 3) the extent of predation by corvids. Of these, the two components that may potentially be impacted by the proposed Loxton WEF 3 development are loss/degradation of habitat and an increase of tortoise mortalities due to corvid predation.

8.3 Description of impacts and proposed mitigating measures

Impacts such as climate change and agricultural sprawl (as described above in Section 7.2) have little to no direct bearing on wind energy production ventures, but the following potential impacts are of more specific relevance in the context of the Loxton WEF 3 site:

- Construction phase: Habitat loss and degradation.
- Construction phase: Tortoise mortalities due to earthworks and roadkill.
- Operation phase: Tortoise mortalities due to roadkill.
- Operation phase: Tortoise mortalities due to predation by corvids.
- Decommissioning phase: Tortoise mortalities due to roadkill.

8.3.1 Construction phase: Habitat loss and degradation

The proposed development of Loxton WEF 3 will inevitably contribute to the overall habitat loss and degradation within the landscape. This will be in the form of habitat loss to the construction of new roads, turbine positions, laydown areas and other associated units of infrastructure. It will also to a certain extent contribute to the fragmentation of the landscape. This level of habitat loss and degradation is of low significance and severity in comparison to vegetation degradation caused by overgrazing and drought events. The following mitigating measures are proposed to reduce or limit the significance of this particular impact:

- The development must avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as HIGH or VERY HIGH (NO-GO) sensitivity areas.
- Access to areas outside of the construction footprint during construction must be limited to minimise additional habitat degradation.

8.3.2 Construction phase: Tortoise mortalities due to earthworks and roadkill

It is possible that some tortoises may inadvertently be killed during earthworks activities. The proposed Loxton WEF 3 layout was designed to mostly avoid development footprints within rocky terrain, and thus the probability of encountering tortoise during earthworks events is significantly reduced. Tortoises may also be killed because of increased movements of various vehicles in the general area. For example, the traffic projections (Schwarz 2023) for the Loxton WEF 3 project during peak traffic (6.30–7.30 and 16.30–17.30) is about 20 vehicles per hour on any one section of the public road network. The following on-site mitigating measures are proposed to reduce or limit the significance of this particular impact:

- The development must avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as HIGH or VERY HIGH (NO-GO) sensitivity areas.
- Limit construction activities to within the defined development footprints to minimise the chances of killing tortoise inadvertently. The site ECO would have to make sure that the contractors and vehicles stay away from sensitive areas, i.e., that they will stay on roads and demarcated construction sites,
- All vehicles must adhere to a low-speed limit, i.e. 40 km/h on site and in areas where Karoo Dwarf Tortoises are likely to be present, both within the wind farm as well as on the public roads to the site.

8.3.3 Operation phase: Tortoise mortalities due to roadkill

An established wind energy facility can potentially impact tortoises in the general area by means of an increase of vehicular traffic. For example, Schwarz (2023) projected for the Loxton WEF 3 study area that during peak traffic (6.30–7.30 and 16.30–17.40) the maximum number of additional vehicles on the public road network in any given hour is not expected to exceed five, and there will be no more than three vehicles on any one section of the public road network. The following on-site mitigating measures are proposed to reduce or limit the significance of this particular impact:

- The development must avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component.

This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as HIGH or VERY HIGH (NO-GO) sensitivity areas.
- Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna.
- Incorporate special design features to on-site roads to provide safer options for tortoises to minimise the potential of roadkill mortalities, where appropriate.
- Keep a log of tortoise on-site roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures.
- Adhere to on-site speed limits and exercise vigilance of tortoises crossing the roads.

8.3.4 Operation phase: Tortoise mortalities due to predation by corvids

The development of a new WEF often also incorporates a network of on-site powerlines. In such cases an increase of corvid (crow/raven) activity could be experienced because the powerlines may offer additional perching and nesting areas. The primary advantage for corvids is not so much the addition of extra perches (i.e. pylons) to the landscape, but rather the increase of nesting opportunities that such structures may provide. This could create a scenario whereby these birds may remain in the area for prolonged periods of time and gradually increase in population size, which could result in an increase of predation on tortoises. However, this particular impact is not applicable to the Loxton WEF 3 project because the powerlines running from wind turbines to the facility substations will follow existing/proposed access roads and will for the most be buried.

8.3.5 Decommissioning phase: Tortoise mortalities due to roadkill

Vehicular traffic will also be a component of the decommissioning phase, which may potentially result in tortoises being killed on roads. Decommissioning of the WEF will by default be of development footprints from mostly within MEDIUM to LOW sensitivity areas and not from the HIGH and VERY HIGH (NO-GO) sensitivity areas, as per the layouts produced during the planning and design phase of this project. The following on-site mitigating measures are proposed to reduce or limit the significance of this particular impact:

- The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as HIGH or VERY HIGH (NO-GO) sensitivity areas.
- Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna.
- Keep a log of on-site tortoise roadkill mortalities.
- Adhere to on-site speed limits and exercise vigilance of tortoises crossing the roads.

8.4 Monitoring

Not much is known about the population demographics of Karoo Dwarf Tortoises within the Loxton WEF 3 site. The working assumption is that this species is rare within this area, and that individuals are mostly clustered in areas of prime habitat – i.e., areas of HIGH and VERY HIGH (NO-GO) sensitivity. Additional information can be obtained by monitoring during the construction, operation and decommissioning phases. This information can be used to assess impact significance and to guide the adjustment and implementation of mitigating measures. A Monitoring Plan must be compiled for the construction and operational phases prior to construction, to provide for monitoring of the following components:

- Monitor construction activities aimed at reducing impacts on the Karoo Dwarf Tortoise, i.e., an on-site ECO must oversee the implementation of mitigating measures.
- Monitor (keep log of) tortoise killed by earthworks and traffic.

- Conduct annual surveys along the on-site powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcases observed along the powerlines (often directly below crow nests).

8.5 Impact assessment tables

The data collected and presented were used to assess the significance of the potential impacts of the proposed projects on the Karoo Dwarf Tortoise, according to conventional criteria and methods. The various impact tables are presented under three development phase categories, i.e. construction phase, operation phase and decommissioning phase. In some cases the same impacts may be relevant to more than one of the development phases, e.g. tortoises may be killed on roads during all three phases. Impact tables are presented for each of these scenarios.

8.5.1 Construction phase: Loxton WEF 3

Table 1: Construction phase impacts on the Karoo Dwarf Tortoise: Habitat loss and degradation.

Issue	**Construction phase impacts on the Karoo Dwarf Tortoise.**	
Description of Impact		
Habitat loss and habitat degradation may impact the Karoo Dwarf Tortoise during construction phase activities in the following three ways: 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high (= no-go) sensitivity areas. • Access to areas outside of the construction footprint during construction must be limited to additional habitat degradation.	
Monitoring		
The following monitoring is recommended:	• Construction activities must be monitored by ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible.	

Table 2: Construction phase impacts on the Karoo Dwarf Tortoise: Tortoise mortalities due to earthworks and roadkill.

Issue	**Construction phase impacts on the Karoo Dwarf Tortoise.**	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the construction phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high (no-go) sensitivity areas. • Limit construction activities within the defined development footprints to minimise the chances of killing tortoise inadvertently. • Incorporate special design features to on-site roads to provide safer options for tortoises to minimise the potential of roadkill mortalities. • All vehicles must adhere to a low-speed limit, i.e. 40 km/h on site and in areas where Karoo Dwarf Tortoises are likely to be present both within the wind farm as well as on the public roads to the site.	
Monitoring		
The following monitoring is recommended:	• Construction activities must be monitored by an on-site ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible.	

8.5.2 Operation Phases: Loxton WEF 3

Table 3: Operation phase impacts on the Karoo Dwarf Tortoise: Tortoise mortalities due to roadkill.

Issue	**Operation phase impact on the Karoo Dwarf Tortoise.**	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed by vehicular traffic on the new roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Tortoise populations are generally able to recover from limited mortalities, and thus no irreplaceable losses are anticipated.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the operation phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and can partially reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA component. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high (= no-go) sensitivity areas. • Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Keep a log of on-site tortoise roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures. • Adhere to on-site speed limits and exercise vigilance of tortoises crossing the roads.	
Monitoring		
The following monitoring is recommended:	• Monitor (keep log of) on-site tortoise roadkill mortalities.	

8.5.3 Decommissioning Phases: Loxton WEF 3

Table 4: Decommissioning phase impacts on the Karoo Dwarf Tortoise: Tortoise mortalities due to roadkill.

Issue	**Operation phase impact on the Karoo Dwarf Tortoise.**	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed by vehicular traffic on the new roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Tortoise populations are generally able to recover from limited mortalities, and thus no irreplaceable losses are anticipated.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the decommissioning phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and can partially reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Keep a log of on-site tortoise roadkill mortalities. • Adhere to on-site speed limits and exercise vigilance of tortoises crossing the roads.	
Monitoring		
The following monitoring is recommended:	• Monitor (keep log of) on-site tortoise roadkill mortalities.	

8.5.4 Cumulative impacts

At a ***regional scale***, several other WEF projects have been initiated within 100 km of Loxton WEF 3 site. These are Loxton WEF 1, Loxton WEF 2, Hoogland North WEF 1 (Redcap/Enel), Hoogland North WEF 2 (Redcap/Enel), Hoogland South WEF 3 (Redcap/Enel), Hoogland South WEF 4 (Redcap/Enel), Nuweveld North WEF (Redcap/Enel), Nuweveld East WEF (Redcap/Enel), Nuweveld West WEF (Redcap/Enel), Taaibos North (WKN), Taaibos South (WKN), Soutrivier North (WKN), Soutrivier Central (WKN) and Soutrivier South (WKN). To varying degrees, these WEF projects all fall within the general distribution of the Karoo Dwarf Tortoise.

At a ***more local scale***, some of these new WEF are situated within a 35 km radius of the Loxton WEF 3 site (Figure 15). These are clustered south and south-east of Loxton WEF 3 (some abutting WEF 3).

At the ***scale of the Loxton WEF 3 site*** itself (Figure 14), the layout design completely avoids development in areas of VERY HIGH (NO-GO) sensitivity, and it curtails developments in HIGH and MEDIUM sensitivity

zones. Although Karoo Dwarf Tortoises may also inhabit some of the intervening LOW sensitivity areas, the overall potential impact of the Loxton WEF 3 development on the local tortoise populations will be minimised by restricting the various development components mostly to the areas of LOW sensitivity.

The other WEF projects in the general region would likewise have gone through similar assessments for Karoo Dwarf Tortoises, including similar strategies to for the zonation of sensitive habitats that should be avoided or curtailed in the development of the various WEFs. Individually, these assessments projected that the various types of impacts during the construction, operation and decommissioning phases would be of LOW impact significance (with mitigation) for localised populations of the Karoo Dwarf Tortoise. The development of additional WEFs in the general vicinity is expected to contribute to 1) the cumulative impact of gradual habitat loss and fragmentation of the natural landscape, 2) mortalities of tortoises by means of earth-works activities and on-road vehicular traffic, and 3) potentially also mortalities of tortoises by crows and ravens due to an increase of these corvid birds in the region that may be benefitted by structures (e.g. electrical pylons) that might be provide additional nesting perches to the landscape. Cumulative impacts tend to progressively weaken the overall ecological resilience/integrity of a natural system and should therefore be assessed in addition the site assessments. It is difficult to project with absolute certainty what the significance of such cumulative impacts might be. Compared to the impacts of agricultural activities in the area (especially cases of large-scale overgrazing) on Karoo Dwarf Tortoises, the various impacts that are specifically associated with WEF developments are substantially lower. The significance ratings of the various WEF impacts are all LOW (with mitigation), and it is likely that the cumulative impacts would also still be of LOW significance (Tables 5 and 6) and would therefore not constitute a fatal flaw for the Loxton WEF 3 project.

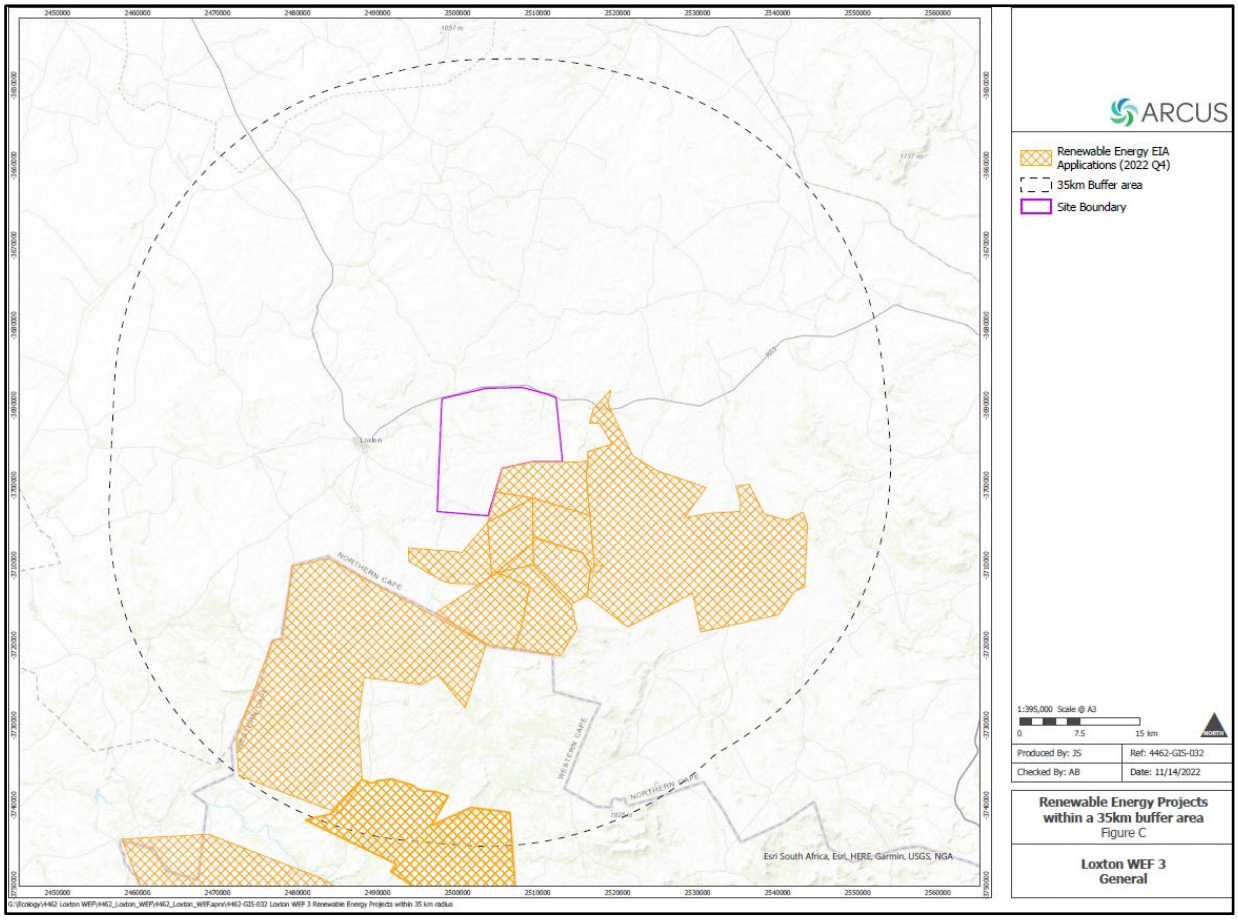


Figure 15: Loxton WEF 3 site (red polygon) in relation to other WEF projects within a 35 km radius.

Table 5: Cumulative impacts on the Karoo Dwarf Tortoise during the construction phase: Habitat loss and degradation.

Description of Impact		
Habitat loss and habitat degradation may impact the Karoo Dwarf Tortoise during construction phase activities in the following three ways: 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape. These types of impact are also associated with other WEF projects in the general region and would therefore also be considered as cumulative impacts to the natural landscape.		
Cumulative impacts		
Nature of cumulative impacts	Cumulative impacts of habitat loss and degradation on the Karoo Dwarf Tortoise are predicted to be low with mitigation because habitat loss in general would be low, and project roads have mostly avoided sensitive habitat. These scenarios also pertain to the other WEF projects in the general region.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 6: Cumulative impacts on the Karoo Dwarf Tortoise during construction, operation and decommissioning phases: Mortalities due to earthworks and roadkill.

Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles during the construction phase, and by vehicular traffic on the new roads during the operation and decommissioning phases. These types of impact are also associated with other WEF projects in the general region and would therefore also be considered as cumulative impacts in this regard.		
Cumulative impacts		
Nature of cumulative impacts	The development would contribute to cumulative impacts on the Karoo Dwarf Tortoise, but this would be transient and the overall long-term contribution to cumulative impacts on this species would be low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

9 OVERALL CONCLUSIONS

As per the SSV assessment, the potential occurrence of Karoo Dwarf Tortoise was assessed as being probable within the Loxton WEF 3 site. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the absence of on-site records and the scarcity of historic and recent records in the general region, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

The site layout design for the Loxton WEF 3 project has been through various iterations during the screening and initial design phases. The sensitivity analysis for the Karoo Dwarf Tortoise was also factored into Loxton WEF 3 layout design, as per the following caveats:

- As a precautionary measure, the dolerite outcrops within the Loxton WEF 3 are considered as NO-GO areas of VERY HIGH sensitivity. The proposed wind farm development footprints may not overlap with any of the specified dolerite habitat nodes.
- As additional caution, other rocky ridges of 10 to 38 degrees slopes are rated as HIGH sensitivity areas. Development within these zones is generally undesirable and may only take place minimally.

- Rocky features with gentle (5 to 9 degrees) slopes are rated as MEDIUM sensitivity areas. A degree of development activities is acceptable within the MEDIUM zones, but it is preferable to side-step these areas where practically feasible.
- The LOW sensitivity areas are deemed to be generally suboptimal for supporting Karoo Dwarf Tortoise populations and development may take place within these areas.

With the exception of the Karoo Dwarf Tortoise, no other SCC reptiles or amphibians were observed during the October 2022 survey (see Table 7) and none are expected to occur within the Loxton WEF 3 study area. The potential occurrence of Karoo Dwarf Tortoises within the study area was taken into consideration during the assessment of potential impacts. The most significant mitigating measure to safeguard these tortoises was the mapping of sensitive zones so that the layout design could avoid areas of HIGH and VERY HIGH sensitivity. The integration of the sensitivity components into the layout design is deemed to be an appropriate buffering scheme that would adequately safeguard Karoo Dwarf Tortoises within the Loxton WEF 3 site. Accordingly, the impacts on Karoo Dwarf Tortoises in the context of the proposed Loxton WEF 3 project are projected to be LOW after mitigation.

As a result, and with the application of the recommended mitigation and avoidance measures, the impacts associated with the Loxton WEF 3 project are considered acceptable. As such, the proposed development is not opposed based on the potential or probable occurrence of Karoo Dwarf Tortoises within the PAOI.

10 ACKNOWLEDGEMENTS

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12 APPENDIX 1 – Herpetofauna records of the 2022 survey

Table 7: List of reptiles and amphibians observed during the October 2022 survey of the Loxton WEF 1, 2 and 3 study areas.

Date	Taxon	Latitude	Longitude	iNaturalist URL
2022/10/15	*Karusasaurus polyzonus*	-31.28773002885282	22.362742982804775	https://www.inaturalist.org/observations/141809448
2022/10/15	*Karusasaurus polyzonus*	-31.274895993992686	22.366957990452647	https://www.inaturalist.org/observations/141812917
2022/10/15	*Stigmochelys pardalis*	-31.262723039835691	22.337642032653093	https://www.inaturalist.org/observations/141672487
2022/10/15	*Psammobates tentorius*	-31.262739971280098	22.337790979072452	https://www.inaturalist.org/observations/141672733
2022/10/15	*Psammobates tentorius*	-31.262953961268067	22.338722040876746	https://www.inaturalist.org/observations/141672734
2022/10/15	*Psammobates tentorius*	-31.266146041452885	22.357246968895197	https://www.inaturalist.org/observations/141676849
2022/10/15	*Amietia poyntoni*	-31.273779021576047	22.364329006522894	https://www.inaturalist.org/observations/141760819
2022/10/15	*Amietia poyntoni*	-31.273779021576047	22.364329006522894	https://www.inaturalist.org/observations/141760820
2022/10/15	*Amietia poyntoni*	-31.273779021576047	22.364329006522894	https://www.inaturalist.org/observations/141760821
2022/10/15	*Amietia poyntoni*	-31.273779021576047	22.364329006522894	https://www.inaturalist.org/observations/141761115
2022/10/15	*Agama atra*	-31.273577017709613	22.366067999973893	https://www.inaturalist.org/observations/141813329
2022/10/15	*Agama aculeata*	-31.270805038511753	22.367935990914702	https://www.inaturalist.org/observations/141813669
2022/10/15	*Amietia poyntoni*	-31.2706040404737	22.368193985894322	https://www.inaturalist.org/observations/141761322
2022/10/15	*Trachylepis variegata*	-31.265225959941745	22.384125972166657	https://www.inaturalist.org/observations/141813996
2022/10/15	*Amietia poyntoni*	-31.265433998778462	22.383835036307573	https://www.inaturalist.org/observations/141762236
2022/10/15	*Trachylepis sulcata*	-31.238651974126697	22.416859986260533	https://www.inaturalist.org/observations/141814310
2022/10/15	*Agama atra*	-31.238605035468936	22.417299030348659	https://www.inaturalist.org/observations/141814898
2022/10/15	*Trachylepis sulcata*	-31.238423986360431	22.416709028184414	https://www.inaturalist.org/observations/141815457
2022/10/16	*Pachydactylus capensis*	-31.305651962757111	22.444726964458823	https://www.inaturalist.org/observations/141815903
2022/10/16	*Pedioplanis lineoocellata*	-31.305651962757111	22.444726964458823	https://www.inaturalist.org/observations/141815904
2022/10/16	*Psammobates tentorius*	-31.2812639772892	22.45017402805388	https://www.inaturalist.org/observations/141676852
2022/10/16	*Stigmochelys pardalis*	-31.28210199996829	22.454992029815912	https://www.inaturalist.org/observations/141676851
2022/10/16	*Stigmochelys pardalis*	-31.282191015779972	22.454961016774178	https://www.inaturalist.org/observations/141676853
2022/10/16	*Stigmochelys pardalis*	-31.282191015779972	22.454961016774178	https://www.inaturalist.org/observations/141676855
2022/10/16	*Stigmochelys pardalis*	-31.282459991052747	22.454990018159151	https://www.inaturalist.org/observations/141676854
2022/10/16	*Psammobates tentorius*	-31.337310997769237	22.419171966612339	https://www.inaturalist.org/observations/141677300
2022/10/16	*Psammobates tentorius*	-31.32773500867188	22.419948969036341	https://www.inaturalist.org/observations/141677718
2022/10/16	*Psammobates tentorius*	-31.321973958984017	22.420753967016935	https://www.inaturalist.org/observations/141677840
2022/10/16	*Psammobates tentorius*	-31.303171003237367	22.409967966377735	https://www.inaturalist.org/observations/141678262

Date	Taxon	Latitude	Longitude	iNaturalist URL
2022/10/16	*Psammobates tentorius*	-31.303144	22.409933	https://www.inaturalist.org/observations/141678263
2022/10/16	*Psammobates tentorius*	-31.303185	22.409944	https://www.inaturalist.org/observations/141678264
2022/10/16	*Psammobates tentorius*	-31.303143	22.409925	https://www.inaturalist.org/observations/141678265
2022/10/16	*Psammobates tentorius*	-31.303151	22.409965	https://www.inaturalist.org/observations/141678266
2022/10/16	*Psammobates tentorius*	-31.303147	22.409987	https://www.inaturalist.org/observations/141678267
2022/10/16	*Agama aculeata*	-31.321487976238132	22.374363988637924	https://www.inaturalist.org/observations/148113493
2022/10/16	*Karusasaurus polyzonus*	-31.332988031208515	22.385972002521157	https://www.inaturalist.org/observations/148113592
2022/10/16	*Amietia poyntoni*	-31.350172022357583	22.390286000445485	https://www.inaturalist.org/observations/141761963
2022/10/16	*Amietia poyntoni*	-31.350177	22.390294	https://www.inaturalist.org/observations/141761964
2022/10/16	*Amietia poyntoni*	-31.350169	22.390277	https://www.inaturalist.org/observations/141761967
2022/10/16	*Amietia poyntoni*	-31.350158	22.390307	https://www.inaturalist.org/observations/141761969
2022/10/16	*Pedioplanis lineoocellata*	-31.359631000086665	22.388068987056613	https://www.inaturalist.org/observations/148113742
2022/10/16	*Karusasaurus polyzonus*	-31.362787038087845	22.386886971071362	https://www.inaturalist.org/observations/148113972
2022/10/16	*Karusasaurus polyzonus*	-31.362913018092513	22.386838020756841	https://www.inaturalist.org/observations/148114333
2022/10/16	*Trachylepis sulcata*	-31.366354040801525	22.383820032700896	https://www.inaturalist.org/observations/148114593
2022/10/16	*Pachydactylus capensis*	-31.368795018643141	22.378000980243087	https://www.inaturalist.org/observations/141816428
2022/10/16	*Pedioplanis lineoocellata*	-31.369233978912234	22.377395974472165	https://www.inaturalist.org/observations/141817067
2022/10/16	*Karusasaurus polyzonus*	-31.369321988895535	22.37708299420774	https://www.inaturalist.org/observations/141817538
2022/10/16	*Pedioplanis lineoocellata*	-31.36868798173964	22.37736102193594	https://www.inaturalist.org/observations/141817539
2022/10/16	*Karusasaurus polyzonus*	-31.368655962869525	22.37736102193594	https://www.inaturalist.org/observations/141817540
2022/10/16	*Vandijkophrynus gariepensis*	-31.387826967984438	22.379149971529841	https://www.inaturalist.org/observations/148116915
2022/10/16	*Vandijkophrynus gariepensis*	-31.387826967984438	22.379149971529841	https://www.inaturalist.org/observations/148116916
2022/10/16	*Psammobates tentorius*	-31.380970990285277	22.402876960113645	https://www.inaturalist.org/observations/148117228
2022/10/16	*Psammobates tentorius*	-31.397801013663411	22.444365033879876	https://www.inaturalist.org/observations/141678460
2022/10/16	*Agama atra*	-31.397906038910151	22.444410966709256	https://www.inaturalist.org/observations/148311625
2022/10/17	*Agama atra*	-31.519034011289477	22.436845963820815	https://www.inaturalist.org/observations/148311626
2022/10/17	*Karusasaurus polyzonus*	-31.52445500716567	22.440793002024293	https://www.inaturalist.org/observations/148311627
2022/10/17	*Agama atra*	-31.52445500716567	22.440793002024293	https://www.inaturalist.org/observations/148311628
2022/10/17	*Amietia poyntoni*	-31.530616963282228	22.452442003414035	https://www.inaturalist.org/observations/141762439
2022/10/17	*Agama atra*	-31.527927964925766	22.452971991151571	https://www.inaturalist.org/observations/148311770
2022/10/17	*Pedioplanis laticeps*	-31.518617011606693	22.456587022170424	https://www.inaturalist.org/observations/148312388
2022/10/17	*Pedioplanis laticeps*	-31.51878297328949	22.456660028547049	https://www.inaturalist.org/observations/148312389
2022/10/17	*Pedioplanis lineoocellata*	-31.506628962233663	22.459895024076104	https://www.inaturalist.org/observations/148312601

Date	Taxon	Latitude	Longitude	iNaturalist URL
2022/10/17	*Agama aculeata*	-31.497976994141936	22.47984797693789	https://www.inaturalist.org/observations/148312717
2022/10/17	*Karusasaurus polyzonus*	-31.494967974722385	22.490784013643861	https://www.inaturalist.org/observations/148313232
2022/10/17	*Karusasaurus polyzonus*	-31.494488026946783	22.491497984156013	https://www.inaturalist.org/observations/148313235
2022/10/17	*Agama atra*	-31.494488026946783	22.491497984156013	https://www.inaturalist.org/observations/148313237
2022/10/17	*Pedioplanis lineoocellata*	-31.49413900449872	22.49263096600771	https://www.inaturalist.org/observations/148313426
2022/10/17	*Pedioplanis lineoocellata*	-31.494155013933778	22.492943024262786	https://www.inaturalist.org/observations/148313427
2022/10/17	*Pedioplanis laticeps*	-31.493825018405914	22.492914022877812	https://www.inaturalist.org/observations/148314681
2022/10/17	*Pedioplanis laticeps*	-31.490827985107899	22.503917030990124	https://www.inaturalist.org/observations/148315526
2022/10/17	*Amietia poyntoni*	-31.490815998986363	22.508372012525797	https://www.inaturalist.org/observations/141763026
2022/10/17	*Amietia poyntoni*	-31.490815998986363	22.508372012525797	https://www.inaturalist.org/observations/141763027
2022/10/17	*Stigmochelys pardalis*	-31.491286978125572	22.508602011948824	https://www.inaturalist.org/observations/141678610
2022/10/17	*Karusasaurus polyzonus*	-31.487947963178158	22.519881958141923	https://www.inaturalist.org/observations/148315982
2022/10/17	*Pedioplanis lineoocellata*	-31.487317979335785	22.52148499712348	https://www.inaturalist.org/observations/148315983
2022/10/17	*Psammobates tentorius*	-31.487118992954493	22.521881964057684	https://www.inaturalist.org/observations/141678699
2022/10/17	*Trachylepis variegata*	-31.48745602928102	22.520771026611328	https://www.inaturalist.org/observations/148316745
2022/10/17	*Pedioplanis lineoocellata*	-31.487495005130768	22.520782006904483	https://www.inaturalist.org/observations/148316746
2022/10/17	*Karusasaurus polyzonus*	-31.487617967650294	22.520307004451752	https://www.inaturalist.org/observations/148316747
2022/10/17	*Pedioplanis lineoocellata*	-31.486051976680756	22.51014101319015	https://www.inaturalist.org/observations/148317130
2022/10/17	*Karusasaurus polyzonus*	-31.479205973446369	22.510511996224523	https://www.inaturalist.org/observations/148317131
2022/10/17	*Agama atra*	-31.479274034500122	22.510015033185482	https://www.inaturalist.org/observations/148317133
2022/10/17	*Trachylepis sulcata*	-31.479449970647693	22.510132966563106	https://www.inaturalist.org/observations/148317134
2022/10/17	*Karusasaurus polyzonus*	-31.479682987555861	22.509440034627914	https://www.inaturalist.org/observations/148317434
2022/10/17	*Stigmochelys pardalis*	-31.478513041511178	22.497036997228861	https://www.inaturalist.org/observations/139132469
2022/10/17	*Karusasaurus polyzonus*	-31.486507030203938	22.473052013665438	https://www.inaturalist.org/observations/148317819
2022/10/17	*Stigmochelys pardalis*	-31.492955982685089	22.467568991705775	https://www.inaturalist.org/observations/141678815
2022/10/18	*Agama aculeata*	-31.425938978791237	22.517826966941357	https://www.inaturalist.org/observations/148318124
2022/10/18	*Agama atra*	-31.426421022042632	22.517500994727015	https://www.inaturalist.org/observations/148318125
2022/10/18	*Pedioplanis lineoocellata*	-31.434306968003511	22.508871993049979	https://www.inaturalist.org/observations/148318126
2022/10/18	*Trachylepis variegata*	-31.433612024411559	22.507955012843013	https://www.inaturalist.org/observations/148320609
2022/10/18	*Amietia poyntoni*	-31.444639004766941	22.508970983326435	https://www.inaturalist.org/observations/141763186
2022/10/18	*Amietia poyntoni*	-31.444639004766941	22.508970983326435	https://www.inaturalist.org/observations/141763424
2022/10/18	*Karusasaurus polyzonus*	-31.423679972067475	22.517692018300295	https://www.inaturalist.org/observations/148321228