

# TANKWA

# PROTECTED ENVIRONMENT

## Management Plan

2023 – 2028



**Prepared by:** Brakfontein Trust, with assistance from South African National Parks (SANParks), Wilderness Foundation Africa (WFA), WWF South Africa (WWF-SA) and the Leslie Hill Succulent Karoo Trust (LHSKT).

**Citation:** Tankwa Protected Environment (TPE), 2023. Management Plan, Version 1, Northern Cape Province, South Africa

## STATUS

The Tankwa Protected Environment has been declared under Section 28 Protected Environment, under the National Environmental Management: Protected Areas Act (No. 57 of 2003).

Declaration date:	Government gazette notice:
YYYY – MM – DD <hr/>	Gazette reference nr. <hr/>

DRAFT

# AUTHORIZATION

This management plan is hereby internally accepted and authorised as required for managing the Tankwa Protected Environment (TPE) in terms of Sections 39 and 41 of the National Environmental Management: Protected Areas Act No 57 of 2003 (NEM:PAA).

Supported by: South African National Parks

Recommended and adopted by:

Name and Title	Signature and Date
<p><b>Management Authority</b></p> <p>Brakfontein Trust (IT nr.: 901/97) by virtue of a resolution herein represented by Mr Francois van der Merwe.</p>	<p>Signature: _____</p> <p>Date: _____</p>
<p><b>South African National Parks</b></p> <p><i>Name of signatory</i></p> <p>_____</p> <p><i>Title of signatory</i></p> <p>_____</p>	<p>Signature: _____</p> <p>Date: _____</p>

Approved by:

Name and title	Signature and date
<p><b>Department Forestry, Fisheries, and the Environment</b></p> <p><i>Name of signatory</i></p> <p>_____</p> <p><i>Title of signatory</i></p> <p>_____</p>	<p>Signature: _____</p> <p>Date: _____</p>

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## ABBREVIATIONS

<b>APO</b>	Annual Plan of Operation
<b>AIP</b>	Alien and Invasive Plants
<b>CARA</b>	Conservation of Agricultural Resources Act
<b>CBA</b>	Critical Biodiversity Area
<b>CITES</b>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>CMA</b>	Catchment Management Authority
<b>CR</b>	Critically Endangered
<b>CREW</b>	Custodians of Rare and Endangered Wildflowers
<b>DFFE</b>	Department of Forestry, Fisheries and Environment
<b>DAELR</b>	Northern Cape Department: Agriculture, Environmental Affairs, Land Reform and Rural Development (The Department)
<b>DWA</b>	National Department of Water Affairs
<b>EIA</b>	Environmental Impact Assessment
<b>EMF</b>	Environmental Management Framework
<b>EMP</b>	Environmental Management Plan
<b>EN</b>	Endangered
<b>ESA</b>	Ecological Support Area
<b>FEPA</b>	Freshwater Ecosystem Priority Area
<b>FPA</b>	Fire Protection Association
<b>GIS</b>	Geographical Information System
<b>IDP</b>	Integrated Development Plan (Municipal)
<b>IUCN</b>	International Union for the Conservation of Nature
<b>LC</b>	Least Concern
<b>LHSKT</b>	Leslie Hill Succulent Karoo Trust
<b>LT</b>	Least Threatened
<b>MA</b>	Management Authority
<b>MAP</b>	Mean Annual Precipitation
<b>MCA</b>	Mountain Catchment Area
<b>MEC</b>	Member of the Executive Council
<b>METT</b>	Management Effectiveness Tracking Tool
<b>MOA</b>	Memorandum of Agreement
<b>MOU</b>	Memorandum of Understanding
<b>NBA</b>	National Biodiversity Assessment
<b>NEM:BA</b>	National Environmental Management: Biodiversity Act
<b>NEM:PAA</b>	National Environmental Management: Protected Areas Act
<b>NEMA</b>	National Environmental Management Act
<b>NFEPA</b>	National Freshwater Ecosystem Priority Area
<b>NGO</b>	Non-governmental Organisation
<b>NPAES</b>	National Protected Area Expansion Strategy
<b>NCPAES</b>	Northern Cape Protected Area Expansion Strategy
<b>NR</b>	Nature Reserve
<b>NSBA</b>	National Spatial Biodiversity Assessment
<b>NWA</b>	National Water Act

<b>ONA</b>	Other Natural Area
<b>PA</b>	Protected Area
<b>PE</b>	Protected Environment
<b>SAHRA</b>	South African Heritage Resources Agency
<b>SANBI</b>	South African National Biodiversity Institute
<b>SANParks</b>	South African National Parks
<b>SDF</b>	Spatial Development Framework
<b>SKEP</b>	Succulent Karoo Ecosystem Programme
<b>SMP</b>	Strategic Management Plan
<b>SDF</b>	Spatial Development Framework (Municipal)
<b>SMME</b>	Small, Micro and Medium Enterprises
<b>SMP</b>	Strategic Management Plan
<b>TKNP</b>	Tankwa Karoo National Park
<b>TKCWC</b>	Tankwa Karoo to Cederberg Wilderness Corridor (the 'corridor')
<b>TPE</b>	Tankwa Protected Environment
<b>VU</b>	Vulnerable
<b>WFA</b>	Wilderness Foundation Africa
<b>WWF-SA</b>	World Wide Fund for Nature South Africa

# 1. BACKGROUND

## 1.1 Purpose of this document

Management plans for biodiversity stewardship sites are strategic documents that provide the framework for the development and operation of biodiversity stewardship sites. These documents inform management at all levels, from the landowner through to South African National Parks (SANParks) support staff. The purpose of the management plan is to:

- Provide the primary strategic tool for management of Tankwa Protected Environment (TPE), informing the need for specific programmes and operational procedures.
- Provide for capacity building, future thinking, and continuity of management.
- Enable the landowner to develop and manage the Tankwa Protected Environment (TPE) in such a way that the purposes for which it has been established are fulfilled.

## 1.2 Structure of the management plan

Section 1.	Background and introduction to the Tankwa Protected Environment management plan.
Section 2.	Strategic management framework for the Tankwa Protected Environment.
Section 3.	Description of the Tankwa Protected Environment – Legislative basis, history and biophysical context, cultural and socio-economic context.
Section 4.	Important biodiversity of the Tankwa Protected Environment.
Section 5.	Legal and administrative framework.
Section 6.	Protected area policy and operational framework which sets out the management objectives and targets for the Tankwa Protected Environment.
Section 7.	Development framework which sets out the zonation plan and development plan for the Tankwa Protected Environment.
Section 8.	Restricted activities listed for the Tankwa Protected Environment
Section 9.	Five-year costing plan which estimates the cost linked to the various key performance areas.
Section 10.	Management plan implementation, review, and annual plan of operations

## 1.3 Adaptive management

Adaptive management (Figure 1.1) is a structured, iterative process in which decisions are made using the best available information, with the aim of obtaining better information through monitoring of performance. Decision making is therefore aimed at achieving the best outcome based on current understanding, whilst accruing the information needed to improve future management. Adaptive management can lead to revision of a part or, if necessary, the whole management plan.

Adaptive management enables landowners and managers to learn through experience; take account of, and respond to, changing factors that affect the Protected Areas; develop or refine management processes; adopt best practice and innovation; and demonstrate that management is appropriate and effective.

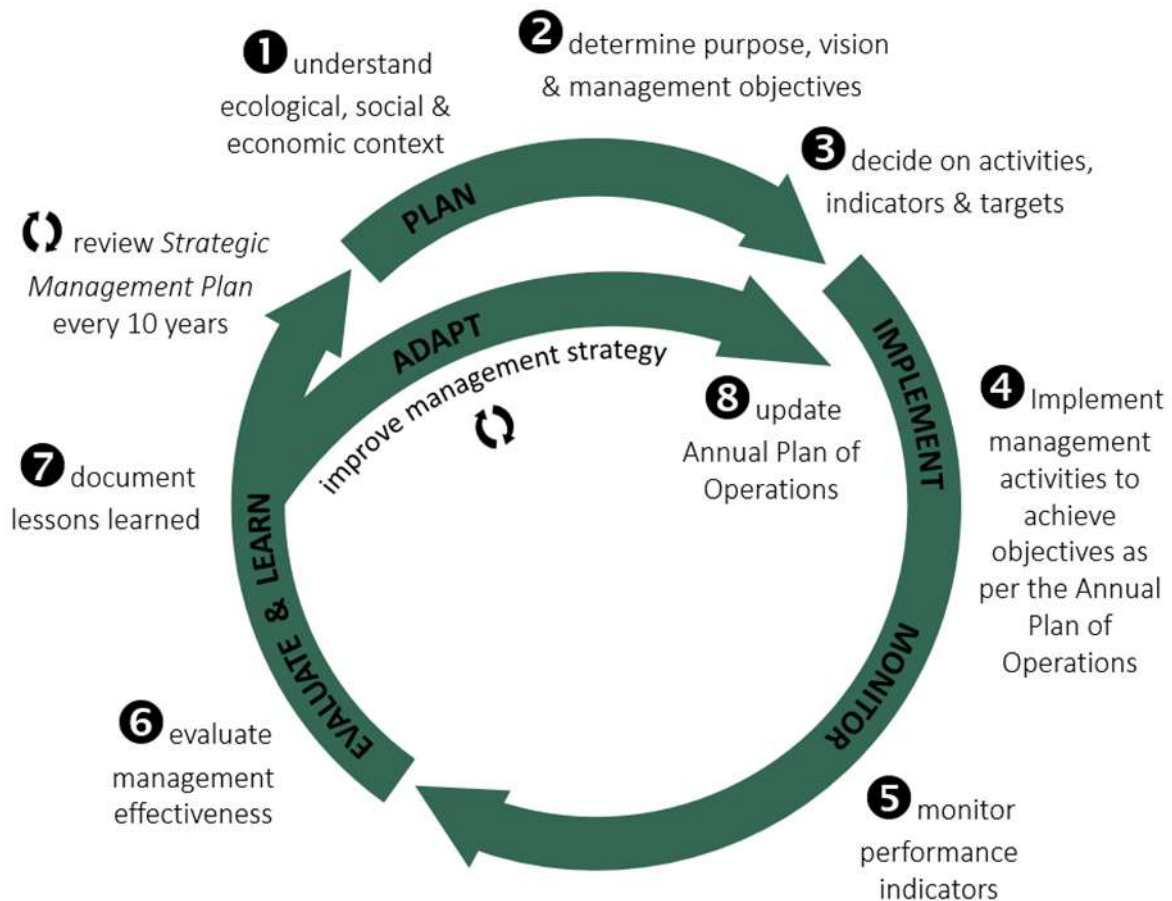


Figure 1.1 The adaptive management cycle

## 1.4 Introduction to the Tankwa Protected Environment

The Tankwa Protected Environment (TPE) (Figure 1.2) is situated within the Namaqua District and Hantam Local Municipalities of the Northern Cape Province of South Africa. The R355, which runs between Ceres and Calvinia, is the closest regional road to the property with Calvinia the closest town.

On a cadastral level the TPE is situated within the first-tier priority zone which was identified for the proposed Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC). The creation of this ecological corridor has long been an ambition in the conservation community that connects the Cederberg Wilderness Area towards the west with the Tankwa Karoo National Park further east and in so doing, creating a mega interprovincial protected area of approximately 240 000 hectares.

The TPE is also situated within the Succulent Karoo biome which is a globally recognised biodiversity hotspot and one of only two arid biodiversity hotspots on the planet. Five National Freshwater Ecosystem Priority Areas (NFEPA) occur on the property which significantly contribute towards the ecological value of the corridor. These NFEPA's include the Doring, Tankwa, Brakfontein, Tra-Tra and Matjiesfontein Rivers with the TPE also forming an important part of their confluence.

Tankwa Protected Environment is a collection of six neighbouring farm portions, covering a total area of 11362.2193 hectares, owned by the Brakfontein Trust (IT nr.:901/97). The TPE comprises of the following farm portions:

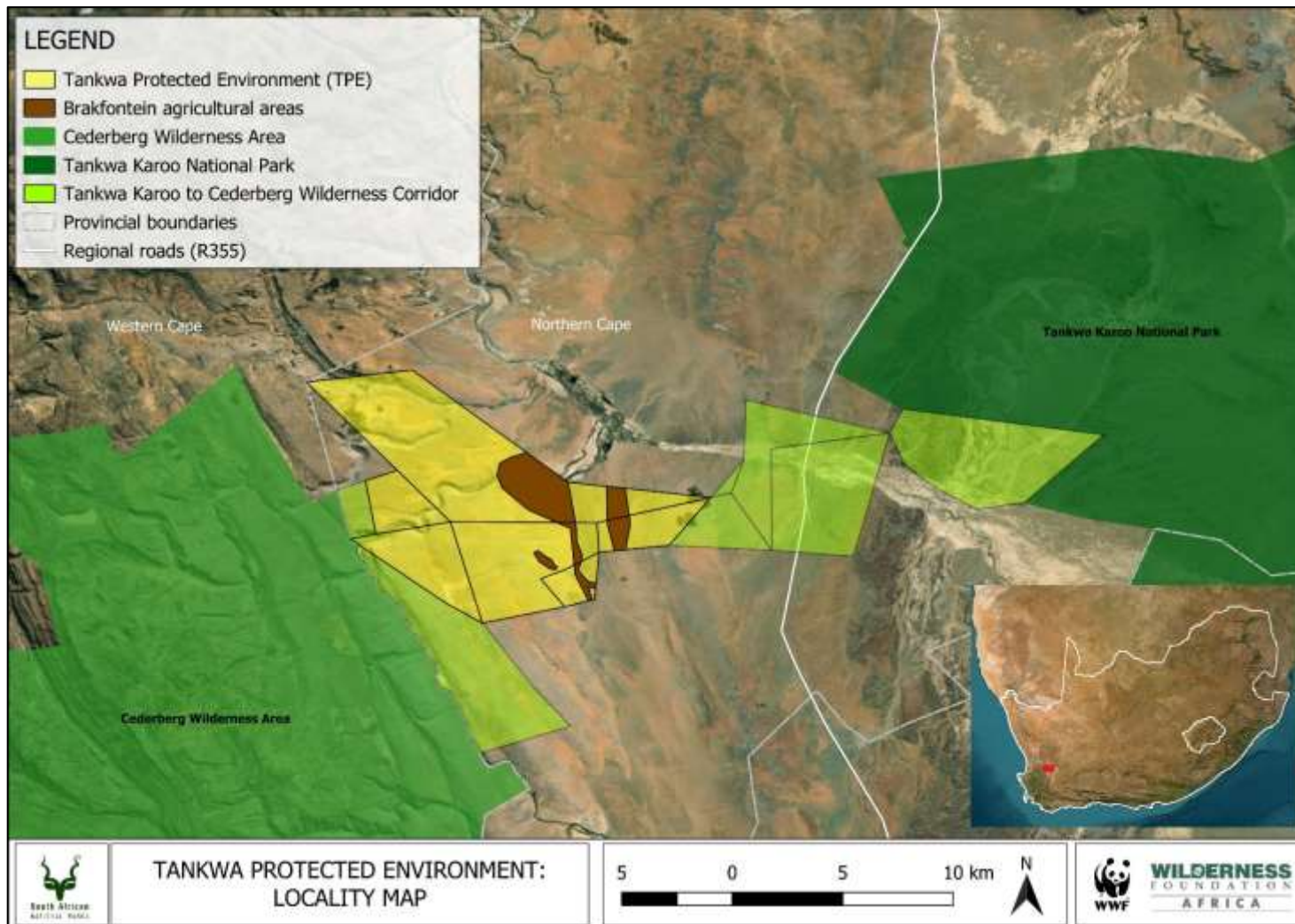
1. REMAINDER OF THE FARM WITKOP 1117, 788.6411HA
2. REMAINDER OF THE FARM ELANDSVLEI 1116, 5660.6966HA
3. REMAINDER OF THE FARM VOETPAD 1113, 735.4166HA
4. THE FARM OS VLEY 1122, 1335.9101HA
5. THE FARM BRAKFORTEIN 1121, 2415.7971HA
6. THE FARM BRAKKEFORTEIN 1120, 425.7578HA

The concept and opportunity to form part of the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC) was introduced to the landowner by Wilderness Foundation Africa (WFA) and SANParks. After the Landowner's willingness to form part of the corridor was established, the property was assessed and presented to the SANParks Land Inclusion Committee. During this review, the committee agreed on the conservation worthiness of the property and that it qualified for Protected Environment status in terms of Section 28 of the National Environmental Management: Protected Areas Act (No. 57 of 2003) (NEM:PAA).

In 2020, the Landowner decided to proceed with the declaration of **10 113.2** hectares of the property as the *Tankwa Protected Environment*, through use of a Protected Environment proclamation diagram (Annexure 1). The notice of proclamation for the Tankwa Protected Environment appeared in the National Government Gazette on [REDACTED].

SANParks has committed to fulfil the role of the conservation authority responsible for supporting the declared protected area through annual visits and evaluating the management of the protected areas established in the corridor. The legal declaration of the protected environments in the corridor have also been processed by SANParks and the National Minister responsible for the Environment.

Through its proclamation, the TPE is subject to the provisions of the Protected Areas Act. The act requires that the management authority (MA) of a protected area must, within 12 months of the assignment as the management authority, submit a management plan for the protected area to the Member of the Executive Council (MEC) or National Minister responsible for the environment, for approval. This document serves as the management plan for the Tankwa Protected Environment.



Figur3 1.2 Locality map for the Tankwa Protected Environment

## 2. STRATEGIC MANAGEMENT FRAMEWORK

The strategic management framework is aimed at providing the basis for the protection, development, and operation of the protected area over a five-year period. It consists of the vision, purpose, and objectives of the Tankwa Protected Environment.

### 2.1 Purpose of the Tankwa Protected Environment

The purpose of the Tankwa Protected Environment is the foundation on which all future actions are based and is in line with the key ecological attributes of the Protected Environment and the overall management philosophy of the management authority. According to Section 17 of the National Environmental Management: Protected Areas Act (NEM: PAA), the purpose of declaring Protected Areas is:

- a) **to protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in a system of protected areas;**
- b) **to preserve the ecological integrity of those areas;**
- c) **to conserve biodiversity in those areas;**
- d) **to protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa;**
- e) to protect South Africa's threatened or rare species;
- f) **to protect an area which is vulnerable or ecologically sensitive;**
- g) **to assist in ensuring the sustained supply of environmental goods and services;**
- h) **to provide for the \*sustainable use of natural and biological resources;**
- i) **to create or augment destinations for nature-based tourism;**
- j) **to manage the interrelationship between natural environmental biodiversity, human settlement, and economic development.**
- k) Generally, to contribute to human, social, cultural, spiritual, and economic development; or
- l) **To rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.**

Considering the above, the Tankwa Protected Environment strives to contribute to the NEM: PAA section 17 listed purposes above (in bold) through formal declaration as a Protected Environment and forming part of the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC). The corridor's overall objectives also include improving sustainable land use practices\* and facilitating the conservation of natural, landscape scale patterns and processes.

*\*The terms 'natural resource use' and 'sustainable land use' in this document generally refers to livestock grazing and low impact eco-tourism activities.*

## 2.2 Vision

The vision statement below describes the desired long-term, over-arching outcome that is a result of the effective management of the Tankwa Protected Environment:

**“A Protected Environment striving to improve ecological functioning and promote sustainable land use within the Tankwa Karoo to Cederberg Wilderness Corridor.”**

## 2.3 Management Focus Areas, Challenges and Opportunities

**Table 2.1** Management focus areas, challenges, and opportunities for the Tankwa Protected Environment

<b>Management Focus Areas</b>	<b>Challenges and Opportunities</b>
<b>Alien invasive flora and fauna</b>	<p>In terms of the Conservation of Agricultural Resources Act No. 43 of 1983, the management of alien invasive plant species (AIP) is a legal requirement on any private property. AIP on the property is largely restricted to riparian areas (including seeps) and infrastructure. AIP outside of these areas only occur at extremely low densities. The Doring and Tra-Tra rivers will be the focus of AIP clearing activities where infestations through <i>Sesbania punicea</i>, <i>Nerium oleander</i> and <i>Eucalyptus camaldulensis</i> occur. A comprehensive, landscape scale clearing plan will be required for the effective management of AIP in these riparian systems.</p> <p>Invasive and problem causing animals, such as feral donkeys and ostrich, will also require management within the greater TKCWC.</p>
<b>Freshwater habitat and alien invasive fish species management</b>	<p>Endemic freshwater fish species and the management of the habitats in which they occur is an important focus area for the TPE. The Doring and Tra-Tra Rivers hosts a range of endangered and endemic freshwater fish species as part of the Olifants-Doring River System (ODRS). The most prominent of these include the Near Threatened (NT) Clanwilliam yellowfish (<i>Labeobarbus seeberi</i>) and Endangered (EN) Clanwilliam sandfish (<i>Labeo seeberi</i>). The primary threat to these indigenous fish species is predation and competition by alien invasive fish species such as the bluegill sunfish (<i>Lepomis macrochirus</i>) and various bass species (<i>Micropterus salmoides</i>, <i>M. punctulatus</i> en <i>M. dolomieu</i>) which were released in the ODRS for recreational angling. Challenges include the locality of the TKCWC relatively low down within the ODRS system which nullifies the potential effectiveness of piscicides. Costs related to the construction of a fish ladder at the Brakfontein weir are high. Partnerships with projects such as Saving Sandfish implemented by Cape Critical Rivers Programme can be investigated. Environmental education is another effective tool that can be used to create awareness among local and recreational anglers.</p>



	The management of alien invasive plants will compliment this management focus area as it will also improve freshwater ecosystem management.
<b>Soil erosion and landscape degradation management</b>	Historically, the property was utilized for extensive livestock farming. Bearing in mind that an extended drought was experienced in the area, signs of degradation directly resulting from livestock grazing practices are limited. Focus will be placed on identifying degraded areas on the property, consulting with specialists (SANParks Scientific Services) in terms of appropriate interventions, and monitoring of veld condition / implemented activities.
<b>Infrastructure management</b>	Focus will be placed on fence line and road maintenance. While corrosion of fencing material is generally low due to the arid climate experienced in the Tankwa Karoo, fences are often damaged by game such as Gemsbok. Although the property has a limited road network, especially in the western quartzite section, roads in the more erosion prone shale sections will require attention. Water provision infrastructure is limited with a natural seep on portion RE/1120 and the Doring River the main source of surface water for livestock and game.
<b>Livestock and veld condition management</b>	Livestock grazing and veld condition management is possibly the most significant management focus area for the TPE as the rangelands on the property are utilized by the Management Authority for commercial livestock grazing. Since the Tankwa Karoo, is considered an extremely marginal extensive livestock farming region, it is vital to implement sustainable grazing guidelines for the TPE as included in the Tankwa Karoo to Cederberg Wilderness Corridor Ecological Guidelines document and section 6.2.5 of this management plan.
<b>Game management</b>	Game numbers need to be considered when calculating stocking rates and densities for livestock. However, the natural movement of game through the TKCWC and neighbouring farms make it difficult to establish exact game numbers for the TPE. For this reason, a corridor wide approach will be considered for game management. A Game Management Plan will be drafted for the TPE which defines management details for all game species present on the property.
<b>Monitoring</b>	The Management Authority can start with basic data collection, including record keeping of rainfall, livestock grazing and game numbers. SANParks can be engaged to assist with the implementation of monitoring programmes and research projects.
<b>Cultural Heritage Management</b>	The TKCWC is largely undiscovered from an archaeological perspective, there are therefore opportunities to partner with organisations such as the Eastern Cederberg Rock Art Group (eCRAG), SANParks and archaeological researchers working in the area. This will likely lead to new

	discoveries of the Middle Stone Age hunter-gatherers era and also more recent history. It will contribute to the preservation of the cultural heritage assets of the PE and also for the rest of the Corridor.
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### 3. DESCRIPTION OF THE TANKWA PROTECTED ENVIRONMENT

#### 3.1 Legislative basis for the management of the Tankwa Protected Environment

There is a large body of legislation that is relevant to the management of Tankwa Protected Environment, but the primary legislation guiding the management of protected areas, is the National Environmental Management: Protected Areas Act (No.57 of 2003) (Hereafter referred to as the Act).

The Act establishes the legal basis for the creation and administration of protected areas in South Africa, as its objectives include provisions “for the protection and conservation of ecologically viable areas representative of South Africa’s biological diversity and its natural landscapes”. The Act sets out the mechanisms for the declaration of protected areas and the requirements for their management.

SANParks and the Northern Cape Department: Agriculture, Environmental Affairs, Land Reform and Rural Development (DAELR/ ‘the Department’) are the conservation authorities responsible for protected area expansion in the Northern Cape. These two entities’ Biodiversity Stewardship Programmes facilitate the establishment and management of protected areas on private land in the province.

For the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC), SANParks is the Biodiversity Stewardship implementing agent and conservation authority responsible for evaluating the management of Stewardship sites in the corridor.

A detailed list of relevant legislation is provided in Appendix 3. Landowners should familiarize themselves with the purpose and contents of the statutes and their subsequent amendments and regulations.

##### 3.1.1 Proclamation status of the Tankwa Protected Environment

Tankwa Protected Environment is proclaimed under Section 28 (1) of the National Environmental Management: Protected Areas Act (Act 57 of 2003). See Appendix 2 for copy of the Tankwa Protected Environment Proclamation Notice.

##### 3.1.2 Declaration agreement

Available on request from the landowner.

#### 3.2 History of the Tankwa Protected Environment

Below follows a written account by Mr. Charl Johannes van der Merwe, father of Francois van der Merwe (signee of this management plan) and co-trustee of the ‘Brakfontein Trust’ regarding the history of the Brakfontein farm, a large section of which has been declared as the Tankwa Protected Environment. Mr. C. J. Van der Merwe purchased the property, known as Brakfontein, in 1983. This acquisition was one the initial steps which eventually enabled the Tankwa Protected Environment to

be declared under their family's ownership. The below account is in Afrikaans, which is Mr. C. J. Van der Merwe's first language:

*"Gedurende die jaar 1983 het ek in 'n posisie gekom waar ek begin oorweeg het om grond by te koop. Ek het die prokureursfirma, F.J. vd Merwe op Calvinia, genader en het Johan Steenkamp my na Brakfontein vir besigtiging geneem. Die plaas het aan Christie Visagie behoort wat dit by sy pa oorgeneem het wat dit op sy beurt by die bekende Hough-familie gekoop het.*

*Op daardie stadium was daar vyf weikampe aan die oostekant van die rivier. Aan die westekant het die grensdraad gedeeltelik oop gelê. In my oorweging vir die koop van die plaas, het ek gedink dat ek minder per GVE vir die plaas betaal as wat die geval in my omgewing sou wees. Die feit dat die Doringrivier, wat vir ag maande van die jaar vloei, deur die plaas geloop het, het boonop die potensiaal van besproeiing gehad en het hierdie faktor die deurslag gegee in my besluit om te koop.*

*Gedurende 1984 het ek daar aktief begin boer. Die fokus was op daardie stadium op die span van draad aan die westekant van die rivier. Dit sou my instaat stel om met 800 ooie te boer en het ek 'n driekamp-weistelsel gevolg. As gevolg van die feit dat boere in die omgewing nie meer met vee boer nie en die totstandkoming van die Tankwa Nasionale Park plaasgevind het, het roofdiere so 'n probleem geraak dat na beesboerdery oorgeskakel moes word. Alhoewel die veld nie noodwendig so geskik is vir beesboerdery nie, kon die bees tog weiding in die rivierloop benut wat nie deur skaap benut kon word nie.*

*Gedurende Augustus 1986 het 'n ingenieur, Lawrence Nissen, Brakfontein besoek met die oog daarop om besproeiingsontwikkeling te beplan. Vir die volgende 20 jaar sou hy 'n groot rol speel in die ontwikkeling van die besproeiing. Die eerste stap was om beplanning te doen vir die stoor van water vir die droë somermaande. Op daardie stadium was die gebied 'n staatswater-beheergebied en het daar 'n besproeiingsraad gefunksioneer. Ek het die vergaderings begin bywoon en was nie verbaas om te hoor hoe die lede stry oor die skaarswater wanneer die rivier swak begin vloei en later loop staan nie. Die fokus was glad nie daarop om stoorkapasiteit te skep sodat almal genoeg water deur die droë somermaande kan hê nie. Nissen het gedurende 1988 'n plan vir 'n gesamentlike dam aan die Raad voorgelê wat deur die meerderheid van die lede verwerp is. Dit het gemaak dat ek verplig was om op my eie 'n dam te bou. Hierdie besluit het daartoe gelei dat daar 'n hofstryd tussen die Raad aan die een kant en Dept. Waterwese en myself aan die anderkant ontstaan het. Dit het 'n vertraging veroorsaak, maar kon ons tog gedurende 1990 begin met die bouwerk.*

*Om die fundamente skoon te kry was 'n uitdaging. Daar was baie sand om te verwyder en baie water wat onder die sand was, moes weggepomp word. 'n Skalielaag wat onder die bank was, moes met bank en al verwyder word en het dit ook beteken dat baie meer beton gegiet moes word as wat aanvanklik beplan is. Die eerste jaar het ons die sand net mooi verwyder toe die rivier weer afgekom het. Die volgende jaar moes ons die proses van skoonmaak herhaal en kon ons wel daarin slaag om met die sementwal tot sowat 'n meter onder die sandoppervlakte te vorder. Die derde jaar kon ons die sand met 'n wieltrekker wegstoot. Ek sal iets nalaat as ek nie die rol van Willem Witbooi uitlig nie. Hy was 'n vakman sonder opleiding. Onder die wakende oog van Nissen en met my bystand met die hegting*

van die staal, het Willem die twaalfmeter hoë struktuur wat die turbine moes huisves, opgerig.

*Die dam se bou het hoë fisiese en finansiële eise gestel. Die situasie is vererger deur die droogte wat op daardie stadium in Calvinia geheers het. Dit het veroorsaak dat die dambouery eers voorlopig gestaak moes word. Soos omstandighede verbeter het, het ons weer begin bou en uiteindelik het my seun, Francois, die dam na sowat 20 jaar voltooi.*

*Die ontwikkeling van die besproeiing het ook oor 'n hele aantal jare gestrek. Ons het gedink die grootste uitdaging is om die dam te bou. Later het ons begin dink dat die besproeiingsontwikkeling die grootste uitdaging bied. Die redes daarvoor was finansiële, maar ook dat ons nie ondervindig gehad het nie en daar ook nie 'n bruikbare voorbeeld in die omgewing was nie. Aanvanklik het ons gespeel met die gedagte om soutbos-weiding te vestig en met vee daarop te boer. Toe die kleinveebedryf egter 'n insinking beleef, het ek besef dat ek na alternatiewe moes kyk. Op 'n stadium het ek erkende wetenskaplikes gekry om advies te gee oor wat ons kan verbou. Hul aanvanklike mening was dat die grond eintlik vir niks geskik is nie. Dit was 'n groot teleurstelling, want tagtig persent van die dam se uitgawes was toe reeds aangegaan. Daar was baie mense wat skepties was oor die hele projek. Onder andere het 'n helikopter op 'n dag daar by die halfvoltooide dam geland. Dit was ministers van die Noord-Kaapse-regering. Toe hul later weer opstyg, het een van hulle opgemerk: "Dit moet 'n mal mens wees wat hier probeer boer." Die wetenskaplikes het later 'n ander deuntjie begin sing en is die eerste wingerd in 1996 aangeplant. Geleidelik is die wingerd uitgebrei tot 25 hektaar droogdruive en 10 hektaar onderstokke wat op kontrak vir die Bosmanboerdery van Lelienfontein gelewer word.*

*Die ontwikkeling van die wingerdboerdery tesame met die verwerwing van meer kundigheid, het die hele aangesig van die boerdery verander. Die veeboerdery is begin met slegs een arbeider en het dit verander na 'n intensiewe boerdery waarby 20 permanente arbeiders en tot 50 tydelike werkers betrokke is. Dit het beteken dat arbeidershuise opgerig moes word wat op sy beurt daartoe gelei het dat die skool vanaf Elandsvlei na Brakfontein geskuif het. Hierdie situasie van besproeiingsontwikkeling en mensontwikkeling is baie bevredigend.*

*Op hierdie stadium sluit die boerdery se mikpunte in om oor te skakel na sonkrag om die water te pomp en om die oppervlak onder wingerd verder uit te brei. Die verhoging van produksie bly steeds 'n bereikbare doelwit met nuwe praktyke en nuwe variëteite wat beskikbaar kom. Hierdie verhoogde produksie wil ons bereik op 'n omgewingsvriendelike manier wat die volhoubaarheid van die boerdery sal verseker."*

## 3.3 Biophysical context of Tankwa Protected Environment

### 3.3.1 Climate and weather

The TPE is situated in a winter-rainfall regime with most rainfall between May and August, while December and January are generally precipitation free. The region has a high spatial variability in terms of rainfall, with some areas referred to as 'rain shadows' experiencing as little as 40mm average rainfall per year. Weather stations in the Tankwa Karoo region recorded a Mean Annual Precipitation (MAP) that varies from a low of 72mm (measured at the neighbouring farm Elandsvlei farm weather

station over a 41-year period before 2006), to a high of 112mm (measured at Reenen over a 79-year period before 2006) (Mucina et. al., 2006).

The Elandsvlei farm which also forms part of the TKCWC recorded a mean maximum temperature of 36.4°C in February with an extreme maximum of 45.9°C in February 1995. The coldest month is July with a mean minimum temperature of 5.8°C. The extreme minimum temperature recorded was -1.3°C in July 1981. Rainfall in the Roggeveld ranges from 300 – 500mm per annum, while the Tanqua Karoo receives between 50 and 300mm per annum (Van der Merwe, 2010).

The climate, and especially rainfall, as an ecological driver of the Tankwa Karoo ecosystem, is described as ‘episodic’ with extended droughts a common occurrence (Balfour, pers. comm., 2020).

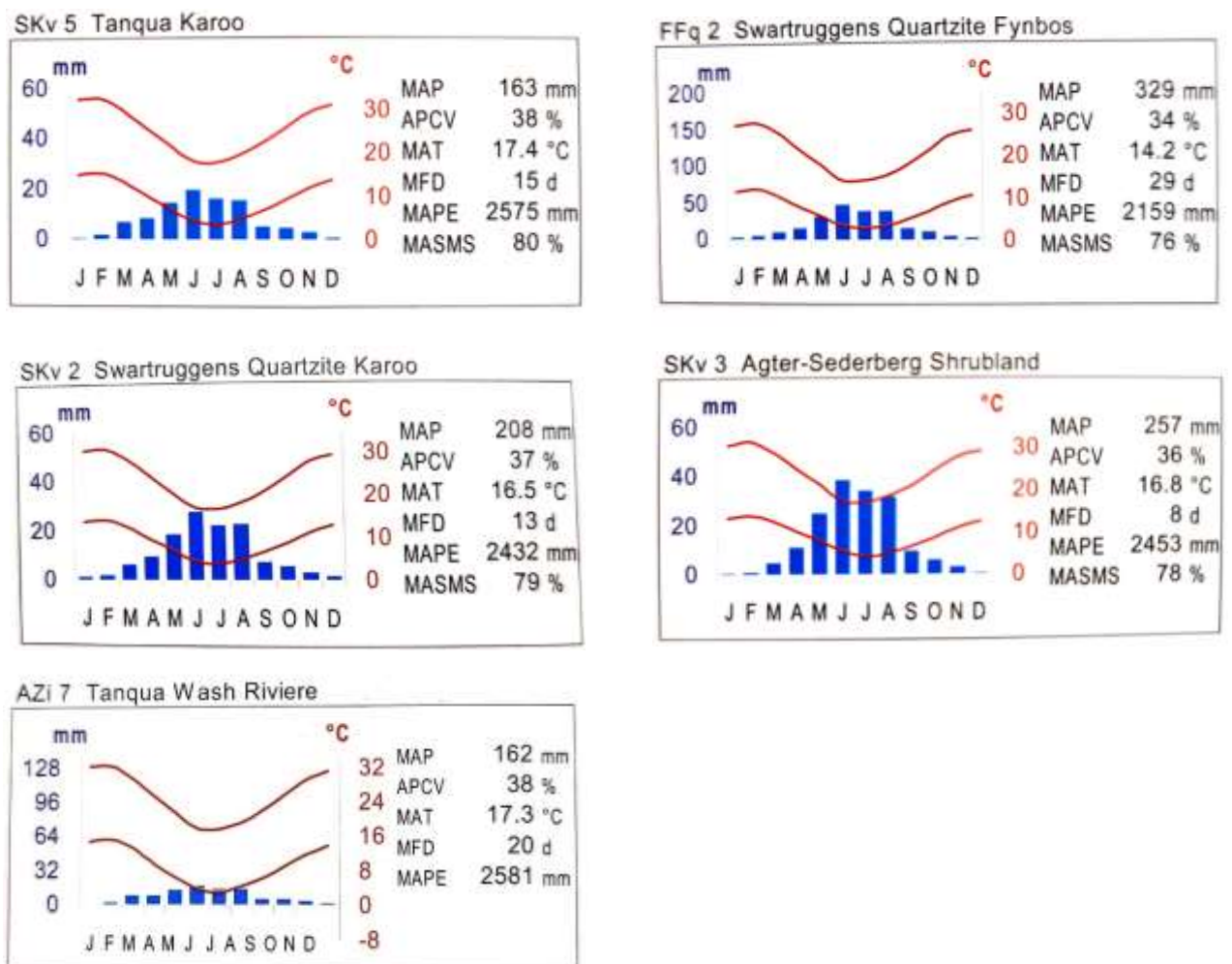


Figure 3.1 Climate diagrams for the various vegetation types found on the TPE.

[MAP = Mean Annual Precipitation; APCV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMS = Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply.)]

### 3.3.2 Topography, geology, land types and soil

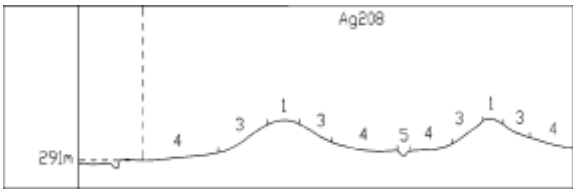
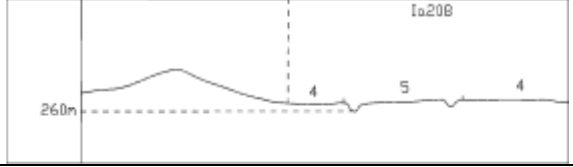
The Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC), including the Tankwa Protected Environment (TPE), is situated along the western edge of the Karoo Super Group with the Dwyka, Weltevrede/Witteberg and Bidouw Groups present on the TPE. The land type\* diagrams below provide further detail regarding the geology of the TPE.

*\*Land types are the classification of areas with distinct uniformity in terms of terrain form, soil types and climate.*

The topography of the TPE varies from the flat plains synonymous with Tankwa Karoo to >200m deep gorges which have been carved in the landscape through various rivers. This diverse topography in combination with a wide range of ‘land types’ results in the diverse habitats and micro-habitats which can be found on the TPE. (Table 3.1 en Figure 3.6) (Bezuidenhout, personal communication, 2020)

**Table 3.1** Land type diagrams and lithology of the Tankwa Protected Environment (also see Figure 3.2)

Land type code	Lithology	Land type diagram
Fa980	Quartzitic sandstones and shale of the Weltevrede / Witteberg Subgroup with shale, siltstone, and sandstone of the met Bidouw Subgroup / Bokkeveld Group.	
Ib517	Quartzitic sandstone and shale of the Weltevrede Subgroup / Witteberg Group with tillite, diamictite and subsidiary shale of the Dwyka Group.	
Fb787	Mainly shale, siltstone and sandstone of the Bidouw Subgroup / Bokkeveld Group with shale and feldspathic sandstone of the Ceres Subgroup / Bokkeveld Group on the low-lying mid slopes.	
Fc808	Tillite, diamictite and subsidiary shale of the Dwyka Group.	

Ag208	Tillite, diamictite and subsidiary shale of the Dwyka Group.	
Ia208	Alluvium with tillite, diamictite and subsidiary shale of the Dwyka Group and shale and siltstone of the Eccca Group.	

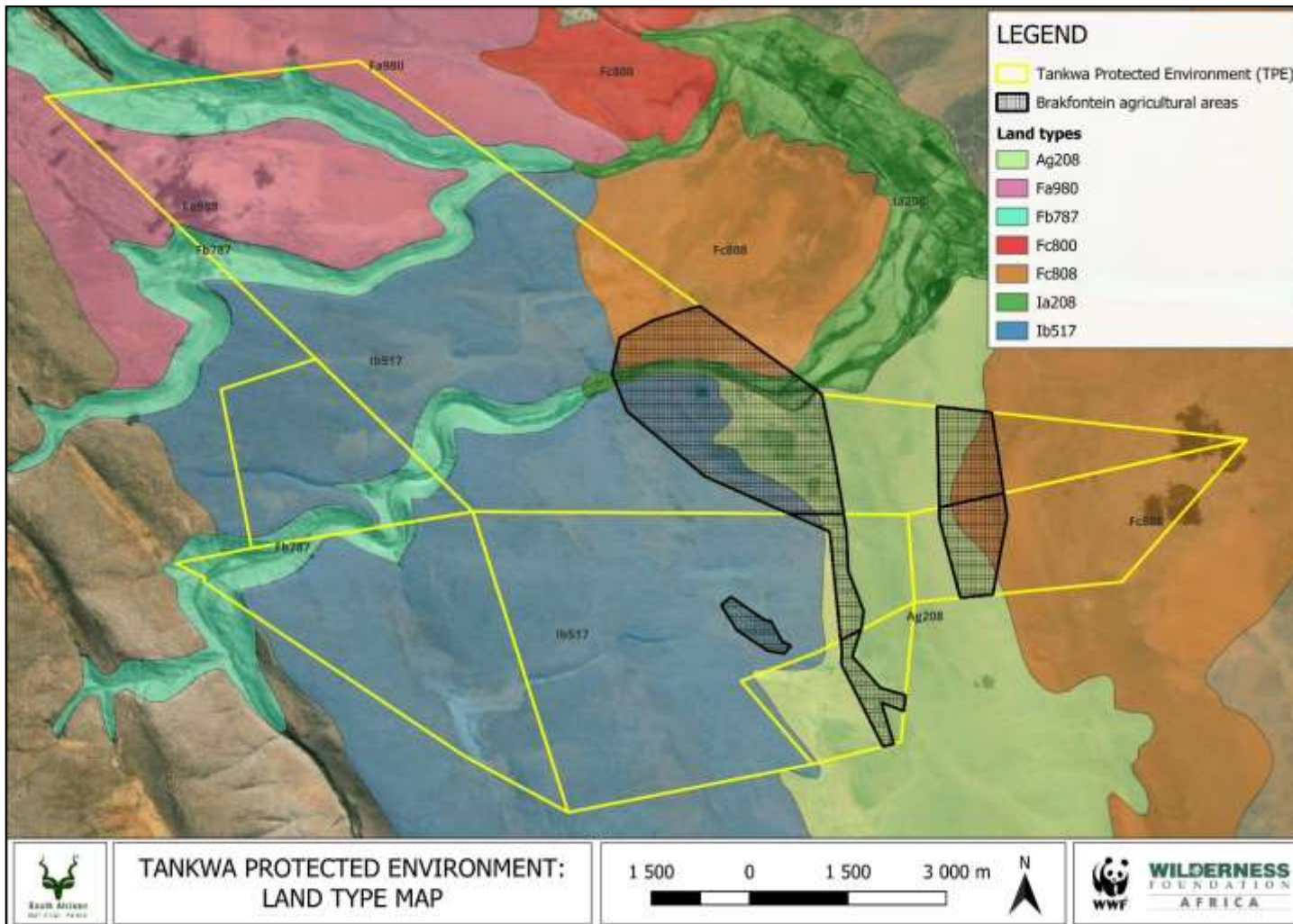


Figure 3.2 Tankwa Protected Environment land type map.



Figure 3.3 below represents a cross section of the area from the Roggeveld plateau (Agterkop), through the Tankwa Karoo National Park (TKNP) up to 'GeoSite 2', a point within the TKCWC. The diagram also indicates that the Dwyka Group (oldest) forms the largest section of the TPE. The Ecca Group forms the remainder of the TKCWC towards the east, and through the central sections of the TKNP. The Beaufort Group (youngest) covers the Roggeveld mountains and eastern plateau (TKNP Geology Brochure, 2014)

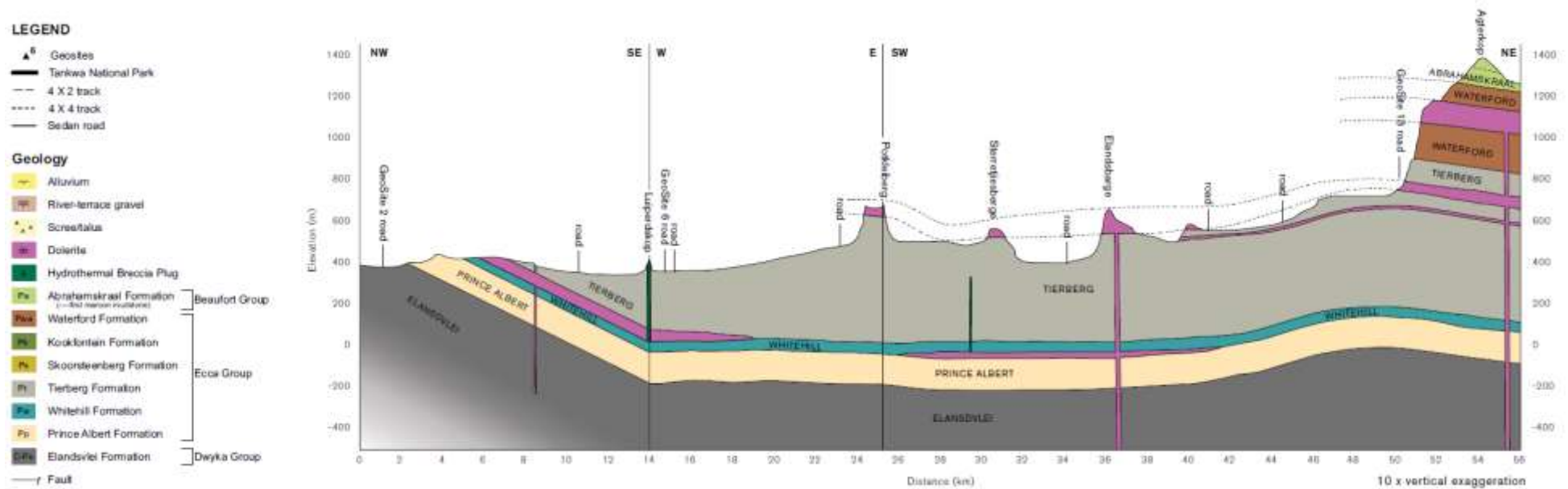


Figure 3.3 Geological cross section from Agterkop near Gannaga pass in the north-eastern section of the TKNP through to GeoSite 2 near Elandsvlei farm in the corridor (TKNP geological fold out map, Council for Geoscience).

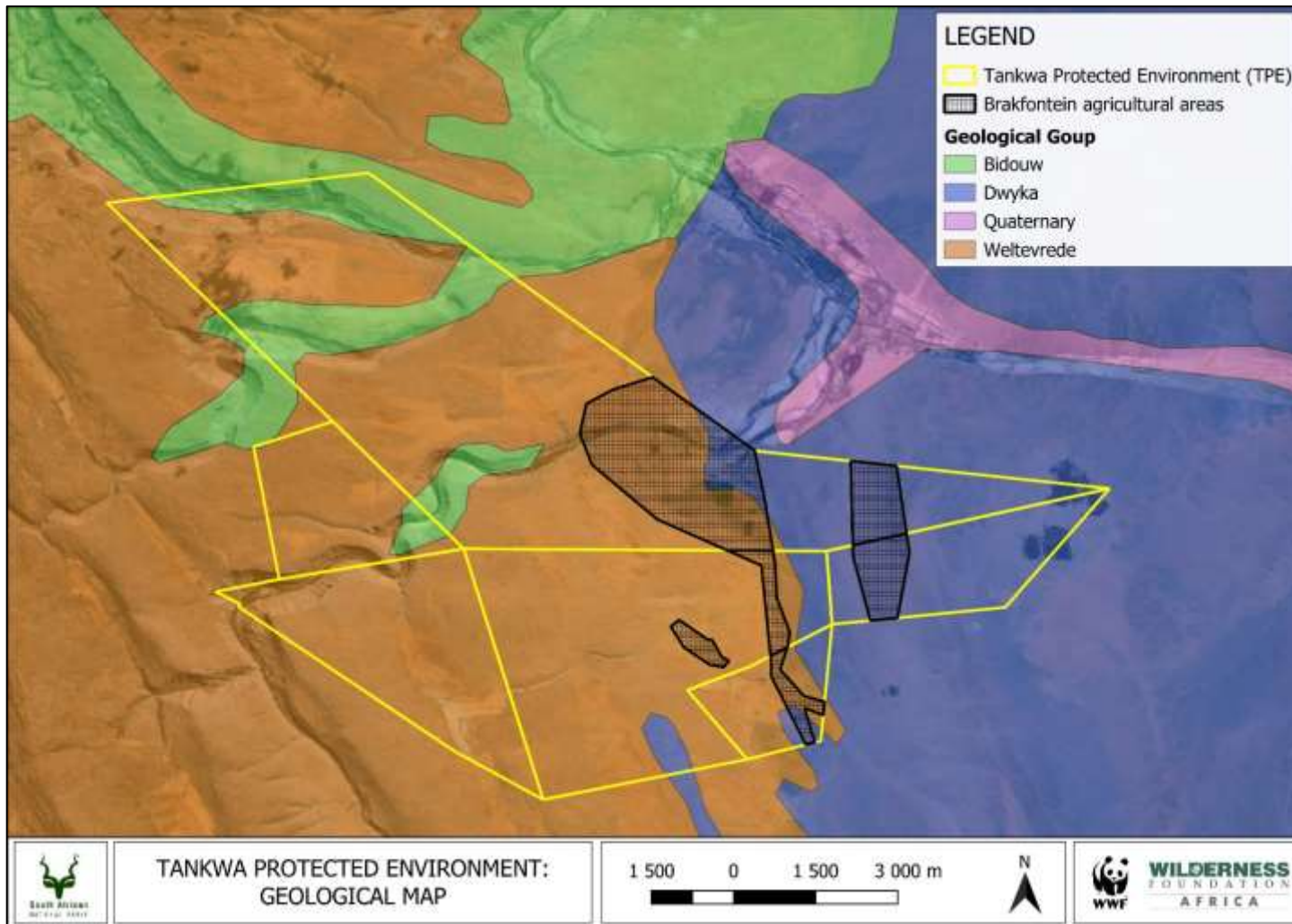


Figure 3.4 Tankwa Protected Environment geological map.

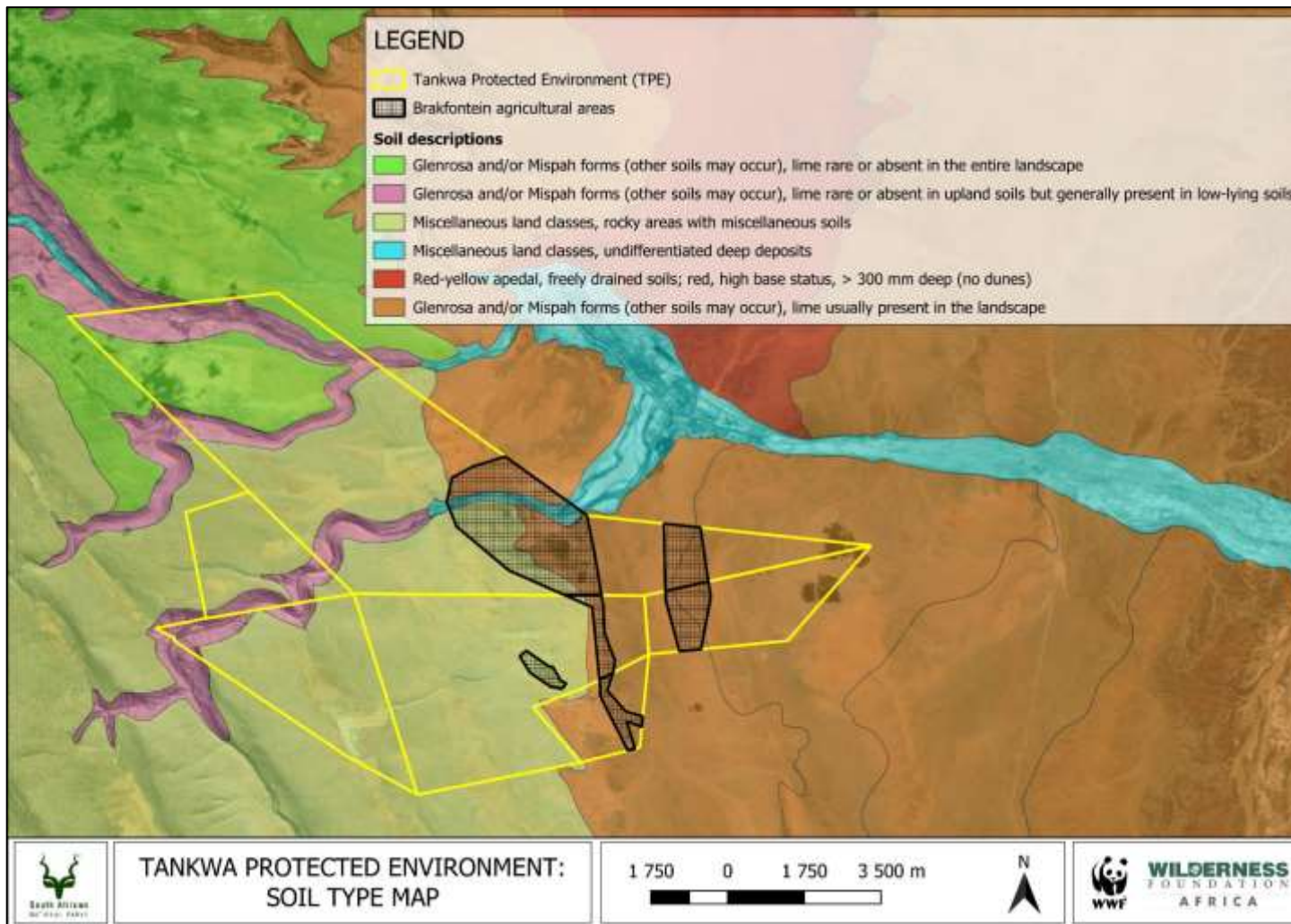


Figure 3.5 Soils of the Tankwa Protected Environment.

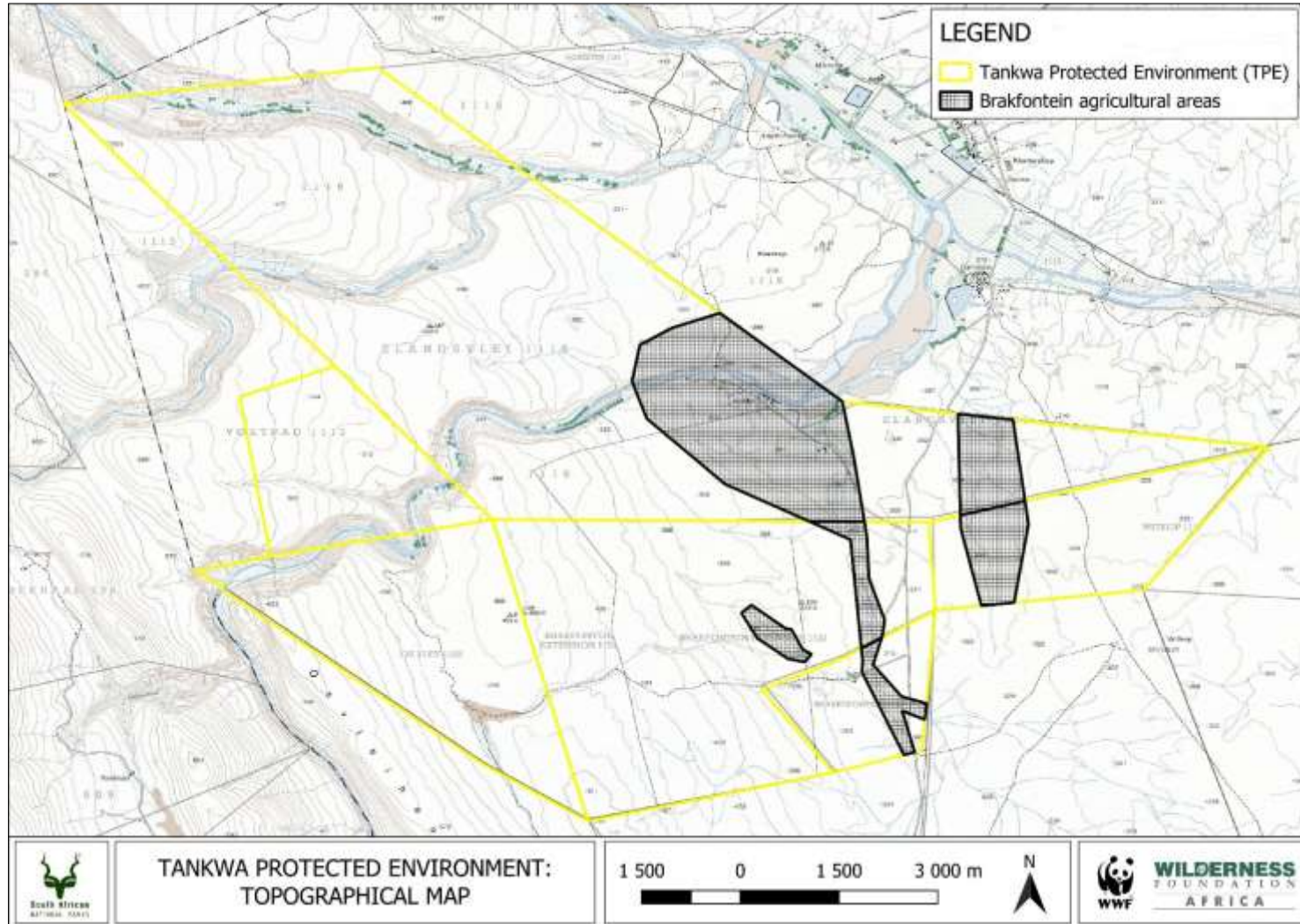


Figure 3.6 Tankwa Protected Environment topographical map.

### 3.3.3 Hydrology

The initial geographic planning of the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC), was predominantly based on National Freshwater Ecosystem Priority Areas (NFEPAS) which represented the most important hydrological features in the area.

The hydrological importance of the Tankwa Environment in the landscape is highlighted by the seven sub-quaternary catchments in which it occurs as well as the four NFEPAS Rivers which flow through it (Doring, Tra-Tra, Brakfonteinspruit and Matjiesfontein rivers) (Figure 3.7). The National Fresh Water Priority Area (NFEPAS) category codes of these quaternary catchments varies between category codes 1 to 4 and include:

- Freshwater ecosystem Priority areas (FEPA code 1) (\*Catchment ID: 7506, 7463 & 7494)
- Fish support area or fish corridor (FEPA code 2) (Catchment ID: 7410 en 7440)
- Phase 2 FEPA (FEPA code 3) (Catchment ID: 7401)
- Upstream management area (FEPA code 4) (Catchment ID: 7441)

*\* 'Catchment ID' refers to quaternary catchments which are included in the Hydrological map (Figure 3.7).*

Surface water includes the Doring River, which usually flows for approximately eight months of the year, and one permanent seep which forms part of the Brakfonteinspruit River (situated on portion RE1120). The Doring River has numerous deep pools which hold their water throughout the dry summer months. The pools play an important ecological role in the landscape and are key to the survival of numerous species, especially during drier periods. The Brakfonteinspruit seep is often utilised by livestock.

The dam wall in the Doring River, situated downstream of the TPE, was completed in the early 2000's, and is used primarily for the irrigation of raisin vineyards on the Brakfontein agricultural sections. This dam wall also results in water remaining in the upper section of the Doring River in the TPE for longer periods which serves as water source for numerous game species. There are currently no active boreholes on the TPE.

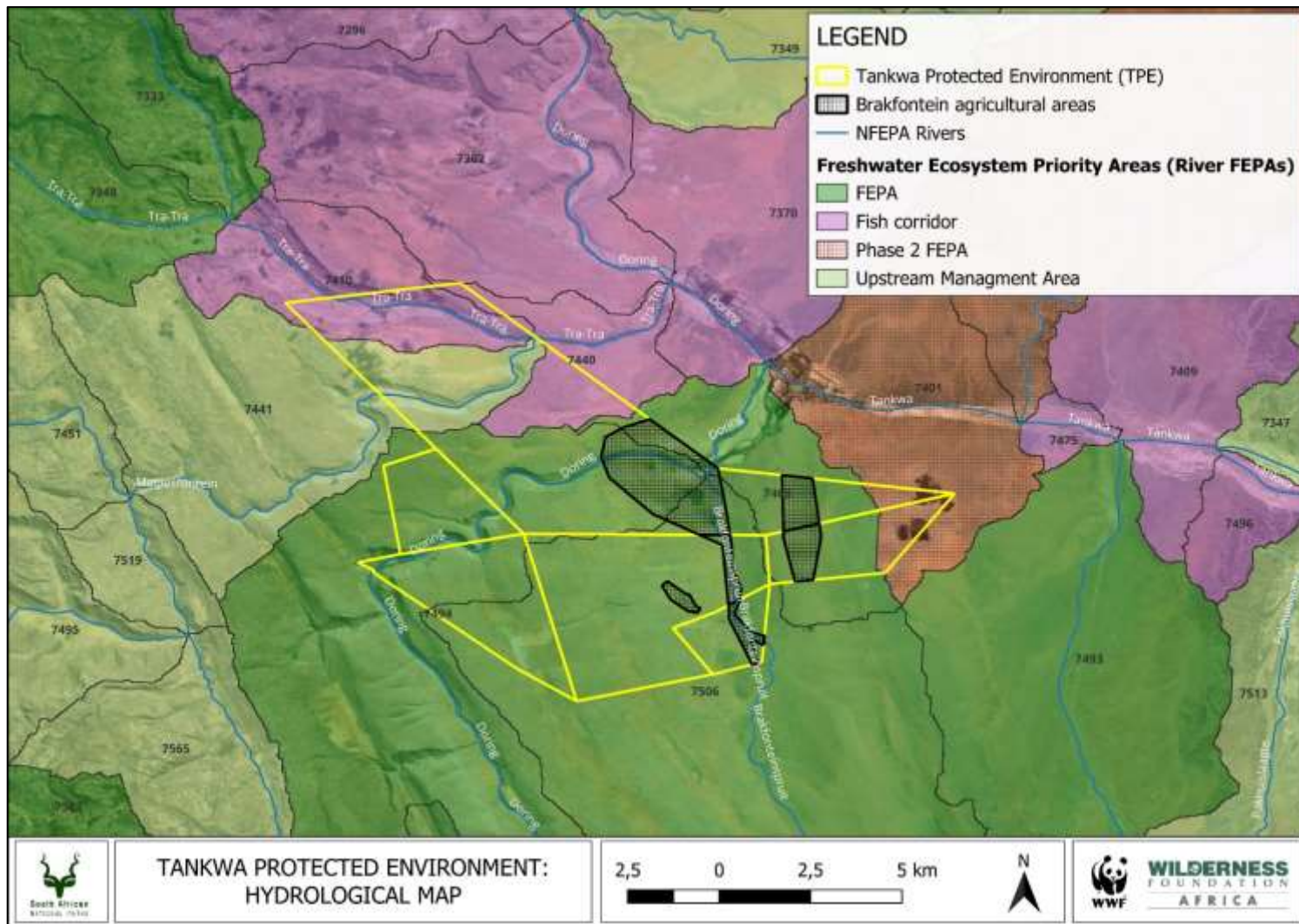
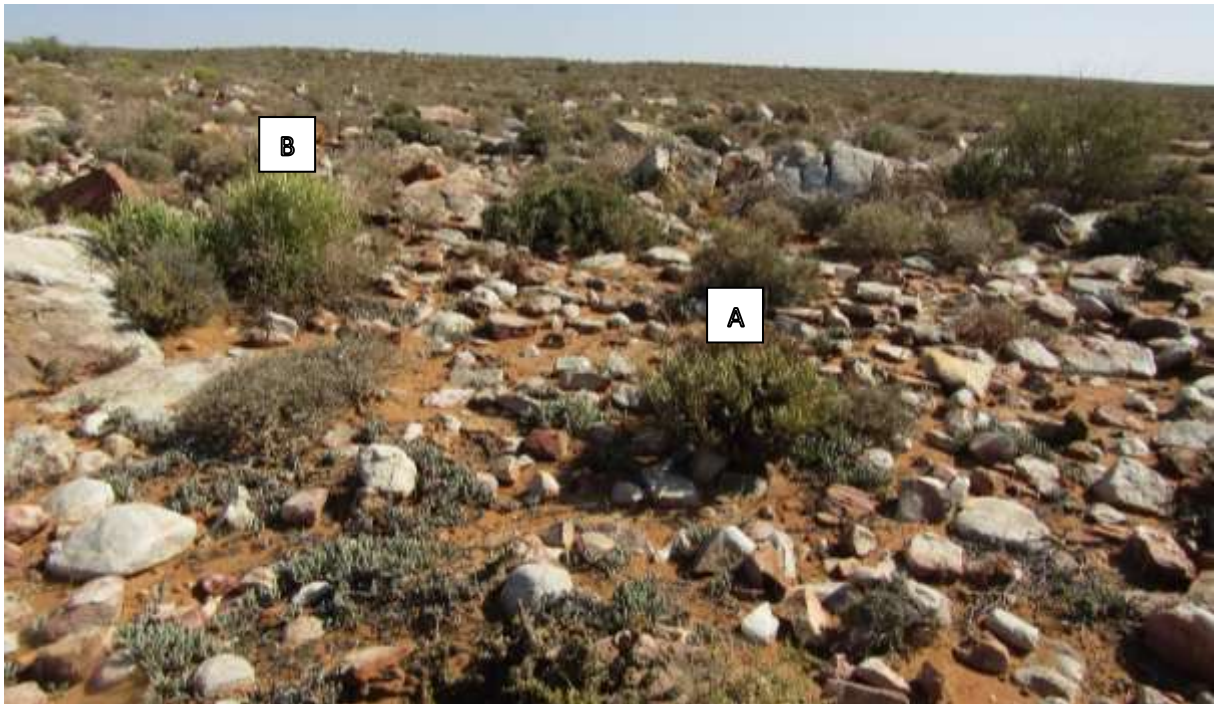


Figure 3.7 Hydrological map for the Tankwa Protected Environment

### 3.3.4 Vegetation

The Tankwa Protected Environment is found in the Tankwa basin in the Rain shadow Valley Karoo Bioregion, one of six bioregions of the Succulent Karoo (Rutherford *et al.*, 2006). Five vegetation types occur on the TPE (Mucina *et al.* 2006 & Figure 3.9) namely Swartruggens Quartzite Karoo (SKv2) (Figure 3.8 – 3.13), Tanqua Karoo (SKv5) (Figure 3.14) as well as small sections of Swartruggens Quartzite Fynbos (FFq2), Agter-Sederberg Shrubland SKv3) and Tankwa Wash Riviere (AZi7), with the last mentioned occurring on the lower lying dolerite and shale plains of the Tankwa basin. The unpredictable, primarily winter rainfall, experienced in the area is usually less than 200mm per annum in the quartzite sections (west) and less than 100mm per annum in the Tankwa basin.

A provisional plant species list for the TPE has been included as Annexure 6.



**Figure 3.8** The Swartruggens Quartzite Karoo vegetation type on a flat section of Elandsvlei 1116 with succulents such as (A) krimpsiek (*Tylecodon wallichii*) and (B) geelmelkbos (*Euphorbia mauritanica*). (Photo: Ben-Jon Dreyer)

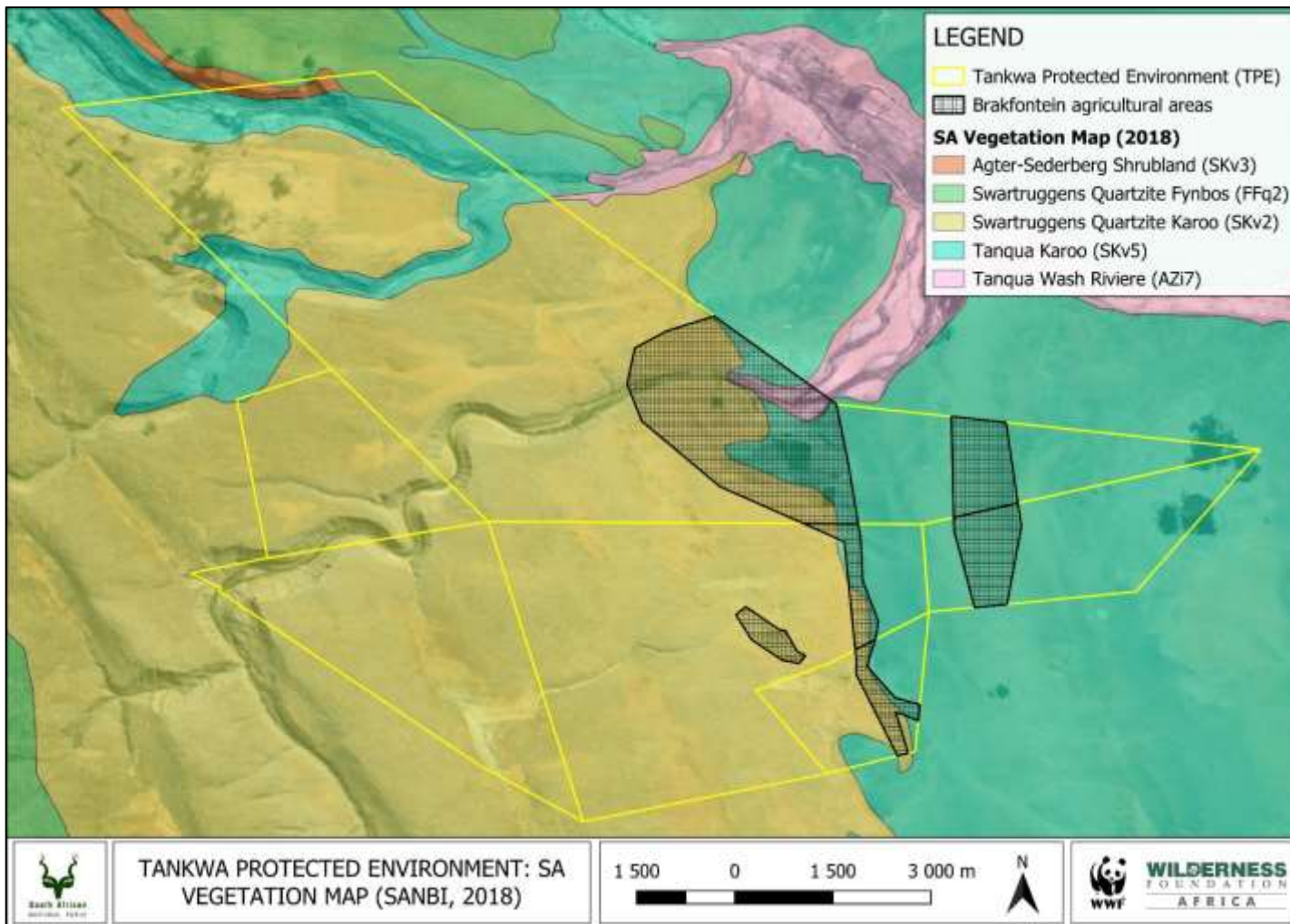


Figure 3.9 National vegetation map of the TPE (South African National Biodiversity Institute Vegetation Map, 2006-2018).



#### 3.3.4.1 Swartruggens Quartzite Karoo

Swartruggens Quartzite Karoo forms the most extensive vegetation type on the TPE occurring along the western quartzite plateau and ridges cut out by the Doring, Tra-Tra and Matjiesfontein rivers flowing through it (Figure 3.10). This dwarf shrubland, with densely scattered quartzite rocks, is typified by dwarf shrubs such *Acanthopsis erosa*, *Lasiosiphon deserticola*, *Helichrysum zeyheri*, *Euryops tenuissimus*, *Dicoma picta*, *Justicia incana*, *Lessertia frutescens* subsp. *microphylla*, *Lobostemon trichotomus* and *Galenia africana*. Succulents are also well represented in this vegetation type with species such *Euphorbia mauritanica*, *Euphorbia hamata*, *Tylecodon wallichii*, *Cotyledon orbiculata* var. *spuria*, *Crassula montana* subsp. *montana*, *Aloe comosa*, *Hoodia gordonii* and *Monsonia crassicaulis*.



**Figure 3.10** The Swartruggens Quartzite Karoo vegetation type (Elandsvlei 1116) with the grass *Stipagrostis ciliata*. (Photo: D'Reull de Beer)

Although this vegetation type is characterised by dwarf shrubs and succulents, several grass species can also be found (Figure 3.13). These grasses such as *Stipagrostis ciliata* var. *capensis* and *Stipagrostis obtusa*, are very palatable and are often overgrazed especially where the composition of rock cover is smaller and thus more accessible for livestock (Figure 3.12).



**Figure 3.11** The Tra-Tra River cutting through the quartzite plateau with sides and ridges covered by Swartruggens Quartzite Karoo vegetation type (Elandsvlei 1116). (Photo: Ben-Jon Dreyer)



**Figure 3.12** Example of a potentially overgrazed section of Swartruggens Quartzite Karoo (Elandsvlei 1116). (Photo: Ben-Jon Dreyer)



**Figure 3.13** Example of Swartruggens Quartzite Karoo vegetation type with *Stipagrostis ciliata* var. *capensis* and *Stipagrostis obtusa* after good rainfall experienced in January 2021. (Photo: Ben-Jon Dreyer, 12 April 2021)

#### 3.3.4.2 Swartruggens Quartzite Fynbos

Only a small section of this vegetation type (44.68 ha) occurs on the most northern boundary of the TPE, just above the Tra-Tra River canyon (Figure 3.9). Vegetation in this section is very similar to that found in the Swartruggens Quartzite Karoo. A few tall woody shrubs such *Searsia undulata* and *Dodonaea viscosa* var. *angustifolia* as well as numerous dwarf shrubs including *Elytropappus rhinocerotis*, *Berkheya fruticosa*, *Dicoma picta*, *Euryops speciosissimus*, *Lobostemon trichotomus*, *Lasiosiphon deserticola*, *Helichrysum zeyheri* and *Justicia incana* occur here. Succulent species which can be found include *Crassula montana* and *Cotyledon orbiculata* var. *spuria*.

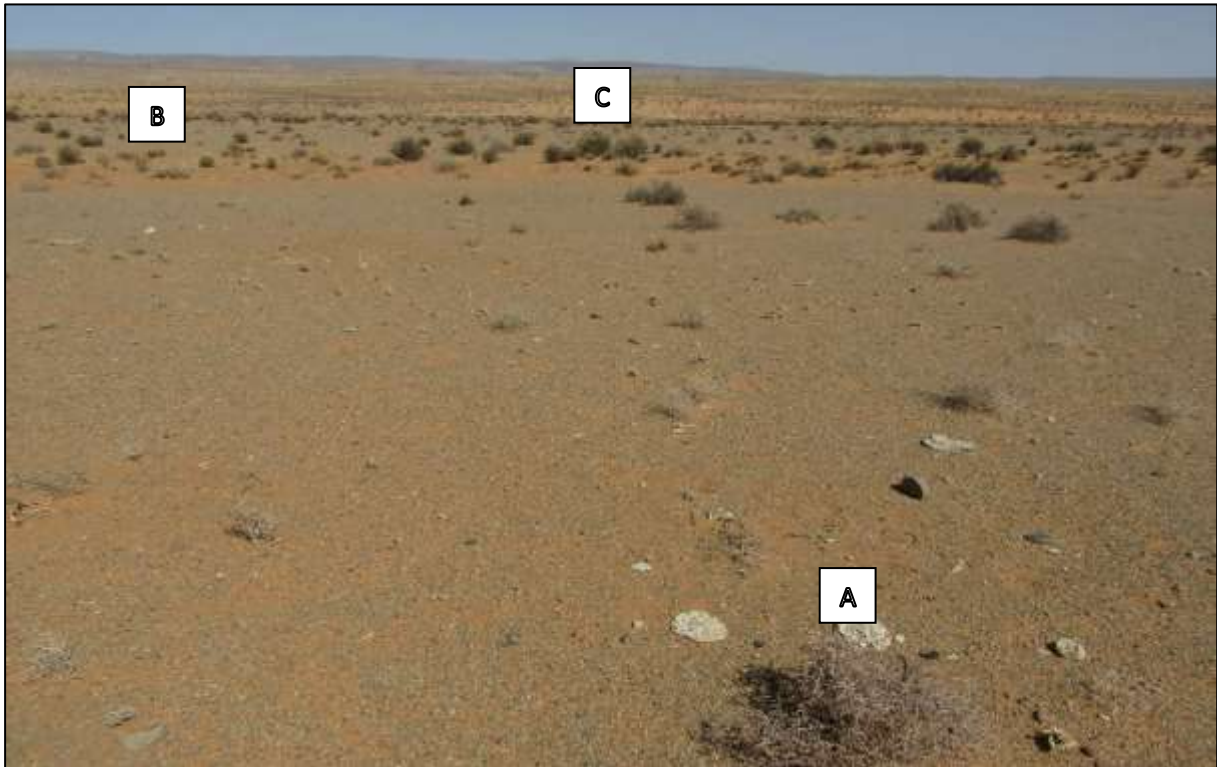
#### 3.3.4.3 Agter-Sederberg Shrubland

This is another vegetation type of which only a small section (40.16 ha) is represented on the TPE where it occurs in a narrow band along the northern quartzite sandstone ridges of the Tra-Tra River canyon. Dwarf shrubs which grow here include *Mesembryanthemum noctiflorum*, *Didelta spinosa* and *Lacomucinaea lineata*. Succulent species such as *Euphorbia mauritanica* and *Tylecodon wallichii* can also be found here.

#### 3.3.4.4 Tanqua Karoo

The Tanqua Karoo vegetation type has very low plant cover and mostly occurs on the dolerite and shale plains on the eastern section of the TPE (Figure 3.9 and 3.14). The loamy sands are densely covered with gravel sized rock cover. In good rainfall years these plains are covered with grasses such as *Stipagrostis obtusa* and *Stipagrostis ciliata*. Scattered dwarf shrubs such as *Tetraena chrysopteron*

*Mesembryanthemum noctiflorum* also occur here. Due to the palatability of the plant species, especially grass species, these plains are often overgrazed.



**Figure 3.14** Typical example of the Tanqua Karoo vegetation type with extremely low plant cover in the foreground, increasing in the background (RE/1121 of TPE). (A) *Tetraena chrysopteron*; (B) *Galenia africana*; (C) *Lycium amoena* (Photo: Ben-Jon Dreyer)

#### 3.3.4.5 Tankwa Wash Riviere

Small section of this vegetation type occurs on the excluded Brakfontein agricultural area, with only a very small section falling within the TPE itself (0.36ha), nearby the confluence of the Tra-Tra and Matjiesfontein Rivers. A large section of the Tanqua Wash Riviere in the Brakfontein agricultural area is utilized for the irrigation of vineyards, date palms and planted grazing (Old-man saltbush and lusern) while other sections are impacted by alien invasive plants such as *Prosopis glandulosa*.

Indigenous species which occur in this vegetation type include *Vachellia karroo*, *Phragmites australis*, *Afroscirpoides dioeca*, *Galenia africana*, *Suaeda fruticosa*, *Lycium amoena* and *Salsola* spp. (ganna).

The Tanqua Wash Riviere found in the Tra-Tra River is less transformed however alien invasive plant (AIP) species are present. The 0.36 hectares that fall within the TPE, is free of any AIP.

### 3.3.5 Mammals

The Namaqualand district and the Succulent Karoo as a whole, hosts a variety of mammal species. Small mammals especially, often play an important role in most arid and semi-arid environments (Van Deventer & Nel, 2006). Over the years SANParks have released numerous game species in the Tankwa Karoo National Park (TKNP), including gemsbok (*Oryx gazella*), red hartebeest (*Alcelaphus buselaphus*), eland (*Taurotragus oryx*) and springbok (*Antidorcas marsupialis*). Some of these individuals have since moved outside of the TKNP and now occur on private land surrounding the Park. Game such as springbok, gemsbok, koedoe (*Tragelaphus strepsiceros*) and eland (the last two are not encountered often) are now found in the TPE and the rest of the TKCWC. Smaller game species like grey rhebok (*Pelea capriolus*), klipspringer (*Oreotragus oreotragus*) and common duiker (*Sylviacapra grimmia*) are resident on the TPE and are sought after species by sport hunters. Steenbok (*Raphicerus campestris*) also occurs in the area according to distribution maps however, none have been recorded by the Management Authority to date.

There are about 75 mammal species recorded for the Succulent Karoo biome (CEPF, 2021) and 44 mammal species recorded for the Tankwa Karoo National Park. It can be expected that most of the mammals recorded for the park occur on, or occasionally move through the TPE.

Although a comprehensive inventory for the fauna of TPE has not yet been completed, species lists can be obtained for specific areas from the *FitzPatrick Institute of African Ornithology's, Virtual Museum* (<http://vmus.adu.org.za/>). See Appendix 4 for the mammal list recorded for 'Tankwa conservation area'.

### 3.3.6 Livestock

Merino sheep and Bonsmara cattle are kept on the TPE for commercial livestock farming purposes. Feral donkey numbers are managed as they tend flourish in this arid environment and severely damage the veld. In 2018, the Management Authority destroyed 78 feral donkeys which occurred on what is now known as the TPE.

### 3.3.7 Avifauna

The Tankwa Karoo is renowned for Karoo birding within the birdwatching community. To date, a 187 bird species have been documented for the Tankwa Karoo National Park.

TPE itself possesses additional habitat for birds, especially waterfowl and water dependant bird species, as it has relatively abundant surface water throughout the year in the Doring and Tra-Tra Rivers. The nearby Brakfontein dam will also contribute in this regard.

The 'South African Bird Atlas Project' (SABAP) possesses a coverage map made up of geographical "pentads". These pentads are 5-minute by 5-minute coordinate grids which are overlain across Southern Africa and contain records of bird species which have previously been identified in a specific pentad. The TPE covers six of these pentads in total, which includes a total of 86 bird species. A species list per pentad is included under Annexure 5.

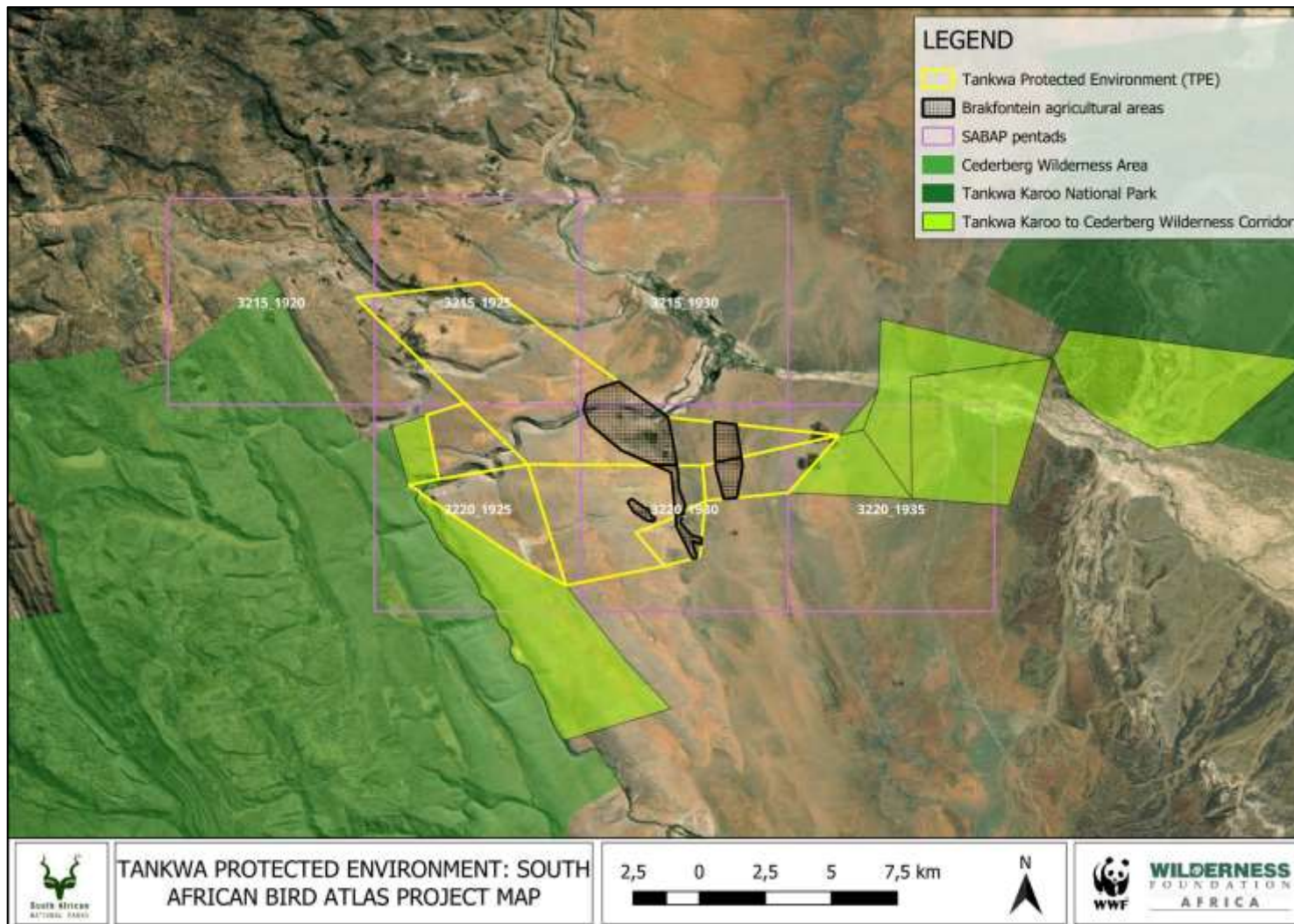


Figure 3.15 TPE ‘South African Bird Atlas Project ‘pentads’ map. (<http://sabap2.birdmap.africa/>)

### 3.3.8 Freshwater fish species

The rivers and tributaries found on the TPE all form part of the Olifants-Doring River System (ODRS). The ODRS is regarded as a national conservation priority due to the high numbers and percentage of endemic freshwater fish species it hosts. Eight of the ten indigenous freshwater species which occur in the ODRS, are endemic to the system (Impson, 2020). Three fish families occur in the ODRS, with the *Cyprinidae* family (carp) being the most dominant (7 out of 10).

During a freshwater fish species survey conducted in September 2030, it was established that three species endemic to the ODRS occur within the TPE. An additional four species could potentially occur in this area as well, but their presence would need to be confirmed with a follow-up survey (Impson, 2020).

The freshwater habitats of the TKCWC are in a relatively poor state, due to among other factors, the alien invasive fish species which were historically released in the upper reaches of the ODRS. The largemouth bass (*Micropterus salmoides*) was released in 1928 for recreational angling purposes while the bluegill sunfish was later released in 1938 as fodder fish for the bass. The smallmouth bass (*Micropterus dolomieu*) was also introduced as a recreational angling fish in 1937.

These alien invasive fish species, which have very few natural predators in the ODRS, prey on small and juvenile indigenous fish species such as the various redfins, Clanwilliam sawfins, Clanwilliam sandfish and Clanwilliam yellowfish resulting in devastating impacts on these indigenous fish populations.

Other threats to the indigenous fish species of the TKCWC include the construction of dams and weirs which impact the migration patterns of species such as the Clanwilliam yellowfish and Clanwilliam sandfish. The presence of AIP, especially along the Doring and Tra-Tra Rivers, impact dry season river flow, wetlands, and other riparian ecosystem drivers.

Proposed management activities and interventions for the improvement of freshwater habitats and associated indigenous fish species are further discussed in section 6.2.

**Table 3.2** Indigenous fish of the ODRS, historic distribution (\*) and likely historical distribution in the TKCWC (#) (Impson, 2020).

Species	Common name	Global distribution	Present in corridor	Conservation status
<i>Austroglanis barnardi</i>	Spotted rock catfish	ODRS		Endangered
<i>Austroglanis gilli</i>	Clanwilliam rock catfish	ODRS	#	Near Threatened
<i>Cedercypris calidus</i>	Clanwilliam redfin	ODRS	#	Near Threatened
<i>Cheilobarbus serra</i>	Clanwilliam sawfin	ODRS	*	Near Threatened
<i>Cheliobarbus erubescens</i>	Twee Rivier redfin	ODRS		Critically Endangered
<i>Enteromius anoplus</i>	Chubbyhead barb	Widespread across RSA, but population in ODRS is genetically unique.	#	Data Deficient
<i>Galaxias zebratus</i>	Cape Galaxias	Widespread in Western Cape, but the ODRS contains some	#	Data Deficient

		genetically distinct populations.		
<i>Labeo seeberi</i>	Clanwilliam sandfish	ODRS	*	Endangered
<i>Labeobarbus seeberi</i>	Clanwilliam yellowfish	ODRS	*	Near Threatened
<i>Pseudobarbus phlegethon</i>	Fiery redfin	ODRS		Endangered

### 3.4 Cultural heritage context of the Tankwa Protected Environment

Recent archaeological studies in the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC) have resulted in several peer reviewed journal articles published on the Stone Age hunter-gatherers in this area. These studies have led to significant archaeological discoveries in the Tankwa Karoo and more specifically on a nearby ridge on the neighbouring farm, Tweefontein, which is now known as the Lekkerlag Protected Environment. Much of the work thus far focussed on the ‘Tweefontein’ site which is now considered to be the largest Middle Stone Age \*unifacial point (Figure 3.18) assemblage in the Northern and Western Cape for either open air or rock shelter sites.

The discovery of this archaeological site is especially important for understanding Middle Stone Age adaptations to an arid, marginal environment. (Antiquity, 2015.)

A survey centred on a 30km long linear transect of the Tankwa River resulted in recording over 7000 artefacts at 45 different localities (Hallinan & Shaw, 2015), emphasizing the archaeological significance of the TKCWC. Figures 3.17 – 3.19 show the artefact recording and analysis process.

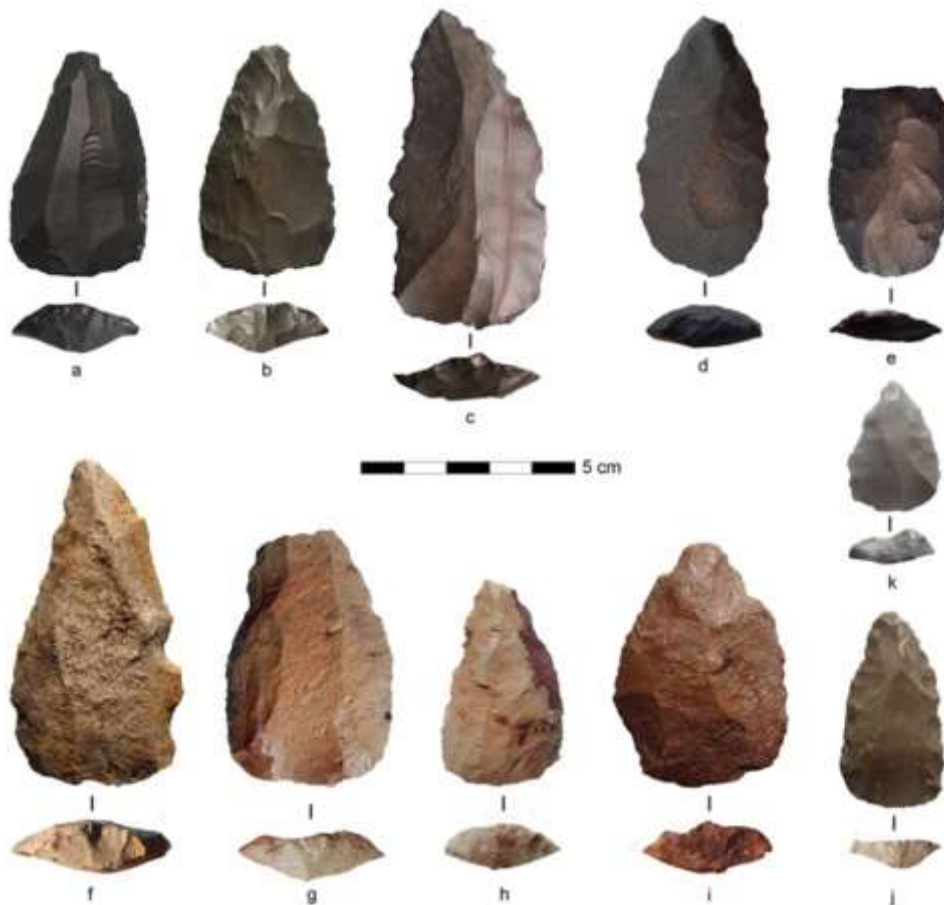




Figure 3.16 Unifacial points collected in the TKCWC (Hallinan & Shaw, 2020).



Figure 3.17 – 3.19 Left: 3-D scanning of a middle stone age unifacial stone point. Above right: Archaeologist Emily Halliwal (right) shows Sarel van der Merwe (left, son Francois en Nicolette van der Merwe) how a 3-D scan of a unifacial stone point is taken. Below right: archaeological survey along a line transect in the TKCWC. (Photos: Nicolette van der Merwe)

Nomadic pastoralism first brought sheep into the succulent Karoo about 2000 years ago, and cattle some 1500 years later. The European pastoralist ('trekboere'/ transhumance farmers) who moved northwards from the Cape Peninsula in the 18th century were nomadic, moving with their flocks to suitable grazing. Sheep farmers moved into the Tankwa and Roggeveld areas in the mid-eighteenth century. In the 19th century the Succulent Karoo became the first biome used for settled European pastoralism (Tankwa Karoo National Park Management Plan, 2014).

The TKCWC, and specifically the TPE, is also rich in Khoisan rock art especially along the Tra-Tra and Doring River canyons. Rock art also occurs outside of the above areas and are often found with other artefacts such as clay pot shards, ostrich eggshell beads and ochre. Place names that can be traced back to the original Khoi language: (Khoisan place names, 2005, unpublished)

- 'Tanqua River': Refer to the San. 'Sanqua' and 'Sonqua' is also used.
- 'Tra-Tra River': Densely vegetated / bushy (Referring to the river and mountains



Figure 3.20. Stone artefacts found on the TPE (Photo: D’Reull de Beer)

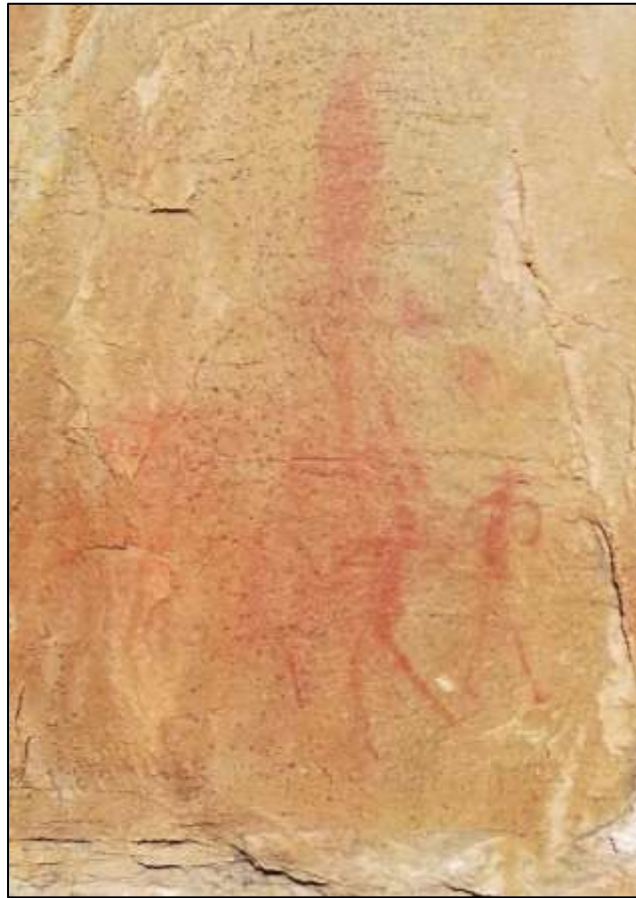


Figure 3.21. Khoisan rock art on the TPE (Photo: D’Reull de Beer)

### 3.5 Socio economic context of the Tankwa Protected Environment

The Tankwa Protected Environment (TPE) is located in the Namaqua District Municipality and Hantam Local Municipality. Based on 2019 statistics, the local government (R364m) subsector is the largest economic contributor with agriculture, (R249m) in the form of livestock farming, in second place (Hantam IDP, 2021). Tourism has however become an increasingly significant contributor to the local economy in recent years.

The Biodiversity Sector Plan (2008) for the Namakwa District Municipality, states that conservation contributes significantly towards the socio-economic wellbeing of the district. The proclamation of protected areas such as that of the TPE is important as these areas provide a platform for conservation, but also economic opportunities such as ecotourism and sustainable resource use.

Table 3.3. provides a brief economic and social overview of the Hantam Local Municipality.

**Table 3.3** Overview of the Hantam Local Municipality social and economic statistics (Hantam IDP, 2021). <https://municipalities.co.za/demographic/1167/hantam-local-municipality>

<b>Total municipal area (km<sup>2</sup>)</b>	36 128		<b>Demographics (in 2019)</b>				
			Population	20 860	Households	6 196	Average household size
<b>Education in 2016 (Northern Cape)</b>		<b>Poverty: Proportion of households (in 2011)</b>					
Learner-School Ratio	509; was 501 in 2014		With no income		6.8%		
Educator-School Ratio	15.9; also 15.9 in 2014		Earning less than R4800 per annum		9.3%		
<b>Access to basic services by households in 2019 as a percentage (percentage change since 2011 in brackets)</b>							
Piped water inside dwelling	58.8% (-1.6%)	Flush toilet connected to sewerage	75.7% (41.7%)	Electricity for lighting	76.4% (0.1%)	Refuse removal	73.1% (1.5%)
<b>Economy (2010 —2017)</b>			<b>Labour in 2017</b>				
Average GDP growth (%)	8.9%		Unemployment rate		10.2%; was 9.6% in 2016		
<b>Largest economic subsectors by contribution to municipal GVA in 2019 (R millions current prices in brackets)</b>							
General government (R364m)		Agriculture (R249m)		Transport, storage and communication (R224m)		Wholesale and retail trade, catering and accommodation (R191m)	
<b>Safety and security – actual number of crimes in 2019 in Hantam Municipality (Namakwa district in brackets)</b>							
Serious crimes	Driving under the influence	Drug-related crime		Murders	Sexual offences		
732; was 993 in 2018 (4678; was 4766 in 2018)	17; was 16 in 2018 (67; was 79 in 2018)	141; was 335 in 2018 (651; was 1085 in 2018)		4; was 5 in 2018 (22; was 21 in 2018)	21; was 19 in 2018 (144; was 132 in 2018)		

## 4. Important Biodiversity of the Tankwa Protected Environment

The contributions and importance of the Tankwa Protected Environment with respect to conservation planning strategies, biodiversity patterns and processes are described in this section.

Main reasons for declaring the TPE:

- a) The TPE is a key geographical link in the establishment of the Tankwa Karoo to Cederberg Wilderness Corridor, which is a protected area expansion priority.
- b) The TPE contributes towards the conservation of four National Freshwater Ecosystem Priority Area (NFEPA) rivers namely the Matjiesfontein, Brakfontein, Doring and Tra-Tra Rivers)
- c) The TPE contributes towards the national conservation targets of four Succulent Karoo and one Fynbos vegetation type.
- d) The TPE includes both Critical Biodiversity 1 (CBA1) and Critical Biodiversity 2 (CBA2) areas.
- e) The TPE falls within the “Cederberg–Kouebokkeveld Complex Important Bird Area (IBA).

### 4.1 Protected area expansion strategies and expansion plans

The National Protected Areas Expansion Strategy (NPAES) (DFFE, 2016) has collated information related to the expansion of each province’s protected area estate. The strategy includes a framework for the expansion of protected areas in the country, identifies priority protected area expansion zones and recommends mechanisms for achieving these expansion targets.

Broadly incorporated into the NPAES, South African National Parks also has an expansion strategy in place for the Tankwa Karoo National Park. This strategy is in the form of a land inclusion plan and recommends various mechanisms to secure properties. The TKCWC, which includes the TPE, is part of this expansion strategy with contractual agreements (Biodiversity Stewardship Agreements) recommended as the primary expansion mechanism.

#### 4.1.1. Critical Biodiversity Areas (CBAs)

The Northern Cape Critical Biodiversity Areas (CBA) Map is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems. This includes the delivery of ecosystem services across terrestrial and freshwater systems. These spatial priorities are also used to inform sustainable development and land use in the Northern Cape Province.

The TPE includes both a CBA1 and CBA2 (Figure 4.1 and Table 4.1)

**Table 4.1** CBA contributions for the TPE (including Brakfontein farm agricultural areas).

<b>CBA Category</b>	<b>Hectares</b>	<b>%</b>
<b>CBA 1</b>	2007.5	17.67
<b>CBA 2</b>	7594.2193	66.84
<b>Ecological Support Areas (ESA)</b>	770.5	6.78
<b>Other Natural Areas (ONA)</b>	990	8.71
<b>Total</b>	11362.2193	100

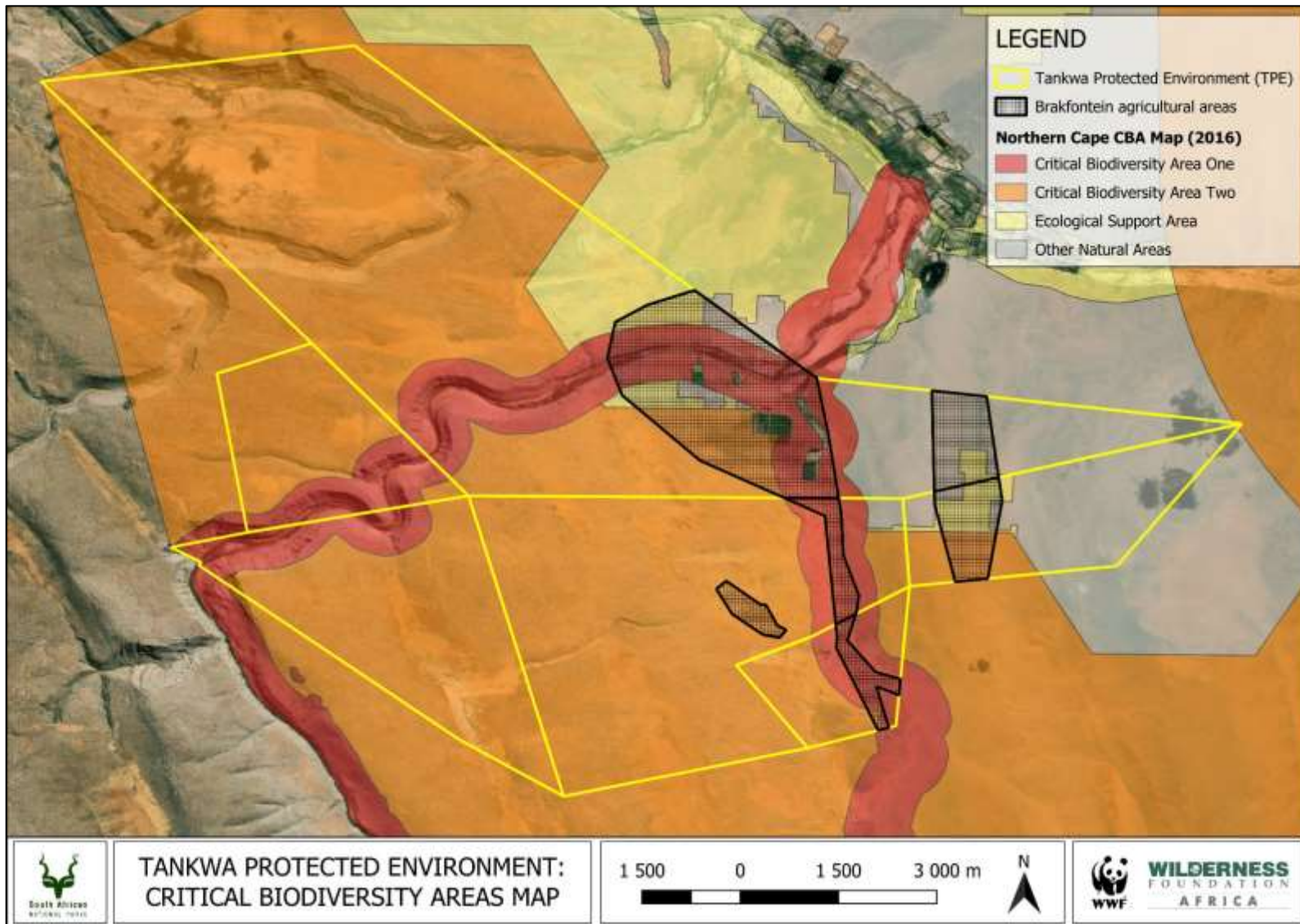


Figure 4.1 Critical Biodiversity Areas map for the Tankwa Protected Environment.

## 4.2 Contributions to the conservation of biodiversity patterns

Based on the 2018, South African Vegetation Map (Figure 3.9), the TPE contributes towards the conservation of five national vegetation types. Four of these vegetation types namely Swartruggens Quartzite Karoo, Tanqua Karoo, Agter-Sederberg Shrubland and Tanqua Wash Riviere, form part of the Succulent Karoo biome while the fifth, Swartruggens Quartzite Fynbos, is classified within the Fynbos biome.

The Tanqua Wash Riviere, Agter-Sederberg Shrubland and Swartruggens Quartzite Fynbos vegetation types, in comparison with the Tanqua Karoo and Swartruggens Quartzite Karoo, are relatively insignificant in terms of their hectare contributions.

**Table 4.2** TPE contributions to national conservation targets per vegetation type

Ecosystem / Vegetation type	TPE contribution (ha)	National target (ha)	% Contribution to national target
SKv5 - Tanqua Karoo	2352.33	132716.743	1.77%
SKv2 - Swartruggens Quartzite Karoo	7675.67	10624.612	72.24%
SKv3 - Agter-Sederberg Shrubland	40.16	17210.7782	0.23%
FFq2 – Swartruggens Quartzite Fynbos	44.68	47724.5344	0.09%
AZi1 - Tanqua Wash Riviere	0.36	40448.4296	0.00%
<b>Total</b>	<b>10113.2</b>		

## 4.3 Contributions to the conservation of biodiversity processes

The Tankwa Protected Environment provides the western link between the TKCWC in the Northern Cape and Cederberg Wilderness Area in the Western Cape. It plays a critical role in terms of ecological connectivity within the TKCWC, which joins two differing and biodiverse landscapes to create a mega interprovincial protected area.

The TPE is situated within the “Rainshadow Valley Karoo Bioregion”, an area between the Cederberg and Roggeveld Plateau. The rain shadow effect results in a scarcity of available natural surface water, especially during drier summer months. The Doring and Tra-Tra Rivers with their deep perennial pools, as well as other ephemeral riverbeds are often utilised as refuge during these dry periods. While these riparian areas serve as a permanent habitat for numerous species they also serve as natural movement and migration corridors through landscape.

The TPE also contributes towards the protection of five NFEPA Classified rivers (Tankwa, Doring, Tra-Tra, Matjiesfontein and Brakfontein spruit Rivers) as well as their confluence within the TKCWC. The TPE is thus significantly contributes towards the ecological feasibility of the TKCWC.

Certain areas have been excluded from the declaration of the TPE, as indicated on the locality map (Figure 1.1), which may lead to the notion that connectivity within the TPE is impeded, impacting natural processes. Most of these set aside agricultural areas have however already been cultivated as

part of the established Brakfontein farming practice while approximately 90% of these areas are also not fenced off thus minimizing their impact on ecological patterns and processes, including the natural movement of animals.

## 4.4 Contributions to the conservation of ecosystem goods and services

The TPE contributes to the conservation of ecosystem services by:

- *Water security*: As discussed in section 4.3, the TPE plays an important role in terms of connectivity within the greater TKCWC as well as the conservation of NFEPA classified river systems and their confluence. Through its declaration as well as sustainable management practices, the TPE will contribute towards ecosystem services through the improved management of the Olifants – Doring River System’s catchment area. This will in turn improve both ground and surface water security.
- *Food security*: As the property has been declared a Protected Environment, the grazing of land by livestock for commercial gain is included as a sustainable management objective of the TPE. The commercial livestock grazing practices of the TPE contributes towards food security which is seen as an ecosystem service.
- *Tourism*: Due to the Tankwa Karoo’s desert like, wilderness landscape and relative proximity to Cape Town, the Tankwa Karoo has increasingly become a recognised tourist destination. The Management Authority owns and manages the ‘*Karmedo River Lodge*’ on the farm Brakfontein and is enthusiastic about the growth of the tourism sector in the area as well as the development potential for low-impact ecotourism activities on the TPE.

## 4.5 Species of conservation concern

Two species of conservation concern have been recorded on the TPE namely, *Lapeirousia fabricii* subsp. *purpurascens* (Figure 4.2) and *Acanthopsis erosa* (Figure 4.3). Both species are listed as “Scarce” by the ‘SANBI Red list of South African Plants’ and are endemic to the Swartruggens Quartzite Karoo vegetation type.





**Figure 4.2** (left) *Lapeirousia fabricii* subsp. *purpurascens* and **Figure 4.3** (right) *Acanthopsis erosa*  
(Credit: Annelise le Roux and D'Reull de Beer)

## 4.6 Threats to biodiversity

### 4.6.1 Overgrazing

The Tankwa Karoo is seen as a marginal, extensive livestock farming area. Careful consideration should thus be given to any form of grazing or other activities where vegetation is disturbed. The area's climate and ecological drivers in general are described as 'episodic' (personal communication, Balfour, 2020). Rainfall events are generally infrequent with droughts being more the norm compared to neighbouring landscapes such as the Roggeveld to the east and Cederberg to the west. Grazing therefore requires adequate management to prevent ecological degradation. The *Tankwa Karoo to Cederberg Wilderness Corridor, Ecological management Guidelines* (2021) are further discussed in section 6.2.5.

### 4.6.2 Alien invasive species

Alien Invasive Plant Species (AIP) pose a significant threat to the TPE, especially within riparian systems. AIP species such as *Prosopis spp.* (Mesquite), *Nerium oleander* (Oleander) en *Sesbania punicea* predominantly occur in the Doring and Tra-Tra River on both the TPE and neighbouring properties upstream and downstream. Less prominent, ephemeral rivers and drainage lines, such as the Brakfonteinspruit en Matjiesfontein River are mostly infested with *Prosopis spp.* Methods for the treatment of AIP are discussed under section 6.2.1.

Since their introduction during the 1920's and 1930's alien invasive fish species (section 3.3.7) continue to persist in the Olifants – Droring River System and remain a threat to its endangered and endemic fish species.

#### 4.6.3 Irresponsible tourism

The Tankwa Karoo generally attracts many 4x4 and motorcycle enthusiasts. Driving off demarcated roads and tracks leaves scars in the landscape that will last decades. This threat to the TPE and, TKCWC as a whole, could be reduced by educating visitors of the sensitive nature of the landscape through non-intrusive signage and other awareness initiatives.

#### 4.6.4. Unauthorised hunting

Game such Gemsbok and Springbok, which are popular hunting species, occur across the TPE. The size and open landscape of the TPE makes it relatively easy for unauthorised persons to hunt these game species which play an important ecological, and aesthetic role on the TPE.

#### 4.6.5 Problem causing animals

Ostrich and feral donkeys are seen as a threat to the TPE due to their impacts through overgrazing and trampling. As such they are regarded as problem causing animals. Additionally, these animals possess low monetary value and thus provide no sustainable economic opportunities. Since livestock farming takes place on the property, Blacked-backed jackal and Baboons are also often seen as problem causing animals by the Management Authority. Selective problem animal control, within the relevant regulatory framework, will be implemented if deemed necessary.

## 5. LEGAL AND ADMINISTRATIVE FRAMEWORK

### 5.1 Legal and policy framework

#### 5.1.1 National Environmental Management: Protected Areas Act, No. 57 of 2003

The National Environmental Management: Protected Areas Act, No. 57 of 2003, aims to provide a representative network of protected areas on state, private and communal land, and to promote the sustainable utilisation of protected areas.

The Act encourages local community participation in the management of protected areas and balances the relationship between the environment, biodiversity, human settlement, and economic development. The Act establishes the platform for biodiversity stewardship by creating a legal framework for cooperation between the state and landowners for the declaration and management of protected areas.

#### 5.1.2 National Environmental Management: Biodiversity Act, No. 10 of 2004

The National Environmental Management: Biodiversity Act, No. 10 of 2004, provides planning instruments for various aspects of biodiversity conservation. The planning tools provided for in the act are aimed at assisting provincial authorities and conservation agencies in identifying biodiversity priorities and addressing threats. The identified tools include the National Biodiversity Framework, bioregional plans, biodiversity management plans, the listing of threatened and protected species or

ecosystems, and the control and enforcement of species and organisms posing a potential threat to biodiversity.

Section 76(1) of the Biodiversity Act states that the management authority of a protected area must incorporate into the management plan an invasive species control and eradication strategy.

### 5.1.3 National Environmental Management Act: EIA Regulations, GNR. 543 of 2010

The National Environmental Management Act EIA Regulations of 2010 lists activities that cannot proceed without prior environmental authorisation. Dependent on the nature of the activities, and on which listing notice applies, authorisation may require either a Basic Assessment process or a Scoping and Environmental Impact Reporting process. It is important to note that the existence of a biodiversity stewardship agreement does not negate the requirement for environmental authorisation should the landowner or any other party which to pursue a listed activity.

### 5.1.4 National Veld and Forest Fire Act, No. 101 of 1998

In terms of the National Veld and Forest Fire Act, No. 101 of 1998, landowners may form fire protection associations for the purpose of predicting, preventing, managing, and extinguishing veld fires.

### 5.1.5 Conservation of Agricultural Resources Act, No. 43 of 1983

The Conservation of Agricultural Resources Act, No. 43 of 1983 is an act of the National Department of Agriculture and makes provision for the conservation of the natural agricultural resources of South Africa. The aim of the act is to ensure landowners maintain the production potential of land, combat and prevent soil erosion, prevent the weakening or destruction of water sources, protect the indigenous vegetation and combat weeds and invader plants.

### 5.1.6 Memorandum of Agreement for the Tankwa Protected Environment, 2020

The Memorandum of agreement for the Tankwa Protected Environment is an agreement between the landowner and South African National Parks governing the management of the Protected Environment. The agreement is the foundation for the current management plan and outlines the agreed upon management objectives for the Protected Environment.

## 5.2 Administrative framework

The Brakfontein Trust, represented by Mr. Francois van der Merwe, is the appointed Management Authority (MA) of the Tankwa Protected Environment. The Management Authority appointment was made as per the Protected Area Management Agreement signed between South African National Parks and the Landowner.

The South African National Parks was the national conservation body responsible for facilitating the proclamation of the TPE through the Department of Forestry, Fisheries and Environment (DFFE) as a Protected Environment under Section 28(1) of the National Environmental Management: Protected Areas Act (Act 57 of 2003).

Management decisions can be made through liaison between the Management Authority and SANParks, however the Management Authorities will ultimately remain responsible for final decisions made and the overall management of the Protected Environment, while SANParks will be responsible

for maintaining the TPE by conducting annual audits and supporting the landowners with technical advice.

## 6. PROTECTED AREA POLICIES AND OPERATIONAL MANAGEMENT FRAMEWORK

### 6.1 Policy statements and guiding management principles

#### 6.1.1 Grazing and Veld Management

Grazing and veld management will be managed in line with the, Tankwa Karoo to Cederberg Wilderness Corridor Ecological Management Guidelines (2021), document. These guidelines were specifically developed in collaboration with landowners from the corridor, local farmers, Western Cape Department Agriculture, SANParks, SAEON, DAELR, WWF, CapeNature, the University of Cape Town, and WFA as well as various ecologists, grazing specialists, and botanists to inform and promote sustainable land use on Protected Areas within the Tankwa Karoo to Cederberg Wilderness Corridor.

#### 6.1.2 Alien Invasive Plant Control

Invasive alien plant species which occur in the Tankwa Protected Environment will be treated according to the categories and directives listed in the National Environmental Management: Biodiversity Act (No. 10 of 2004), through implementation of a strategic clearing plan. This plan will prioritise species according to objectives, with effective management techniques and monitoring guidelines. The plan will also allow, as applicable, for the management authority to exclude individual plants/trees, from clearing operations. This includes species such as *Prosopis glandulosa* which are often utilised for shade around homesteads. The Management Authorities will however still have the responsibility of demarcating such individuals/groups of plants, and ensuring systems are in place to control their spread as required by NEMBA. Naturally occurring indigenous trees will also be planted in areas where shade is required as part of a succession plan to replace shade providing AIP's.

#### 6.1.3 Alien Invasive Fauna

Alien invasive fauna and their impacts are often overlooked, especially in arid ecosystems such as the Tankwa Karoo. These invasive species not only affect indigenous and endemic biodiversity, but also the overall functioning of sensitive ecosystems.

The TPE forms part of the Olifants – Doring River System (ODRS) with sections of both the Doring and Tra-Tra Rivers flowing through the property. In total, there are eight (8) endemic fish species which occur in the ODRS, of which at least three are potentially still found in the TKCWC and TPE specifically. The continued survival of these endemic fish species is severely threatened by alien invasive fish species through interspecific competition for food and other resources, predation and change in habitat quality. Juvenile, and smaller endemic fish species are especially susceptible to predation by carnivorous alien fish species such as Largemouth bass, Smallmouth bass, and Bluegill sunfish, while species such as Carp, affect habitat quality through their bottom feeding behaviour which results in murky water.

In November 2020 a survey was conducted by researcher and freshwater aquatic ecologist, Dean Impson. This survey focussed on freshwater river systems in the TKCWC and confirmed that this

section of the ODRS had already been impacted by alien invasive fish species. These impacts require specific management actions which will be further discussed under section 6.2.

#### 6.1.4 Soil Erosion and Landscape Degradation

There are limited signs of soil erosion present on the TPE. This is mainly due to the relatively flat topography found across the property coupled with low rainfall and rocky soils, as well as the low impact land use activities which are generally implemented in the area.

In this regard, the focus of the Management Authority will largely be to establish the extent of current degradation on the TPE, investigate the feasibility and effectiveness of potential rehabilitation mechanisms and put monitoring systems in place which will identify any new forms of degradation.

#### 6.1.5 Problem Animal Control

Problem animal control will be considered where deemed absolutely necessary and conducted in accordance with the regulations set out in section 63 of the Northern Cape Nature Conservation Act (Act No. 9 of 2009) and in consultation with SANParks.

#### 6.1.6 Fire Management

Although the Tankwa Protected Environment is not situated within a fire prone or driven ecosystem, the Management Authority will still endeavour to comply with legislative requirements pertaining to fires as well as join the nearest local Fire Protection Association (FPA) if there is an active FPA functioning in the area.

#### 6.1.7 Monitoring and Research

The Management Authority encourages and supports monitoring and research projects within the Tankwa Protected Environment, specifically those relevant to informing management actions and decisions as part of an adaptive management strategy. This is however done on condition that the information and results from research activities are shared with the Management Authority.

#### 6.1.8 Access Control

The Management Authority will control access to the Tankwa Protected Environment. SANParks will be granted access upon request, by giving reasonable notice, to fulfil their obligations in terms of monitoring and auditing as set out in the Tankwa Protected Environment Management Agreement and this Management Plan.

#### 6.1.9 Financial and Human Resources

The necessary management interventions will be funded by the Management Authority. Where possible and justifiable for the organization, SANParks will aim to support the Management Authority with certain management activities, for example alien vegetation clearing as part of their DFFE funded Biodiversity and Social Projects.

The Management Authority furthermore employs and manages staff which can assist with the implementation of general management activities such as infrastructure maintenance and livestock management.

#### 6.1.10 Fencing and Infrastructure

Perimeter and internal camp fences will be maintained and patrolled by the Management Authority. Maintenance of these fences will have the aim of livestock and grazing management. Other

infrastructure such as buildings and those essential for water provision will, be maintained and installed as required.

#### 6.1.11 Water and Riparian System Management

Water is one of the most important natural resources in South Africa and is becoming increasingly scarce due to changes in climatic conditions and increased anthropogenic pressures. For this reason, the effective management of catchments and ephemeral river systems in the TPE is required to secure the availability of this resource for current and future generations.

The impact of water extraction as well as siltation, pollution, and eutrophication, have significant negative impacts on riparian systems. For this reason, control measures must be put in place by the Management Authority to prevent and mitigate the impacts of the above-mentioned influences and should always be seen as a priority management objective.

#### 6.1.12 Wildlife Management

Numerous indigenous game species occur on the TPE including Klipspringer, Steenbok, Gemsbok, Springbok, Grey rhebok as well as Red hartebeest. Not all these species remain resident on the TPE but rather move through the property on a seasonal basis in search of grazing and water sources. An example thereof is Gemsbok and Red hartebeest which trek from the plains in the east to the Doring and Tra-Tra River systems during periods of drought. Some of these animals may however remain in the area for extended periods due to available sources of grazing, thus resulting in the need for dedicated monitoring activities to measure their impacts on veld condition and inform potential management actions.

The Management Authority, with inputs from SANParks, will develop a game management plan which will prescribe management strategies and inform management decisions with the aim of conserving biodiversity and ensuring optimal ecological functioning. The management of game will be based on results from the TPE monitoring programme (veld condition and plant cover) as well as biennial game counts through cooperation with SANParks.

#### 6.1.13 Monitoring and Research

Monitoring and data collection is essential to the implementation of an adaptive management strategy. The aim of monitoring activities on the TPE is to gather and manage knowledge of the local ecology, while also measuring the effectiveness of implemented management activities. Information gathered is used to inform biodiversity management decisions and improve overall management of the TPE.

Opportunities also exist for area specific research programmes, which will contribute towards the perpetuation of species and ecological systems within the TPE and TKCWC as a whole. The Management Authority encourages research activities in the TKCWC and would like to see the TPE be used for research projects which can inform management decisions.

#### 6.1.14 Tourism

The Management Authority currently manages small-scale, self-catering accommodation, which is situated outside of the TPE, and as such is managed separate of the Protected Environment. Although tourism is not currently seen as a priority venture for the Management Authority, it is important that opportunities are identified in advance to inform future development plans. Potential tourism developments include:

- Development of small-scale, self-catering camping facilities.
- Hiking trails for both guided and unguided hikes.
- Mountain bike trails.
- Recreational angling.

The following guidelines should be followed when identifying potential tourism opportunities:

- Tourism products should not compromise the values of the TPE or pose a threat to biodiversity and ecological functioning.
- Consider the various environmental authorisations which may be required.
- Tourism products should be designed in a way that capitalises on the unique beauty and biodiversity characteristics of the TPE.
- Does the proposed product satisfy market driven demands and opportunities? This should be assessed to establish the feasibility of the proposed tourism product.

### 6.1.15 Cultural Heritage

While the TPE was mainly declared to protect the unique ecological components present on the property, there are also numerous paleontological, archaeological, and cultural features in the landscape which need to be discovered, examined, and adequately managed. Partnerships with specialists in these fields are necessary to assist with the identification and recording of these important heritage assets to ensure their integrity is conserved and maintained, and to allow for further research and knowledge sharing.

## 6.2 Biodiversity management objectives

### 6.2.1 Alien invasive plant control

**To manage alien invasive plants (AIP) on the property and limit their impact on biodiversity and ecosystem functioning.**

Various alien invasive plant species have been identified across the TPE (see Table 6.1 below). The density and composition of AIP infestations, however, varies across the property and is closely linked to riparian systems and transformed areas. *Prosopis glandulosa* and its variants, as well as annual species such as *Argemone ochroleuca*, are mostly found in dry riverbeds where they occur at relatively low densities while some scattered individuals also occur across the TPE outside of these dry riverbeds. The largest AIP infestations occur along the Doring and Tra-Tra River systems. The Doring River is dominated by scattered to dense stands of *Nerium oleander* and *Sesbania punicea*. The Tra-Tra River on the other hand is dominated by *N. oleander* and *Eucalyptus camaldulensis*.

The following management strategies will be implemented for the treatment of AIP on the TPE:

**Prevention:** The first objective of the Management Authority is to prevent the introduction of any new alien invasive plant species into the reserve whether it be through external influences and distribution mechanisms such as rivers and animal movement, or unintentional propagation for example ornamental plants. While external modes of introduction, such as rivers, might be difficult to control, liaison with stakeholders and continued monitoring for new AIP's will assist in ensuring a rapid response to any new recordings.

**Early detection and eradication:** Whenever a new AIP specie is recorded, its extent will be established, and species-specific control measures put in place. These control measures should be researched

beforehand to ensure that they are the most effective methods available for the species and included into this AIP Control Plan. The treatment of newly recorded species / emerging populations should be seen as priority as it is much easier and cost effective when done while plants are still young, and densities low with the aim of eradication.

For the above-mentioned reason, an early detection and eradication strategy will be followed for all areas where AIP occur at low densities. These areas cover the largest section of the TPE, outside of riparian zones, in the so called “rangelands”. The areas with low infestation densities (<1%) will be mapped into separate management units and prioritised for cost effective treatment. Control measures should thus be easy to implement, while highly effective. In most cases complete eradication will be the main management strategy followed.

**Containment and control:** This strategy aims to prevent the spread of AIPs on the TPE. This strategy will only be implemented where:

- 1) The density and extent of an AIP population is too great for the Management Authority to follow an eradication strategy without assistance from a government funded programme such as Working for Water. In such cases the Management Authority will still put measures in place to prevent the spread of the AIP population through demarcation and treatment of emerging seedlings.
- 2) Where certain individual AIP’s serve a specific purpose, whether it be as supplementary feed or the provision of shade. In such cases AIP’s which the Management Authority desires to keep must be demarcated and strict measures put in place to prevent the spread of these individuals. Measures will include:
  - a. The immediate removal of emerging seedlings.
  - b. Collection and incineration of seeds or any other propagative plant parts.
  - c. Implementation of a succession plan where indigenous alternatives are planted for eventual replacement of the alien invasive species.

The above will however, only be considered as a last resort, and will be entirely dependent on the species’ NEMBA category, proximity to riparian areas and the Management Authorities ability to implement adequate preventative measures.

A combination of the following methods will be used to control AIP’s:

- Mechanical (chainsaw/lopping & pruning)
- Chemical (herbicide)
- Manual (hand pulling)
- Biocontrol

**Table 6.1** Alien invasive plant species list for TPE.

Species	Common name	NEMBA category*
<i>Eucalyptus camaldulensis</i>	Red river gum	1b
<i>Atriplex nummularia</i>	Old man saltbush	2
<i>Nerium oleander</i>	Oleander	1b



<i>Sesbania punicea</i>	Red sesbania	1b
<i>Argemone ochroleuca</i>	Mexican poppy	1b
<i>Opuntia ficus-indica</i>	Prickly pear	1b
<i>Prosopis glandulosa</i>	Mesquite	3
<i>Salsola tragus</i>	Russian tumbleweed	1b

\*Any AIP species which occur in a riparian, or formal Protected Area (declared in terms of NEM:PAA) must be treated as category 1b species.

Planned management activities include:

- Identify, quantify, and map the extent of all invasive alien plant species on the TPE.
- Use data to draft a Strategic Clearing Plan (SCP). The SCP should include species densities, control methods and follow-up schedules.
- Research adequate biocontrol agents for the control of *S. punicea*, including any legal requirements before release.
- Consult with SANParks regarding the inclusion of the TPE in the Strategic Alien Clearing Lower-Level Plan of the TKNP as part of the Biodiversity and Social Projects (BSP), Working for Water Programme.
- Implement activities as set out in the SCP, including scheduled follow-up treatments.
- Monitor treatment effectiveness as well as for new infestations.

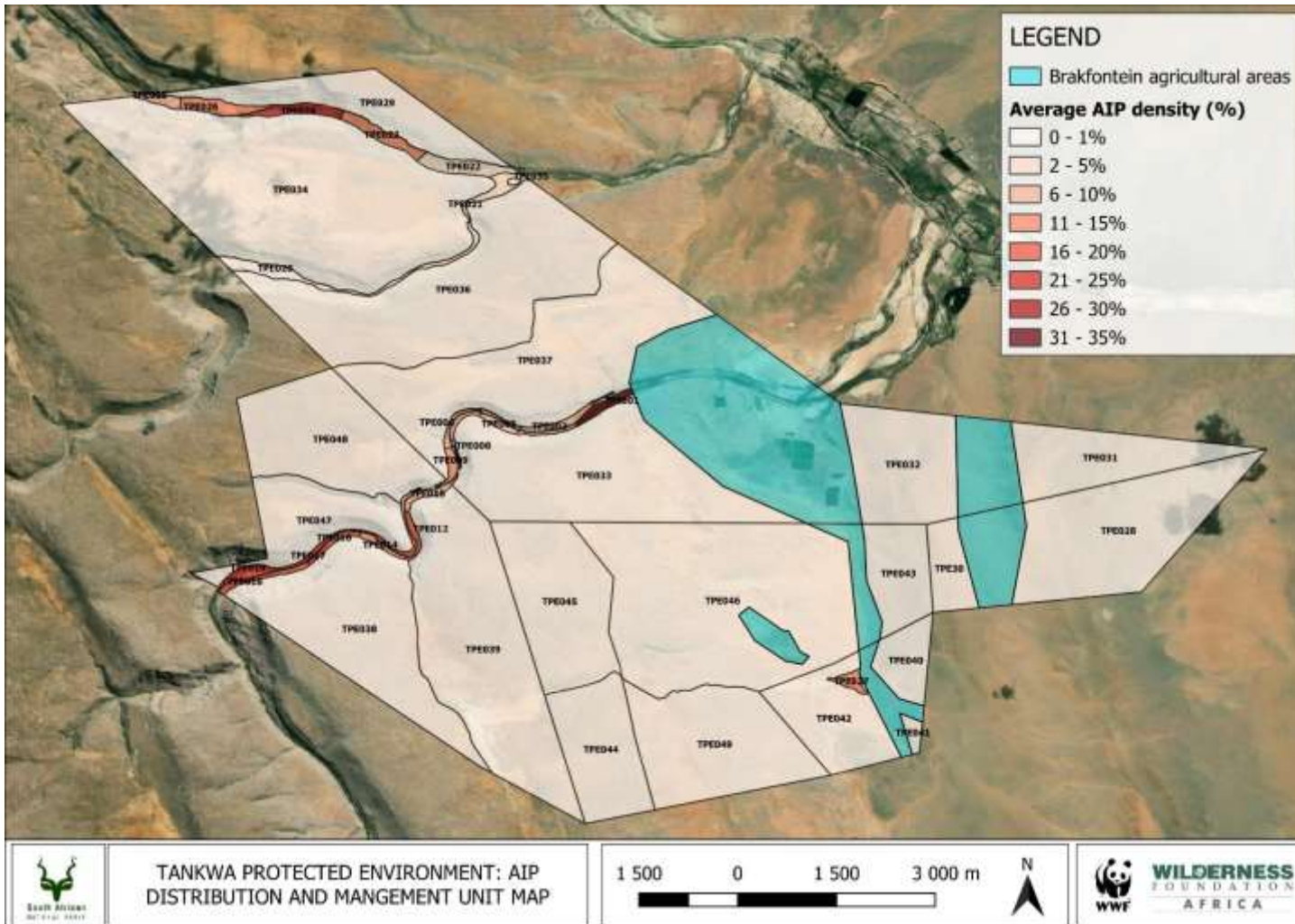


Figure 6.1 Tankwa PE Alien and Invasive Plant distribution and management unit map.

### 6.2.2 Alien Invasive fish species control

***To mitigate, and where possible control, the impacts of alien invasive fish species.***

As discussed under section 6.1.3, alien invasive fish species have had a range of negative impacts on endemic fish species as well as the freshwater ecosystem functioning of the Olifants-Doring River System (ODRS). It will however be extremely difficult for the Management Authority to implement large scale management interventions that will completely eradicate these invasive fish species from the TPE. This is largely due to the geographic extent over which the ODRS spans as well as the extensive establishment of alien invasive fish species within it. There are however a variety of practical and effective management activities that can be implemented by the Management Authority to improve the conservation of endemic fish species and the freshwater ecosystems in which they occur.

The impacts of alien invasive fish species will be addressed through the implementation of certain management principals as identified and recommended in the November 2020 report on freshwater fish species in the Tankwa Karoo to Cederberg Wilderness Corridor, compiled by researcher and freshwater aquatic ecologist, Dean Impson.

The report includes the following general recommendations which will be implemented by the Management Authority.

- Liaison with researchers and projects such as “Saving Sandfish” which focus on rehabilitation and replenishment of indigenous fish populations.
- Encourage local and recreational anglers to remove/destroy any alien invasive fish species they catch while returning any endemic fish species that are caught. Any endemic fish that are caught must be handled with wet hands and set free as soon as possible.
- Create awareness around the conservation of endemic fish species and freshwater ecosystems of the Olifants-Doring River System.
- Strategic placement of information boards and signage.

### 6.2.3 Soil erosion and landscape degradation control

***To identify areas across the TPE showing signs of degradation, and implement suitable and effective control measures where required, to improve overall ecosystem function.***

There are currently few to no signs of soil erosion, or other forms of landscape degradation, on the TPE. This can largely be attributed to the relatively flat topography, low rainfall, soil structures which are generally not erosion prone and the low-impact land use activities which are implemented in the area. While the condition of the veld on the TPE is not currently in an optimal state, and may be seen as degraded in some sections, it is largely the result of the extended drought which was experienced in the area over the past years. Veld condition, and the impact of livestock and game thereon, is discussed in section 6.2.5 below.

Although the Management Authority has the objective to maintain key ecological processes and mitigate the impacts of potential degradation (both present and future), the focus for the first five years of this management plan will be placed on monitoring in order to identify and quantify any potential degradation on the TPE. This information will be used to inform potential rehabilitation activities as part of the TPE Rehabilitation Plan. Due to the arid climate and sensitive ecosystems that are present on the TPE, it is important that the effectiveness and suitability of proposed rehabilitation methods are first established. Specialists should be contracted to investigate and prescribe

rehabilitation strategies while SANParks Scientific Services can also be approached for their inputs as similar rehabilitation projects are currently being implemented in the nearby TKNP.

The following interim management activities will be implemented:

- Establish the extent of land degradation across the TPE by identifying and mapping eroded / degraded areas.
- Consult with SANParks Scientific Services to establish the effectiveness of rehabilitation interventions on similar degraded areas in the TKNP.
- Seek input from specialists regarding potential rehabilitation mechanisms.
- Implement monitoring tools that will measure the impact of degradation, identify any new degradation, and inform management strategies and actions (fixed-point photography, veld condition assessments).

#### 6.2.4 Infrastructure management

***Maintenance and patrolling of fences for the effective management of livestock as well as security. Continuous maintenance of buildings and water provision infrastructure.***

Planned management activities include:

- Patrol and maintain both internal camp and border fences on a regular basis.
- Maintain existing water infrastructure (pumps, water tanks, water troughs) to ensure adequate water provision for wildlife and livestock.
- General maintenance of buildings and other infrastructure essential to the management of the TPE.

#### 6.2.5 Livestock and veld condition management

***To effectively monitor and manage the impact of livestock on natural vegetation, with the aim of ensuring optimal veld condition.***

Grazing and livestock management in the TPE will be managed in line with the principles identified and recommended in the Tankwa Karoo to Cederberg Wilderness Corridor, Ecological Management Guidelines (2021) document (or latest revised version of the Ecological Management Guidelines).

This includes the following general principles:

- A camp system should ideally be implemented which allows for the controlled shifting of livestock across the property.
- Vegetation condition and signs of visible livestock utilisation (new growth removal etc.) should be used as indicators to guide stocking rates and camp rotation, rather than animal condition.
- As far as possible veld should not be extensively utilised or over exposed to livestock grazing within the first eight weeks after receiving rain. To allow for the establishment and persistence of perennial plants, livestock should ideally be removed once not more than 50% of new growth has been removed. The complete defoliation of plants needs to be avoided.
- It is recommended that livestock and game stocking densities should not exceed 50% to 70% of the agricultural carrying capacity per vegetation type. In the case of the TPE a stocking rate of 50% will be implemented to facilitate the improvement and rehabilitation of veld condition (species composition and cover).

- Resident indigenous game species need to be considered when calculating the overall stocking rate for the property.
- Annual monitoring should take place to measure the overall condition of the veld in grazing camps. These monitoring findings will largely form the basis for livestock management. Monitoring methods include annual veld condition assessments and biennial fixed-point photography.

The Table 6.1 below indicates the recommended stocking rates per vegetation type present on the TPE, as adapted from the National Long terms Agricultural Carrying Capacity Norms.

**Table 6.2 Recommended stocking rates for the TPE.**

Vegetation Type (ha)*	Agricultural Carrying Capacity (ha/LSU)	Recommended Carrying Capacity for TPE	Recommended ha/LSU for corridor TPE	Recommended ha/SSU for TPE	Max. number of SSU's recommended for TPE	Recommended Carrying Capacity for TPE
Swartruggens Quartzite Karoo (7760.51 ha)	72	50%	140	35.1	55	221
Tanqua Karoo (2352.69 ha)	110		220	53.7	11	44

*\*Due to the small representation of certain vegetation types present on the TPE, coupled with a shared similarity in terms of dominant plant species, the following vegetation types were grouped together for the stocking rate calculations as included in Table 6.2 above.*

- *Swartruggens Quartzite Fynbos (44.68 ha) and Agter-Sederberg Shrubland (40.16 ha) is included under Swartruggens Quartzite Karoo (7675.67 ha) for a total of 7760.51 ha.*
- *Tanqua Wash Riviere (0.36 ha) is included under Tanqua Karoo (2352.33 ha) for a total of 2352.69 ha.*

As per table above a maximum number of 66 large stock units (LSU's) can be sustainably managed on the TPE over a twelve-month period, with the aim of rehabilitation and the improvement of veld condition. Numerous factors should however be taken into account when considering the stocking of the TPE at the above capacity including:

- Indigenous, resident game numbers on the TPE.
- Persistent droughts and other climatic conditions.
- Monitoring findings on veld condition and plant species composition.
- Ability to implement a rotational grazing system.

Monitoring methods and principles identified in the Tankwa Karoo to Cederberg Wilderness Corridor, Ecological Management Guidelines (2021) document should be followed and incorporated into the monitoring plan of the TPE.

Planned livestock management activities will include:

- Record keeping of livestock numbers and grazing days per camp.

- Monitoring of veld condition and plant species composition.
- General livestock management as per “Tankwa Karoo to Cederberg Wilderness Corridor, Ecological Management Guidelines”.

### 6.2.6 Wildlife management

***To promote the conservation of indigenous wildlife through the implementation of effective game management, while contributing towards the rehabilitation of plant growth and overall ecosystem functioning of the Tankwa Protected Environment.***

The TPE and Tankwa Karoo to Cederberg Wilderness Corridor hosts a variety of indigenous wildlife. It should however be noted that not all these species are necessarily resident on the TPE. Due to the arid climate, coupled with episodic rainfall events, most large herbivores continuously move through the region in search of adequate sources of grazing and surface water. An example thereof is Gemsbok and Red hartebeest which “locally” migrate from the east of the TKCWC to the Doring and Tra-Tra River systems in the west during times of drought. The numbers of game species on the TPE will thus fluctuate between seasons and rainfall events. Smaller game species such as Klipspringer (*Oreotragus oreotragus*), Grey rhebok (*Pelea capreolus*), Steenbok (*Raphicerus campestris*) and Common duiker (*Sylvicapra grimmia*) will permanently occur on the TPE as they are highly territorial and occupy much smaller ranges. Gemsbok (*Oryx gazella*), Springbok (*Antidorcas marsupialis*) and Ostrich (*Struthio camelus*) are some of the larger game species which might remain resident on the TPE, albeit in small groups, while Kudu (*Tragelaphus strepsiceros*) and Red hartebeest (*Alcelaphus buselaphus caama*) will move through on a seasonal basis.

In open systems without fences, game would have historically migrated as required with numbers fluctuating in line with climatic conditions. While fences on and around the TPE are not game proof, and some game species still “locally” migrate through the area, these fences may still result in game remaining on specific areas for extended periods. Numerous game species also have the tendency of selective grazing which may have negative impacts, especially when remaining in livestock camps for extended periods. This, coupled with the fact that the TPE is still utilised for commercial livestock grazing, necessitates the effective management of game and associated activities to ensure that veld condition, biodiversity and ecological functioning are maintained in an optimal state.

To ensure the effective management of game it is essential to draft a comprehensive game management plan which can be used to inform management decisions and prescribe well thought out management strategies. As part of this game management plan, it is important to confirm veld condition as well as current game numbers. While veld condition and carrying capacities are discussed under section, 6.2.5 Livestock and veld condition management, it is still necessary to establish actual game numbers on the TPE. This will be done by liaising with SANParks and their Scientific Services unit to include the TPE and, TKCWC as a whole, in the aerial census which is conducted on a biennial basis for Tankwa Karoo National Park. Data collected during this census will then be used, through consultation with SANParks, to inform management decisions including the need to cull. The game management plan will address the following:

- Description of habitat and vegetation types present on the TPE.
- Species list which includes game currently present on the TPE as well those which would have historically occurred.
- Game numbers informed by biennial game counts (aerial census).
- Population management which includes:

- Population numbers and composition
- Game capture
- Culling and hunting
- Fencing
- Water provision
- Monitoring of veld condition.
- General management recommendations.

The following primary game management activities are planned during the current implementation cycle of this strategic management plan:

- Liaison with SANParks Scientific Services regarding the inclusion of the TPE in Tankwa Karoo National Park's biennial aerial game census.
- Drafting of a comprehensive Game Management Plan for the TPE through consultation with SANParks.
- Implementation of approved TPE Game Management Plan.
- Monitoring of veld condition and game numbers.
- Establish list of faunal species found on TPE, which includes species of special conservation concern, by means of visual sightings and camera trap data.
- Ensure that the TPE complies with all requirements and regulations of the Northern Cape Nature Conservation Act.

### 6.2.7 Monitoring

***To adapt, inform and evaluate the management strategy through monitoring and data collection activities.***

The following monitoring activities will be implemented:

- Liaise with stakeholders and partners to assist with implementation of monitoring activities.
- Annual rainfall records.
- Record alien invasive plant control activities implemented as well as new or emerging infestations.
- Record any rehabilitation or restoration work completed including annual fixed-point photographs to measure the effectiveness of such interventions.
- Completion of biennial vegetation assessments whereby overall veld condition and species composition is monitored and recorded and used to inform livestock management.
- Implementation of fixed-point photography in different vegetation/landscape units. One fixed point per site will be established with photographs taken on a biennial basis to measure changes in veld condition and cover.

## 7. DEVELOPMENT FRAMEWORK

### 7.1 Zonation plan

The aim of the TPE zonation plan (Figure 7.1) is to provide spatial guidelines which inform the various land use and management activities which can take place within the Protected Environment, while ensuring that these activities do not contradict each other or the values of the TPE. It is furthermore also a requirement of the National Environmental Management: Protected Areas Act (No. 57 of 2003), that the management plan for a Protected Area include a zonation plan which indicates which activities are allowed on the property.

The TPE has been divided into three use zones, namely:

- Conservation zone
- High impact zone
- Heritage features zone

A detailed explanation of each zone with objectives, management guidelines and allowed activities is set out in table 7.1 below.

### 7.2 Development plan

No new developments are currently planned for the TPE Conservation and Heritage zones. All standard environmental legislation will be complied with in the event of new developments.



Table 7.1 Zone description and management objectives

USE ZONE	ZONE DESCRIPTION	MANAGEMENT OBJECTIVES	ALLOWED ACTIVITIES
<b>CONSERVATION ZONE</b>	<p>This zone predominantly covers the rangelands on the property. The main goal is to maintain the area in as near natural state as possible with controlled visitor interaction and management interventions.</p> <p>Commercial livestock grazing is implemented on a seasonal basis using the recommended stocking rates as set out in section 6.2.5 of the TPE Strategic Management Plan and 'TKCWC Ecological Guidelines 2021' document provided.</p> <p>Basic agricultural infrastructure is also located within this zone including water troughs, fences and roads.</p>	<p>a) Maintain area in as near natural state as possible, with limited interference of, and impact on, biological and ecological patterns and processes.</p> <p>b) To provide and maintain natural forage for commercial grazing purposes, implemented at recommended stocking rates (<i>TKCWC Ecological Guidelines, 2021</i>).</p> <p>c) Water provision for livestock purposes.</p> <p>c) General maintenance of management infrastructure.</p> <p>d) Ensure ecosystem integrity and functionality.</p> <p>e) Rehabilitation of degraded sites to counter the effects of erosion and alien and invasive species.</p>	<p><b>1) The following activities are allowed in the Conservation zone:</b></p> <ul style="list-style-type: none"> <li>a) Grazing by livestock and game at recommended stocking rates as set out in section 6.2.5 of the TPE Strategic Management Plan and 'TKCWC Ecological Guidelines 2021' document provided;</li> <li>b) Ecotourism activities and hunting of game for management purposes; and</li> <li>c) Development of small-scale infrastructure necessary for the management and sustainable utilisation of the TPE such as access roads, fences, boreholes, pipelines and associated infrastructure.</li> </ul> <p><b>2) No person may:</b></p> <ul style="list-style-type: none"> <li>a) Plough or transform virgin land without the required authorisation and prior consultation;</li> <li>b) Develop large-scale infrastructure; and</li> <li>c) Undertake any activity which is not in line with the management philosophy and objectives of the TPE. Activities implemented in this zone should be agriculture, conservation and/or ecotourism orientated.</li> </ul>
<b>HIGH IMPACT ZONE</b>	<p>The High impact zone includes infrastructure associated with the administration, maintenance, management, tourism and other Management Authority related purposes of the TPE. Future high impact infrastructure development will be located within this zone.</p>	<p>a) Provision and maintenance of infrastructure necessary for the management and sustainable utilisation of the TPE.</p> <p>b) Provision of space for potential future high impact developments.</p>	<p><b>1) The following activities are allowed in the High impact zone, if compliant with the relevant legal requirements and authorizations:</b></p> <ul style="list-style-type: none"> <li>a) High impact agricultural activities such as irrigation and ploughing of land;</li> <li>b) Development of largescale infrastructure including staff housing, administrative buildings, storage facilities, intensive feeding lots/kraals, main roads, dams and tourism accommodation facilities; and</li> <li>c) Any activity which is allowed in the Conservation zone.</li> </ul> <p><b>2) No person may undertake any activity that is not in line with the management philosophy and objectives of the TPE. Activities implemented in this zone should be agriculture, conservation and/or ecotourism orientated.</b></p>

<b>HERITAGE FEATURES ZONE</b>	Areas which contain, or are likely to contain, Middle Stone Age San and other cultural heritage artifacts and features.	a.) Protection of areas which contain cultural heritage features.	<p><b>1) The following activities are allowed in the Heritage features zone:</b></p> <ul style="list-style-type: none"> <li>a) Research;</li> <li>b) Controlled visitor access; and</li> <li>c) Grazing by livestock and game at recommended stocking rates as set out in section 6.2.5 of the TPE Strategic Management Plan and '<i>TKCWC Ecological Guidelines 2021</i>' document provided.</li> </ul> <p><b>2) No heritage features and/or artifacts may be removed, damaged, destroyed or contaminated in any way.</b></p>
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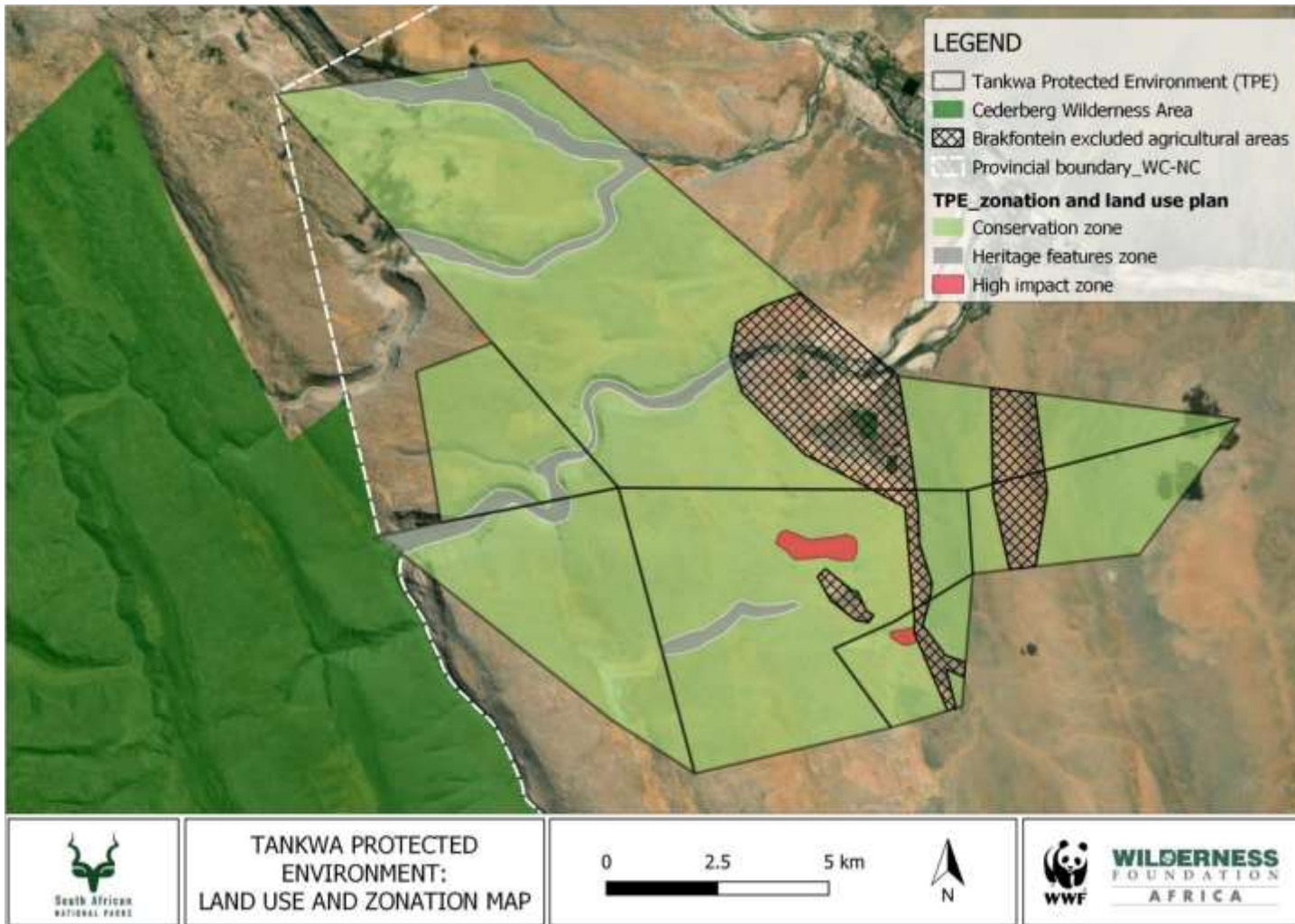


Figure 7.1 Tankwa Protected Environment zonation plan.

## 8. RESTRICTED ACTIVITIES

A NEM:PAA Section 51 Notice has been drafted and gazetted as part of the declaration of the Tankwa Protected Environment. The purpose of a NEM:PAA Section 51 Notice is to restrict and regulate development and other activities that may be inappropriate or impede the purpose for which the Tankwa Protected Environment was declared.

Below follows the restrictions as contained in the Tankwa Protected Environment, NEM:PAA Section 51 Notice.

### 8.1 Restriction of development and other activities in the Conservation Zone

Insofar as development and other activities in the Conservation Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from conservation, agricultural and/or ecotourism land uses.

Development or activities within the Conservation Zone, in accordance with **Table 7.1** and **Figure 7.1** are limited to:

- (a) Grazing by livestock and game at recommended stocking rates as set out in section 6.2.5 of the TPE Strategic Management Plan and '*TKCWC Ecological Guidelines 2021*' document;
- (b) Ecotourism activities and hunting of game for management purposes; and
- (c) Development of small-scale infrastructure necessary for the management and sustainable utilisation of the TPE such as access roads, fences, boreholes, pipelines, and associated infrastructure.

### 8.2 Restriction of development and other activities in the High Impact Zone

Insofar as development and other activities in the High Impact Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from agricultural and/or ecotourism land uses.

Developments or activities within the High Impact Zone, in accordance with **Table 7.1** and **Figure 7.1**, are limited to:

- (a) High impact agricultural activities such as irrigation and ploughing of land;
- (b) Development of largescale infrastructure including staff housing, administrative buildings, storage facilities, intensive feeding lots/kraals, main roads, dams, and tourism accommodation facilities; and
- (c) Any activity, which is allowed in the Conservation zone.

### 8.3 Restriction of development and other activities in the Heritage Features Zone

Insofar as development and other activities in the Heritage Features Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from agricultural and/or ecotourism land uses.

Developments or activities within the Heritage Features Zone, in accordance with **Table 7.1** and **Figure 7.1**, are limited to:

- (a) Research;
- (b) Controlled visitor access; and
- (c) Grazing by livestock and game at recommended stocking rates as set out in section 6.2.5 of the TPE Strategic Management Plan and '*Tankwa Karoo to Cederberg Wilderness Corridor Ecological Management Guidelines 2021*' (Wilderness Foundation Africa, 2021) document provided.

## 9. MANAGEMENT PLAN IMPLEMENTATION, REVIEW AN ANNUAL PLAN OF OPERATIONS

Monitoring and reporting assists with the evaluation of overall management of the Protected Environment. Depending on the outcomes, it can be used to directly adapt management strategies and activities to achieve the desired outcomes. During the annual review of the Annual Plan of Operation costing estimates per scheduled management action will be included, as applicable, to ensure adequate planning and provision for the implementation of said management actions.

### 9.1 Annual Plan of Operations

The Annual Plan of Operation (APO) forms an integral part of the Protected Area Management Plan. The APO gives life to the Operational Management Framework in the Strategic Management Plan by listing specific management actions. To facilitate effective review, each management action comprises the following components:

- a description of the management actions
- the Key Performance Indicator (KPI)
- the KPI target
- the person responsible for implementation
- the budget assigned to the activity
- the deadline for completion.

The APO for the Tankwa Protected Environment will be captured in a separate document which is directly linked to the Management Plan and will be one of the main tools used to measure management effectiveness during annual audits and evaluations. Pending the findings of these audits and reviews, the Management Authority will draft a list of management activities to be included in the next year's APO with revised KPI targets, budgets, deadlines, and responsible persons. SANParks will assist the Management Authority in terms of annual auditing and drafting of APO's.

### 9.2 Management plan review and annual audit

The purpose of undertaking an annual review of implementation of the Protected Area Management Plan will be to:

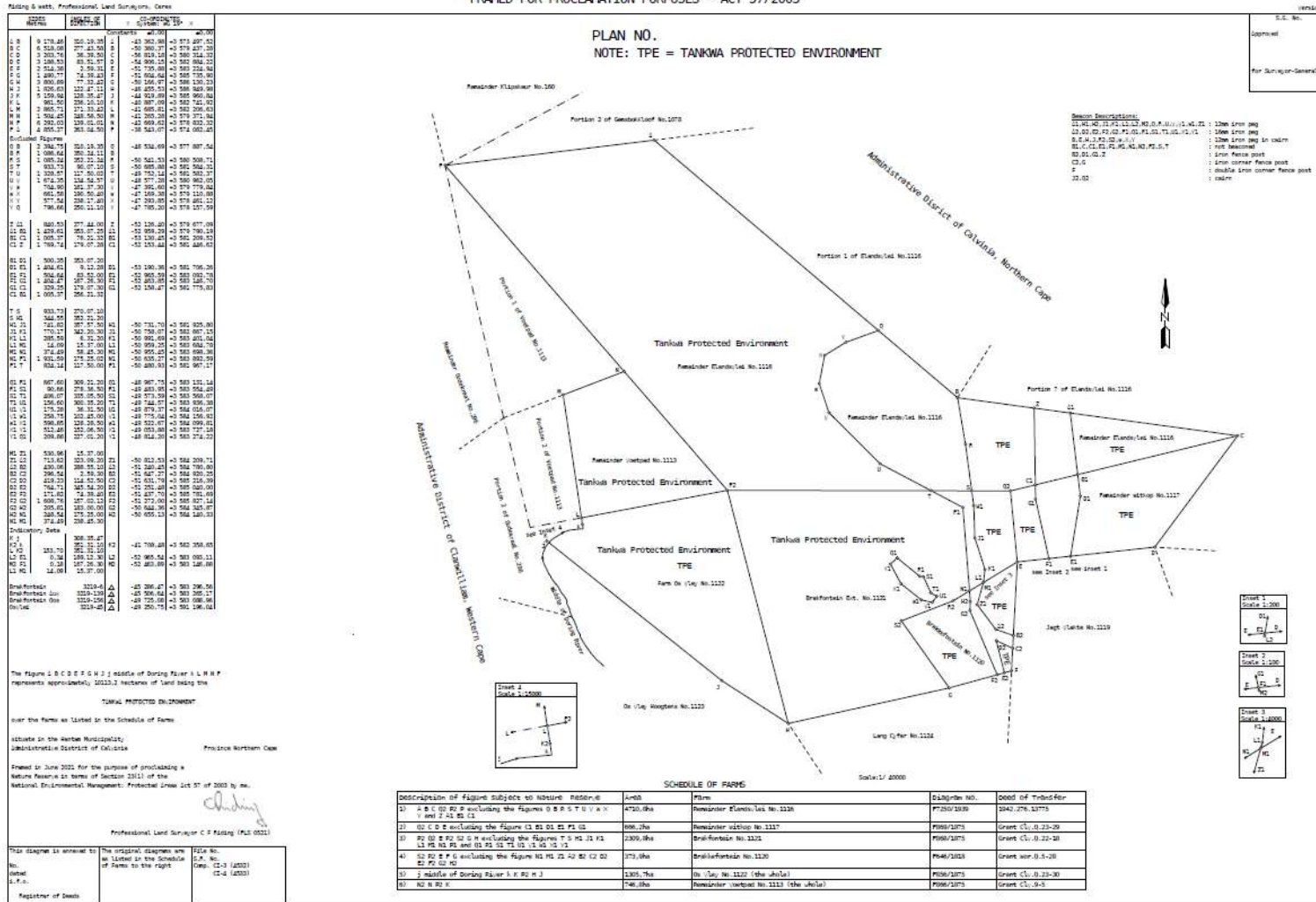
- Determine how effectively the management plan has been implemented.
- Assist in determining the focus for the Annual Plan of Operation and the setting of appropriate time frames and budgets.
- Enable effective adaptive management by identifying changes and modifying management interventions.

The Management Authority and SANParks will meet annually for the evaluation and audit of the TPE. The annual audit will form the basis of the Management Plan review. This should include records of recommendations for update/changes to the annual revision of the management schedules as well as the five-year plan. The Annual Plan of Operation (APO) is in a similar format to the Annual Audit, allowing for a seamless transition of information from Audit to new APO.



# ANNEXURE 1. Declaration diagram of the Tankwa Protected Environment

FRAMED FOR PROCLAMATION PURPOSES - ACT 57/2003





ANNEXURE 2. Copy of the Tankwa Protected Environment declaration notice published in the National government gazette.

(include when available)

### ANNEXURE 3. List of statutes to which the Tankwa Protected Environment is subject to.

#### **Biodiversity and Cultural Resource Management and Development:**

- Animals Protection Act [No. 71 of 1962]
- Atmospheric Pollution Prevention Act [No. 45 of 1965]
- Conservation of Agricultural Resources Act [No. 43 of 1983]
- Constitution of the Republic of South Africa [No. 108 of 1996]
- Criminal Procedures Act [1977]
- Environment Conservation Act [No. 73 of 1989]
- Forest Act [No. 122 of 1984]
- Hazardous Substances Act [No. 15 of 1973]
- National Environmental Management Act [No. 107 of 1998]
- National Environmental Management: Biodiversity Act [No. 10 of 2004]
- National Environmental Management: Protected Areas Act [No. 57 of 2003]
- National Forests Act [No. 84 of 1998]
- National Heritage Resources Act [No. 25 of 1999]
- National Water Act [No. 36 of 1998]
- National Water Amendment Act [No. 45 of 1999]
- National Veld and Forest Fire Act [No 101 of 1998]
- Nature Conservation Ordinance [No. 15 of 1974]

#### **General Management:**

- Companies Act [No.71 of 2008]
- Promotion of Access to Information Act [No. 2 of 2000]
- Occupational Health and Safety Act [No. 85 of 1993]
- Development Facilitation Act [No. 67 of 1995]
- Disaster Management Act [No. 57 of 2002]
- Fire Brigade Services Act [No. 99 of 1987]
- Local Government: Municipal Systems Act [No. 32 of 2000]
- National Road Traffic Act [No. 93 of 1996]
- National Building Standards Act [No. 103 of 1977]
- Water Services Act [No. 108 of 1997]

#### **Human Resource Management:**

- Basic Conditions of Employment Act [No. 75 of 1997]
- Broad-Based Black Economic Empowerment Act [No. 53 of 2003]
- Compensation for Occupational Injuries and Diseases Act [No. 130 of 1993]
- Employment Equity Act [No. 55 of 1998]
- Labour Relations Act [No. 66 of 1995]
- Occupational Health and Safety Act [No. 85 of 1993]
- Pension Funds Act [No. 24 of 1956]
- Skills Development Act [No. 97 of 1998]

- Skills Development Levies Act [No. 9 of 1999]
- Unemployment Insurance Act [No. 63 of 2001]

**A brief summary of the most applicable legislation:**

Protected Areas are proclaimed under section 23(1) of the National Environmental Protected Areas Act, 57 of 2003, (“the Protected Areas Act”).

- **Protected Areas Act (Act No. 57 of 2003)**

The [Minister/MEC] is empowered, under section 28 of the National Environmental Protected Areas Act, 57 of 2003, (“the Protected Areas Act”) to declare an area as a Protected Environment.

- **Biodiversity Act (Act No. 10 Of 2004)**

Objectives of Act

- a) within the framework of the National Environmental Management Act, to provide for —
  - i. the management and conservation of biological diversity within the Republic and of the components of such biological diversity;
  - ii. the use of indigenous biological resources in a sustainable manner; and
  - iii. the fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources;
- b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
- c) to provide for co-operative governance in biodiversity management and conservation; and
- d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

- **National Veld and Forest Fire Act (Act No. 101 of 1998)**

Purpose

‘The purpose of the Act is to prevent and combat veld, forest and mountain fires throughout the Republic.’

Firebreaks

In terms of section 12 and 14 every landowner must prepare and maintain a firebreak as determined in section 13. Failure to do so is an offence in terms of section 25(3), unless he has been exempted by the Minister in terms of section 15.

Fighting Preparedness

There is also a further duty on landowners to have equipment, protective clothing and trained personnel available in the eventuality that there may be fire on their property (section 17). Failure to meet this requirement is an offence in terms of section 25(4).

- **Conservation of Agricultural Resources Act, 1983 (No 43 of 1983)**

Purpose

CARA is an act of the National Department of Agriculture and makes provision for the conservation of the natural agricultural resources of South Africa through:

- i. Maintaining the production potential of land;
- ii. Combating and preventing erosion;
- iii. Preventing the weakening or destruction of water sources;
- iv. Protecting the vegetation; and
- v. Combating weeds and invader plants.

**Other Relevant Legislation:**

- Municipal Systems Act
- National Water Act, 1998 (No 36 of 1998)
- Constitution of the Republic of South Africa Act, 1996 (No 108 of 1996)
- Environment Conservation Act No 73 of 1989
- Forest Act No 122 of 1984
- National Environmental Management Act, 1998 (No 107 of 1998)
- National Heritage Resources Act, 1999 (No 25 of 1999)
- World Heritage Convention Act, 1999 (No 109 of 1999)
- Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970)
- The administration of the Act has been assigned to the Board by virtue of Act 3 of 2000 as published in Provincial Gazette Extraordinary No. 5442 dated 24 March 2000
- Land Use Planning Ordinance 15/1985 (section 29)

There may be other legislation applicable to the Protected Environment and it is the landowner's/Management Authority's responsibility to identify and comply with applicable legislation.

ANNEXURE 4. Provisional mammal species list for the Tankwa Protected Environment, (Fitzpatrick Institute of African Ornithology, 2021. Mammal MAP Virtual Museum, 'Tankwa Conservation Area') (<http://vmus.adu.org.za/>)

#	Species	Family	Scientific name	Common name	Red list	Last recorded
	code				category	
1	211990	Bovidae	<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	Least Concern (2008)	2018-09-07
2	212190	Bovidae	<i>Antidorcas marsupialis</i>	Springbok	Least Concern (2016)	2018-09-07
3	216020	Bovidae	<i>Oryx gazella</i>	Gemsbok	Least Concern (2016)	2018-09-07
4	213320	Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern (2016)	2017-04-12
5	215700	Bovidae	<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern (2016)	2012-10-25
6	198600	Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern (2016)	2012-04-07
7	199080	Canidae	<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern (2016)	2018-09-07
8	199410	Canidae	<i>Vulpes chama</i>	Cape Fox	Least Concern (2016)	1987-09-27
9	192070	Felidae	<i>Felis silvestris</i>	Wildcat	Least Concern (2016)	1991-04-24
10	196300	Herpestidae	<i>Herpestes pulverulentus</i>	Cape Grey Mongoose	Least Concern (2016)	2012-10-26
11	157560	Leporidae	<i>Lepus capensis</i>	Cape Hare	Least Concern	1987-09-27
12	106540	Macroscelididae	<i>Macroscelides proboscideus</i>	Short-eared Elephant Shrew	Least Concern (2016)	1987-09-27
13	217960	Muridae	<i>Aethomys granti</i>	Grant's Rock Mouse	Least Concern	1987-09-26
14	217970	Muridae	<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern	1997-11-26
15	144330	Muridae	<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	Least Concern (2016)	1987-09-27
16	144580	Muridae	<i>Gerbilliscus paeba</i>	Paeba Hairy-footed Gerbil	Least Concern (2016)	1987-09-27
17	147990	Muridae	<i>Micaelamys granti</i>	Grant's Micaelamys	Least Concern (2016)	1987-09-26
18	151100	Muridae	<i>Otomys irroratus</i>	Southern African Vlei Rat (Fynbos type)	Least Concern (2016)	2005-07-23
19	151170	Muridae	<i>Otomys saundersiae</i>	Saunders' Vlei Rat	Least Concern	
20	218000	Muridae	<i>Otomys unisulcatus</i>	Karoo Bush Rat	Least Concern (2016)	1987-09-27
21	151210	Muridae	<i>Parotomys brantsii</i>	Brants's Whistling Rat	Least Concern (2016)	2012-04-09
22	150360	Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern (2016)	1987-09-26

23	203170	Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern (2016)	
24	205210	Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened (2016)	2012-10-25
25	136680	Nesomyidae	<i>Malacothrix typica</i>	Large-eared African Desert Mouse	Least Concern (2016)	1987-09-27
26	137030	Nesomyidae	<i>Petromyscus barbouri</i>	Barbour's Pygmy Rock Mouse	Least Concern (2016)	1987-10-10
27	176970	Nycteridae	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	Least Concern (2016)	
28	107300	Procaviidae	<i>Procavia capensis</i>	Cape Rock Hyrax	Least Concern (2016)	2017-04-11
29	163350	Soricidae	<i>Myosorex varius</i>	Forest Shrew	Least Concern (2016)	1985-11-12
30	163010	Soricidae	<i>Suncus varilla</i>	Lesser Dwarf Shrew	Least Concern (2016)	1927-01-01
31	190500	Vespertilionidae	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat	Near Threatened	2012-04-06
32	195120	Viverridae	<i>Genetta genetta</i>	Common Genet	Least Concern (2016)	1988-07-17
33	195300	Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)	1986-04-27

ANNEXURE 5. Bird species list per SABAP 'pentad' overlapping the TPE.  
(<http://sabap2.birdmap.africa/>)

TOTALE SPESIES VIR TANKWA BESKERMDE OMGEWING: 86 SPESIES (Datum: 30 Junie 2021)				
<b>PENTAD:</b>	<b>3215_1920</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
No records				
<b>PENTAD:</b>	<b>3215_1925</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
873	Bunting	Cape	<i>Emberiza</i>	<i>capensis</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albobularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
572	Chat	Sickle-winged	<i>Emarginata</i>	<i>sinuata</i>
638	Cisticola	Grey-backed	<i>Cisticola</i>	<i>subruficapilla</i>
626	Eremomela	Karoo	<i>Eremomela</i>	<i>gregalis</i>
165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
123	Kestrel	Rock	<i>Falco</i>	<i>rupicolus</i>
4134	Korhaan	Southern Black	<i>Afrotis</i>	<i>afra</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
1	Ostrich	Common	<i>Struthio</i>	<i>camelus</i>
525	Tit	Grey	<i>Melaniparus</i>	<i>afra</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
564	Wheatear	Mountain	<i>Myrmecocichla</i>	<i>monticola</i>
<b>PENTAD:</b>	<b>3215_1930</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
72		Hamerkop	<i>Scopus</i>	<i>umbretta</i>
432	Barbet	Acacia Pied	<i>Tricholaema</i>	<i>leucomelas</i>
404	Bee-eater	European	<i>Merops</i>	<i>apiaster</i>
808	Bishop	Southern Red	<i>Euplectes</i>	<i>orix</i>
873	Bunting	Cape	<i>Emberiza</i>	<i>capensis</i>
871	Bunting	Lark-like	<i>Emberiza</i>	<i>impetuani</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albobularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
571	Chat	Tractrac	<i>Emarginata</i>	<i>tractrac</i>
212	Coot	Red-knobbed	<i>Fulica</i>	<i>cristata</i>
50	Cormorant	Reed	<i>Microcarbo</i>	<i>africanus</i>
522	Crow	Pied	<i>Corvus</i>	<i>albus</i>

316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
317	Dove	Laughing	<i>Spilopelia</i>	<i>senegalensis</i>
318	Dove	Namaqua	<i>Oena</i>	<i>capensis</i>
95	Duck	African Black	<i>Anas</i>	<i>sparsa</i>
139	Eagle	Booted	<i>Hieraetus</i>	<i>pennatus</i>
133	Eagle	Verreaux's	<i>Aquila</i>	<i>verreauxii</i>
368	Eagle-Owl	Spotted	<i>Bubo</i>	<i>africanus</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
678	Flycatcher	Fairy	<i>Stenostira</i>	<i>scita</i>
665	Flycatcher	Fiscal	<i>Melaenornis</i>	<i>silens</i>
89	Goose	Egyptian	<i>Alopochen</i>	<i>aegyptiaca</i>
88	Goose	Spur-winged	<i>Plectropterus</i>	<i>gambensis</i>
165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
55	Heron	Black-headed	<i>Ardea</i>	<i>melanocephala</i>
54	Heron	Grey	<i>Ardea</i>	<i>cinerea</i>
81	Ibis	African Sacred	<i>Threskiornis</i>	<i>aethiopicus</i>
123	Kestrel	Rock	<i>Falco</i>	<i>rupicolus</i>
245	Lapwing	Blacksmith	<i>Vanellus</i>	<i>armatus</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
488	Lark	Red-capped	<i>Calandrella</i>	<i>cinerea</i>
509	Martin	Brown-throated	<i>Riparia</i>	<i>paludicola</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
392	Mousebird	Red-faced	<i>Urocolius</i>	<i>indicus</i>
391	Mousebird	White-backed	<i>Colius</i>	<i>colius</i>
311	Pigeon	Speckled	<i>Columba</i>	<i>guinea</i>
238	Plover	Three-banded	<i>Charadrius</i>	<i>tricoloris</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
524	Raven	White-necked	<i>Corvus</i>	<i>albicollis</i>
581	Robin-Chat	Cape	<i>Cossypha</i>	<i>caffra</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
784	Sparrow	House	<i>Passer</i>	<i>domesticus</i>
181	Spurfowl	Cape	<i>Pternistis</i>	<i>capensis</i>
733	Starling	Common	<i>Sturnus</i>	<i>vulgaris</i>
746	Starling	Pied	<i>Lamprotornis</i>	<i>bicolor</i>
735	Starling	Wattled	<i>Creatophora</i>	<i>cinerea</i>
760	Sunbird	Southern Double-collared	<i>Cinnyris</i>	<i>chalybeus</i>
493	Swallow	Barn	<i>Hirundo</i>	<i>rustica</i>
502	Swallow	Greater Striped	<i>Cecropis</i>	<i>cucullata</i>
495	Swallow	White-throated	<i>Hirundo</i>	<i>albigularis</i>
385	Swift	Little	<i>Apus</i>	<i>affinis</i>



1104	Thrush	Karoo	<i>Turdus</i>	<i>smithi</i>
525	Tit	Grey	<i>Melaniparus</i>	<i>afer</i>
686	Wagtail	Cape	<i>Motacilla</i>	<i>capensis</i>
606	Warbler	African Reed	<i>Acrocephalus</i>	<i>baeticatus</i>
653	Warbler	Namaqua	<i>Phragmacia</i>	<i>substriata</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
843	Waxbill	Common	<i>Estrilda</i>	<i>astrild</i>
803	Weaver	Southern Masked	<i>Ploceus</i>	<i>velatus</i>
568	Wheatear	Capped	<i>Oenanthe</i>	<i>pileata</i>
564	Wheatear	Mountain	<i>Myrmecocichla</i>	<i>monticola</i>
<b>PENTAD:</b>	<b>3220_1925</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
861	Canary	Black-headed	<i>Serinus</i>	<i>alario</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albogularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
621	Crombec	Long-billed	<i>Sylvietta</i>	<i>rufescens</i>
626	Eremomela	Karoo	<i>Eremomela</i>	<i>gregalis</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
391	Mousebird	White-backed	<i>Colius</i>	<i>colius</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
867	Seedeater	Streaky-headed	<i>Crithagra</i>	<i>gularis</i>
745	Starling	Red-winged	<i>Onychognathus</i>	<i>morio</i>
764	Sunbird	Dusky	<i>Cinnyris</i>	<i>fuscus</i>
760	Sunbird	Southern Double-collared	<i>Cinnyris</i>	<i>chalybeus</i>
525	Tit	Grey	<i>Melaniparus</i>	<i>afer</i>
<b>PENTAD:</b>	<b>3220_1930</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
808	Bishop	Southern Red	<i>Euplectes</i>	<i>orix</i>
218	Bustard	Ludwig's	<i>Neotis</i>	<i>ludwigii</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
522	Crow	Pied	<i>Corvus</i>	<i>albus</i>
52	Darter	African	<i>Anhinga</i>	<i>rufa</i>
316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
96	Duck	Yellow-billed	<i>Anas</i>	<i>undulata</i>
61	Egret	Western Cattle	<i>Bubulcus</i>	<i>ibis</i>

89	Goose	Egyptian	<i>Alopochen</i>	<i>aegyptiaca</i>
245	Lapwing	Blacksmith	<i>Vanellus</i>	<i>armatus</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
374	Nightjar	Freckled	<i>Caprimulgus</i>	<i>tristigma</i>
238	Plover	Three-banded	<i>Charadrius</i>	<i>tricoloris</i>
581	Robin-Chat	Cape	<i>Cossypha</i>	<i>caffra</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
90	Shelduck	South African	<i>Tadorna</i>	<i>cana</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
784	Sparrow	House	<i>Passer</i>	<i>domesticus</i>
98	Teal	Cape	<i>Anas</i>	<i>capensis</i>
564	Wheatear	Mountain	<i>Myrmecocichla</i>	<i>monticola</i>
<b>PENTAD:</b>	<b>3220_1935</b>			
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
871	Bunting	Lark-like	<i>Emberiza</i>	<i>impetuanii</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
572	Chat	Sickle-winged	<i>Emarginata</i>	<i>sinuata</i>
522	Crow	Pied	<i>Corvus</i>	<i>albus</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
245	Lapwing	Blacksmith	<i>Vanellus</i>	<i>armatus</i>
463	Lark	Large-billed	<i>Galerida</i>	<i>magnirostris</i>
238	Plover	Three-banded	<i>Charadrius</i>	<i>tricoloris</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
485	Sparrow-Lark	Grey-backed	<i>Eremopterix</i>	<i>verticalis</i>
843	Waxbill	Common	<i>Estrilda</i>	<i>astrild</i>

ANNEXURE 6. Plant species list for the Tankwa Protected Environment (March, 2021)

<b>Number of species recorded:</b>			<b>68</b>
<b>Species of conservation concern: scarce and endemic</b>			<b>2</b>
<b>Alien species:</b>			<b>5</b>
<b>STATUS</b>	<b>ENDEMIC TO</b>	<b>FAMILY</b>	<b>GENUS &amp; SPECIE</b>
Scarce	Swartruggens Quartzite Karoo	ACANTHACEAE	<i>Acanthopsis erosa</i>
		ACANTHACEAE	<i>Justicia incana</i>
		AIZOACEAE	<i>Galenia africana</i>
		AIZOACEAE	<i>Mesembryanthemum noctiflorum subsp. stramineum</i>
		AIZOACEAE	<i>Mesembryanthemum pallens</i>
		AIZOACEAE	<i>Mesembryanthemum vaginatum</i>
		AMARANTHACEAE	<i>Sericocoma avolans</i>
		AMARYLLIDACEAE	<i>Crinum variable</i>
		ANACARDIACEAE	<i>Searsia undulata</i>
		APOCYNACEAE	<i>Hoodia gordonii</i>
Alien		APOCYNACEAE	<i>Nerium oleander</i>
		APONOGETONACEAE	<i>Aponogeton distachyos</i>
		ASPHODELACEAE	<i>Aloe comosa</i>
		ASTERACEAE	<i>Arctotis subacaulis</i>
		ASTERACEAE	<i>Berkheya fruticosa</i>
		ASTERACEAE	<i>Dicoma picta</i>
		ASTERACEAE	<i>Euryops tenuissimus</i>
		ASTERACEAE	<i>Helichrysum hebelepis</i>
		ASTERACEAE	<i>Helichrysum zeyheri</i>
		ASTERACEAE	<i>Leysera gnaphalodes</i>
		ASTERACEAE	<i>Leysera tenella</i>
		ASTERACEAE	<i>Pegolettia retrofracta</i>
		ASTERACEAE	<i>Pteronia scariosa</i>
		ASTERACEAE	<i>Pteronia villosa</i>
		ASTERACEAE	<i>Senecio arenarius</i>
		BORAGINACEAE	<i>Lobostemon cf. trichotomus</i>
		BORAGINACEAE	<i>Trichodesma africanum</i>
Alien		CACTACEAE	<i>Opuntia ficus-indica</i>
		CAMPANULACEAE	<i>Wahlenbergia oxyphylla</i>
Alien		CHENOPODIACEAE	<i>Atriplex lindleyi subsp. inflata</i>
Alien		CHENOPODIACEAE	<i>Atriplex nummularia</i>
		COLCHICACEAE	<i>Ornithoglossum undulatum</i>
		CRASSULACEAE	<i>Cotyledon orbiculata var. spuria</i>
		CRASSULACEAE	<i>Crassula montana</i>
		CRASSULACEAE	<i>Crassula umbella</i>

		CRASSULACEAE	<i>Tylecodon paniculatus</i>
		CRASSULACEAE	<i>Tylecodon ventricosus</i>
		CYPERACEAE	<i>Cyperus laevigatus</i>
		CYPERACEAE	<i>Juncus acutus</i>
		EUPHORBIACEAE	<i>Euphorbia hamata</i>
		EUPHORBIACEAE	<i>Euphorbia mauritanica</i>
		FABACEAE	<i>Lessertia frutescens subsp. microphylla</i>
Alien		FABACEAE	<i>Prosopis glandulosa</i>
		GERANIACEAE	<i>Monsonia crassicaulis</i>
		GERANIACEAE	<i>Pelargonium alternans</i>
		GERANIACEAE	<i>Pelargonium magenteum</i>
		HYACINTHACEAE	<i>Lachenalia multifolia</i>
		IRIDACEAE	<i>Ferraria variabilis</i>
		IRIDACEAE	<i>Geissorhiza aspera</i>
Scarce	Swartruggens Quartzite Karoo	IRIDACEAE	<i>Lapeirousia fabricii subsp. purpurascens</i>
		IRIDACEAE	<i>Micranthus tubulosus</i>
		MOLLUGINACEAE	<i>Kewa salsoloides</i>
		MOLLUGINACEAE	<i>Limeum aethiopicum var. aethiopicum</i>
		MONTINIACEAE	<i>Montinia caryophyllaceae</i>
		MORACEAE	<i>Ficus cordata</i>
		POACEAE	<i>Cladoraphis spinosa</i>
		POACEAE	<i>Stipagrostis ciliata var. capensis</i>
		POACEAE	<i>Stipagrostis obtusa</i>
		POLYGALACEAE	<i>Muraltia spinosa</i>
		SCROPHULARIACEAE	<i>Aptosimum indivisum cf</i>
		SCROPHULARIACEAE	<i>Hebenstretia glaucescens</i>
		SOLANACEAE	<i>Lycium amoenum</i>
		THYMELAEACEAE	<i>Lasiosiphon deserticola</i>
		URTICACEAE	<i>Forsskaolea candida</i>
		VISCACEAE	<i>Viscum capense</i>
		ZYGOPHYLLACEAE	<i>Roepera cordifolia</i>
		ZYGOPHYLLACEAE	<i>Tetraena chrysopteron</i>