

BOTANICAL SURVEY :  
TURKSVYDAM PROJECT,  
UPINGTON

(amended report)



24 October 2020

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# EXECUTIVE SUMMARY

The site is situated south of Upington and south of the Orange River, at approximately 28° 27' 50.0" South, and 21° 16' 51.0" East in the 2821 AD UPINGTON topocadastral grid. The site is currently undeveloped, although in places some disturbance has occurred in the past.

Altitude ranges from approximately 800 m to 820 m above sea level. In the south, the site is drained from east to west by an ephemeral stream towards the Louisvale spruit which then flows northwards to the Orange River. The northern site is drained northwards by an ephemeral stream towards the Orange River. The geology consists mainly of red-brown windblown sand (Qg) of the Gordonia Formation, Kalahari Group and migmatite, biotite-rich and aluminous gneisses (Mbe). The site falls in the Ag1 Land Type. Land Type Ag consists of red-yellow, freely drained sandy soils with a high base status and generally less than 300 mm deep.

The mean annual rainfall measured at the Upington weather station is 182 mm and the mean annual temperature for Upington is 19.1°C. Extreme maximum and minimum temperatures measured at Upington are 42°C and -4.2°C respectively.

## Plant communities

The site falls in the Bushmanland Arid Grassland, which is classified as 'least threatened' because little of the area has been transformed.

Six plant communities were distinguished on the Turksvydam site. These were:

1. *Vachellia erioloba* riparian open woodland
2. *Rhigozum trichotomum* - *Salsola tuberculata* plains dwarf shrubland
3. *Senegalia mellifera* - *Prosopis glandulosa* shrubland along furrow
4. *Aloe claviflora* plains dwarf shrubland
5. *Senegalia mellifera* - *Salsola tuberculata* plains shrubland
6. *Prosopis glandulosa* - *Tamarix usneoides* open bushveld of borrow pit

Aquatic plant community (community 1):

The drainage lines should be excluded from any development and a buffer zone of non-disturbance of about 32 m along the main channels should be set aside to minimise any impacts on the vegetation. The drainage lines are dry for most of the year and flow for short periods after relatively heavy rains. The flow of water along the drainage lines should not be impeded and prevention of erosion should be a high priority, e.g. erections of gabions.

## Protected and endemic flora

Plant species lists generated for the 2821 AD quarter degree grid were supplemented with data from other relevant sources including Red Data lists. These lists indicated that various species of conservation significance occurred in this quarter degree grid (Appendix B).

The most important species of conservation significance recorded during the current survey (in February 2014) are, e.g. *Ammocharis coranica*, *Vachellia erioloba*, *Boscia albitrunca*, *Boscia foetida*, *Anacampteros*

*albissima*, *Hoodia gordonii*, *Aloe claviflora* and a stapeliad species (Apocynaceae). Other Northern Cape protected species have been listed in Table A.

## Alien plant species

Four declared invasive plant species were recorded on site. The four declared invasive plant species were three Category 1b species (*Atriplex inflata*, *Cylindropuntia fulgida* and *Salsola kali*) and one Category 3 species (*Prosopis glandulosa*). Alien plant species constitute 4% of the plant species checklist for the site.

## Flora

Protected and endemic plant species of the site include the following:

**Table A.** Protected, endemic and alien plant species at the Turksvydam site

Species	Endemic*	NCNCA*			NFA*	CITES* App. II	NEM:BA TOPS	Red list <sup>1</sup>
		Sch 1*	Sch 2*	Sch 6*				
<i>Ammocharis coranica</i>			X				LC	
<i>Atriplex inflata</i>				X				
<i>Vachellia erioloba</i>					X		LC	
<i>Aloe claviflora</i>			X			X	LC	
<i>Anacampseros albissima</i>			X			X	LC	
<i>Boscia albitrunca</i>			X		X		LC	
<i>Boscia foetida</i> subsp. <i>foetida</i>			X				LC	
<i>Cylindropuntia fulgida</i>				X				
<i>Galenia africana</i>			X				LC	
<i>Galenia papulosa</i>			X				LC	
<i>Hoodia gordonii</i>		X					LC	
<i>Plinthus karoocicus</i>			X				LC	
<i>Prosopis glandulosa</i>				X				
<i>Mesembryanthemum coriarium</i>			X				LC	
<i>Mesembryanthemum crystallinum</i>			X				LC	
<i>Ornithogalum</i> sp.			X					
<i>Salsola kali</i>				X				
<i>Tetraena microcarpa</i>	X						LC	
<i>Tetraena tenuis</i>	X						LC	
<i>Tetraena rigida</i>	X						LC	
<i>Tetraena decumbens</i>	X						LC	
<i>Tetraena simplex</i>	X							
Apocynaceae sp.			X					

\*Endemic: Gariep Centre of Endemism

\*NCNCA: Northern Cape Nature Conservation Act 2009 (No. 9 of 2009)

\*Schedule 1: Specially protected species

\*Schedule 2: Protected species

\*Schedule 6: Alien invasive plant species

\*NFA: Protected trees: National Forest Act, (Act 84 of 1998).

\*CITES (2019): Convention on the Trade in Endangered Species of Wild Fauna and Flora

\*NEM:BA -TOPS Threatened or Protected Species

<sup>1</sup>According to NewPosa

Protected tree species such as *Vachellia erioloba* may not be removed or damaged without permits issued by the relevant authorities. Any NCNCA protected species may also not be removed/destroyed without a permit.

## Fauna

Most of the site has a sparse vegetation cover due to the informal settlement, and is not favourable for faunal occupation. However, the indigenous trees and shrubs, especially *Vachellia erioloba*, *Boscia albitrunca*, *Boscia foetida* and *Senegalia mellifera* should be protected as far as possible. Besides some being protected tree species, they form important food sources and habitats for various animal species. The underbrush normally associated with these species also forms an important micro-habitat for a number of animal species.

## Critical Biodiversity Areas

The area where the proposed reservoir will be built falls in a CBA 2, although it is located in an old quarry (borrow pit) and the area is highly degraded. The remainder of the site around the proposed reservoir and part of the proposed agricultural development in the site falls in Ecological Support Areas (ESAs). An ESA is not essential for meeting biodiversity targets but plays an important role in supporting the ecological functioning in a CBA. Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for Terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets.

## National Screening Tool

The National web based environmental screening tool is mandatory for planning any development that requires environmental authorisation. The screening report generated by the tool indicates the environmental sensitivity of the development site for relevant environmental themes associated with the project. The results indicate "medium" sensitivity for the Agriculture theme and "low" sensitivity for the Aquatic biodiversity theme. No intersecting layers were generated for the Plant Species biodiversity theme or the Terrestrial biodiversity theme.

## Sensitivity

The six plant communities that were distinguished on site were evaluated in terms of their sensitivity (Table B). Only two communities had a moderate sensitivity rating. The rating of these communities was increased by the presence of a large proportion of NCNCA protected species, the presence of NFA nationally protected tree species and in the case of community 1, its conservation value as a watercourse (ephemeral stream). A moderate sensitivity means a sensitivity rating that is real and sufficiently important to require management, e.g. management or protection of the rare/threatened fauna and flora, protection of the specific habitat on the property and/or rehabilitation. All other communities had a significance rating of low or very low.

**Table B.** Sensitivity of the plant communities (see Figures 9 & 25)

	Plant communities					
	1	2	3	4	5	6
Threatened status (x5)	5	5	5	5	5	0
% Red data species (x4)	0	0	0	0	0	0
Number protected trees (x3)	3	3	0	0	0	0
% NCNCA species (x4)	4	8	0	8	4	4
% Endemic species (x2)	6	6	4	4	4	4
Conservation value (x4)	12	4	0	4	4	0
Species richness (x2)	6	6	4	4	4	4
Connectivity (x2)	2	2	2	4	4	2
Erosion (x2)	4	2	2	2	2	2
Resilience (x3)	6	6	3	9	6	3
Sum:	48	42	20	36	33	19
<b>Sensitivity rating:</b>	<b>M</b>	<b>M</b>	<b>VL</b>	<b>L</b>	<b>L</b>	<b>VL</b>

## Impacts

The overall significance of the impacts on the affected plant communities was moderate (Table C).

**Table C.** Significance assessment of impacts on the plant communities taking mitigation measures into consideration

	Plant community					
	1*	2	3	4	5	6*
Intensity ( $\alpha$ )	1	5	3	5	5	1
Duration ( $\beta$ )	1	4	4	4	4	4
Scale ( $\delta$ )	1	1	1	1	1	1
Probability ( $\epsilon$ )	2	5	5	5	5	5
Significance ( $\alpha+\beta+\delta$ )* $\epsilon$ :	6	50	40	50	50	30
<b>Significance rating:</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>

1\* - assumption is that drainage lines are excluded from development.

6\* - borrow pit or quarry where reservoir is planned is severely degraded habitat

A low significance implies that if the negative impacts have little real effects it should not have an influence on the decision to proceed with the project. A moderate significance implies that the impact is real and sufficiently important to require mitigation and management measures before the proposed project can be approved.

## Mitigation

Mitigation measures during the development at the site include:

- Buffer zones should be provided along drainage lines where possible, i.e. a 32 m zone of undisturbed habitat. A buffer zone is a collar of land that filters out inappropriate influences from surrounding activities, also known as edge effects and prevents flooding of homesteads.
- Development should be contained within the footprint of the proposed development and unnecessary disturbance or clearance of vegetation adjacent to the sites should be avoided.

- Use existing and dedicated access roads to limit disturbance of the natural vegetation.
- Stream crossings are to be designed not to impede or disrupt the direction and flow of water.
- Dust control measures should be implemented during vineyard and reservoir construction.
- No-go areas, e.g. drainage lines should be avoided.
- All plant species recorded on site are considered as 'least concern', except for *Acanthopsis hoffmannseggiana* that is classified as Data Deficient.
- No alien invasive plant species should be used in landscaping on site.
- Raise awareness regarding the negative impacts of alien invasive plant species and implement a monitoring program for the early detection of alien invasive plant species.

The adherence to the suggested mitigation measures should limit impacts on the natural vegetation and associated fauna and thus limit the development footprint.

The necessary flora permits are required from Northern Cape Nature Conservation to adhere to the Northern Cape Nature Conservation Act (No 9 of 2009) in terms of the removal or destruction of protected flora. Permits are also required from the Department of Environment, Forestry and Fisheries to remove protected tree species.

The Environmental Control Officer should monitor and report to the Environmental Assessment Practitioner as to whether the construction is contained within these boundaries and that the surrounding natural vegetation has not been negatively affected.

# TERMS OF REFERENCE

- Summarise available literature on the vegetation of the area as well as the physical environment, e.g. climate, geology, land types, soil, topography and drainage.
- Stratify the area into relatively homogeneous units or habitats based on physiography and vegetation cover, using aerial images and topocadastral maps.
- Do a field survey of the stratified units to enable a classification, description and mapping of plant communities (habitats).
- Compile checklists of flora and identify rare plant species, protected species, endemic species as well as alien invasive species.
- Describe the environment in terms of its ecology, including the vegetation type; level of degradation; overview of plant species that were recorded on the site; and protected and/or Red Data species (flora) that may occur on the site.
- Do a sensitivity analysis and compile a sensitivity map.
- Assess the possible impacts of the proposed development on the ecosystems and flora, assess their significance and propose mitigation measures.



# ASSUMPTIONS, LIMITATIONS AND UNCERTAINTIES

The following assumptions, limitations or uncertainties are listed regarding the botanical assessment of the proposed Turksvydam site:

- This document has been prepared for the particular purpose outlined in the TOR and no responsibility is accepted for the use of this document for any other purpose or in other contexts.
- Rare and threatened plant and animal species are generally uncommon and/or localised and the once-off survey may fail to locate such species.
- It is assumed that the dominant woody and succulent plant species present on the proposed development site would be encountered in the once-off field survey in March 2020. However, many bulbous plants are dormant for a part of the year and very few bulbous plants were encountered during the survey. The number of annual plant species recorded is probably an underestimate of the potential number of species that could occur on site, because of the lack of rainfall and the relatively dry and hot conditions preceding the site visit.

# GENERAL INFORMATION

**Study site:** Turksvydam  
**District Municipality:** ZF Mgcawu  
**Local Municipality:** Dawid Kruiper

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# REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms of the EIA Regulations under the National Environmental Management Act, (Act No. 107 of 1998 (NEMA)).

## Appointment of specialist

Ekotrust cc was commissioned by EnviroAfrica cc to provide specialist consulting services for the botanical assessment of the Turksvydam project in Upington, Northern Cape province.

## Company profile:

Name of Company: Ekotrust cc  
(Registration number: CK90/05465/23)  
Sole Member: Dr Noel van Rooyen  
Founding date: 1990

Ekotrust cc specializes in habitat evaluation, vegetation classification and mapping, floristic diversity assessments, rare species assessments, alien plant assessments and management, wildlife management, wildlife production and economic assessments, veld condition assessment, bush encroachment, fire management, carrying capacity, wildlife numbers and ratios.

## Declaration of independence

I, Noel van Rooyen, declare that:

- I am a member of Ekotrust cc: (CK90/05465/23);
- I act as an independent specialist consultant in the fields of ecology and botany;
- I regard the information contained in the report to be objective, true and correct within the framework of assumptions and limitations;
- I undertake to disclose to the applicant and the competent authority all information in my possession that reasonably has or may have the potential of influencing any decision to be taken by the competent authority; and
- I do not have any business, financial, personal or other interest in the activity or application other than fair remuneration for work performed in connection with the activity or application.

## Indemnity and conditions relating to this report

The observations, findings, recommendations and conclusions provided in the current report are based on the compiler's best scientific and professional knowledge and other available information. If new information should become available Ekotrust cc reserves the right to modify aspects of the report. This report (hard copy and/or electronic) must not be amended or extended without the prior written consent of the author. Furthermore, any recommendations, statements or conclusions drawn from or based on this

report must make reference to the report. If these recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety (as an Appendix).

Although Ekotrust cc has exercised due care in preparing this report, it accepts no liability, and by receiving this document, the client indemnifies Ekotrust cc against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

## Scope and purpose of report

The scope and purpose of the report are summarised in the “Terms of Reference” section of this report.



Dr Noel van Rooyen

Date: 24 October 2020

# CHAPTER 1

## INTRODUCTION

A botanical assessment of the land where the Turksvydam project in Upington is planned, was commissioned to determine the possible impacts that the proposed development may have on the biophysical environment. The site is currently undeveloped, although some disturbance has occurred in the past, e.g. the quarry near the N14 main road and the diversion of one of the drainage lines in the proposed agricultural site in the south (Figures 1, 2 & 3).



**Figure 1.** Location of the Turksvydam site near Upington, Northern Cape. Two sites for development are indicated: (i) the northern site includes the proposed reservoir and pipeline (water line servitude) northwards to the canal and (ii) the southern proposed agricultural site.

Loss of habitat is regarded as the foremost cause of loss of biodiversity. It is therefore essential that the impact of a development on biodiversity in sensitive and irreplaceable habitats on the site is minimised through careful planning and avoidance of sensitive areas.

The aims of this botanical survey were to classify and describe the various vegetation units as well as their sensitivity and status. The possible occurrence of protected and/or Red Data plant species was assessed and a sensitivity map was compiled. The potential impacts of the development are determined and mitigation measures proposed.

A screening report was generated by the 'National Screening tool' of the Department of Environmental affairs. The use of this screening tool (<https://screening.environment.gov.za/>) is mandatory for planning development that require EA, and the report generated must be submitted together with an EA application.





**Figure 2.** The northern site indicating the position of the proposed reservoir and pipeline (water line servitude). A 32 m buffer zone should be used along the drainage lines (blue dashed line).



**Figure 3.** The southern agricultural site earmarked for vineyard development (shaded). The man-made furrow is indicated.

This furrow was constructed many years ago, but the vegetation found along this furrow cannot be considered as representative of a natural drainage line. The vineyard development plans to remove this furrow and to re-open the natural drainage line. However, this would imply that the current vineyard at the lower end of the natural drainage channel would impede the natural flow of water to the Louisvale spruit. **This issue needs to be assessed by a wetland specialist, since no specific details were available on how this issue would be addressed.**

## CHAPTER 2

# ENVIRONMENTAL LEGISLATION

### 2.1 Introduction

The White Paper on the conservation and sustainable use of South Africa's biodiversity and the National Environmental Management Act (Act No. 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity and that the sustainable, equitable and efficient use of biological resources must be promoted. Various acts provide control over natural resources in terms of their conservation, the use of biological resources and avoidance of negative impacts on biodiversity. Some international conventions are also relevant to sustainable development.

### 2.2 National Environmental Management Act (Act No. 107 of 1998) (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or well-being. It is administered by DEFF but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

NEMA requires that measures are taken that "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." In addition: (1) NEMA requires that the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied, (2) a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions, and (3) sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

This report considers the Environmental Impact Assessment (EIA) Regulations 2014, with amendments in 2017, under the National Environmental Management Act, (Act No. 107 of 1998) (NEMA 1998, 2014, 2017). According to the Regulations (2017) under Listing Notice 1 (GRN No. 327), Listing Notice 2 (GRN No 325) and Listing Notice 3 (GRN No 324), the activities listed are identified as activities that may require Environmental Authorisation prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of the Act.

## 2.3 National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA)

As the principal national act regulating biodiversity protection, NEM:BA, which is administered by DEA, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term biodiversity according to the Convention on Biodiversity (CBD) refers to the variability among living organisms from all sources including, *inter alia* terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

### 2.3.1 *Threatened ecosystems*

Section 53 of NEM:BA lists the threatened status of ecosystems, i.e. critically endangered ecosystems, endangered ecosystems, and vulnerable ecosystems. The list of threatened ecosystems was published in 2011 (NEM:BA, 2011).

### 2.3.2 *Threatened or Protected Species (ToPS) Regulations*

Section 56 of NEM:BA makes provision for the declaration of species which are of such high conservation value, national importance or are considered threatened that they need protection, i.e. critically endangered species, endangered species and vulnerable species. Lists of species that are threatened or protected, and associated activities that are prohibited and/or exempted from restriction have been published in the Government Gazette Vol 574, No 36375 of 16 April 2013 (NEM:BA 2013). Any proposed removal of threatened or protected species and/or prohibited/restricted activities will require a permit in term of these Threatened or Protected Species (ToPS) Regulations of 2013, as read with NEM:BA.

### 2.3.3 *Alien and Invasive Species (AIS) Regulations*

Chapter 5 of NEM:BA provides for the protection of biodiversity from alien and invasive species. The act defines alien species and contemplates the listing of invasive species in regulations. As for ToPS, the act defines certain activities that are restricted in connection with declared listed alien or invasive species which include, among others, importing, exporting, growing, breeding, transporting and selling those species, and would therefore require Environmental Authorisation.

## 2.4 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA)

NEM:PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

## 2.5 National Forests Act (Act No. 84 of 1998)(NFA)

The National Forest Act makes provision for the declaration of for example specially protected areas, forest nature reserves, forest wilderness areas and protected woodlands. A list of tree species declared protected in terms of the NFA, is published annually. In terms of section 15(1) of this act, no person may cut, disturb,



damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. The competent authority responsible for considering and issuing the license will be the national Department of Environment, Forestry and Fisheries (DEFF).

## 2.6 National Water Act (Act No. 36 of 1998)

The National Water Act places strong emphasis on sustainable use of water resources, and its purpose as per Subsection 2(g) of the NWA includes protecting aquatic and associated ecosystems and their biological diversity. Wetlands, riparian zones and watercourses are defined as water resources by the Water Act and any contemplated activities that could affect these areas require authorisation.

The key mechanism through which NEMA (2014, 2017) attempts to mitigate the impacts of development on streamflows and wetlands is by specifying a buffer zone of some 32 m from the edge of the watercourse and wetland areas NEMA (2014, 2017) that should not be developed without authorisation. It is therefore necessary to delineate all watercourses and wetlands and their associated buffer zones in areas to be developed.

According to the National Water Act (No 36 of 1998) the following activities defined as water uses may have been contravened in the past in the southern parts of Turksvydam:

- Section 21 (c): "impeding or diverting the flow of water in a watercourse; and
- Section 21 (i): "altering the beds, banks, course or characteristics of a watercourse".

## 2.7 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

The objectives of CARA (1983, 2001) are to provide for the conservation of the natural agricultural resources by the maintenance of the production potential of the land, by combating and preventing erosion and weakening or destruction of the water resources, and by protecting the vegetation and combating weeds and invader plants. In order to achieve the objectives, certain control measures are prescribed which shall be complied with by land users to whom they apply. The activities which are mentioned relate to (*inter alia*):

- the cultivation of virgin soil;
- the utilisation and protection of land that is cultivated;
- the irrigation of land;
- the prevention or control of waterlogging or salinization of land;
- the utilisation and protection of vleis, marshes, water sponges, watercourses and water sources;
- the regulation of the flow pattern of run-off water;
- the control of weeds and invader plants;
- the restoration or reclamation of eroded land or land that is otherwise disturbed or denuded;
- the protection of water sources against pollution on account of farming practices; and
- the construction, maintenance, alteration or removal of soil conservation works or other structures on land.

In addition, lists of alien invasive plant species are provided with associated categories indicating the appropriate management and mitigation of these declared alien invasive species.

## 2.8 Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCONCA)

The Northern Cape Nature Conservation Act (Act No. 9 of 2009) restricts activities involving specially protected, protected and indigenous plant species.

Section 50 deals with the restricted activities involving protected plants and states that no person may, without a permit, pick, import, export, transport, cultivate or trade in a specimen of a protected plant.

Section 51 involves the picking, receipt, possession, acquisition or handling of indigenous plants and states that no person may, without a permit, pick an indigenous plant – (a) on a public road; (b) on land next to a public road within a distance of 100 meters measured from the centre of the road; or (c) within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 meters from the middle of a river on either side of the natural water course.

The Act lists different categories of flora and fauna, i.e. Schedules 1, 2, 3 and 6 for flora and Schedules 1, 2, 3, 4, 5 and 6 for fauna. The lists of flora in the Act were consulted and compared with lists of plant species recorded during the vegetation surveys of the sites.

Permit applications pertaining to selected plant species in terms of the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (see Appendix C) will have to be lodged with the Northern Cape Department of Environment and Nature Conservation.

## 2.9 Convention on Biodiversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources; and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

## 2.10 Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)

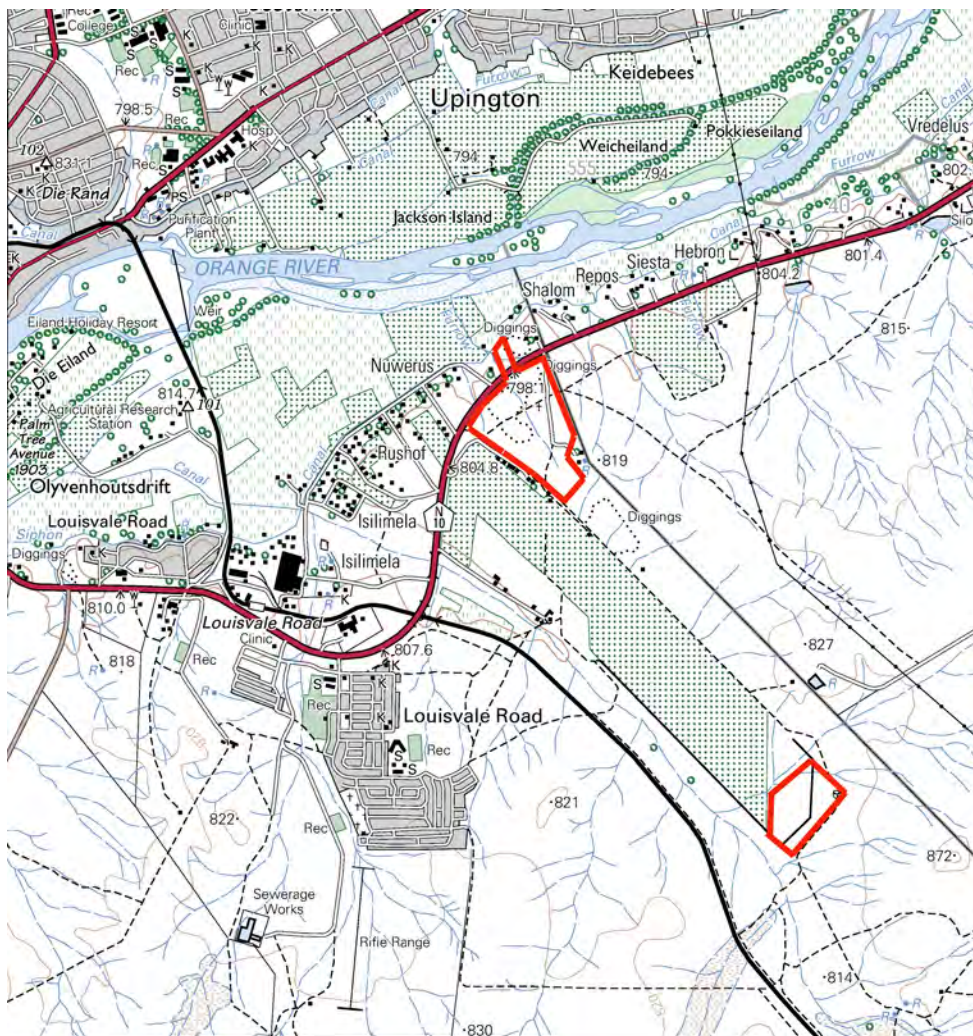
CITES is an international agreement to which countries adhere voluntarily. The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES (2019) are listed in three appendices reflecting the degree of protection that the species needs. Appendix I includes species which are threatened with extinction and trade in these species is permitted only in exceptional circumstances. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix III lists species that are protected in at least one country that has asked other CITES parties for assistance in controlling the trade (Website: [www.cites.org](http://www.cites.org)).

## CHAPTER 3

### ENVIRONMENTAL DESCRIPTION

#### 3.1 Location

The site is situated south of Upington and south of the Orange River, at approximately 28° 27' 50.0" South, and 21° 16' 51.0" East (Figure 4). The areas that were evaluated cover approximately 60 ha and are currently undeveloped, although some disturbance has occurred in the past, e.g. the quarry near the N14 main road and the diversion of one of the drainage lines in the southern portion. The topocadastral grid reference is 2821 AD UPINGTON EAST.



**Figure 4.** Topocadastral map of the area indicating the location of the two sites that were evaluated at Turksvydam (red).

## 3.2 Terrain morphology and drainage

The site occurs at a mean altitude of 810 m with altitude ranging from approximately 800 m to 820 m above sea level (Figure 1). In the south, the site is drained from east to west by an ephemeral stream towards the Louisvale spruit which then flows northwards to the Orange River. The northern site is drained northwards by an ephemeral stream towards the Orange River.

## 3.3 Climate

### 3.3.1 Regional climate

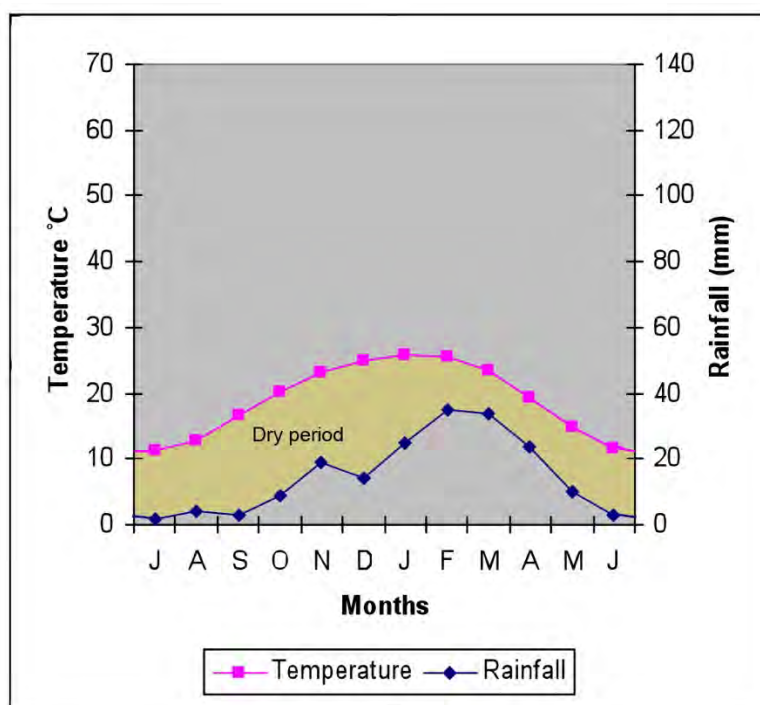
A summary of the broad climate of the region is provided by Mucina & Rutherford (2006) for the Bushmanland Arid Grassland in which the Turksvydam site falls. Rainfall occurs primarily in late summer/autumn and is very variable from one year to the next (coefficient of variation 39%). The mean annual precipitation ranges from 70 to 200 mm, and the mean annual potential evaporation is 2771 mm. The mean annual temperature is 17.4°C, with maximum and minimum monthly temperatures of 40.6°C and -3.7°C for January and July respectively. Frost occurs on average on 25 days per annum.

### 3.3.2 Rainfall

The mean annual rainfall measured at the Upington weather station is 182 mm (Table 1; Figure 5). The total annual rainfall may vary from 65 mm to 539 mm during dry and wet years respectively, indicating a high variation in the annual rainfall and therefore a rainfall scenario that is highly unpredictable. The rainy season is predominantly from November to April when about 83% of the annual rainfall occurs. The wettest months are February and March and the driest months are from June to September, when less than 5 mm of rain per month is recorded. The maximum rainfall measured over a 24-hour period at Upington was 67 mm in April. The highest monthly rainfall recorded was 228 mm measured in January.

**Table 1.** Rainfall statistics for Upington - AGR weather station (0317 447 AX; 28° 27' S; 21° 15' E; 793 m above sea level) for a period of 25 years

Month	Mean month	24 h max	Max per month	Min per month
Jan	25	44	228	0
Feb	35	39	135	0
Mar	34	27	118	0
Apr	24	67	136	0
May	10	27	36	0
June	3	11	17	0
July	2	11	11	0
Aug	4	43	47	0
Sep	3	19	19	0
Oct	9	19	25	0
Nov	19	60	69	0
Dec	14	34	75	0
Year	182	67	539	65



**Figure 5.** Climate diagram for the Upington region. The rainfall curve stays below the temperature curve indicating an all year relatively dry period.

### 3.3.3 Temperature

The mean annual temperature for Upington is 19.1°C (Table 2). The extreme maximum and minimum temperatures measured over a 25 year period were 42°C and -4.2°C respectively (Table 2). The mean daily maximum for January is 34.3°C and for July it is 20.8°C. The mean daily minimum for January is 17.4°C and for July it is 1.7°C. Frost may occur from May to September, over a period of approximately 150 days.

**Table 2.** Temperature data (°C) for Upington - AGR Weather Station (0317/447 AX; 28° 27' S; 21° 15' E; 793 m a.s.l.) for a period of 25 years

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Max	34.3	33.4	31.6	27.6	23.9	20.7	20.8	22.5	26.1	29.1	31.9	33.7	28.0
*Ext. Max	42.0	40.1	39.5	37.7	33.0	28.5	28.5	32.4	37.0	38.7	40.0	42.0	42.0
Min	17.4	17.4	15.5	11.0	5.8	2.7	1.7	3.4	7.3	11.0	14.2	16.4	10.3
*Ext. Min	11.3	11.0	8.0	3.5	-0.9	-3.8	-4.2	-3.2	0.0	3.5	8.0	9.9	-4.2
Mean	25.8	25.4	23.5	19.3	14.9	11.7	11.3	12.9	16.7	20.1	23.1	25.0	19.1

Max = mean daily maximum temperature for the month

\*Ext. Max = extreme maximum temperature recorded per month

Min = mean daily minimum temperature for the month

\*Ext. Min = extreme minimum temperature recorded per month

Mean = mean monthly temperature for each month and for the year

### 3.3.4 Cloud cover and relative humidity

The cloud cover is highest from February to April when a mean cloud cover of more than two eights occurs (Table 3). The percentage relative air humidity at 08:00 ranges from more than 80% in April to July to less than 60% in November and December. The humidity at 14:00 ranges from 40% in March and April to 31% in



November (Table 3).

Table 3. Cloud cover (in eights) at 14:00 and relative air humidity at 08:00 and 14:00 at the Upington - AGR weather station (0317/447 AX; 28° 27' S; 21° 15' E; 793 m above sea level) over a period of 25 years

	Cloud (0 – 8)	Relative air humidity %	
	14:00	08:00	14:00
Jan	2.0	63	36
Feb	2.6	71	39
Mar	2.6	77	40
Apr	2.2	84	40
May	1.5	87	39
June	1.3	85	39
July	0.9	83	37
Aug	1.1	79	35
Sept	1.5	71	32
Oct	2.0	64	33
Nov	1.8	59	31
Dec	1.7	58	32
Year	1.8	74	37

### 3.4 Geology

Geologically the sites consist of red-brown windblown sand (Qg) of the Gordonia Formation, Kalahari Group in the south and west as well as migmatite, biotite-rich and aluminous gneisses (Mbe) in the central parts. Alluvium is found along the Orange River in the north (Figure 6).

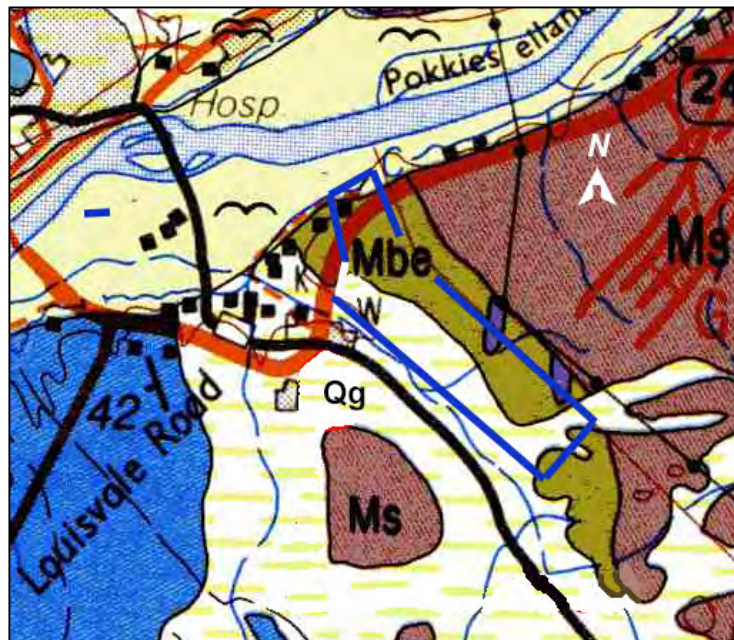
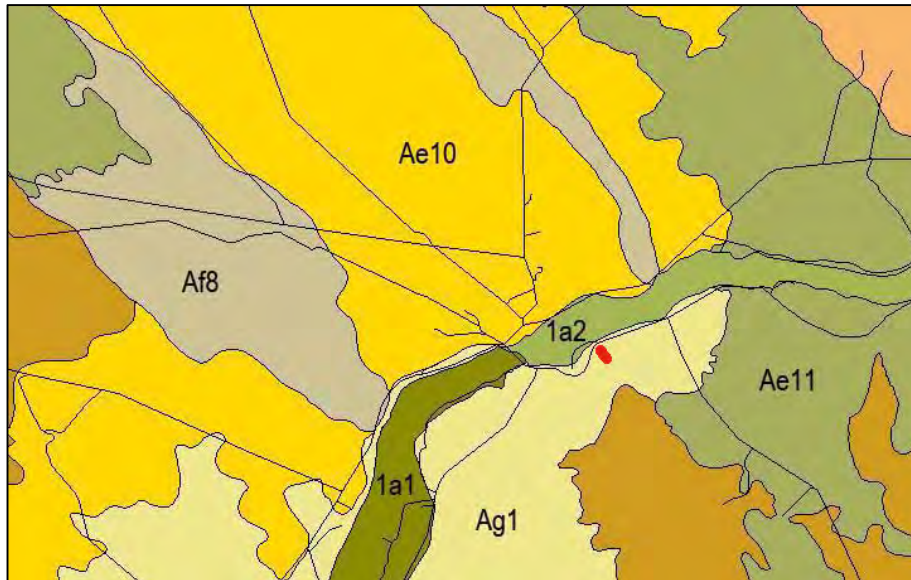


Figure 6. Geology of the Turksvydam site (blue line) and surrounds.

### 3.5 Land Types

Land Types denote areas that display a marked degree of uniformity with respect to terrain form, soil pattern and climate. A terrain unit is any part of the land surface with homogeneous form and slope. Terrain unit 1 represents a crest, 2 = scarp, 3 = midslope, 4 = footslope/plains and 5 = valley bottom.



**Figure 7.** Land Types of the region with the Turksvydam site indicated with a red dot.

The site falls in the Ag1 Land Type (Figure 7). Land Type Ag consists of red-yellow, freely drained sandy soils with a high base status and generally less than 300 mm deep. Water tables and dunes are absent in this land type. The Ag1 Land Type consists of terrain units 1, 3, 4 and 5 with these terrain units covering 8%, 22%, 50% and 20% of the area respectively. Rocks cover about 60% of terrain unit 1 and 30% of terrain unit 3. The Mispah soil form dominates in terrain units 1 and 3. Hutton soils cover most of terrain units 4 and 5. The clay content of the fine to coarse, sandy soils range from 3 – 10% in the A-horizon and from 6 – 15% in the B-horizon.

## CHAPTER 4

# METHODOLOGY

### 4.1 Approach

The objective of the study was to assess the vegetation and flora of the Turksvydam site in order to identify any rare plant species and sensitive areas that should be avoided during development.

The study commenced as a desktop study, followed by field-based surveys and verification in March 2020. Hard copy and digital information from spatial databases, topocadastral, geological and land type maps, and vegetation types (Mucina & Rutherford 2006, BGIS SANBI 2018) were sourced to provide information on topography, geology, land types and broad vegetation types of the study area. Information on the climate was sourced from Weather Bureau (1988, 1998).

The study site was stratified into relatively homogeneous vegetation/terrain units on Google Earth satellite images based on physiography and vegetation cover. This stratification was used to determine the position and number of sample plots, and was the basis for identifying habitat types and to produce a vegetation map.

The vegetation survey consisted of visiting the mapping units and systematically recording all identifiable woody species, grasses, forbs and alien (exotic) plant species within each of the stratified units on site, and estimating their cover-abundance. Physical habitat features, e.g. geology, topography, soil colour and texture, and rock cover, were noted. A checklist of the plant species of the site was compiled. During the site visit, digital photographs of the sample plots and some individual plant species were taken and representative photographs of the different plant communities are included in the report.

### 4.2 Data analyses

A classification of the vegetation data was done with the TURBOVEG and JUICE computer programmes (Hennekens & Schaminee 2001), which includes the TWINSpan divisive clustering technique. A differential table was compiled and the different plant communities were described and mapped (Table 4).

### 4.3 Plant species checklists

All plant species recorded in the sample plots are listed in the checklist (see Appendix A). An additional plant species checklist of the 2821 A UPINGTON EAST grid was obtained from the NewPosa database of the South African National Biodiversity Institute (SANBI, March 2020)(Appendix B).

### 4.4 Sensitivity assessment

The National Screening Tool was used to determine environmental sensitivity.

Additionally, a sensitivity assessment of each plant community was also done using several environmental and diversity features to award a rating to each plant community. A sensitivity map was drawn based on a



number of criteria discussed in Chapter 8.

#### 4.5 Impact assessment

The significance of the possible impacts of the proposed Turksvydam development on the ecosystem and flora and fauna of the site, is discussed and mitigation measures proposed (Chapters 9 & 10).

#### 4.6 Red listed plant species

The site was systematically surveyed for rare, threatened and/or endemic plant species during March 2020. The Red Data status, conservation and protected status of plant species recorded on site were determined with the aid of the NewPosa website of the South African National Biodiversity Institute ([newPosa.sanbi.org](http://newPosa.sanbi.org)), the list of nationally protected trees according to the National Forests Act (No 84 of 1998)(NFA 2019), the draft threatened and protected species list (TOPS list: 2013) of the National Environmental Management: Biodiversity Act, (No 10 of 2004) (NEM:BA), CITES appendices (2019), the IUCN (2019) lists of threatened species, and the Northern Cape Nature Conservation Act (No 9 of 2009). The lists of alien invasive species were also consulted (NEM:BA 2016).

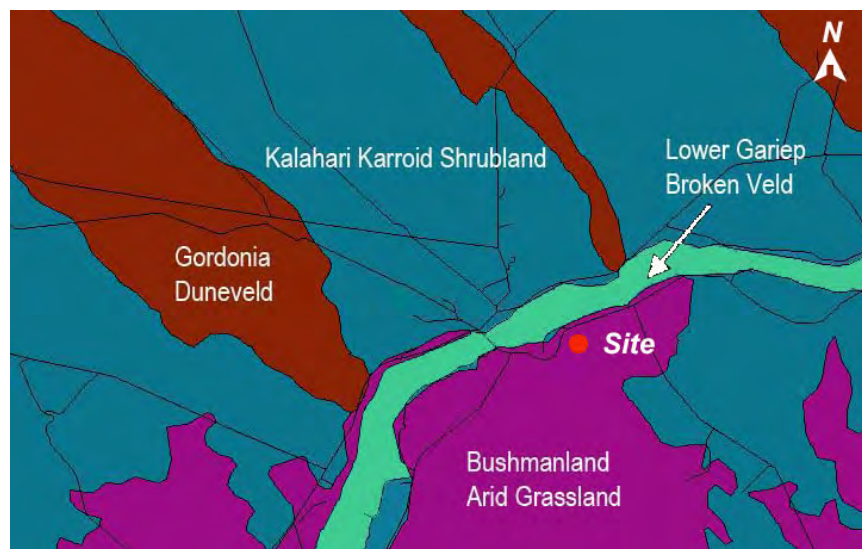
Coordinates of protected species found on site are provided in Appendix C.

# CHAPTER 5

## VEGETATION

### 5.1 Introduction

Phytogeographically, the site falls in the Karoo-Namib Region of White (1983), an extensive region in the west of southern Africa. Most of the vegetation types in the Orange River valley and surrounds fall in the Nama-Karoo Biome as described by Rutherford & Westfall (1986) and Mucina & Rutherford (2006). Acocks (1953), Mostert *et al.* (1971) and Gubb (1980) described the area as the Orange River Broken Veld. Low & Rebelo (1998) classified the area as part of the Orange River Nama Karoo and according to the latter authors, only 1.47% of the latter vegetation type was formally conserved, although little of the area was transformed, except along the Orange River.



**Figure 8.** Vegetation types (Mucina & Rutherford 2006) in the vicinity of the site (red dot).

According to Mucina & Rutherford (2006), the vegetation types occurring in the Upington region (see Figure 8) are the Kalahari Karroid Shrubland (Nkb5), Bushmanland Arid Grassland (Nkb 3), Lower Gariep Broken Veld (Nkb 1) and along the Orange River, the Lower Gariep Alluvial Vegetation (AZa 3) (Figure 8). The site itself falls in the Bushmanland Arid Grassland. This vegetation type has a “least threatened” conservation status (Mucina & Rutherford 2006, NEM:BA 2011, BGIS SANBI 2018).

### 5.2 Vegetation types

#### 5.2.1 Bushmanland Arid Grassland (Nkb 3)

The Bushmanland Arid Grassland covers 45 479 km<sup>2</sup> and occurs from the edge of the Namaqualand Klipkoppe in the west to Prieska in the east. The northern border is more or less the Orange River and the southern border is formed by the edge of the Bushmanland Basin.

This type consists of extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grasses predominantly of the genus *Stipagrostis*. Dwarf shrubs such as *Salsola* spp. and *Rhigozum trichotomum* are the dominant species. In years of abundant rain, flower displays of annual forbs can be expected.

The most important grass species include *Stipagrostis uniplumis*, *Stipagrostis obtusa*, *Stipagrostis ciliata*, *Aristida congesta*, *Enneapogon desvauxii* and *Schmidtia kalahariensis*. Small trees and shrubs are sparsely distributed and include *Senegalia mellifera*, *Boscia foetida*, *Lycium cinereum*, *Rhigozum trichotomum*, *Cadaba aphylla*, *Phaeoptilum spinosum* and *Parkinsonia africana*. Prominent dwarf shrubs, such as *Aptosimum spinescens*, *Hermannia spinosa*, *Pentzia spinescens*, *Aptosimum elongatum*, *Barleria rigida*, *Blepharis mitrata*, *Justicia incanum* and *Oedera humilis* occur widespread. *Acanthopsis hoffmannseggiana*, *Barleria lichtensteiniana*, *Dicoma capensis*, *Sesamum capense*, *Mesembryanthemum coriarium* and *Tribulus terrestris* are some of the herbs in the area.

### 5.3 Plant communities of the Turksvydam site (Table 4, Figure 9)

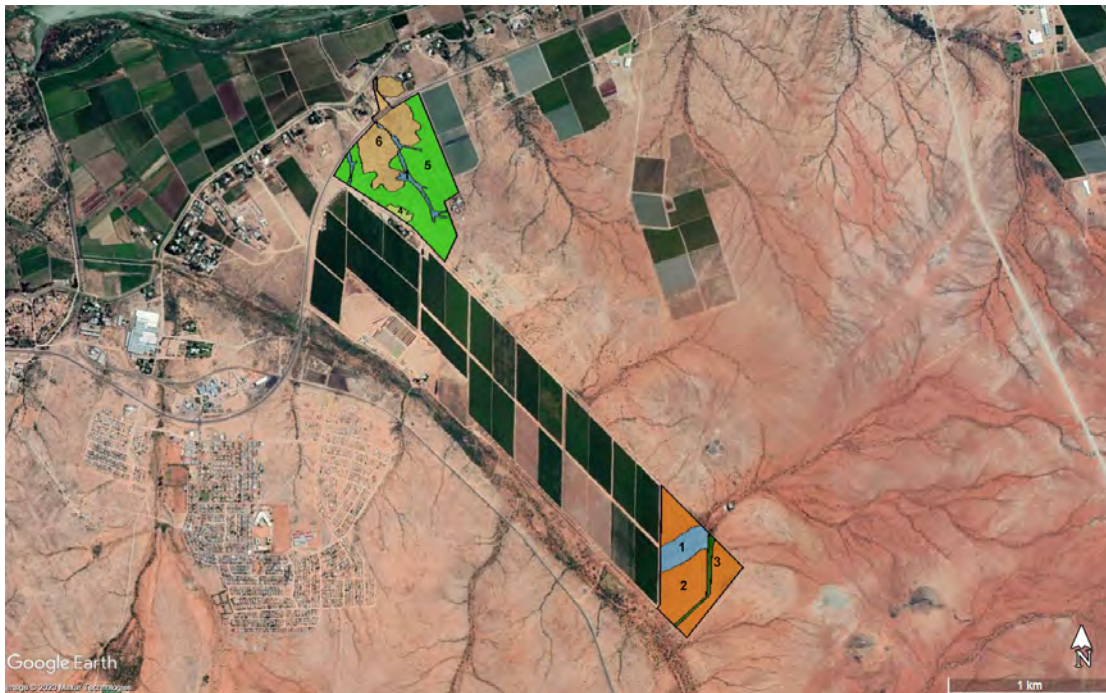
The tree and shrub species that dominated the site and occurred over most of the area were *Senegalia mellifera* as well as the alien tree *Prosopis glandulosa*. Amongst the grass species *Stipagrostis ciliata*, *Stipagrostis obtusa*, *Stipagrostis uniplumis*, *Enneapogon desvauxii*, *Cenchrus ciliaris* and *Schmidtia kalahariensis* were dominant.

#### Plant communities on the Turksvydam site (Figure 9):

The following six plant communities were identified on site:

1. *Vachellia erioloba* riparian open woodland
2. *Rhigozum trichotomum* - *Salsola tuberculata* plains dwarf shrubland
3. *Senegalia mellifera* - *Prosopis glandulosa* shrubland along furrow
4. *Aloe claviflora* plains dwarf shrubland
5. *Senegalia mellifera* - *Salsola tuberculata* plains shrubland
6. *Prosopis glandulosa* - *Tamarix usneoides* open bushveld of borrow pit

Additionally, the Louisvale spruit to the east of the site is characterised by vast stands of *Phragmites australis*. Some trees of *Vachellia erioloba*, *Ziziphus mucronata* and *Stipagrostis namaquensis* occur on the floodplains along the stream.



**Figure 9.** Vegetation map of the Turksvydam site. Numbers indicated on the map correspond to the numbers of plant communities described below.

#### LEGEND

1	<i>Vachellia erioloba</i> riparian open woodland
2	<i>Rhigozum trichotomum</i> - <i>Salsola tuberculata</i> plains dwarf shrubland
3	<i>Senegalia mellifera</i> - <i>Prosopis glandulosa</i> shrubland along furrow
4	<i>Aloe claviflora</i> plains dwarf shrubland
5	<i>Senegalia mellifera</i> - <i>Salsola tuberculata</i> plains shrubland
6	<i>Prosopis glandulosa</i> - <i>Tamarix usneoides</i> open bushveld of borrow pit

**Table 4.** Differential table of the vegetation of the Turksvydam site

Plant community	1	2	3	4	5	6
Sample plot number	1 5 11	2 4 6	3 8	7 10	9	
<b>Species group 1</b>						
<i>Vachellia erioloba</i>	1 2a +					
<i>Ziziphus mucronata</i>	+ 1 +					
<i>Stipagrostis namaquensis</i>	1 1					
<i>Galenia africana</i>	2a +	+			+	
<i>Boscia albitrunca</i>		+				
<i>Hermannia tomentosa</i>	+					
<i>Heliotropium ciliatum</i>		+				
<i>Justicia incana</i>		+				
<i>Justicia divaricata</i>		+				
<i>Gisekia pharnaceoides</i>		+				
<b>Species group 2</b>						
<i>Tetraena tenuis</i>		2a + +				
<i>Euphorbia inaequilatera</i>		+ +				
<i>Monsonia umbellata</i>		+ +				
<i>Dipcadi sp.</i>		+ +		+		
<i>Ornithogalum sp.</i>		+ +				
<b>Species group 3</b>						
<i>Aristida adscensionis</i>		+ + +				
<i>Euphorbia sp.</i>		+ + +				
<i>Aptosimum albomarginatum</i>		1 +				
<i>Enneapogon scaber</i>		+ +				+
<i>Tribulus terrestris</i>	+	+ +			+	
<i>Blepharis mitrata</i>		+ +				
<b>Species group 4</b>						
<i>Lycium bosciifolium</i>	+ + +	+ + +				
<i>Cenchrus ciliaris</i>	+ + +	+ + +				
<i>Aptosimum spinescens</i>		+ +		+		
<i>Amaranthus sp.</i>	+ + +	+ +				
<i>Tribulus zeyheri</i>	+ + +			+		
<i>Asparagus pearsonii</i>	+ +	+ +		+		
<i>Boscia foetida</i> subsp. <i>foetida</i>		+ +				+
<i>Geigeria ornativa</i>		+ + +				
<i>Kewa salsoloides</i>		+ +		+		
<i>Bulbine sp.</i>		+ +				
<i>Sesamum triphyllum</i>		+ + +		+		
<i>Phaeoptilum spinosum</i>	1 1	+ +		+		
<b>Species group 5</b>						
<i>Tetraena rigida</i>				1		
<i>Ledebouria sp.</i>				+		
<i>Leucosphaera bainesii</i>				1		
<i>Hoodia gordonii</i>				+		
<i>Parkinsonia africana</i>				+		
<i>Eriospermum roseum</i>				+		
<i>Anacampteros albissima</i>				+		
<i>Dicoma capensis</i>	+			+		
<b>Species group 6</b>						
<i>Aloe claviflora</i>				1 + +		
<i>Oropetium capense</i>				+ +		
<b>Species group 7</b>						
<i>Atriplex inflata</i>		+				+ +
<i>Tamarix usneoides</i>						1 +
<i>Phragmites australis</i>						+ +
<i>Galenia papulosa</i>						+ +
<b>Species group 8</b>						
<i>Salsola aphylla</i>					2a +	
<i>Stipagrostis anomala</i>					+ +	
<i>Cylindropuntia fulgida</i>					+ +	
<i>Dipcadi sp. 2</i>						+ +
<i>Eragrostis trichophora</i>						+ +
<b>Species group 9</b>						
<i>Kleinia longiflora</i>		+ + +		+ + +		+ +
<i>Stipagrostis obtusa</i>		+ + +		+ + +		+ +
<i>Enneapogon desvauxii</i>		+ +		+ 1 +		+ +
<i>Tapinanthus oleifolius</i>		+ +		+ + +		+ +
<i>Eragrostis porosa</i>		+ + +		+ + +		+ +
<i>Eriocephalus ambiguus</i>		+ +		+ +		+ +
<i>Plinthus karoocicus</i>		+ +				+ +
<i>Tragus berteronianus</i>		+ +		+ + +		+ +
<i>Justicia spartioides</i>		+ +				+ +
<b>Species group 10</b>						
<i>Indigofera alternans</i>		+ + +		+ + +		+ +
<i>Tetraena simplex</i>		+ + +		+ + +		+ +
<i>Trianthema parvifolium</i>		+ + +		+ + +		+ +
<b>Species group 11</b>						

<i>Senegalia mellifera</i>		1		+		2b	1	2a	2b	2a
<i>Schmidtia kalahariensis</i>		+	+	+	+	2a	1			+
<i>Tribulus cristatus</i>		2a	+	1	+	+	+	+	+	+
<i>Justicia australis</i>		+		1	2a	1	+	+		+
<i>Tetraena microcarpa</i>		+	+	+	+	1	+	1	1	+
<i>Limium aethiopicum</i>		+		+	+	+	+	+	+	+
<i>Talinum crispatum</i>		+				+	+	+		+
<i>Polygala seminuda</i>		+		+		+		+		+
<b>Species group 12</b>										
<i>Prosopis glandulosa</i>	2a	2a	1	+		2a		+		2a
<i>Salsola tuberculata</i>	1		1	2b	1	2b	1	1	1	+
<i>Stipagrostis ciliata</i>	1	+		+			+			+
<i>Rhigozum trichotomum</i>	+		+	+	2b	2a	1		1	
<i>Stipagrostis uniplumis</i>	+	+	+	+	+	1	+	+	+	+
<i>Mesembryanthemum coriarium</i>	+	1	2a	+				+		1
<i>Salsola kali</i>	+	+							+	+
<i>Mesembryanthemum crystallinum</i>		+								+
<b>Species group 13</b>										
<i>Panicum maximum</i>				+						
<i>Pentzia calcarea</i>				+						
<i>Senna italica</i>				+						
<i>Sericocoma avolans</i>				+						
<i>Schinus molle</i>					+					
<i>Ptychlobium biflorum</i>										+
<i>Tetraena decumbens</i>										+
<i>Barleria lichtensteiniana</i>										+
<i>Barleria rigida</i>										+
<i>Pelostomum leucorrhizum</i>										+
<i>Solanum capense</i>										+
<i>Aptosimum lineare</i>										+
<i>Sarcocaulon crassicaule</i>										+
<i>Acanthopsis hoffmannseggiana</i>										+
<i>Ammocharis coranica</i>										+
Apocynaceae sp.										+
<i>Trachyandra</i> sp.										+
<i>Eragrostis nindensis</i>										+
<i>Talinum cafferum</i>										+

### Description of plant communities:

#### 1. *Vachellia erioloba* Riparian Open Woodland

This plant community is found along the drainage lines on site and occurs on sandy alluvium and wind-blown sand. This community is excluded from the proposed agricultural development in the south of the Turksvydam site. A 32 m buffer is applicable between any development and drainage lines.

The community is differentiated by species group 1 (Table 4). The most prominent tree species are *Vachellia erioloba*, *Ziziphus mucronata*, *Boscia albitrunca*, *Boscia foetida* and the alien *Prosopis glandulosa* (Figure 10). The shrub layer is characterised by *Senegalia mellifera*, *Lycium bosciifolium* and *Phaeoptilum spinosum*. The dwarf shrubs are represented by *Salsola tuberculata*, *Rhigozum trichotomum*, *Galenia africana* and *Mesembryanthemum coriarium*.

The grass layer is poorly developed and includes *Stipagrostis namaquensis*, *Cenchrus ciliaris*, *Schmidtia kalahariensis*, *Stipagrostis ciliata*, *Stipagrostis uniplumis* and *Panicum maximum*. The forb layer is characterised by *Gisekia pharnaceoides*, *Tribulus zeyheri*, *Kewa salsoloides*, *Tribulus cristatus*, *Heliotropium ciliatum* and the alien *Salsola kali*.





**Figure 10.** *Vachellia erioloba* riparian open woodland.

Rare and/or protected species in community 1:

IUCN Red listed:	None
NEM:BA:	None
NFA:	<i>Vachellia erioloba</i> , <i>Boscia albitrunca</i>
NCNCA:	<i>Boscia albitrunca</i> <i>Boscia foetida</i> <i>Galenia africana</i> <i>Mesembryanthemum coriarium</i> <i>Mesembryanthemum crystallinum</i>
CITES:	None
Endemic species:	<i>Tetraena microcarpa</i>

## 2. *Rhigozum trichotomum* - *Salsola tuberculata* Plains Dwarf Shrubland

This dwarf shrubland occurs on the sandy plains in the southern parts of the site. The sandy soils are derived from gneiss. The community is differentiated by species group 2 (Table 4). The only trees in this community include individuals of *Boscia albitrunca* and *Boscia foetida*. The shrub layer is represented by *Lycium bosciifolium*, *Phaeoptilum spinosum* and *Senegalia mellifera* (Figure 11). The dwarf shrubs cover 20 - 30% of the area and include *Salsola tuberculata*, *Tetraena tenuis*, *Aptosimum albomarginatum*, *Kleinia longiflora*, *Eriocephalus ambiguus*, *Plinthus karooicus*, *Justicia australis*, *Sarcocaulon (Monsonia) crassicaule* and *Tetraena microcarpa*. The grass layer is poorly developed and includes *Aristida adscensionis*, *Enneapogon scaber*, *Stipagrostis uniplumis*, *Stipagrostis obtusa*, *Eragrostis porosa*, *Enneapogon desvauxii*, *Schmidtia kalahariensis* and *Cenchrus ciliaris*. The forb layer includes *Monsonia umbellata*, *Blepharis mitrata*, *Geigeria ornativa*, *Sesamum triphyllum*, *Indigofera alternans*, *Tetraena simplex*, *Trianthema parvifolium*, *Tribulus cristatus*, *Limeum aethiopicum* and *Polygala seminuda*. The geophyte *Ammocharis coranica* and a stapeliad species (Apocynaceae) were recorded in this community.

Rare and/or protected species in community 2:

IUCN Red listed:	None
NEM:BA:	None

NFA:	<i>Boscia albitrunca</i>
NCNCA:	<i>Ammocharis coranica</i>
	<i>Boscia albitrunca</i>
	<i>Boscia foetida</i>
	<i>Galenia africana</i>
	<i>Mesembryanthemum coriarium</i>
	<i>Ornithogalum</i> sp.
	<i>Plinthus karooicus</i>
	Apocynaceae sp.
CITES:	None
Endemic species:	<i>Tetraena decumbens</i>
	<i>Tetraena tenuis</i>
	<i>Tetraena microcarpa</i>



**Figure 11.** *Rhigozum trichotomum* - *Salsola tuberculata* plains dwarf shrubland on sandy soils and quartz and gneiss gravel.

### 3. *Senegalia mellifera* - *Prosopis glandulosa* Shrubland along the furrow

This man-made furrow cuts through the southern part of the site and was made to re-route one of the drainage lines when the vineyards were developed in the past. Although it canalised water in the direction of the Louisvale spruit, the substrate is rather rocky and the plant species found along this furrow resemble species found on the plains or rocky areas. The sandy soils are derived from gneiss.

The community is differentiated by species groups 3 & 4 (Table 4). The dominant shrubs include *Senegalia mellifera*, *Prosopis glandulosa*, *Lycium bosciifolium* and *Phaeoptilum spinosum* (Figure 12). The dwarf shrubs are represented by *Salsola tuberculata*, *Aptosimum spinescens*, *Asparagus pearsonii*, *Justicia australis* and *Tetraena microcarpa*. The most conspicuous grasses include *Aristida adscensionis*, *Enneapogon scaber*, *Stipagrostis obtusa*, *Stipagrostis ciliata*, *Stipagrostis uniplumis* and *Schmidtia kalahariensis*. The most prominent forbs include *Tribulus terrestris*, *Blepharis mitrata*, *Barleria lichtensteiniana*, *Barleria rigida*, *Geigeria ornativa*, *Sesamum triphyllum*, *Tribulus cristatus* and *Limeum aethiopicum*.



## Rare and/or protected species in community 3:

IUCN Red listed:	None
NEM:BA:	None
NFA:	None
NCNCA:	None
CITES:	None
Endemic species:	<i>Tetraena microcarpa</i>



**Figure 12.** *Senegalia mellifera* - *Prosopis glandulosa* shrubland along furrow.

#### 4. *Aloe claviflora* Plains Dwarf Shrubland

This small community occurs on some quartzite and gravel outcrops derived from migmatite, biotite-rich and aluminous gneiss (Figure 13). The community is differentiated by species group 5 and is characterised by *Aloe claviflora* (Table 4). Other protected species include *Hoodia gordonii* and *Anacampseros albissima*. The geophyte *Eriospermum roseum* was also recorded in this community. *Parkinsonia africana* is the only tree found in this community while the shrubs are represented by *Senegalia mellifera*. The most prominent dwarf shrubs include *Tetraena rigida*, *Leucosphaera bainesii*, *Aptosimum spinescens*, *Kleinia longiflora*, *Eriocephalus ambiguus*, *Justicia australis*, *Roepera microcarpa*, *Salsola tuberculata* and *Mesembryanthemum coriarium*. The grass layer is poorly developed and includes species such as *Oropetium capense*, *Enneapogon desvauxii*, *Tragus berteronianus*, *Stipagrostis ciliata* and *Stipagrostis uniplumis*. The forb layer is characterised by *Dicoma capensis*, *Indigofera alternans*, *Tribulus cristatus*, *Limeum aethiopicum* and *Talinum crispatum*.

## Rare and/or protected species in community 4:

IUCN Red listed:	None
NEM:BA:	None
NFA:	None
NCNCA:	<i>Aloe claviflora</i> <i>Anacampseros albissima</i> <i>Hoodia gordonii</i> <i>Mesembryanthemum coriarium</i>

CITES:	<i>Aloe claviflora</i> <i>Anacampseros albissima</i> <i>Hoodia gordonii</i>
Endemic species:	<i>Tetraena microcarpa</i> <i>Tetraena rigida</i>



**Figure 13.** *Aloe claviflora* plains dwarf shrubland on shallow quartz gravel.

#### 5. *Senegalia mellifera* - *Salsola tuberculata* Plains Shrubland

This plains shrubland is degraded in places and is dominated by the shrubs *Senegalia mellifera*, *Salsola tuberculata*, *Salsola aphylla* and the alien *Prosopis glandulosa* (Figure 14). The sandy soils are derived from gneiss. The community is differentiated by species groups 6 & 8 (Table 4). The most prominent dwarf shrubs include *Aloe claviflora*, *Tetraena microcarpa*, *Kleinia longiflora*, *Plinthus karoocicus*, *Justicia spartioides*, *Justicia australis* and *Rhigozum trichotomum*. The grass layer includes *Enneapogon desvauxii*, *Tragus berteronianus*, *Stipagrostis uniplumis*, *Stipagrostis ciliata* and *Oropetium capense*. The most prominent forbs are *Tetraena simplex*, *Tribulus cristatus*, *Limeum aethiopicum* and *Polygala seminuda*. The presence of the invasive alien *Cylindropuntia fulgida* is of concern.

Rare and/or protected species in community 5:

IUCN Red listed:	None
NEM:BA:	None
NFA:	None
NCNCA:	<i>Aloe claviflora</i> <i>Galenia africana</i> <i>Plinthus karoocicus</i>
CITES:	None
Endemic species:	<i>Tetraena microcarpa</i>



**Figure 14.** *Senegalia mellifera* - *Salsola tuberculata* plains shrubland.

6. *Prosopis glandulosa* - *Tamarix usneoides* Open Bushveld of the borrow pit

This old borrow pit (or quarry) is rather degraded and invaded by alien plant species such as *Prosopis glandulosa*, *Atriplex inflata* and *Salsola kali*. The community is differentiated by species group 7 (Table 4). Tree and shrub species include *Tamarix usneoides*, *Senegalia mellifera*, *Boscia foetida* and *Salsola aphylla* (Figure 15). The dwarf shrubs include *Mesembryanthemum coriarium*, *Galenia papulosa*, *Salsola tuberculata*, *Kleinia longiflora*, *Justicia australis* and *Tetraena microcarpa*. The grass layer is poorly developed and includes *Stipagrostis uniplumis*, *Stipagrostis ciliata*, *Stipagrostis obtusa*, *Schmidtia kalahariensis*, *Tragus berteronianus*, *Eragrostis porosa* and *Eragrostis trichophora*. The forbs are represented by *Tetraena simplex*, *Trianthema parvifolium*, *Indigofera alternans*, *Tribulus cristatus* and *Limeum aethiopicum*.



**Figure 15.** *Prosopis glandulosa* - *Tamarix usneoides* open bushveld of borrow pit (quarry).



## Rare and/or protected species in community 6:

IUCN Red listed:	None
NEM:BA:	None
NFA:	None
NCNCA:	<i>Boscia foetida</i> <i>Galenia papulosa</i> <i>Mesembryanthemum coriarium</i> <i>Mesembryanthemum crystallinum</i>
CITES:	None
Endemic species:	<i>Tetraena microcarpa</i>

**Pipeline from the borrow pit (quarry) towards the canal in the north:**

The pipeline route starts at the borrow pit, crosses the N14 main road and follows a route of degraded vegetation towards the canal (see Figures 16 - 22). The woody plant species recorded along the route include *Vachellia erioloba* (not close to the pipeline route), *Ziziphus mucronata*, *Lycium bosciifolium*, *Rhigozum trichotomum* and the aliens *Prosopis glandulosa* and *Schinus molle*. Other prominent species include *Mesembryanthemum coriarium*, *Tetraena microcarpa* and *Salsola tuberculata* while the grass and forb layer is poorly developed and include *Cenchrus ciliaris*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis*, *Tribulus cristatus*, *Tetraena simplex*, *Kewa salsoloides* and the alien *Atriplex inflata*. The grass species next to the road around the culvert include *Cenchrus ciliaris*, *Urochloa mosambicensis*, *Schmidtia kalahariensis*, *Eragrostis trichophora* and *Stipagrostis uniplumis*.

Below is a series of photos along the proposed pipeline from the borrow pit in the south, across the N14 main road towards the canal in the north:



**Figure 16.** Facing southwards from the N14 main road towards the borrow pit (quarry) and proposed reservoir.



**Figure 17.** Culvert at the N14 main road.



**Figure 18.** Culvert at the N14 main road.



**Figure 19.** Short section parallel to N14 main road



**Figure 20.** Facing northwards towards the canal.



**Figure 21.** Facing northwards towards the canal.



**Figure 22.** Canal in the north of the site where proposed pipeline will be connected.

# CHAPTER 6

## FLORA

### 6.1 Threats

Indirect pressures such as changing of land use, land degradation, clearing of indigenous vegetation, overgrazing, invasion of land by alien species, informal settlements, urban development, industrial and agricultural pollution, mining, impoundments, cultivation, water abstraction and climate change all contribute towards a loss of biodiversity. Loss of habitat is regarded as the foremost cause of loss of biodiversity. Development (or change in land use) usually contributes to habitat loss and degradation in many biodiversity important areas. Much of the impact can be minimised through careful planning and avoidance of sensitive areas.

### 6.2 Vegetation types

#### *Bushmanland Arid Grassland*

The site falls in the Bushmanland Arid Grassland, which covers a large area in the Northern Cape (45 479 km<sup>2</sup>) and is classified as 'least threatened' (Mucina & Rutherford 2006). However, very little is statutorily conserved in the Augrabies Falls National Park. The biogeographically important taxon in the Bushmanland Arid Grassland is the succulent *Tridentea dwequensis* (Mucina & Rutherford 2006). This species was not encountered on site.

### 6.3 Species richness

The mean species richness for the property is 38 species per community. The mean species richness for the region is approximately 33 species per community, with a mean of 41 species per community recorded in the Augrabies Falls National Park (Bezuidenhout 1996). The mean of 38 species per community in the proposed Turksvydam site compares well with the fairly undisturbed Augrabies Falls National Park.

Community	Species per community	Mean species per sample plot
1	50	27
2	52	34
3	34	34
4	30	30
5	33	22
6	31	31
Mean	38	30

### 6.4 Red listed plant species

Red Data Lists are a source of information for decision-makers to improve monitoring of the rate of loss of biodiversity and should include an assessment of the cause of a species' conservation status. Species threatened by habitat destruction need to be conserved through mechanisms that conserve the entire ecosystem, where possible.



The National Forests Act (No 84 of 1998) (NFA 2019), the National Environmental Management: Biodiversity Act, (Act 10 of 2004)(draft TOPS 2013 list), the red list categorization of the South African National Biodiversity Institute as provided by NewPosa, CITES (2019) lists, the IUCN (2013) lists of Threatened Plants and the lists of protected species of the Northern Cape Nature Conservation Act (No 9 of 2009), were consulted (Table 5).

No red-listed species with a conservation status higher than “least concern” was recorded on the Turksvydam site.

## 6.5 Northern Cape Nature Conservation Act (No 9 of 2009)(NCNCA)

Lists of Schedules 1 – 6 Flora were consulted and the following species occurring on site are listed (Table 5):

- Schedule 1 - Specially protected species: *Hoodia gordonii*
- Schedule 2 - Protected species:

Thirteen species were recorded and are listed in Table 5.

- Schedule 3: Common indigenous plant species:

These are all indigenous species except those listed as Schedule 1 and 2 species.

- Schedule 6 - Invasive plant species:

<i>Atriplex inflata</i>	(category 1b)	Communities 1, 6
<i>Cylindropuntia fulgida</i>	(category 1b)	Community 5
<i>Prosopis glandulosa</i>	(category 3):	Community 2, 3, 4, 6, 7
<i>Salsola kali</i>	(category 1b):	Community 1, 2, 3, 4, 5, 7

**Comment:** In the NCNCA, a number of families and genera, for example the family Mesembryanthemaceae (Aizoaceae), is listed as either Specially Protected Species or Protected Species. This blank classification may be because of the presence of one or two species of vulnerable or higher status in the genus. Unfortunately this then includes many species that are either common, or even weedy, e.g. *Galenia africana*, *Galenia papulosa*, *Plinthus karoicus*, *Mesembryanthemum coriarium* and *Mesembryanthemum crystallinum* which need not be awarded special conservation status. Many of the NCNCA listed species that were recorded on site are common and of “least concern”. Nevertheless, permit applications must be done for all species as required by the Northern Cape Department of Environment and Nature Conservation.



**Table 5.** Protected, endemic and alien plant species at the Turksvydam site

Species	Endemic*	NCNCA*			NFA*	CITES* App. II	NEM:BA TOPS	Red list <sup>1</sup>
		Sch 1*	Sch 2*	Sch 6*				
<i>Ammocharis coranica</i>			X				LC	
<i>Atriplex inflata</i>				X				
<i>Vachellia erioloba</i>					X		LC	
<i>Aloe claviflora</i>			X		X	X	LC	
<i>Anacampseros albissima</i>			X				LC	
<i>Boscia albitrunca</i>			X		X		LC	
<i>Boscia foetida</i> subsp. <i>foetida</i>			X				LC	
<i>Cylindropuntia fulgida</i>				X				
<i>Galenia africana</i>			X				LC	
<i>Galenia papulosa</i>			X				LC	
<i>Hoodia gordonii</i>		X					LC	
<i>Plinthus karoocicus</i>			X				LC	
<i>Prosopis glandulosa</i>				X				
<i>Mesembryanthemum coriarium</i>			X				LC	
<i>Mesembryanthemum crystallinum</i>			X				LC	
<i>Ornithogalum</i> sp.			X					
<i>Salsola kali</i>				X				
<i>Tetraena microcarpa</i>	X						LC	
<i>Tetraena tenuis</i>	X						LC	
<i>Tetraena rigida</i>	X						LC	
<i>Tetraena decumbens</i>	X						LC	
<i>Tetraena simplex</i>	X							
Apocynaceae sp.			X					

\*Endemic: Gariep Centre of Endemism

\*NCNCA: Northern Cape Nature Conservation Act 2009 (No. 9 of 2009)

\*Schedule 1: Specially protected species

\*Schedule 2: Protected species

\*Schedule 6: Alien invasive plant species

\*NFA: Protected trees: National Forest Act, (Act 84 of 1998).

\*CITES (2019): Convention on the Trade in Endangered Species of Wild Fauna and Flora

\*NEM:BA -TOPS Threatened or Protected Species

<sup>1</sup>NewPosa

## 6.6 National Environmental Management: Biodiversity Act, (Act 10 of 2004) (TOPS lists 2013):

None of the plant species recorded on site are listed in the NEM:BA lists of critically endangered, endangered or vulnerable species.

## 6.7 Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

Critical Biodiversity Areas (CBAs) are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. An ESA is not essential for meeting biodiversity targets but plays an important role in supporting the ecological functioning in a CBA.

The Orange River is classified as a CBA 1 area, while the area where the proposed reservoir will be built falls in a CBA 2 area (Namakwa Biodiversity Sector Plan 2016, Figure 23). The proposed reservoir falls in a CBA 2

but is located in an old quarry (borrow pit) and the area is highly degraded. The remainder of the site around the proposed reservoir and part of the proposed agricultural development in the site falls in Ecological Support Areas (ESAs). Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for Terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets.

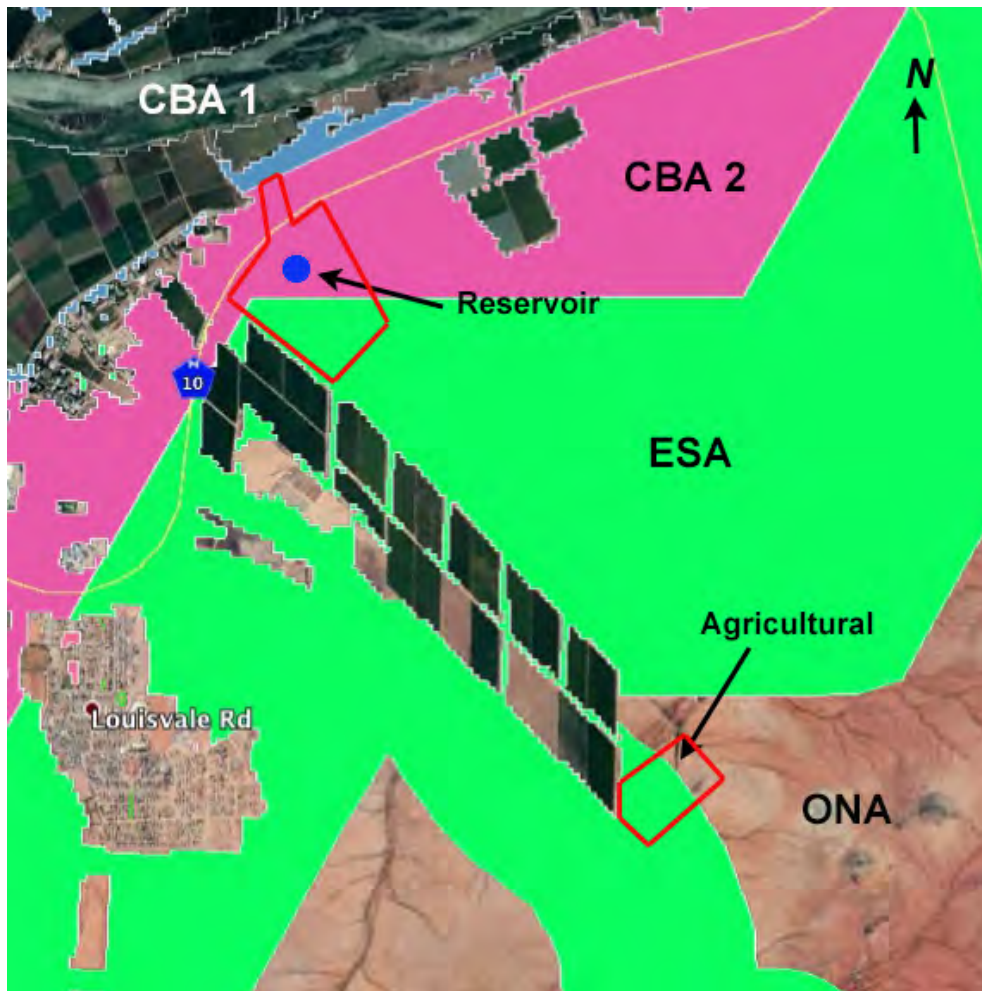


Figure 23: Critical Biodiversity Areas (CBA 1 & CBA 2), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) (Namakwa Biodiversity Sector Plan 2016; biodiversityadvisor.sanbi.org; accessed March 2020). Development boundaries indicated in red.

## 6.8 Red List of South African Plants (NewPosa.sanbi.org)

None of the plant species recorded on site are listed in the National Red List of Plants as critically endangered, endangered or vulnerable species. *Acanthopsis hoffmannseggiana* is classified as Data Deficient (DD). All other plant species recorded on site are considered as 'least concern' (Table 5) or they were alien species.

## 6.9 CITES classification (2019 lists)

Appendix I lists species that are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.

*Aloe claviflora*, *Anacampseros albissima* and *Hoodia gordonii* are the CITES Appendix II species that were recorded on site (Table 5).

## 6.10 Gariep Centre of Endemism

The term endemic refers to a species that is restricted in its distribution and therefore occurs only in a specific region. The site falls on the eastern boundary of the Gariep Centre of Endemism as delimited by Van Wyk & Smith (2001). A total of approximately 2700 species/infraspecific plant taxa are found in this centre with about 560 endemic or near-endemic species/infraspecific plant taxa (20.7%). About 80% of the taxa are succulents.

Genera that are well represented among the endemic succulents include *Anacampseros*, *Euphorbia*, *Roepera* and *Tetraena*. The Gariep Centre is regarded as the principal centre of diversity and endemism for the genera *Roepera* and *Tetraena* (previously *Zygophyllum*) in southern Africa (Van Wyk & Smith 2001). Of the 54 native *Zygophyllum* species, 21 have been recorded in the Gariep Centre of Endemism. Two *Roepera* and three *Tetraena* species were recorded on site.

## 6.11 Southern Kalahari endemic species

The flora of the southern Kalahari is generally species-poor. Less than 2.5% of the total species list of the southern Kalahari is regarded as endemic (Van Rooyen & Van Rooyen 1998). The plant species that have been listed as endemic and/or near-endemic to the southern Kalahari (Van Rooyen & Van Rooyen 1998; Lubbinge 1999; Smit 2000; Mucina & Rutherford 2006) include the tree *Vachellia haematoxylon*, *Vachellia luederitzii* var. *luederitzii*, the dwarf shrub *Plinthus sericeus*, the grasses *Antheophora argentea*, *Megaloprotacne albescens*, *Stipagrostis amabilis* and *Panicum kalaharensis*, and the forbs *Helichrysum arenicola*, *Kohautia ramossissima*, *Neuradopsis austro-africana* and *Neuradopsis bechuanicus*.

None of the listed Kalahari endemic species were found on site.

## 6.12 Protected trees (National Forest Act, Act 84 of 1998)

*Vachellia erioloba* and *Boscia albitrunca* were the only nationally protected tree species on site (Table 5, see Appendix C for GPS coordinates).

Permits are required for the utilization, e.g. harvesting for wood, medicinal purposes, of declared protected trees. The effect of the Act is that no person may cut, disturb, damage or destroy any indigenous, living protected tree in a natural forest; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except in terms of a license granted by the Minister (or a delegated authority) to an applicant and

subject to a period and conditions as may be stipulated. Certain exemptions are also described in the Act. The listing of a tree species as protected does not mean it cannot be used, but is meant to ensure sustainable use through licensing control measures.

### 6.13 IUCN (2019)

No species present on site are listed in the IUCN Red Lists of Threatened Plants.

### 6.14 Disjunct distributions (Van Wyk & Smith 2001)

An intriguing aspect of some taxa is their links with other Gondwana fragments (notably South America) and/or the arid areas in northeast Africa. An example of genera that occur on site is *Roepera* and *Tetraena* (previously *Zygophyllum*).

### 6.15 Medicinal plant species

The following plant species found on the site are used medicinally for different ailments (Van Wyk *et al.* 1997; Van Wyk & Gericke 2000, Van der Walt 2010). They are:

*Aptosimum spinescens*  
*Boscia albitrunca*  
*Boscia foetida* subsp. *foetida*  
*Dicoma capensis*  
*Sesamum triphyllum*  
*Sericocoma avolans*  
*Vachellia erioloba*  
*Ziziphus mucronata*

### 6.16 Poisonous plant species

A number of plant species found on site have poisonous properties, especially for livestock (see Vahrmeijer 1987; Kellerman *et al.* 1990; Van Wyk *et al.* 2002). They are:

*Aloe claviflora*  
*Galenia africana*  
*Geigeria ornativa*  
*Mesembryanthemum coriarium*  
*Salsola tuberculata*  
*Tribulus* spp.  
*Vachellia erioloba*

### 6.17 Alien plant species

The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEM:BA, was published in Government Notice R598 in Government Gazette 37885 dated 1 August 2014 (NEMBA 2014). The Alien and Invasive Species (AIS) lists in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of NEM:BA was subsequently published in Government Notice R 864 of 29 July 2016 (NEMBA 2016).

In terms of the aforementioned legislation, the following categories of declared alien and invasive plants are recognised in South Africa:

**Exempted Alien Species** means an alien species that is not regulated in terms of this statutory framework.

**Prohibited Alien Species** mean an alien species listed by notice by the Minister, in respect of which a permit may not be issued as contemplated in section 67(1) of the act.

**Category 1a Listed Invasive Species** mean a species listed as such by notice in terms of section 70(1)(a) of the act, as a species that must be combatted or eradicated. Landowners are obliged to take immediate steps to control Category 1a species.

**Category 1b Listed Invasive Species** mean species listed as such by notice in terms of section 70(1)(a) of the act, as species that must be controlled or 'contained'. However, where an Invasive Species Management Programme has been developed for a Category 1b species, then landowners are obliged to "control" the species in accordance with the requirements of that programme. Therefore, Category 1a triggers an immediate obligation to control, whereas that obligation only comes into effect for Category 1b species when an Invasive Species Management Programme is implemented for that species in the specific area.

Species recorded on site:

*Atriplex inflata*

*Cylindropuntia fulgida* (see Figure 24)

*Salsola kali*



Figure 24. The alien invasive species *Cylindropuntia fulgida* in community 5 on site.

**Category 2 Listed Invasive Species** mean species listed by notice in terms of section 70(1)(a) of the act, as species that require a permit to carry out a restricted activity e.g. cultivation within an area specified in the Notice or an area specified in the permit, as the case may be. Category 2 includes plant species that have economic, recreational, aesthetic or other valued properties, notwithstanding their invasiveness. It is important to note that a Category 2 species that falls outside the demarcated area specified in the permit, becomes a Category 1b invasive species. Permit-holders must take all the necessary steps to prevent the escape and spread of the species.

**Category 3 Listed Invasive Species** mean species listed by notice in terms of section 70(1)(a) of the act, as species that are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of act, as specified in the notice. Category 3 species are less-transforming invasive species which are regulated by activity. The principal focus with these species is to ensure that they are not introduced, sold or transported. However, Category 3 plant species are automatically Category 1b species within riparian and wetland areas.

Species recorded on site:

*Prosopis glandulosa*

Invasive alien plant species listed in terms of the Conservation of Agricultural Resources Act (No. 43 of 1983 - Regulation 15, 30 March 2001), and the National Environmental Management Act: Biodiversity Act (No. 10 of 2004)(NEM:BA 2014), should be controlled and eradicated with an emphasis on urgent action in biodiversity priority areas.

Alien invaders should be controlled by mechanical and/or chemical means. Mechanical means include ringbarking (girdling), uprooting, chopping, slashing and felling. An axe or chain saw or brush cutter can be used. Stumps or ringbarked stems should be treated immediately with a chemical weed killer. Follow-up treatment is sometimes needed.



## CHAPTER 7

# ECOLOGICAL SENSITIVITY ANALYSIS OF THE SITE

### 7.1 National Screening Tool

The National web-based environmental screening tool is mandatory for planning development that requires environmental authorisation. The screening report generated by the tool indicates development site environmental sensitivity for relevant environmental themes associated with the project. The results indicate "medium" sensitivity for the Agriculture theme and "low" sensitivity for the Aquatic biodiversity theme. No intersecting layers were generated for the Plant Species biodiversity theme or the Terrestrial biodiversity theme.

### 7.2 Site sensitivity analysis

Sensitivity is the vulnerability of a habitat to any impact, for example a dune, wetland or ridge system would be more vulnerable to development than would a sandy plain. Several features of a development site can be identified and assessed to derive a sensitivity score, e.g.:

- threatened status of the regional vegetation type wherein the proposed site is situated;
- percentage of red list plant species per community or site;
- number of protected tree species per community or site;
- percentage of provincial protected plant species;
- percentage of endemic plant species per community or site (endemic to vegetation type);
- conservation value of community (habitat) or site;
- species richness per plant community and per sample plot (number of plant species);
- degree of connectivity and/or fragmentation of the habitat, i.e. high connectivity and low fragmentation infers a low rating;
- soil erosion potential; and
- resilience (this is a measure of the ability of a particular habitat/plant community to recover after an impact, i.e. high resilience infers low rating).

An **overall sensitivity model** (Table 6) is developed for each plant community on site. This is achieved by weighting each criterion and calculating the sum for the community, which reflects the sensitivity and sensitivity ranking (see Sensitivity map, Figure 25).

The parameters that were used to allocate the different categories of sensitivity (very low, low, moderate, high and very high) were the following:

1. Threatened status of the ecosystem (depends on the percentage area intact, or degree of transformation) (Driver *et al.* 2005, Mucina & Rutherford 2006, NEM:BA 2011).

The ecosystems are classified into the following categories:

- Low sensitivity: If “Least Threatened”, the vegetation type has most of its habitat intact, i.e. more than 80%; or the vegetation type is adequately statutory or formally conserved in parks and reserves.
- Moderate sensitivity: If “Vulnerable”, the vegetation type has from 60% to 80% of the ecosystem intact; less than 40% has been transformed which could result in some ecosystem functioning being altered, and/or the ecosystem is statutory poorly conserved. For example, the vegetation type is rich in plant species but is not a pristine example of a vegetation type, therefore some transformation or disturbance occurred, such as human structures and degraded veld due to overgrazing and/or bush encroachment.
- High sensitivity: If “Endangered”, the vegetation type has from 40% to 60% of the ecosystem intact; or 40% to 60% transformed due to disturbance, cultivation or alien species; or the ecosystem is statutory poorly conserved e.g. less than about 3% conserved.
- Very high sensitivity: If “Critically Endangered”, the vegetation type has only 16% to 36% of the ecosystem intact. The richer the ecosystem is in terms of species, the higher the percentage threshold.

Category rating:	Score
Low (LT)	= 1
Moderate (VU)	= 2
High (EN)	= 3
Very high (CE)	= 4

2. Percentage of IUCN red list plant species (listed higher than ‘least concern’, LC).

This refers to the number of species having a status higher than ‘least concern’ (LC) (NewPosa [www://newposa.sanbi.org](http://www://newposa.sanbi.org)). The category rating calculated as percentage of the mean number of species per plot per community.

Category rating:	Score
None (0%)	= 0
Low (>0 – 2%)	= 1
Moderate (>2 – 5%)	= 2
High (>5%)	= 3

3. Presence of protected tree species (National Forests Act, No. 84 of 1998; NFA 2019)

The presence of protected tree species in a vegetation type is rated as follows:

Category rating:	Score
None (0 species)	= 0
Low (1 or 2 species)	= 1
Moderate (3 – 4 species)	= 2
High (>4 species)	= 3

4. Presence of Northern Cape protected plant species (Northern Cape Nature Conservation Act, No 9 of 2009):

The presence of protected species in a plant community is rated on the percentage of protected species in relation to the total plant species in a plant community. The weedy species (*Galenia africana*, *Galenia papulosa*, *Mesembryanthemum coriarium* and *Mesembryanthemum crystallinum*) were not included in this assessment.

<i>Category rating:</i>		<i>Score</i>
None	(0%)	= 0
Low	(>0 - 5%)	= 1
Moderate	(>5 – 10%)	= 2
High	(>10%)	= 3

5. Percentage of plant species endemic to the regional vegetation type (Van Wyk & Smith 2001; Mucina & Rutherford 2006).

The presence of endemic species was rated as the number of endemic species expressed as a percentage of the mean number of species per plot per community.

<i>Category rating:</i>		<i>Score</i>
None	(0%)	= 0
Low	(>0 - 2%)	= 1
Moderate	(2–5%)	= 2
High	(>5%)	= 3

6. Conservation value of the terrain type and/or habitat.

The criteria are low, moderate and high. The presence of e.g. quartzite outcrops, ridges, wetlands and dunes should be considered to have a moderate to high conservation value. However, this should be seen in the context of the presence of representative habitat in the broader region or in conservation areas.

<i>Category rating:</i>		<i>Score</i>
Low		= 1
Moderate		= 2
High		= 3

7. Plant community species richness

The assessment consists of determining the mean number of species per sample plot in a habitat.

<i>Category rating:</i>		<i>Score</i>
Low	(<30)	= 1
Moderate	(30 – 50)	= 2
High	(>50)	= 3

8. Degree of connectivity and/or fragmentation of the ecosystem

The degree of connectivity with surrounding or adjacent natural areas and/or fragmentation of plant communities, is indicated as low, moderate or high, e.g. high connectivity with surrounding similar habitat, or low fragmentation of habitat is considered as having a low rating.

<i>Category rating (note reverse order)</i>		<i>Score</i>
Low		= 3
Moderate		= 2
High		= 1

9. Erosion potential of the soil

The erosion potential of the soil is rated as follows:

<i>Category rating:</i>	<i>Score</i>
Low	= 1
Moderate	= 2
High	= 3

10. Resilience is a measure of the ability of a particular habitat/plant community to recover after an impact, i.e. high resilience infers low rating.

<i>Category rating (note reverse order)</i>	<i>Score</i>
Low	= 3
Moderate	= 2
High	= 1

### 7.3 Weighting of sensitivity criteria

The sensitivity criteria are weighted in the following manner:

Threatened status of the vegetation type	= x5
Percentage of red list plant species	= x4
Number of NFA protected tree species	= x3
Percentage of NCNCA protected species	= x4
Percentage of endemic species	= x2
Conservation value (habitat)	= x4
Plant community species richness	= x2
Degree of connectivity/fragmentation of habitat	= x2
Erosion	= x2
Resilience	= x3

**Table 6.** Sensitivity of the plant communities (see Figures 9 & 25)

	Plant communities					
	1	2	3	4	5	6
Threatened status (x5)	5	5	5	5	5	0
% Red data species (x4)	0	0	0	0	0	0
Number protected trees (x3)	3	3	0	0	0	0
% NCNCA species (x4)	4	8	0	8	4	4
% Endemic species (x2)	6	6	4	4	4	4
Conservation value (x4)	12	4	0	4	4	0
Species richness (x2)	6	6	4	4	4	4
Connectivity (x2)	2	2	2	4	4	2
Erosion (x2)	4	2	2	2	2	2
Resilience (x3)	6	6	3	9	6	3
Sum:	48	42	20	36	33	19
<b>Sensitivity rating:</b>	<b>M</b>	<b>M</b>	<b>VL</b>	<b>L</b>	<b>L</b>	<b>VL</b>

The drainage lines and the sandy plains in the south of the site have a moderate sensitivity. The severely disturbed areas could be regarded as having a very low sensitivity.

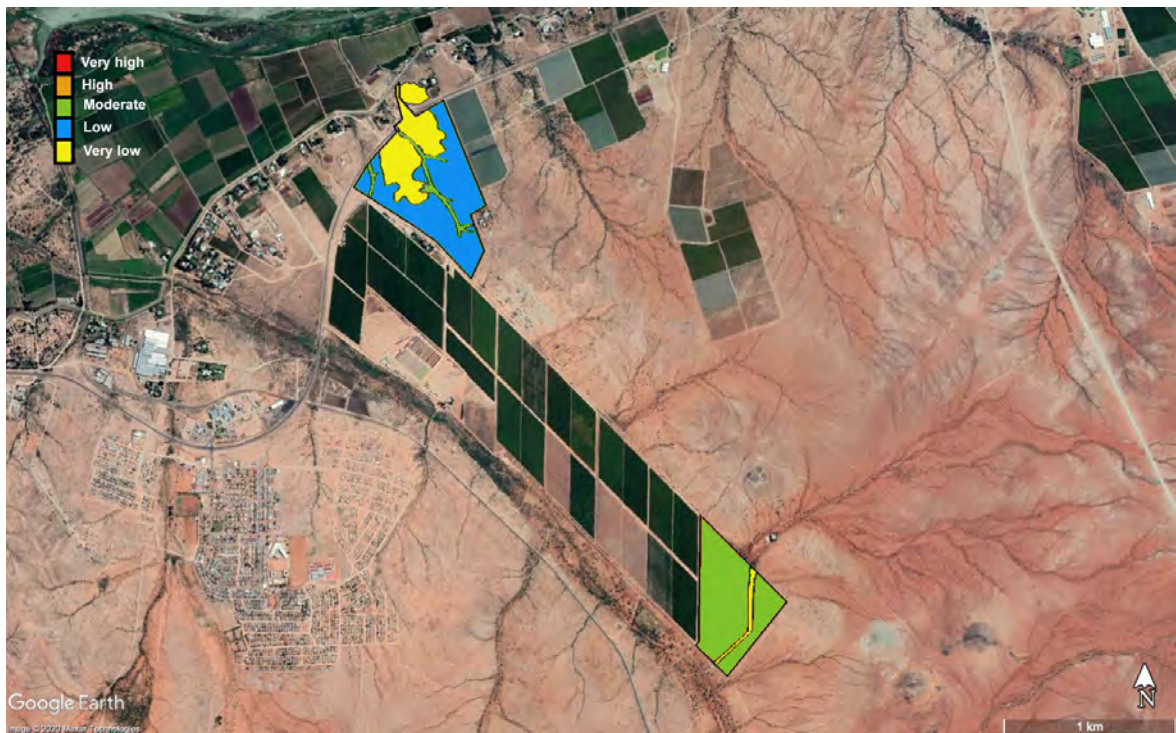


Figure 25. Sensitivity map of the Turksvydam site.

## 7.4 Sensitivity rating

The sensitivity categories are as follows:

≤30	= very low	(VL)	(rating scale = 1)
31 – 40	= low	(L)	(rating scale = 2)
41 – 50	= moderate	(M)	(rating scale = 3)
51 – 65	= high	(H)	(rating scale = 4)
>65	= very high	(VH)	(rating scale = 5)

These categories are interpreted as:

- **Very low** (1) sensitivity means that a minimum score is allocated to almost all the sensitivity criteria used. It is usually applicable to habitats that have been transformed, especially by human activities.
- **Low** (2) sensitivity means the sensitivity is not significant enough and should not have an influence on the decision about the project. However, any protected species may not be removed/destroyed without a permit.
- **Moderate** (3) means a sensitivity rating that is real and sufficiently important to require management, e.g. management or protection of the rare/threatened fauna and flora, protection of the specific habitat on the property and/or rehabilitation.
- **High** (4) means a sensitivity rating where the habitat should be excluded from any development.
- **Very high** (5) means a sensitivity rating that should influence the decision whether or not to proceed with the project.



## CHAPTER 8

## ENVIRONMENTAL IMPACTS AND MITIGATION

<b>IMPACT: NATURAL VEGETATION</b>
<p><b>Direct impacts:</b></p> <ul style="list-style-type: none"> <li>• Transformation of natural habitat to vineyard.</li> <li>• Total loss of indigenous vegetation on the footprint of the development.</li> <li>• Increased dust levels during vineyard preparation.</li> <li>• Increased weedy and alien invasive plants.</li> <li>• Loss of faunal habitat.</li> </ul>
<p><b>Indirect impacts:</b></p> <ul style="list-style-type: none"> <li>• Loss of biodiversity.</li> <li>• Some disturbance will inevitably occur in the direct surroundings of the site.</li> </ul>
<p><b>Cumulative impacts:</b></p> <ul style="list-style-type: none"> <li>• Additional infrastructure development, for example, water pipelines, power lines and access roads and the spread of alien invaders due to loss of natural vegetation, will exacerbate the negative impact of the development on the natural vegetation.</li> <li>• Loss of habitat for indigenous fauna and flora.</li> </ul>
<p><b>Residual impacts:</b></p> <ul style="list-style-type: none"> <li>• Despite mitigation measures, loss of the natural vegetation will occur. The site falls in the Bushmanland Arid Shrubland, which is classified as 'least threatened' because little of the area has been transformed.</li> <li>• The residual impacts on the surrounding vegetation will be low if mitigation is successful in restricting disturbance.</li> </ul>
<p><b>Mitigation:</b></p> <ul style="list-style-type: none"> <li>• Development should be contained within the proposed footprint and unnecessary clearance or disturbance adjacent to the site should be avoided.</li> <li>• No-go areas, e.g. drainage lines should be avoided.</li> <li>• Two protected tree species were recorded on site. They are mainly restricted to the drainage line in the south (plant community 1). This habitat should be avoided and not be transformed. Permits have to be obtained for the removal of any protected tree species.</li> <li>• Dust control measures should be implemented during vineyard preparation and reservoir construction.</li> <li>• Prevent soil erosion on and from the site.</li> <li>• Vehicles should remain on existing demarcated roads.</li> <li>• Stream crossings to be designed not to impede or disrupt the direction and flow of water.</li> </ul>

<b>IMPACT: ALIEN VEGETATION</b>
<p><b>Direct impacts:</b></p> <ul style="list-style-type: none"> <li>As a result of the loss of indigenous vegetation and resulting disturbance, alien plant species might invade the area.</li> </ul>
<p><b>Indirect impacts:</b></p> <ul style="list-style-type: none"> <li>Disturbance will favour alien species and without proper control measures, alien species may spread through the area.</li> </ul>
<p><b>Cumulative impacts:</b></p> <p>The establishment of declared weedy and alien invasive plant species on the disturbed site could lead to their spread into the surrounding natural vegetation and onto neighbouring properties.</p>
<p><b>Residual impacts:</b></p> <p>Low residual impact if the declared weedy and alien invasive species are controlled.</p>
<p><b>Mitigation:</b></p> <ul style="list-style-type: none"> <li>Development should be restricted to the proposed site.</li> <li>Use existing and dedicated access roads to limit disturbance of the natural vegetation.</li> <li>Raise awareness regarding the negative impacts of alien invasive plant species.</li> <li>Establish a monitoring program for the early detection and control of alien invasive plant species.</li> <li>Indigenous trees and shrubs should be retained where possible.</li> <li>No alien invasive plant species should be used in landscaping on or around the site.</li> <li>Alien invasive species should be eradicated on site. Monitor and control new declared weedy and alien invasive species. However, restrict the use of herbicides for the control of alien species.</li> </ul>

**IMPACT: DRAINAGE CHANNELS**

Note: The man-made furrow to divert one of the natural drainage channels to the Louisvale spruit is not included in this evaluation. This furrow was constructed many years ago, but the vegetation found along this furrow cannot be considered as representative of a natural drainage line. The vineyard development plans to remove this furrow and to re-open the natural drainage line. However, this would imply that the current vineyard at the lower end of the natural drainage channel would impede the natural flow of water to the Louisvale spruit. **This issue needs to be assessed by a wetland specialist, since no specific details were available on how this issue would be addressed.**

**Direct impacts:**

- Loss of vegetation in smaller drainage channels.
- Loss of protected tree species.
- Loss of biodiversity and habitat for fauna.
- Impeding and/or diversion of the natural flow of water.
- Increase in weedy and alien invasive plant species.
- Increase in soil erosion.

**Indirect impacts:**

- Loss of biodiversity.

**Cumulative impacts:**

- Increase in silt transport towards the Orange River

**Residual impacts:**

- Diversion of current drainage channels could occur.

**Mitigation:**

- No diversion of drainage channels should occur.
- No impeding of water flow should occur.
- Use existing and dedicated access roads to limit disturbance of the natural vegetation.
- Monitor and control declared weedy and alien invasive species.
- Measures to prevent soil erosion should be applied.
- Minimise clearance of natural vegetation and disturbance to the areas surrounding the development.
- Measures should be put in place to rehabilitate denuded and disturbed areas as soon as possible with indigenous vegetation.

## CHAPTER 9

# ASSESSMENT OF SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

### 9.1 Introduction

The proposed development is assessed in terms of scale, severity (intensity and duration) and probability of the impact. An assessment of the significance of the impacts of the development on the natural and alien vegetation during the construction and operational phases is summarised in Table 7.

### 9.2 Significance of impacts

The significance of environmental impacts is assessed by means of the criteria of probability, severity (intensity and duration), direction (negative, neutral or positive) and scale (extent).

#### 9.2.1 Severity

Severity is calculated from the ratings given to intensity and duration of the impact. Reversibility should be evaluated along with intensity and is the ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed.

An **intensity** ( $\alpha$ ) rating is awarded to each impact as follows:

- Small impact - a minor impact on the environment and processes will occur; the ecosystem pattern, process and functioning are not affected.  
Rating = 1
- Minor impact – the ecosystem pattern, process and functioning are minimally affected and a minor impact may occur.  
Rating = 2
- Moderate intensity – valued, important, sensitive or vulnerable systems or communities are negatively affected but ecosystem pattern, process and functions can continue albeit in a slightly modified way.  
Rating = 3
- High intensity – environment affected to the extent that the ecosystem pattern, process and functions are altered and may even temporarily or permanently cease. Valued, important, sensitive or vulnerable systems, communities or species are substantially affected.  
Rating = 4
- Very high intensity - environment affected to the extent that the ecosystem pattern, process and functions are completely destroyed and may permanently cease.  
Rating = 5

The **duration** rating ( $\beta$ ) is awarded as follows:

- Very short term – up to 1 year  
Rating = 1
- Short term – 1 up to 5 years  
Rating = 2
- Moderate term - >5 – 15 years  
Rating = 3
- Long term – >15 – 30 years: The impact will occur during the operational life of the activity, and recovery may occur with mitigation (restoration and rehabilitation).  
Rating = 4
- Permanent – the impact will destroy the ecosystem functioning and mitigation (restoration and rehabilitation) will not contribute in such a way or in such a time span that the impact can be considered transient.  
Rating = 5

#### 9.2.2 Scale rating ( $\delta$ ):

Site specific	= 1
Local (surrounding areas)	= 3
Regional (provincial)	= 5

#### 9.2.3 Probability ( $\epsilon$ )

Probability ( $\epsilon$ ) describes the probability or likelihood of the impact actually occurring, and is rated as follows:

- Highly improbable – where the impact will not occur, either because of design or historic experience.  
Rating = 1
- Improbable – where the impact is unlikely to occur (but there is some possibility), either because of design, mitigation or historic experience.  
Rating = 2
- Probable - there is a good probability that the impact will occur (<50% chance of occurring).  
Rating = 3
- Highly probable - most likely that the impact will occur (50 – 90% chance of occurring).  
Rating = 4
- Definite – the impact will occur regardless of any prevention or mitigating measures (>90% chance of occurring).  
Rating = 5

The **significance rating** is determined through a synthesis of the characteristics described above where:

$$S = (\alpha + \beta + \delta) * \epsilon:$$

The significance rating provided in Table 7 should be interpreted taking the following assumptions into consideration:



- The drainage channels (plant community 1) will not form part of the vineyard development and therefore the intensity of the impact is rated as low.
- Plant communities 2, 3 and 5 within the footprint of the development will be destroyed and the significance of the impact is rated as moderate.
- Plant community 4 is a man-made community, but will also be destroyed. The significance of the impact is rated as moderate.
- Plant community 6 is severely degraded and therefore the intensity of the impact is low. The overall significance of the impact on this plant community is low.

**Table 7.** Significance assessment of impacts on the plant communities **taking mitigation measures into consideration**

	Plant community					
	1*	2	3	4	5	6*
Intensity ( $\alpha$ )	1	5	3	5	5	1
Duration ( $\beta$ )	1	4	4	4	4	4
Scale ( $\delta$ )	1	1	1	1	1	1
Probability ( $\epsilon$ )	2	5	5	5	5	5
Significance ( $\alpha+\beta+\delta$ )* $\epsilon$ :	6	50	40	50	50	30
<b>Significance rating:</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>

1\* - assumption is that drainage lines are excluded from development.

6\* - borrow pit or quarry where reservoir is planned is severely degraded habitat

The **significance rating** influences the development project as follows:

- Low significance (significance rating  $\leq 30$  points)

If the negative impacts have little real effects it should not have an influence on the decision to proceed with the project. In such circumstances there is a significant capacity of the environmental resources in the area to respond to change and withstand stress and they will be able to return to their pre-impacted state within the short-term.

- Moderate significance (significance rating  $>30 - 60$  points)

If the impact is negative, it implies that the impact is real and sufficiently important to require mitigation and management measures before the proposed project can be approved. In such circumstances there is a reduction in the capacity of the environmental resources in the area to withstand stress and to return to their pre-impacted state within medium to long-term.

- High significance (significance rating  $>60$  points)

Negative impact: this should weigh towards a decision to terminate the proposal, or mitigation should be formulated and performed to reduce significance to at least a moderate significance rating. In these circumstances the environmental resources have mostly been destroyed and the capacity of the environmental resources in the area to respond to change and withstand further stress has been or is close to being exceeded. If mitigation cannot be effectively implemented, the proposed activity should be terminated.

**Overall, the significance of the impact in the affected plant communities was rated as moderate. It is important that all mitigation measures are diligently implemented.**

## CHAPTER 10

# DISCUSSION, MITIGATION AND RECOMMENDATIONS

### 10.1 Vegetation type (ecosystem, regional)

The site falls in the Bushmanland Arid Grassland with a conservation status of “least concern” with very little of the areas transformed. However, little is conserved and that occurs in the Augrabies Falls National Park. The size of the development is insignificant in relation to the area covered by the vegetation unit, i.e. 45 479 km<sup>2</sup>.

### 10.2 Terrestrial plant communities

Community 1 had the highest sensitivity rating of the terrestrial plant communities (moderate). The rating of this community was increased primarily by its conservation value as watercourse (ephemeral stream) and furthermore, the presence of a large proportion of NCNCA protected species and the presence of NFA nationally protected tree species.

Plant community 2 also had a moderate sensitivity. The rating of this community was increased primarily by a large proportion of NCNCA protected species and the presence of NFA nationally protected tree species.

### 10.3 Aquatic plant communities (community 1)

The relatively high sensitivity rating of the stream habitat is due to its conservation and environmental value as watercourse, the presence of two nationally protected tree species and some NCNCA protected plant species. The streams on site should be excluded from any development and a buffer zone of non-disturbance of about 32 m along the main channels should be set aside to minimize any impacts on the vegetation. The drainage lines are dry for most of the year and flow for short periods after relatively heavy rains. The flow of water along the drainage lines should not be impeded or diverted and prevention of erosion should be a high priority, e.g. erections of gabions.

The issue regarding the diversion of the flow (community 1) and the furrow (community 3) needs to be assessed by a wetland specialist, since no specific details were available on how this issue would be addressed.

### 10.4 Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

The area where the proposed reservoir will be built falls in a CBA 2 area. However, the actual site falls in an old quarry (borrow pit) and the area is highly degraded. The remainder of the site around the proposed reservoir and part of the proposed agricultural development in the site falls in Ecological Support Areas (ESAs). An ESA is not essential for meeting biodiversity targets but plays an important role in supporting the

ecological functioning in a CBA. Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for Terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets.

## 10.5 Protected and endemic flora

The species of conservation significance recorded during the current survey (in March 2020) are *Ammocharis coranica*, *Vachellia erioloba*, *Boscia albitrunca*, *Boscia foetida*, *Anacampseros albissima*, *Hoodia gordonii*, *Aloe claviflora* and a stapeliad species (Apocynaceae). The species endemic to the Gariep Centre of Endemism occur widespread and no special measures need to be applied for them, e.g. *Roepera* and *Tetraena* species.

## 10.6 Alien plant species

Four declared invasive plant species were recorded on site. The four declared invasive plant species were three Category 1b species (*Atriplex inflata*, *Cylindropuntia fulgida* and *Salsola kali*) and one Category 3 species (*Prosopis glandulosa*). Alien plant species constitute 4% of the plant species checklist for the site.

## 10.7 National Screening Tool

The National web based environmental screening tool is mandatory for planning development that requires EA. The screening report generated by the tool indicates development site environmental sensitivity for relevant environmental themes associated with the project. The results indicate "medium" sensitivity for the Agriculture theme and "low" sensitivity for the Aquatic biodiversity theme. No intersecting layers were generated for the Plant Species biodiversity theme or the Terrestrial biodiversity theme.

## 10.8 Mitigation

Mitigation measures:

- Buffer zones should be provided along drainage lines where possible, i.e. a 32 m zone of undisturbed habitat. A buffer zone is a collar of land that filters out inappropriate influences from surrounding activities, also known as edge effects and prevents flooding of homesteads.
- Development should be contained within the footprint of the proposed development and unnecessary disturbance or clearance of vegetation adjacent to the sites should be avoided.
- Use existing and dedicated access roads to limit disturbance of the natural vegetation.
- Stream crossings to be designed not to impede or disrupt the direction and flow of water.
- Dust control measures should be implemented during vineyard and reservoir construction.
- No-go areas, e.g. drainage lines should be avoided.
- All plant species recorded on site are considered as 'least concern', except for *Acanthopsis hoffmannseggiana* that is classified as Data Deficient.
- No alien invasive plant species should be used in landscaping on site.
- Raise awareness regarding the negative impacts of alien invasive plant species and implement a monitoring program for the early detection of alien invasive plant species.

The adherence to the suggested mitigation measures should limit impacts on the natural vegetation and associated fauna.

The necessary flora permits are required from Northern Cape Nature Conservation to adhere to the Northern Cape Nature Conservation Act (No 9 of 2009) in terms of the removal or destruction of protected flora. Permits are also required from the Department of Environment, Forestry and Fisheries to remove protected tree species.

The Environmental Control Officer should monitor and report to the Environmental Assessment Practitioner as to whether the construction is contained within these boundaries and that the surrounding natural vegetation has not been negatively affected.

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## APPENDIX A

## Plant species list of Turksvydam site, Upington

Trees	6
Shrubs	3
Dwarf shrubs	25
Forbs	27
Geophytes	7
Grasses	17
Succulents	7
Parasites	1
Aliens	5
<b>Total</b>	<b>98</b>

## Trees

*Boscia albitrunca*  
*Boscia foetida* subsp. *foetida*  
*Parkinsonia africana*  
*Tamarix usneoides*  
*Vachellia erioloba*  
*Ziziphus mucronata*

## Shrubs

*Lycium bosciifolium*  
*Phaeoptilum spinosum*  
*Senegalia mellifera*

## Dwarf shrubs

*Aptosimum albomarginatum*  
*Aptosimum lineare*  
*Aptosimum spinescens*  
*Asparagus pearsonii*  
*Eriocephalus ambiguus*  
*Galenia africana*  
*Hermannia tomentosa*  
*Justicia divaricata*  
*Justicia genistifolium*  
*Justicia incanum*  
*Justicia spartioides*  
*Leucosphaera bainesii*  
*Limeum aethiopicum*  
*Pentzia calcarea*  
*Plinthus karrooicus*  
*Rhigozum trichotomum*  
*Tetraena microcarpa*  
*Salsola aphylla*  
*Salsola tuberculata*  
*Sarcocaulon (Monsonia) crassicaule*  
*Senna italica*  
*Solanum capense*

*Tetraena decumbens*  
*Tetraena rigida*  
*Tetraena tenuis*

Forbs

*Acanthopsis hoffmannseggiana*  
*Amaranthus* sp.  
*Barleria lichtensteiniana*  
*Barleria rigida*  
*Blepharis mitrata*  
*Dicoma capensis*  
*Euphorbia inaequilatera*  
*Euphorbia* sp.  
*Galenia papulosa*  
*Geigeria ornativa*  
*Gisekia pharnaceoides*  
*Heliotropium ciliatum*  
*Indigofera alternans*  
*Kewa salsoloides*  
*Monsonia umbellata*  
*Peliostomum leucorrhizum*  
*Polygala seminuda*  
*Ptycholobium biflorum*  
*Sericocoma avolans*  
*Sesamum triphyllum*  
*Talinum cafferum*  
*Talinum crispatum*  
*Tetraena simplex*  
*Trianthema parvifolium*  
*Tribulus cristatus*  
*Tribulus terrestris*  
*Tribulus zeyheri*

Geophytes

*Ammocharis coranica*  
*Bulbine* sp.  
*Dipcadi* spp.  
*Eriospermum roseum*  
*Ledebouria* sp.  
*Ornithogalum* sp.  
*Trachyandra* sp.

Grasses

*Aristida adscensionis*  
*Cenchrus ciliaris*  
*Enneapogon desvauxii*  
*Enneapogon scaber*  
*Eragrostis nindensis*  
*Eragrostis porosa*  
*Eragrostis trichophora*  
*Oropetium capense*  
*Panicum maximum*  
*Phragmites australis*  
*Schmidtia kalahariensis*

*Stipagrostis anomala*  
*Stipagrostis ciliata*  
*Stipagrostis namaquensis*  
*Stipagrostis obtusa*  
*Stipagrostis uniplumis*  
*Tragus berteronianus*

Parasite

*Tapinanthus oleifolius*

Succulents

*Aloe claviflora*  
*Anacampseros albissima*  
*Hoodia gordonii*  
*Kleinia longiflora*  
*Mesembryanthemum coriarium*  
*Mesembryanthemum crystallinum*  
*Apocynaceae* sp.

Aliens plants

*Atriplex inflata*  
*Cylindropuntia fulgida*  
*Prosopis glandulosa*  
*Salsola kali*  
*Schinus molle*

## APPENDIX B

Plant species list according to the 2821 A grid  
(NewPosa database, 2020)

Family	Species	IUCN
Acanthaceae	<i>Acanthopsis hoffmannseggiana</i>	DD
Acanthaceae	<i>Barleria lichtensteiniana</i>	LC
Acanthaceae	<i>Barleria rigida</i>	LC
Acanthaceae	<i>Blepharis mitrata</i>	LC
Acanthaceae	<i>Justicia australis</i>	LC
Acanthaceae	<i>Justicia divaricata</i>	LC
Acanthaceae	<i>Justicia spartioides</i>	LC
Aizoaceae	<i>Galenia sarcophylla</i>	LC
Aizoaceae	<i>Mesembryanthemum coriarium</i>	LC
Aizoaceae	<i>Mesembryanthemum crystallinum</i>	LC
Aizoaceae	<i>Mesembryanthemum guerichianum</i>	LC
Aizoaceae	<i>Mesembryanthemum sp.</i>	LC
Aizoaceae	<i>Mesembryanthemum subnodosum</i>	LC
Aizoaceae	<i>Mesembryanthemum tetragonum</i>	LC
Amaranthaceae	<i>Atriplex semibaccata</i>	Alien
Amaranthaceae	<i>Leucosphaera bainesii</i>	LC
Amaranthaceae	<i>Salsola barbata</i>	LC
Amaranthaceae	<i>Salsola kali</i>	Alien
Amaranthaceae	<i>Salsola tuberculata</i>	LC
Amaryllidaceae	<i>Boophone disticha</i>	LC
Amaryllidaceae	<i>Crinum bulbispermum</i>	LC
Amaryllidaceae	<i>Nerine laticoma</i>	LC
Anacampserotaceae	<i>Anacampseros filamentosa subsp. tomentosa</i>	LC
Anacardiaceae	<i>Searsia ciliata</i>	LC
Anacardiaceae	<i>Searsia lancea</i>	LC
Anacardiaceae	<i>Searsia pendulina</i>	LC
Apocynaceae	<i>Adenium oleifolium</i>	LC
Apocynaceae	<i>Gomphocarpus fruticosus subsp. fruticosus</i>	LC
Apocynaceae	<i>Larryleachia marlothii</i>	LC
Asphodelaceae	<i>Aloe claviflora</i>	LC
Asteraceae	<i>Amellus tridactylus subsp. arenarius</i>	LC
Asteraceae	<i>Athanasia minuta subsp. minuta</i>	LC
Asteraceae	<i>Berkheya annectens</i>	LC
Asteraceae	<i>Bidens bipinnata</i>	Alien
Asteraceae	<i>Dicoma capensis</i>	LC
Asteraceae	<i>Dimorphotheca pluvialis</i>	LC
Asteraceae	<i>Dimorphotheca polyptera</i>	LC
Asteraceae	<i>Eriocephalus ambiguus</i>	LC
Asteraceae	<i>Felicia muricata subsp. muricata</i>	LC
Asteraceae	<i>Geigeria filifolia</i>	LC
Asteraceae	<i>Geigeria ornativa subsp. ornativa</i>	LC
Asteraceae	<i>Geigeria pectidea</i>	LC
Asteraceae	<i>Helianthus annuus</i>	Alien
Asteraceae	<i>Helichrysum micropoides</i>	LC
Asteraceae	<i>Hirpicium echinus</i>	LC
Asteraceae	<i>Ifloga molluginoides</i>	LC
Asteraceae	<i>Nolletia annetjiae</i>	LC
Asteraceae	<i>Pteronia leucoclada</i>	LC
Asteraceae	<i>Pteronia mucronata</i>	LC



Asteraceae	<i>Senecio consanguineus</i>	LC
Asteraceae	<i>Senecio sophioides</i>	LC
Asteraceae	<i>Ursinia nana</i> subsp. <i>nana</i>	LC
Bignoniaceae	<i>Rhigozum obovatum</i>	LC
Boraginaceae	<i>Trichodesma africanum</i>	LC
Brassicaceae	<i>Heliophila deserticola</i> var. <i>deserticola</i>	LC
Brassicaceae	<i>Heliophila minima</i>	LC
Burseraceae	<i>Commiphora gracilifrondosa</i>	LC
Campanulaceae	<i>Wahlenbergia denticulata</i> var. <i>denticulata</i>	LC
Capparaceae	<i>Boscia foetida</i> subsp. <i>foetida</i>	LC
Celastraceae	<i>Gymnosporia linearis</i> subsp. <i>lanceolata</i>	LC
Colchicaceae	<i>Ornithoglossum vulgare</i>	LC
Corbichoniaceae	<i>Corbichonia decumbens</i>	LC
Crassulaceae	<i>Cotyledon orbiculata</i> var. <i>dactylopsi</i>	LC
Cucurbitaceae	<i>Kedrostis capensis</i>	LC
Cyperaceae	<i>Cyperus usitatus</i>	LC
Euphorbiaceae	<i>Euphorbia avasmontana</i>	LC
Euphorbiaceae	<i>Euphorbia mauritanica</i>	LC
Fabaceae	<i>Adenolobus garipensis</i>	LC
Fabaceae	<i>Calobota linearifolia</i>	LC
Fabaceae	<i>Cyamopsis serrata</i>	LC
Fabaceae	<i>Indigostrum niveum</i>	LC
Fabaceae	<i>Indigofera alternans</i>	LC
Fabaceae	<i>Indigofera alternans</i> var. <i>alternans</i>	LC
Fabaceae	<i>Melolobium macrocalyx</i>	LC
Fabaceae	<i>Parkinsonia africana</i>	LC
Fabaceae	<i>Pomaria lactea</i>	LC
Fabaceae	<i>Prosopis glandulosa</i> var. <i>glandulosa</i>	Alien
Fabaceae	<i>Prosopis glandulosa</i> var. <i>torreyana</i>	Alien
Fabaceae	<i>Prosopis velutina</i>	Alien
Fabaceae	<i>Ptychlobium biflorum</i> subsp. <i>biflorum</i>	LC
Fabaceae	<i>Requienia sphaerosperma</i>	LC
Fabaceae	<i>Senna italica</i> subsp. <i>arachoides</i>	LC
Fabaceae	<i>Tephrosia dregeana</i> var. <i>dregeana</i>	LC
Fabaceae	<i>Vachellia haematoxylon</i>	LC
Fabaceae	<i>Vachellia karroo</i>	LC
Geraniaceae	<i>Monsonia crassicaulis</i>	LC
Geraniaceae	<i>Monsonia luederitziana</i>	LC
Gisekiaceae	<i>Gisekia africana</i> var. <i>africana</i>	LC
Hyacinthaceae	<i>Albuca virens</i> subsp. <i>arida</i>	LC
Hyacinthaceae	<i>Dipcadi gracillimum</i>	LC
Hyacinthaceae	<i>Dipcadi papillatum</i>	LC
Iridaceae	<i>Babiana flabellifolia</i>	LC
Iridaceae	<i>Ferraria variabilis</i>	LC
Iridaceae	<i>Lapeirousia littoralis</i>	LC
Iridaceae	<i>Lapeirousia littoralis</i> subsp. <i>littoralis</i>	LC
Iridaceae	<i>Lapeirousia plicata</i> subsp. <i>foliosa</i>	LC
Iridaceae	<i>Maraea polystachya</i>	LC
Loranthaceae	<i>Tapinanthus oleifolius</i>	LC
Malvaceae	<i>Hermannia abrotanoides</i>	LC
Malvaceae	<i>Hermannia bicolor</i>	LC
Malvaceae	<i>Hermannia erodioides</i>	LC
Malvaceae	<i>Hermannia minutiflora</i>	LC
Malvaceae	<i>Hermannia modesta</i>	LC
Malvaceae	<i>Hermannia spinosa</i>	LC
Malvaceae	<i>Radyera urens</i>	LC
Malvaceae	<i>Sida rhombifolia</i> subsp. <i>rhombifolia</i>	LC
Meliaceae	<i>Nymania capensis</i>	LC
Nyctaginaceae	<i>Phaeoptilum spinosum</i>	LC
Oxalidaceae	<i>Oxalis lawsonii</i>	LC
Pedaliaceae	<i>Rogeria longiflora</i>	LC

Poaceae	<i>Antheophora pubescens</i>	LC
Poaceae	<i>Aristida congesta</i> subsp. <i>congesta</i>	LC
Poaceae	<i>Aristida vestita</i>	LC
Poaceae	<i>Brachiaria glomerata</i>	LC
Poaceae	<i>Cenchrus ciliaris</i>	LC
Poaceae	<i>Cenchrus incertus</i>	NE
Poaceae	<i>Centropodia glauca</i>	LC
Poaceae	<i>Dinebra retroflexa</i>	LC
Poaceae	<i>Echinochloa holubii</i>	LC
Poaceae	<i>Enneapogon desvauxii</i>	LC
Poaceae	<i>Enneapogon scaber</i>	LC
Poaceae	<i>Eragrostis annulata</i>	LC
Poaceae	<i>Eragrostis aspera</i>	LC
Poaceae	<i>Eragrostis biflora</i>	LC
Poaceae	<i>Eragrostis brizantha</i>	LC
Poaceae	<i>Eragrostis echinochloidea</i>	LC
Poaceae	<i>Eragrostis mexicana</i> subsp. <i>virescens</i>	NE
Poaceae	<i>Eragrostis porosa</i>	LC
Poaceae	<i>Eragrostis procumbens</i>	LC
Poaceae	<i>Leptochloa fusca</i>	LC
Poaceae	<i>Melinis repens</i> subsp. <i>repens</i>	LC
Poaceae	<i>Phalaris canariensis</i>	NE
Poaceae	<i>Schmidtia kalahariensis</i>	LC
Poaceae	<i>Setaria italica</i>	NE
Poaceae	<i>Sporobolus ioclados</i>	LC
Poaceae	<i>Stipagrostis amabilis</i>	LC
Poaceae	<i>Stipagrostis anomala</i>	LC
Poaceae	<i>Stipagrostis ciliata</i> var. <i>capensis</i>	LC
Poaceae	<i>Stipagrostis obtusa</i>	LC
Poaceae	<i>Stipagrostis uniplumis</i> var. <i>uniplumis</i>	LC
Poaceae	<i>Tragus berteronianus</i>	LC
Poaceae	<i>Triraphis ramosissima</i>	LC
Polygalaceae	<i>Polygala seminuda</i>	LC
Polygonaceae	<i>Oxygonum alatum</i> var. <i>alatum</i>	LC
Polygonaceae	<i>Persicaria lapathifolia</i>	Alien
Rubiaceae	<i>Kohautia cynanchica</i>	LC
Ruscaceae	<i>Eriospermum roseum</i>	LC
Salicaceae	<i>Salix mucronata</i> subsp. <i>mucronata</i>	LC
Santalaceae	<i>Thesium hystricoides</i>	LC
Scrophulariaceae	<i>Aptosimum elongatum</i>	LC
Scrophulariaceae	<i>Aptosimum procumbens</i>	LC
Scrophulariaceae	<i>Aptosimum spinescens</i>	LC
Scrophulariaceae	<i>Gomphostigma virgatum</i>	LC
Scrophulariaceae	<i>Jamesbrittenia atropurpurea</i> subsp. <i>pubescens</i>	LC
Scrophulariaceae	<i>Jamesbrittenia integerrima</i>	LC
Scrophulariaceae	<i>Manulea schaeferi</i>	LC
Scrophulariaceae	<i>Peliostomum leucorrhizum</i>	LC
Scrophulariaceae	<i>Selago divaricata</i>	LC
Scrophulariaceae	<i>Selago paniculata</i>	LC
Solanaceae	<i>Lycium pumilum</i>	LC
Solanaceae	<i>Solanum burchellii</i>	LC
Thymelaeaceae	<i>Lasiosiphon polycephalus</i>	LC
Zygophyllaceae	<i>Augea capensis</i>	LC
Zygophyllaceae	<i>Roepera leptopetala</i>	LC
Zygophyllaceae	<i>Roepera lichtensteiniana</i>	LC
Zygophyllaceae	<i>Tetraena simplex</i>	LC
Zygophyllaceae	<i>Tribulus pterophorus</i>	LC
Zygophyllaceae	<i>Tribulus terrestris</i>	LC
Zygophyllaceae	<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	LC

## APPENDIX C

## GPS coordinates of rare plant species

***Vachellia erioloba:***

Most individuals are restricted to plant community 1 (drainage line) in the south of the site and one individual north of the N14 main road near the proposed pipeline route. GPS coordinate of community 1: 28° 29' 02" S; 21° 18' 11" E. The height (m) of the 51 individuals recorded on site:

10 m; 9 m; 8 m; 7 m; 7 m; 7 m; 7 m; 7 m; 6 m; 6 m; 6 m; 5.5 m; 5.5 m; 5 m; 5 m; 5 m; 5 m; 5 m; 5 m; 5 m; 4.5 m; 4.5 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 4 m; 3.5 m; 3.5 m; 3.5 m; 3.5 m; 3 m; 3 m; 3 m; 3 m; 3 m; 3 m; 3 m; 2.5 m; 2.5 m; 2.5 m; 2.5 m; 1.5 m; 0.5 m.

***Boscia albitrunca:***

Most individuals restricted to plant community 1 (drainage line) in the south of the site and one individual in community 2. GPS coordinates: 28° 29' 02" S; 21° 18' 11" E. The height (m) of the five individuals recorded on site (in community 1):

3 m; 3 m; 2.0 m, 1.5 m; 1.5 m

***Ammocharis coranica:***

GPS coordinate: 28° 29' 05.3" S; 21° 18' 08.7" E

***Anacampseros albissima:***

GPS coordinate: 28° 27' 56.0" S; 21° 17' 06.8"

**Apocynaceae (Stapeliad):**

GPS coordinate: 28° 29' 04.9" S; 21° 18' 09.1" E

***Hoodia gordonii:***

GPS coordinate (approx.): 28° 27' 57.0" S; 21° 17' 12.0" E

***Aloe claviflora***

Common in community 4 with GPS coordinate: 28° 27' 56.0" S; 21° 17' 07.0"

## APPENDIX D

## Curriculum vitae: DR NOEL VAN ROOYEN

## 1. Biographical information

Surname	Van Rooyen
First names	Noel
ID number	501225 5034 084
Citizenship	South African
Business address	Ekotrust CC 7 St George Street Lionviham 7130 Somerset West South Africa
Mobile	082 882 0886
e-mail	<a href="mailto:noel@ekotrust.co.za">noel@ekotrust.co.za</a>
Current position	Member of Ekotrust cc
Professional registration	Botanical Scientist : Pr.Sci.Nat; Reg no. 401430/83

Academic qualifications include BSc (Agric), BSc (Honours), MSc (1978) and DSc degrees (1984) in Plant Ecology at the University of Pretoria, South Africa. Until 1999 I was Professor in Plant Ecology at the University of Pretoria and at present I am a member of Ekotrust cc.

## 2. Publications

I am the author/co-author of 127 peer reviewed research publications in national and international scientific journals and was supervisor or co-supervisor of 9 PhD and 33 MSc students. More than 350 projects were undertaken by Ekotrust cc as consultant over a period of more than 40 years.

## a. Books

VAN ROOYEN, N. 2001. *Flowering plants of the Kalahari dunes*. Ekotrust CC, Pretoria. (In collaboration with H. Bezuidenhout & E. de Kock).

VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. *Flowering plants of the southern Kalahari*. Somerset West.

Author / co-author of various chapters on the Savanna and Grassland Biomes in:

LOW, B. & REBELO, A.R. 1996. *Vegetation types of South Africa, Lesotho and Swaziland*, Department of Environmental Affairs and Tourism, Pretoria.

KNOBEL, J. (Ed.) 1999, 2006. *The Magnificent Natural Heritage of South Africa*. (Chapters on the Kalahari and Lowveld).

VAN DER WALT, P.T. 2010. *Bushveld*. Briza, Pretoria. (Chapter on Sour Bushveld).

Contributed to chapters on vegetation, habitat evaluation and veld management in the book:

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2016. *Game Ranch Management*. 5th edition. Van Schaik, Pretoria.

Co-editor of the book:

BOTHMA, J. du P. & VAN ROOYEN, N. (eds). 2005. *Intensive wildlife production in southern Africa*. Van Schaik, Pretoria.

### 3. Ekotrust CC: Core Services

Ekotrust CC specializes in vegetation surveys, classification and mapping, wildlife management, wildlife production and economic assessments, vegetation ecology, veld condition assessment, carrying capacity, biodiversity assessments, rare species assessments, carbon pool assessments and alien plant management.

### 4. Examples of projects previously undertaken

Numerous vegetation surveys and vegetation impact assessments for Baseline, Scoping and Environmental Impact Assessments (EIA's) were made both locally and internationally.

Numerous projects have been undertaken in game ranches and conservation areas covering aspects such as vegetation surveys, range condition assessments and wildlife management. Of note is the Kgalagadi Transfrontier Park; iSimangaliso Wetland Park, Ithala Game Reserve, Phinda Private Game Reserve, Mabula Game Reserve, Tswalu Kalahari Desert Reserve, Maremani Nature Reserve and Associate Private Nature Reserve (previously Timbavati, Klaserie & Umbabat Private Game Reserve).

Involvement in various research programmes: vegetation of the northern Kruger National Park, Savanna Ecosystem Project at Nylsvley, Limpopo; Kuiseb River Project (Namibia); Grassland Biome Project; Namaqualand and Kruger Park Rivers Ecosystem research programme.

### 6. Selected references of other projects done by Ekotrust CC

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## APPENDIX E

# National Screening Report: Environmental Sensitivities

**SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION OR  
FOR A PART TWO AMENDMENT OF AN ENVIRONMENTAL AUTHORISATION  
AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE  
ENVIRONMENTAL SENSITIVITY**

**EIA Reference number:** EIA

**Project name:** Turksvydam

**Project title:** Vinyard and reservoir

**Date screening report generated:** 19/10/2020 13:38:45

**Applicant:** D vd Merwe

**Compiler:** -

**Compiler signature:**

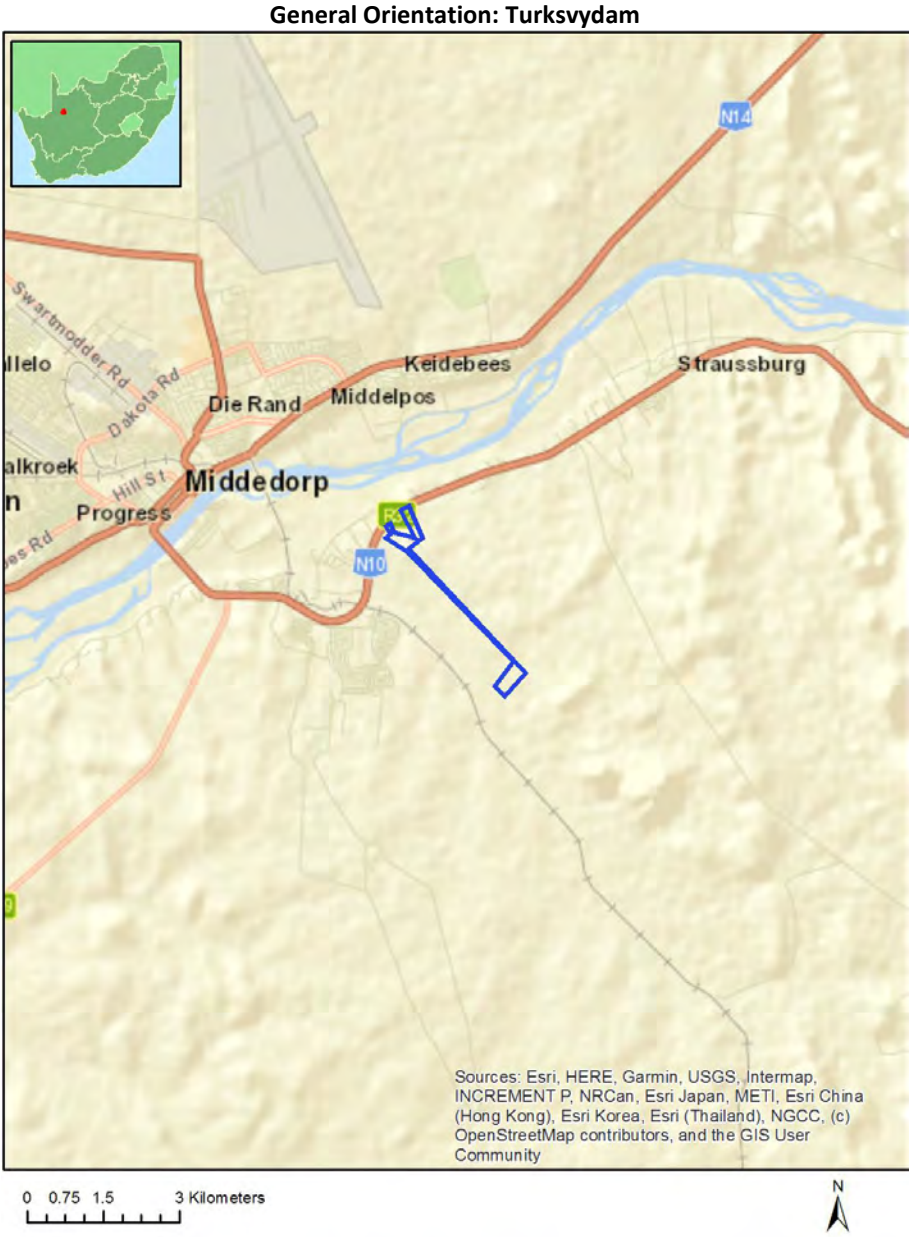
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# Proposed Project Location

Orientation map 1: General location



## Map of proposed site and relevant area(s)



## Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	OLYVENHOUTS DRIFT SETTLEMENT (Kenhardt)	1074	0	28°27'49.76S	21°17'7.3E	Erven
2	OLYVENHOUTS DRIFT SETTLEMENT (Kenhardt)	754	0	28°28'40.84S	21°17'30.79E	Erven
3	OLYVENHOUTS DRIFT SETTLEMENT (Kenhardt)	1076	0	28°30'7.36S	21°18'59.57E	Erven

Development footprint<sup>1</sup> vertices:  
No development footprint(s) specified.

## Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

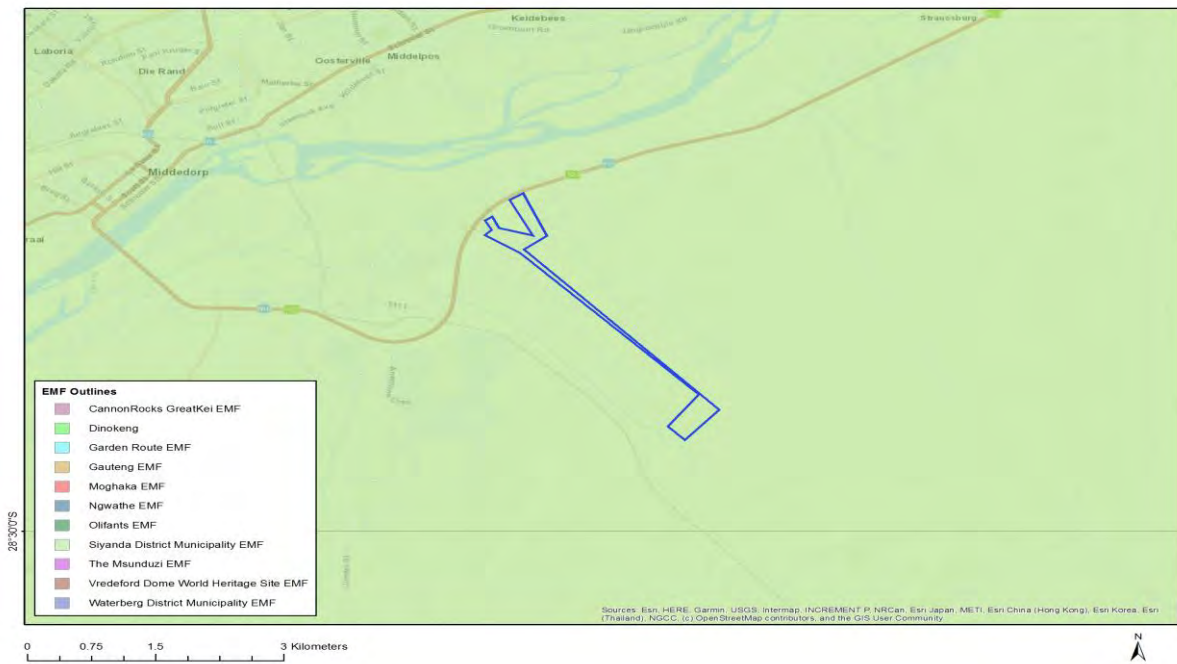
No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	14/12/16/3/3/2/657	Solar CSP	Approved	22.9
2	14/12/16/3/3/2/619	Solar PV	Approved	29.6
3	14/12/16/3/3/2/290	Solar PV	Approved	14.9

<sup>1</sup> "development footprint", means the area within the site on which the development will take place and includes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.



4	12/12/20/1831/2	Solar CSP	Approved	22.9
5	12/12/20/1831/1	Solar CSP	Approved	22.9
6	12/12/20/2169	Solar PV	Approved	9
7	14/12/16/3/3/2/297	Solar CSP	Approved	14.9
8	14/12/16/3/3/2/291	Solar PV	Approved	14.9
9	14/12/16/3/3/2/292	Solar PV	Approved	14.9
10	14/12/16/3/3/2/618	Solar PV	Approved	29.6
11	12/12/20/2056	Solar CSP	Approved	10.8
12	14/12/16/3/3/3/82	Solar CSP	Approved	27.9
13	14/12/16/3/3/2/293	Solar CSP	Approved	19
14	14/12/16/3/3/2/656	Solar CSP	Approved	22.9
15	14/12/16/3/3/2/298	Solar CSP	Approved	14.9
16	14/12/16/3/3/2/289	Solar PV	Approved	14.9
17	12/12/20/1831	Solar CSP	Approved	22.9
18	14/12/16/3/3/2/614	Solar PV	Approved	30
19	14/12/16/3/3/2/816	Solar PV	Approved	29.6
20	14/12/16/3/3/2/821	Solar PV	Approved	0.3
21	12/12/20/2146	Solar PV	Approved	4.8
22	12/12/20/777	Solar CSP	Approved	18.8
23	14/12/16/3/3/2/294	Solar CSP	Approved	23.5
24	14/12/16/3/3/2/296	Solar CSP	Approved	14.9
25	12/12/20/1831/3	Solar PV	Approved	22.9

### Environmental Management Frameworks relevant to the application



<b>Environmental Management Framework</b>	<b>LINK</b>
Siyanda District Municipality EMF	<a href="https://screening.environment.gov.za/ScreeningDownloads/EMF/SIYANDA_EMF_REPORT_2008.doc">https://screening.environment.gov.za/ScreeningDownloads/EMF/SIYANDA_EMF_REPORT_2008.doc</a>

## Environmental screening results and assessment outcomes

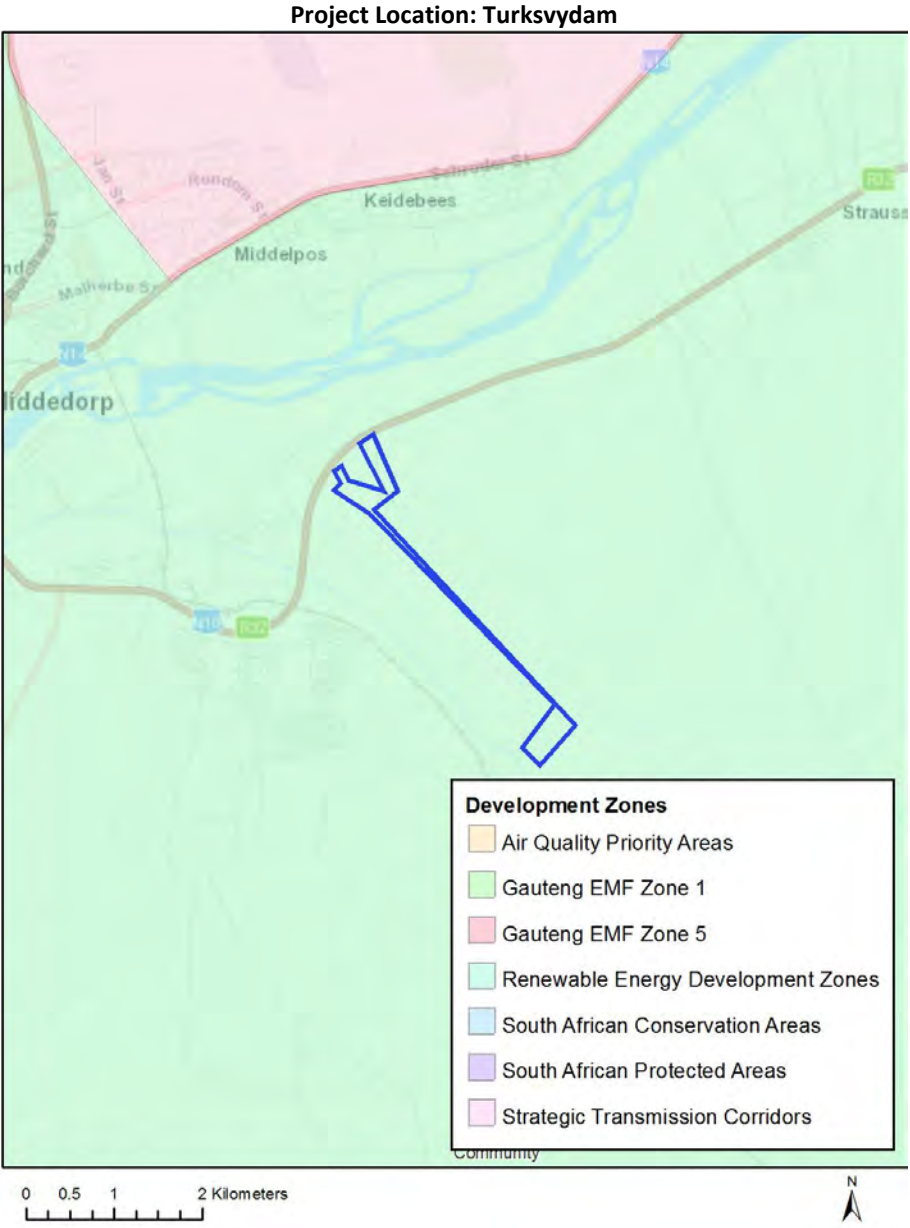
The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is: Transformation of land | Indigenous vegetation | Transformation of land - Indigenous vegetation.

### Relevant development incentives, restrictions, exclusions or prohibitions

The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

<b>Incentive, restriction or prohibition</b>	<b>Implication</b>
Strategic Transmission Corridor- Northern corridor	<a href="https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/GNR_350_of_13_April_2017.pdf">https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/GNR_350_of_13_April_2017.pdf</a>
Renewable energy development zones 7- Upington	<a href="https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/GNR_350_of_13_April_2017.pdf">https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/GNR_350_of_13_April_2017.pdf</a>

Map indicating proposed development footprint within applicable development incentive, restriction, exclusion or prohibition zones



**Proposed Development Area Environmental Sensitivity**

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme			X	
Aquatic Biodiversity				

Theme				
Civil Aviation Theme		X		
Defence Theme			X	

### Specialist assessments identified

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

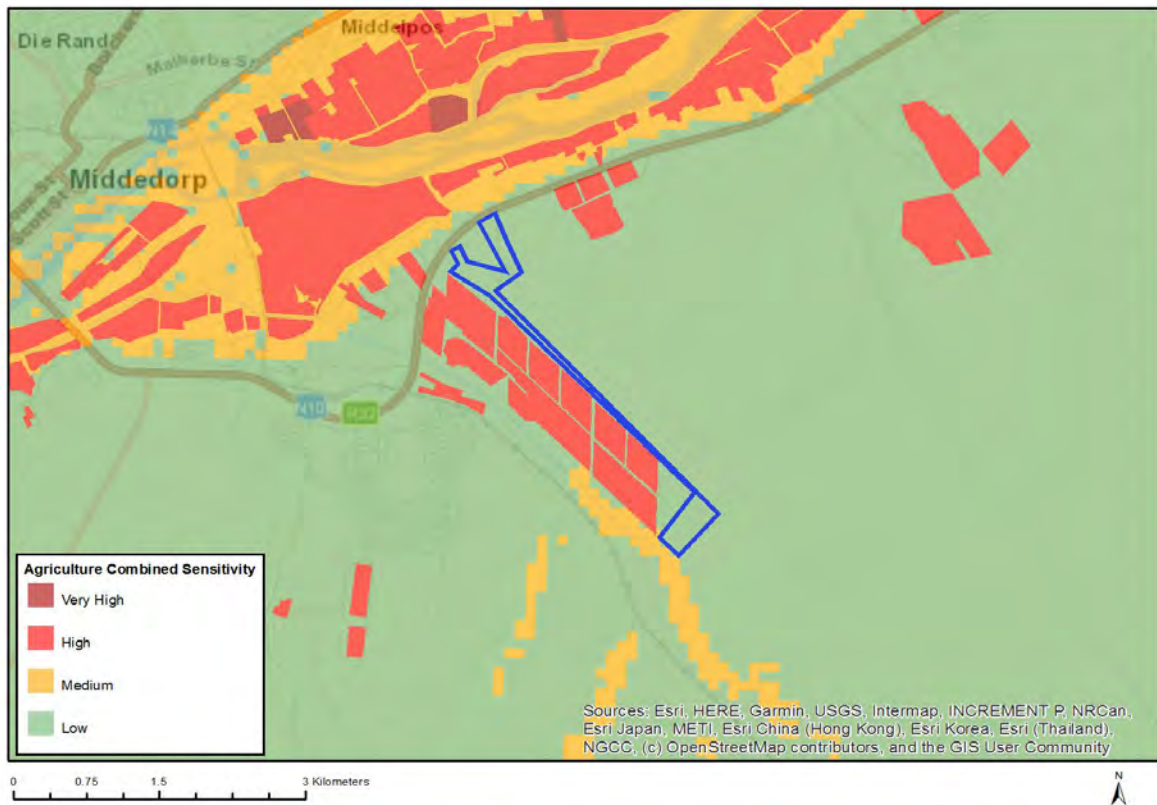
N o	Specialist assessment	Assessment Protocol
1	Landscape/Visual Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>
2	Archaeological and Cultural Heritage Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>
3	Palaeontology Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>
4	Terrestrial Biodiversity Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf</a>
5	Aquatic Biodiversity Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf</a>
6	Avian Impact Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Avifauna_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Avifauna_Assessment_Protocols.pdf</a>
7	Socio-Economic Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>
8	Plant Species Assessment	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>

	ent	
9	Animal Species Assessm ent	<a href="https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf">https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf</a>

## Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

### MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



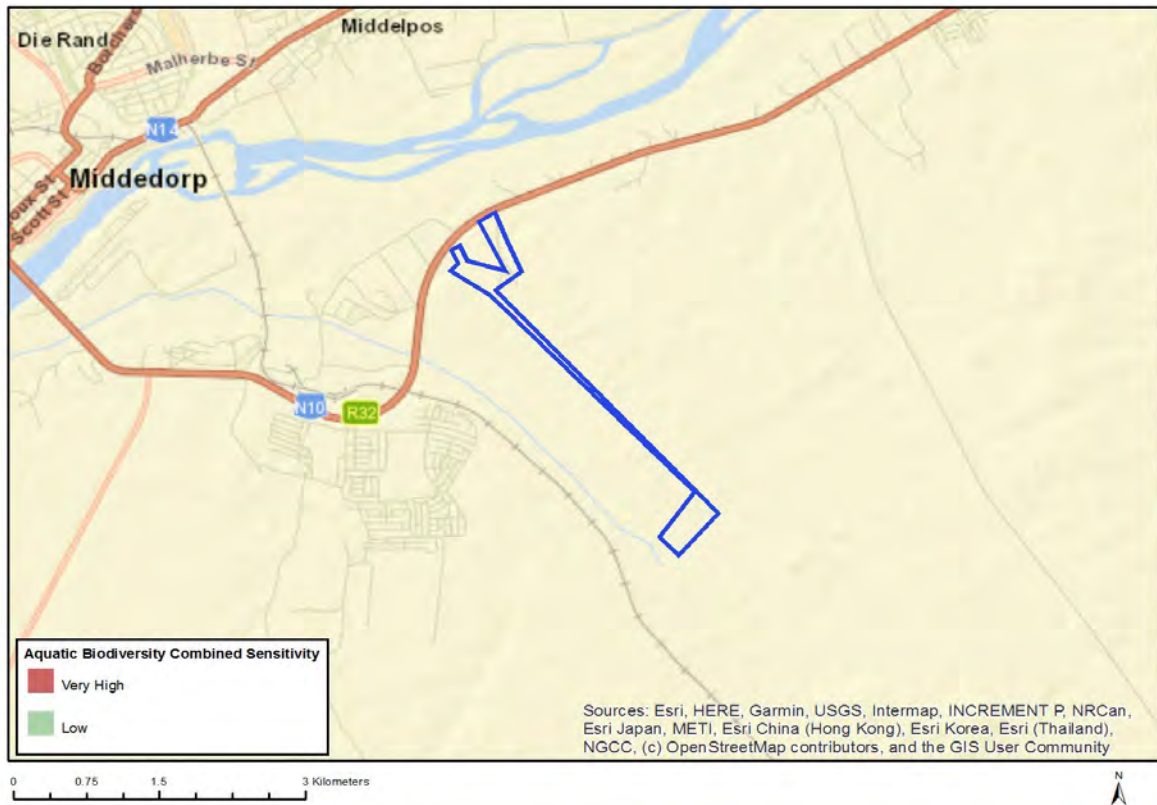
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

#### Sensitivity Features:

Sensitivity	Feature(s)
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate



## MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

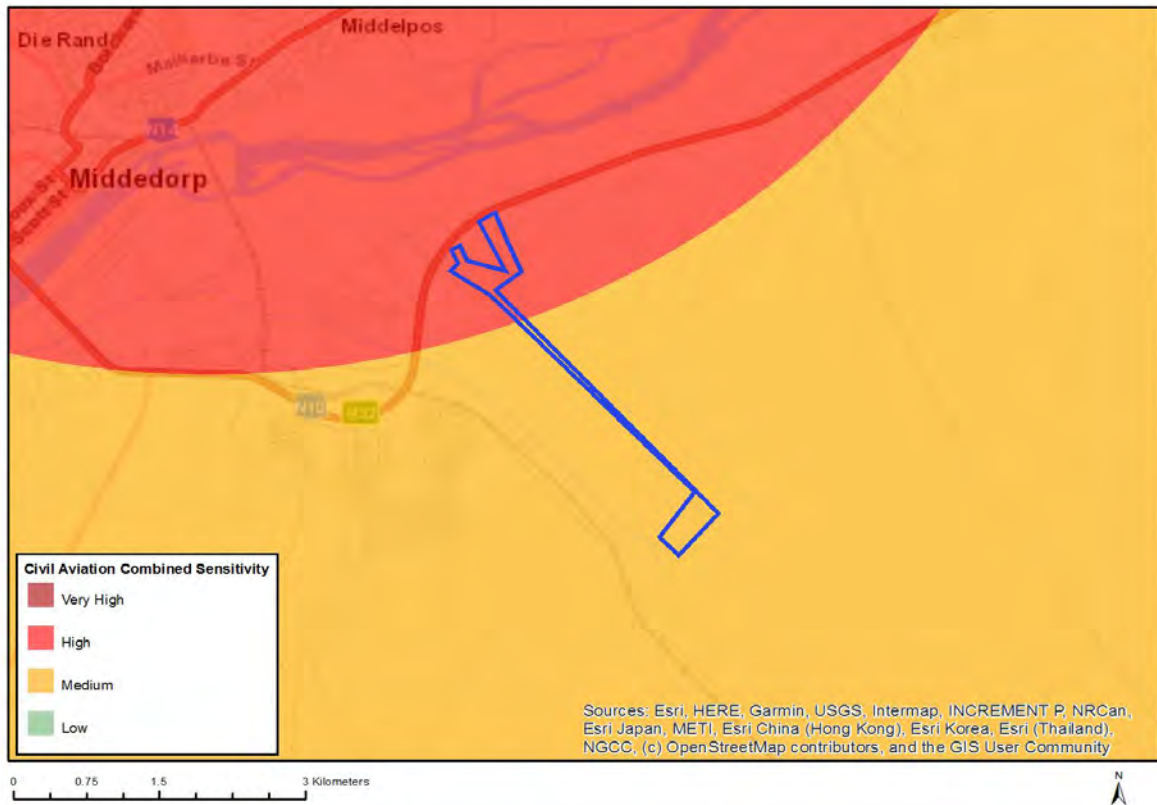


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity

### Sensitivity Features:

Sensitivity	Feature(s)
	Low sensitivity

## MAP OF RELATIVE CIVIL AVIATION THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

### Sensitivity Features:

Sensitivity	Feature(s)
High	
Medium	

MAP OF RELATIVE DEFENCE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

**Sensitivity Features:**  
 No sensitivity features found.