

Ecological Assessment Report

**Letsemeng Local Municipality Landfill
Site Development, Luckhof, Free State**

Province

July 2021

Compiled for:



Compiled by:

Rikus Lamprecht

Ecological Specialist (Pr.Sci.Nat)

EcoFocus Consulting

072 230 9598

ajhlamprecht@gmail.com

Table of Content

1.	Introduction.....	1
2.	Date and Season of Ecological Site Assessment.....	2
3.	Assessment Rational	3
4.	Objectives of the Assessment	4
5.	Methodology	5
6.	Assessment Area	12
6.1.	Climate.....	14
6.2.	Geology and Soils	14
6.3.	Vegetation and Conservation Status	14
7.	Assumptions, Uncertainties and Gaps in Knowledge	17
8.	Results and Discussion	20
8.1.	Current Existing Vegetation and Site Description	20
8.2.	Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)	27
8.3.	Ecological Site Sensitivity Map	28
8.4.	Species List for the Assessment Area	30
9.	Ecological Impact Assessment	31
9.1.	Construction Phase.....	31
9.2.	Operational Phase	38
9.3.	Cumulative Impacts.....	40
9.4.	Risk Ratings of Potential Impacts	41
9.4.1.	Construction Phase	42
9.4.2.	Operational Phase.....	61
10.	Summary and Conclusion.....	72
11.	References	77
12.	Details of the Specialist.....	78

Executive Summary

The project applicant, Letsemeng Local Municipality proposes to construct a new/additional municipal landfill site for disposal and management of domestic and general waste, which is generated from the town of Luckhof, Free State Province. The proposed development will entail formal construction and development on an area of approximately 25 ha for the landfill site.

NSVT Consultants was appointed by the applicant as the independent Environmental Assessment Practitioner (EAP) to conduct the Ecological Impact Assessment (EIA) process.

Due to the nature of the potential impacts of the proposed development on the local ecology, an Ecological study is required. This is required in order to determine the potential presence of ecologically/conservationally significant species, habitats or wetland areas, which may be affected by the proposed development. Any potential ecological impacts associated with the proposed development must be identified and impact mitigation as well as -management measures in accordance with the NEMA (Act 107 of 1998) Mitigation Hierarchy, must subsequently be recommended, in order to attempt to reduce/alleviate the identified potential ecological impacts

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist to conduct the required Ecological study for the proposed development. This report constitutes the Ecological Assessment.

A site assessment for the proposed development footprint area was conducted on 28 June 2021. This date forms part of the winter season. It must therefore be noted that the timing of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is therefore recommended that an additional ecological walkthrough be conducted, prior to the commencement of the proposed development, during the flowering period of underground bulb plant species. This will ensure that no provincially protected or other conservationally significant species have potentially been omitted.

Methodology

The proposed development area was assessed on foot and visual observations/identifications were made of habitat conditions, any ecologically sensitive/conservationally significant areas as well as relevant species present. Identified species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969). Georeferenced photographs were taken of ecologically sensitive/conservationally significant areas as well as any Red Data Species Listed, nationally- or provincially protected species if encountered, in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

Potential ecological impacts of the proposed development on the surrounding environment were identified, evaluated, rated and discussed. The Present Ecological State (PES) as well as the Ecological Importance and Sensitivity (EIS) of the proposed development area were also determined and discussed.

Assessment Area

The assessment area consists of a single footprint area of approximately 25 ha in size. The assessment area is situated on the Remaining Extent of the Farm De Dorpsgronden van Luckhoff no 577 (SG 21 Digit Code: F0110000000057700000), approximately 1.3 km east of the town of Luckhof. The town forms part of the Letsemeng Local Municipality which in turn, forms part of the Xhariep District Municipality, Free State Province. Access to the assessment area is obtained by way of the R 48 provincial road, Rabie Street and a subsequent dirt road from the west.

Results and Conclusion

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

According to SANBI (2006-2019), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3), which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

‘Ground truthing’ during the site assessment however suggests that the broader area rather forms part of a transitional zone between the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types.

The entire assessment area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan (Collins, 2018), which sets out biodiversity priority areas in the province.

Current Existing Vegetation and Site Description

The assessment area and broader surrounding landscape to the north, east and south is currently undeveloped and constitutes an open medium-height terrestrial karroid grassland landscape. Virtually the entire karroid grassland landscape is however in a slightly disturbed state, which has mainly been caused by historic and continued anthropogenic activities. The karroid grassland landscape and broader surrounding areas to the north, east and south, are utilised by residents of the local community for livestock grazing purposes. Slight disturbance as a result of historic and continued long-term overgrazing, is evident throughout the karroid grassland landscape and broader surrounding undeveloped areas to the north, east and south. It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.

The majority of the assessment area had also been burnt at the time of the site assessment and it is reasonably assumed that the assessment area and broader surrounding undeveloped areas are likely anthropogenically burnt on a regular basis.

The provincially protected species *Ruschia spinosa* is well-represented throughout the assessment area. Individuals/clusters of the provincially protected species *Aloe broomii* and *Aloe claviflora* respectively, were merely found to be sparsely present throughout the assessment area. Remnants of merely a single individual of the provincially protected species *Ammocharis coranica* were also found to be present within the assessment area.

The provincially protected species *Euphorbia crassipes* and the provincially specially protected species *Hoodia gordonii* were found to be very sparsely present throughout the landscape surrounding the assessment area. It is therefore likely that individuals of these two species could also be present within the assessment area.

A Provincial Flora Permit has to be obtained from the Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs (DESTEa), prior to the commencement of any construction activities and the subsequent potential removal of any provincially protected species individuals. It is however recommended that representative numbers of individuals/clusters of the identified provincially protected species be adequately relocated to other suitable and similar areas as to where they were removed from. These relocation processes must be completed prior to the commencement of any vegetation clearance- and/or construction activities.

A very small slightly elevated isolated rocky outcrop is present within the central portion of the assessment area. This outcrop however does not possess any significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape and is therefore not viewed as being of any specific conservational significance.

No Red Data Listed-, other provincially- or nationally protected plant species or any other species of conservational significance, were found to be present throughout the assessment area.

The assessment area does not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (<https://www.birdlife.org.za/what-we-do/important-bird-and-biodiversity-areas/media-and-resources/#1553597171790-6f83422a-a731>). No conservationally significant or important bird species/nests or locally distinct habitats were observed during the site assessment or are necessarily expected to utilise the assessment area for breeding, foraging and/or persistence purposes. Only common local resident bird species and nests were found to be present.

No other conservationally significant or important faunal species or locally distinct habitats were observed throughout the assessment area, during the site assessment either. Merely a single individual of the provincially protected antelope species *Raphicerus campestris* (steenbok), was found traversing the assessment area. Due to the presence of the existing town to the west, the assessment area is subjected to continued anthropogenic activity and disturbance. It is therefore not anticipated that any conservationally significant or important faunal species would necessarily utilise the assessment area or the localised surrounding undeveloped landscape for breeding, foraging and/or persistence purposes.

The assessment area falls within the D33C quaternary surface water catchment- and drainage area. A significant first-order ephemeral water drainage line is situated approximately 370 m south of the assessment area. This drainage line flows in a south-westerly direction and discharges into a large artificially constructed earth dam, located approximately 1 km south-west of the assessment area. The outflow of the dam eventually discharges into a significant fourth-order ephemeral watercourse to the west. This watercourse, along with other adjoining watercourses, eventually drain into the Orange River situated approximately 24 km to the west. The earth dam and significant watercourse therefore form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west. It is however not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line, due to the distance between the drainage line and the assessment area as well as the ephemeral nature of the drainage line.

A small historic artificially excavated water flow channel is situated approximately 220 m west of the assessment area. This channel flows in a southerly direction and also discharges into the earth dam. For the same reasons as discussed above, it is also not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the channel.

It is however recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and - integrity.

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

The landfill site must also be sufficiently lined underground in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.

Further mitigation and management measures are also recommended under heading 9, which should be implemented in order to attempt to prevent any direct or indirect ecological impact on the drainage line, channel and groundwater.

A very small preferential water flow path traverses the assessment area. This preferential path flows in a south-westerly direction and also discharges into the earth dam. Due to the very small size of this preferential path, it is however not viewed as being of any conservational significance.

Due to the lack of continuous water flow through the assessment area, the drainage line, channel and preferential path do not possess any distinct riparian zone or significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape.

Conclusion

The assessment area scored a moderate Ecological Importance and Sensitivity (EIS) value and is therefore merely viewed as being of low to moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Ecological Support Area one (ESA 1), provincially protected plant species and the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

The destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, was identified and addressed as the only significant potential long-term ecological impact associated with the construction phase of the proposed development. This impact could merely add low to moderate cumulative impact to existing negative impacts caused by the presence of existing town to the west.

The alteration/contamination of soil and groundwater characteristics/quality as well as chemical air emissions pollution, were identified and addressed as significant potential long-term ecological impacts associated with the operational phase of the proposed development. These impacts could add moderately-high to high cumulative impact to existing negative impacts caused by the presence of existing town to the west.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels by implementation of the recommended mitigation measures.

The proposed development of the assessment area should therefore be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigation measures as per this ecological report must however be adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

List of Figures

Figure 1: Locality map illustrating the assessment area	13
Figure 2: Vegetation map illustrating the vegetation type associated with the assessment area.....	15
Figure 3: Conservation status map illustrating the conservation status associated with the assessment area.....	16
Figure 4: Two images illustrating examples of the slightly disturbed open medium-height terrestrial karroid grassland landscape, associated with the assessment area and broader surrounding landscape to the north, east and south	23
Figure 5: Image illustrating an example of the majority of the assessment area, which had been burnt at the time of the site assessment.....	23
Figure 6: Image illustrating the presence of the significant first-order ephemeral water drainage line, which is situated approximately 370 m south of the assessment area.....	25
Figure 7: Image illustrating the presence of the small historic artificially excavated water flow channel, which is situated approximately 220 m west of the assessment area	26
Figure 8: Image illustrating the presence of the very small preferential water flow path, which traverses the assessment area.....	26

List of Tables

Table 1: Criteria for PES calculations	6
Table 2: Criteria for EIS calculations	7
Table 3: Scale utilised for the evaluation of the Environmental Risk Ratings.....	8
Table 4: Scale used for the evaluation of the Environmental Significance Ratings	10
Table 5: Environmental Risk and Significance Ratings.....	42
Table 6: Environmental Risk and Significance Ratings.....	61

Abbreviations

BA	Basic Assessment
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
DAFF	Department of Agriculture Forestry and Fisheries
DESTEA	Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
MAP	Mean Annual Precipitation
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMA	National Environmental Management Act (Act 107 of 1998)
NFA	National Forests Act (Act 84 of 1998)
NWA	National Water Act (Act 36 of 1998)
ONA	Other Natural Area
PES	Present Ecological State
WULA	Water Use License Application

Declaration of Independence

I, Adriaan Johannes Hendrikus Lamprecht, ID 870727 5043 083, declare that I:

- am the Director and Ecological Specialist of EcoFocus Consulting (Pty) Ltd
- act as an independent specialist consultant in the field of botany and ecology
- am assigned as the Ecological Specialist consultant by the Environmental Assessment Practitioner (EAP), NSVT Consultants, for the proposed development
- do not have or will not have any financial interest in the undertaking of the proposed project activity other than remuneration for work as stipulated in the Purchase Order terms of reference
- confirm that remuneration for my services relating to the proposed development is not linked to approval or rejection of the project by the competent authority
- have no interest in secondary or subsequent developments as a result of the authorisation of the proposed project
- have no and will not engage in any conflicting interests in the undertaking of the activity
- undertake to disclose to the applicant and the competent authority any information that has or may have the potential to influence the decision of the competent authority
- will provide the applicant and competent authority with access to all relevant project information in my possession whether favourable or not

AJH Lamprecht



Signature

1. Introduction

The project applicant, Letsemeng Local Municipality proposes to construct a new/additional municipal landfill site for disposal and management of domestic and general waste, which is generated from the town of Luckhof, Free State Province. The proposed development will entail formal construction and development on an area of approximately 25 ha for the landfill site.

NSVT Consultants was appointed by the applicant as the independent Environmental Assessment Practitioner (EAP) to conduct the Ecological Impact Assessment (EIA) process.

Due to the nature of the potential impacts of the proposed development on the local ecology, an Ecological study is required. This is required in order to determine the potential presence of ecologically/conservationally significant species, habitats or wetland areas, which may be affected by the proposed development. Any potential ecological impacts associated with the proposed development must be identified and impact mitigation as well as -management measures in accordance with the NEMA (Act 107 of 1998) Mitigation Hierarchy, must subsequently be recommended, in order to attempt to reduce/alleviate the identified potential ecological impacts

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist to conduct the required Ecological study for the proposed development. This report constitutes the Ecological Assessment.

Preliminary preparations conducted prior to the ecological site assessment were as follows:

- Georeferenced spatial information was obtained of the proposed development area in order to determine the direct impact footprint area.
- A desktop study was conducted of the information/data available on the relevant vegetation types and national/provincial conservation significance status, associated with the proposed development area.

2. Date and Season of Ecological Site Assessment

A site assessment for the proposed development footprint area was conducted on 28 June 2021. This date forms part of the winter season. It must therefore be noted that the timing of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is therefore recommended that an additional ecological walkthrough be conducted, prior to the commencement of the proposed development, during the flowering period of underground bulb plant species. This will ensure that no provincially protected or other conservationally significant species have potentially been omitted.

3. Assessment Rational

South Africa is a country rich in natural resources and splendour and is rated as having some of the highest biodiversity in the world. Other than the pure aesthetic value which our biodiversity and natural resources provides, it also plays a significant positive role in our national economy. While continuous economic development and progress is a key national focus area, which forms a cornerstone in the socio-economic improvement of society and the livelihoods of communities and individuals, the preservation and management of the integrity and sustainability of our natural resources is also essential in achieving this objective.

Socio-economic development and progress can therefore not be completely inhibited for the sake of ensuring environmental conservation, therefore solutions and compromises rather need to be explored in order to achieve the need for socio-economic development without unreasonably jeopardising the needs of environmental conservation. A sustainable and responsible balance needs to be maintained in order to accommodate the requirements of both.

Adequate, sustainable and responsible utilisation and management of our natural resources is crucial. Finding the required balance between socio-economic development and environmental conservation, should therefore always be a priority focus point during any proposed development process.

Various environmental legislation in South Africa makes provision for the protection of our natural resources and the functionality of ecological systems in order to ensure sustainability. Such acts include the National Environmental Management: Biodiversity Act (Act 10 of 2004), National Forests Act (Act 84 of 1998), Conservation of Agricultural Resources Act (Act 43 of 1983), National Water Act (Act 36 of 1998) and framework legislation such as the National Environmental Management Act (Act 10 of 2004).

An Ecological Assessment of the proposed development area was therefore conducted in order to identify and quantify any potential ecological impacts associated with the proposed development.

4. Objectives of the Assessment

Ecological and habitat survey:

- Describe the vegetation within the assessment area and identify and list conservationally significant faunal and floral species encountered within the assessment area.
 - List any nationally- and/or provincially protected- and/or Red Data Listed species.
- Identify and discuss any ecologically sensitive/conservationally significant areas, which are potentially present within the assessment area.
- Identify, delineate and discuss any watercourses/wetlands, which are potentially present within the assessment area.
- Determine and discuss the Present Ecological State (PES) of the assessment area and directly surrounding areas, in order to provide an indication of the extent of degradation and/or transformation of the assessment area.
- Determine the Ecological Importance and Sensitivity (EIS) of the assessment area and directly surrounding areas, in order to provide an indication of the ecological sensitivity/conservational significance of the assessment area.
- Identify, evaluate, rate and discuss any potential ecological impacts associated with the proposed development.
 - Provide recommendations on impact mitigation as well as -management measures in accordance with the NEMA (Act 107 of 1998) Mitigation Hierarchy, in order to attempt to reduce/alleviate the identified potential ecological impacts.
- Provide recommendations on the ecological suitability/acceptability of the assessment area for the proposed development.
- A digital report (this document) as well as digital .KML files of any identified ecologically sensitive/conservationally significant areas within the assessment area, will be provided to the applicant.

5. Methodology

- The proposed development area was assessed on foot and visual observations/identifications were made of habitat conditions, any ecologically sensitive/conservationally significant areas as well as relevant species present.
- Identified species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969).
- Georeferenced photographs were taken of ecologically sensitive/conservationally significant areas as well as any Red Data Species Listed, nationally- or provincially protected species if encountered, in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

The **Present Ecological State (PES)** of the assessment area was determined and discussed as per the table below.

- The Present Ecological State (PES) refers to the current state or condition of an area in terms of all its characteristics and reflects the change to the area from its reference condition. The value gives an indication of the alterations that have occurred in the ecosystem.

Table 1: Criteria for PES calculations

Ecological Category	Score	Description
A	> 90-100%	Unmodified , natural and pristine.
B	> 80-90%	Largely natural . A small change in natural habitats and biota may have taken place but the ecosystem functionality has remained essentially unchanged.
C	> 60-80%	Moderately modified . Moderate loss and transformation of natural habitat and biota have occurred, but the basic ecosystem functionality has still remained predominantly unchanged.
D	> 40-60%	Largely modified . A significant loss of natural habitat, biota and subsequent basic ecosystem functionality has occurred.
E	> 20-40%	Seriously modified . The loss of natural habitat, biota and basic ecosystem functionality is extensive.
F	0-20%	Critically/Extremely modified . Transformation has reached a critical level and the ecosystem has been modified completely with a virtually complete loss of natural habitat and biota. The basic ecosystem functionality has virtually been destroyed and the transformation is irreversible.

The **Ecological Importance and Sensitivity (EIS)** of the assessment area was determined and discussed as per the table below.

- The Ecological Importance and Sensitivity (EIS) of an area is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Both abiotic and biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance, once it has occurred.

Table 2: Criteria for EIS calculations

EIS Categories	Score	Description
Low/Marginal	D	Not ecologically important and/or sensitive on any scale. Biodiversity is ubiquitous and not unique or sensitive to habitat modifications.
Moderate	C	Ecologically important and sensitive on local or possibly provincial scale. Biodiversity is still relatively ubiquitous and not usually sensitive to habitat modifications.
High	B	Ecologically important and sensitive on provincial or possibly national scale. Biodiversity is relatively unique and may be sensitive to habitat modifications.
Very High	A	Ecologically important and sensitive on national and possibly international scale. Biodiversity is very unique and sensitive to habitat modifications.

Potential ecological impacts of the proposed development were identified, evaluated, rated and discussed as per the methodology described below. The tables below indicate and explain the methodology and criteria used for the evaluation of the Environmental Risk Ratings as well as the calculation of the final Environmental Significance Ratings of the identified potential ecological impacts. Each identified potential ecological impact is scored for each of the Evaluation Components as per the table below.

Table 3: Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating Scale and Description/Criteria
Magnitude of Negative or Positive Impact	<p>10 - Very high: Bio-physical features and/or ecological functionality/processes may be severely impacted upon.</p> <p>8 - High: Bio-physical features and/or ecological functionality/processes may be significantly impacted upon.</p> <p>6 - Medium: Bio-physical features and/or ecological functionality/processes may be moderately impacted upon.</p> <p>4 - Low: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon.</p> <p>2 - Very Low: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon.</p> <p>0 - Zero: Bio-physical features and/or ecological functionality/processes will not be impacted upon.</p>
Duration of Negative or Positive Impact	<p>5 – Permanent: Impact will continue on a permanent basis.</p> <p>4 - Long term: Impact should cease a period (> 40 years) after the operational phase/project life of the activity.</p> <p>3 - Medium term: Impact may occur for the period of the operational phase/project life of the activity.</p> <p>2 - Short term: Impact may only occur during the construction phase of the activity after which it will cease.</p> <p>1 - Immediate: Impact may only occur as a once off during the construction phase of the activity.</p>
Extent of Positive or Negative Impact	<p>5 - International: Impact will extend beyond National boundaries.</p> <p>4 - National: Impact will extend beyond Provincial boundaries but remain within National boundaries.</p> <p>3 - Regional: Impact will extend beyond 5 km of the development footprint but remain within Provincial boundaries.</p> <p>2 - Local: Impact will not extend beyond 5 km of the development footprint.</p> <p>1 - Site-specific: Impact will only occur on or within 200 m of the development footprint.</p> <p>0 – No impact.</p>
Irreplaceability of Natural Resources being impacted upon	<p>5 – Definite loss of irreplaceable natural resources.</p> <p>4 – High potential for loss of irreplaceable natural resources.</p> <p>3 – Moderate potential for loss of irreplaceable natural resources.</p> <p>2 – Low potential for loss of irreplaceable natural resources.</p> <p>1 – Very low potential for loss of irreplaceable natural resources.</p> <p>0 – No impact.</p>

Reversibility of Impact	<p>5 – Impact cannot be reversed.</p> <p>4 – Low potential that impact may be reversed.</p> <p>3 – Moderate potential that impact may be reversed.</p> <p>2 – High potential that impact may be reversed.</p> <p>1 – Impact will be reversible.</p> <p>0 – No impact.</p>
Probability of Impact Occurrence	<p>5 - Definite: Probability of impact occurring is > 95 %.</p> <p>4 - High: Probability of impact occurring is > 75 %.</p> <p>3 - Medium: Probability of impact occurring is between 25 % - 75 %.</p> <p>2 - Low: Probability of impact occurring is between 5 % - 25 %.</p> <p>1 - Improbable: Probability of impact occurring is < 5 %.</p>
Cumulative Impact	<p>High: Numerous similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts.</p> <p>Medium: Few similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts.</p> <p>Low: Virtually no similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts. The development is anticipated to be an isolated occurrence and should therefore have a negligible cumulative impact.</p> <p>None: No cumulative impact.</p>

Once the Environmental Risk Ratings have been evaluated for each identified potential ecological impact, the Significance Score of each impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Environmental Significance of each identified potential ecological impact, as per Table 4 below. The Environmental Significance rating process is completed for all identified potential ecological impacts both before and after implementation of the recommended mitigation measures.

Table 4: Scale used for the evaluation of the Environmental Significance Ratings

Environmental Significance Score	Environmental Significance Rating	Description/Criteria
125 – 150	Very High	An impact of very high significance after mitigation will mean that the development may not take place. The impact cannot be suitably reduced and mitigated to within acceptable levels.
100 – 124	High	An impact of high significance after mitigation should influence a decision about whether or not to proceed with the development. Additional, impact-specific mitigation measures must be implemented if the continuation of the development is to be considered.
75 – 99	Medium-High	Additional, impact-specific mitigation measures must be implemented for an impact of medium-high significance if the continuation of the development is to be considered.
50 – 74	Medium	An impact of medium significance after mitigation must be adequately managed in accordance with the mitigation measures provided by the specialist.
< 50	Low	If any mitigation measures are provided by the specialist for an impact of low significance after mitigation, the impact must be adequately managed in accordance with these measures.
+	Positive impact	A positive impact is likely to result in a beneficial consequence/effect and should therefore be viewed as a motivation for the development to proceed.

Wetlands/watercourses which are potentially present within the assessment area, were identified, delineated and discussed as per the methodology described below:

For the purposes of this investigation a wetland was defined according to the definition in the National Water Act (Act 36 of 1998) as: “land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances, supports or would support vegetation typically adapted to life in saturated soil.”

In 2005 DWAF published a wetland delineation procedure in a guideline document titled “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas”. Guidelines for the undertaking of biodiversity assessments exist. These guidelines contain a number of stipulations relating to the protection of wetlands and the undertaking of wetland assessments.

The wetland delineation procedure identifies the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas. This constitutes the part of the wetland that might remain flooded or saturated close to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.

The guidelines also state that the locating of the outer edge of the temporary zone must make use of four specific indicators namely:

- terrain unit indicator,
- soil form indicator,
- soil wetness indicator and
- vegetation indicator.

In addition, the wetland/watercourse and a protective buffer zone beginning from the outer edge of the wetland temporary zone, was designated as sensitive in a sensitivity map. The guidelines stipulate buffers to be delineated around the boundary of a wetland. An adequate protective buffer zone, beginning from the outer edge of the wetland temporary zone, was implemented and designated as sensitive within which no development must be allowed to occur.

6. Assessment Area

The assessment area consists of a single footprint area of approximately 25 ha in size. The assessment area is situated on the Remaining Extent of the Farm De Dorpsgronden van Luckhoff no 577 (SG 21 Digit Code: F0110000000057700000), approximately 1.3 km east of the town of Luckhof. The town forms part of the Letsemeng Local Municipality which in turn, forms part of the Xhariep District Municipality, Free State Province. Access to the assessment area is obtained by way of the R 48 provincial road, Rabie Street and a subsequent dirt road from the west.

See locality map below (see A3 sized map in the Appendices).

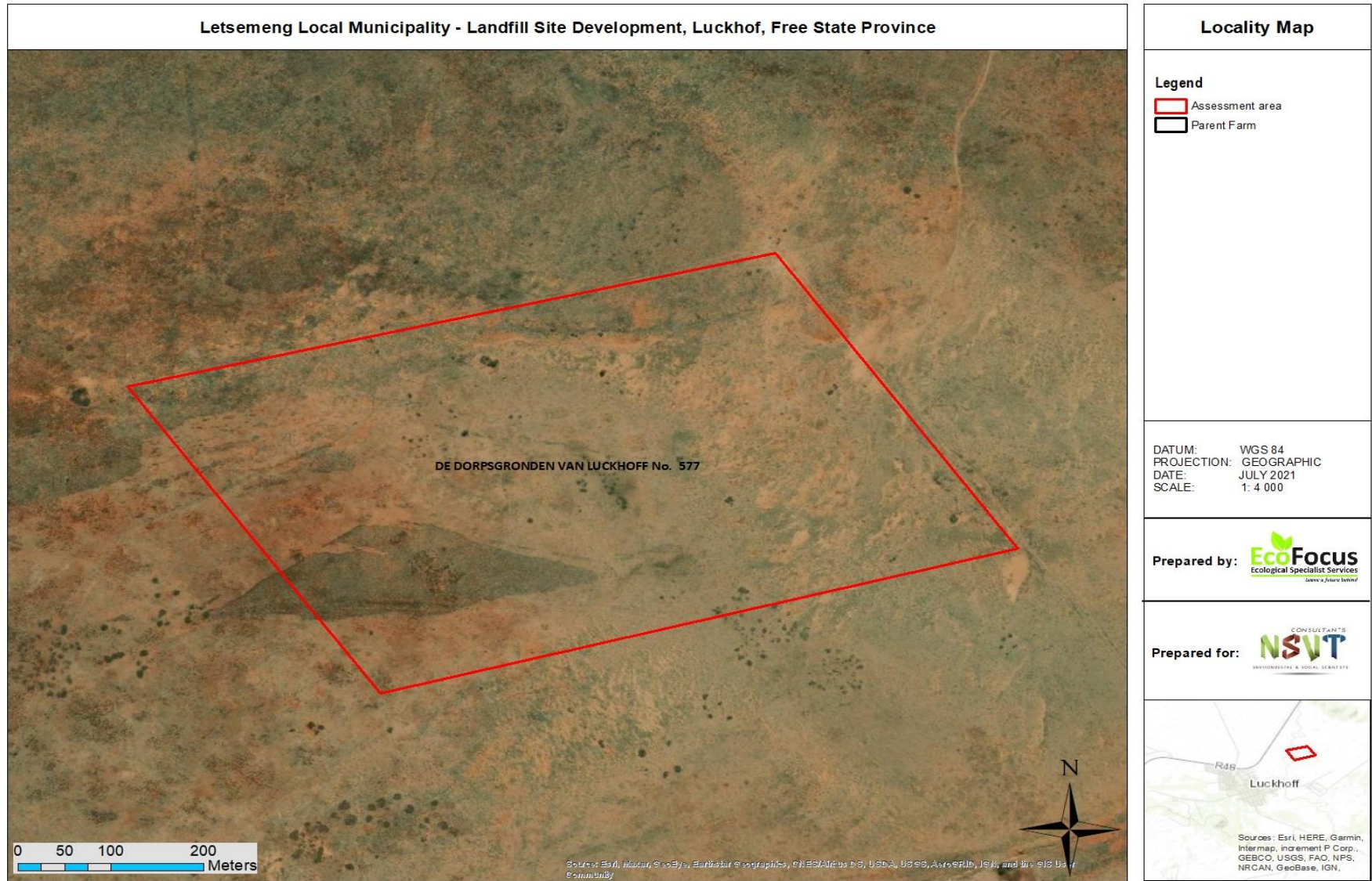


Figure 1: Locality map illustrating the assessment area

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 389 mm (www.climate-data.org). The maximum average monthly temperature is approximately 25°C in the summer months while the minimum average monthly temperature is approximately 9.3°C during the winter. Maximum daily temperatures can reach up to 33.1°C in the summer months and dip to as low as 1°C during the winter.

6.2. Geology and Soils

According to Mucina & Rutherford (2006) the geology of the landscape and associated vegetation type can be described as the following:

The underlying geology is mainly formed by shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both of the Ecca Group) as well as Dwyka Group diamictites. Broad areas are covered by superficial deposits including calcretes of the Kalahari Group. Soils are variable from shallow to deep, red-yellow apedal and freely draining with potential scattered rocky dolerite outcrops.

6.3. Vegetation and Conservation Status

Vegetation Types

According to SANBI (2006-2019), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3), which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

‘Ground truthing’ during the site assessment however suggests that the broader area rather forms part of a transitional zone between the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types.

Conservation Status

The entire assessment area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan (Collins, 2018), which sets out biodiversity priority areas in the province. ESA’s are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a Critical Biodiversity Area (CBA) or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or not necessary to meet them in natural or near-natural areas (Collins, 2018).

See vegetation and conservation status maps below (see A3 sized maps in the Appendices).

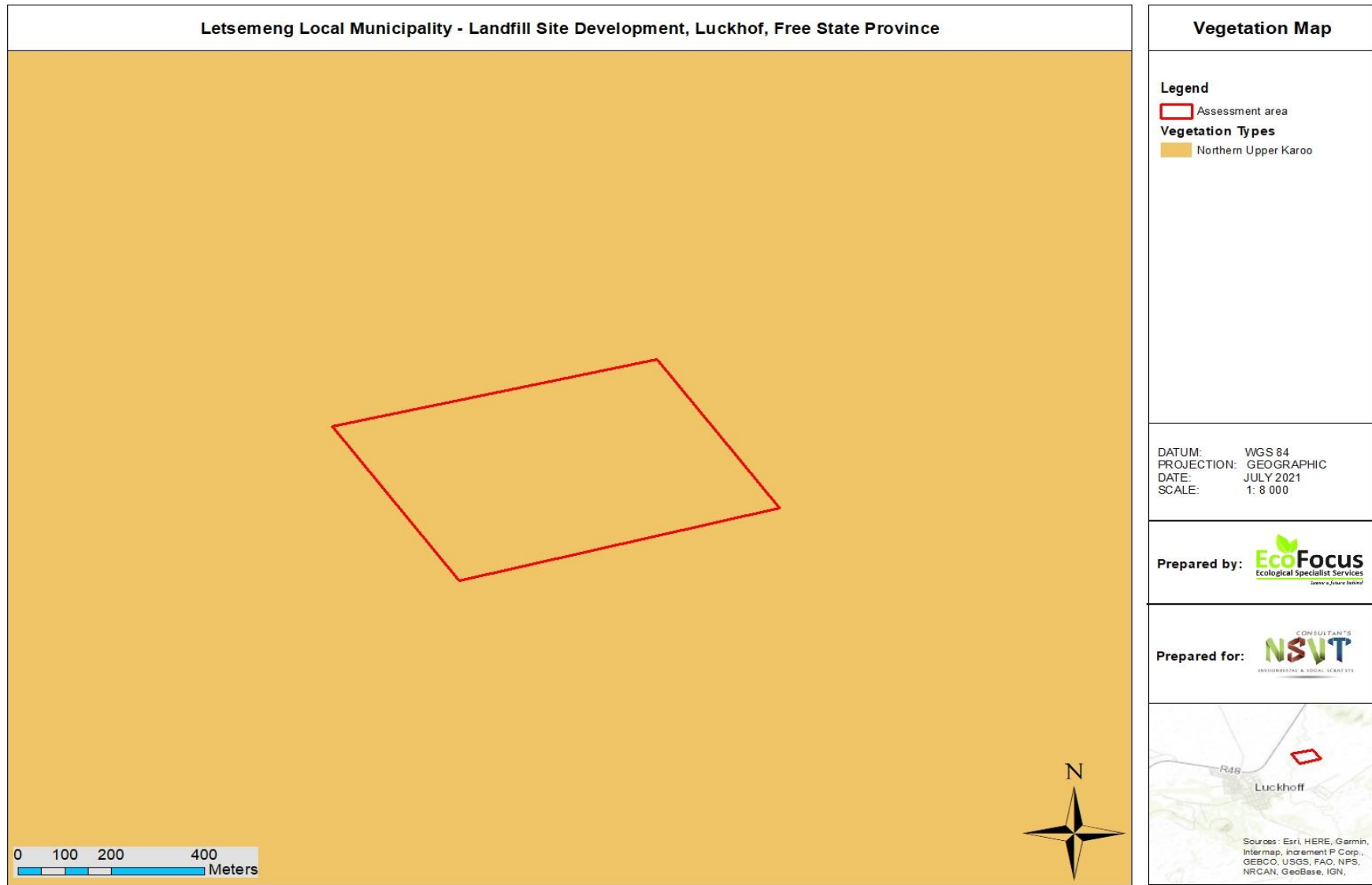


Figure 2: Vegetation map illustrating the vegetation type associated with the assessment area

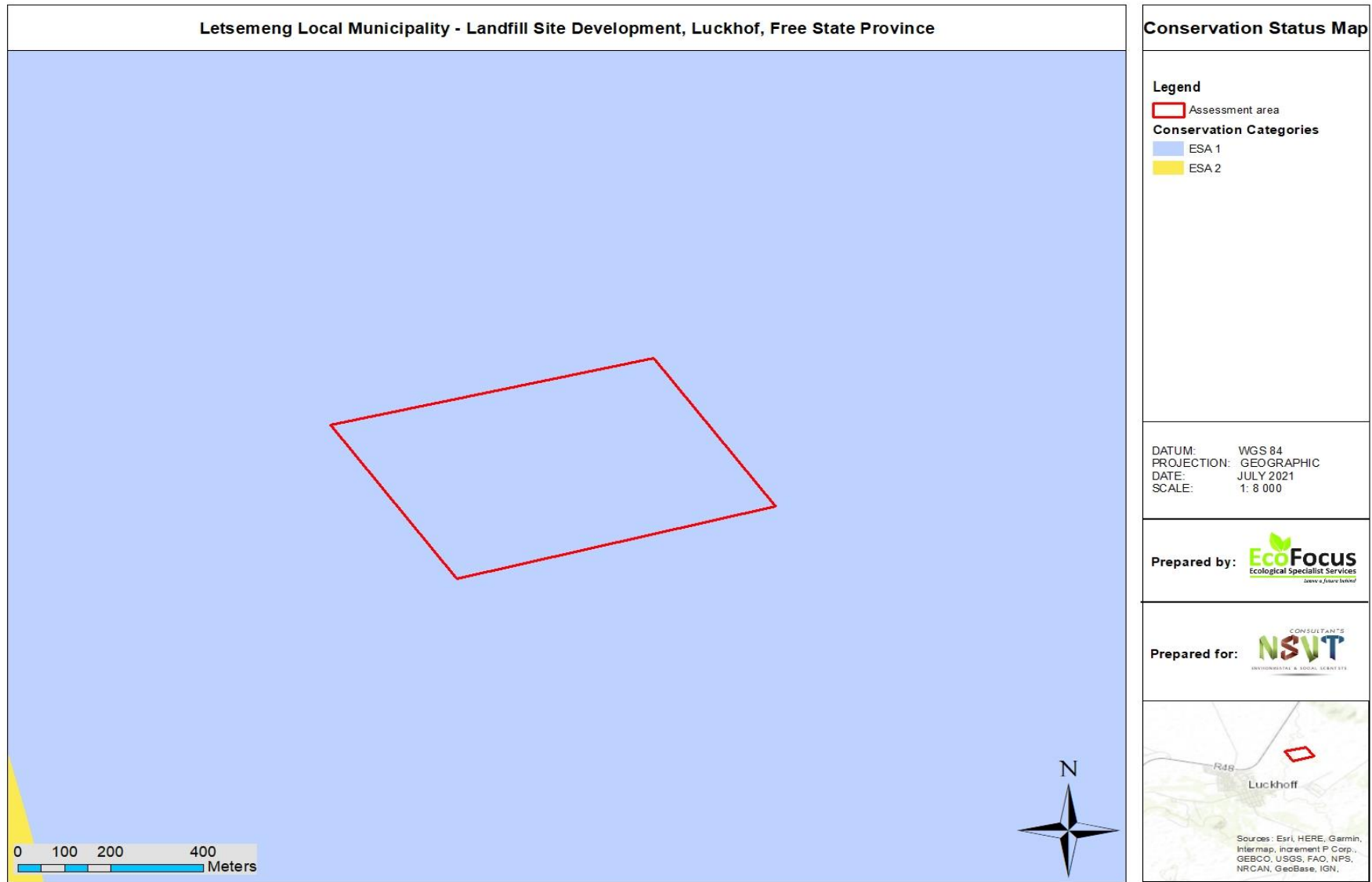


Figure 3: Conservation status map illustrating the conservation status associated with the assessment area

7. Assumptions, Uncertainties and Gaps in Knowledge

Various assumptions need to be made during the assessment process at the hand of the relevant specialist. It is therefore assumed that:

- all relevant project information provided to the ecological specialist by the EAP, was correct and valid at the time that it was provided.
- the proposed development area as provided by the EAP, is correct and will not be significantly deviated from, as this was the only area assessed.
- strategic level investigations undertaken by the applicant prior to the commencement of the Environmental Impact Assessment process, determined that the proposed development area represents a potentially suitable and technically acceptable location.
- the public, local communities, relevant organs of state and landowners will receive a sufficient reoccurring opportunity to participate and comment on the proposed development during the Environmental Impact Assessment process, through the provision of adequately facilitated public participation interventions and timeframes as stipulated in the NEMA: EIA Regulations, 2014.
- the need and desirability of the proposed development is based on strategic national, provincial and local plans and policies which reflect the interests of both statutory and public viewpoints.
- the EIA process is a project-level framework and the specialists are limited to assessing the anticipated environmental impacts associated with the construction and operational phases of the proposed development.
- it is assumed that strategic level decision making by the relevant authorities will be conducted through cooperative governance principles, with the consideration of environmentally sustainable and responsible development principles underpinning all decision making

Given that an EIA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the EIA process, namely process-related and prediction-related.

- Uncertainty of prediction is critical at the data collection phase as observations, recommendations and conclusions are made, solely based on professional specialist opinion. Final certainty will only be obtained upon actual implementation of the proposed development. Adequate research, specialist experience and expertise should however minimise this uncertainty.
- Uncertainty of relevant decision making relates to the interpretation of provided information by relevant authorities during the BA process. Continual two-way communication and coordination between EAP's and relevant authorities should however decrease the uncertainty of subjective interpretation. The importance of widespread/comprehensive consultation towards minimising the risk/possibility of omitting significant information and impacts is further stressed. The use of quantitative impact significance rating formulas (as utilised in this document) can further standardise the objective interpretation of results and limit the occurrence and scale of uncertainty and subjectivity.
- The principle of human nature provides for uncertainties and unpredictability with regards to the socio-economic impacts of the proposed development and the subsequent public reaction/opinion which will be received during the Public Participation Process (PPP)

Gaps in knowledge can be attributed to:

- The ecological assessment process was undertaken prior to the availing of certain information which would only be derived from the final development design and layout. The design layout for the proposed development, had not been finalised yet at the time of the ecological assessment.
- It must be noted that the timing of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is therefore recommended that an additional ecological walkthrough be conducted, prior to the commencement of the proposed development, during the flowering period of underground bulb plant species. This will ensure that no provincially protected or other conservationally significant species have potentially been omitted from the report.

- Existing residential transformation associated with the town, is evident within the local landscape to the west of the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.
- The potential for future landfill site developments in the same geographical area, which could lead to further cumulative impacts, cannot be meaningfully anticipated. It is however unlikely that further similar landfill site developments and subsequent transformation will take place within the local or broader area, over time.

EcoFocus Consulting is an independent ecological specialist company. All information and recommendations as per this report are therefore provided in a fair and unbiased/objective manner and are based on the qualitative data gathered and professional specialist opinion.

8. Results and Discussion

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

8.1. Current Existing Vegetation and Site Description

The assessment area and broader surrounding landscape to the north, east and south is currently undeveloped and constitutes an open medium-height terrestrial karroid grassland landscape. Virtually the entire karroid grassland landscape is however in a slightly disturbed state, which has mainly been caused by historic and continued anthropogenic activities. The karroid grassland landscape and broader surrounding areas to the north, east and south, are utilised by residents of the local community for livestock grazing purposes. Slight disturbance as a result of historic and continued long-term overgrazing, is evident throughout the karroid grassland landscape and broader surrounding undeveloped areas to the north, east and south. It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.

The majority of the assessment area had also been burnt at the time of the site assessment and it is reasonably assumed that the assessment area and broader surrounding undeveloped areas are likely anthropogenically burnt on a regular basis.

The karroid grassland landscape of the assessment area is mainly dominated by the hardy unpalatable grass species *Aristida spp.* while the grass species *Eragrostis lehmanniana* is also well-represented (Van Oudtshoorn, 2004). These two species are both robust/resilient Increaser 2 type grass species, which often tend to endure and increase in the event of disturbance and/or overgrazing as well as colonise disturbed areas, due to their robust/resilient nature (Van Oudtshoorn, 2004).

Other grass species also found to be relatively well-represented include *Schmidtia pappophoroides* and *Heteropogon contortus* while the grass species *Enneapogon cenchroides* was merely found to be sparsely present throughout the karroid grassland landscape of the assessment area.

The assessment area possesses a well-defined karroid shrub layer, while merely a limited number of small tree and woody shrub individuals of the species *Ziziphus mucronata*, *Searsia ciliata* and *S lancea* are very sporadically present throughout the landscape. The karroid shrub layer is mainly dominated by fairly equal representations of the shrub species *Euryops subcarnosus*, *Eriocephalus spinescens*, *Pentzia globosa*, *Hertia pallens* and the provincially protected species *Ruschia spinosa*.

Other shrub species also found to be present include *Phaeoptilum spinosum*, *Felicia muricata*, *Barleria rigida*, *Stachys rugosa*, *Thesium hystrix*, *Crotolaria orientalis*, *Salsola aphylla* and *Asparagus spp.* while the species *Rhigozum trichotomum* is merely sporadically present in dense isolated patches throughout the assessment area. The species *Laggera decurrens*, *Wahlenbergia nodosus*, *Cadaba aphylla* were also merely found to be sparsely present throughout the assessment area.

A diverse forb or succulent layer was not evident throughout the assessment area, during the site assessment. The forb species *Moraea pallida*, *Oxalis depressa*, *Sesamum triphyllum*, *Solanum panduriforme* as well as individuals/clusters of the provincially protected species *Aloe broomii* and *Aloe claviflora* respectively, were merely found to be sparsely present throughout the area. Remnants of merely a single individual of the provincially protected species *Ammocharis coranica* were also found to be present within the assessment area.

The provincially protected species *Euphorbia crassipes* and the provincially specially protected species *Hoodia gordonii* were found to be very sparsely present throughout the landscape surrounding the assessment area. It is therefore likely that individuals of these two species could also be present within the assessment area.

A Provincial Flora Permit has to be obtained from the Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA), prior to the commencement of any construction activities and the subsequent potential removal of any provincially protected species individuals. It is however recommended that representative numbers of individuals/clusters of the identified provincially protected species be adequately relocated to other suitable and similar areas as to where they were removed from. These relocation processes must be completed prior to the commencement of any vegetation clearance- and/or construction activities.

A very small slightly elevated isolated rocky outcrop is present within the central portion of the assessment area. This outcrop however does not possess any significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape and is therefore not viewed as being of any specific conservational significance.

No Red Data Listed-, other provincially- or nationally protected plant species or any other species of conservational significance, were found to be present throughout the assessment area.

The assessment area does not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (<https://www.birdlife.org.za/what-we-do/important-bird-and-biodiversity-areas/media-and-resources/#1553597171790-6f83422a-a731>). No conservationally significant or important bird species/nests or locally distinct habitats were observed during the site assessment or are necessarily expected to utilise the assessment area for breeding, foraging and/or persistence purposes. Only common local resident bird species and nests were found to be present.

No other conservationally significant or important faunal species or locally distinct habitats were observed throughout the assessment area, during the site assessment either. Merely a single individual of the provincially protected antelope species *Raphicerus campestris* (steenbok), was found traversing the assessment area. Due to the presence of the existing town to the west, the assessment area is subjected to continued anthropogenic activity and disturbance. It is therefore not anticipated that any conservationally significant or important faunal species would necessarily utilise the assessment area or the localised surrounding undeveloped landscape for breeding, foraging and/or persistence purposes.

See photographs below.



Figure 4: Two images illustrating examples of the slightly disturbed open medium-height terrestrial karroid grassland landscape, associated with the assessment area and broader surrounding landscape to the north, east and south



Figure 5: Image illustrating an example of the majority of the assessment area, which had been burnt at the time of the site assessment

The assessment area falls within the D33C quaternary surface water catchment- and drainage area. A significant first-order ephemeral water drainage line is situated approximately 370 m south of the assessment area. This drainage line flows in a south-westerly direction and discharges into a large artificially constructed earth dam, located approximately 1 km south-west of the assessment area. The outflow of the dam eventually discharges into a significant fourth-order ephemeral watercourse to the west. This watercourse, along with other adjoining watercourses, eventually drain into the Orange River situated approximately 24 km to the west. The earth dam and significant watercourse therefore form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west. It is however not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line, due to the distance between the drainage line and the assessment area as well as the ephemeral nature of the drainage line.

A small historic artificially excavated water flow channel is situated approximately 220 m west of the assessment area. This channel flows in a southerly direction and also discharges into the earth dam. For the same reasons as discussed above, it is also not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the channel.

It is however recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and - integrity.

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

The landfill site must also be sufficiently lined underground in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.

Further mitigation and management measures are also recommended under heading 9, which should be implemented in order to attempt to prevent any direct or indirect ecological impact on the drainage line, channel and groundwater.

A very small preferential water flow path traverses the assessment area. This preferential path flows in a south-westerly direction and also discharges into the earth dam. Due to the very small size of this preferential path, it is however not viewed as being of any conservational significance.

Due to the lack of continuous water flow through the assessment area, the drainage line, channel and preferential path do not possess any distinct riparian zone or significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape.

See photographs below.



Figure 6: Image illustrating the presence of the significant first-order ephemeral water drainage line, which is situated approximately 370 m south of the assessment area



Figure 7: Image illustrating the presence of the small historic artificially excavated water flow channel, which is situated approximately 220 m west of the assessment area



Figure 8: Image illustrating the presence of the very small preferential water flow path, which traverses the assessment area

8.2. Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

The Present Ecological State (PES) of the assessment area is classified as Class B as it is largely natural. A small change in natural habitat and biota has taken place mainly as a result of historic and continued anthropogenic activities such as slight overgrazing and anthropogenic burning. The ecosystem functionality has however remained essentially unchanged.

The Ecological Importance and Sensitivity (EIS) of the assessment area is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local scale. The entire assessment area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan (Collins, 2018). The assessment area also houses significant numbers of provincially protected plant species individuals. The significant first-order ephemeral water drainage line and small historic artificially excavated water flow channel both discharge into the large artificially constructed earth dam, which along with the subsequent significant fourth-order ephemeral watercourse, form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west. Biodiversity is however still relatively ubiquitous and not usually sensitive to habitat modifications.

The assessment area is therefore merely viewed as being of low to moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Ecological Support Area one (ESA 1), provincially protected plant species and the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area. It is the opinion of the specialist that the proposed development of the assessment area should be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigation measures as per this ecological report must however be adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

8.3. Ecological Site Sensitivity Map

The site sensitivity map below (see A3 sized map in the Appendices) illustrates the presence of the significant first-order ephemeral water drainage line, small historic artificially excavated water flow channel and the very small preferential water flow path.

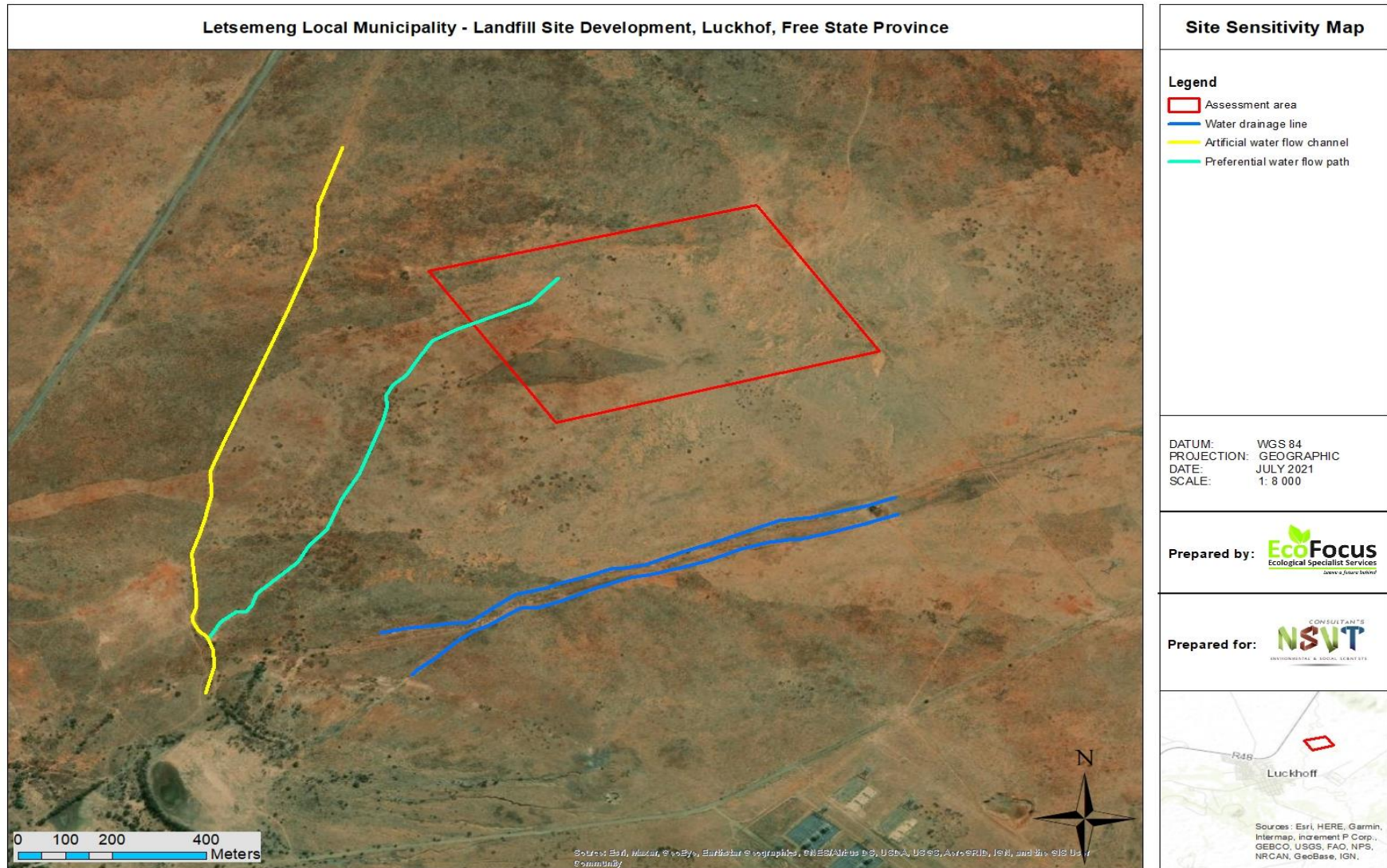


Figure 7: Site sensitivity map illustrating the presence of the significant first-order ephemeral water drainage line, small historic artificially excavated water flow channel and the very small preferential water flow path

8.4. Species List for the Assessment Area

Table 5: Species list for the assessment area (Provincially protected species highlighted in yellow)

Graminoids	Forbs & Succulents	Karroid & Woody Shrubs/Trees
<i>Aristida spp.</i>	<i>Aloe broomii</i>	<i>Asparagus spp.</i>
<i>Enneapogon cenchroides</i>	<i>Aloe claviflora</i>	<i>Barleria rigida</i>
<i>Eragrostis lehmanniana</i>	<i>Ammocharis coranica</i>	<i>Cadaba aphylla</i>
<i>Heteropogon contortus</i>	<i>Euphorbia crassipes</i>	<i>Crotolaria orientalis</i>
<i>Schmidtia pappophoroides</i>	<i>Hoodia gordonii</i>	<i>Eriocephalus spinescens</i>
-	<i>Moraea pallida</i>	<i>Euryops subcarnosus</i>
-	<i>Oxalis depressa</i>	<i>Felicia muricata</i>
-	<i>Sesamum triphyllum</i>	<i>Hertia pallens</i>
-	<i>Solanum panduriforme</i>	<i>Laggera decurrens</i>
-	-	<i>Pentzia globosa</i>
-	-	<i>Phaeoptilum spinosum</i>
-	-	<i>Rhigozum trichotomum</i>
-	-	<i>Ruschia spinosa</i>
-	-	<i>Salsola aphylla</i>
-	-	<i>Searsia ciliata</i>
-	-	<i>Searsia lancea</i>
-	-	<i>Stachys rugosa</i>
-	-	<i>Thesium hystrix</i>
-	-	<i>Wahlenbergia nodosus</i>
-	-	<i>Ziziphus mucronata</i>

9. Ecological Impact Assessment

The following section identifies the potential ecological impacts (both positive and negative) which the proposed development will have on the surrounding environment.

Once the potential ecological impacts are identified, they are assessed by rating their Environmental Risk after which the final Environmental Significance is calculated and rated for each identified ecological impact.

The same Environmental Risk rating process is then followed for each ecological impact to determine the Environmental Significance, if the recommended mitigation measures were to be implemented.

The objective of this section is therefore firstly to identify all the potential ecological impacts of the proposed development and secondly to determine the significance of the impacts and how effective the recommended mitigation measures will be able to reduce their significance. The potential ecological impacts which are still rated as highly significant, even after implementation of mitigations, can then be identified in order to specifically focus on implementation of effective management strategies for them.

9.1. Construction Phase

Transformation of vegetation within the assessment area associated with the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

According to SANBI (2006-2019), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3), which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

'Ground truthing' during the site assessment however suggests that the broader area rather forms part of a transitional zone between the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types.

The assessment area and broader surrounding landscape to the north, east and south is currently undeveloped and constitutes an open medium-height terrestrial karroid grassland landscape. Virtually the entire karroid grassland landscape is however in a slightly disturbed state, which has mainly been caused by historic and continued anthropogenic activities. The karroid grassland landscape and broader surrounding areas to the north, east and south, are utilised by residents of the local community for livestock grazing purposes. Slight disturbance as a result of historic and continued long-term overgrazing, is evident throughout the karroid grassland landscape and broader surrounding undeveloped areas to the north, east and south.

The majority of the assessment area had also been burnt at the time of the site assessment and it is reasonably assumed that the assessment area and broader surrounding undeveloped areas are likely anthropogenically burnt on a regular basis.

The significance of this potential impact will be medium.
Mitigation measures to reduce impacts are recommended under heading 9.4.

Transformation of an Ecological Support Area one (ESA 1) associated with the assessment area

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

The entire assessment area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan (Collins, 2018), which sets out biodiversity priority areas in the province.

The assessment area falls within the D33C quaternary surface water catchment- and drainage area. A significant first-order ephemeral water drainage line is situated approximately 370 m south of the assessment area. This drainage line flows in a south-westerly direction and discharges into a large artificially constructed earth dam, located approximately 1 km south-west of the assessment area. The outflow of the dam eventually discharges into a significant fourth-order ephemeral watercourse to the west. This watercourse, along with other adjoining watercourses, eventually drain into the Orange River situated approximately 24 km to the west. The earth dam and significant watercourse therefore form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west.

It is however not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line, due to the distance between the drainage line and the assessment area as well as the ephemeral nature of the drainage line.

A small historic artificially excavated water flow channel is situated approximately 220 m west of the assessment area. This channel flows in a southerly direction and also discharges into the earth dam. For the same reasons as discussed above, it is also not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the channel.

A very small preferential water flow path traverses the assessment area. This preferential path flows in a south-westerly direction and also discharges into the earth dam. Due to the very small size of this preferential path, it is however not viewed as being of any conservational significance.

The assessment area scored a moderate Ecological Importance and Sensitivity (EIS) value and is therefore merely viewed as being of low to moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Ecological Support Area one (ESA 1), provincially protected plant species and the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

The provincially protected species *Ruschia spinosa* is well-represented throughout the assessment area. Individuals/clusters of the provincially protected species *Aloe broomii* and *Aloe claviflora* respectively, were merely found to be sparsely present throughout the assessment area. Remnants of merely a single individual of the provincially protected species *Ammocharis coranica* were also found to be present within the assessment area.

The provincially protected species *Euphorbia crassipes* and the provincially specially protected species *Hoodia gordonii* were found to be very sparsely present throughout the landscape surrounding the assessment area. It is therefore likely that individuals of these two species could also be present within the assessment area.

A very small slightly elevated isolated rocky outcrop is present within the central portion of the assessment area. This outcrop however does not possess any significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape and is therefore not viewed as being of any specific conservational significance.

No Red Data Listed-, other provincially- or nationally protected plant species or any other species of conservational significance, were found to be present throughout the assessment area.

The assessment area does not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (<https://www.birdlife.org.za/what-we-do/important-bird-and-biodiversity-areas/media-and-resources/#1553597171790-6f83422a-a731>). No conservationally significant or important bird species/nests or locally distinct habitats were observed during the site assessment or are necessarily expected to utilise the assessment area for breeding, foraging and/or persistence purposes. Only common local resident bird species and nests were found to be present.

No other conservationally significant or important faunal species or locally distinct habitats were observed throughout the assessment area, during the site assessment either. Merely a single individual of the provincially protected antelope species *Raphicerus campestris* (steenbok), was found traversing the assessment area. Due to the presence of the existing town to the west, the assessment area is subjected to continued anthropogenic activity and disturbance. It is therefore not anticipated that any conservationally significant or important faunal species would necessarily utilise the assessment area or the localised surrounding undeveloped landscape for breeding, foraging and/or persistence purposes.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4

Terrestrial alien invasive species establishment

No significant alien invasive species establishments were found to be present within the assessment area. The assessment area and broader undeveloped landscape surrounding the proposed development footprint, could however potentially be prone to significant alien invasive species establishment due to surface disturbance and vegetation clearance caused by construction activities.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Surface material erosion

The assessment area constitutes a flat to slightly sloping landscape mainly towards the south-west. The assessment area and surrounding undeveloped landscape could therefore merely potentially be prone to slight surface soil erosion, due to the loosening of materials and clearance of vegetation caused by construction activities, which usually binds surface material.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Dust generation and emissions

The construction activities associated with the proposed development, could potentially result in slight fugitive dust emissions due to vegetation clearance and movement of machinery and equipment. Generated dust could spread into- and contaminate the significant water drainage line and the broader undeveloped landscape surrounding the proposed development footprint.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding and contamination of the flow regime of the significant first-order ephemeral water drainage line and the small historic artificially excavated water flow channel within the associated local and broader quaternary surface water catchment- and drainage area

The assessment area falls within the D33C quaternary surface water catchment- and drainage area. A significant first-order ephemeral water drainage line is situated approximately 370 m south of the assessment area. This drainage line flows in a south-westerly direction and discharges into a large artificially constructed earth dam, located approximately 1 km south-west of the assessment area. The outflow of the dam eventually discharges into a significant fourth-order ephemeral watercourse to the west. This watercourse, along with other adjoining watercourses, eventually drain into the Orange River situated approximately 24 km to the west. The earth dam and significant watercourse therefore form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west.

It is however not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line, due to the distance between the drainage line and the assessment area as well as the ephemeral nature of the drainage line.

A small historic artificially excavated water flow channel is situated approximately 220 m west of the assessment area. This channel flows in a southerly direction and also discharges into the earth dam. For the same reasons as discussed above, it is also not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the channel.

A very small preferential water flow path traverses the assessment area. This preferential path flows in a south-westerly direction and also discharges into the earth dam. Due to the very small size of this preferential path, it is however not viewed as being of any conservational significance.

The activities associated with the construction phase could potentially result in impeding of natural surface water flow towards the significant water drainage line and the water flow channel within the associated local and broader quaternary surface water catchment- and drainage area, due to artificial obstruction of flow during rainfall events. It could potentially also result in contamination of natural surface water flow within the associated local and broader quaternary surface water catchment- and drainage area, due to hydrocarbon and/or other chemical spills by construction machinery and equipment.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.2. Operational Phase

The destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, was identified and addressed as the only significant potential long-term ecological impact associated with the construction phase of the proposed development.

A number of additional significant potential ecological impacts, could however likely occur during the operational phase of the proposed development. The following potential ecological impacts are associated with the operational phase:

Ecological degradation of the broader undeveloped landscape surrounding the proposed development footprint and alien invasive species establishment

The broader undeveloped landscape surrounding the proposed development footprint could potentially be prone to continued significant ecological degradation and alien invasive species establishment due to the ecological 'edge effect' caused by continuous disturbances from the landfill site operational activities. Landfill sites tend to decrease the ecological integrity of the immediately surrounding landscape due to inadequate containment of light weighted plastics and other waste products which unintendedly and undesirably get dispersed into the surrounding environment and subsequently impact on the ecology.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Death of wild animals due to ingestion of light weighted plastics and other waste products

Wild animals could inadvertently ingest light weighted plastics and other waste products, which have been unintendedly and undesirably dispersed into the broader undeveloped landscape surrounding the proposed development footprint. Such ingestions could cause serious physiological harm or even death of animals.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Continued impeding and contamination of the flow regime of the significant first-order ephemeral water drainage line and the small historic artificially excavated water flow channel within the associated local and broader quaternary surface water catchment- and drainage area

The established landfill site could potentially continuously impede on the natural surface water flow towards the significant water drainage line and the water flow channel within the associated local and broader quaternary surface water catchment- and drainage area, due to continued artificial obstruction of flow during rainfall events.

The operations of the established landfill site could further potentially result in continued contamination of natural surface water flow within the associated local and broader quaternary surface water catchment- and drainage area, due to dirty surface water runoff.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Alteration/contamination of soil and groundwater characteristics/quality

Potential leakages and/or seepages of contaminated liquid waste materials disposed of at the landfill site during the operational phase, could potentially infiltrate into the groundwater system and result in significant continued chemical and biological contamination and subsequent reduction in groundwater quality.

The significance of this potential impact will be medium-high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Chemical air emissions pollution

The operations of the established landfill site will likely generate significant amounts of chemical emissions into the air as a result of waste incineration. This could likely have a detrimental effect on the air quality of the broader surrounding area.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

The assessment area scored a moderate Ecological Importance and Sensitivity (EIS) value and is therefore merely viewed as being of low to moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Ecological Support Area one (ESA 1), provincially protected plant species and the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

The destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, was identified and addressed as the only significant potential long-term ecological impact associated with the construction phase of the proposed development. This impact could merely add low to moderate cumulative impact to existing negative impacts caused by the presence of existing town to the west.

The alteration/contamination of soil and groundwater characteristics/quality as well as chemical air emissions pollution, were identified and addressed as significant potential long-term ecological impacts associated with the operational phase of the proposed development. These impacts could add moderately-high to high cumulative impact to existing negative impacts caused by the presence of existing town to the west.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential cumulative ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels by implementation of the recommended mitigation measures.

It is therefore not anticipated that the proposed development will necessarily add any significant residual cumulative ecological impacts to the surrounding environment, if all recommended mitigation measures as per this ecological report are adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

9.4. Risk Ratings of Potential Impacts

The following section provides the Environmental Risk as well as the Environmental Significance Ratings for the potential ecological impacts associated with the proposed developments both before and after implementation of the recommended mitigation measures.

9.4.1. Construction Phase

Table 5: Environmental Risk and Significance Ratings

	Assessment area	No-go alternative
Identified Environmental Impact	Transformation of vegetation within the assessment area associated with the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Medium (56)	-

Mitigation Measures to be implemented

The proposed development construction footprint must be kept as small as practicably possible to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the broader undeveloped landscape surrounding the proposed development footprint, may take place.

No site construction basecamps may be established within the broader undeveloped landscape surrounding the proposed development footprint.

Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the broader undeveloped landscape outside the cordoned off area.

Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern and restrict movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.

Existing roads and farm tracks in close proximity to the proposed development construction footprint area, must be used during the construction phase. No new temporary roads or tracks may be constructed or implemented within the broader undeveloped landscape surrounding the proposed development footprint.

Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.

	It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (39)	-
	Assessment area	No-go alternative
Identified Environmental Impact	Transformation of an Ecological Support Area one (ESA 1) associated with the assessment area	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	-

Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (42)	-
Mitigation Measures to be implemented	<p>It is not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line or the flow channel, due to the distances between them and the assessment area as well as the ephemeral nature of the drainage line.</p> <p>Implement an adequate Stormwater and Erosion Management Plan during the construction and operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation within the local and broader quaternary surface water catchment- and drainage area, in order to attempt to improve the ecological functionality and -integrity of the catchment.</p> <p>It is recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and -integrity.</p>	

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

The detailed design layouts and measurement/capacity parameters of the cut-off berms/trenches and contamination/evaporation ponds must be calculated and determined by a suitably qualified and experienced engineer.

The proposed development construction footprint must be kept as small as practicably possible to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the broader undeveloped landscape surrounding the proposed development footprint, may take place.

No site construction basecamps may be established within the broader undeveloped landscape surrounding the proposed development footprint.

Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the broader undeveloped landscape outside the cordoned off area.

Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern and restrict movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.

	<p>Existing roads and farm tracks in close proximity to the proposed development construction footprint area, must be used during the construction phase. No new temporary roads or tracks may be constructed or implemented within the broader undeveloped landscape surrounding the proposed development footprint.</p> <p>Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (26)	-

	Assessment area	No-go alternative
Identified Environmental Impact	Destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium (68)	-

Mitigation Measures to be implemented

A Provincial Flora Permit has to be obtained from the Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA), prior to the commencement of any construction activities and the subsequent potential removal of any provincially protected species individuals.

It is however recommended that representative numbers of individuals/clusters of the identified provincially protected species be adequately relocated to other suitable and similar areas as to where they were removed from. These relocation processes must be completed prior to the commencement of any vegetation clearance-and/or construction activities.

The proposed development construction footprint must be kept as small as practicably possible to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the broader undeveloped landscape surrounding the proposed development footprint, may take place.

No site construction basecamps may be established within the broader undeveloped landscape surrounding the proposed development footprint.

Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the broader undeveloped landscape outside the cordoned off area.

Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern and restrict movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.

	<p>Existing roads and farm tracks in close proximity to the proposed development construction footprint area, must be used during the construction phase. No new temporary roads or tracks may be constructed or implemented within the broader undeveloped landscape surrounding the proposed development footprint.</p> <p>Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (42)	-

	Assessment area	No-go alternative
Identified Environmental Impact	Terrestrial alien invasive species establishment	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	-
Reversibility of Impact	High (2)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (36)	-

<p style="text-align: center;">Mitigation Measures to be implemented</p>	<p>Implement an adequate Alien Invasive Species Management and Prevention Plan during the construction and operational phases. Such a Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.</p>	
<p style="text-align: center;">Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>
<p style="text-align: center;">Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (11)</p>	<p>-</p>

	Assessment area	No-go alternative
Identified Environmental Impact	Surface material erosion	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	-
Reversibility of Impact	High (2)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (36)	-
Mitigation Measures to be implemented	Implement an adequate Stormwater and Erosion Management Plan during the construction and operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation, in order to prevent any significant soil erosion in and around the assessment area.	

	<p>Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (11)	-
	Assessment area	No-go alternative
Identified Environmental Impact	Dust generation and emissions	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Short term (2)	-

Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (42)	-
Mitigation Measures to be implemented	<p>Implement suitable dust management and prevention measures during the construction phase of the proposed development.</p> <p>Construction areas and –roads to be sufficiently wetted down during the construction phase in order to prevent significant fugitive dust emissions.</p> <p>Adequate operational procedures for machinery and equipment must be developed to strictly govern and restrict movement of machinery, in order to avoid unnecessary fugitive dust emissions and ensure environmentally responsible construction practices and activities.</p>	

	<p>Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.</p>	
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>
<p>Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (26)</p>	<p>-</p>

	Assessment area	No-go alternative
Identified Environmental Impact	Impeding and contamination of the flow regime of the significant first-order ephemeral water drainage line and the small historic artificially excavated water flow channel within the associated local and broader quaternary surface water catchment- and drainage area	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Short term (2)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-

Mitigation Measures to be implemented

It is not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line or the flow channel, due to the distances between them and the assessment area as well as the ephemeral nature of the drainage line.

Implement an adequate Stormwater and Erosion Management Plan during the construction and operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation within the local and broader quaternary surface water catchment- and drainage area, in order to attempt to improve the ecological functionality and -integrity of the catchment.

It is recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and -integrity.

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

The detailed design layouts and measurement/capacity parameters of the cut-off berms/trenches and contamination/evaporation ponds must be calculated and determined by a suitably qualified and experienced engineer.

Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.

It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.

If hydrocarbons or other chemicals are to be stored on site during the construction phase, the storage areas must be situated as far away as practicably possible from the significant water drainage line and the flow channel.

Hydrocarbon and other chemical storage areas must be adequately banded in order to be able to contain a minimum of 150 % of the capacity of storage tanks/units.

Adequate hydrocarbon and other chemical storage, handling, usage and spillage clean-up procedures must be developed and all relevant construction personnel must be sufficiently trained on- and apply these procedures during the entire construction phase.

Spill kits must be readily available on the construction site. All employees must be adequately trained on the correct procedure and use of the spill kits.

A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation if required, in accordance with the National Water Act (Act 36 of 1998).

Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (12)	-

9.4.2. Operational Phase

Table 6: Environmental Risk and Significance Ratings

	Assessment area	No-go alternative
Identified Environmental Impact	Ecological degradation of the broader undeveloped landscape surrounding the proposed development footprint and alien invasive species establishment	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (42)	-

<p style="text-align: center;">Mitigation Measures to be implemented</p>	<p>Ensure that sufficient waste containment, storage and disposal measures are implemented in order to adequately manage and contain light weighted plastics and other waste products to prevent significant undesired dispersal into the broader undeveloped landscape surrounding the proposed development footprint. This will subsequently prevent ecological degradation and alien invasive species establishment.</p> <p>Active annual community and municipal waste clean-up initiatives will have to be implemented in order to attempt to remove and adequately dispose of existing garbage/waste throughout the broader undeveloped landscape surrounding the proposed development footprint.</p> <p>Implement an adequate Alien Invasive Species Management and Prevention Plan during the construction and operational phases. Such a Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>A Waste Management License application must be submitted to the competent authority, in accordance with the National Environmental Management: Waste Amendment Act (Act 26 of 2014).</p>	
<p style="text-align: center;">Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>
<p style="text-align: center;">Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (22)</p>	<p>-</p>

	Assessment area	No-go alternative
Identified Environmental Impact	Death of wild animals due to ingestion of light weighted plastics and other waste products	
Magnitude of Negative or Positive Impact	Medium (6)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Medium (51)	-

<p>Mitigation Measures to be implemented</p>	<p>Ensure that sufficient waste containment, storage and disposal measures are implemented in order to adequately manage and contain light weighted plastics and other waste products to prevent significant undesired dispersal into the broader undeveloped landscape surrounding the proposed development footprint.</p> <p>Active annual community and municipal waste clean-up initiatives will have to be implemented in order to attempt to remove and adequately dispose of existing garbage/waste throughout the broader undeveloped landscape surrounding the proposed development footprint.</p> <p>A Waste Management License application must be submitted to the competent authority, in accordance with the National Environmental Management: Waste Amendment Act (Act 26 of 2014).</p>	
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>
<p>Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (24)</p>	<p>-</p>

	Assessment area	No-go alternative
Identified Environmental Impact	Continued impeding and contamination of the flow regime of the significant first-order ephemeral water drainage line and the small historic artificially excavated water flow channel within the associated local and broader quaternary surface water catchment- and drainage area	
Magnitude of Negative or Positive Impact	Medium (6)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Medium (57)	-

Mitigation Measures to be implemented

If all the recommended mitigation measures for the construction phase are adequately implemented and managed, it should prove sufficient in preventing any continued impeding of- or significant impact on the significant water drainage line and flow channel within the associated local and broader quaternary surface water catchment- and drainage area.

It is not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line or the flow channel, due to the distances between them and the assessment area as well as the ephemeral nature of the drainage line.

Implement an adequate Stormwater and Erosion Management Plan during the construction and operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation within the local and broader quaternary surface water catchment- and drainage area, in order to attempt to improve the ecological functionality and -integrity of the catchment.

It is recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and -integrity.

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

	<p>The detailed design layouts and measurement/capacity parameters of the cut-off berms/trenches and contamination/evaporation ponds must be calculated and determined by a suitably qualified and experienced engineer.</p> <p>The storm water management measures incorporated into the development layout designs should be inspected on a minimum biannual basis (twice a year). They must be adequately maintained to ensure that sufficient volumes and quality of surface water runoff from the footprint area, are still channelled back into the local and broader quaternary surface water catchment- and drainage area.</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (15)	-
	Assessment area	No-go alternative
Identified Environmental Impact	Alteration/contamination of soil and groundwater characteristics/quality	
Magnitude of Negative or Positive Impact	High (8)	-
Duration of Negative or Positive Impact	Long term (4)	-

Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (92)	-
Mitigation Measures to be implemented	<p>The landfill site must be sufficiently lined underground in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.</p> <p>The integrity of the lining must be re-evaluated and maintained annually in order to ensure its continued functionality.</p> <p>A leachate pond must be constructed in order to store and treat leachates for adequate disposal.</p> <p>Adequate leakage detection and prevention systems must be installed in order to detect any potential leakages and subsequent contamination of underground water.</p>	

	<p>Groundwater samples must be collected directly downstream of the proposed development area prior to the commencement of the operational phase. The quality must be chemically and biologically analysed by an accredited laboratory in order to serve as baseline values for the groundwater quality.</p> <p>Groundwater samples must then be collected and the quality must be chemically and biologically analysed by an accredited laboratory on a continual minimum 6 monthly basis and compared with the baseline data.</p> <p>If any contamination or reduction in groundwater quality is determined due to the development, the competent authority must immediately be notified and the necessary steps must be followed by the applicant to locate and remediate the source of contamination, as soon as practicably possible.</p> <p>A Waste Management License application must be submitted to the competent authority, in accordance with the National Environmental Management: Waste Amendment Act (Act 26 of 2014).</p>	
Cumulative Impact Rating after mitigation implementation	<p>Low</p>	<p>-</p>
Environmental Significance Score and Rating after mitigation implementation	<p>Low (36)</p>	<p>-</p>

	Assessment area	No-go alternative
Identified Environmental Impact	Chemical air emissions pollution	
Magnitude of Negative or Positive Impact	Medium (6)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium (72)	-
Mitigation Measures to be implemented	A comprehensive Air Emissions Impact Assessment must be conducted in order to determine and predict the potential significance and extent of the air emissions pollution plume. Such an assessment must be conducted by a suitably qualified and experienced air emissions specialist.	

	<p>Adequate design, technology and operational mitigation measures must then be recommended by the air emissions specialist in order to reduce the impact significance and extent of the air emissions pollution plume to within acceptable and legally compliant levels.</p> <p>An Air Emissions License Application must be submitted to the competent authority in accordance with the National Environment Management: Air Quality (Act 39 of 2004), as amended.</p> <p>Air emissions and stack monitoring must be then be continually conducted in accordance with the conditions as set out in the relevant Air Emissions License. This must be done in order to ensure continued legal compliance with the minimum required air emissions quality standards.</p> <p>A Waste Management License application must be submitted to the competent authority, in accordance with the National Environmental Management: Waste Amendment Act (Act 26 of 2014).</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (30)	-

10. Summary and Conclusion

The assessment area consists of a single footprint area of approximately 25 ha in size. The area constitutes a flat to slightly sloping landscape mainly towards the south-west. The mechanical clearance associated with the proposed landfill site development, will in all probability completely transform the majority of the existing surface vegetation within the assessment area. The broader region surrounding the assessment area however constitutes a vast, continuous undeveloped and relatively homogenous natural landscape.

According to SANBI (2006-2019), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3), which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

'Ground truthing' during the site assessment however suggests that the broader area rather forms part of a transitional zone between the Northern Upper Karoo (NKu 3) and Xhariep Karroid Grassland (Gh 3) vegetation types.

The entire assessment area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan (Collins, 2018), which sets out biodiversity priority areas in the province.

Current Existing Vegetation and Site Description

The assessment area and broader surrounding landscape to the north, east and south is currently undeveloped and constitutes an open medium-height terrestrial karroid grassland landscape. Virtually the entire karroid grassland landscape is however in a slightly disturbed state, which has mainly been caused by historic and continued anthropogenic activities. The karroid grassland landscape and broader surrounding areas to the north, east and south, are utilised by residents of the local community for livestock grazing purposes. Slight disturbance as a result of historic and continued long-term overgrazing, is evident throughout the karroid grassland landscape and broader surrounding undeveloped areas to the north, east and south. It is recommended that a sufficient grazing management plan and practices must be implemented for livestock of the local community in order to prevent continued significant overgrazing of surrounding undeveloped areas and to attempt to improve/restore the ecological condition, over time.

The majority of the assessment area had also been burnt at the time of the site assessment and it is reasonably assumed that the assessment area and broader surrounding undeveloped areas are likely anthropogenically burnt on a regular basis.

The provincially protected species *Ruschia spinosa* is well-represented throughout the assessment area. Individuals/clusters of the provincially protected species *Aloe broomii* and *Aloe claviflora* respectively, were merely found to be sparsely present throughout the assessment area. Remnants of merely a single individual of the provincially protected species *Ammocharis coranica* were also found to be present within the assessment area.

The provincially protected species *Euphorbia crassipes* and the provincially specially protected species *Hoodia gordonii* were found to be very sparsely present throughout the landscape surrounding the assessment area. It is therefore likely that individuals of these two species could also be present within the assessment area.

A Provincial Flora Permit has to be obtained from the Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs (DESTEa), prior to the commencement of any construction activities and the subsequent potential removal of any provincially protected species individuals. It is however recommended that representative numbers of individuals/clusters of the identified provincially protected species be adequately relocated to other suitable and similar areas as to where they were removed from. These relocation processes must be completed prior to the commencement of any vegetation clearance- and/or construction activities.

A very small slightly elevated isolated rocky outcrop is present within the central portion of the assessment area. This outcrop however does not possess any significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape and is therefore not viewed as being of any specific conservational significance.

No Red Data Listed-, other provincially- or nationally protected plant species or any other species of conservational significance, were found to be present throughout the assessment area.

The assessment area does not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (<https://www.birdlife.org.za/what-we-do/important-bird-and-biodiversity-areas/media-and-resources/#1553597171790-6f83422a-a731>). No conservationally significant or important bird species/nests or locally distinct habitats were observed during the site assessment or are necessarily expected to utilise the assessment area for breeding, foraging and/or persistence purposes. Only common local resident bird species and nests were found to be present.

No other conservationally significant or important faunal species or locally distinct habitats were observed throughout the assessment area, during the site assessment either. Merely a single individual of the provincially protected antelope species *Raphicerus campestris* (steenbok), was found traversing the assessment area. Due to the presence of the existing town to the west, the assessment area is subjected to continued anthropogenic activity and disturbance. It is therefore not anticipated that any conservationally significant or important faunal species would necessarily utilise the assessment area or the localised surrounding undeveloped landscape for breeding, foraging and/or persistence purposes.

The assessment area falls within the D33C quaternary surface water catchment- and drainage area. A significant first-order ephemeral water drainage line is situated approximately 370 m south of the assessment area. This drainage line flows in a south-westerly direction and discharges into a large artificially constructed earth dam, located approximately 1 km south-west of the assessment area. The outflow of the dam eventually discharges into a significant fourth-order ephemeral watercourse to the west. This watercourse, along with other adjoining watercourses, eventually drain into the Orange River situated approximately 24 km to the west. The earth dam and significant watercourse therefore form an important part of the local and broader quaternary surface water catchment- and drainage area towards the west. It is however not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the drainage line, due to the distance between the drainage line and the assessment area as well as the ephemeral nature of the drainage line.

A small historic artificially excavated water flow channel is situated approximately 220 m west of the assessment area. This channel flows in a southerly direction and also discharges into the earth dam. For the same reasons as discussed above, it is also not anticipated that the proposed development will result in any significant direct or indirect ecological impact on the channel.

It is however recommended that a sufficient stormwater cut-off berm/trench be constructed on the upstream side directly adjacent outside and along the northern and eastern boundaries of the assessment area. This cut-off berm/trench must prevent clean surface water runoff from entering the proposed development footprint area by diverting and channelling surface water runoff around the footprint area towards the south-west for dispersal. This will ensure clean/dirty water separation on site as well as ensuring continued flow within the local and broader quaternary surface water catchment- and drainage area, in order to maintain its ecological functionality and - integrity.

It is further recommended that a similar cut-off berm/trench and associated contamination/evaporation ponds be constructed on the downstream side directly adjacent inside the boundary of the assessment area. This cut-off berm/trench and associated contamination/evaporation ponds must prevent dirty surface water runoff from leaving the proposed development footprint area by containing and storing surface water runoff from the footprint area for evaporation and subsequent adequate disposal of undesired solid materials.

The landfill site must also be sufficiently lined underground in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.

Further mitigation and management measures are also recommended under heading 9, which should be implemented in order to attempt to prevent any direct or indirect ecological impact on the drainage line, channel and groundwater.

A very small preferential water flow path traverses the assessment area. This preferential path flows in a south-westerly direction and also discharges into the earth dam. Due to the very small size of this preferential path, it is however not viewed as being of any conservational significance.

Due to the lack of continuous water flow through the assessment area, the drainage line, channel and preferential path do not possess any distinct riparian zone or significant variation in vegetation species composition or -structure, relative to the surrounding terrestrial karroid grassland landscape.

Conclusion

The assessment area scored a moderate Ecological Importance and Sensitivity (EIS) value and is therefore merely viewed as being of low to moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Ecological Support Area one (ESA 1), provincially protected plant species and the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

The destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, was identified and addressed as the only significant potential long-term ecological impact associated with the construction phase of the proposed development. This impact could merely add low to moderate cumulative impact to existing negative impacts caused by the presence of existing town to the west.

The alteration/contamination of soil and groundwater characteristics/quality as well as chemical air emissions pollution, were identified and addressed as significant potential long-term ecological impacts associated with the operational phase of the proposed development. These impacts could add moderately-high to high cumulative impact to existing negative impacts caused by the presence of existing town to the west.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels by implementation of the recommended mitigation measures.

The proposed development of the assessment area should therefore be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigation measures as per this ecological report must however be adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

11. References

Collins, N.B. 2018. Free State Province Biodiversity Plan: CBA map. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

Collins, N.B. 2018. Free State Province Biodiversity Plan: Technical Report v1.0. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

Conservation of Agricultural Resources Act (Act 43 of 1983)

Free State Nature Conservation Ordinance (No 8 of 1969)

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

National Environmental Management Act (Act 107 of 1998)

National Environmental Management: Biodiversity Act (Act 10 of 2004)

National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014

National Environmental Management: Waste Amendment Act (Act 26 of 2014)

National Forests Act (Act 84 of 1998)

National Water Act (Act 36 of 1998)

South African National Biodiversity Institute (2006-2019). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors)

Van Oudtshoorn, F. 2004. Gids tot Grasse van SuidAfrika. 2nd Ed. Briza Publikasies

www.climate-data.org

12. Details of the Specialist

Adriaan Johannes Hendrikus Lamprecht (Pr.Sci.Nat)

M.Env.Sci. Ecological remediation and sustainable utilisation (NWU: Potchefstroom)

South African Council for Natural Scientific Professions (SACNASP): Professional Ecological Scientist
(No 115601)

EcoFocus Consulting (Pty) Ltd

Physical Address: Edenglen number 7
 Waterberg Street
 Langenhovenpark
 Bloemfontein, 9330

Mobile Phone: 072 230 9598

Email Address: ajhlamprecht@gmail.com

Abbreviated Curriculum Vitae

Qualifications

- M.Env.Sci Ecological Remediation and Sustainable Utilisation/Vegetation Ecology
 - 2010 - North West University Potchefstroom
- B.Sc Botany and Zoology (Cum Laude)
 - 2008 - North West University Potchefstroom

Accredited courses completed

- Implementing Environmental Management Systems ISO 14001
 - 2011 - North West University Potchefstroom
- Environmental Law for Environmental Managers
 - 2011 - North West University Potchefstroom
- SASS 5 Aquatic Biomonitoring Training Course
 - 2017 – GroundTruth Consulting

Professional registrations

- South African Council for Natural Scientific Professions (**SACNASP**)
 - Professional Ecological Scientist Registration number 115601
- International Association for Impact Assessment (**IAIA**)
 - Registration number 5232
- South African Green Industries Council (**SAGIC**) Invasive Species training
 - Registration number 2405/2459

Employment and Experience Background

Upon completion of his studies, Rikus started his career in 2011 as an **Environmental Professional in Training (PIT) at Anglo American Thermal Coal: Environmental Services**. He received environmental training and practical implementation experience in all environmental facets of the mining industry with the focus on: Environmental rehabilitation, land management (biodiversity and invasive species eradication), waste & water-, air quality-, game reserve-, environmental management and legislation, as well as corporate reporting. He was also appointed as the Biodiversity management custodian at Anglo American Thermal Coal collieries.

He was subsequently employed by **Fraser Alexander Tailings from October 2011 to the end of November 2015 as an Environmental Contracts Manager**, where he was responsible for the technical and operational management of all Fraser Alexander Tailings' mining environmental rehabilitation work. He was responsible for all facets of project management, as well as implementation of rehabilitation and environmental strategies, by planning activities, organising physical, financial and human resources, delegating task responsibilities, leading people, controlling risks and providing technical support.

He conducted a significant amount of quantitative and qualitative ecological vegetation monitoring during his employment period with the company. Such monitoring mainly included environmentally rehabilitated mining areas in the open-cast coal-, gold-, platinum- and chrome mining industries situated in the Free State, Gauteng, Mpumalanga, North-West and Limpopo Provinces. He was involved with analysis, processing and interpretation of environmental monitoring data and compilation of high quality technical/scientific environmental monitoring reports for clients. He was subsequently further involved with providing adequate ecological management and maintenance recommendations for rehabilitated areas. He also provided technical/scientific environmental rehabilitation support to mining clients, with regards to sufficient soil preparation and amelioration, grassing processes, as well as grass species mixtures and ratios.

He was then employed by **Enviroworks Consulting from January 2016 to the end of May 2017 as a Senior Ecological Specialist** where he was responsible for virtually all Ecological, Aquatic and Wetland specialist assessments and reporting related to Environmental Impact Assessment (EIA) and Basic Assessment (BA) projects. He also completed numerous EIA and BA projects as the main project Environmental Assessment Practitioner (EAP).

Rikus then subsequently established the company EcoFocus Consulting (Pty) Ltd at the end of May 2017, which provides high quality professional environmental and ecological specialist services and solutions to the industrial development-, construction-, mining-, agricultural and other sectors.

He possesses significant qualifications, vast knowledge, skills and practical experience in the specialist field of ecological and environmental management. This, coupled with his disciplined, determined and goal-driven approach, as well as his high level of personal standards, ensure high quality, timely and outcomes-based outputs and service delivery relating to any project.

Ecological & Wetland Specialist Assessment & Report Completion for the last two years

2021

- Proposed 126.77 ha Orania Residential development project in Orania, Northern Cape Province.
- Grazing and Invasive Species Follow-up Assessment for the Farm Tweefontein no 3344, outside Newcastle, KwaZulu-Natal Province.
- Proposed 245.5 ha Kgatelopele Local Municipality Residential development project in Danielskuil, Northern Cape Province.
- Relocation of provincially protected plant species individuals for the proposed 30 ha Portion 30 of the Farm Lilyvale no 2313 Residential development project in Bloemfontein, Free State Province.
- Proposed 0.5 ha Mduwelanga Projects Agricultural development project outside Paul Roux, Free State Province.
- Proposed Moledi Gorge Watercourse Weir NEMA Section 24G development outside Derby, North West Province.
- Revision of a proposed 135 ha Farm Zulani no 167 agricultural development project outside Douglas, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Kuilenburg no 241, outside Reitz, Free State Province.

- Revision of the Biodiversity Offset Feasibility Report for a proposed 385 ha Idstone Farming agricultural development projects outside Douglas, Northern Cape Province.
- Erosion and Invasive Species Management Plan for the Farms Nebo A no 957, Tevrede no 1088, Sarona no 1089 & Uitkyk no 1119, outside Reitz, Free State Province.
- Proposed 267.2 ha Tswaing Local Municipality residential development project in Ottosdal, North West Province.
- Proposed 10.2 ha PepsiCo Inc residential development project in Marchand, Northern Cape Province.

2020

- Proposed 120 ha Northern Cape Department Agriculture Hopetown Agricultural Development outside Hopetown, Northern Cape Province.
- Proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Stormwater Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- GIS Master Layout Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Preliminary Ecological Specialist Findings and Opinion Letter for the proposed 294 ha Northern Cape Department Agriculture Bucklands Agricultural Development, Douglas Northern Cape Province.
- Proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.

- Rehabilitation and Alien Invasive Species Management Plan for a proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.
- Proposed 2064 ha Free State Strategic Solar Project Development outside Bethulie, Free State Province.
- Proposed 7.83 ha Carpe Diem Raisins NEMA Section 24G Evaporation Pond Development project outside Upington, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 7.83 ha Carpe Diem Raisins NEMA Section 24G Evaporation Pond Development project outside Upington, Northern Cape Province.
- Desktop Protected Species and Alien Invasive Species Management Plan for a proposed Northern Cape N 8 & N 10 highway maintenance project between Britstown, Prieska, Groblershoop and Upington, Northern Cape Province.
- Proposed 10.7 ha Dikgatlong Local Municipality NEMA Section 24G residential development in Barkly West, Northern Cape Province.
- Erosion and Rehabilitation Monitoring Report for the Farms Die Kranse no 1174 and De Rotsen no 52 outside Vrede, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Tweefontein no 3344, outside Newcastle, KwaZulu-Natal Province.
- Grazing and Invasive Species Management Plan for the Farm Malpha Noord no 1063, outside Senekal, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Mizpah no 706, outside Memel, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Welgelegen no 102, outside Clarens, Free State Province.
- Proposed 123 ha Slovo Park Residential development project in Brandfort, Free State Province.
- Proposed 2.43 ha Zeekoefontein Resort development project in Vaal Oewer, Gauteng Province.
- Grazing and Invasive Species Assessment for the Farm De Hoek no 1238, outside Bethlehem, Free State Province.
- Proposed 236 ha Northern Cape Department Agriculture Bucklands Agricultural Development outside Douglas, Northern Cape Province.
- Proposed 9.1 ha Motheo College Expansion NEMA Section 24G development in Bloemfontein, Free State Province.

- Proposed 84.7 ha Sol Plaatje Local Municipality Residential development project in Kimberley, Northern Cape Province.
- Proposed 201 ha Siyathemba Local Municipality Residential development project in Prieska, Northern Cape Province.
- Proposed 60.2 ha Siyancuma Local Municipality Residential development project in Douglas, Northern Cape Province.
- Proposed 58.9 ha Maremane Communal Property Association Residential development project in Maremane, Northern Cape Province.
- Proposed 15 ha Maketshemo Trading Filling Station and Truckstop development project in Winburg, Free State Province.
- Rehabilitation and Alien Invasive Species Management Plan for the Moledi Gorge Watercourse Weir decommissioning outside Derby, North West Province.
- GIS Master Layout Plan for a proposed 35 ha Gladium Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Proposed 46.5 ha Siyathemba Local Municipality Residential development project in Niekerkshoop, Northern Cape Province.
- Proposed 475 m Setsoto Local Municipality Pipeline development and water treatment works upgrade project in Clocolan, Free State Province.

2019

- Water Use License Application (WULA) Risk Assessment for a proposed Kopanong Local Municipality Bridge Upgrading development project in Philippolis, Free State Province.
- Proposed 4.9 ha Royal Vision Developments Gravel Quarry development project outside Kroonstad, Free State Province.
- Proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.
- Proposed 42.7 ha Arborlane Estates (Pty) Ltd NEMA Section 24G agricultural development project outside Augrabies, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.
- Proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.

- Watercourse delineation and report for a proposed 5.36 ha Filling Station and Shopping Centre Development project in Thaba Nchu, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Driefontein no 274, outside Ficksburg, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- GIS Master Layout Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Proposed 535 ha Farms Bultfontein & Folmink agricultural development project outside Prieska, Northern Cape Province.
- Proposed 6.42 ha Phokwane Local Municipality Residential development project in Jan Kempdorp, Northern Cape Province.
- Stormwater Management Plan for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- GIS Master Layout Plan for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- Proposed 13.8 ha Phokwane Local Municipality Cemetery expansion project in Jan Kempdorp, Northern Cape Province.
- Proposed 19.9 ha Vergenoeg NEMA Section 24G residential development project in Wesselsbron, Free State Province.
- Proposed 20.5 ha Khalinkomo NEMA Section 24G residential development project in Wesselsbron, Free State Province.
- Erosion and Rehabilitation Monitoring Report for the Farms Die Kranse no 1174 and De Rotsen no 52 outside Vrede, Free State Province.

- Grazing and Invasive Species Management Plan for the Farm Zaaihoek no 1251, outside Vrede, Free State Province.
- Grazing and Invasive Species Management Plan for Plot 19 of the Farm Ballyduff no 1594, in Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Mooiuitzicht no 205, outside Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Rietfontein no 1457, outside Bethlehem, Free State Province.
- Proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed Kopanong Local Municipality Bridge Upgrading development project in Philippolis, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Erfenis no 1014, outside Bethlehem, Free State Province.
- Proposed 35 ha Gladium Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farms Liebenbergsvlei no 148 & Aasvogelkrans no 96, outside Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Dwarsberg no 350, outside Paul Roux, Free State Province.
- Proposed 50 ha Siyathemba Local Municipality residential development project in Prieska, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 35 ha Gladium Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.

- Water Use License Application (WULA) Risk Assessment for a proposed 35 ha Gladium Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Stormwater Management Plan for a proposed 35 ha Gladium Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Waterval West no 653, outside Steynsrus, Free State Province.
- Proposed 7.6 ha Annie van den Hever NEMA Section 24G agricultural development project outside Hanover, Northern Cape Province.
- Revision of a proposed 535 ha Farms Bultfontein & Folmink agricultural development project outside Prieska, Northern Cape Province.