



Leave a future behind

Ecological Assessment Report

**Dihlabeng Local Municipality Sewer
Bridge and Pipeline Development, Paul
Roux, Free State Province**

February 2020

Compiled for:



Compiled by:

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Leave a future behind

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Executive Summary

The project applicant, Dihlabeng Local Municipality proposes to develop a new sewer pipeline of approximately 1.58 km in length within the town of Paul Roux, Free State Province. The proposed sewer pipeline will traverse the Sand River and a sewer tunnel bridge will therefore also have to be constructed directly adjacent to the existing traffic bridge, in order to convey the proposed pipeline across the watercourse. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Basic Assessment (BA) 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 significant species, habitats or wetland areas within the proposed project footprint which may be affected by the proposed development. Proposed mitigation and management measures in accordance with the NEMA (Act 107 of 1998) mitigation hierarchy must also be recommended in order to attempt to reduce/alleviate the identified potential impacts.

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist to conduct the required Ecological study for the proposed project. This report constitutes the Ecological Assessment. A site assessment for the proposed development footprint area was conducted on 13 February 2020. This date forms part of the growing season and most plant species present could therefore be successfully identified.

Methodology

The proposed sewer pipeline route and sewer bridge location was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present. 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 and the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969). Georeferenced photographs were taken of ecologically sensitive areas as well as of relevant nationally or provincially protected species if encountered in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

Potential impacts of the proposed project on the surrounding natural environment were identified, evaluated and rated. The Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the proposed project area were also assessed and rated.

Assessment Area

The proposed sewer pipeline route is approximately 1.58 km in length and is situated within the town of Paul Roux. The town forms part of the Dihlabeng Local Municipality which in turn, forms part of the Thabo Mufutsanyane District Municipality, Free State Province.

The majority of the proposed pipeline route runs parallel and directly adjacent south of the N 5 national highway while only the south-western portion diverts away from the highway. The pipeline must be constructed a minimum of 25 m away from the road centre in accordance with the information received from the EAP. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

The starting point of the proposed pipeline is situated on the Remaining Extent of the Farm Mary Ann no 712 and the finishing point on the Remaining Extent of the Farm Sekoko no 1504 (SG 21 Digit Codes: F0300000000071200000 and F0300000000150400000 respectively). The proposed pipeline route also traverses the following farm portions:

- Remaining Extent of the Farm Zandrivier no 256 (SG 21 Digit Code: F0300000000025600000)
- Remaining Extent of the Farm Wassau no 711 (SG 21 Digit Code: F0300000000071100000)
- Portion 2 of the Farm Sekoko no 1504 (SG 21 Digit Code: F0300000000150400002)

The proposed sewer tunnel bridge is located on the Remaining Extents of the Farms Zandrivier no 256 and Wassau no 711.

According to SANBI (2006-2019), the entire assessment area falls within the Eastern Free State Clay Grassland vegetation type (Gm 3) which is characterised by flat to slightly undulating and undulating/rolling closed grasslands with streams and rivers that drain the foothills of the Drakensberg. This vegetation type is classified as vulnerable because of significant transformation and degradation mostly caused by agricultural activities (SANBI, 2006-2019).

The Eastern Free State Clay Grassland vegetation type (Gm 3) is also officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December

2011). This in turn, also renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The entire assessment area falls within an Ecological Support Area two (ESA 2) in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, 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 that play an important role in delivering ecosystem services (Collins, 2017).

Results and Conclusion

The proposed sewer tunnel bridge will be constructed directly adjacent to the existing traffic bridge of the N 5 national highway which traverses the Sand River. The Sand River constitutes a significant perennial watercourse and forms an important part of the regional surface water catchment- and drainage area. The small portion of the River where the sewer tunnel bridge is to be constructed, mainly constitutes an aquatic environment dominated by aquatic and hydrophytic vegetation.

Virtually the entire portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway (majority of pipeline), is situated within a significantly sized wetland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). The relevant vegetation type is officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

Although continuous grazing by cattle from the local community takes place within the hydrophytic grassy wetland area, no signs of any significant overgrazing are evident and the wetland seems to be in a relatively healthy and stable condition.

This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway. Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional impact to the wetland.

A small artificially constructed earth dam is also present directly adjacent south of the most north-easterly portion of the proposed pipeline route, which dams up a small ephemeral water drainage line. The drainage line however continues to flow through the earth dam overflow and underneath the N 5 national highway in a northerly directly. The proposed pipeline route will therefore also traverse this small water drainage line.

The remaining south-western portion of the proposed pipeline route which diverts away from the N 5 national highway, mainly runs along the boundary fence of the adjacently located cemetery. This portion constitutes a terrestrial area associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

The portion running along the cemetery boundary fence as well as the most southerly portion of the proposed pipeline route is however in a slightly disturbed state caused by anthropogenic disturbances such as historic fence, road and pipeline construction.

The remaining terrestrial portions of the proposed pipeline route support undisturbed relatively natural grassland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

With the exception of the provincially protected species *Helichrysum rugulosum* only found to be present within the remaining relatively undisturbed natural portions of the terrestrial grassland, no Red Data Listed species or any other species of conservational significance were found to be present within the proposed sewer tunnel bridge area or along the proposed pipeline route. The area also 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>).

Although no important bird species were identified during the site assessment, the Sand River and wetland support an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes. Significant numbers of eyed pansy butterfly individuals (*Junonia orithya*) were found to be present within the wetland area.

The assessment area therefore scored a moderate EIS value and is viewed as being of moderate to high conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, the Sand River regional surface water catchment- and drainage area as well as the important ecological services provided by the wetland and the associated important aquatic habitat.

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the broader continuous wetland area to the south and the small portion of the Sand River. It is imperative that the degree and duration of the construction impacts of the proposed development on the small portion of the Sand River, the wetland area and the remaining undisturbed relatively natural terrestrial grassland portions be minimised as far as practicably possible. The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the Sand River and wetland and to ensure the continued ecological functionality and -integrity of the terrestrial grassland.

It is the opinion of the specialist that the proposed development should not pose any potentially significant long term cumulative ecological impacts which cannot be suitably reduced and mitigated to within acceptable residual levels. The only potentially significant ecological impacts associated with the impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line as well as the inhibiting of the ecological services provided by the wetland, can be suitably reduced and mitigated to within acceptable residual levels.

The project should therefore be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigations measures as per this ecological report must however be adequately implemented and managed for the remainder of the construction phase and subsequent operational phase. All necessary authorisations, permits and licenses must also be obtained as soon as reasonably and practicably possible.

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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 of 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
NCPSBP	Northern Cape Provincial Spatial Biodiversity Plan 2016
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 project
- 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 project 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, Dihlabeng Local Municipality proposes to develop a new sewer pipeline of approximately 1.58 km in length within the town of Paul Roux, Free State Province. The proposed sewer pipeline will traverse the Sand River and a sewer tunnel bridge will therefore also have to be constructed directly adjacent to the existing traffic bridge, in order to convey the proposed pipeline across the watercourse. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Basic Assessment (BA) 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 significant species, habitats or wetland areas within the proposed project footprint which may be affected by the proposed development. Proposed mitigation and management measures in accordance with the NEMA (Act 107 of 1998) mitigation hierarchy must also be recommended in order to attempt to reduce/alleviate the identified potential impacts.

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

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

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

2. Date and Season of Ecological Site Assessment

A site assessment for the proposed development footprint area was conducted on 13 February 2020. This date forms part of the growing season and most plant species present could therefore be successfully identified.

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 project area was therefore conducted in order to determine and quantify the impacts of the development on the natural environment in the area.

4. Objectives of the Assessment

Ecological and habitat survey:

- Describe the vegetation on 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.
- Determine and discuss the Present Ecological State (PES) and extent of degradation and/or transformation of the vegetation on the assessment area and surrounding areas. Also indicate the Ecological Importance and Sensitivity (EIS) of the assessment area in order to provide an indication of the conservational significance of the assessment area.
- Identify and delineate all watercourses/wetland areas potentially present within the assessment area.
- Identify, evaluate and rate the potential ecological impacts of the proposed development on the natural environment.
- Provide recommendations on mitigation and management measures in order to attempt to reduce/alleviate these identified potential ecological impacts.
- Provide recommendations on the suitability of the proposed development area.
- A digital report (this document) as well as the digital KML files of any identified ecologically sensitive/conservationally significant areas will be provided to the applicant.

5. Methodology

- The proposed sewer pipeline route and sewer bridge location were assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present.
- 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 and the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969).
- Georeferenced photographs were taken of ecologically sensitive areas as well as of relevant 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 proposed project area was assessed and rated 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 proposed project area was assessed and rated 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, and 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 impacts of the proposed project on the surrounding natural environment were identified, evaluated and rated 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 potential environmental 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>

<p>Extent of Positive or Negative Impact</p>	<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>
<p>Irreplaceability of Natural Resources being impacted upon</p>	<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>
<p>Reversibility of Impact</p>	<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>
<p>Probability of Impact Occurrence</p>	<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>
<p>Cumulative Impact</p>	<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 potential ecological impact, the Significance Score of each potential ecological 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 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 were identified and delineated on the proposed project areas 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 proposed sewer pipeline route is approximately 1.58 km in length and is situated within the town of Paul Roux. The town forms part of the Dihlabeng Local Municipality which in turn, forms part of the Thabo Mufutsanyane District Municipality, Free State Province.

The majority of the proposed pipeline route runs parallel and directly adjacent south of the N 5 national highway while only the south-western portion diverts away from the highway. The pipeline must be constructed a minimum of 25 m away from the road centre in accordance with the information received from the EAP. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

The starting point of the proposed pipeline is situated on the Remaining Extent of the Farm Mary Ann no 712 and the finishing point on the Remaining Extent of the Farm Sekoko no 1504 (SG 21 Digit Codes: F0300000000071200000 and F03000000000150400000 respectively). The proposed pipeline route also traverses the following farm portions:

- Remaining Extent of the Farm Zandrivier no 256 (SG 21 Digit Code: F0300000000025600000)
- Remaining Extent of the Farm Wassau no 711 (SG 21 Digit Code: F0300000000071100000)
- Portion 2 of the Farm Sekoko no 1504 (SG 21 Digit Code: F03000000000150400002)

The proposed sewer tunnel bridge is located on the Remaining Extents of the Farms Zandrivier no 256 and Wassau no 711.

See locality map below.

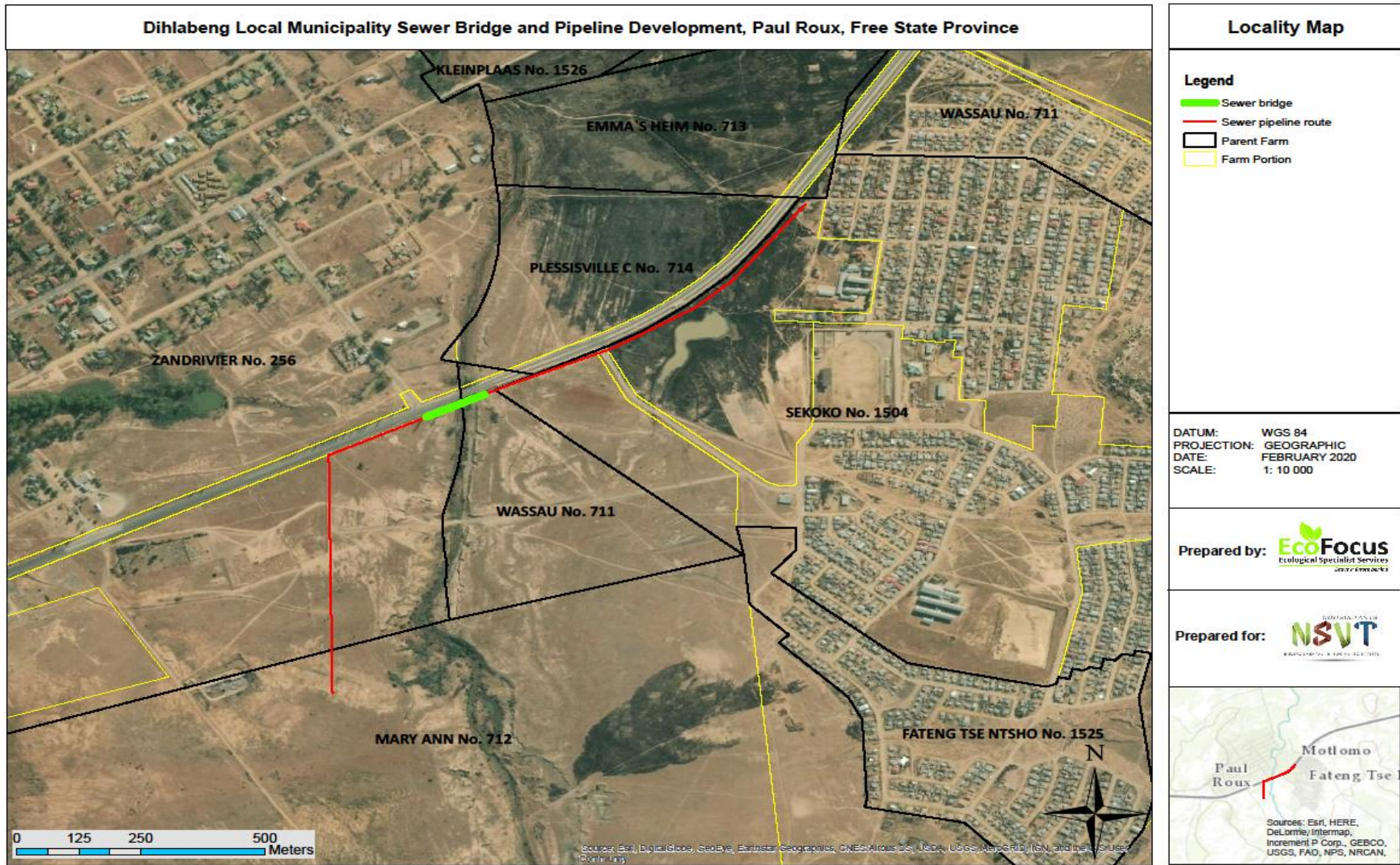


Figure 1: Locality map illustrating the assessment area (see A3 sized map in the Appendices)

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 688 mm (www.climate-data.org). The maximum average monthly temperature is approximately 20.7°C in the summer months while the minimum average monthly temperature is approximately 7.8°C during the winter. Maximum daily temperatures can reach up to 27.6°C in the summer months and dip to as low as -1.3°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:

Mudstones, sandstones and shale of the Beaufort Group. Glenrosa, Bonheim, Avalon and Mayo soils dominate outcrops and slightly elevated areas. Mayour landtypes are Bb, Bd and Ca.

6.3. Vegetation and Conservation Status

According to SANBI (2006-2019), the entire assessment area falls within the Eastern Free State Clay Grassland vegetation type (Gm 3) which is characterised by flat to slightly undulating and undulating/rolling closed grasslands with streams and rivers that drain the foothills of the Drakensberg. This vegetation type is classified as vulnerable because of significant transformation and degradation mostly caused by agricultural activities (SANBI, 2006-2019).

The Eastern Free State Clay Grassland vegetation type (Gm 3) is also officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This in turn, also renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The entire assessment area falls within an Ecological Support Area two (ESA 2) in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, 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 that play an important role in delivering ecosystem services (Collins, 2017).

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route.

See vegetation and conservation status maps below.

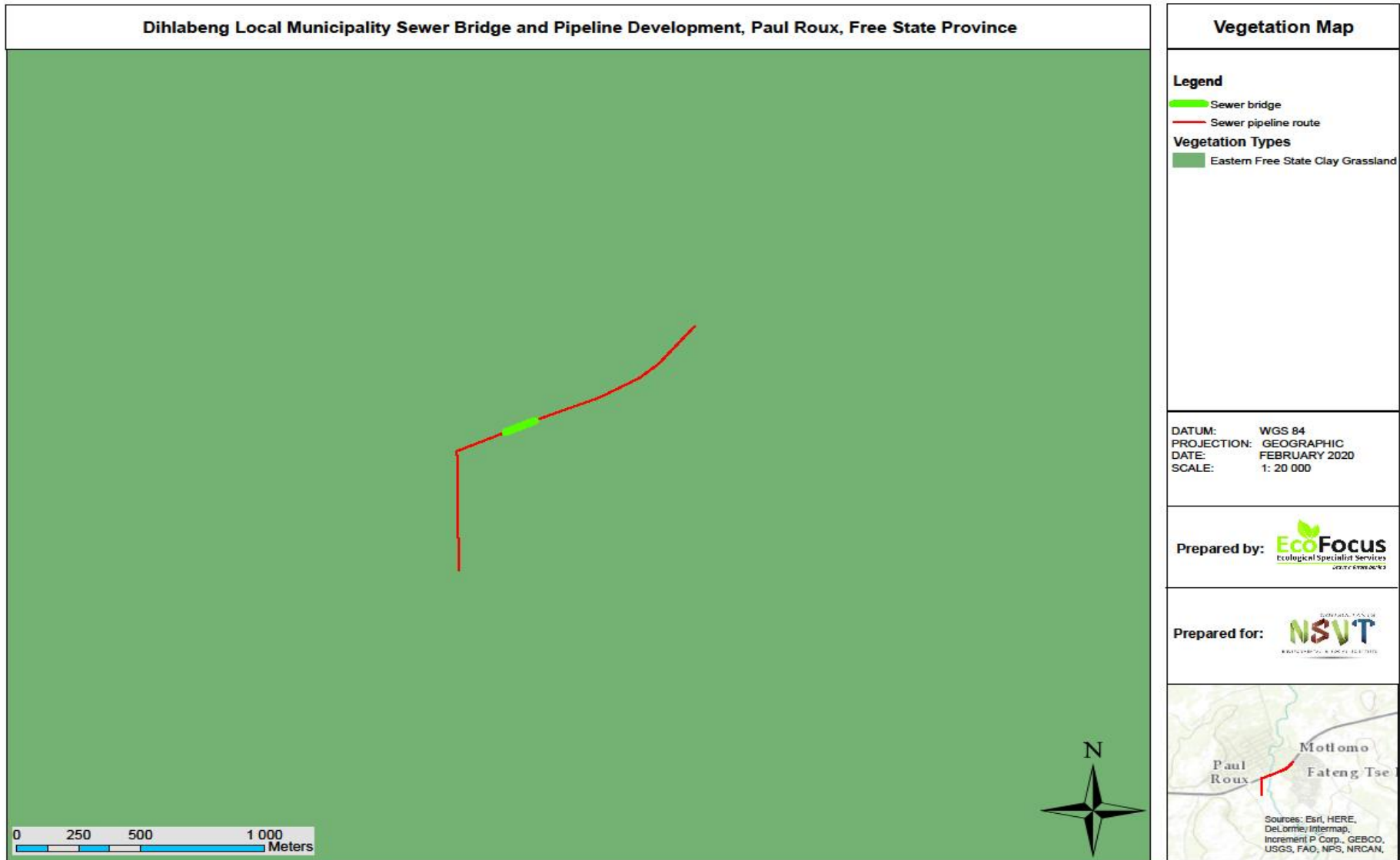


Figure 2: Vegetation map illustrating the vegetation type associated with the assessment area (see A3 sized map in the Appendices)

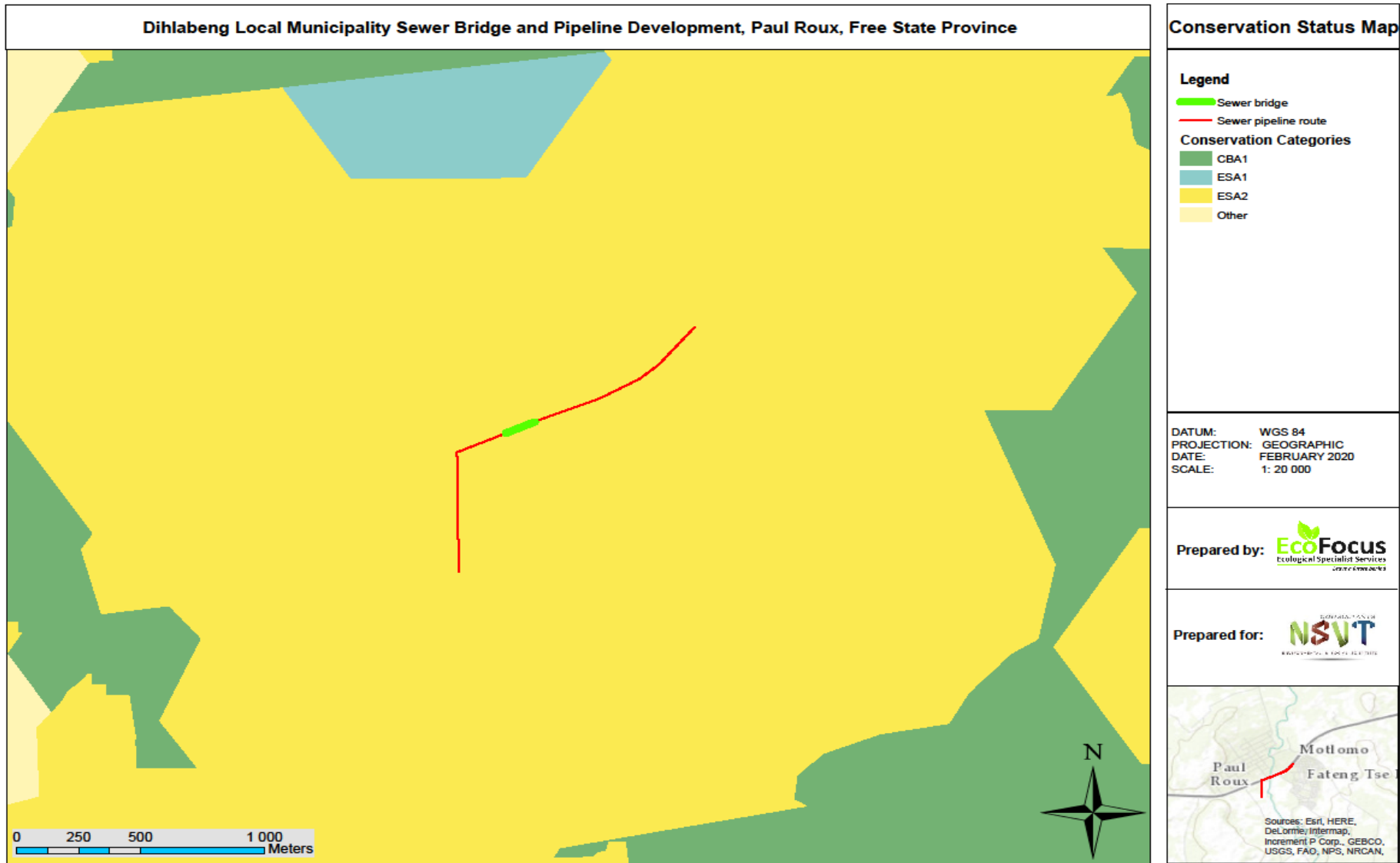


Figure 3: Conservation status map illustrating the conservation status associated with the assessment area (see A3 sized map in the Appendices)

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 by the applicant to the ecological specialist was correct and valid at the time that it was provided.
- the proposed project area as provided by the applicant, 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 Basic Assessment process, determined that the proposed development footprint represents potentially suitable and technically acceptable locations.
- the public, local communities, relevant organs of state and landowners will receive a sufficient reoccurring opportunity to participate and comment on the proposed project 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 project is based on strategic national, provincial and local plans and policies which reflect the interests of both statutory and public viewpoints.
- the BA 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 project.
- 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 a BA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the BA process, namely process-related and prediction-related.

- Uncertainty of prediction is critical at the data collection phase as observations and conclusions are made, only 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 study process was undertaken prior to the availing of certain information which would only be derived from the final project design and layout. The design layout had not been finalised yet at the time of the ecological study.
- The potential of future similar developments in the same geographical area, which could lead to cumulative impacts cannot be meaningfully anticipated.

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 based on professional specialist opinion.

8. Results and Discussion

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route.

8.1. Sewer Tunnel Bridge

8.1.1. Current Existing Vegetation and Site Description

The proposed sewer tunnel bridge will be constructed directly adjacent to the existing traffic bridge of the N 5 national highway which traverses the Sand River. The Sand River constitutes a significant perennial watercourse and forms an important part of the regional surface water catchment- and drainage area. The small portion of the River where the sewer tunnel bridge is to be constructed, mainly constitutes an aquatic environment dominated by aquatic and hydrophytic vegetation.

No significant woody component is present and merely a small number of tree individuals of the legally declared invasive species *Populus spp.* (Category 2) and the exotic species *Salix babylonica* are sparsely present within the broader landscape.

Individuals of the legally declared invasive species *Rosa rubiginosa* (Category 1b) are also sparsely present within the proposed sewer tunnel bridge area. All individuals of this legally declared invasive species must be actively eradicated from the proposed sewer tunnel bridge area and adequately disposed of in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014.

The proposed sewer tunnel bridge area is mainly dominated by the aquatic species *Typha capensis*, *Phragmites australis* & *Cyperus spp.* Other hydrophytic grass species also found to be present on the banks of the River include *Eragrostis plana*, *Paspalum dilatatum* & *Sporobolus africanus*.

No Red Data Listed species or any other species of conservational significance were found to be present within the proposed sewer tunnel bridge area. The area also 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>).

Although no important bird species were identified during the site assessment, the River supports an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes.

It is therefore imperative that the degree and duration of the construction impacts of the proposed development on the small portion of the Sand River be minimised as far as practicably possible. The development footprint through this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through this portion must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse.

See photographs below.



Figure 4: Two images illustrating the aquatic environment associated with the area where the proposed sewer tunnel bridge will traverse the Sand River

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

The Present Ecological State (PES) of the proposed sewer tunnel bridge area is classified as Class B as it is largely natural. A small change in natural habitats and biota may have taken place due to the presence of the N 5 national highway and the subsequent existing traffic bridge which traverses the Sand River, but the ecosystem functionality has remained essentially unchanged.

The Ecological Importance and Sensitivity (EIS) of the proposed sewer tunnel bridge area is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local or possibly provincial scale mainly due to the Sand River forming an important part of the regional surface water catchment- and drainage area and subsequently supporting an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes.

The proposed sewer tunnel bridge area is therefore viewed as being of moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type as well as the Sand River regional surface water catchment- and drainage area and the associated important aquatic habitat.

8.2. Pipeline Route

8.2.1. Current Existing Vegetation and Site Description

The localised area forms part of a broad surface water catchment- and drainage area surrounding the Sand River, which flows from the south towards the north. Virtually the entire portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway (majority of pipeline), is situated within a significantly sized wetland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway.

A small artificially constructed earth dam is also present directly adjacent south of the most north-easterly portion of the proposed pipeline route, which dams up a small ephemeral water drainage line. The drainage line however continues to flow through the earth dam overflow and underneath the N 5 national highway in a northerly directly. The proposed pipeline route will therefore also traverse this small water drainage line.

The wetland area is mainly dominated by the hydrophytic grass species *Eragrostis plana*, *Paspalum dilatatum*, *Sporobolus africanus* & *Themeda triandra* while clumps of the aquatic species *Cyperus spp.* are also scattered along the proposed pipeline route. Other grass species also found to be present include *Eragrostis curvula*, *E chloromelas*, *E obtusa*, *E gummiflua*, *Cynodon dactylon*, *Chloris gayana*, *Aristida spp.*, *Digitaria eriantha* & *Setaria spp.*

Although continuous grazing by cattle from the local community takes place within the hydrophytic grassy wetland area, no signs of any significant overgrazing are evident and the wetland seems to be in a relatively healthy and stable condition.

Forb species found to be present include *Felicia filifolia*, *Felicia sp.*, *Berkheya rigida*, *B radula*, *Conyza bonariensis*, *C podocephala*, *Hermannia depressa*, *Ruschia hamata*, *Gomphocarpus fruticosus*, *Scabiosa columbaria*, *Verbena aristigera*, *Salvia repens*, *Gerbera piloselloides*, *Rumex crispus*, *Hibiscus trionum* & *Geigeria aspera*.

Individuals of the legally declared invasive species *Verbena bonariensis*, *Rosa rubiginosa*, *Datura stramonium* & *Argemone mexicana* (all Category 1b) were also found to be sparsely scattered along the proposed pipeline route. All individuals of these legally declared invasive species must be actively eradicated from the proposed pipeline route and adequately disposed of in accordance with

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

No Red Data Listed species or any other species of conservational significance were found to be present along the wetland portion of the proposed pipeline route. The area also 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>).

Although no important bird species were identified during the site assessment, the wetland supports an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes. Significant numbers of eyed pansy butterfly individuals (*Junonia orithya*) were found to be present within the wetland area.

Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional impact to the wetland. It is however recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the broader continuous wetland area to the south. It is imperative that the degree and duration of the construction impacts of the proposed development on the wetland area be minimised as far as practicably possible. The development footprint through this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through this portion must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the wetland.

See photographs below.



Figure 5: Two Images illustrating the presence of the wetland along the portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway



Figure 6: Two images illustrating the presence of the small artificially constructed earth dam which is present directly adjacent to the most north-easterly portion of the proposed pipeline route as well as the small ephemeral water drainage line which flows through the earth dam and underneath the N 5 national highway

The remaining south-western portion of the proposed pipeline route which diverts away from the N 5 national highway, mainly runs along the boundary fence of the adjacently located cemetery. This portion constitutes a terrestrial area associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

The portion running along the cemetery boundary fence as well as the most southerly portion of the proposed pipeline route is however in a slightly disturbed state caused by anthropogenic disturbances such as historic fence, road and pipeline construction.

See photographs below.



Figure 7: Two images illustrating examples of the slightly disturbed and overgrazed state of the proposed pipeline route portion running along the cemetery boundary fence as well as the most southerly portion of the proposed pipeline route

The remaining terrestrial portions of the proposed pipeline route support undisturbed relatively natural grassland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). The grassland area is mainly dominated by the grass species *Themeda triandra* & *Eragrostis spp.* while other terrestrial grass species similar to those of the wetland area are also present.

The forb species composition is also relatively similar to that of the wetland area while additional forbs species also found to be present include *Hibiscus microcarpus*, *Ledebouria luteola* and the provincially protected species *Helichrysum rugulosum*.

With the exception of the provincially protected species *Helichrysum rugulosum*, no Red Data Listed species or any other species of conservational significance were found to be present along the terrestrial portion of the proposed pipeline route. The area also 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 important bird species, unique or specialised bird habitats were observed or are expected to utilise the assessment areas for breeding and/or persistence purposes.

Although no Red Data Listed species or any other species of conservational significance were found to be present along the terrestrial portion of the proposed pipeline route, the relevant Eastern Free State Clay Grassland vegetation type (Gm 3) is officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

It is therefore imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions be minimised as far as practicably possible. The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued ecological functionality and -integrity of the terrestrial grassland.

See photographs below.



Figure 8: Two images illustrating examples of the of the remaining undisturbed relatively natural terrestrial grassland portions along the proposed pipeline route

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

The Present Ecological State (PES) of the majority of the proposed pipeline route is classified as Class B as it is largely natural. A small change in natural habitats and biota may have taken place due to the presence of the N 5 national highway, the cemetery boundary fence as well as historic road and pipeline construction, but the ecosystem functionality has remained essentially unchanged.

The Ecological Importance and Sensitivity (EIS) of the wetland portion of the proposed pipeline route is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local or possibly provincial scale mainly due to the important ecological services provided by the wetland and it subsequently supporting an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes.

The wetland portion of the proposed pipeline route is therefore viewed as being of moderate to high conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type as well as the ecological services provided and the associated important aquatic habitat.

The Ecological Importance and Sensitivity (EIS) of the terrestrial grassland portion of the proposed pipeline route is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local or possibly provincial scale mainly due to the presence of the relevant Eastern Free State Clay Grassland vegetation type (Gm 3), which is officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The terrestrial grassland portion of the proposed pipeline route is therefore viewed as being of moderate conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem and broader vegetation type.

8.3. Ecological Site Sensitivity Map

The site sensitivity map below illustrates the locations of the Sand River, the small artificially constructed earth dam and associated small ephemeral water drainage line, the wetland portion of the proposed pipeline route as well as the disturbed and remaining undisturbed terrestrial grassland portions of the proposed pipeline route.

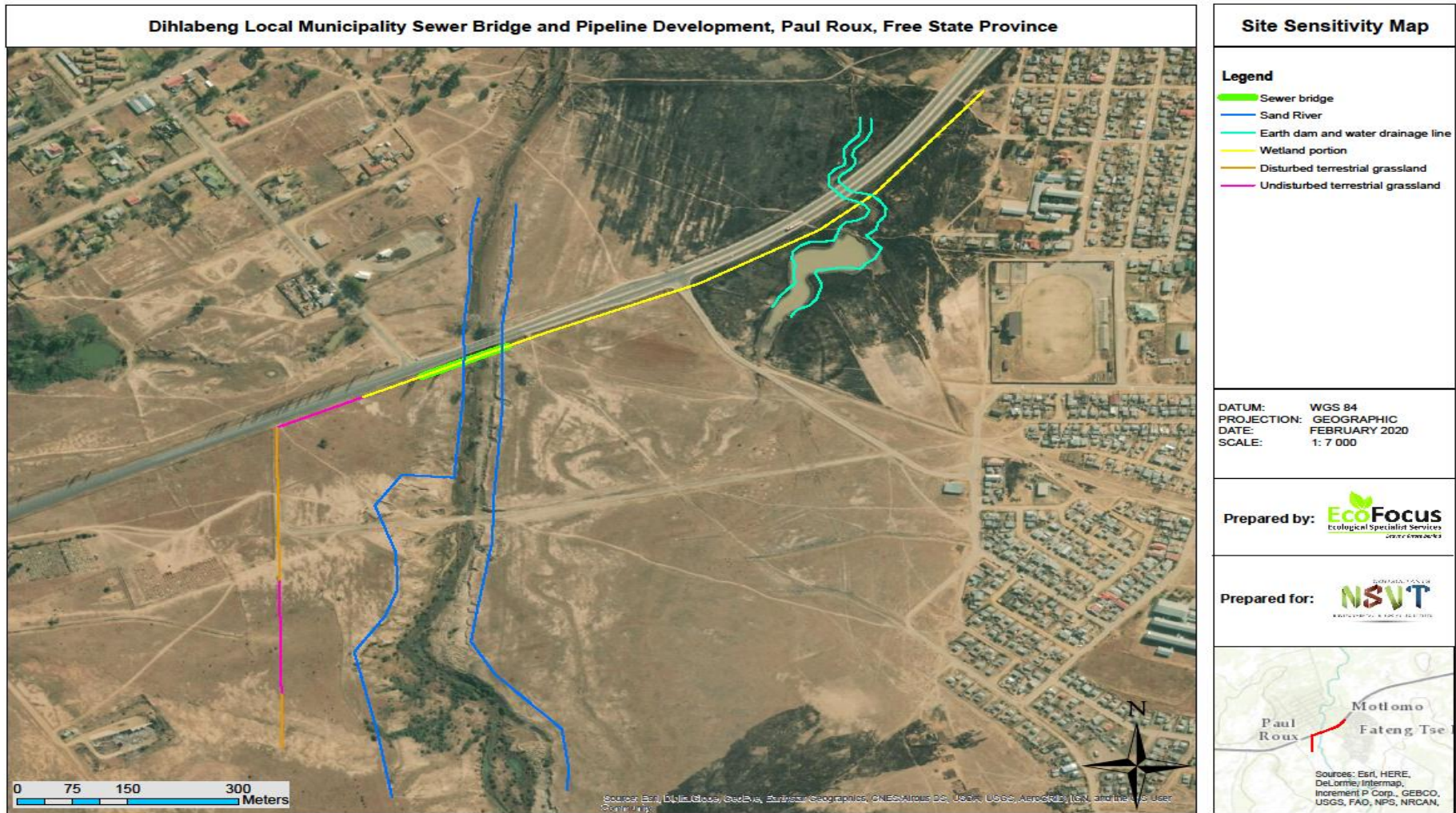


Figure 9: Site sensitivity map illustrating the locations of the Sand River, the small artificially constructed earth dam and associated small ephemeral water drainage line, the wetland portion of the proposed pipeline route as well as the disturbed and remaining undisturbed terrestrial grassland portions of the proposed pipeline route (see A3 sized map in the Appendices)

8.4. Species List for the Assessment Area

Table 5: Species list for the assessment area (Legally declared invasive species highlighted in pink)

Graminoids	Forbs	Shrubs & trees
<i>Aristida spp.</i>	<i>Argemone mexicana</i>	<i>Populus spp.</i>
<i>Chloris gayana</i>	<i>Berkheya radula</i>	<i>Rosa rubiginosa</i>
<i>Cynodon dactylon</i>	<i>Berkheya rigida</i>	<i>Salix babylonica</i>
<i>Cyperus spp.</i>	<i>Conyza bonariensis</i>	-
<i>Digitaria eriantha</i>	<i>Conyza podocephala</i>	-
<i>Eragrostis chloromelas</i>	<i>Datura stramonium</i>	-
<i>Eragrostis curvula</i>	<i>Felicia filifolia</i>	-
<i>Eragrostis gummiflua</i>	<i>Felicia spp.</i>	-
<i>Eragrostis obtusa</i>	<i>Geigeria aspera</i>	-
<i>Eragrostis plana</i>	<i>Gerbera piloselloides</i>	-
<i>Paspalum dilatatum</i>	<i>Gomphocarpus fruticosus</i>	-
<i>Phragmites australis</i>	<i>Helichrysum rugulosum</i>	-
<i>Setaria spp.</i>	<i>Hermannia depressa</i>	-
<i>Sporobolus africanus.</i>	<i>Hibiscus microcarpus</i>	-
<i>Themeda triandra</i>	<i>Hibiscus trionum</i>	-
<i>Typha capensis</i>	<i>Ledebouria luteola</i>	-
-	<i>Rumex crispus</i>	-
-	<i>Ruschia hamata</i>	-
-	<i>Salvia repens</i>	-
-	<i>Scabiosa columbaria</i>	-
-	<i>Verbena aristigera</i>	-
-	<i>Verbena bonariensis</i>	-

9. Ecological Impact Assessment

The following section identifies the potential ecological impacts (both positive and negative) which the proposed project 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 project 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 implement of effective management strategies for them.

9.1. Construction Phase

Transformation of vegetation along the proposed sewer tunnel bridge and sewer pipeline route associated with the Eastern Free State Clay Grassland vegetation type (Gm 3)

The majority of the proposed pipeline route constitutes an undisturbed relatively natural grassland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). It therefore scored a relatively high PES value. The portion running along the cemetery boundary fence as well as the most southerly portion of the proposed pipeline route is however in a slightly disturbed state caused by anthropogenic disturbances such as historic fence, road and pipeline construction.

The relevant vegetation type is officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within

the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The significance of this potential impact will be low for the sewer tunnel bridge but medium for the sewer pipeline route.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Transformation of an Ecological Support Area two (ESA 2) associated with the assessment area

The entire assessment area falls within an Ecological Support Area two (ESA 2) in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province.

The area scored a moderate EIS value and is therefore viewed as being of moderate to high conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, the Sand River regional surface water catchment- and drainage area as well as the important ecological services provided by the wetland and the associated important aquatic habitat.

This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway. Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional impact to the wetland.

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The significance of this potential impact will be medium.

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

With the exception of the provincially protected species *Helichrysum rugulosum* only found to be present within the remaining relatively undisturbed natural portions of the terrestrial grassland, no Red Data Listed species or any other species of conservational significance were found to be present within the proposed sewer tunnel bridge area or along the proposed pipeline route. The area also 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>).

Although no important bird species were identified during the site assessment, the Sand River and wetland support an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes. Significant numbers of eyed pansy butterfly individuals (*Junonia orithya*) were found to be present within the wetland area.

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Terrestrial and aquatic alien invasive species establishment

No significant establishments of any alien invasive species were found to be present within the assessment area. Merely a small number of tree individuals of the legally declared invasive species *Populus spp.* (Category 2) are sparsely present within the broader landscape surrounding the proposed sewer tunnel bridge area while individuals of the legally declared invasive species *Rosa rubiginosa* (Category 1b) are also sparsely present within the proposed sewer tunnel bridge area.

Individuals of the legally declared invasive species *Verbena bonariensis*, *Rosa rubiginosa*, *Datura stramonium* & *Argemone mexicana* (all Category 1b) were also found to be sparsely scattered along the proposed pipeline route.

The assessment area and surrounding areas could however potentially be prone to significant alien invasive species establishment due to surface disturbances caused by construction activities. The presence of the Sand River and small ephemeral water drainage line could further also potentially act as significant transport/distribution vectors for numerous terrestrial and aquatic invasive species into the broader region.

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 is relatively flat to slightly sloping. The narrow linear section of the proposed pipeline route should not pose significant risk of potential surface soil erosion due to the loosening of materials and clearance of vegetation caused by construction activities which usually binds surface material.

The proposed sewer tunnel bridge area could however potentially be prone to significant soil erosion due to the flow of the Sand River.

The significance of this potential impact will be zero for the sewer pipeline route but medium for the sewer tunnel bridge.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line

The proposed sewer tunnel bridge will be constructed directly adjacent to the existing traffic bridge of the N 5 national highway which traverses the Sand River. The Sand River constitutes a significant perennial watercourse and forms an important part of the regional surface water catchment- and drainage area.

The localised area forms part of a broad surface water catchment- and drainage area surrounding the Sand River, which flows from the south towards the north. Virtually the entire portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway (majority of pipeline), is situated within a significantly sized wetland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway.

A small artificially constructed earth dam is also present directly adjacent south of the most north-easterly portion of the proposed pipeline route, which dams up a small ephemeral water drainage line. The drainage line however continues to flow through the earth dam overflow and underneath the N 5 national highway in a northerly directly. The proposed pipeline route will therefore also traverse this small water drainage line.

The activities associated with the construction phase could potentially result in contamination and impeding of natural surface water flow towards the north due to artificial obstruction of flow during rainfall events and hydrocarbon or other chemical spills by construction machinery and equipment.

The significance of this potential impact will be medium for the sewer pipeline route but medium-high for the sewer tunnel bridge.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Inhibiting of the ecological services provided by the wetland

Virtually the entire portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway (majority of pipeline), is situated within a significantly sized wetland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

The wetland portion of the proposed pipeline route scored a moderate EIS value and is therefore viewed as being of moderate to high conversational significance mainly due to the important ecological services provided by the wetland and it subsequently supporting an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes.

This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway. Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional impact to the wetland.

The development of the proposed pipeline will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The significance of this potential impact will be medium-high for the sewer pipeline route but medium for the sewer tunnel bridge.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.2. Operational Phase

Once the construction phase has been completed, there should be no significant additional potential ecological impacts associated with the operational phase over and above the already discussed long term impacts of the construction phase. The impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line as well as the inhibiting of the ecological services provided by the wetland, were identified and addressed during the construction phase as significant potential long term ecological impacts.

A number of identified potential ecological impacts could however change in nature and increase in significance from the construction phase into the operational phase and will continue throughout the entire lifespan and operational phase of the proposed project. The following additional potential ecological impacts could therefore take place during the operational phase:

Continued impeding of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line

The established sewer pipeline and sewer tunnel bridge of the proposed development could potentially continuously impede on the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line due to continued artificial obstruction of natural surface water flow during rainfall events.

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

Mitigation measures to reduce impacts are recommended under heading 9.4.

Continued inhibiting of the ecological services provided by the wetland

The established sewer pipeline and sewer tunnel bridge of the proposed development could potentially continuously inhibit the ecological services provided by the wetland due to continued artificial obstruction of natural surface water flow during rainfall events.

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

Mitigation measures to reduce impacts are recommended under heading 9.4.

Sewage contamination of soil and groundwater, the Sand River catchment and drainage area as well as the wetland

The established sewer pipeline and sewer tunnel bridge of the proposed development could potentially result in contamination of the soil and groundwater, the Sand River catchment and drainage area as well as the wetland with sewage in the event of pipe leakages or overflows.

The significance of this potential impact will be medium for the sewer pipeline route but zero for the sewer tunnel bridge.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line as well as the inhibiting of the ecological services provided by the wetland, were identified and addressed as the only significant potential long term ecological impacts which could cumulatively add to the existing negative impacts on the broader regional surface water catchment- and drainage area of the Sand River.

This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway. Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional cumulative impact to the wetland.

It is however recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the broader continuous wetland area to the south. It is imperative that the degree and duration of the construction impacts of the proposed development on the wetland area be minimised as far as practicably possible. The development footprint through this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through this portion must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the wetland.

It is the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all these 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 mitigations measures as per this ecological report are adequately implemented and managed for both the construction and operational phases of the proposed project. All necessary authorisations, permits and licenses must also be obtained prior to any commencement.

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 for the proposed project both before and after implementation of the recommended mitigation measures.

9.4.1. Construction Phase

Table 6: Environmental Risk and Significance Ratings

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Transformation of vegetation along the proposed sewer tunnel bridge and sewer pipeline route associated with the Eastern Free State Clay Grassland vegetation type (Gm 3)		
Magnitude of Negative or Positive Impact	Very low (2)	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	Site specific (1)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	-
Reversibility of Impact	Low (4)	Low (4)	-
Probability of Impact Occurrence	Medium (3)	High (4)	-
Cumulative Impact Rating prior to mitigation	Low	Medium	-

Environmental Significance Score and Rating prior to mitigation	Low (45)	Medium (64)	-
Mitigation Measures to be implemented	<p>It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the relevant vegetation type, the broader continuous wetland area to the south and the small portion of the Sand River.</p> <p>It is imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions, the broader continuous wetland area to the south and the small portion of the Sand River be minimised as far as practicably possible.</p> <p>The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.</p> <p>No unnecessary/unauthorised footprint expansion into the surrounding undeveloped areas outside the proposed development footprint may take place.</p> <p>No site construction basecamps may be established within the surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, - machinery or -equipment operate or impact within the surrounding undeveloped areas outside the cordoned off area.</p>		

	<p>Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.</p> <p>Existing roads 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 surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>The construction footprint through all these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland as well as to ensure the continued ecological functionality and -integrity of the terrestrial grassland. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>Low</p>	<p>-</p>
<p>Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (28)</p>	<p>Low (28)</p>	<p>-</p>

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Transformation of an Ecological Support Area two (ESA 2) associated with the assessment area		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	-
Reversibility of Impact	Low (4)	Low (4)	-
Probability of Impact Occurrence	Medium (3)	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	Low	-
Environmental Significance Score and Rating prior to mitigation	Medium (51)	Medium (51)	-

Mitigation Measures to be implemented	<p>It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the relevant vegetation type, the broader continuous wetland area to the south and the small portion of the Sand River.</p> <p>It is imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions, the broader continuous wetland area to the south and the small portion of the Sand River be minimised as far as practicably possible.</p> <p>The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.</p> <p>No unnecessary/unauthorised footprint expansion into the surrounding undeveloped areas outside the proposed development footprint may take place.</p> <p>No site construction basecamps may be established within the surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, - machinery or -equipment operate or impact within the surrounding undeveloped areas outside the cordoned off area.</p> <p>Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.</p>
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	<p>Existing roads 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 surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>The construction footprint through all these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland as well as to ensure the continued ecological functionality and -integrity of the terrestrial grassland. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>Low</p>	<p>-</p>
<p>Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (28)</p>	<p>Low (28)</p>	<p>-</p>

	Sewer tunnel bridge	Pipeline route	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	Very low (2)	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	-
Reversibility of Impact	Low (4)	Low (4)	-
Probability of Impact Occurrence	Low (2)	Low (2)	-
Cumulative Impact Rating prior to mitigation	Low	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (45)	Low (45)	-

Mitigation Measures to be implemented	<p>A Provincial Flora Permit has to be obtained from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA) for the removal/destruction of all the provincially protected species <i>Helichrysum rugulosum</i> individuals, prior to the commencement of any construction activities.</p> <p>It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the relevant vegetation type, the broader continuous wetland area to the south and the small portion of the Sand River.</p> <p>It is imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions, the broader continuous wetland area to the south and the small portion of the Sand River be minimised as far as practicably possible.</p> <p>The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.</p> <p>No unnecessary/unauthorised footprint expansion into the surrounding undeveloped areas outside the proposed development footprint may take place.</p> <p>No site construction basecamps may be established within the surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, - machinery or -equipment operate or impact within the surrounding undeveloped areas outside the cordoned off area.</p>
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	<p>Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities.</p> <p>Existing roads 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 surrounding undeveloped areas outside the proposed development footprint and specifically not within the broader continuous wetland area to the south.</p> <p>The construction footprint through all these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland as well as to ensure the continued ecological functionality and -integrity of the terrestrial grassland. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (14)	Low (14)	-

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Terrestrial and aquatic alien invasive species establishment		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	-
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Medium (3)	Medium (3)	-
Reversibility of Impact	High (2)	High (2)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium (64)	Medium (64)	-

Mitigation Measures to be implemented	<p>All the identified alien invasive species individuals must be actively eradicated from the assessment area and adequately disposed of in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014.</p> <p>Implement an adequate Alien Invasive Species Establishment 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>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant alien invasive species establishment. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
Cumulative Impact Rating after mitigation implementation	<p>Low</p>	<p>Low</p>	<p>-</p>
Environmental Significance Score and Rating after mitigation implementation	<p>Low (12)</p>	<p>Low (12)</p>	<p>-</p>

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Surface material erosion		
Magnitude of Negative or Positive Impact	Medium (6)	-	-
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	High (4)	-	-
Cumulative Impact Rating prior to mitigation	Medium	-	-
Environmental Significance Score and Rating prior to mitigation	Medium (64)	-	-

<p>Mitigation Measures to be implemented</p>	<p>Adequate stormwater and erosion management measures must be implemented for the proposed sewer tunnel bridge area during the construction and operational phases. This must be done in order to sufficiently manage stormwater runoff in order to prevent any significant erosion from occurring.</p> <p>Areas within and immediately surrounding the proposed sewer tunnel bridge area must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant alien invasive species establishment. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>	<p>-</p>
<p>Environmental Significance Score and Rating after mitigation implementation</p>	<p>Low (11)</p>	<p>-</p>	<p>-</p>
	<p>Sewer tunnel bridge</p>	<p>Pipeline route</p>	<p>No-go alternative</p>
<p>Identified Environmental Impact</p>	<p>Impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line</p>		
<p>Magnitude of Negative or Positive Impact</p>	<p>High (8)</p>	<p>Medium (6)</p>	<p>-</p>
<p>Duration of Negative or Positive Impact</p>	<p>Short term (2)</p>	<p>Short term (2)</p>	<p>-</p>

Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	-
Reversibility of Impact	Medium (3)	Medium (3)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium-High	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (80)	Medium (72)	-
Mitigation Measures to be implemented	<p>Adequate stormwater and erosion management measures must be implemented for the entire assessment area during the construction and operational phases. This must be done to ensure and sufficiently manage storm water runoff, clean/dirty water separation towards the Sand River, wetland and the small ephemeral water drainage line in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland.</p> <p>It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the relevant vegetation type, the broader continuous wetland area to the south and the small portion of the Sand River.</p>		

It is imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions, the broader continuous wetland area to the south and the small portion of the Sand River be minimised as far as practicably possible.

Where the proposed sewer tunnel bridge traverses the Sand River, it is recommended that the pipeline be placed over the watercourse on aboveground elevated concrete slabs in order to ensure the continued flow and ecological integrity of the watercourse.

The construction footprint through all these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.

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 Sand River, wetland and small ephemeral water drainage line.

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 emergency spill procedures must be developed and all relevant construction personnel must be sufficient trained on- and apply these procedures during the entire construction phase.

	<p>A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation in accordance with the National Water Act (Act 36 of 1998).</p> <p>A comprehensive South African Scoring System 5 (SASS 5) aquatic bio-monitoring assessment must be conducted of the Sand River directly downstream of the proposed project area prior to commencement of the construction phase. This information will serve as baseline watercourse health data to be used for subsequent monitoring assessments to be conducted. Such an assessment must be conducted by a suitably qualified and experienced ecologist.</p> <p>Water samples of the Sand River must be collected directly downstream of the proposed project area prior to commencement of the construction phase. The quality of these samples must be chemically and biologically analysed by an accredited laboratory in order to serve as baseline water quality data to be used for subsequent monitoring assessments to be conducted.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (30)	Low (30)	-

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Inhibiting of the ecological services provided by the wetland		
Magnitude of Negative or Positive Impact	Medium (6)	High (8)	-
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	-
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	-
Reversibility of Impact	Medium (3)	Medium (3)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	Medium-High	-
Environmental Significance Score and Rating prior to mitigation	Medium (72)	Medium-High (80)	-

Mitigation Measures to be implemented	<p>Adequate stormwater and erosion management measures must be implemented for the entire assessment area during the construction and operational phases. This must be done to ensure and sufficiently manage storm water runoff, clean/dirty water separation towards the Sand River, wetland and the small ephemeral water drainage line in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland.</p> <p>It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the relevant vegetation type, the broader continuous wetland area to the south and the small portion of the Sand River.</p> <p>It is imperative that the degree and duration of the construction impacts of the proposed development on the remaining undisturbed relatively natural terrestrial grassland portions, the broader continuous wetland area to the south and the small portion of the Sand River be minimised as far as practicably possible.</p> <p>Where the proposed sewer tunnel bridge traverses the Sand River, it is recommended that the pipeline be placed over the watercourse on aboveground elevated concrete slabs in order to ensure the continued flow and ecological integrity of the watercourse.</p> <p>The construction footprint through all these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the watercourse and wetland. A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p> <p>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 Sand River, wetland and small ephemeral water drainage line.</p>
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	<p>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.</p> <p>Adequate hydrocarbon and other chemical storage, handling, usage and emergency spill procedures must be developed and all relevant construction personnel must be sufficient trained on- and apply these procedures during the entire construction phase.</p> <p>A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation in accordance with the National Water Act (Act 36 of 1998).</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (30)	Low (30)	-

9.4.2. Operational Phase

Table 7: Environmental Risk and Significance Ratings

	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Continued impeding of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line		
Magnitude of Negative or Positive Impact	High (8)	Medium (6)	-
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	-
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	-
Reversibility of Impact	Medium (3)	Medium (3)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium-High	Medium-High	-

Environmental Significance Score and Rating prior to mitigation	Medium-High (84)	Medium-High (76)	-
Mitigation Measures to be implemented	If all the recommended mitigations 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 watercourse and wetland.		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (32)	Low (32)	-
	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Continued inhibiting of the ecological services provided by the wetland		
Magnitude of Negative or Positive Impact	Medium (6)	High (8)	-
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	-

Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	-
Reversibility of Impact	Medium (3)	Medium (3)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium-High	Medium-High	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (76)	Medium-High (84)	-
Mitigation Measures to be implemented	If all the recommended mitigations measures for the construction phase are adequately implemented and managed, it should prove sufficient in preventing any continued inhibiting of- or significant impact on the ecological services provided by the wetland.		
Cumulative Impact Rating after mitigation implementation	Low	Low	-

Environmental Significance Score and Rating after mitigation implementation	Low (32)	Low (32)	-
	Sewer tunnel bridge	Pipeline route	No-go alternative
Identified Environmental Impact	Sewage contamination of soil and groundwater, the Sand River catchment and drainage area as well as the wetland		
Magnitude of Negative or Positive Impact	-	High (8)	-
Duration of Negative or Positive Impact	-	Medium term (3)	-
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	-	Medium (3)	-

Cumulative Impact Rating prior to mitigation	-	Medium	-
Environmental Significance Score and Rating prior to mitigation	-	Medium (66)	-
Mitigation Measures to be implemented	<p>Adequate leakage detection and prevention measures must be implemented for the pipeline in order to detect any potential leakages and subsequent contamination of underground water, the Sand River of the wetland.</p> <p>The integrity of the pipeline must be inspected on a minimum biannual basis (twice a year) in order to ensure that there is no risk of leakages or overflows occurring. If any leakages or compromises to the integrity of the pipeline are detected, these issues must immediately be resolved and the leakages repaired. The competent authority must also immediately be notified of any such leakages.</p> <p>Contaminated areas must also be rehabilitated as soon as practicably possible after detection. A suitably qualified and experienced ecologist must be appointed to advise on- and oversee the rehabilitation process.</p> <p>A comprehensive South African Scoring System 5 (SASS 5) aquatic bio-monitoring assessment must be conducted of the Sand River directly downstream of the proposed project area on a minimum annual basis in order to ensure that the ecological functionality and integrity of the watercourse is maintained. This information must then be compared to the baseline data collected during the initial assessment prior to the commencement of the operational phase. Such an assessment must be conducted by a suitably qualified and experienced ecologist.</p> <p>Water samples of the Sand River must be collected directly downstream of the proposed project area on a minimum annual basis. The quality of these samples must be chemically and biologically analysed by an accredited laboratory and compared to</p>		

	<p>the baseline data collected during the initial assessment prior to the commencement of the operational phase.</p> <p>If any reduction in SASS 5 scores (watercourse health) or chemical and biological water quality is determined due to the project, 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/health reduction as soon as practicably possible.</p>		
Cumulative Impact Rating after mitigation implementation	-	Low	-
Environmental Significance Score and Rating after mitigation implementation	-	Low (19)	-

10. Summary and Conclusion

The proposed sewer tunnel bridge will be constructed directly adjacent to the existing traffic bridge of the N 5 national highway which traverses the Sand River. The Sand River constitutes a significant perennial watercourse and forms an important part of the regional surface water catchment- and drainage area. The small portion of the River where the sewer tunnel bridge is to be constructed, mainly constitutes an aquatic environment dominated by aquatic and hydrophytic vegetation.

Virtually the entire portion of the proposed pipeline route which runs parallel and directly adjacent south of the N 5 national highway (majority of pipeline), is situated within a significantly sized wetland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3). The relevant vegetation type is officially classified as a nationally listed vulnerable ecosystem type in accordance with the Department of Environmental Affairs' (DEA) List of Nationally Threatened Ecosystems (Government Gazette No 34809, 9 December 2011). This renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

Although continuous grazing by cattle from the local community takes place within the hydrophytic grassy wetland area, no signs of any significant overgrazing are evident and the wetland seems to be in a relatively healthy and stable condition.

This large wetland area has however been fragmented into a northern and southern portion by the presence of the N 5 national highway. Due to the already fragmented nature of the large wetland area, the development of the proposed pipeline should not pose any significant additional impact to the wetland.

A small artificially constructed earth dam is also present directly adjacent south of the most north-easterly portion of the proposed pipeline route, which dams up a small ephemeral water drainage line. The drainage line however continues to flow through the earth dam overflow and underneath the N 5 national highway in a northerly direction. The proposed pipeline route will therefore also traverse this small water drainage line.

The remaining south-western portion of the proposed pipeline route which diverts away from the N 5 national highway, mainly runs along the boundary fence of the adjacently located cemetery. This portion constitutes a terrestrial area associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

The portion running along the cemetery boundary fence as well as the most southerly portion of the proposed pipeline route is however in a slightly disturbed state caused by anthropogenic disturbances such as historic fence, road and pipeline construction.

The remaining terrestrial portions of the proposed pipeline route support undisturbed relatively natural grassland associated with the relevant Eastern Free State Clay Grassland vegetation type (Gm 3).

With the exception of the provincially protected species *Helichrysum rugulosum* only found to be present within the remaining relatively undisturbed natural portions of the terrestrial grassland, no Red Data Listed species or any other species of conservational significance were found to be present within the proposed sewer tunnel bridge area or along the proposed pipeline route. The area also 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>).

Although no important bird species were identified during the site assessment, the Sand River and wetland support an important aquatic habitat which is likely utilised by a wide variety of specialised waterbirds, amphibian species and aquatic invertebrates for breeding, foraging and persistence purposes. Significant numbers of eyed pansy butterfly individuals (*Junonia orithya*) were found to be present within the wetland area.

The assessment area therefore scored a moderate EIS value and is viewed as being of moderate to high conversational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, the Sand River regional surface water catchment- and drainage area as well as the important ecological services provided by the wetland and the associated important aquatic habitat.

The development of the proposed pipeline and bridge will only directly impact on and transform a narrow linear section along the route. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

It is recommended that the proposed pipeline be constructed as close as possible to the N 5 national highway in order to restrict the impact and prevent significant impact on the broader continuous wetland area to the south and the small portion of the Sand River. It is imperative that the degree and duration of the construction impacts of the proposed development on the small portion of the Sand River, the wetland area and the remaining undisturbed relatively natural terrestrial grassland portions be minimised as far as practicably possible. The development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and subsequent ecological functionality and -integrity of the Sand River and wetland and to ensure the continued ecological functionality and -integrity of the terrestrial grassland.

It is the opinion of the specialist that the proposed development should not pose any potentially significant long term cumulative ecological impacts which cannot be suitably reduced and mitigated to within acceptable residual levels. The only potentially significant ecological impacts associated with the impeding and contamination of the flow regimes of the Sand River, the wetland and the small ephemeral water drainage line as well as the inhibiting of the ecological services provided by the wetland, can be suitably reduced and mitigated to within acceptable residual levels.

The project should therefore be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigations measures as per this ecological report must however be adequately implemented and managed for the remainder of the construction phase and subsequent operational phase. All necessary authorisations, permits and licenses must also be obtained as soon as reasonably and practicably possible.

11. References

Collins, N.B. 2017. Free State Province Biodiversity Plan: CBA map. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

Collins, N.B. 2017. 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)

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

National Environmental Management: Biodiversity Act (Act 10 of 2004); National list of ecosystems that are threatened and in need of protection, Government Gazette No 34809, 9 December 2011

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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)

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
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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

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- 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, which provides high quality professional environmental and ecological specialist services and solutions to the industrial development-, construction-, mining-, agricultural and other sectors, at the end of May 2017.

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 mind-set, 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

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.

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.

2018

- Proposed 30 ha Portion 30 of the Farm Lilyvale no 2313 Residential development project in Bloemfontein, Free State Province.
- Proposed 20 ha Luckhoff Waste Facility development project in Luckhoff, Free State Province.

- Proposed 19 ha agricultural development project outside Griekwastad, Northern Cape Province.
- Proposed 135 ha agricultural development project outside Griekwastad, Northern Cape Province.
- Five proposed Dawid Kruiper Local Municipality Residential Developments around Upington, Northern Cape Province.
- Grazing and Erosion Management Plan for the Farm Retiefs Nek no 123, outside Bethlehem, Free State Province.
- Grazing and Erosion Management Plan for the Farm Dekselfontein no 317, outside Bethlehem, Free State Province.
- Proposed 12 ha agricultural development project in Petrusville, Northern Cape Province.
- Proposed 270 ha industrial park development project in Secunda, Mpumalanga Province.
- Proposed 233 ha industrial park development project in Sabie, Mpumalanga Province.
- Proposed Dawid Kruiper Local Municipality Residential Development around Upington, Northern Cape Province.
- Two proposed 15 ha agricultural development projects outside Hopetown, Northern Cape Province.
- Two Alien Invasive Species Management Plans for two proposed 15 ha agricultural development projects outside Hopetown, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 15 ha agricultural development project outside Hopetown, Northern Cape Province.
- Proposed 169 ha industrial park development project in Sabie, Mpumalanga Province.
- Grazing and Erosion Management Plan for the Farm Barnea no 231, outside Bethlehem, Free State Province.
- GIS locality, vegetation and sensitivity map for the proposed 7.13 ha Karoo Hoogland Local Municipality Residential Development project in Sutherland, 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.
- Drafting of an official Environmental Policy for Teambo Facilitators (Pty) Ltd in Bloemfontein, Free State Province.
- Proposed 11.6 ha COGHSTA NEMA Section 24G residential development project in Douglas, Northern Cape Province.
- Proposed 3.26 ha COGHSTA NEMA Section 24G residential development project in Strydenburg, Northern Cape Province.

- Proposed 25.6 ha COGHSTA NEMA Section 24G residential development project in Loxton, Northern Cape Province.
- Biodiversity offset feasibility assessment and report for a proposed 805 ha agricultural development project outside Douglas, Northern Cape Province.
- Proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Ecological exemption letter for the proposed Vanderkloof Tegnologie Chicken Abattoir development project in Petrusville, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Stormwater and Erosion Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Revision of a proposed 17.7 ha Luckhoff Waste Facility development project in Luckhoff, Free State Province.
- Proposed 113.3 ha Dawn Valley Estate development project in Bloemfontein, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Klipfontein no 71, outside Lindley, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Meyerskop no 1801, outside Bethlehem, Free State Province.
- Proposed 2.24 ha Mullerstuine Cemetery development project in Vanderbijlpark, Gauteng Province.
- Species of Special Concern & Alien Invasive Species assessment and report for all the Transnet Engineering Group 5 Free State Province Sites.
- Species of Special Concern & Alien Invasive Species assessment and report for all the Transnet Engineering Group 6 Northern Cape Province Sites.
- Proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Proposed 545 ha residential development project in Leandra, Mpumalanga Province.
- Proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.

- Water Use License Application (WULA) Risk Assessment for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- Protected Species Relocation Management Plan for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Grazing Management Plan for the Farm Fairdale no 1048, outside Vrede, Free State Province.
- Proposed 14.4 ha Frankfort Landfill Site expansion project in Frankfort, Free State Province.