



*Leave a future behind*

# Rehabilitation and Alien Invasive Species Management Plan

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

February 2020

Compiled for:



Compiled by:

Rikus Lamprecht

Ecological Specialist (Pr.Sci.Nat)

EcoFocus Consulting

072 230 9598

**EcoFocus Consulting (Pty) Ltd**

Registration : 2017/223847/07

7 Edenglen, Waterberg Street, Langenhovenpark, Bloemfontein, 9330

T 072 230 9598

E ajhlamprecht@gmail.com

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## Abbreviations

BA	Basic Assessment
CBA	Critical Biodiversity Area
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
ESA	Ecological Support Area
NEMA	National Environmental Management Act (Act 107 of 1998)
ONA	Other Natural Areas
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  $\leq 1.5$  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.

A site assessment for the development footprint area was conducted on 13 February 2020 and the final Ecological Assessment Report was subsequently completed and submitted on 24 February 2020.

## 2. Management Plan Rational

Environmental rehabilitation mainly constitutes the reparation of a previously disturbed area in order to attempt to re-establish the necessary ecosystem processes and restore ecological functionality, productivity and services. Depending on the level of disturbance, it is most often not possible to immediately restore a previously disturbed area to its original ecological and functional state but active artificial intervention assists in paving the way for- and accelerating the natural ecological succession and restoration processes.

Best rehabilitation practice is usually based on rehabilitating areas concurrently and as soon as practicably possible after the disturbance has ceased. This approach assists in preventing significant deterioration of important growth medium/soil physical, chemical and biological qualities and characteristics which are ultimately required to support the re-establishment of vegetation and ecological functionality associated with the area.

Delays and the lack of concurrent rehabilitation processes will also promote the undesired establishment and spreading of opportunistic alien invasive plant species. Alien species are either non-indigenous plant, animal or invertebrate species which were introduced to the country in the past or they can even be indigenous species which have been translocated to outside its natural distribution range due to human intervention. Invasive species constitute such alien species as described above which cause or have the potential to cause environmental, economic or harm to human health. Such invasive species have the potential to rapidly establish themselves at the cost of indigenous species. This results in damage to ecosystems and habitats, loss of biodiversity and often in the case of plant species, excessive water consumption in a country already classified as semi-arid.

The National Environmental Management: Biodiversity Act (Act 10 Of 2004); Alien and Invasive Species Regulations, 2014 & Lists, 2016 legally governs the management of alien invasive species. It lists 383 invasive plant species into four categories that must be managed, controlled or eradicated from areas where they may cause harm to the indigenous environment. These four categories are:

- Category 1a: Invasive species which must be combated and eradicated. Any form of trade or planting is strictly prohibited.
- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited.

- Category 2: Invasive species or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees. Plants in riparian areas are Cat 1b.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade is however prohibited. Plants in riparian areas are Cat 1b.

In order to ensure legislative compliance, disturbed areas should be adequately rehabilitated and alien invasive species which may establish on the assessment areas during the continued construction phase and subsequent operational phase, need to be sufficiently managed in accordance with the requirements of the legal categories into which they fall. Adequate planning and a structured, systematic approach to alien invasive species management forms a crucial aspect in ensuring the success of the process. Poor planning can significantly increase the cost involved as well as negatively impact on the desired success of the process. It is therefore imperative that a structured and practically implementable management plan be followed.



### **3. Objectives of the Rehabilitation and Alien Invasive Species Management Plan**

- Provide management and monitoring guidelines for ecological rehabilitation of the disturbed areas within and surrounding the assessment area.
- Prevention of significant alien invasive species establishment and spreading during the continued construction phase and subsequent operational phase of the proposed development.

#### 4. 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  $\leq 1.5$  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: F03000000000025600000)
- Remaining Extent of the Farm Wassau no 711 (SG 21 Digit Code: F03000000000071100000)
- 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.

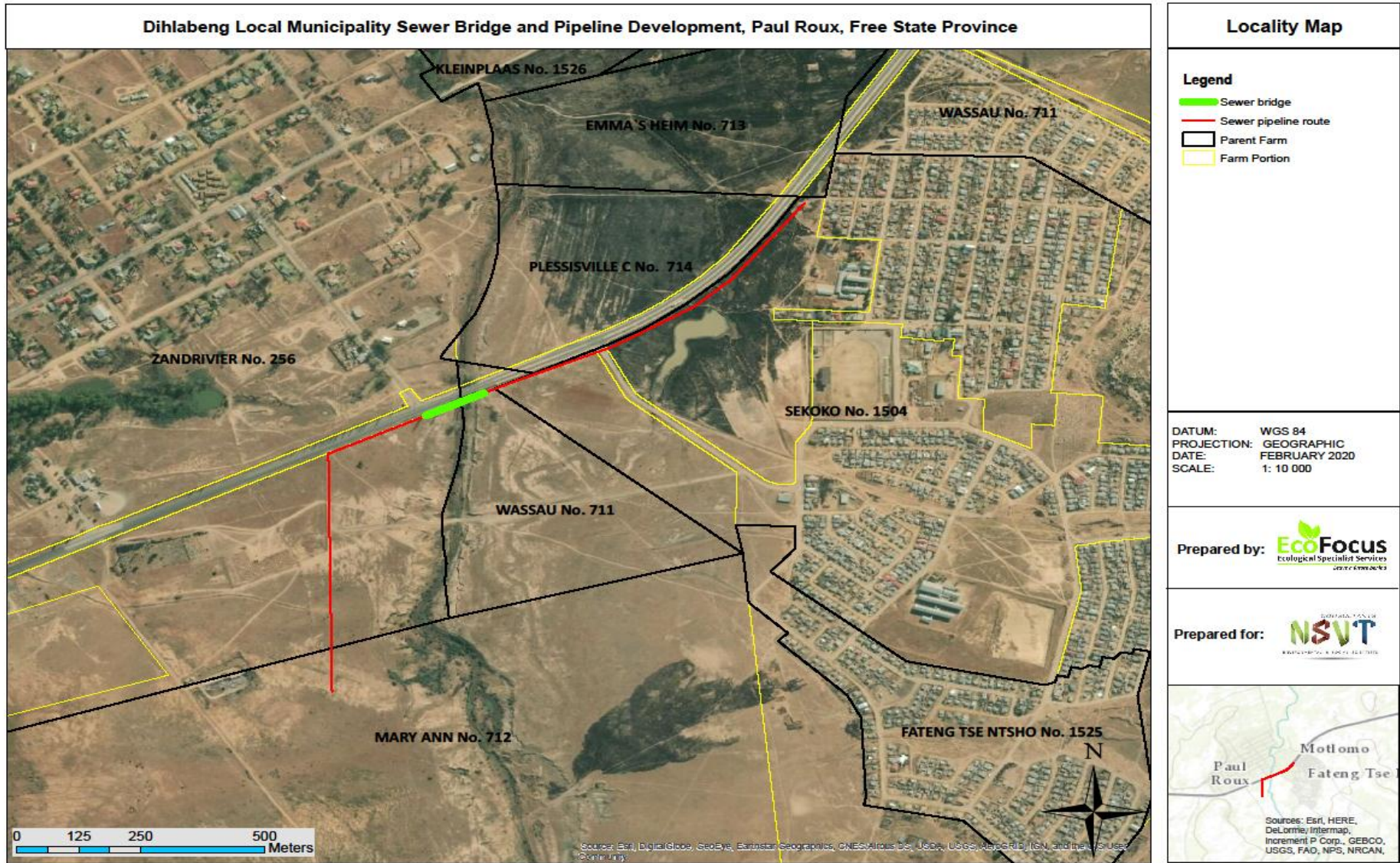


Figure 1: Locality map illustrating the assessment area (see A3 sized map in the Appendices)

#### 4.1. 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](http://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.

#### 4.2. 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.

#### 4.3. 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.

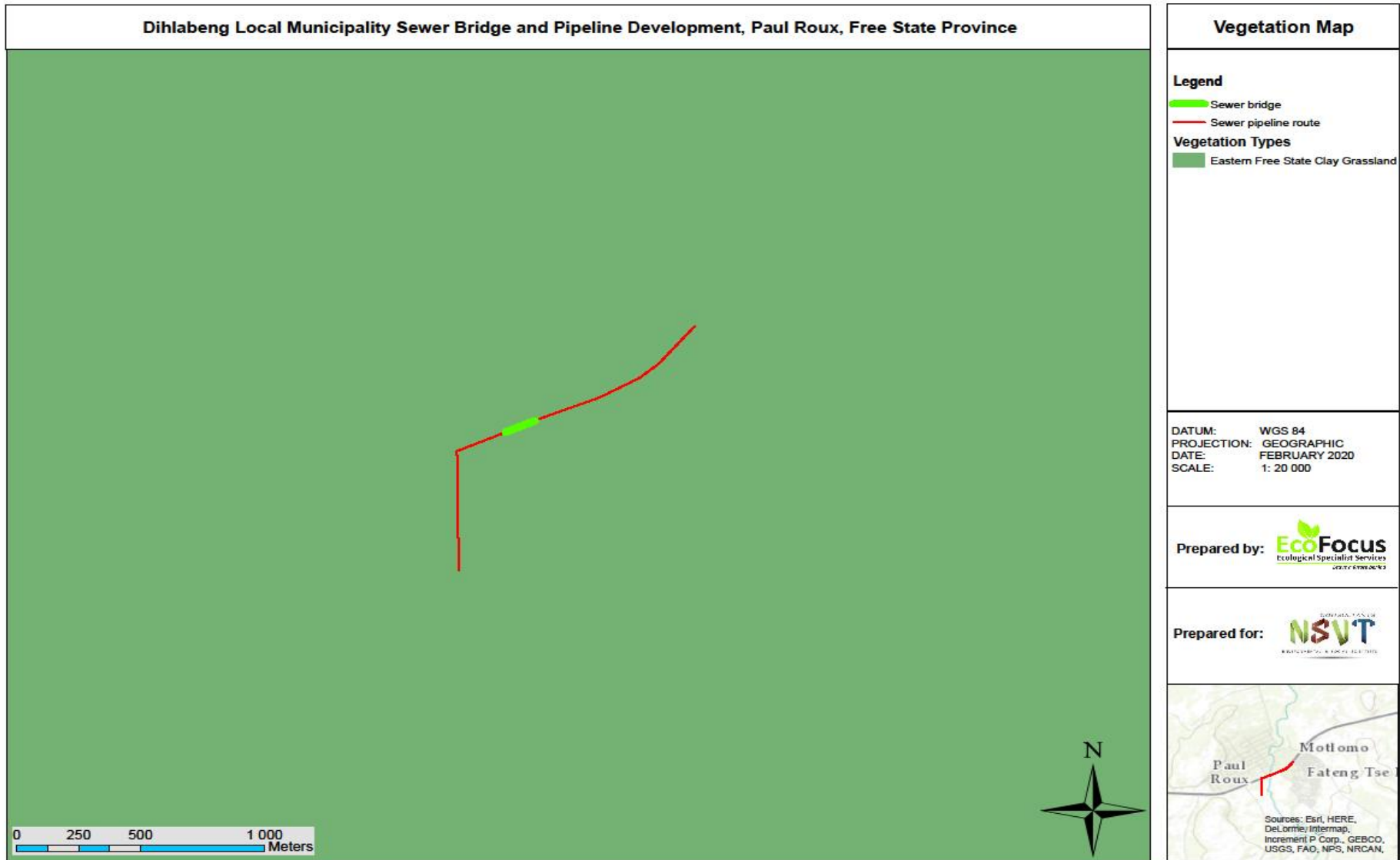


Figure 2: Vegetation map illustrating the vegetation type associated with the assessment area (see A3 sized map in the Appendices)

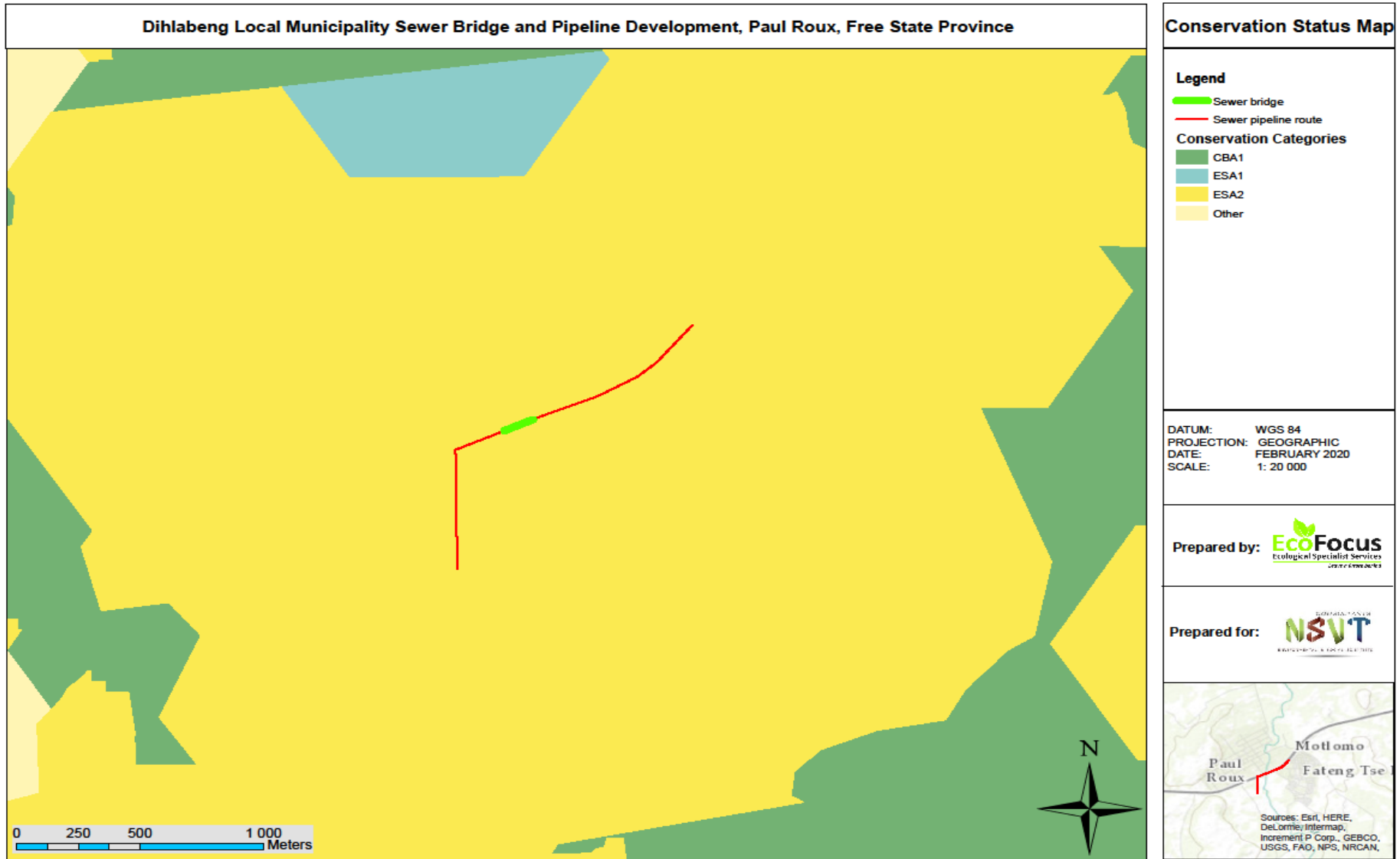


Figure 3: Conservation status map illustrating the conservation status associated with the assessment area (see A3 sized map in the Appendices)

## 5. Findings of the Ecological Assessment Report

### Ecological Rehabilitation

- **Sewer tunnel bridge**

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 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.

- **Pipeline route**

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.

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.

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.



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*, 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.

### **Alien Invasive Species**

At the time of the site visit, 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.

All of these 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.

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.

## 6. Ecological Rehabilitation Management Process

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 ecological rehabilitation processes of these two main areas of the development namely the sewer tunnel bridge and pipeline route, will be discussed separately.

### 6.1. Rehabilitation of the Sewer Tunnel Bridge Area

Soils will be loosened and excavated within the Sand River bed and against the adjacent banks of the River as a result of construction activities. These loosened materials must be consolidated and vegetation must be adequately re-established within the River bed and on the River banks. The following steps must be taken during the consolidation and re-establishment process:

#### Soil Consolidation, Preparation and Amelioration

- If significant volumes of soils are to be excavated and removed from the adjacent Sand River banks where the sewer tunnel bridge will traverse the River, these topsoil materials must be adequately stockpiled within the terrestrial area surrounding the River.
- The flow of the River must be adequately diverted away from- and around the small construction footprint during construction in order to ensure the continued flow through underneath the N 5 national highway. This should prevent any significant impeding of the River and subsequently ensure the continued ecological functionality and -integrity of the River. Under no circumstances may the continued flow of the River be completely impeded for any short amount of time. This diversion should also prevent any significant contamination of the River by dirty surface water runoff due to the loosening of materials on the River banks.
  - Sandbags must be stacked in order to adequately channel the continued flow of the River around the small construction footprint.
- After the sewer tunnel bridge infrastructure construction has been completed, adequate reshaping of the surface topography on disturbed areas within the River bed and against the adjacent River banks must be conducted as soon as practicably possible.
  - The final surface topography of the disturbed areas must be mechanically shaped to restore the original pre-construction flow regime of the River. This must be done in

order to ensure the continued natural free flowing surface water drainage of the River as was present prior to construction. This will prevent undesired and unnatural ponding/accumulation of stationary water and also reduce the risk of surface erosion caused by unmanaged and unnatural flow regimes.

- If required, gabion retaining walls must subsequently be implemented where significant disturbance has taken place against the River banks directly adjacent to the sewer tunnel bridge up- and downstream. These gabion retaining walls must adequately prevent significant soil erosion from occurring against the River banks.
- If required, gabion mattresses must be implemented downstream of the sewer tunnel bridge within the River bed.
  - It is however unlikely that this will be required as the natural aquatic vegetation within the River bed should sufficiently manage the continued natural flow of the River.
- After implementation of the gabions has been completed (if required), adequate placing of the stockpiled topsoil materials on disturbed areas must be conducted as soon as practicably possible.
  - The placed topsoil must, as far as practicably possible, not be significantly compacted during the placing process as this will complicate the final grass seeding process by preventing adequate seed germination and root penetration.
- Photographs must be taken of all the individual steps.

Although the stockpiled materials will likely not lay dormant for an extended period of time, it is still recommended that an adequate fertiliser mixture be manually top-dressed over the prepared areas, as this will ensure that the macro-nutrients required for sufficient plant growth are made available. This must be conducted as soon as practicably possible after placing of the stockpiled topsoil at the commencement of the new growing season to follow.

- **2:3:4 (33) + Zn fertiliser** must be evenly distributed/spread over the prepared surface areas. This must be done manually by hand at a **ratio of 100 g/m<sup>2</sup>**.
  - It is recommended that industrial buckets be filled with fertilisers and used for the manual amelioration and spreading process.
  - Buckets must be weighed to ensure the desired fertiliser volumes are achieved over the areas.
  - If the areas are unnecessarily over-fertilised, it could have a negative financial implication on the applicant.

- If the areas are under-fertilised, the macro-nutrients required for sufficient plant growth might not be provided to the disturbed areas which could result in lower seed germination and grass establishment success.
- Photographs must be taken of all the individual steps.

### Grass seeding

A suitable seed mixture of indigenous grass species needs to be planted on the prepared and ameliorated areas in order to consolidate and bind the newly placed topsoil materials and subsequently prevent erosion from occurring. The correct selection of species tolerant to the specific conditions is essential to ensure successful establishment on the modified growth medium. It is also important that a good combination of pioneer (annual) as well as sub-climax and climax (perennial) species be used.

The seeding process must be conducted as soon as practicably possible and concurrently with the fertilising of the areas at the commencement of the new growing season to follow. If the seeding process is delayed, it will provide an opportunity for undesired alien invasive species to obtain a germination and establishment 'head-start'/advantage over the desired grasses. This will subsequently complicate the invasive species management process as significantly more weeds will establish than would have been the case if grass seeding was done immediately and concurrently with fertilising.

- It is recommended that the following seed mixture be evenly distributed/spread, manually by hand, over the ameliorated areas.
  - *Eragrostis teff* (Teff) (uncoated seed) 2 kg/ ha
  - *Chloris gayana* (Rhodes grass) (coated seed) 3 kg/ ha
  - *Digitaria eriantha* (Smutsfinger grass) (coated seed) 5 kg/ ha
  - *Cenchrus ciliaris* (Foxtail buffalo grass) (coated seed) 5 kg/ ha
  - *Cynodon dactylon* (Couch grass) (coated seed) 3 kg/ ha
  - *Medicago sativa* (inoculated Lucerne) (coated seed) 2 kg/ ha

*Eragrostis teff* (Teff) is an annual pioneer species which forms part of the seed mixture as a nurse crop to initially stabilise the soil and provide more favourable conditions for the other perennial species to germinate and establish. Teff germinates rapidly and therefore provides quick, sufficient initial cover to combat erosion and dust emissions.

Couch as well as Rhodes grass are perennial species which spread runners (stolons) on the soil surface to further colonise and cover bare areas. Such stolons can shoot new roots on their nodes and develop an entirely new tuft on an area where no seed was present. This process is known as vegetative reproduction and it renders them important components of the seed mixture due to the fact that they tend to cover bare areas relatively quickly with this process and induce broad surface contact which in turn reduces the likelihood of erosion. Couch grass also spreads via rhizomes which are underground runners with a similar function to stolons. They also assist in below surface soil stabilisation.

Lucerne is a perennial species and is known as a legume which is a plant that can fix nitrogen from the atmosphere into the soil for use by itself and other plants. It therefore forms an important component of the seed mixture to ensure the continued cycling and availability of nitrogen in the soil which is an essential macro-nutrient for plant survival.

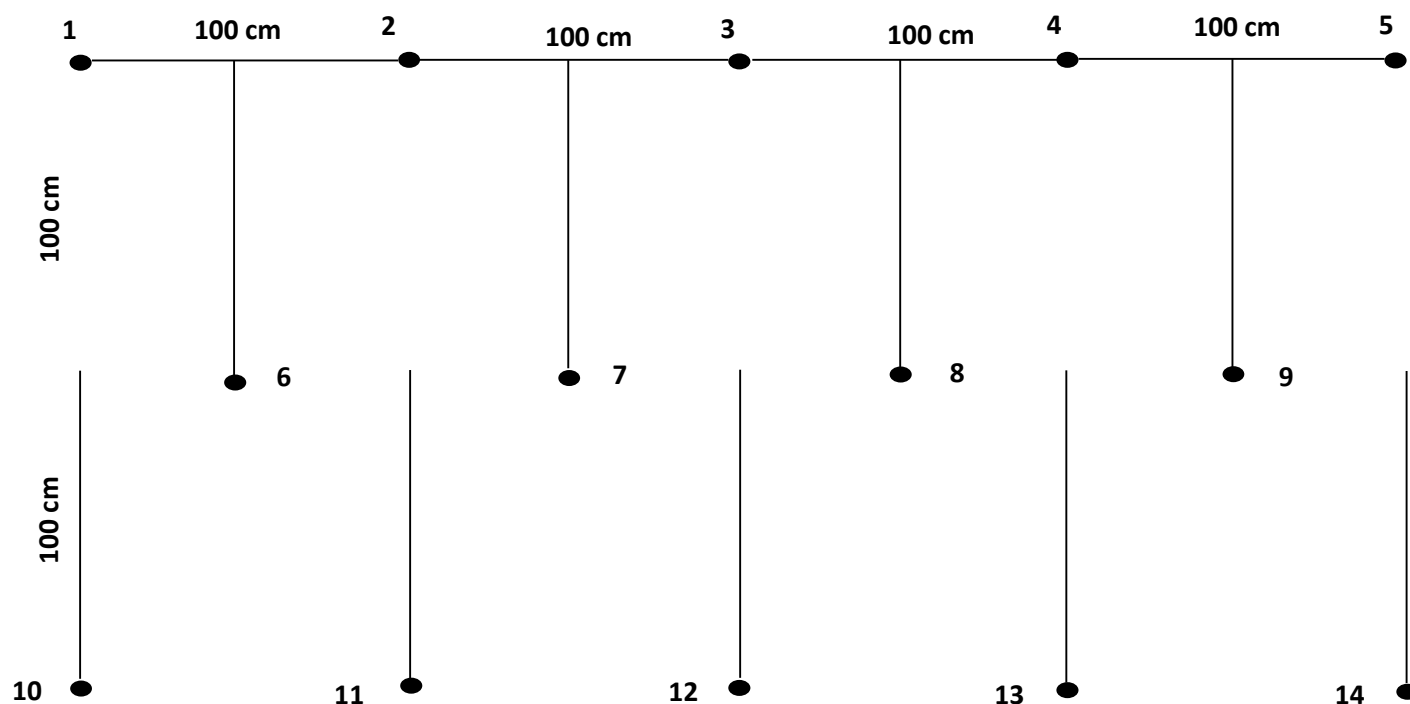
Smutsfinger and Blue buffalo grass are two strong growing perennial climax species which should eventually dominate the rehabilitated areas after a few seasons once a stabilised ecological state is reached. They produce good surface cover with broad leaves and large dense tufts which in turn assist in combating surface erosion and dust emissions.

- It is recommended that industrial buckets be filled with seeds and used for the spreading process.
- Buckets must be weighed to ensure the desired seed volumes are achieved over the areas.
- If the areas are unnecessarily over-seeded, it could have a negative financial implication on the applicant.
- If the areas are under-seeded, it could result in lower seed germination and grass establishment success.
- Photographs must be taken of all the individual steps.

As time goes on, it is expected that native hydrophytic grass species from the surrounding natural areas will start to infiltrate and establish within these rehabilitated areas.

### Re-Establishment of *Phragmites australis* (common reed) & *Typha capensis* (bulrush)

- The River bed and bank portions which have been re-shaped, topsoiled, ameliorated and seeded with grass, must also be re-established with the native aquatic species *Phragmites australis* (common reed) and *Typha capensis* (bulrush).
- Stem cuttings or rhizomes of approximately 30 cm in length must be collected for each species from the River portion directly surrounding the disturbed areas.
- Rhizomes must be planted at a depth of approximately 10 cm in a grid at a spacing of approximately 100 cm apart (see the recommended square grid pattern below). The planting of rhizome individuals of the two species can be alternated within the square grid pattern.
- It is recommended that a minimum of 5 rows with 5 rhizome individuals each be planted.
- The following square grid pattern is recommended to be followed for the planting of the rhizome individuals.
- Photographs must be taken of all the individual steps.



## 6.2. Rehabilitation of the Pipeline Route

The entire pipeline route will merely constitute a narrow linear section of approximately  $\leq 1.5$  m wide. Soils will be loosened and excavated along the proposed pipeline route as a result of construction activities. These loosened materials must be consolidated and vegetation must be adequately re-established along the proposed pipeline route. The following steps must be taken during the consolidation and re-establishment process:

### Soil Consolidation, Preparation and Amelioration

- The upper topsoil must firstly be excavated and adequately stockpiled directly adjacent to the excavated pipeline trench.
- The lower subsoil must then be separately excavated and stockpiled separately from the topsoil directly adjacent to the excavated pipeline trench but on the opposite side of the trench from where the topsoil is being stockpiled.
- After placing of the pipeline has been completed, adequate placing of the stockpiled topsoil and subsoil materials on disturbed areas must be conducted as soon as practicably possible.
  - The stockpiled subsoil must firstly be placed on the disturbed areas after which the stockpiled topsoil must be placed on top of the subsoil.
  - The placed topsoil must, as far as practicably possible, not be significantly compacted during the placing process as this will complicate the final grass seeding process by preventing adequate seed germination and root penetration.
- Photographs must be taken of all the individual steps.

Although the stockpiled materials will likely not lay dormant for an extended period of time, it is still recommended that an adequate fertiliser mixture be manually top-dressed over the prepared areas, as this will ensure that the macro-nutrients required for sufficient plant growth are made available. This must be conducted as soon as practicably possible after placing of the stockpiled subsoil and topsoil at the commencement of the new growing season to follow.

- **2:3:4 (33) + Zn fertiliser** must be evenly distributed/spread over the prepared surface areas. This must be done manually by hand at a **ratio of 100 g/m<sup>2</sup>**.
  - It is recommended that industrial buckets be filled with fertilisers and used for the manual amelioration and spreading process.
  - Buckets must be weighed to ensure the desired fertiliser volumes are achieved over the areas.



- If the areas are unnecessarily over-fertilised, it could have a negative financial implication on the applicant.
- If the areas are under-fertilised, the macro-nutrients required for sufficient plant growth might not be provided to the disturbed areas which could result in lower seed germination and grass establishment success.
- Photographs must be taken of all the individual steps.

### Grass seeding

A suitable seed mixture of indigenous grass species needs to be planted on the prepared and ameliorated areas in order to consolidate and bind the newly placed topsoil materials and subsequently prevent erosion from occurring. The correct selection of species tolerant to the specific conditions is essential to ensure successful establishment on the modified growth medium. It is also important that a good combination of pioneer (annual) as well as sub-climax and climax (perennial) species be used.

The seeding process must be conducted as soon as practicably possible and concurrently with the fertilising of the areas at the commencement of the new growing season to follow. If the seeding process is delayed, it will provide an opportunity for undesired alien invasive species to obtain a germination and establishment 'head-start'/advantage over the desired grasses. This will subsequently complicate the invasive species management process as significantly more weeds will establish than would have been the case if grass seeding was done immediately and concurrently with fertilising.

- It is recommended that the following seed mixture be evenly distributed/spread, manually by hand, over the ameliorated areas.
  - *Eragrostis teff* (Teff) (uncoated seed) 2 kg/ ha
  - *Chloris gayana* (Rhodes grass) (coated seed) 3 kg/ ha
  - *Digitaria eriantha* (Smutsfinger grass) (coated seed) 5 kg/ ha
  - *Cenchrus ciliaris* (Foxtail buffalo grass) (coated seed) 5 kg/ ha
  - *Cynodon dactylon* (Couch grass) (coated seed) 3 kg/ ha
  - *Medicago sativa* (inoculated Lucerne) (coated seed) 2 kg/ ha

- It is recommended that industrial buckets be filled with seeds and used for the spreading process.
- Buckets must be weighed to ensure the desired seed volumes are achieved over the areas.
- If the areas are unnecessarily over-seeded, it could have a negative financial implication on the applicant.
- If the areas are under-seeded, it could result in lower seed germination and grass establishment success.
- Photographs must be taken of all the individual steps.

As time goes on, it is expected that native hydrophytic grass species from the surrounding natural areas will start to infiltrate and establish within the rehabilitated wetland area while native terrestrial grass species will start to infiltrate and establish within the rehabilitated terrestrial grassland areas.

## 7. Problematic Alien Invasive Species on Site

At the time of the site visit, 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. It is recommended that all these invasive species individuals be physically removed and disposed of by means of the physical control process described under heading 8.1.

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.

An existing seedbank of certain alien invasive species will most likely be present within the soils on the assessment area. Such alien invasive species are known as opportunistic pioneer species which usually colonise newly disturbed areas. Therefore, as the construction phase commences and soil disturbance takes place, it will likely create a suitable environment for the emergence and potential establishment of such alien invasive species. Problematic alien invasive species usually associated with such developments include the following (alphabetical order):



Scientific Name	Common Name	Listed Category
<i>Argemone mexicana</i>	Yellow-flowered Mexican poppy	1b



Scientific Name	Common Name	Listed Category
<i>Cirsium vulgare</i>	Spear thistle, Scottish thistle, Skotse dissel	1b



Scientific Name	Common Name	Listed Category
<i>Datura stramonium/ D ferox</i>	Common thorn apple, olieboom	1b



Scientific Name	Common Name	Listed Category
<i>Ricinus communis</i>	Cator oil plant, kasterolieboom	2



Scientific Name	Common Name	Listed Category
<i>Rosa rubiginosa</i>	Eglantine	1b





Scientific Name	Common Name	Listed Category
<i>Solanum elaeagnifolium</i>	Silver-leaf bitter apple, satansbos	1 b



Scientific Name	Common Name	Listed Category
<i>Solanum sisymbriifolium</i>	Wild tomato, dense throned bitter apple, wilde tamatie	1 b



Scientific Name	Common Name	Listed Category
<i>Verbena bonariensis</i>	Wild verbena, tall verbena, purple top, pers verbena	1 b



Scientific Name	Common Name	Listed Category
<i>Xanthium spinosum/ X strumarium</i>	Spiny cocklebur, large cocklebur, boetebos	1 b

**Leave a future behind**

**EcoFocus Consulting (Pty) Ltd**

Registration : 2017/223847/07

7 Edenglen, Waterberg Street, Langenhovenpark, Bloemfontein, 9330

T 072 230 9598

E ajhlamprecht@gmail.com

## 8. Alien Invasive Species Management Process

There are two options which can be implemented for the management of alien invasive species that might establish on site during the construction phase. These options are chemical control processes such as herbicide and pesticide application and/or physical control processes such as active removal. Physical control is recommended as the preferred management option, due to the small size of the proposed development footprint as well as its more environmentally friendly nature compared to chemical control. It is specifically not recommended that a chemical control approach be followed for the management of the Sand River or wetland area as this could potentially result in additional negative ecological impacts to the ecological functionality and -integrity of the watercourses.

### 8.1. Physical Control

- During the construction phase, conduct a bi-weekly (every two weeks) walkthrough of the proposed development area as well as a minimum 50 m perimeter around the area, in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- Physically remove all identified alien invasive species seedlings from the soil by manually pulling them out with as much as possible of their root systems still intact.
- Place all removed alien invasive species seedlings in a metal drum or any other suitable containing unit and close the drum/containing unit in order to isolate the seedlings.
- Place the closed drum/containing unit on a concrete slab or any other suitable impermeable surface in direct sunlight in order to isolate the alien invasive species seedlings from any natural vegetation and prevent spreading of materials.
- Leave the closed drum/containing unit in direct sunlight for a minimum period of one week in order for all alien invasive species seedlings and materials to adequately dry out and die.
- Once all alien invasive species seedlings and materials have adequately dried out and died, remove the material from the drum/containing unit and place the materials in a minimum 1 m deep hole which is isolated from any natural vegetation. The hole location may not be situated within the wetland area.
- Safely burn all the dried out and dead alien invasive species seedlings and materials inside the hole and close the hole up again after the fire has died.
- It is recommended that the same hole be utilised for every burning event in order to keep the burnt materials contained and isolated to one location.
- The Geographic Information System (GIS) coordinates of the hole location where the burning is being done must be captured.

- If burning and underground burial of dried out and dead materials is not possible, materials will have to be transported and disposed of at a suitable registered bio-hazard waste site. This can however prove to be a very costly exercise.
- Photographs must be taken of all the individual steps.
- Once the ecological rehabilitation of the sewer tunnel bride area and pipeline route has been completed, conduct a bi-weekly (every two weeks) walkthrough of the developed area as well as a minimum 50 m perimeter around the area, in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- The same physical management processes as for the construction phase need to be implemented during the subsequent operational phase.
- This must be done for the first three months after the ecological rehabilitation of the sewer tunnel bride area and pipeline route has been completed, in order to ensure successful germination of seeded grass species and the absence of any significant alien invasive species establishments.
- Photographs must be taken of all the individual steps.
- After the first three months, continue to conduct a walkthrough every six months of the developed area as well as a minimum 50 m perimeter around the area during the subsequent operational phase of the proposed development. This must be done in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- The same physical management processes as for the construction phase need to be implemented during the subsequent operational phase.

## 8.2. Chemical Control

- It is not recommended that a chemical control approach be followed for the management of the Sand River or wetland area as this could potentially result in additional negative ecological impacts to the ecological functionality and -integrity of the watercourses.
- During the construction phase, conduct a bi-weekly (every two weeks) walkthrough of the proposed development area as well as a minimum 50 m perimeter around the area, in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- Based on the relevant species which are found to be establishing on site, a suitably qualified and experienced registered pest control officer must be consulted in order to advise on the most suitable chemical herbicide products and doses to use for the relevant species on site as well as the application process and frequency.
- Apply recommended chemical herbicides to the alien invasive species established areas as per the recommendations of the registered pest control officer.
- Photographs must be taken of all the individual steps.
- Once the ecological rehabilitation of the sewer tunnel bride area and pipeline route has been completed, conduct a bi-weekly (every two weeks) walkthrough of the developed area as well as a minimum 50 m perimeter around the area, in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- The same chemical management processes as for the construction phase need to be implemented during the subsequent operational phase.
- This must be done for the first three months after the ecological rehabilitation of the sewer tunnel bride area and pipeline route has been completed, in order to ensure successful germination of seeded grass species and the absence of any significant alien invasive species establishments.
- Photographs must be taken of all the individual steps.
- After the first three months, continue to conduct a walkthrough every six months of the developed area as well as a minimum 50 m perimeter around the area during the subsequent operational phase of the proposed development. This must be done in order to identify all seedlings of any alien invasive species which might start to germinate and establish.
- The same chemical management processes as for the construction phase need to be implemented during the subsequent operational phase.

## 9. Conclusion

If the ecological rehabilitation and alien invasive species management processes are adequately followed and completed as per this report, it is anticipated that this should be sufficient to ensure successful re-establishment of aquatic and terrestrial vegetation on disturbed areas within and around the development area. It should also prevent the significant establishment or spreading of any legally declared alien invasive species within and around the development area. Other best-practice clearing methods for different alien invasive species can also be obtained from the following website: <http://www.dwaf.gov.za/wfw/Control> if required.

It is recommended that an Environmental Control Officer (ECO) be appointed to oversee the construction phase of the proposed development; the ECO should also oversee the ecological rehabilitation and alien invasive species management processes. The ECO must compile a final Rehabilitation and Alien Invasive Species Management Report with a short description of the processes followed and all the photographs of the individual steps. This must be provided to the specialist upon completion in order to provide final feedback to the competent authority.

Follow up photographs must be taken by the ECO, 3 months after completion of the ecological rehabilitation process in order to determine the condition of the re-established vegetation and whether it has adequately recovered after the disturbances caused by the development. This must also be provided to the specialist in order to provide final feedback to the competent authority.



## 10. 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.

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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: Biodiversity Act (Act 10 Of 2004); Alien and Invasive Species Regulations, 2014 & Lists, 2016

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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](http://www.climate-data.org)

## 11. Details of the Specialist

Adriaan Johannes Hendrikus Lamprecht (Pr.Sci.Nat)

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

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

EcoFocus Consulting (Pty) Ltd

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

Mobile Phone:           072 230 9598

Email Address:           ajhlamprecht@gmail.com

## Abbreviated Curriculum Vitae

### Qualifications

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

### Accredited courses completed

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

### Professional registrations

- South African Council for Natural Scientific Professions (**SACNASP**)
  - Professional Ecological Scientist Registration number 115601

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7 Edenglen, Waterberg Street, Langenhovenpark, Bloemfontein, 9330

T 072 230 9598

E ajhlamprecht@gmail.com

- 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.