Wetlands Assessment - Proposed Kalabasfontein Coal Mining Project Extension

Mpumalanga Province, South Africa

Amended July 2019

CLIENT

Prepared for:

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Report Name	**Wetlands Assessment - Proposed Kalabasfontein Coal Mining Project Extension**	
Reference	**Kalabasfontein - Biodiversity**	
Submitted to	**EIMS Environmental (Pty) Ltd**	
Report Reviewer	**Andrew Husted**	[signature]
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Report Writer (Wetlands)	**Wayne Jackson**	[signature]
	Wayne Jackson is a Soils Scientist & Hydrologist, and has 9 years' experience in the classification of soils and wetlands, both nationally and internationally. Wayne completed a B.Sc. degree (Soil Science and Hydrology) from the University of Kwa-Zulu Natal and has 8 years of consulting experience.	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

EXECUTIVE SUMMARY

GNR 326	Appendix 6 (n): Specialist Opinion
The Underground mining poses a risk if subsidence occurs, however all efforts must be made to minimise the risk of subsidence as avoiding this impact is the most effective way to mitigate it. The preferred Vent Shaft is situated some distance from the wetlands and is considered low risk. However, the access road might pose a risk if it is to cross any wetland areas. The Powerlines are also considered low risk if they are constructed as close to the road reserve as possible and they footprint locations are placed outside of the wetland areas where possible. Considering the above-mentioned conclusions, it is the opinion of the specialist that the Kalabasfontein project area, with the current proposed infrastructures layout areas, may be favourably considered.	

Forzando Coal Mines (Pty) Ltd has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to act as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment for the proposed Kalabasfontein project. An application for the amendment to the existing Mine Works Programme (MWP) and EMPR, through an MPRDA Section 102 Application, and a full Environmental Impact Assessment (EIA) for the proposed new mining area is, therefore, required to support an application for environmental authorisation (EA). A water use licence application (WULA) for the relevant water use triggers associated with the proposed project will also be undertaken. The Biodiversity Company (TBC) was appointed by EIMS to conduct the wetland assessment and impact assessment for the proposed project including the New proposed ventilation shaft and the powerline.

The purpose of the specialist study is to provide relevant input into the EIA process and to provide a report for the proposed activities associated with mining and ancillary activities proposed to take place on site.

Seven wetland types were identified within the project area, and these were split into nine (9) HGM units, namely;

- Floodplain (HGM 1 and HGM 2);
- Unchannelled valley bottom (HGM 3);
- Channelled valley bottom (HGM 4);
- Hillslope seep (HGM 5);
- Flat (HGM 6);
- Depression (HGM 7 and HGM 8); and
- Artificial dams (HGM 9).

The overall wetland health for HGM 1 was determined to be Largely Modified (D), with the remaining HGM units determined to be Moderately Modified (C).

All HGM units exhibited a moderately high benefit for indirect benefits such as; sediment trapping, and phosphate/nitrate/toxicant assimilation. HGM 7, 8, and 9 had a moderately high benefit for flood attenuation. The floodplains HGM 1 and HGM 2 exhibited a moderately high benefit for biodiversity maintenance providing suitable habitat for fauna and flora. HGM 3 and

HGM 8 had a moderately high benefit for erosion control. The remaining benefits were rated as intermediate or lower.

The EIS was calculated to have a Very High (A) importance for HGM 1. This rating can be attributed to the ecological importance of the floodplain from an NFEPA perspective as well as the national ecosystem classifications (see section 7.5) rating this area as vulnerable. HGM 2, 3, 4, 8, and 9 were rated as High (B) importance. HGM 5, 6, and 7 were rated as Moderate (C) importance.

The recommended minimum buffer according to the guidelines is 25 m for the vent shafts and 10 m for the associated powerline for all phases.

A conservative buffer zone was suggested of 25 m for the vent shafts and 10 m for the associated powerline, this buffer is calculated assuming mitigation measures are applied. This would typically include a commitment to rehabilitate and manage buffer zones to ensure that these areas function optimally.

It must be noted that the alternative vent shaft is within the wetland buffer and it is recommended that the preferred shaft location be used. The powerline (both alternatives) will traverse many wetland areas and it is recommended that the powerline route be situated on the existing servitude and that spans are planned to cross wetland areas and their associated buffer zones.

Overall, the impacts of the underground mining have much lower significance and impact than those for opencast mining operations as this type of mining has less of an influence on biodiversity in the area. Nonetheless, underground mining also requires some surface infrastructure (and ventilation shafts in the case of this project), and the significance of these impacts cannot be overlooked or underestimated. However, for this particular project existing infrastructure will be used and as such there is a lower impact rating overall.

DOCUMENT GUIDE

The table below provides the NEMA (2014) Requirements for Ecological Assessments, and also the relevant sections in the reports where these requirements are addressed:

GNR 326	Description	Section in the Report
Specialist Report		
Appendix 6 (a)	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii.
Appendix 6 (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page vi
Appendix 6 (c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 3
Appendix 6 (cA)	An indication of the quality and age of base data used for the specialist report;	Section 7 & 8
Appendix 6 (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
Appendix 6 (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 8
Appendix 6 (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
Appendix 6 (f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a, site plan identifying site alternatives;	Section 8
Appendix 6 (g)	An identification of any areas to be avoided, including buffers;	Section 8
Appendix 6 (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 8
Appendix 6 (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
Appendix 6 (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity **[including identified alternatives on the environment]** or activities;	Section 10
Appendix 6 (k)	Any mitigation measures for inclusion in the EMPr;	Section 10
Appendix 6 (l)	Any conditions for inclusion in the environmental authorisation;	Section 10 & 11
Appendix 6 (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	None
Appendix 6 (n)	A reasoned opinion— i. **[as to]** whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 12.1
Appendix 6 (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	None
Appendix 6 (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
Appendix 6 (q)	Any other information requested by the competent authority.	None

DECLARATION

I, Wayne Jackson, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Wayne Jackson

Wetland Specialist

The Biodiversity Company

15th July 2019

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1. Introduction & Background

Forzando Coal Mines (Pty) Ltd. applied to the Department of Mineral Resources (DMR) for the conversion of Old Order Mining Rights to New Order Mining Rights for its mining operations at the Forzando North Shaft and Forzando South Shaft. These conversions were granted in November 2011 and executed on 28 June 2013.

This application is for the extension of the current mining areas (under Section 102 of MPRDA (Act No. 28 of 2002)) by inclusion of contiguous areas which are held under Prospecting Rights 1035PR & 1170PR. Through an intensive drilling exercise on these areas, economically viable blocks of coal have been defined. The plan is to access these newly defined blocks of coal from the existing Forzando South incline. Underground mining has been selected as the appropriate mining method for the Kalabasfontein project.

Annexation of these Prospecting Rights into the existing Forzando South Mining Right is motivated by subsequent reduction of Reserves at Forzando North Shaft. This diminution is as a result of unexpected poor ground conditions as well as burnt coal (Forzando Coal Mines (Pty) Ltd. 2018).

Kalabasfontein project area is situated in Mpumalanga, 20 kilometres north of Bethal and 20 kilometres east of Ga-Nala (Kriel). It is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR respectively which fall within the Msukaligwa Local Municipality. The project area comprises two Prospecting Rights, 1035PR & 1170PR, which covers a total area of ~1 547.8296ha over portions 7, 8, Remaining Extent (RE), 11 and 13 of the farm Kalabasfontein 232 IS.

As part of the Kalabasfontein project, two alternative sites have been proposed for a new ventilation shaft, namely Portion 7 of the farm Uitgedacht 229 IS and Portion 22 of the farm Uitgedacht 229 IS. Initial granting of both Prospecting Rights was in 2006 to Forzando Coal Mines (Pty) Ltd. Subsequent to this, in respect of 1035PR and before the right could lapse on the 2nd of November 2009, a Prospecting Rights renewal was applied for in October 2009. In respect of PR 1170 the renewal was applied for on 12 January 2011 before the right could expire on 9 April 2011. Both renewals were granted on the 31st July 2015 with execution finalised on the 27th October 2015, extending the validity of both Prospecting Rights to the 30th of July 2018. The proposed extension of the current mining area will require minimal new surface infrastructure as the mining method to be employed is underground mining and existing surface infrastructure from the Forzando South mine will be used.

Forzando Coal Mines (Pty) Ltd has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to act as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment for the proposed Kalabasfontein project. An application for the amendment to the existing Mine Works Programme (MWP) and EMPR, through an MPRDA Section 102 Application, and a full Environmental Impact Assessment (EIA) for the proposed new mining area is, therefore, required to support an application for environmental authorisation (EA). A water use licence application (WULA) for the relevant water use triggers associated with the proposed project will also be undertaken. The Biodiversity Company (TBC) was appointed by EIMS to conduct the wetland assessment and impact assessment for the proposed project including the New proposed ventilation shaft and the powerline.

One wet-season wetland survey was conducted in September 2018/October 2018. The survey was conducted by wetland specialists over a total period of six days.

The purpose of the specialist study is to provide relevant input into the EIA process and to provide a report for the proposed activities associated with mining and ancillary activities proposed to take place on site.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.1 Project Area

The Kalabasfontein project area is situated in Mpumalanga, 20 kilometres north of Bethal and 20 kilometres east of Ga-Nala (Kriel). It is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR respectively which fall within the Msukaligwa Local Municipality, (Figure 1).

As part of the Kalabasfontein project, two alternative sites have been proposed for a new ventilation shaft, namely Portion 7 of the farm Uitgedacht 229 IS and Portion 22 of the farm Uitgedacht 229 IS. Land use in the considered catchments consists predominantly of grassland areas, wetlands, farmsteads and irrigated agriculture as well as the urban footprint of the town of Bethal.

The project area covers a total area of approximately 1 547.83 hectares in separate blocks over a number of properties and farm portions. The two alternative shaft sites are located on portion 7 of the farm Uitgedacht 229 IS and portion 22 of the farm Uitgedacht 229 IS.

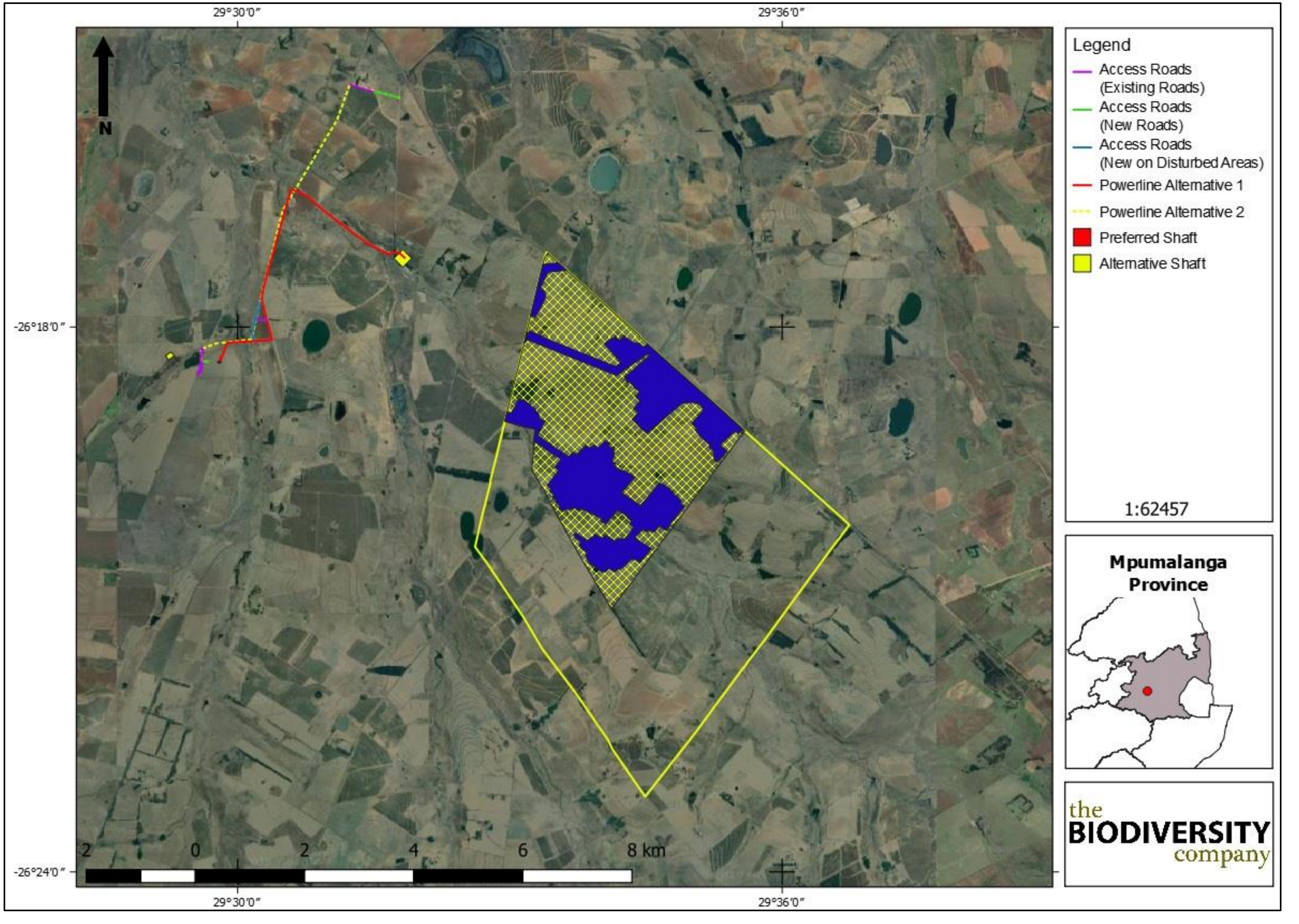


Figure 1: The proposed Kalabasfontein project area

2. Project Description

This section provides a detailed project description. The aim of the project description is to indicate the activities that are planned to take place at the Forzando South operations as well as the proposed Kalabasfontein project area and amendments that are being applied for in this application. Furthermore, the detailed mine/project description is presented to facilitate the understanding of the project related activities which result in the impacts identified and assessed and for which management measures have been proposed.

2.1 Mining Operations Overview

Although Kalabasfontein annexation is intended to extend the Life of Mine (LOM) of Forzando South Coal Mine, it will come into production a year after the annexation is granted by the DMR. The Kalabasfontein project has an estimated LOM of 17 years with the project schedule and timeframe being based on the Forzando South equipment availabilities, efficiencies and both skilled and unskilled labour force. Mining in the Kalabasfontein project area is based on two Continuous Miner (CM) sections.

The access corridor to Kalabasfontein Reserves was identified during exploration drilling. Reserves will be mined through access from one of Forzando South Reserves block. This will eliminate intense preparation work of developing a new incline, as there will be infrastructure available at the face.

Currently, Forzando South mine is scheduled until 2037. However, the Kalabasfontein portion will be mined as soon as permission is granted, in order to ensure sustained production volumes and quantities from the 5 CM sections that are currently being mined. The mine will maintain its production rate of 2.2 Million tonnes (Mt) per annum. Commissioning of Kalabasfontein will not add to the production of Forzando South but will provide relocation areas for existing Forzando South sections. Since the Kalabasfontein project will be mined concurrently with Forzando South, production decline will be due to depletion of Reserves. In the second quarter of year 17 (2037), the first section will pull out and leave the one section to deplete the remaining Reserves.

2.2 Current Authorisations

The following rights, authorisations and approvals are currently in place and have been considered in the compilation of the report:

- Mining Right (MP380MR) dated 28 June 2013;
- Prospecting Rights (MP 30/5/1/1/2/1035PR) dated 31 July 2015;
- Prospecting Rights (MP 30/5/1/1/2/1170PR) dated 31 July 2015;
- Water Use Licence (04/B11A/A/ACGIJ/521) dated 19 July 2011;
- Amended Water Use Licence (04/B11A/A/ACGIJ/521) dated 15 June 2017; and
- Waste Licence (12/9/11/L180/6) dated 22 February 2010.

2.3 Infrastructure Requirements

As the Kalabasfontein project will use the existing Forzando South and Forzando North infrastructure, additional infrastructure requirements will be minimal. Anticipated demand for water, power and the on-site infrastructure requirements is detailed in the mine works programme (MWP). These requirements are based on staff required over the production period for permanent employees and contractors. Water and electricity requirements for the construction of mine access (ventilation shaft) and surface infrastructure are temporary, lasting for approximately 12 months.

The Forzando North plant is designed to treat ROM of approximately 2.2 Million tons per annum (Mtpa). This will include coal from the proposed Kalabasfontein Project. The plant will be manned for operations on a 24 hour/day, 7 days/week basis, with the exclusion of statutory public holidays.

Below are plant design parameters used:

- A production of 10,000t per day;
- A production of 3,300t per shift;
- Feed to ROM bin (peak) of 3,600t per hour at 50mm Top Size;
- ROM material top size (mm): 350mm;
- Primary crusher feed: 1,200t per hour (peak);
- ROM stockpile surge capacity 10,000t (max): 4,500t (live);
- Overland conveyor design maximum and average of 1,125t/hr and 750t/hr respectively;
- Conveyor operation: 2 shifts per day for 5 days a week.

2.4 Mining Method to be Employed: Underground Mining

Bord and pillar mining using CM's was selected as the primary extraction method. In bord and pillar mining, parallel roads are developed in the development direction. Perpendicular roads, called splits, are developed at predetermined intervals to the parallel roads. These roads interlink, creating pillars. The roads mined concurrently are determined by the size of the pillars required to support the overburden above the coal seam and the length of the production equipment trailing cables.

Pillar size is determined by the safety factor formula; which is the pillar strength divided by the pillar load (mass of the overburden carried by the pillar). Panel design will be based on either the Probability of Failure (PoF) or the safety factor design criterion. A PoF of 0.1% or SF of 2.0 will be used for main development, whereas a PoF of 1% or SF of 1.6 will be used for production panels depending on the stability and rock engineering characteristics that will be determined by a Rock/Geotechnical Engineer. The dimensions of the roads and the support requirements are determined by a Geotechnical Engineer and documented in a code of practice for the prevention of roof falls.

2.5 Surface Infrastructure

As the Kalabasfontein project will use the existing Forzando South and Forzando North infrastructure, it is envisaged that additional infrastructure requirements will be minimal. A ventilation shaft will be required, this will be located outside the Kalabasfontein project area, either on portion 7 or portion 22 of the farm Uitgedacht 229 IS approximately 6km away. Existing access roads will be used, however, the need to expand these will be determined during the EIA phase of the project.

2.6 Administration Buildings, Engineering Bays, Workshops and Other Buildings

As the Kalabasfontein project will be an extension of the Forzando South operations, it anticipated that the existing infrastructure will be utilized during all phases of the project. The existing surface infrastructure related to Forzando North can be summarised as follows:

- Coal beneficiation plant;
- Coal discard dumps;
- Rail line of about 1,6 km to the Richards Bay Coal Terminal railway line;
- Rail loop of about 400 m diameter;
- Coal product load-out stockpile located to the west of the discard dump;
- ROM coal stockpile;
- Water pollution control dams;
- Metallurgical coal stockpiles; and
- Administration, workshops, change house and related buildings.

At present the existing surface infrastructure related to Forzando South can be summarised as follows:

- Power lines;
- Ventilation shafts (one upcast & one downcast);
- ROM coal stockpile;
- Overland conveyor from boxcut to Forzando North plant;
- Water pollution control dams; and
- Administration, workshops, change house and related buildings.

3. Scope of Work

TBC was commissioned by EIMS to conduct a wetland baseline and impact assessment for the proposed Kalabasfontein project. The Terms of Reference (ToR) for this study included the following:

- The outer edge of the wetland areas will be identified and delineated;
- The integrity (health) of the wetland will be assessed;
- A high level wetland functioning assessment will be completed;
- Buffer zones will be prescribed in accordance with provincial requirements;

- Once the baseline assessment has been completed and the infrastructural layout plans and drawings have been finalised the specialists will commence with the impact assessment;
- The significance of potential impacts on the above-mentioned attributes will be assessed using an agreed upon impact assessment matrix; and
- Suitable and practically implementable mitigation measures will be identified, and the significance of potential impacts will be reassessed post mitigation.

4. Limitations

The following aspects were considered as limitations;

- The results of this assessment are based on data collected during a single season survey. Aquatic & wetland ecosystems are dynamic by nature and seasonal changes can be extreme, the absence of phenological data is a limiting factor of this assessment;
- The GPS used for wetland and riparian delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side;
- Wetland systems identified at desktop level within 500 m of the project area were considered for the identification and desktop delineation, with wetland areas within the project area being the focus for ground truthing;
- Due to the extent of agricultural activities on site, the use of vegetation as a means to identify and delineate the boundary of wetlands was limited. In order to address this shortcoming", findings from the soil assessment were used to supplement the delineation and characterisation of the wetland areas; and
- A buffer zone was determined using methods prescribed by Macfarlane *et al.*, 2014. Whilst caution was taken in applying this tool, a notable limitation is that the tool does not consider groundwater linkages that may be sustaining a wetland system.

5. Methodologies

5.1 Wetland Assessment

The following information sources were considered for the desktop assessment;

- Information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org);
- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- Mpumalanga Biodiversity Sector Plan (2011);
- The National Freshwater Ecosystem Priority Areas (Nel, et al., 2011);
- The Mpumalanga Highveld Wetlands; and
- Contour data (5m).

5.2 Wetland Identification and Mapping

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification (Ollis, Snaddon, Job, & Mbona, 2013).

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

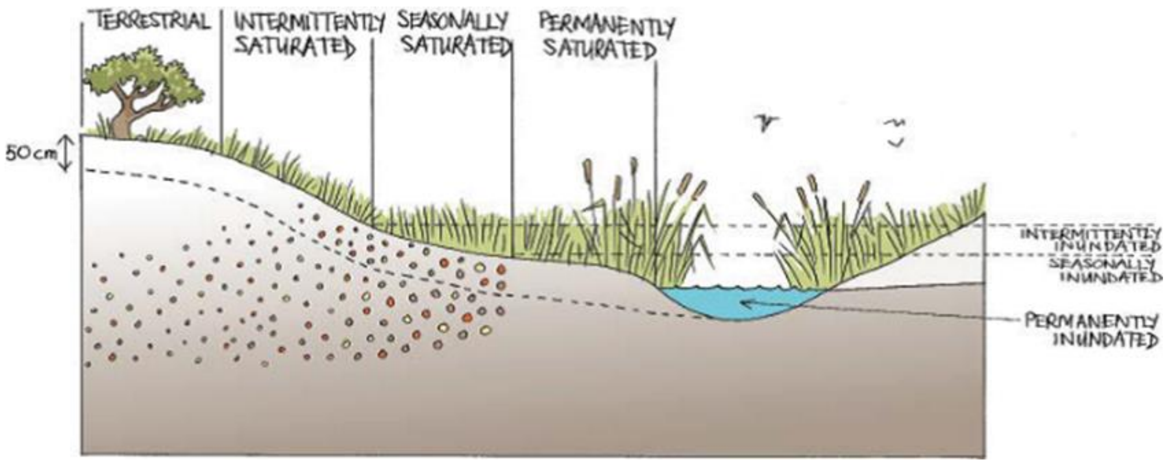


Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

5.2.1 Wetland Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 1).

Table 1: Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

5.2.2 Present Ecological Status (PES)

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 2.

Table 2: The Present Ecological Status categories (Macfarlane, et al., 2009)

Impact Category	Description	Impact Score Range	PES
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**

5.2.3 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3, (Rountree *et al*., 1999).

Table 3: Description of Ecological Importance and Sensitivity categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

5.2.4 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and also then includes structural features at the lower levels of classification (Ollis *et al*. 2013).

5.2.5 Determining Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al*. 2014) was used to determine the appropriate buffer zone for the proposed activity.

5.2.6 Risk Assessment

The risk assessment was completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016). The significance of the impact is calculated according to Table 4.

The matrix assesses impacts in terms of consequence and likelihood. Consequence is calculated based on the following formula:

Consequence = Severity + Spatial Scale + Duration

Whereas likelihood is calculated as:

Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection.

Significance is calculated as:

Significance \ Risk= Consequence X Likelihood.

Table 4: Significance ratings matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s)impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

6. Key Legislative Requirements

6.1 National Water Act (Act No. 36 of 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS.

For the purposes of this project, a wetland area is defined according to the NWA (Act No. 36 of 1998): "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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

Wetlands have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

6.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

7. Project Area

7.1 General Land Use

The dominant land use of the surrounding area is cultivated land/agriculture, predominately maize and to a lesser extent other crop plants such as Soya. Natural vegetation is utilized for livestock grazing, predominately by cattle. Subsistence farming also occurs on site, with cattle grazing across various portions of the project area, including wetland areas. Other land uses nearby include other coal mining operations as well as the urban footprint of the town of Bethal. The following infrastructure exists in the project area and surrounds:

- Agricultural properties and cultivated fields;
- Various secondary farm roads, minor tar roads (R35 and R38), and a national highway (N17) south of the project area;
- Many farm dams and at least three notably large man-made dams;
- Wetland areas;
- Rocky ridges and caves;
- Power lines – especially large Eskom powerlines transecting multiple farm portions;
- Telephone lines;
- Agricultural homesteads and fields; and
- Urban dwellings.

7.2 Description of the Project Area

Kalabasfontein project area is situated in Mpumalanga, 20 kilometres north of Bethal and 20 kilometres east of Ga-Nala (Kriel). It is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR respectively which fall within the Msukaligwa Local Municipality. The project area comprises two prospecting rights, 1035PR & 1170PR, which covers a total of approximately 1 547.83 ha over portions 7, 8, RE, 11 and 13 of the farm Kalabasfontein 232 IS. A new ventilation shaft will be located either on Portion 7 of the farm Uitgedacht 229 IS or on Portion 22 of the farm Uitgedacht 229 IS as part of the Kalabasfontein project.

7.2.1 Vegetation Types

The grassland biome comprises many different vegetation types. The project area is situated within one vegetation type; namely the Eastern Highveld Grassland (GM12) according to Mucina & Rutherford (2006) (Figure 2).

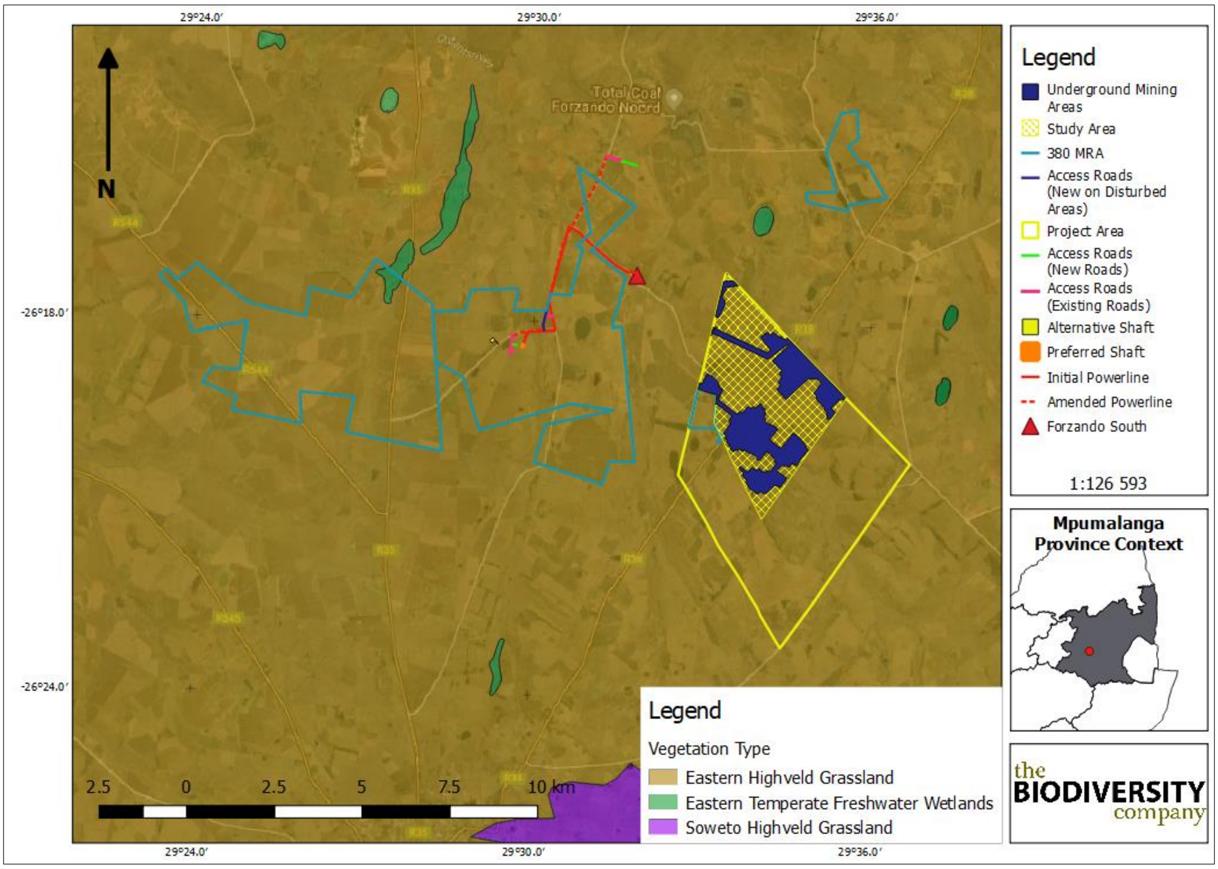


Figure 2: The project area showing the vegetation types based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS,2017)

7.2.2 Eastern Highveld Grassland

This vegetation type occurs on slightly to moderately undulating planes, including some low hills and pan depressions. The vegetation is a short dense grass land dominated by the usual highveld grass composition (Aristida, Digitaria, Eragrostis, Themeda, Tristachya etc.) with small scattered rocky outcrops with, wiry sour grasses and some woody species. Some 44%

transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. No serious alien invasions are reported (Mucina & Rutherford, 2006).

7.3 Geology & Soils

The geology of the area is shale, sandstone, clay and conglomerate of the Ecca Group, Karoo Sequence; dolerite; occasional felsitic lava of the Rooiberg Group, Transvaal Sequence.

According to the land type database (Land Type Survey Staff, 1972 - 2006) the project falls within the Bb4 land type. It is expected that, the dominant soils in the crest and midslope positions will be soils of the Avalon and Hutton forms. The soils that dominate the footslopes and the valley bottoms are Escourt, Katspruit, and Rensburg soil forms.

7.4 The MBSP Freshwater Assessment

The MBSP Freshwater Assessment outlines priority areas for freshwater biodiversity in Mpumalanga. The resulting features are predominantly derived from the NFEPA products, layers include CBA Rivers (based on FEPA and free-flowing rivers), CBA Wetlands (based on FEPA wetlands), CBA Aquatic species (Odonata & crab taxa of conservation concern only), ESA Wetland Clusters (FEPA wetland clusters), and ESA Wetlands (all other non-FEPA wetlands). The MTPA created an updated land-cover using SPOT 2010 imagery. This data, together with high-resolution aerial imagery, was used to update and clean some of the features (MTPA et al., Freshwater Assessment, 2011).

The Kalabasfontein project area in relation to the MBSP Freshwater Assessment overlaps with the following areas: Ecological Support Areas (ESAs), Heavily Modified Areas (HMAs) and Other Natural Areas (ONAs) (Figure 3).

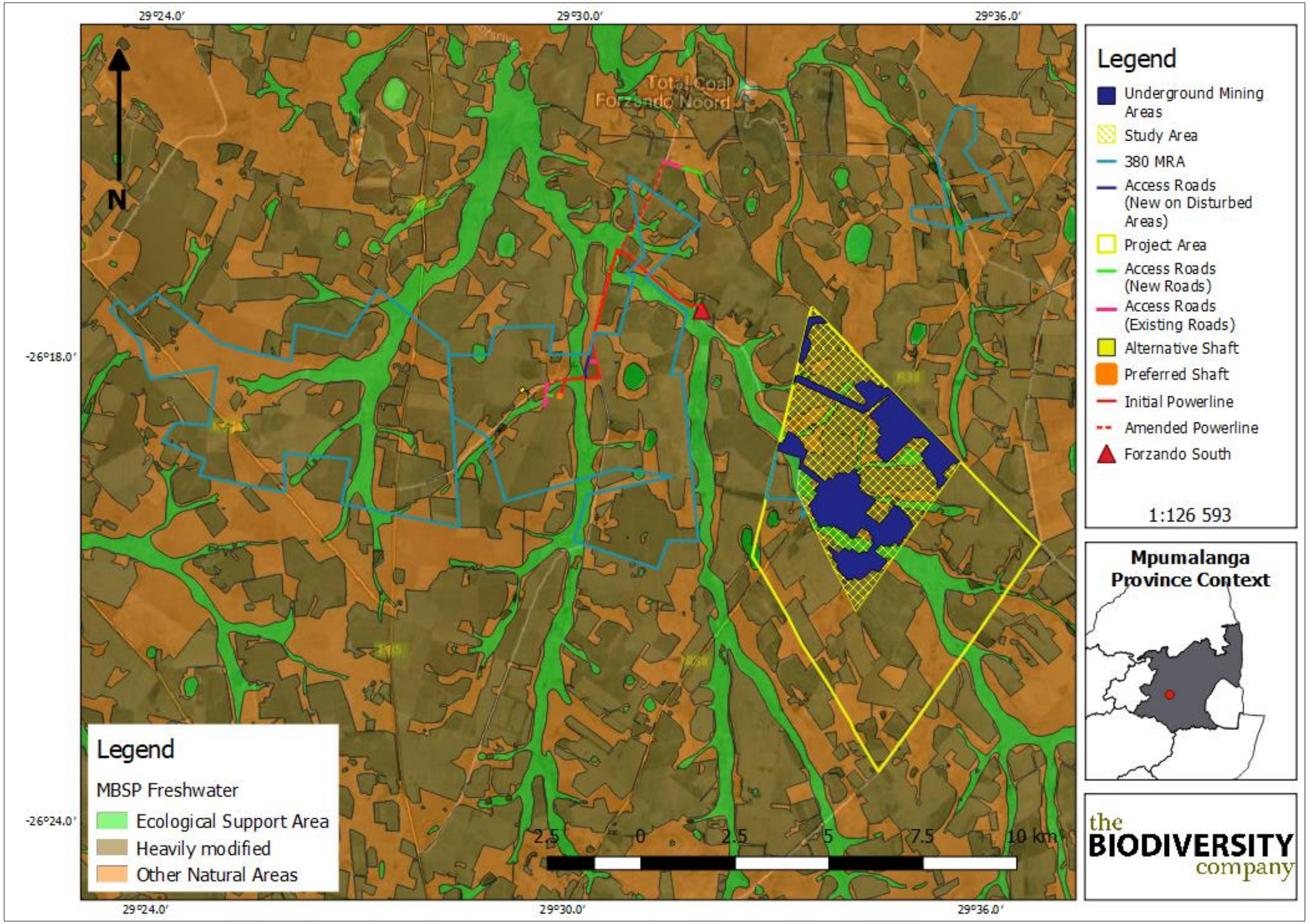


Figure 3: The Kalabasfontein project area in relation to the MBSP Freshwater Assessment

7.5 Mpumalanga Highveld Wetlands and NFEPA

The National Freshwater Ecosystem Priority Areas (Nel et al., 2011) were used to determine the presence of NFEPA wetlands.

The purpose of the Mpumalanga Highveld Wetlands project was to:

- Ground-truth and refine the current data layers of the extent, distribution, condition and type of freshwater ecosystems in the Mpumalanga Highveld coal belt, to support informed and consistent decision-making by regulators in relation to the water-biodiversity-energy nexus;
- To incorporate these revised data layers into the atlas of high-risk freshwater ecosystems and guidelines for wetland offsets, currently being developed by SANBI, to improve the scientific robustness of these tools; and
- To support the uptake, and development of the necessary capacity to apply the data, atlas and guidelines by regulators and the coal mining industry in their planning and decision-making processes'' (SANBI, 2012).

The Mpumalanga Highveld Wetlands data also classifies NFEPA land cover based on the defined condition of each area. These are known as the NFEPA wetland conditions categories. The categories are listed in Figure 4 and are represented in relation to the project area in Figure 5.

Description of NFEPA wetland conditions categories.
PES equivalent provides a description of the condition category that is broadly equivalent to that used by the Department of Water Affairs to describe Present Ecological State. Percentage of total area in each condition category is also provided.

PES equivalent	NFEPA condition	Description	% of total wetland area*
Natural or Good	AB	Percentage natural land cover ≥ 75%	47
Moderately modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50,000 "artificial" inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as "artificial" in the wetland delineation GIS layer	4
	Z3	Percentage natural land cover < 25%	20

* *This percentage excludes the unmapped wetlands that have been irreversibly lost due to draining, ploughing and concreting*

Figure 4: A breakdown of the NFEPA wetland condition categories as defined by the MH dataset

Figure 5 shows the project area in relation to the Mpumalanga Highveld Wetlands data as provided by SANBI. The Kalabasfontein project area intersects with wetland areas classified as FEPA wetlands. The majority of these wetlands are classified as Class D wetlands (Figure 6). This means that these areas have been classified as heavily to critically modified.

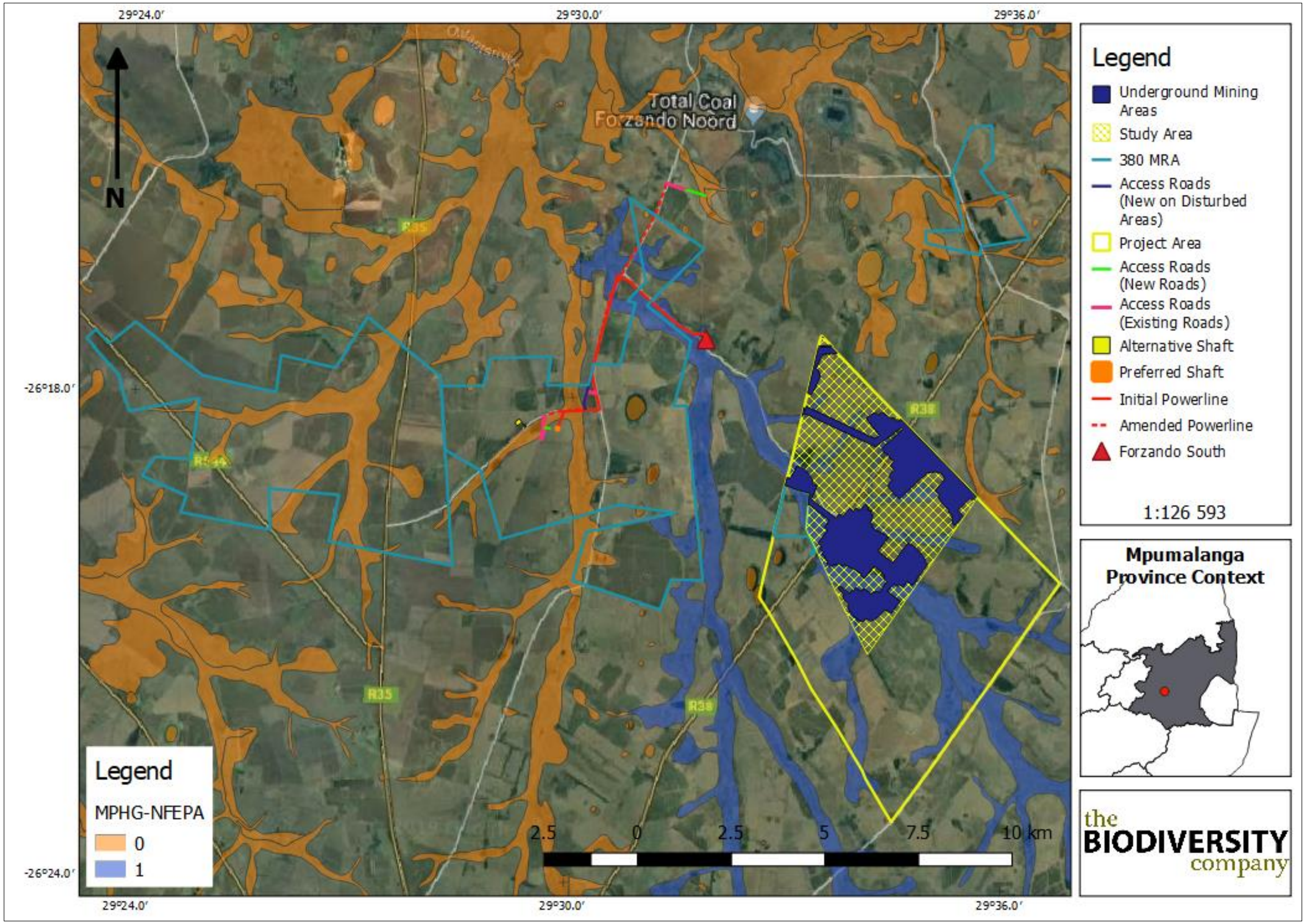


Figure 5: Shows the overall project area in relation to the Mpumalanga Highveld Wetlands (SANBI, 2012)

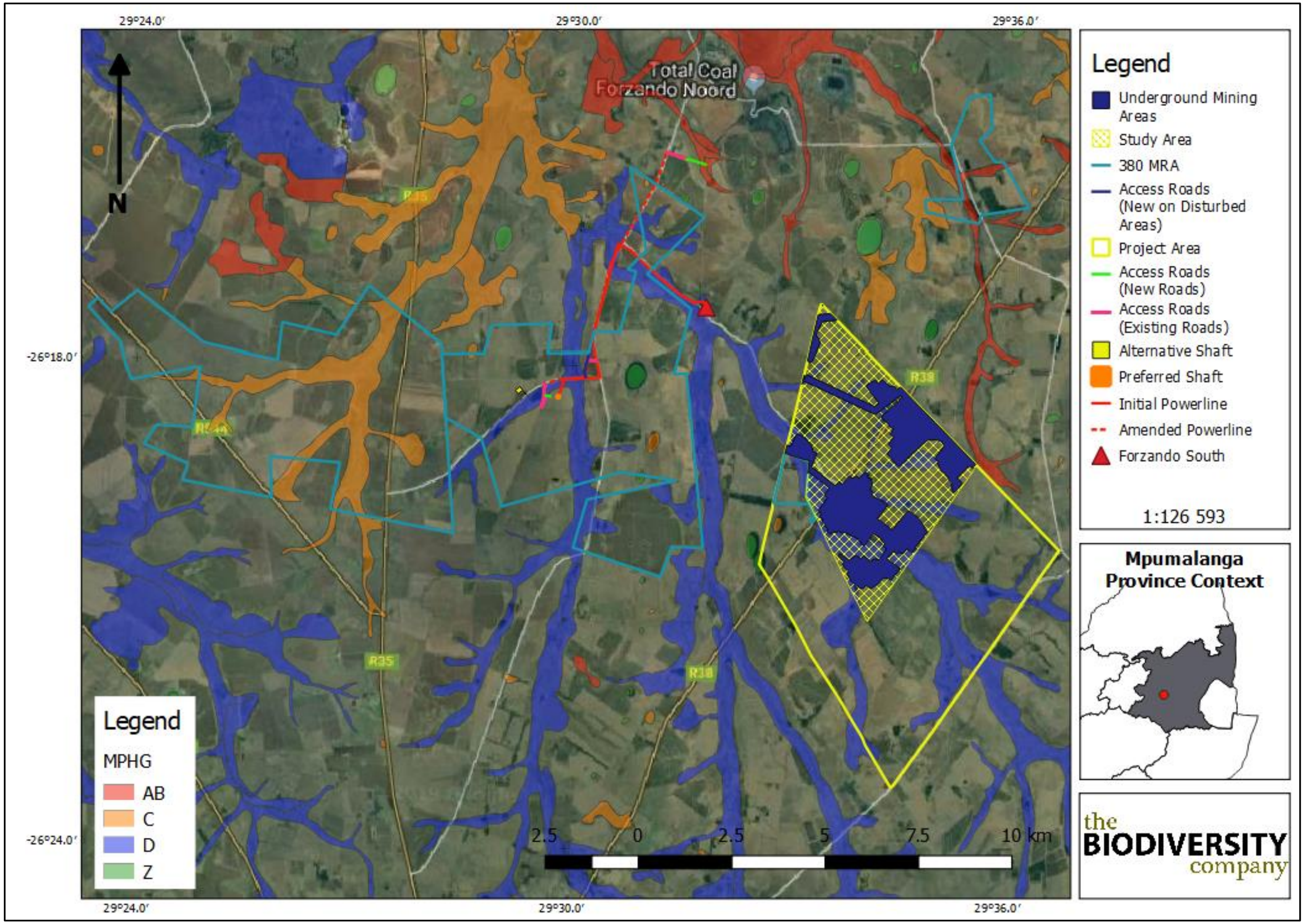


Figure 6: Shows the overall project area in relation to the Mpumalanga Highveld Wetlands in relation the wetland conditions

7.5.1 Present Ecological Status (PES), Ecological Importance (EI) and Ecological Sensitivity (ES)

Desktop information on the PES, EI and ES of the 3 SQRs was obtained from DWS (2018).

The upstream site (SCH2) in the Joubertvleispruit is situated in SQR B11A-1443. The reach spans 17 km of the Joubertvleispruit. The PES category of the reach is classed as largely modified (Class D). The largely modified state of the reach is attributed to moderate to large impacts to instream habitat, wetland and riparian zone continuity, flow modifications and minor potential impacts on physico-chemical conditions (water quality).

The control site (SCH1) is situated in SQR B11A-1430. The reach spans 25 km of the Viskuile River. The PES category of the reach is classed as moderately modified (Class C) (Table 3). The moderately modified state of the reach is attributed to moderate to large impacts to instream habitat, wetland and riparian zone continuity, flow modifications and minor potential impacts on physico-chemical conditions (water quality).

The downstream site (SCH3) is situated in SQR B11A-1411. The reach spans 5 km of the Viskuile River. The PES category of the reach is classed as moderately modified (Class C) (Table 4). The moderately modified state of the reach is attributed to moderate to large impacts to instream habitat, wetland and riparian zone continuity, flow modifications and minor potential impacts on physico-chemical conditions (water quality).

8. Results & Discussion

8.1 Wetland Assessment

The survey included assessing all the wetland indicators as well as assessing the integrity or health of the wetland, the wetland's ability to provide goods and services (eco-services) and the EIS of the wetlands.

The wetland survey was conducted in September 2018 and October 2018 by wetland specialists to assess all project aspects and areas. A hand-held auger and a GPS tablet was used to log all information in the field. The soils were classified to the family level as per the "Soil Classification - A Taxonomic System for South Africa" (Soil Classification Working Group, 1991). Owing to the extent of agricultural activities within the project area, Soil Form was used to supplement the wetland study.

The dominant land use in the project area was agriculture, grazing, and mining. The agricultural production is dominated by maize, whilst the grazing is dominated by cattle. The maize production areas are dominated by Huttons, Avalons, and Clovelly soil forms. The grazing areas are dominated by Rensburg, Arcadia, Longlands, and Westleigh soil forms.

The wetland delineation is shown in Figure 7 and the HGM units in Figure 8 and Table 5 with the wetland classification as per SANBI guidelines (Ollis et al. 2013).

Seven wetland types were identified within the project area, and these were categorised into nine (9) HGM units, namely;

- Floodplain (HGM 1 and HGM 2);
- Unchannelled valley bottom (HGM 3);
- Channelled valley bottom (HGM 4);
- Hillslope seep (HGM 5);
- Flat (HGM 6);
- Depression (HGM 7 and HGM 8); and
- Artificial dams (HGM 9).

The wetlands are described in the following sections in more detail. For the sake of this assessment, HGM units have been collectively assessed for this study.

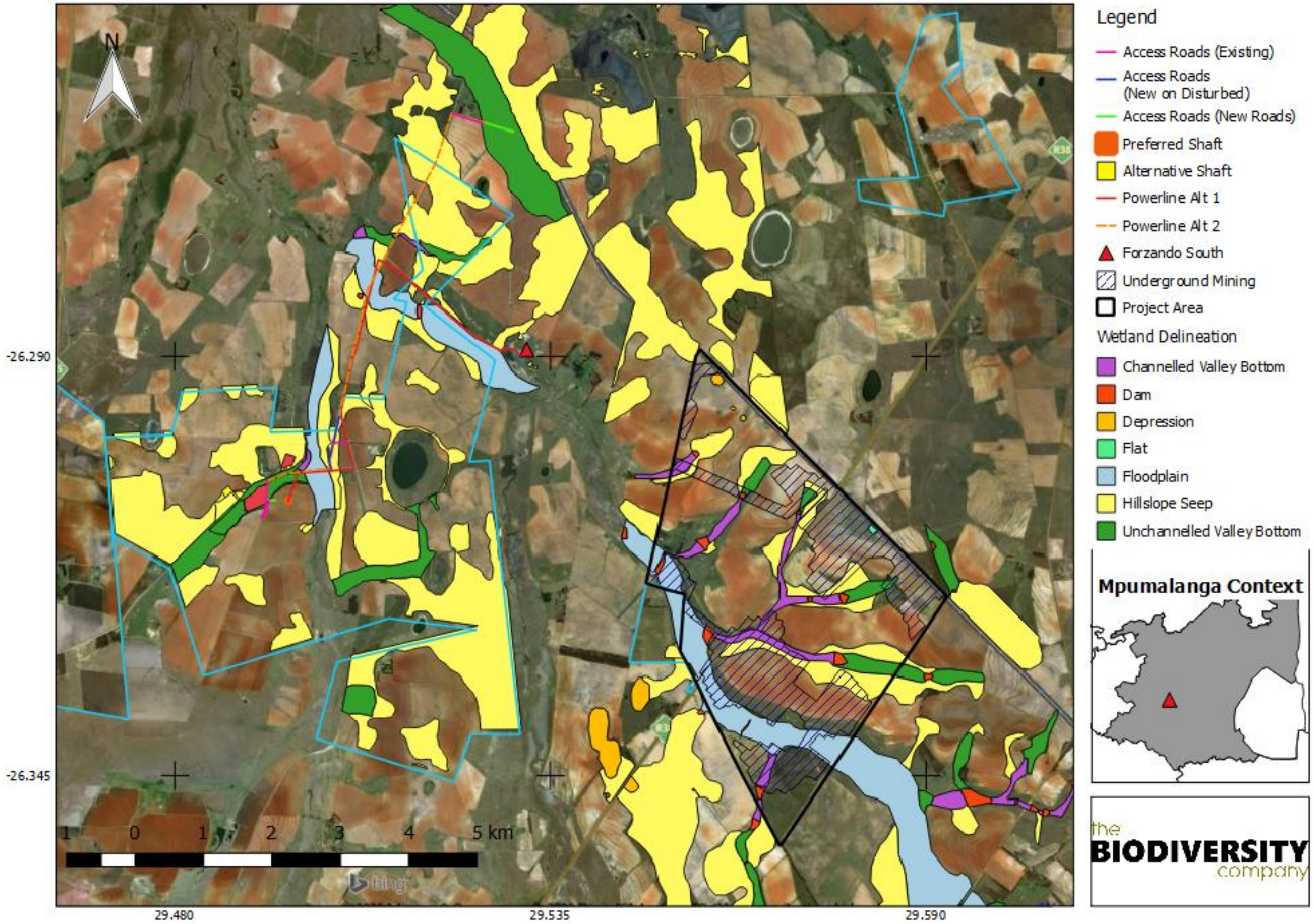


Figure 7: Kalabasfontein project wetland delineation

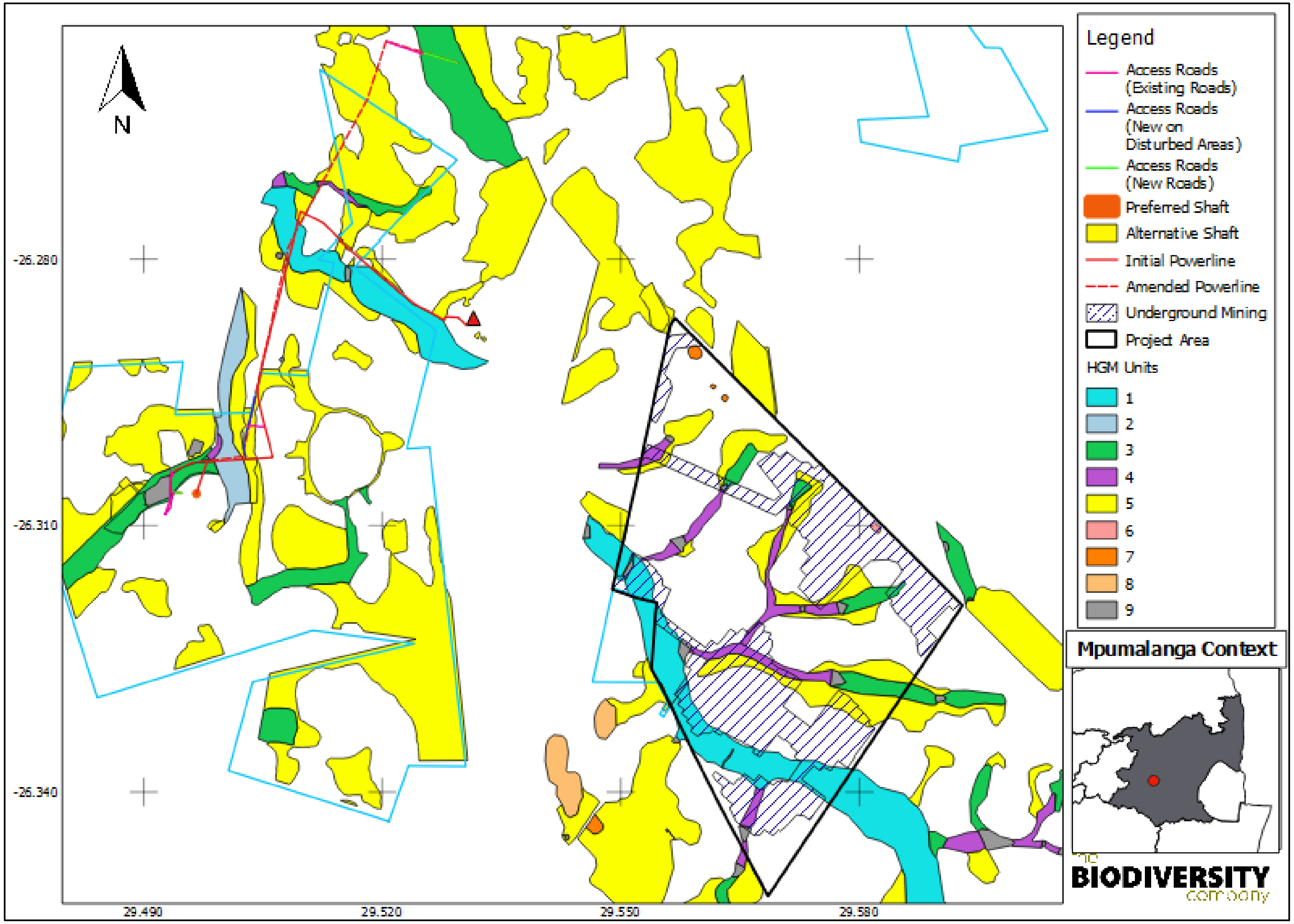


Figure 8: Kalabasfontein project HGM units

Table 5: Wetland classification as per SANBI guideline (Ollis et al. 2013).

Wetland Name	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion	NFEPA Wet Veg Group	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Highveld	Mesic Highveld grassland group 4	Valley Floor	Floodplain	Flat	N/A
HGM 2				Valley Floor	Floodplain	Flat	N/A
HGM 3				Valley Floor	Unchannelled valley bottom	N/A	N/A
HGM 4				Valley Floor	Channelled valley bottom	N/A	N/A
HGM 5				Slope	Hillslope seep	With channelled outflow	N/A
HGM 6				Bench	Flat	N/A	N/A
HGM 7				Bench	Depression	Exorheic	Without channelled outflow
HGM 8				Bench	Depression	Exorheic	Without channelled outflow
HGM 9				Valley Floor	Depression	Dammed	With channelled outflow

8.1.1 Floodplain (HGM 1 and HGM 2)

Floodplain wetland are on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by overtopping of the channel bank. Water movement through the wetland is predominantly horizontal and bidirectional (i.e. in and out of the wetland), in the form of diffuse surface or subsurface flow, although significant temporary containment of water may occur in floodplain depressions. Water generally exits a floodplain wetland as diffuse surface and/or subsurface flow (often returning to the river channel), but infiltration and evapotranspiration of water from a floodplain wetland can also be significant, particularly if there are a number of depressional areas within the wetland (Ollis *et al*. 2013). This has been illustrated in Figure 9.

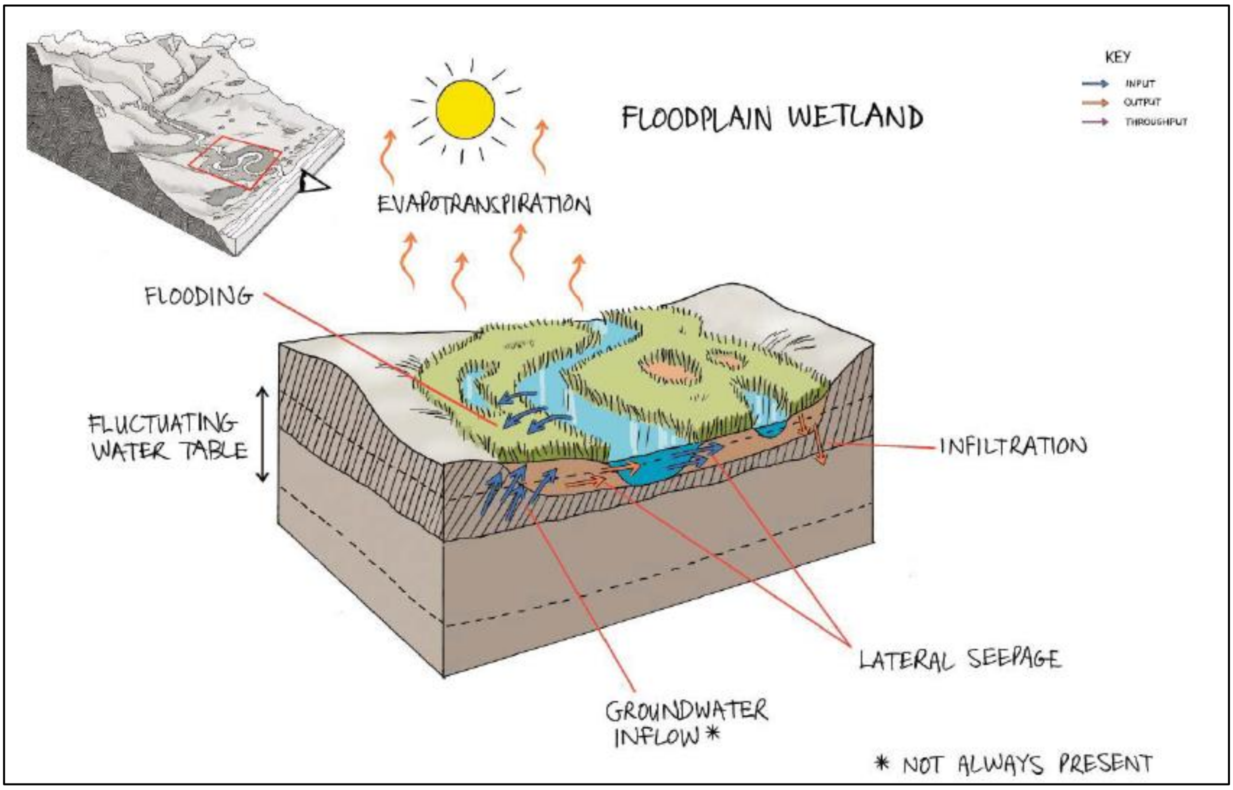


Figure 9: Illustration of floodplain flow dynamics (Ollis et al. 2013)

The floodplains have defined channels, as a result of erosion, with water generally flowing to the west. The floodplain flats are being used for grazing and baling of grass and the ground cover is sparse. The floodplains within the project area are shown in Figure 10. The dominant wetland vegetation that was identifiable within the project area was *Typha capensus, Imperata cylindrica,* and *Phragmites australus* as shown in Figure 11. It must be noted that the vegetation was dry, and identification was impaired as a result. The dominant soil forms identified were the Katspruit, Westleigh, and Rensburg forms as shown in Figure 12.

Figure 10: Photographs of the floodplains in the project area

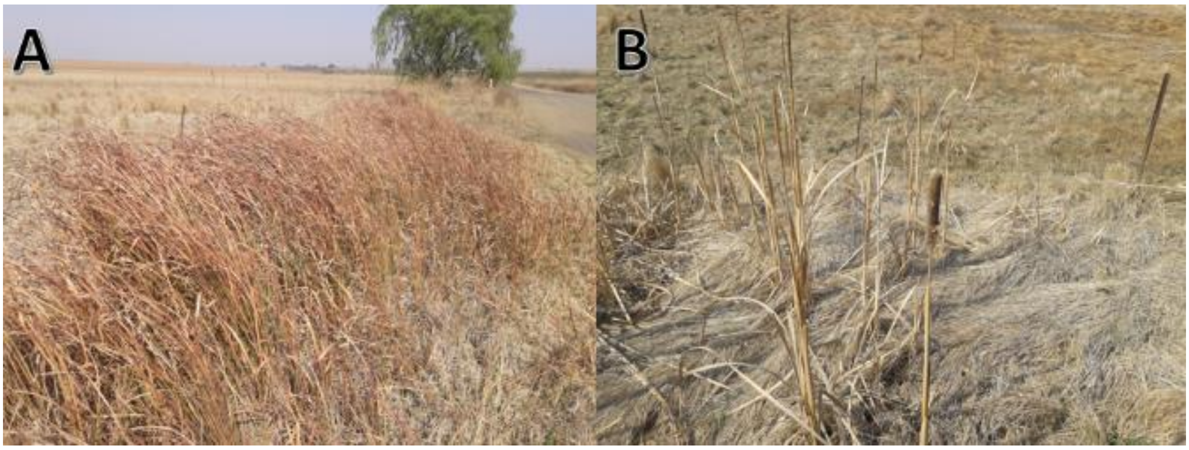


Figure 11: Wetland vegetation that could be identified, A) Imperata cylindrica, B) Typha capensus

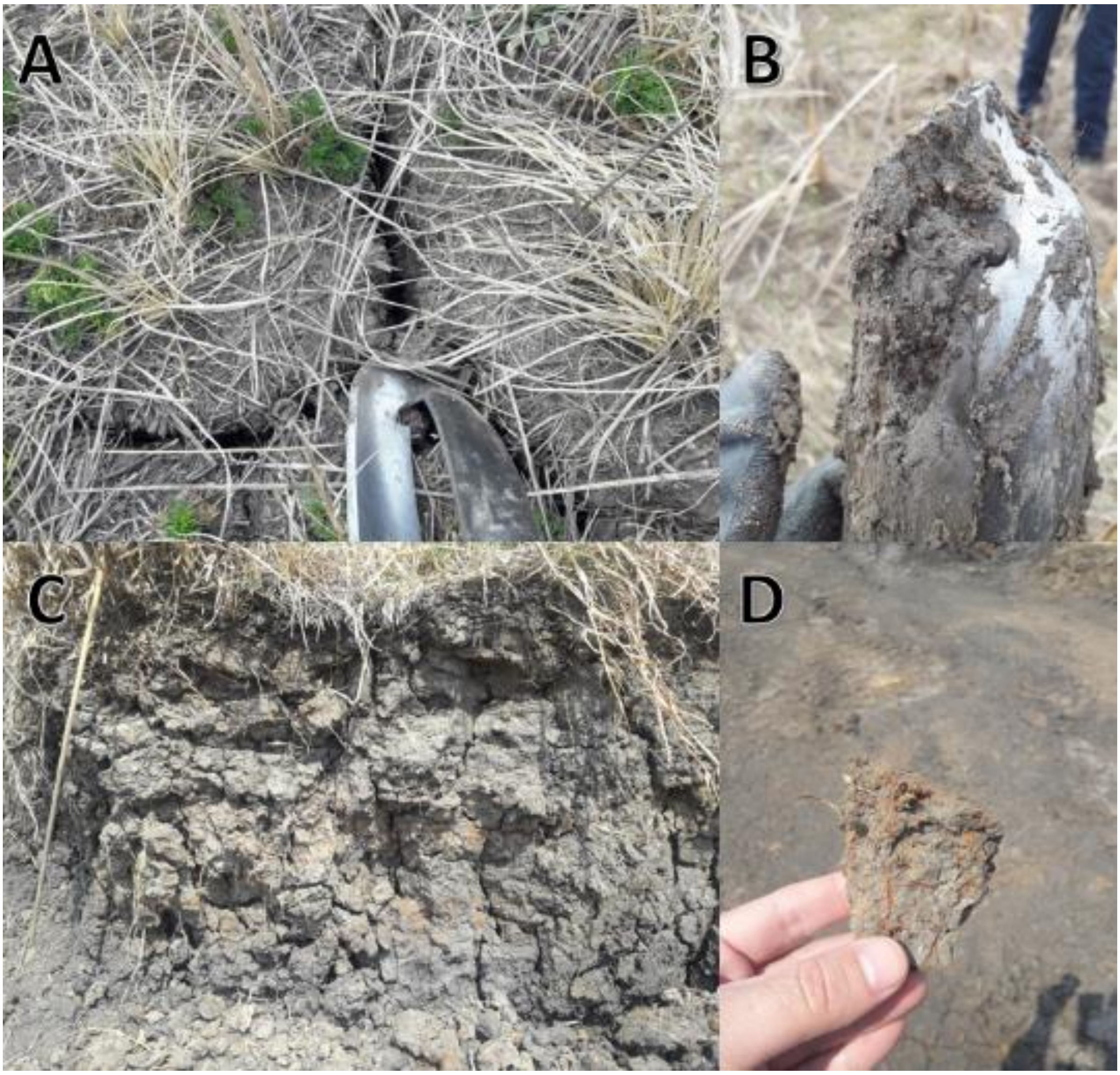


Figure 12: Soils identified in the project area, A) Rensburg, B) Saturated soil, C) Katspruit, D) G-horizon

8.1.2 Unchannelled Valley Bottom (HGM 3)

Unchannelled valley bottom wetland is a valley bottom wetland without a river channel running through it. Unchannelled valley bottom wetlands are characterised by their location on valley floors, an absence of distinct channel banks, and the prevalence of diffuse flows (Ollis et al. 2013). This has been illustrated in Figure 13.

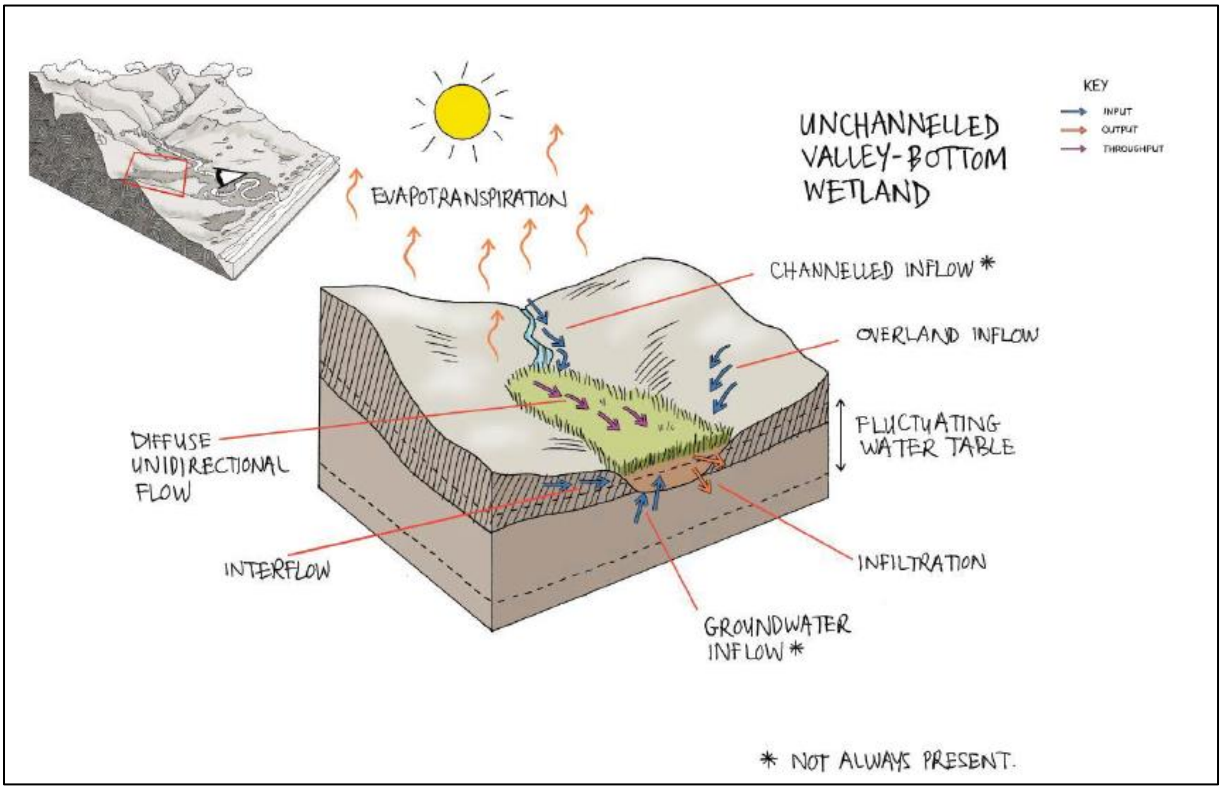


Figure 13: Illustration of unchannelled valley bottom flow dynamics (Ollis et al. 2013)

The unchannelled valley bottom wetlands or situated on the upper reaches of the micro-catchments. The unchannelled valley bottoms are being used for grazing and the ground cover is sparse. The unchannelled valley bottoms within the project area are shown in Figure 14. The dominant wetland vegetation that was identifiable within the project area was *Typha capensus, Imperata cylindrica,* and *Schoenoplectus spp.* as shown in Figure 15. The dominant soil forms identified were the Westleigh, and Katspruit as shown in Figure 16.

Figure 14: Photographs of the unchannelled valley bottom wetlands in the project area

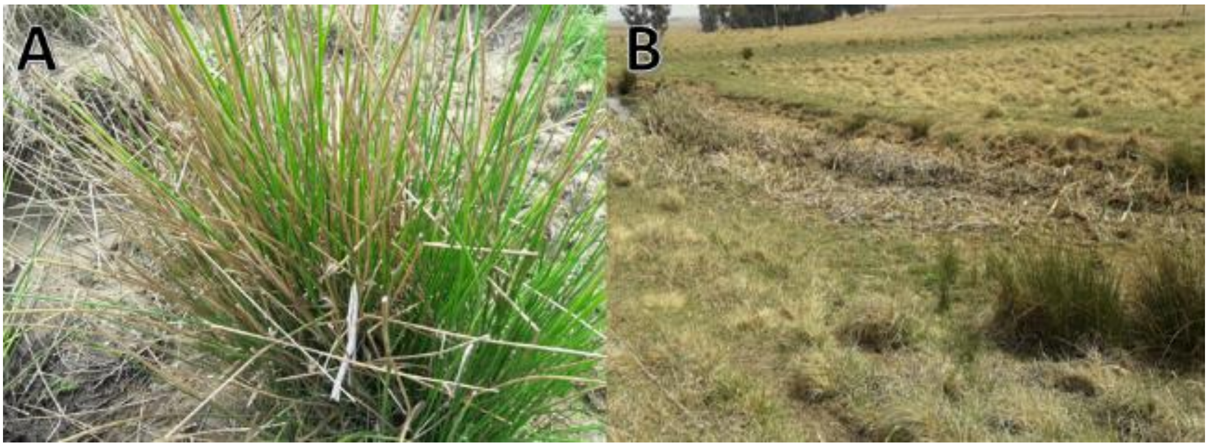


Figure 15: Wetland vegetation that could be identified, A) Schoenoplectus spp., B) Typha capensus

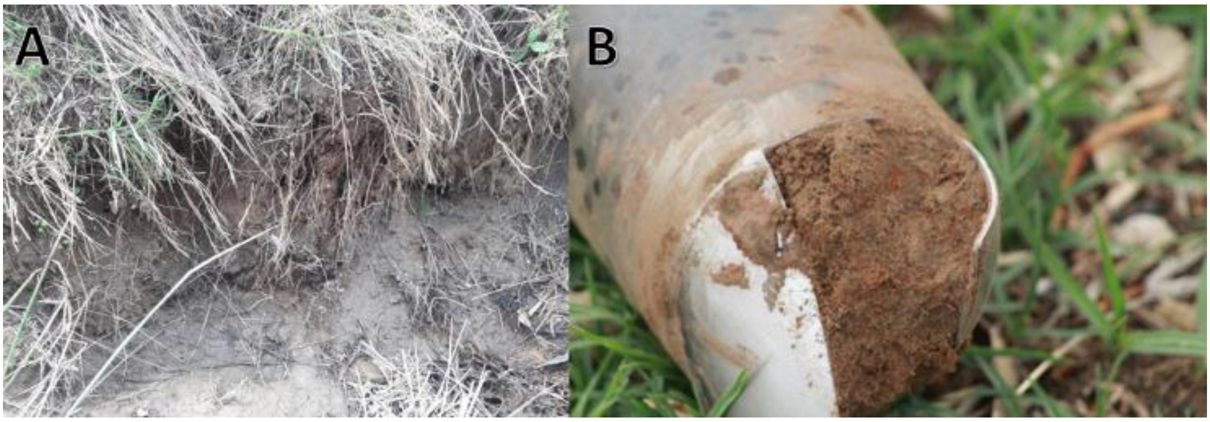


Figure 16: Soils identified in the project area, A) Katspruit, B) Signs of wetness in a Westleigh profile

8.1.3 Channelled Valley Bottom (HGM 4)

Channelled valley bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland (Ollis et al. 2013). This has been illustrated in Figure 17.

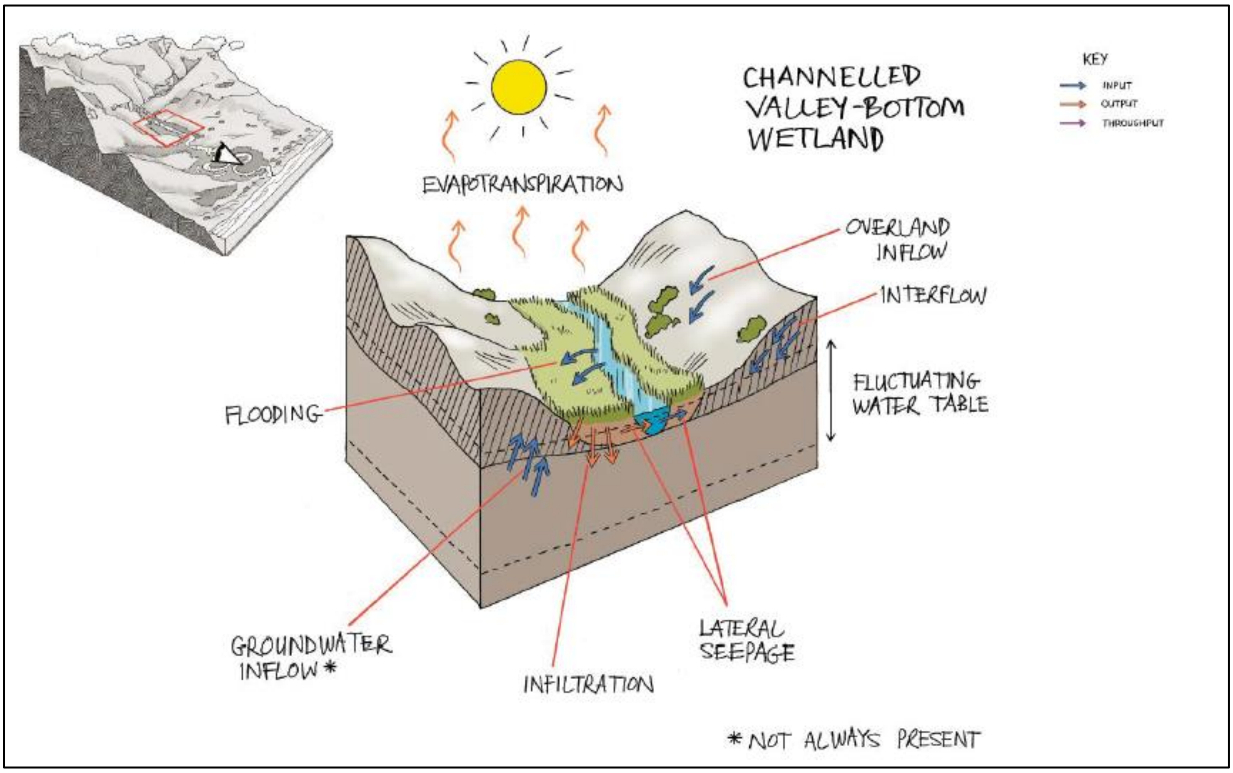


Figure 17: Illustration of channelled valley bottom flow dynamics (Ollis et al. 2013)

The channelled valley bottoms have defined channels, as a result of erosion. The channelled valley bottoms within the project area are shown in Figure 18. The dominant wetland vegetation that was identifiable within the project area was *Typha capensus, Imperata cylindrica,* and *Schoenoplectus spp.* as shown in Figure 19. The dominant soil forms identified were the Katspruit, Westleigh, and Rensburg as shown in Figure 20.

Figure 18: Photographs of the channelled valley bottom wetlands in the project area

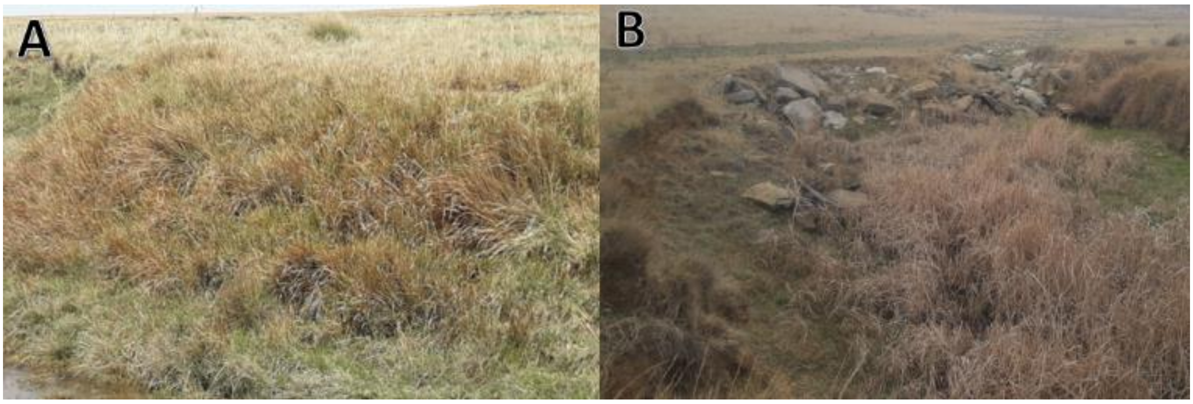


Figure 19: Wetland vegetation that could be identified, A) Imperata cylindrica, B) Typha capensus

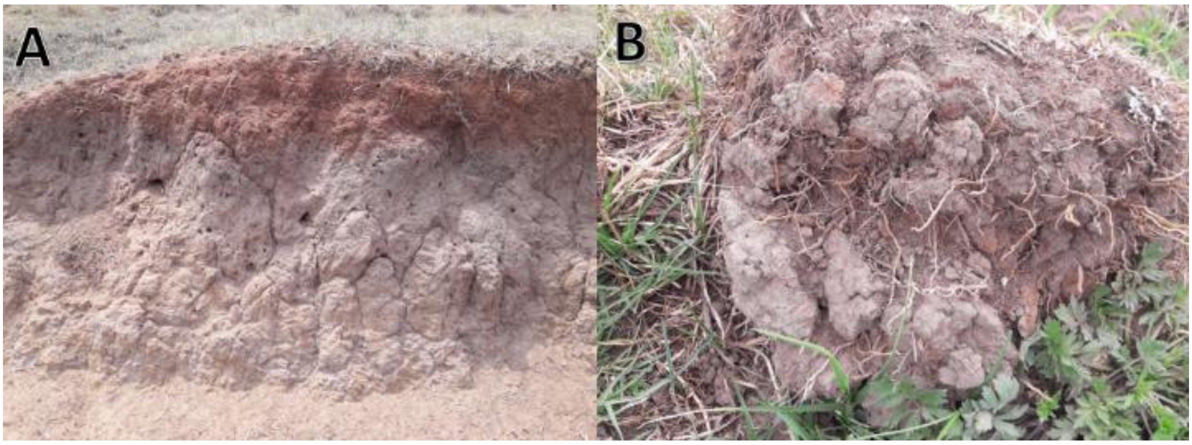


Figure 20: Soils identified in the project area, A) Longlands, B) Katspruit

8.1.4 Hillslope Seep (HGM 5)

Hillslope seep are wetland areas located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend onto a valley floor. Water inputs are primarily via subsurface flows from an up-slope direction. Water movement through the seep is mainly in the form of interflow, with diffuse overland flow often being significant during and after rainfall events (Ollis et al. 2013). A conceptual diagram of a seep, showing the dominant movement of water into, through and out of a typical seep is provided in Figure 21.

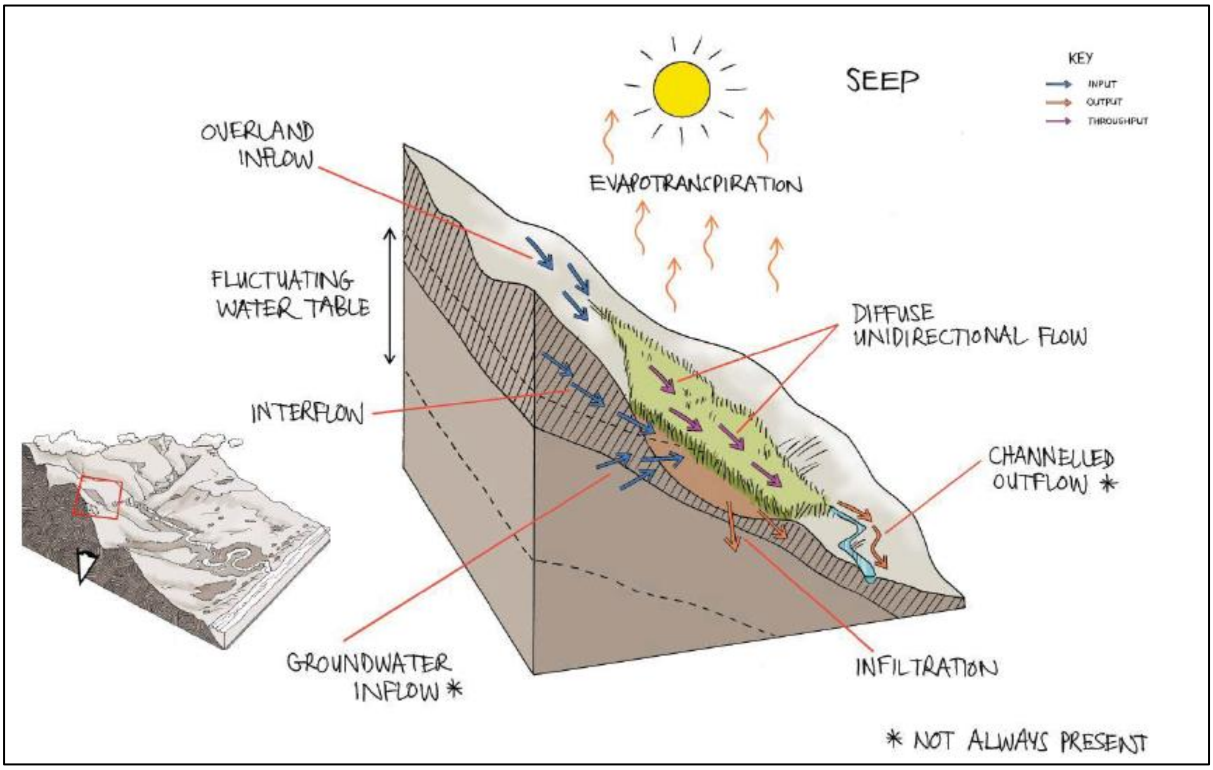


Figure 21: Illustration of hillslope seep flow dynamics (Ollis et al. 2013)

The hillslope seeps are large areas either feeding the valley bottom wetlands or the areas of flat topography as seen in the southern portion of the project area. Large areas of seeps have been ploughed for commercial agriculture. The seeps within the project area are shown in Figure 22. The dominant wetland vegetation that was identifiable within the project area was *Imperata cylindrica,* with most other vegetation being ploughed or being too dry to identify, as shown in Figure 23. The dominant soil forms identified were the Longlands, Westleigh, and Katspruit as shown in Figure 24.

Figure 22: Photographs of hillslope seep wetlands in the project area

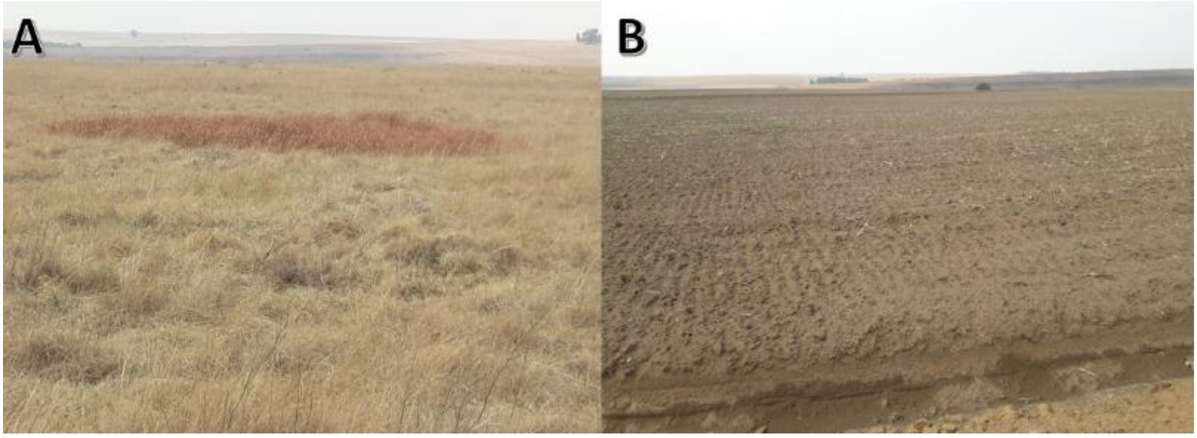


Figure 23: Wetland vegetation that could be identified, A) Imperata cylindrica, B) Ploughed fields

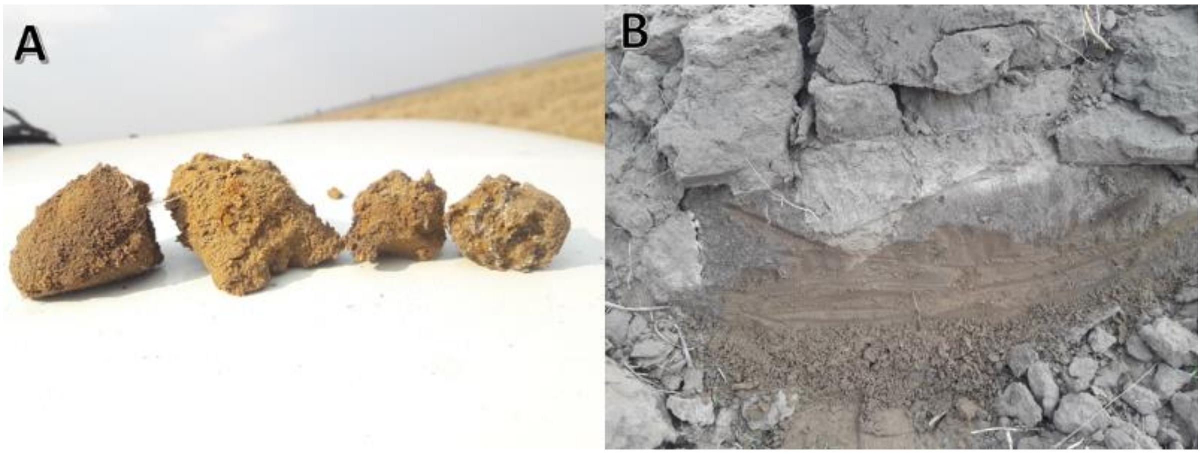


Figure 24: Soils identified in the project area, A) Longlands/Avalon, B) E-horizon

8.1.5 Flat (HGM 6)

Wetland flats are level or near-level wetlands that are not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat (Ollis et al. 2013). This has been illustrated in Figure 25.

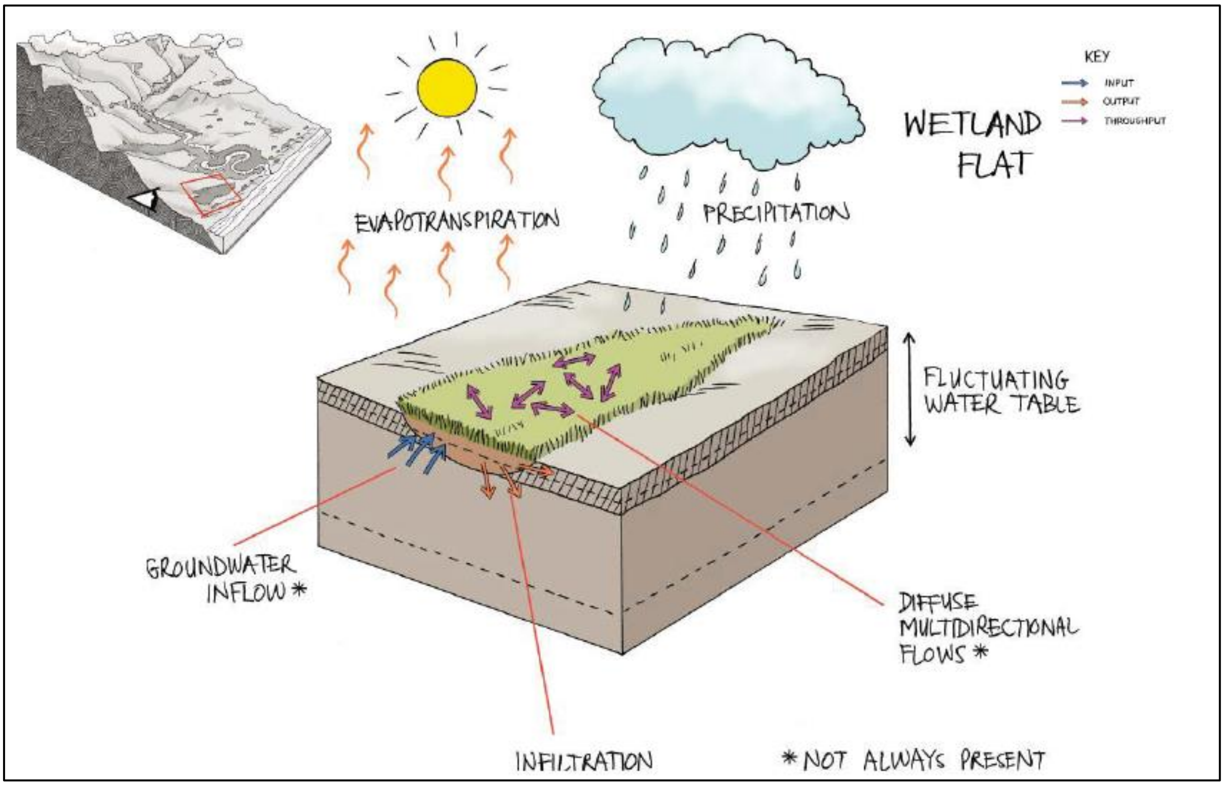


Figure 25: Illustration of bench flat flow dynamics (Ollis et al. 2013)

The flat wetland is fed by seepage from sandstone layer in Hills. The road acts as a dam wall stopping water from flowing through to the floodplain. The wetland flats within the project area are shown in Figure 26. No wetland vegetation was identifiable within the project. The dominant soil forms identified were the Rensburg, Katspruit, and Tukulu forms as shown in Figure 27.

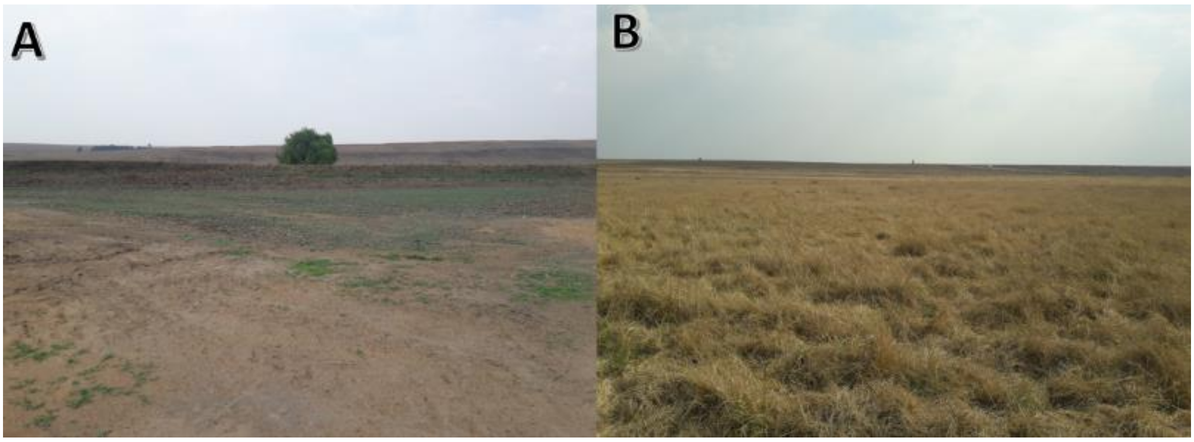


Figure 26: Photographs of the bench flat wetlands in the project area

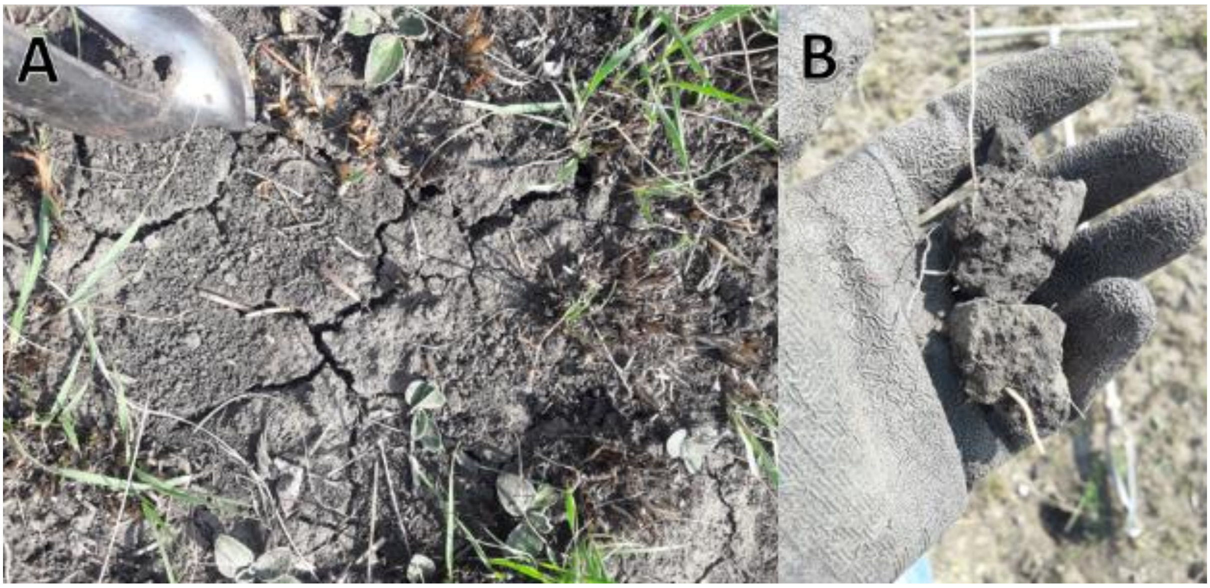


Figure 27: Soils identified in the project area, A) Rensburg, B) Tukulu

8.1.6 Depression (HGM 7 and HGM 8)

Depressions are wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates (Ollis et al. 2013). This has been illustrated in Figure 28.

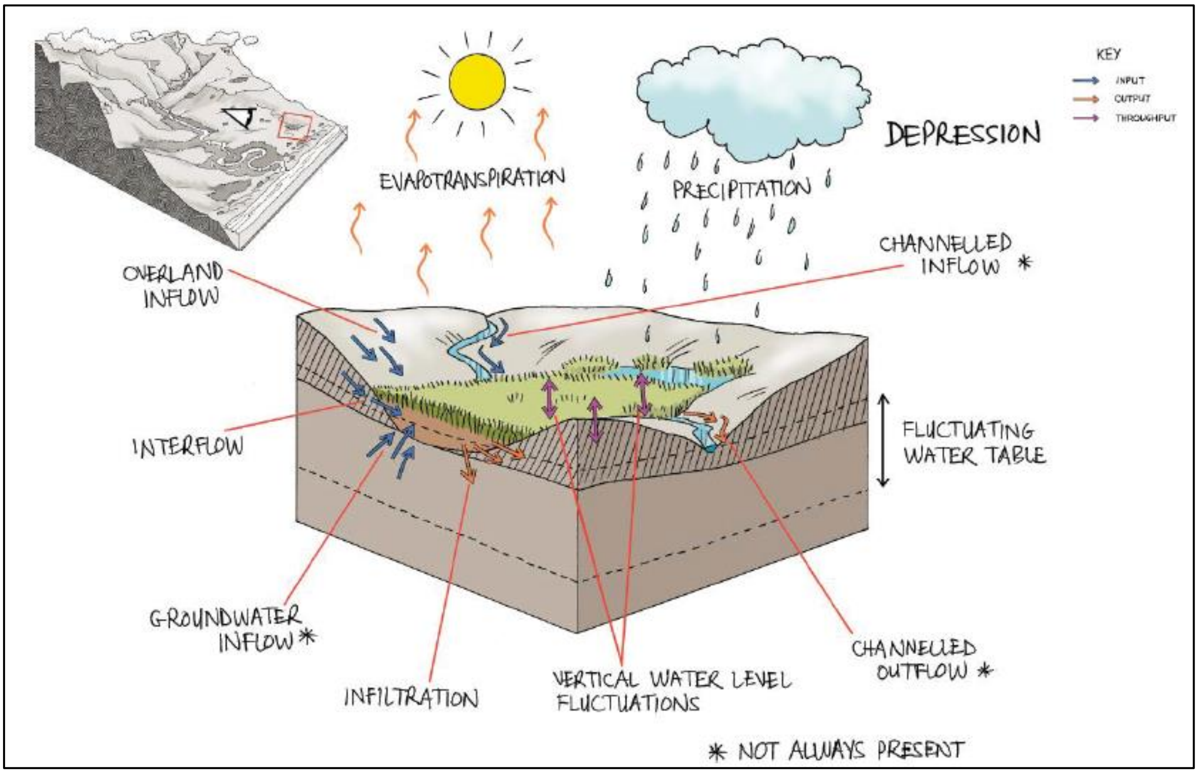


Figure 28: Illustration of depression flow dynamics (Ollis et al. 2013)

The two types of depressions within the project area are shown in Figure 29. The dominant wetland vegetation that was identifiable within the project area was *Typha capensus, Imperata cylindrica,* and *Phragmites australus*. The dominant soil forms identified were the Katspruit, Westleigh, and Rensburg.

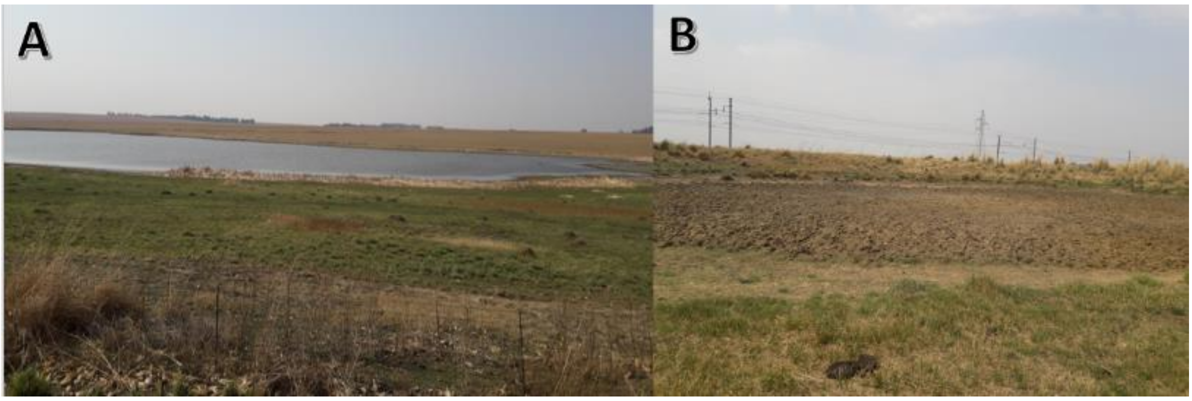


Figure 29: Photographs of the depressions in the project area

8.2 Present Ecological State

The PES for the assessed HGM units is presented in Table 6. The overall wetland health for HGM 1 was determined to be Largely Modified (D), with the remaining HGM units determined to be Moderately Modified (C). The impacts affecting the wetland health are shown in Figure 30. The PES was assessed for the natural wetlands HGM 1 to HGM 8, with HGM 9 (the artificial dams being omitted as these cannot be assessed.

Table 6: Summary of the scores for the wetland PES

Wetland Area	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	C: Moderately Modified	3.5	D: Largely Modified	4.7	D: Largely Modified	4.0
Overall PES Score	4.0		Overall PES Class		D: Largely Modified	
HGM 2	C: Moderately Modified	3.5	C: Moderately Modified	3.7	D: Largely Modified	4.0
Overall PES Score	3.7		Overall PES Class		C: Moderately Modified	
HGM 3	C: Moderately Modified	3.5	C: Moderately Modified	2.7	D: Largely Modified	4.1
Overall PES Score	3.4		Overall PES Class		C: Moderately Modified	
HGM 4	C: Moderately Modified	3.5	C: Moderately Modified	3.1	D: Largely Modified	4.1
Overall PES Score	3.6		Overall PES Class		C: Moderately Modified	
HGM 5	C: Moderately Modified	3.5	B: Largely Natural	1.6	C: Moderately Modified	3.9
Overall PES Score	3.1		Overall PES Class		C: Moderately Modified	

HGM 6	C: Moderately Modified	3.5	B: Largely Natural	1.4	C: Moderately Modified	4.2
Overall PES Score	3.1		Overall PES Class		C: Moderately Modified	
HGM 7	C: Moderately Modified	3.5	B: Largely Natural	1.4	C: Moderately Modified	3.6
Overall PES Score	2.9		Overall PES Class		C: Moderately Modified	
HGM 8	B: Largely Natural	1.5	B: Largely Natural	1.5	D: Largely Modified	5.8
Overall PES Score	2.7		Overall PES Class		C: Moderately Modified	

The two identified floodplains (HGM 1 and HGM 2) are generally in a good condition, however dams have been constructed within the floodplain. These dams have altered the hydrological component (moderately modified condition) as well as the geomorphological and vegetative components (largely modified condition). The reaches downstream have undergone severe erosion. This was caused by the dam overtopping and water rushing through the spillways, the increased flows and changed input locations caused new channels to be eroded altering the flow dynamics and locations of the floodplain channels. As a result of the erosion the dam's ultimately fail. The floodplain does however gradually recover to an equilibrated state. This cycle continues all the way down the reach.

The road crossing structures create an area of increased flow velocity as well as a reduction in wetland area. The increased flow velocities cause erosion downstream.

The seeps, flats and depressions had a largely natural geomorphological rating, but the hydrological/vegetation components were moderately modified. These wetlands were subjected to grazing pressures and commercial cropping land uses. The flats and depressions have also been utilised as water holes for cattle, which compacts the surface of the wetland as well as reduces the ground cover through grazing and trampling

There are patches of alien vegetation within the HGM units reducing water throughputs in the system. The cropped areas are generally bare after harvesting and these increase the sediment loads as well as the runoff into the floodplain. The area is also used for grazing and this reduces ground cover and surface roughness, which increases surface runoff volumes and velocities. The increased runoff increases the risk of erosion.

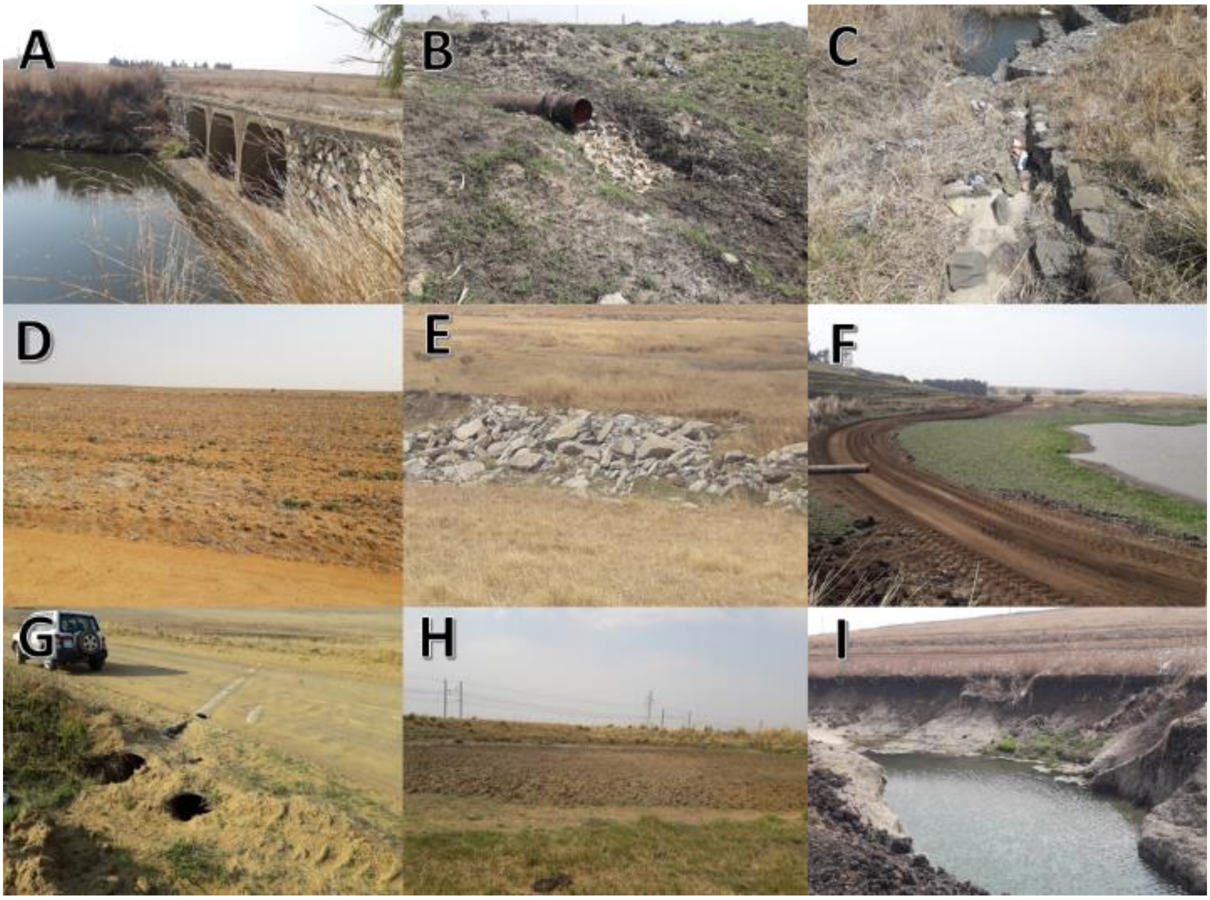


Figure 30: The current impacts on the wetland systems, A) Crossing infrastructure altering flow dynamics , B) Additional water inputs, C) Stormwater inputs from roads, D) Commercial agriculture, bare areas, and sediment sources, E) Incorrect erosion control, F) Dams within floodplains, G) Dirt roads with limited through flow for seeps, H) Depressions and flats used as watering holes, I) Deeply eroded channels

8.3 Ecosystem Service Assessment

The Ecosystem services provided by the HGM units present were assessed and rated using the WET-EcoServices method (Kotze, et al. 2009). The summarised results for the HGM units are shown in Table 7.

All HGM units exhibited a moderately high benefit for indirect benefits such as; sediment trapping, and phosphate/nitrate/toxicant assimilation. HGM 7, 8, and 9 had a moderately high benefit for flood attenuation. The floodplains HGM 1 and HGM 2 exhibited a moderately high benefit for biodiversity maintenance providing suitable habitat for fauna and flora. HGM 3 and HGM 8 had a moderately high benefit for erosion control. The remaining benefits were rated as intermediate or lower.

Although the wetlands are impacted upon, in the local setting, sudden downpours and flash floods are a common occurrence and the wetland channels allows for floods to be attenuated and slowed down and minimise damage. The wetlands further assist with the provision of a continuous water source for the downstream areas.

Table 7: The EcoServices being provided by the wetlands associated with the project

Wetland Unit				HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6	HGM 7	HGM 8	HGM 9
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation	2.0	1.9	2.0	1.9	1.8	2.0	2.2	2.2	2.2
			Streamflow regulation	2.0	2.0	2.0	1.8	1.7	1.0	1.0	1.3	2.0
		Water Quality enhancement benefits	Sediment trapping	2.4	2.5	2.5	2.4	2.8	2.9	2.2	2.7	2.2
			Phosphate assimilation	2.3	2.3	2.6	2.2	2.7	2.8	2.4	2.5	2.3
			Nitrate assimilation	2.3	2.3	2.8	2.1	2.7	2.6	2.4	2.6	2.1
			Toxicant assimilation	2.4	2.3	2.5	2.1	2.5	2.5	2.1	2.4	2.1
			Erosion control	1.9	1.8	2.2	1.7	1.6	1.9	1.9	2.1	1.5
			Carbon storage	1.7	1.7	2.0	1.7	0.7	0.7	0.7	2.0	1.3
	Direct Benefits		**Biodiversity maintenance**	3.0	3.0	1.8	1.6	1.1	1.0	1.5	1.6	1.6
		Provisioning benefits	Provisioning of water for human use	1.3	1.3	1.0	1.0	0.6	0.5	0.7	1.1	1.2
			Provisioning of harvestable resources	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Provisioning of cultivated foods	1.6	1.6	1.6	1.6	1.2	1.2	1.2	1.2	1.2
		Cultural benefits	Cultural heritage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Tourism and recreation	1.7	1.7	0.6	0.7	0.1	0.1	0.1	1.7	1.7
			Education and research	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Overall				25.4	25.3	24.3	21.5	20.3	19.9	19.2	24.2	22.1
Average				1.7	1.7	1.6	1.4	1.4	1.3	1.3	1.6	1.5

8.4 Ecological Importance & Sensitivity

The EIS assessment was applied to the HGM units described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetlands. The results of the assessment are shown in Table 8. The following was also considered for the determination of the EIS (from TBC, 2018):

- Much of the project area is identified as either HMAs or ONAs, while a smaller percentage are classified as ESAs and as CBAs. A large CBA bisects the southern portion of the main project area.;
  - According to the MPAES (2013) this CBA area is also a provincially protected area and part of the 'provincial protected area expansion strategy';
- According to this, the overall project area, overlaps entirely with ecosystems that are listed as Vulnerable (VU);
- The majority of the terrestrial ecosystems associated with the development are rated as *not protected* and small pockets in both the portions of the project area are rated as *poorly protected*;
- Based on the SANBI (2010) Protected Areas Map and the National Protected Areas Development Strategy (NPAES) the project area does not overlap with, nor will the proposed development impact upon, any formally or informally protected area;
- One river occur along the southern boundary of the main project area and is classified as an NFEPA river. This river is classed as 'D', which means it is considered to be heavily modified;
- The project area is situated entirely within one vegetation type; namely the Eastern Highveld Grassland (GM12). This vegetation type is listed as Endangered;
- One bird SCC was recorded during the survey, namely Secretary bird (*Sagittarius serpentarius*) during the October 2018 survey; and
- Overall, mammal diversity in the project area was moderate to high, with fifteen (15) mammal species being recorded during the October 2018 survey. Three (3) mammal species of conservation concern were recorded.

The EIS was calculated to have a Very High (A) importance for HGM 1. This rating can be attributed to the ecological importance of the floodplain from an NFEPA perspective as well as the national ecosystem classifications rating this area as vulnerable. HGM 2, 3, 4, 8, and 9 were rated as High (B) importance. HGM 5, 6, and 7 were rated as Moderate (C) importance.

The Hydrological Functionality of HGM 1, 2, 3, and 8 were rated as High (B) importance. HGM 4, 5, 6, and 7 were rated as Moderate (C) importance. The wetland's hydrology ensured that there was a constant water source within the area. Furthermore, the flood attenuation offered by the wetland contributes to the protection of the local area from flooding and drought. The Direct Human Benefits were calculated to have a have a Low (D) for all HGM units.

Table 8: The EIS assessment results for the project area

Wetland Importance and Sensitivity	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6	HGM 7	HGM 8	HGM 9
Ecological Importance & Sensitivity	3.2	2.8	2.3	2.2	1.6	1.6	1.6	2.3	2.3
Hydrological/Functional Importance	2.1	2.1	2.3	2.0	2.1	2.0	1.9	2.2	2.0
Direct Human Benefits	0.5	0.9	0.7	0.7	0.5	0.4	0.5	0.8	0.8

8.5 Buffer Assessment

The buffer assessment is only applicable to the vent shaft and powerline areas, as the buffer preserves surface impacts to the wetland and cannot address the underground mining impacts.

The wetland buffer zone tool was used to calculate the appropriate buffer required for the project aspects above. According to the buffer guideline (Macfarlane, *et al*. 2014) a high-risk activity would require a buffer that is 95% effective to reduce the risk of the impact to a low level threat.

The recommended minimum buffer according to the guidelines is 25 m for the vent shafts and 10 m for the associated powerline (Table 9) for all phases.

Table 9: Post-mitigation buffer requirement

Required Buffer after mitigation measures have been applied	
Vent and Shafts	25 m
Powerline	10 m

A conservative buffer zone was suggested of 25 m for the vent shafts and 10 m for the associated powerline, this buffer is calculated assuming mitigation measures are applied. This would typically include a commitment to rehabilitate and manage buffer zones to ensure that these areas function optimally.

It must be noted that the alternative vent shaft is within the wetland buffer and it is recommended that the preferred shaft location be used. The powerline (both alternatives) will traverse many wetland areas and it is recommended that the powerline route be situated on the existing servitude and that spans are planned to cross wetland areas and their associated buffer zones.

9. Impact (Risk) Assessment

Wetlands are expected to be located within the 500m regulated areas, and a risk assessment has been conducted to present the potential level of risk posed by various aspects of the proposed ventilation shaft, powerline, and underground mining areas.

9.1 Underground Mining

The largest impact considered for underground mining will be the risk of subsidence. This will change drainage patterns, topographical features and possible wetland areas, altering the landscape and its functioning. If subsidence occurs, it will severely impact on the "Flow regime" and "Habitat" of the wetland systems. The impact will affect the region through altering of the landscape. The duration of the impact was rated as lowering the PES values permanently. Although the impact has low chance of occurring, it will have large and long-lasting impact on the wetland systems. The risk pre-mitigation was rated as moderate and the risk will not be lowered to a low level with mitigation. However, mitigation is crucial to minimise the risk as far as possible.

Aspects associated with the respective phases of the project are presented in the subsequent sections. Findings from the DWS aspect and impact register/risk assessment are provided in Table 10, Table 11, and Table 12 .

9.2 Ventilation Shaft

Wetlands are located within 500m of both vent shaft areas, and a risk assessment has been conducted to determine the level of risk posed by the proposed project to the wetlands, if any.

All aspects considered for the three respective project phases of the proposed project were determined to pose at least a moderate risk pre-mitigation. Mitigation measures have been prescribed to further reduce to the level of risk posed by the proposed project. All aspects then are rated as low risk.

Despite the Low risk rating determined by the risk matrix, it is the opinion of the specialist that the proposed vent shaft location poses no risk to any wetland area within the required 500m (radius) assessment area for the two proposed vent shafts, however the access to this location might pose a risk.

Aspects associated with the respective phases of the project are presented in the subsequent sections. Findings from the DWS aspect and impact register/risk assessment are provided in Table 13, Table 14, and Table 15.

9.3 Powerline

Wetlands are located within 500m of the powerline route, and a risk assessment has been conducted to determine the level of risk posed by the proposed project to the wetlands, if any.

All aspects considered for the three respective project phases of the proposed project were determined to pose at least a moderate risk pre-mitigation. Mitigation measures have been prescribed to further reduce to the level of risk posed by the proposed project. All aspects then are rated as low risk.

It is the opinion of the specialist that the proposed powerline (both alternatives) poses low risk to wetlands within the required 500m (radius) assessment area, however the access to this location might pose a risk. The powerline must also be placed as close to the road reserve as possible to reduce impacts.

Aspects associated with the respective phases of the project are presented in the subsequent sections. Findings from the DWS aspect and impact register/risk assessment are provided in Table 16, Table 17, and Table 18.

9.4 Risk Tables

Table 10: Impacts Assessed for the Underground mining area

Activity	Aspect	Impact
Andrew Husted (Pr Sci Nat 400213/11)		
Construction phase	Subsidence	Change in land topography and drainage of the landscape.
Operation phase	Subsidence	Change in land topography and drainage of the landscape.

Table 11: DWS Risk Impact Matrix for the Underground mining area

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Subsidence	5	1	5	3	**3.5**	3	4	**10.5**
Operational Phase								
Subsidence	5	1	5	3	**3.5**	3	4	**10.5**

Table 12: DWS Risk Impact Matrix for the Underground mining area (continued)

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	Confidence Level	Control Measures	Borderline LOW MODERATE Rating Classes	PES & EIS
Construction Phase											
Subsidence	4	1	1	3	9	94.5	Moderate	80%	Section 11	Moderate	D/C & Very High to Moderate
Operational Phase											
Subsidence	4	1	1	3	9	94.5	Moderate	80%	Section 11	Moderate	D/C & Very High to Moderate

Table 13: Impacts Assessed for the proposed Vent Shaft

Activity	Aspect	Impact
Andrew Husted (Pr Sci Nat 400213/11)		
Construction phase	Clearing of vegetation Stripping of topsoil Laydown yards Heavy machinery operation Stockpiling topsoil and subsoil Constructing of temporary access routes	The clearing of vegetation and stripping of topsoil will increase runoff and increase the potential of erosion and sedimentation of the wetland systems. The operation of heavy machinery brings the risk of hydrocarbon spills which will pollute the wetland systems. Stockpiles change drainage patterns and act as a source of sediment if not revegetated. Access routes changes drainage as well as having the potential to alter wetlands structures if the locations are not set to avoid wetlands
Operation phase	Stormwater management Heavy machinery operation Soil Stockpiles Alien vegetation encroachment	The increased impervious areas will alter the quantity and quality of the runoff from the site. The increased runoff has the potential to cause erosion and sedimentation within nearby wetland systems. The operation of heavy machinery brings the risk of hydrocarbon spills which will pollute the wetland systems. Stockpiles change drainage patterns and act as a source of sediment if not revegetated. Alien vegetation will encroach into disturbed areas and alter the vegetative component and functioning of wetland systems.
Rehabilitation phase	Stormwater management Heavy machinery operation Soil Stockpiles Replacement of soils in the predetermined order Revegetation of rehabilitated areas Alien vegetation encroachment	The stormwater system will be removed, and the rehabilitation will attempt to reinstate the natural drainage from a water quality and quantity perspective. The operation of heavy machinery brings the risk of hydrocarbon spills which will pollute the wetland systems. Soil Stockpiles will be used to rehabilitate which will mitigate the impacts they had in the construction and operational phases. Revegetating the rehabilitated areas will improve the natural wetland system and reduce the erosion and sediment sources. With the correct alien management plan in place the impact of alien vegetation can be reduced.

Table 14: DWS Risk Impact Matrix for the proposed Vent Shaft

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Clearing of vegetation	3	3	3	3	**3**	2	2	**7**
Stripping of topsoil	3	3	3	3	**3**	2	2	**7**
Laydown yards	2	3	2	3	**2.5**	2	2	**6.5**
Heavy machinery operation	1	4	2	3	**2.5**	1	3	**6.5**
Stockpiling topsoil and subsoil	2	3	2	3	**2.5**	2	2	**6.5**
Constructing of temporary access routes	2	2	2	2	**2**	2	2	**6**
Operational Phase								
Stormwater management	4	3	3	2	**3**	2	3	**8**
Heavy machinery operation	1	4	2	2	**2.25**	1	2	**5.25**
Soil Stockpiles	3	3	4	3	**3.25**	2	3	**8.25**
Alien vegetation encroachment	1	1	3	2	**1.75**	2	3	**6.75**
Rehabilitation Phase								
Stormwater management	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**7**
Heavy machinery operation	1	3	1	3	**2**	1	2	**5**
Soil Stockpiles	2	3	3	3	**2.75**	2	2	**6.75**
Replacement of soils in the predetermined order	3	3	3	3	**3**	3	2	**8**
Revegetation of rehabilitated areas	3	3	3	3	**3**	2	2	**7**
Alien vegetation encroachment	2	1	3	3	**2.25**	2	2	**6.25**

Table 15: DWS Risk Impact Matrix for the proposed Vent Shaft (continued)

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	Confidence Level	Control Measures	Borderline LOW MODERATE Rating Classes	PES & EIS
Construction Phase											
Clearing of vegetation	5	3	1	2	11	77	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Stripping of topsoil	5	3	1	2	11	77	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Laydown yards	5	3	1	2	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Heavy machinery operation	5	2	1	3	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Stockpiling topsoil and subsoil	5	2	1	3	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Constructing of temporary access routes	5	2	5	1	13	78	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Operational Phase											
Stormwater management	3	2	1	3	9	72	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Heavy machinery operation	2	2	1	3	8	42	Low	80%	Section 11	Low	D/C & Very High to Moderate
Soil Stockpiles	2	2	1	3	8	66	Moderate		Section 11	Low	D/C & Very High to Moderate
Alien vegetation encroachment	2	4	1	2	9	60.75	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Decommissioning Phase											
Stormwater management	4	3	1	3	11	77	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Heavy machinery operation	4	2	1	3	10	50	Low	80%	Section 11	Low	D/C & Very High to Moderate
Soil Stockpiles	3	3	1	2	9	60.75	Moderate	80%	Section 11	Low	D/C & Very High to Moderate

Replacement of soils in the predetermined order	3	3	1	2	9	72	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Revegetation of rehabilitated areas	2	2	1	2	7	49	Low	80%	Section 11	Low	D/C & Very High to Moderate
Establish working area	2	4	1	2	9	56.25	Moderate	80%	Section 11	Low	D/C & Very High to Moderate

Table 16: Impacts Assessed for the proposed Powerline (both alternatives)

Activity	Aspect	Impact
Andrew Husted (Pr Sci Nat 400213/11)		
Construction phase	Clearing of vegetation	The clearing of vegetation and stripping of topsoil will increase runoff and increase the potential of erosion and sedimentation of the wetland systems. The operation of heavy machinery brings the risk of hydrocarbon spills which will pollute the wetland systems. Stockpiles change drainage patterns and act as a source of sediment if not revegetated. Access routes changes drainage as well as having the potential to alter wetlands structures if the locations are not set to avoid wetlands
	Stripping of topsoil	
	Laydown yards	
	Heavy machinery operation	
	Stockpiling topsoil and subsoil	
	Constructing of temporary access routes	
Operation phase	Stormwater management	The increased impervious areas will alter the quantity and quality of the runoff from the site. The increased runoff has the potential to cause erosion and sedimentation within nearby wetland systems. The operation of heavy machinery brings the risk of hydrocarbon spills which will pollute the wetland systems. Stockpiles change drainage patterns and act as a source of sediment if not revegetated. Alien vegetation will encroach into disturbed areas and alter the vegetative component and functioning of wetland systems.
	Heavy machinery operation	
	Soil Stockpiles	
	Alien vegetation encroachment	

Table 17: DWS Risk Impact Matrix for the proposed Powerline (both alternatives)

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Clearing of vegetation	3	3	3	3	**3**	2	2	**7**
Stripping of topsoil	3	3	3	3	**3**	2	2	**7**
Laydown yards	2	3	2	3	**2.5**	2	2	**6.5**
Heavy machinery operation	1	4	2	3	**2.5**	1	3	**6.5**
Stockpiling topsoil and subsoil	2	3	2	3	**2.5**	2	2	**6.5**
Constructing of temporary access routes	2	2	2	2	**2**	2	2	**6**
Operational Phase								
Stormwater management	4	3	3	2	**3**	2	3	**8**
Heavy machinery operation	1	4	2	2	**2.25**	1	2	**5.25**
Soil Stockpiles	3	3	4	3	**3.25**	2	3	**8.25**
Alien vegetation encroachment	1	1	3	2	**1.75**	2	3	**6.75**

Table 18: DWS Risk Impact Matrix for the proposed Powerline (both alternatives) (continued)

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	Confidence Level	Control Measures	Borderline LOW MODERATE Rating Classes	PES & EIS
Construction Phase											
Clearing of vegetation	5	3	1	2	11	77	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Stripping of topsoil	5	3	1	2	11	77	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Laydown yards	5	3	1	2	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Heavy machinery operation	5	2	1	3	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Stockpiling topsoil and subsoil	5	2	1	3	11	71.5	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Constructing of temporary access routes	5	2	5	1	13	78	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Operational Phase											
Stormwater management	3	2	1	3	9	72	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Heavy machinery operation	2	2	1	3	8	42	Low	80%	Section 11	Low	D/C & Very High to Moderate
Soil Stockpiles	2	2	1	3	8	66	Moderate	80%	Section 11	Low	D/C & Very High to Moderate
Alien vegetation encroachment	2	4	1	2	9	60.75	Moderate	80%	Section 11	Low	D/C & Very High to Moderate

10. Impact Assessment

10.1 Methodology

The impact assessment methodology was provided by EIMS and is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

10.2 Current Impacts

The impacts affecting the wetland health are shown in Figure 35.

- Commercial crop production and plantations;
- Fences;
- Overgrazing and trampling of natural vegetation and wetlands by livestock;
- Farm roads and highways;
- Artificial impoundments;
- Artificial drainage in agricultural fields;
- Erosion;
- Alien and/or Invasive Plants (AIP);
- Water contamination; and
- Vegetation removal.

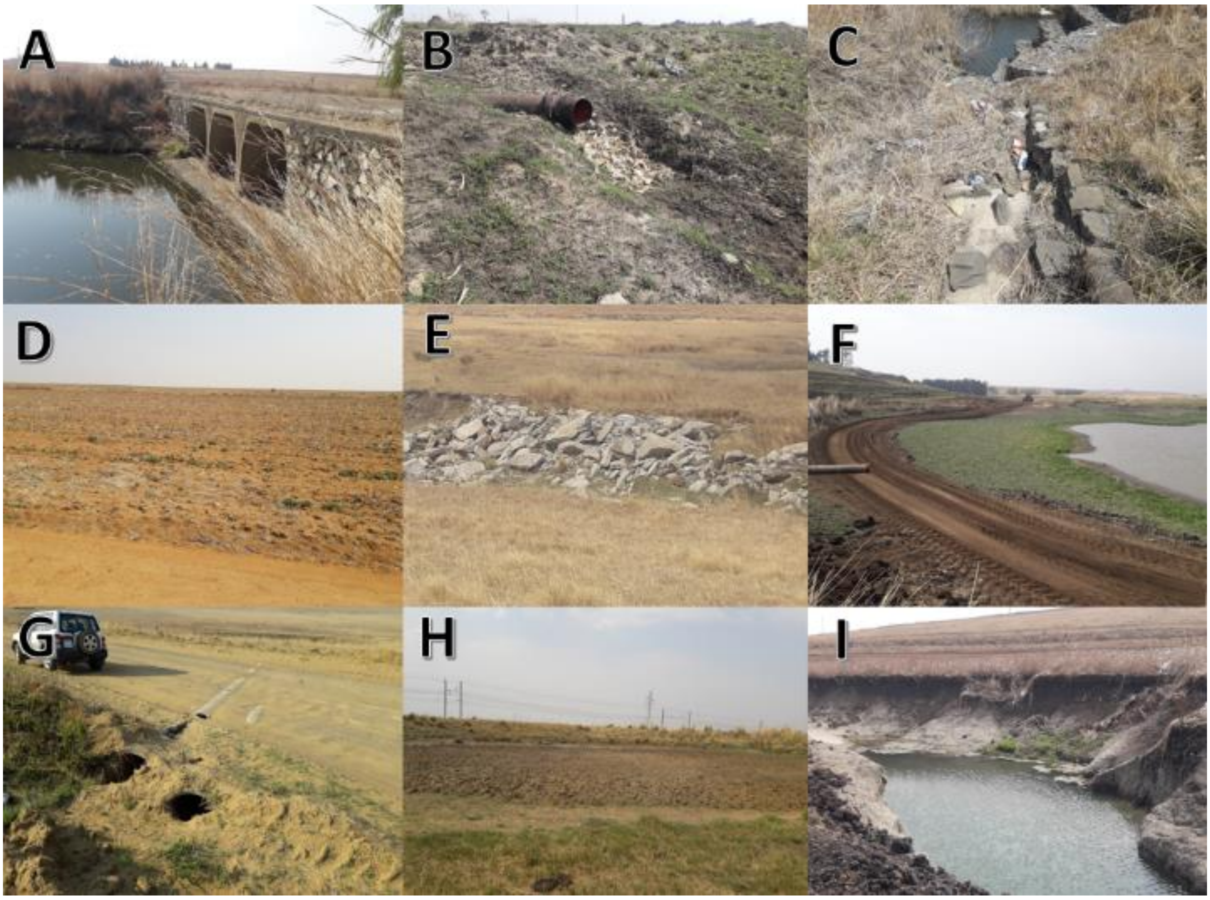


Figure 31: The current impacts on the wetland systems, A) Crossing infrastructure altering flow dynamics , B) Additional water inputs, C) Stormwater inputs from roads, D) Commercial agriculture, bare areas, and sediment sources, E) Incorrect erosion control, F) Dams within floodplains, G) Dirt roads with limited through flow for seeps, H) Depressions and flats used as watering holes, I) Deeply eroded channels

10.3 Anticipated Impact Framework

The proposed project could result in the loss and modifications of water resources, notably the delineated wetland areas. The following list provides a framework for the anticipated major impacts associated with the project.

1. Loss / degradation of wetlands
    a. Project activities that can cause loss of habitat
        i. Physical removal of vegetation
        ii. Access roads and servitudes
        iii. Construction camps & laydown areas
        iv. Infrastructure development
        v. Soil dust precipitation
        vi. Coal dust precipitation
        vii. Stochastic events such as fire (cooking fires or cigarettes from staff)
    b. Secondary impacts anticipated
        i. Loss of shallow recharge zones

   ii. Increased potential for soil erosion (in conjunction with alterations in hydrological regimes)
   iii. Increased potential for establishment of alien & invasive vegetation
   iv. Loss of ecosystem services

2. Spread and/or establishment of alien and/or invasive species
   a. Project activities that can cause the spread and/or establishment of alien and/or invasive species
      i. Vegetation removal
      ii. Soil excavations and soil transportation
      iii. Transportation vehicles potentially spreading seed while moving on, to and from mining areas
      iv. Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents
      v. Creation of infrastructure suitable for breeding activities of alien and/or invasive birds
3. Environmental pollution due to increased sedimentation and erosion of watercourses
   a. Project activities that can cause pollution in water courses
      i. Erosion
      ii. Clearing of vegetation
      iii. Earth moving (removal and storage of soil]
      iv. Excavation
      v. Soil dust precipitation
   b. Secondary impacts associated with pollution in water courses
      i. Groundwater pollution
      ii. Loss of ecosystem services
4. Impaired water quality (surface and groundwater)
   a. Project activities that can cause pollution in water courses
      i. Chemical (organic/inorganic) spills
      ii. Acid mine drainage (decanting)
      iii. Untreated runoff or effluent
      iv. Coal dust precipitation
5. Alterations in hydrological regime (flow of surface and sub-surface water)
   a. Project activities that can cause alterations in hydrological regime
      i. Excavations and infrastructure development
      ii. Road network creation
      iii. Alterations to surface topography (due to voids and surface structures)
      iv. Dewatering of underground mine area
   b. Secondary impacts associated with alterations in hydrological regime
      i. Loss of ecosystem services
      ii. Worsening of the ecological status of wetlands
      iii. Increased or reduced runoff dependent on system manipulation
      iv. Loss of soil fertility and topsoil recharge through interruption of seasonal recharge and natural flow, including natural sedimentation
      v. Scouring and erosion of wetlands
      vi. Loss of soil fertility and topsoil recharge through interruption of seasonal recharge and natural flow, including natural sedimentation

10.4 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management. A summary of the findings from a wetland perspective is presented in Table 19. Please note that not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases of the project lifecycle.

Table 19: Unplanned Events, Risks and their Management Measures

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spill into wetland habitat	Contamination of sediments and water resources associated with the spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downstream wetlands.	Erosion control measures must be put in place.
PCD overflow	The degradation of downstream water quality.	The overflow must be stopped immediately, and the impacted area remediated. Spill protection berms must be in place as well.

10.5 Assessment of Significance

The summary tables below show the significance of the various impacts, which range from moderate to low before mitigation for the construction phase of the underground mining portion of the project. The significance of the impact's changes to a significance of moderate or low for all listed activities following the implementation of mitigation measures and recommendations.

Overall, the impacts of the underground mining have much lower significance and impact than those for opencast mining operations as this type of mining has less of an influence on biodiversity in the area. Nonetheless, underground mining also requires some surface infrastructure (and ventilation shafts in the case of this project), and the significance of these impacts cannot be overlooked or underestimated. However, for this particular project existing infrastructure will be used and as such there is a lower impact rating overall. It is important to note that both powerline alternatives have been included in the same impact assessment given the fact that similar resources are located within the powerline's corridors and that the proposed activities are similar.

10.5.1 Planning Phase

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This would include compiling of mine and waste management plans, obtaining of necessary permits, environmental and social impact assessments, characterisation of baseline site conditions, design of mine layouts and facilities and consultation with various contractors involved with a diversity of proposed project related activities going forward.

Table 20, Table 21, and Table 22 below show the significance of potential impacts in the planning phase impacts on wetland health and functionality before and after implementation of mitigation measures.

These impacts occur from poor identification of wetlands and planning to avoid or mitigate these areas.

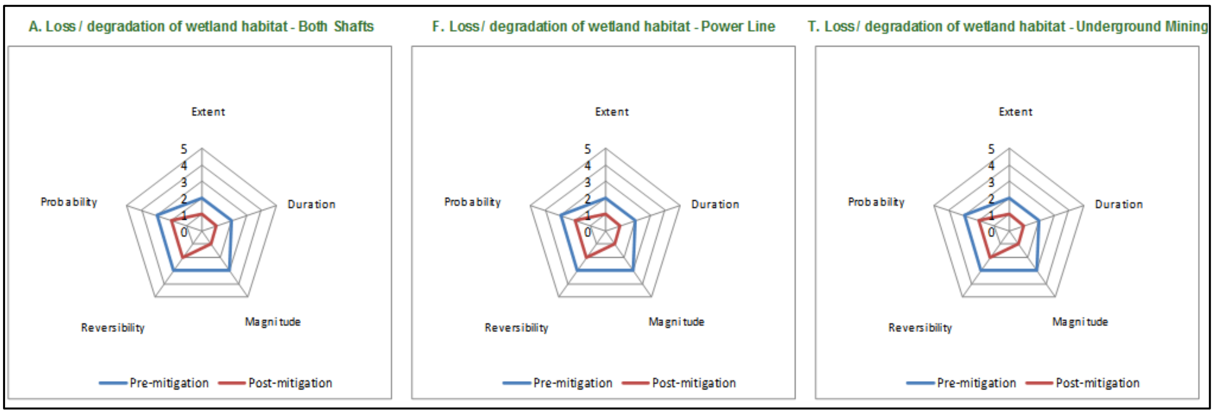


Table 20: Impact significance of the loss of wetland habitat for the vent shafts during the planning phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Both Shafts**				
Phase	**Planning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	1	Magnitude of Impact	3	1
Extent of Impact	2	1	Reversibility of Impact	3	2
Duration of Impact	2	1	Probability	3	2
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
Following the correct environmental procedures and ensuring the wetlands are delineated by specialists so that planning can take these systems into consideration to avoid and mitigate impacts were possible. *Use preferred Vent Shaft Location*					
Environmental Risk (Post-mitigation)					2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17

Final Significance	2.92

Table 21: Impact significance of the loss of wetland habitat for the powerline during the planning phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Power Line**				
Phase	**Planning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	1	Magnitude of Impact	3	1
Extent of Impact	2	1	Reversibility of Impact	3	2
Duration of Impact	2	1	Probability	3	2
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
Following the correct environmental procedures and ensuring the wetlands are delineated by specialists so that planning can take these systems into consideration to avoid and mitigate impacts were possible					
Environmental Risk (Post-mitigation)					2.50
Degree of confidence in impact prediction:					High
2.50					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					2.92

Table 22: Impact significance of the loss of wetland habitat for the underground mining during the planning phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Underground Mining**				
Phase	**Planning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	1	Magnitude of Impact	3	1
Extent of Impact	2	1	Reversibility of Impact	3	2
Duration of Impact	2	1	Probability	3	2
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					

Following the correct environmental procedures and ensuring the wetlands are delineated by specialists so that planning can take these systems into consideration to avoid and mitigate impacts were possible	
Environmental Risk (Post-mitigation)	2.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	1
Low: Issue not raised in public responses	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
Final Significance	2.92

10.5.2 Construction Phase

The construction phase activities have the potential to degrade wetland health and functioning through added sediment loads, erosion, and diversion.

Hydrological or flow dynamic impacts are likely to include reduced water volumes, sedimentation, bed, channel and flow modification, as well as the loss of wetland habitat through direct modification during the construction of wetland crossings (where needed), infrastructure, ventilation shafts and powerlines.

Table 23, Table 24, and Table 25 below show the significance of potential construction phase impacts on wetland systems before and after implementation of mitigation measures.

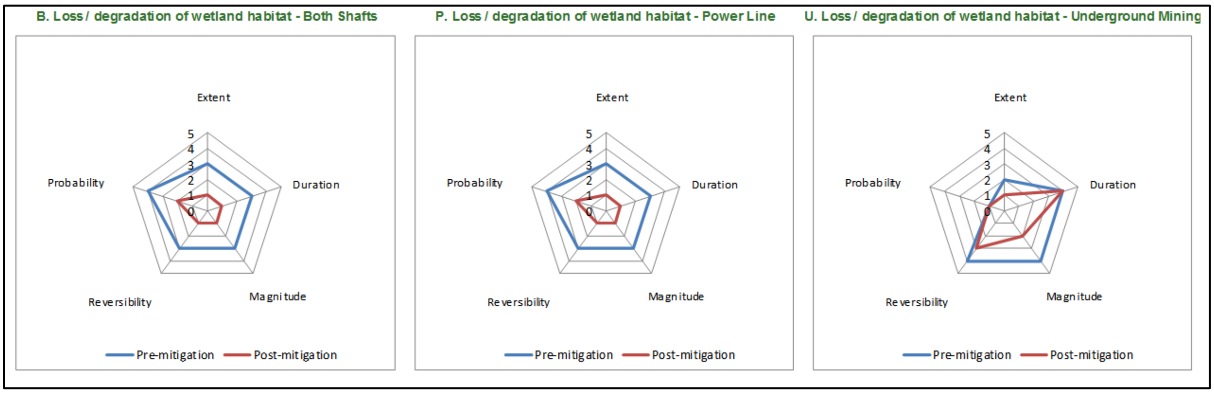


Table 23: Impact significance of the loss of wetland habitat for the vent shafts during the construction phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Both Shafts**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	1

Extent of Impact	3	1	Reversibility of Impact	3	1
Duration of Impact	3	1	Probability	4	2
Environmental Risk (Pre-mitigation)					-12.00
Mitigation Measures					
Use preferred Vent Shaft Location *Compile a suitable stormwater management plan, All chemicals and toxicants during construction must be stored in bunded areas, All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site, All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping", Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area, Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems; All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.*					
Environmental Risk (Post-mitigation)					-2.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					-2.33

Table 24: Impact significance of the loss of wetland habitat for the powerline (both alternatives) during the construction phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Powerline (both alternatives)**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	1
Extent of Impact	3	1	Reversibility of Impact	3	1
Duration of Impact	3	1	Probability	4	2
Environmental Risk (Pre-mitigation)					-12.00
Mitigation Measures					
Separate clean and dirty water continue with surface water and biomonitoring programmes, Compile a suitable stormwater management plan, All chemicals and toxicants during construction must be stored in bunded areas, All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site, All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping", Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area, Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems; All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.					
Environmental Risk (Post-mitigation)					-2.00

Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	1
Low: Issue not raised in public responses	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
Final Significance	-2.33

Table 25: Impact significance of the loss of wetland habitat for the underground mining during the construction phase

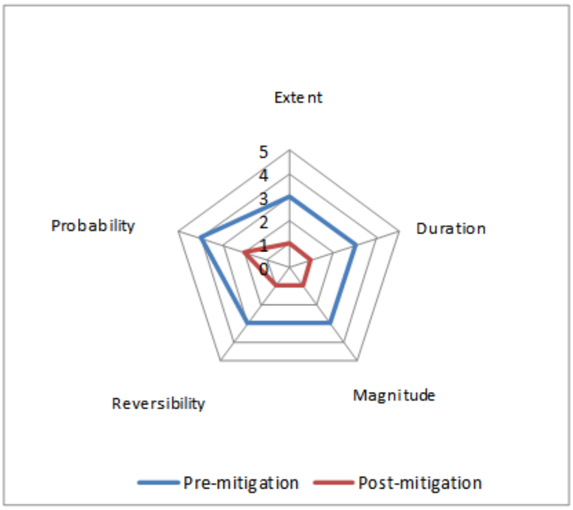
Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Underground Mining**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	2	1	Reversibility of Impact	4	3
Duration of Impact	4	4	Probability	1	1
Environmental Risk (Pre-mitigation)					-3.50
Mitigation Measures					
Monitoring of subsidence and mining according to the recommended safety factors					
Environmental Risk (Post-mitigation)					-2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					-2.92

10.5.3 Operational Phase

The storage, transport and processing of carboniferous material presents a risk to contaminate the downstream wetlands. During rainfall events runoff which has been in contact with this material may enter local wetland ecosystems.

Table 26 and Table 27 below show the significance of potential operation phase impacts on wetland systems before and after implementation of mitigation measures.

No impacts are anticipated during the operational phase of the powerline.



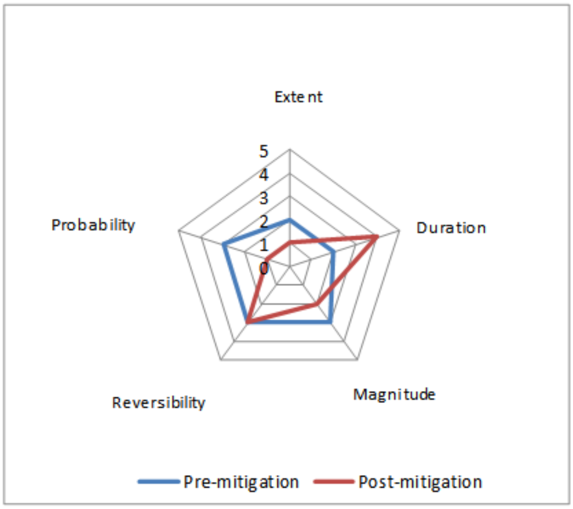


Table 26: Impact significance of the loss of wetland habitat for the vent shafts during the operational phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Both Shafts**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	1
Extent of Impact	3	1	Reversibility of Impact	3	1
Duration of Impact	3	1	Probability	4	2
Environmental Risk (Pre-mitigation)					-12.00
Mitigation Measures					
Use preferred Vent Shaft Location *Compile a suitable stormwater management plan, The stormwater management plan should incorporate "soft" engineering measures as much as possible, limiting the use of artificial materials. These measures may include grassy swales, bio-retention ponds / depressions filled with aquatic vegetation or the use of vegetation to dissipate flows at discharge locations, Stormwater channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion, Rehabilitation of old workings must be re-profiled to the natural topography, Stockpiles must be sloped to limit the run-off velocity of the area.* *An alien invasive plant management plan needs to be compiled and implemented to control and prevent the spread of invasive aliens, Clean vehicles on-site, and prioritise vehicles gaining access from surrounding areas*					
Environmental Risk (Post-mitigation)					-2.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					

Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
Final Significance	-2.33

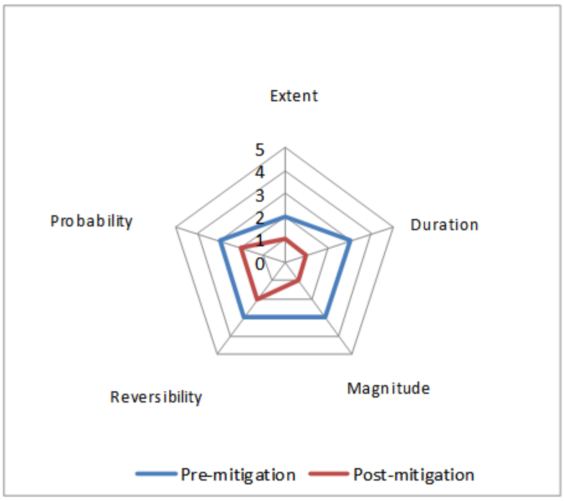
Table 27: Impact significance of the loss of wetland habitat for the underground mining during the operational phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Underground Mining**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	2
Extent of Impact	2	1	Reversibility of Impact	3	3
Duration of Impact	2	4	Probability	3	1
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
Monitoring of subsidence and mining according to the recommended safety factors					
Environmental Risk (Post-mitigation)					-2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					-2.92

10.5.4 Rehabilitation Phase

The removal of infrastructure and rehabilitation activities will be a large-scale operation and thus has the potential to contaminate surface water. The tables below Table 28 and Table 29 show the significance of potential rehabilitation phase impacts on the wetland systems. The powerline is most likely to be handed over to the landowners for use and no rehabilitation will be required.

E. Loss / degradation of wetland habitat - Both Shafts



X. Loss / degradation of wetland habitat - Underground Mining

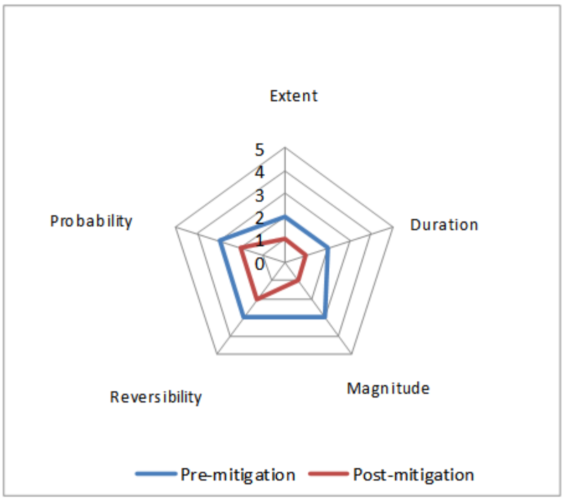


Table 28: Impact significance of the loss of wetland habitat for the vent shafts during the rehabilitation phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Both Shafts**				
Phase	**Rehabilitation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	1	Magnitude of Impact	3	1
Extent of Impact	2	1	Reversibility of Impact	3	2
Duration of Impact	3	1	Probability	3	2
Environmental Risk (Pre-mitigation)					-8.25
All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site, All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping", Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area, Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems; All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.					
Environmental Risk (Post-mitigation)					2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					2.92

Table 29: Impact significance of the loss of wetland habitat for the underground mining during the rehabilitation phase

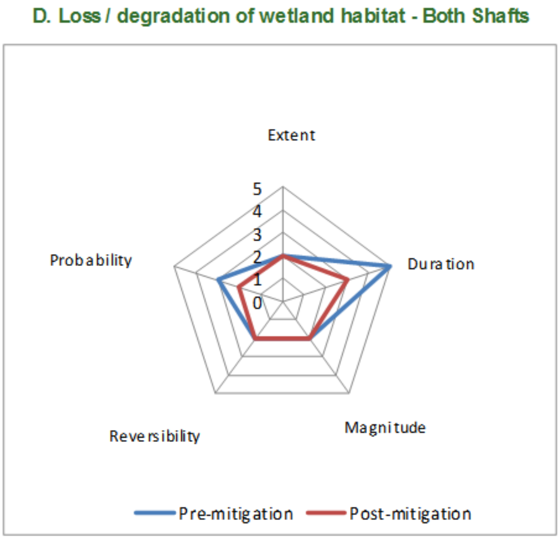
Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Underground Mining**				
Phase	**Rehabilitation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	1	Magnitude of Impact	3	1
Extent of Impact	2	1	Reversibility of Impact	3	2
Duration of Impact	2	1	Probability	3	2
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
Monitoring of subsidence and mining according to the recommended safety factors. *Rehabilitation if subsidence has occurred*					
Environmental Risk (Post-mitigation)					2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					2.92

10.5.5 Closure and Decommissioning Phase

Typically, following the cessation of underground mining activities groundwater returns to the voids created by the mining process. This process results in the contamination of the groundwater resource. Following this influx of groundwater, seepage and decant at specific locations can result in the ingress of contaminated water in downstream wetland systems, thus severely degrading the health and functioning of the wetlands.

In addition, in line with the precautionary principle, it is anticipated that the undermining of wetlands and river systems within the Kalabasfontein project area will result in the subsidence of the surface. The resultant potential impacts include serious changes to surface hydrology resulting in the significant alteration of catchment areas and subsequent habitat levels impacts. The powerline is most likely to be handed over to the landowners for use and no decommissioning is envissioned.

The tables below Table 30 and Table 31 show the significance of potential closure and decommissioning phase impacts on wetland systems before and after implementation of mitigation measures.



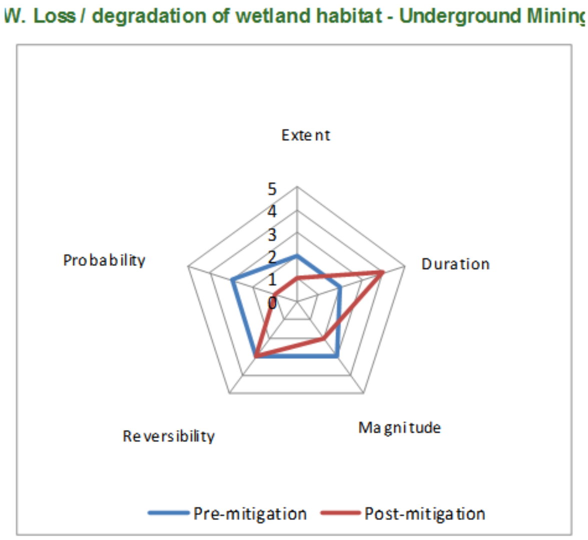


Table 30: Impact significance of the loss of wetland habitat for the vent shafts during the closure and decommissioning phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Both Shafts**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	2	2
Extent of Impact	2	2	Reversibility of Impact	2	2
Duration of Impact	5	3	Probability	3	2
Environmental Risk (Pre-mitigation)					-8.25
Mitigation Measures					
Monitor and assess rehabilitation success					
Environmental Risk (Post-mitigation)					-4.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					-5.25

Table 31: Impact significance of the loss of wetland habitat for the underground mining during the closure and decommissioning phase

Impact Name	**Loss / degradation of wetland habitat**				
Alternative	**Underground Mining**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	2
Extent of Impact	2	1	Reversibility of Impact	3	3
Duration of Impact	2	4	Probability	3	1
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
Monitoring of subsidence and mining according to the recommended safety factors *Rehabilitation if subsidence has occurred*					
Environmental Risk (Post-mitigation)					-2.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
Final Significance					-2.92

11 Sensitivity Mapping

11.1 Methodology

EIMS has developed a comprehensive sensitivity mapping methodology for use by all specialists in order to standardise the scoring system which allows for a comparative assessment of all impacts. The methodology utilises a revised scoring table as well as including a base score for the entire study area in question. This deviated from the past approach where features were scored based on their inherent sensitivity.

The updated methodology has shifted the focus from: (1) Scoring inherent environmental sensitivity towards' (2) Scoring the proposed project impact on landscape features. The new scoring methodology (Figure 32) shifted focus to identifying sensitive/non-sensitive areas in terms of the development activity, rather than the original method which focused purely on the sensitivity of the landscape/environment.

The new scoring methodology has made provision for specialists to score areas/features that would be suitable or preferred for development. It should be noted that features/areas should be scored in terms of the proposed project context and not purely on "perceived sensitivity of landscape features". Thus, the specialist should continually be asking themselves the question "how will this feature be affected by the proposed development". In cases where the development is anticipated to create a high negative impact, the high or very high scoring should be applied. High and very high scores must be justified. The final shape files must include a column indicating why each feature was assigned a certain score/sensitivity. In addition, a separate column must be provided indicating the numerical score in Figure 32.

To ensure that accurate site selection decisions will take place, the specialist must score sensitivity relative to the site in question. Ideally the specialist should only use very high sensitivity in rare cases, where such a score can be justified. Please note that legal licencing requirements or permit requirements should not be factored into the sensitivity score, this should be represented by a separate shape file indicating additional legal requirements.

Sensitivity Rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1	Preferrable Negotiabl
Low/Poor	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	0	
High	The proposed development will negatively influence the current status of the feature.	+1	Restricted
Very High	The proposed development will negatively significantly influence the current status of the feature.	+2	

Figure 32: The sensitivity matrix utilised for the sensitivity mapping process (as provided by EIMS)

11.2 Wetland Sensitivity

The sensitivity scores were rated on a scale as seen in Figure 32. The sensitivity scores for each wetland area as well as the buffer from the wetland were then visually mapped (Figure 33).

The wetlands are protected by legislation and these areas are rated as no-go zones. The 100m desktop buffer for the wetland zones were rated as having a High sensitivity, based on the fact that if an activity were to take place in this zone with no mitigation, then the impact may alter the wetlands. The 200m buffer zone was determined to be medium sensitivity as impacts may impact on wetlands downstream indirectly. The 500m buffer zone is indicated as a Low sensitivity, but this is the regulated area that must be assessed.

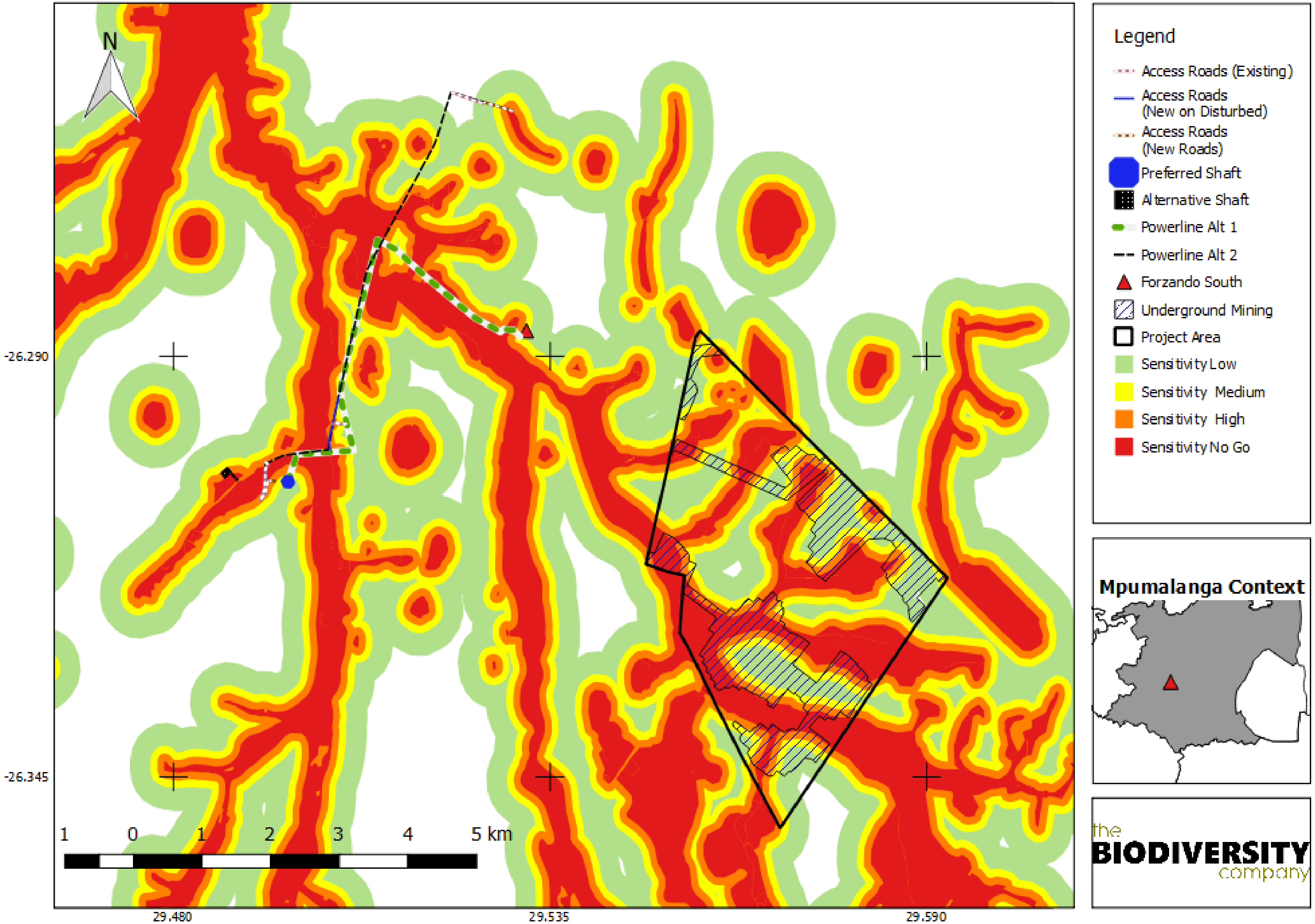


Figure 33: The sensitivity of the wetland areas for the project

12. Mitigation

The mitigation actions provided below are important to consider in conjunction with other specialist assessments which include but are not limited to the following specialist studies: Groundwater, Surface Water and Wetlands. These mitigation measures should be implemented in the Environmental Management Plan (EMP) should the project go-ahead. The mitigation hierarchy proposed by Macfarlane *et al*., (2016) was considered for this study (Figure 34).

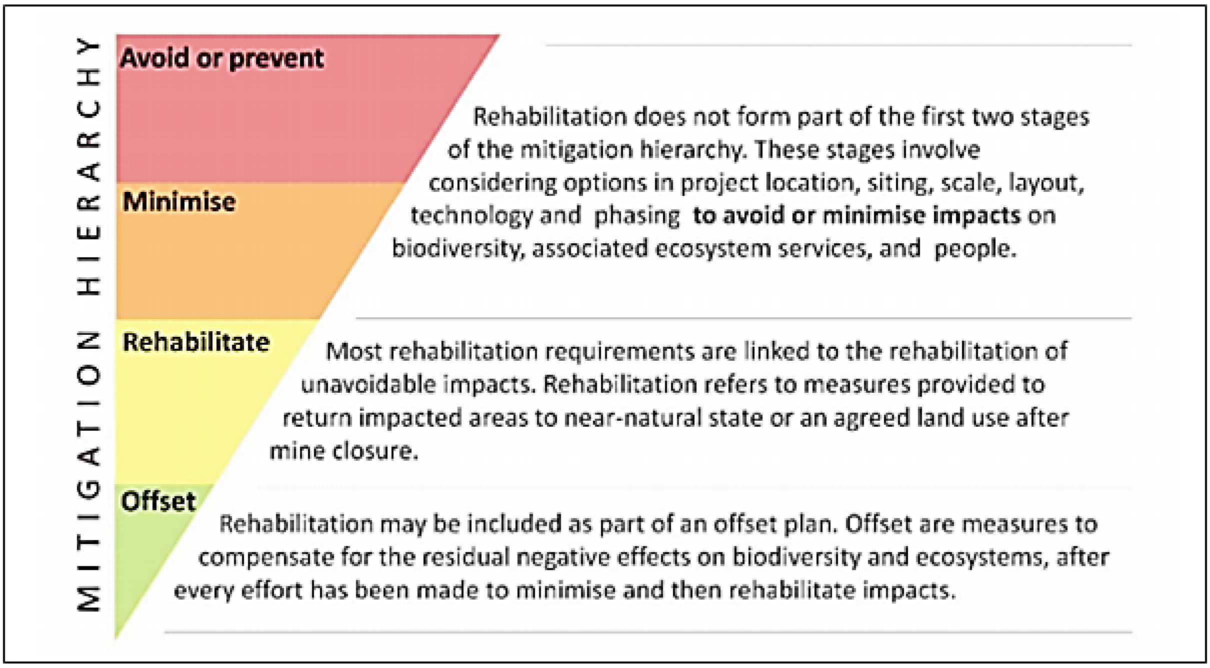


Figure 34: The Mitigation Hierarchy (Macfarlane et al., 2016)

As observed above, avoiding and preventing loss of sensitive landscapes are the first stage of the mitigation hierarchy. Considering this, the layout of the proposed infrastructure within the Kalabasfontein project area should, wherever possible, remain away from areas that are defined as sensitive as outlined in this report.

Table 32 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators.

Table 32: Mitigation measures including requirements for timeframes, roles and responsibilities

Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
• Underground workings must adhere to a safety factor that will minimise the risk of subsidence. • Any loss/alteration of flow dynamics must be quantified, and mitigation options to re-introduce water in a safe and environmentally friendly way must be assessed.	Operation Closure	Permanent	Applicant / Contractor	Monthly surface and groundwater quantity and quality	Avoid or minimise the loss of water input, and impaired water quality	Water quality guidelines (DWS,1996)
• Separate clean and dirty water. • Construct diversion berms and drains around working areas. • Incorporate green /soft engineering storm water measures. Avoid unnecessary vegetation clearing and avoid preferential surface flow paths. • No cleaning of vehicles, machines and equipment in water resources. • No servicing of machines, vehicles and equipment on site. • Storage of potential contaminants in bunded areas. • All contractors must have spill kits available and be trained in the correct use thereof. • All released water must be within DWAF (1996) water quality standards for aquatic ecosystems, and discharge must be managed to avoid scouring and erosion of the receiving systems.	Construction Operation	Ongoing	Applicant / Contractor	Biomonitoring (bi-annual) Water quality monitoring, frequency to be advised by hydrology specialist	Maintain drinking water quality standards	Water quality guidelines (DWS,1996)

• Contain wastewater in a PCD. Contaminated water must not be discharged into the watercourses. • Clean and dirty water must be separated. This water could be looked at for treatment and then re-introduced to mitigate losses to the catchment water hydro-dynamics. • All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping", • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. • Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems. • All waste generated on-site must be adequately managed. • Separation and recycling of different waste materials should be supported						
• Compile a suitable stormwater management plan. • Construct cut-off berms downslope of working areas. • Demarcate footprint areas to be cleared to avoid unnecessary clearing.	Construction Operation	Ongoing	Applicant / Contractor	Biomonitoring (bi-annual) Water quality monitoring, frequency to be advised by	Maintain drinking water quality standards	Water quality guidelines (DWS,1996)

• Exposed areas must be ripped and vegetated to increase surface roughness. • Create energy dissipation at discharge areas to prevent scouring. • Temporary and permanent erosion control methods may include silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching.				hydrology specialist		
• Separate clean and dirty water. continue with surface water and biomonitoring programmes. • All chemicals and toxicants during construction must be stored in bunded areas. • All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site. • All contractors and employees should undergo induction which is to include a component of environmental awareness. • The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. • Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.	Construction Operation	Ongoing	Applicant / Contractor	Biomonitoring (bi-annual) Water quality monitoring, frequency to be advised by hydrology specialist	Maintain drinking water quality standards	Water quality guidelines (DWS,1996)

• All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.						
• Clean vehicles on-site, and prioritise vehicles gaining access from surround areas	Construction Operation Closure	Ongoing	Applicant / Contractor	Monthly inspections, with removal to be determined on a needs basis	Maintain drinking water quality standards	National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM:BA): Category 1a/b: Invasive species requiring compulsory control. Remove and destroy.
• All surface infrastructure must be removed from the site. • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. • A seed mix must be applied to rehabilitated and bare areas. • Any gullies or dongas must also be backfilled. • The area must be shaped to a natural topography. • Trees (or vegetation stands) removed must be replaced. • No grazing must be permitted to allow for the recovery of the area.	Closure	Ongoing	Applicant	Biomonitoring (bi-annual) Wetland monitoring (bi-annual) Water quality monitoring, frequency to be advised by hydrology specialist	Maintain drinking water quality standards	Water quality guidelines (DWS,1996)

• Attenuation ponds may be created in channels to retain water in the catchment.						
• Rehabilitation of the area and shaping of the topography must minimise the ingress of water into the mining area. • Additionally, measures must also be considered to implement constructed wetlands at likely decant areas, and the planting of tree reduce groundwater recharge. • Decommission cut-off berms and drains last. • Debris must be placed in preferential flow paths. • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. • A seed mix must be applied to rehabilitated and bare areas. • Any gullies or dongas must also be backfilled. • The area must be shaped to a natural topography.	Closure	Ongoing	Applicant	Water quality monitoring, frequency to be advised by hydrology specialist	Maintain drinking water quality standards	Water quality guidelines (DWS,1996)

13. Recommendations

These recommendations may supplement the prescribed mitigation measures, but these recommendations must be investigated prior to the issuing of environmental authorisation. These recommendations must be investigated for the feasibility to realistically achieve what is intended for this project. The following recommendations are applicable for this project:

1. The recommended buffer width is 25 m for the Vent shaft and 10 m for the Powerline implemented from the onset of the construction phase of the project this means that no activity is prohibited to take place within the buffer zone unless approved by a water use license.
2. In the event that wetland areas will be impacted, a wetland rehabilitation plan is required.

14. Conclusion

Seven wetland types were identified within the two project areas, and these were split into nine (9) HGM units, namely;

- Floodplain (HGM 1 and HGM 2);
- Unchannelled valley bottom (HGM 3);
- Channelled valley bottom (HGM 4);
- Hillslope seep (HGM 5);
- Flat (HGM 6);
- Depression (HGM 7 and HGM 8); and
- Artificial dams (HGM 9).

The overall wetland health for HGM 1 was determined to be Largely Modified (D), with the remaining HGM units determined to be Moderately Modified (C).

All HGM units exhibited a moderately high benefit for indirect benefits such as; sediment trapping, and phosphate/nitrate/toxicant assimilation. HGM 7, 8, and 9 had a moderately high benefit for flood attenuation. The floodplains HGM 1 and HGM 2 exhibited a moderately high benefit for biodiversity maintenance providing suitable habitat for fauna and flora. HGM 3 and HGM 8 had a moderately high benefit for erosion control. The remaining benefits were rated as intermediate or lower.

The EIS was calculated to have a Very High (A) importance for HGM 1. This rating can be attributed to the ecological importance of the floodplain from an NFEPA perspective as well as the national ecosystem classifications (see section 7.5) rating this area as vulnerable. HGM 2, 3, 4, 8, and 9 were rated as High (B) importance. HGM 5, 6, and 7 were rated as Moderate (C) importance.

The recommended minimum buffer according to the guidelines is 25 m for the vent shafts and 10 m for the associated powerline for all phases.

A conservative buffer zone was suggested of 25 m for the vent shafts and 10 m for the associated powerline, this buffer is calculated assuming mitigation measures are applied. This would typically include a commitment to rehabilitate and manage buffer zones to ensure that these areas function optimally.

It must be noted that the alternative vent shaft is within the wetland buffer and it is recommended that the preferred shaft location be used. The powerline (both alternatives) will traverse many wetland areas and it is recommended that the powerline route be situated on the existing servitude and that spans are planned to cross wetland areas and their associated buffer zones.

Overall, the impacts of the underground mining have much lower significance and impact than those for opencast mining operations as this type of mining has less of an influence on biodiversity in the area. Nonetheless, underground mining also requires some surface infrastructure (and ventilation shafts in the case of this project), and the significance of these impacts cannot be overlooked or underestimated. However, for this particular project existing infrastructure will be used and as such there is a lower impact rating overall.

15. Impact Statement

An impact statement is required as per the NEMA regulations with regards to the proposed development.

The Underground mining poses a risk if subsidence occurs, however all efforts must be made to minimise the risk of subsidence as avoiding this impact is the most effective way to mitigate it.

The preferred Vent Shaft is situated some distance from the wetlands and is considered low risk. However, the access road might pose a risk if it is to cross any wetland areas.

The Powerline is also considered low risk if it is constructed as close to the road reserve as possible and the footprint locations are placed outside of the wetland areas where possible.

Considering the above-mentioned conclusions, it is the opinion of the specialist that the Kalabasfontein project area, with the current proposed infrastructures layout areas, may be favourably considered.

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