



Hendrina South 132kV Powerline, near Hendrina, Mpumalanga Province.

Wetland/Riparian Delineation and Functional Assessment Report

January 2023

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2023.01.10

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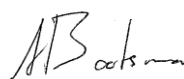



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This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as information available at the time of study. Therefore the author reserves the right to modify aspects of the report, including the recommendations, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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Document number	Checked by:	Electronic Signature:	Date
Technical Review	Antoinette Bootsma		2022.10.19
Client review			
Final Report	Antoinette Bootsma		



EXECUTIVE SUMMARY

Limosella Consulting was appointed by SiVEST to undertake a wetland and/or riparian delineation and functional assessment to inform the Environmental Authorization for The proposed 132 kV powerline that originates at the Hendrina Powerstation and ends in a proposed substation approximately 20 km south of the power station. There are currently two proposed routes, following similar routes except a small extra turn for option one. The proposed substation has no alternatives. The route options are as follows:

- Hendrina South Option 1_123kV(26km)
- Hendrina South Option 1_123kV(26km)

The terms of reference for the current study were as follows:

- Delineate the wetland and riparian areas;
- Classify the watercourse according to the system proposed in the national wetlands inventory if relevant,
- Undertake functional and integrity assessment of wetlands areas within the area assessed as specified in General Notice 267 of 24 March 2017;
- Undertake an impact assessment as specified in the NEMA 2014 regulations (as amended),
- Recommend suitable buffer zones, both generic (as required in GDARD, 2014) and scientific as specified in General Notice 267 of 24 March 2017, following Macfarlane *et al* 2015 ; and
- Discuss appropriate mitigation and management procedures relevant to the conserving wetland areas on the site.

The wetland types potentially impacted by the proposed powerline and substation are described in full in Section 2 and include 4 types Seepage-, Channeled Valley Bottom-, Unchannelled Valley Bottom, and Depressional Pan Wetlands. The following buffer zones were calculated for the wetlands based on the generic risk categories for Above Ground Power Line Distribution.

- Seepage Wetland – 24 m
- Valley Bottom Wetlands (Channelled and Unchannelled) – 26 m
- Depressional Pan Wetlands – 27 m

Both the proposed 132 kV Eskom power line options start at the existing Hendrina Powerstation and continue south on the same route and both the options cross a total of 9 wetlands before the options split towards the end. Option 1 then crosses an additional 2 wetlands while Option B crosses an additional 3 wetlands, one of which is very large. Based on the number of wetlands crossing, the ecological health of the wetlands crossed, and access to the infrastructure the follow options are preferred (Table Below):



Alternative	Preference	Reasons (incl. potential issues)
POWERLINE ALTERNATIVES		
Powerline Option 1 *	Favourable - The impact will be relatively insignificant	11 Wetlands Crossings, Adjacent to the tarred access road
Powerline Option 2	Least Preferred - The alternative will result in a high impact	12 Wetland Crossings. Limited access road

*This opinion should be revisited if it does not agree with other specialist findings.

The important factors relevant to the project are summarised the table below:

	Quaternary Catchment and WMA areas	Important Rivers possibly affected		
	B11A and B12B – #2 WMA Olifants	The main rivers associated with the northern section (Catchment B12B) are Woes-Alleenspruit and East Woes-Alleenspruit. Both drain into the Klein-Olifants River. The main rivers associated with the southern section (Catchment B11A) are the Leeufonteinspruit and Olifants Rivers. The Leeufonteinspruit drains into the Olifants River. B11A and B12B		
NEMA 2014 Impact Assessment	The impact scores for the following aspects are relevant:		Without Mitigation	With Mitigation
	Changes to flow dynamics	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Sedimentation	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Establishment of alien plants	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Pollution of watercourses	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L



	Loss of fringe vegetation and habitat	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Loss of aquatic biota	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
Does the specialist support the development?	The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. It should be noted that Appendix D2 of GN 509 states that the construction of new transmission or distribution powerlines, and minor maintenance on roads, river crossings, towers, and substations, where the footprint remains the same, are exempt from a WUL.			
CBA and other important areas	Although the proposed development is located on an endangered vegetation type the proposed development goes through predominantly Heavily modified areas with smaller sections crossing Moderately Modified (Old Lands) and areas described as other natural areas. The powerline is sufficiently buffered from any CBA irreplaceable areas.			



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1 INTRODUCTION

Limosella Consulting was appointed by SiVEST to undertake a wetland and/or riparian delineation and functional assessment to inform the Environmental Authorization for the Proposed Eskom 132kV powerline from Hendrina Powerstation to a new proposed substation approximately 20 km south, near Hendrina, Mpumalanga Province.

A site visit was conducted on 9 January 2023.

1.1 Project Description

The proposed 132 kV powerline originates at the Hendrina Power Station and ends in a proposed substation approximately 20 km south of the power station. There are currently two proposed routes, following similar routes except for a small extra turn for option one. The proposed substation has no alternatives. The route options are as follows:

- Hendrina South Option 1_123kV(26km)
- Hendrina South Option 1_123kV(26km)
- Substation - Option 1 (3ha)

The terms of reference for the current study were as follows:

- Delineate the wetland and riparian areas;
- Classify the watercourse according to the system proposed in the national wetlands inventory if relevant,
- Undertake functional and integrity assessment of wetlands areas within the area assessed as specified in General Notice 267 of 24 March 2017;
- Undertake an impact assessment as specified in the NEMA 2014 regulations,
- Recommend suitable buffer zones, both generic (as required in GDARD, 2014) and scientific as specified in General Notice 267 of 24 March 2017, following Macfarlane *et al* 2015 ; and
- Discuss appropriate mitigation and management procedures relevant to the conserving wetland areas on the site.

1.2 Assumptions and Limitations

- No aquatic habitat suitable for the assessment of instream macroinvertebrate or water quality conditions was present at the time of the initial site visit.
- The information provided by the client forms the basis of the planning and layouts discussed.
- All wetlands within 500 m of any developmental activities should be identified as per the DWS regulations. To meet the timeframes and budget constraints for the project, wetlands within the study sites were delineated on a fine scale based on detailed soil and vegetation sampling. Wetlands that fall outside of the site, but that fall within 500 m of the proposed activities were delineated based on desktop analysis of vegetation gradients visible from aerial imagery.



- The detailed field study was conducted from a once-off field trip and thus would not depict any seasonal variation in the wetland plant species composition and richness.
- Description of the depth of the regional water table and geohydrological and hydrogeological processes falls outside the scope of the current assessment
- Floodline calculations fall outside the scope of the current assessment.
- A Red Data scan, fauna and flora, and aquatic assessments were not included in the current study
- The recreation grade GPS used for wetland and riparian delineations is accurate to within five meters.
- Wetland delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, during converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go areas identified in the current report be pegged in the field in collaboration with the surveyor for precise boundaries. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by for example photocopying and printing.
- The calculation of buffer zones does not consider climate change or future changes to watercourses resulting from increasing catchment transformation.
- Sampling by its nature means that the entire study area cannot be assessed. In this case, the entirety of the study site could not be assessed due to time constraints and access restrictions. Therefore, the assessment findings are only applicable to the areas sampled and extrapolated to the rest of the study site.
- Some areas of the powerline could not be assessed due to a lack of access roads, closed or private access roads as well as locked. Extrapolation and historical imagery were used here.
- The original layers received from the client differed from the final working layers, and these additional sections were not assessed during the site visit.

1.3 Definitions and Legal Framework

This section outlines the definitions, key legislative requirements, and guiding principles of the wetland study and the Water Use Authorisation process.

The National Water Act, 1998 (Act No. 36 of 1998) [NWA] provides for Constitutional water demands including pollution prevention, ecological and resource conservation, and sustainable utilisation. In terms of this Act, all water resources are the property of the State and are regulated by the Department of Water and Sanitation (DWS). The NWA sets out a range of water use-related principles that are to be applied by DWS when taking decisions that significantly affect a water resource. The NWA defines a water resource as including a watercourse, surface water, estuary, or aquifer. A watercourse includes a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, pan, or dam, into which or from which water flows; any collection of water that the Minister may declare to be a watercourse; and were relevant its beds and banks.

The NWA defines a wetland as “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life



in saturated soil.” In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often performs important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river’s footprint (DWA, 2005). It is defined by the NWA as follows: “Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas”.

Water uses for which authorisation must be obtained from DWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) apply to any activity related to a watercourse:

Section 21(c): Impeding or diverting the flow of water in a watercourse; and

Section 21(i): Altering the bed, banks, course, or characteristics of a watercourse.

Authorisations related to wetlands are regulated by Government Notice 509 of 2016 regarding Section 21(c) and (i). This notice grants General Authorisation (GA) for the above water uses on certain conditions. This regulation also stipulates that water uses must be registered with the responsible authority. Any activity that is not related to the rehabilitation of a wetland and which takes place within 500 m of a wetland is excluded from a GA under either of these regulations unless the impacts score as low in the required risk assessment matrix (DWS, 2016). Such an activity requires a Water Use Licence (WUL) from the relevant authority.

Conditions for impeding or diverting the flow of water or altering the bed, banks, course, or characteristics of a watercourse (Section 21(c) and (i) activities) include:

9. (3) (b). The water user must ensure that the selection of a site for establishing any impeding or diverting the flow or altering the bed, banks, course, or characteristics of a watercourse works:

(i) is not located on a bend in the watercourse;

(ii) avoid high gradient areas, unstable slopes, actively eroding banks, interflow zones, springs, and seeps;

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions, and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).



- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.982, R.983, R. 984 and R.985 of 2014, promulgated under NEMA.
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983).
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA.
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).
- GN 267 (Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals)

Any activity that is not related to the rehabilitation of a wetland and which takes place within 500m of a wetland is excluded from a GA under either of these regulations, unless the impacts score as low in the required assessment matrix. Wetlands situated within 500m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 1199). Such an activity requires a Water Use Licence (WUL) from the relevant authority.

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions, and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.982, R.983, R. 984, and R.985 of 2014, promulgated under NEMA.
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983).
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA.
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).

1.4 The locality of the study site

The proposed 132 kV powerline starts at the Hendrina Power Station with the coordinates of 26° 2'5.14" S and 29°35'46.33"E and ends approximately 20 km south at the coordinates of 26°12'6.61"S and 29°33'41.93"E (Figure 1).



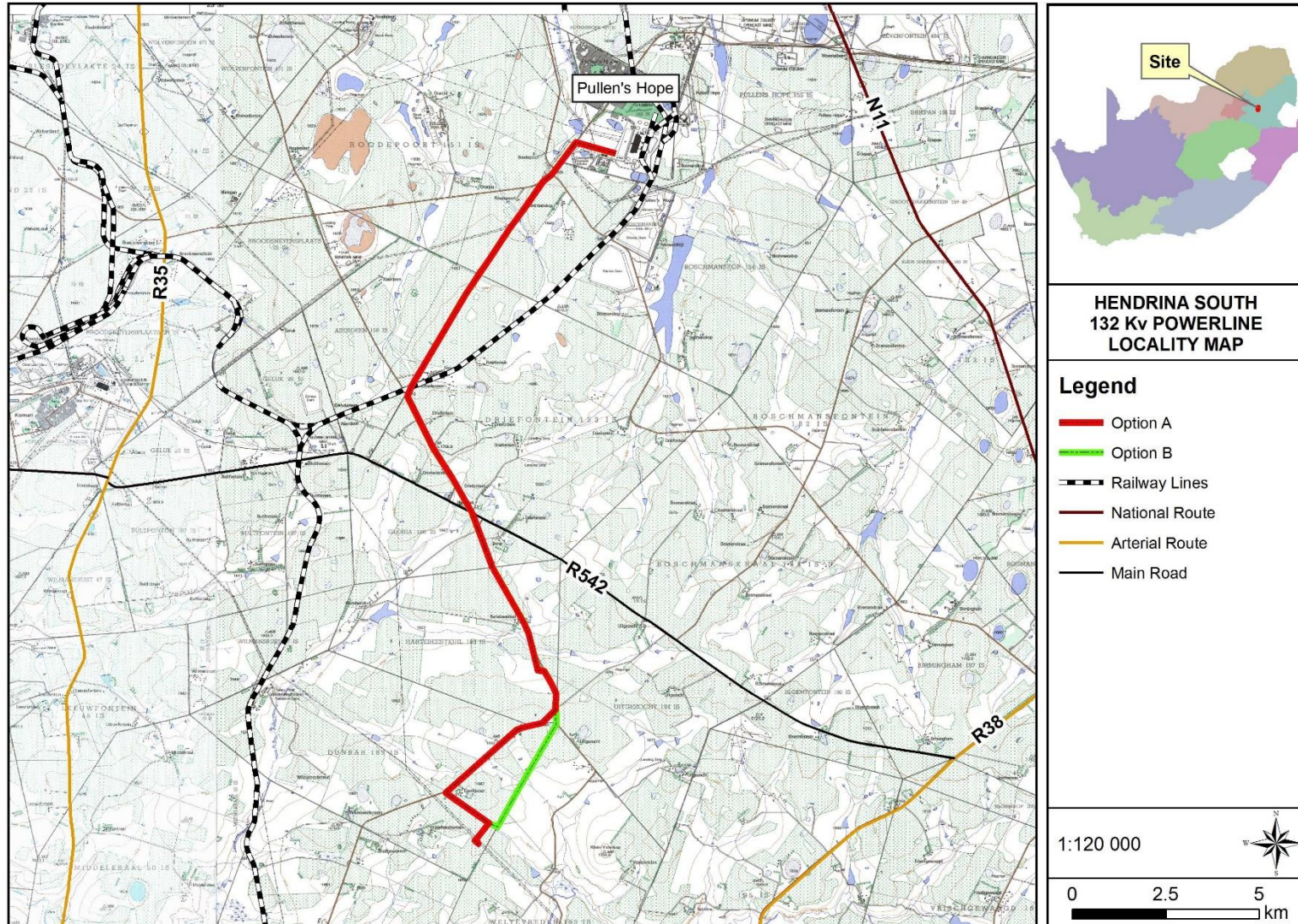


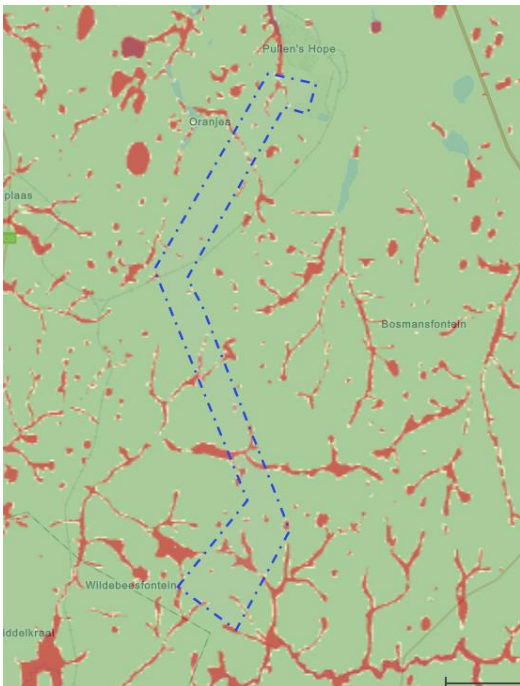
Figure 1: Locality Map



1.5 Description of the Receiving Environment

A review of available literature and spatial data formed the basis of a characterisation of the biophysical environment in its theoretically undisturbed state and consequently an analysis of the degree of impact on the ecology of the study site in its current state. Table 1 below provides a summary of the important aspects.

Table 1: A summary of relevant site information obtained from a review of available spatial data

National Screening Tool (https://screening.environment.gov.za/screeningtool)	
	<p>The Aquatic Biodiversity of the study site is made up of areas with Low sensitivity and areas of Very High sensitivity. The areas of Very High sensitivity coincide with the rivers and streams that flow through the landscape.</p>
Hydrology and National Freshwater Ecosystem Priority Area (NFEPA) (2011) Database	
Strategic Water Source Area (Le Maitre <i>et al.</i>, 2018)	The study site is not located within a Strategic Water Source Area.
Important Rivers (CDSM, 1996) (Figure 2)	<p>The main rivers associated with the northern section (Catchment B12B) are Woes-Alleenspruit and East Woes-Alleenspruit. Both drain into the Klein-Olifants River.</p> <p>The main rivers associated with the southern section (Catchment B11A) are the Leeufonteinspruit and Olifants Rivers. The Leeufonteinspruit drains into the Olifants River.</p>
Quaternary Catchment	B11A and B12B
WMA (Government Gazette, 16 September 2016)	<p>#2 Olifants</p> <p>Major rivers include:</p> <ul style="list-style-type: none"> • Elands



	<ul style="list-style-type: none"> • Wilge • Steelpoort • Olifants • Letaba.
DWAF (2014) http://www.dwa.gov.za/iwgs/rhp/eco/peseismodel.aspx	<p>Woes-Alleenspruit River - 1223(PES=E)(EI=Moderate)(ES=High)</p> <p>Woes-Alleenspruit East River - 1233(PES=E)(EI=Low)(ES=Moderate)</p> <p>Leeufonteinspruit River - 1331(PES=D)(EI=Moderate)(ES=High)</p> <p>Olifants River - 1369(PES=C)(EI=High)(ES=High)</p>
Wetland Ecosystem Type	Mesic Highveld Grassland Group 4
NFEPA Wetlands	Both NFEPA and NBA wetlands are common around the entire study site. Most of the wetlands within 100 m of the powerlines are ranked as 5 and only 3 are ranked as 6.
General Description (Mucina & Rutherford, 2006)	
GPS Coordinates	<p>Start: 26° 2'7.29"S and 29°35'43.02"E</p> <p>End: 26°12'2.72"S and 29°33'45.96"E</p>
Topography (Mucina & Rutherford, 2006)	Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (<i>Aristida</i> , <i>Digitaria</i> , <i>Eragrostis</i> , <i>Themeda</i> , <i>Tristachya</i> , etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species.
Climate (Mucina & Rutherford, 2006)	Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm
Broad Vegetation Units (VEGMAP 2018, SANBI BGIS) (Figure 3)	Gm 12 – Eastern Highveld Grassland
Conservation Status	Endangered
Geology (Mucina & Rutherford, 2006)	The study site is underlain by Arenite
Soils (ENPAT and Mucina & Rutherford, 2006) (Figure 4)	The soil classification available for the study site indicates the presence of Bb4 and Ba33 soils. The largest part of the study site is located on Bb4 soil, with a very small section in the center located on Ba33 Soil. Bb4 soils are characterised by Plinthic catena: dystrophic and/or mesotrophic; red soils not widespread, upland duplex and marginal soils rare Ba33 have similar characteristics except in that red soils are widespread.



Conservation Plan (C-Plan)**Mpumalanga Conservation Plan (C-Plan) (Figure 5)**

The proposed development goes through predominantly Heavily modified areas with smaller sections crossing Moderately Modified (Old Lands) and areas described as other natural areas. The powerline is sufficiently buffered from any CBA irreplaceable areas.



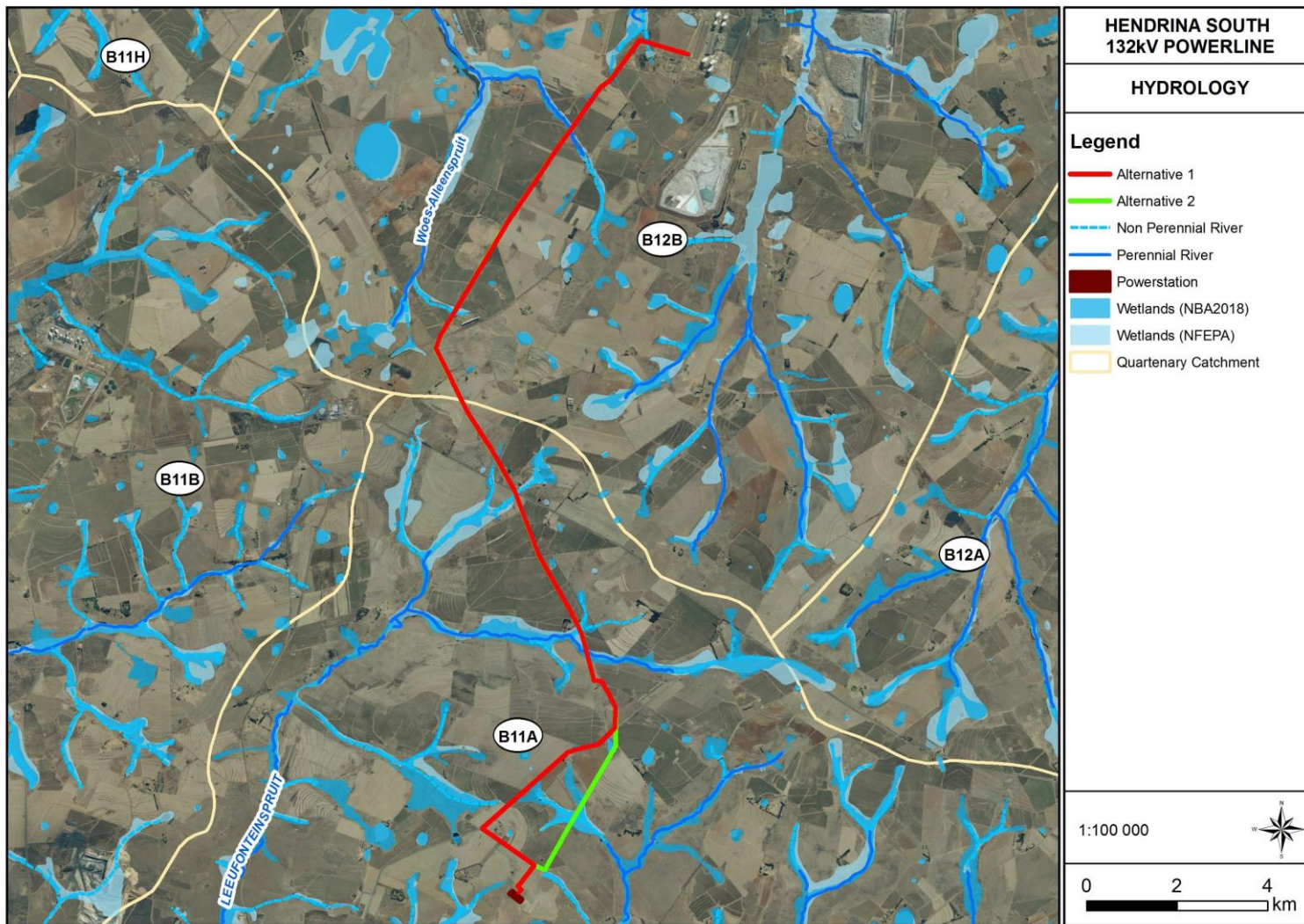


Figure 2: Hydrology of the study site and surrounds as per existing spatial layers.



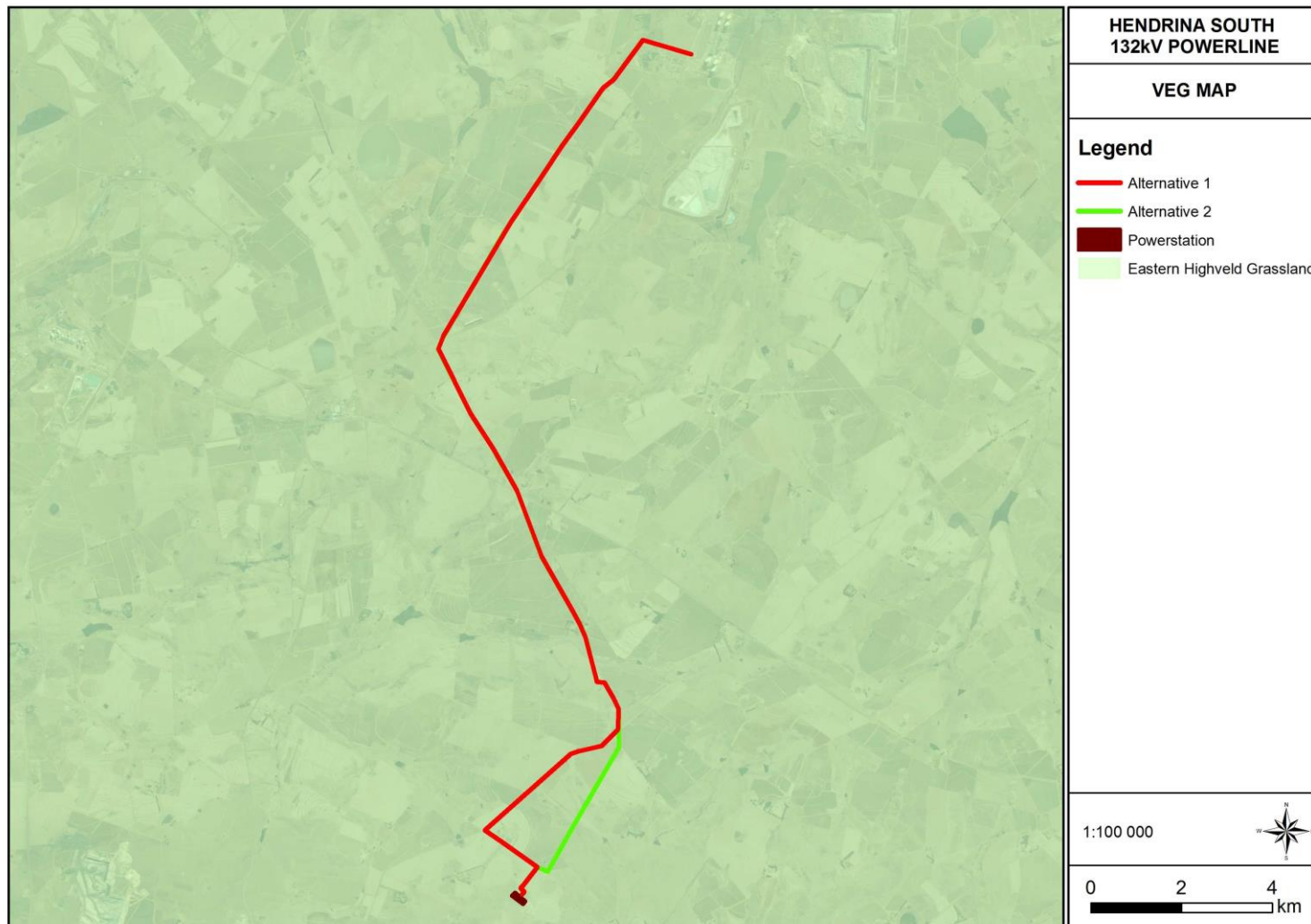


Figure 3: Vegetation type of the study area.



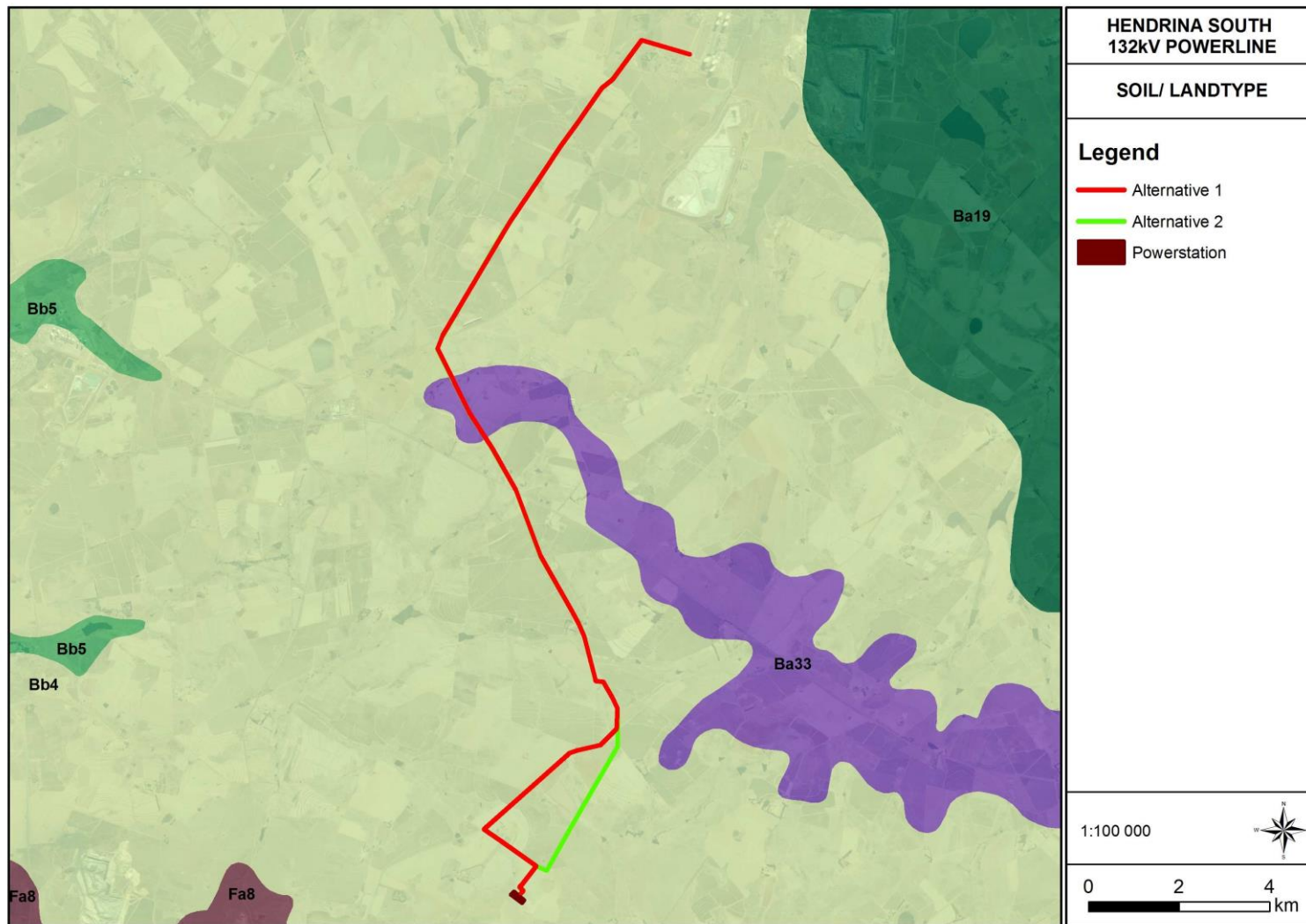


Figure 4: Soil of the proposed the study area.



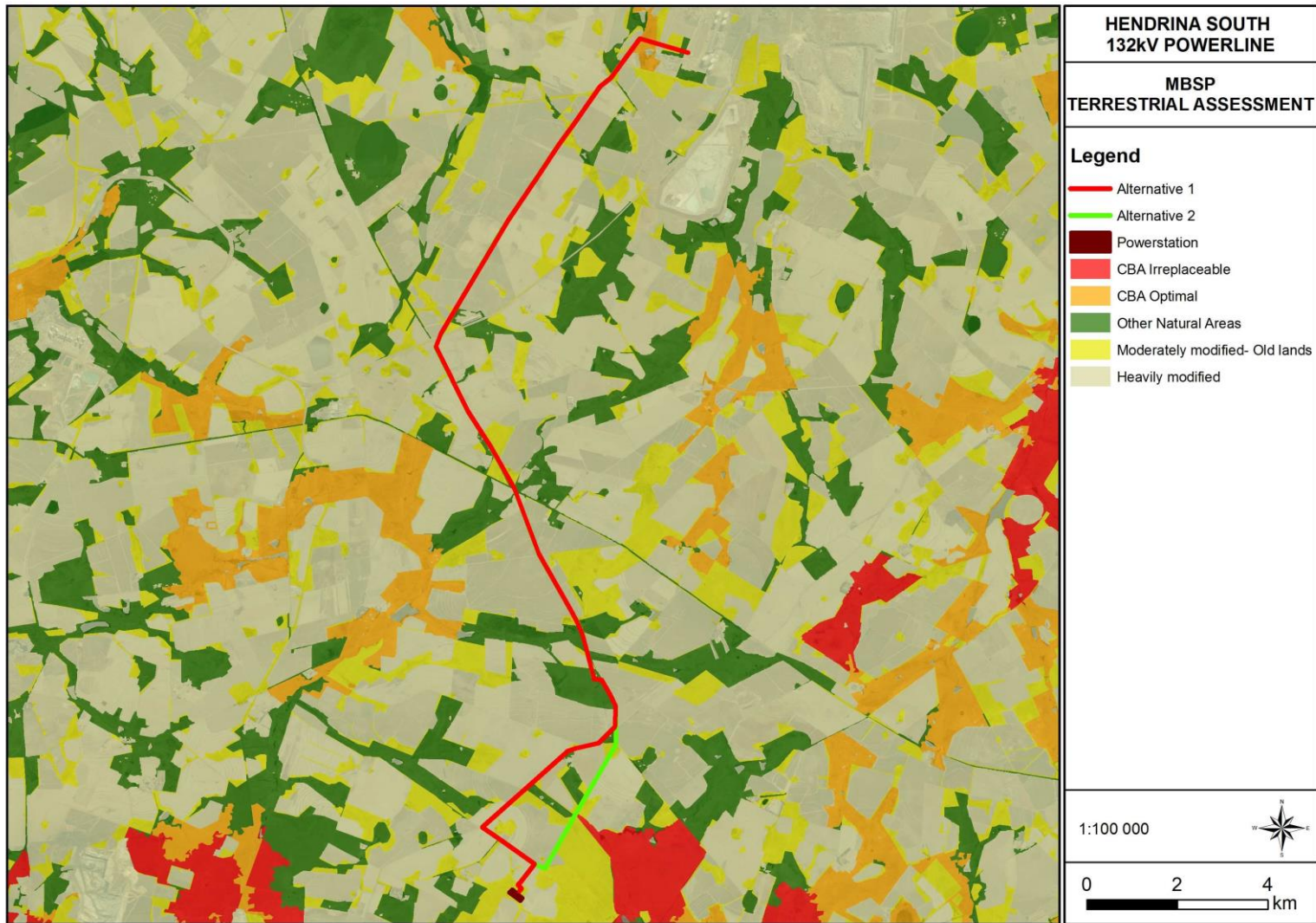


Figure 5: The North-West C-Plan for the proposed the study area.



2 Classification System for Wetlands and Other Aquatic Systems

All wetland or riparian features encountered were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems, hereafter referred to as the “Classification System” (Ollis *et al.* 2013). The same approach of classifying wetlands in terms of a functional unit was followed. HGM units encompass three key elements (Kotze *et al.*, 2005):

- **Geomorphic setting** - This refers to the landform, its position in the landscape, and how it evolved (e.g. through the deposition of river-borne sediment);
- **Water source** - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
- **Hydrodynamics** - This refers to how water moves through the wetland.

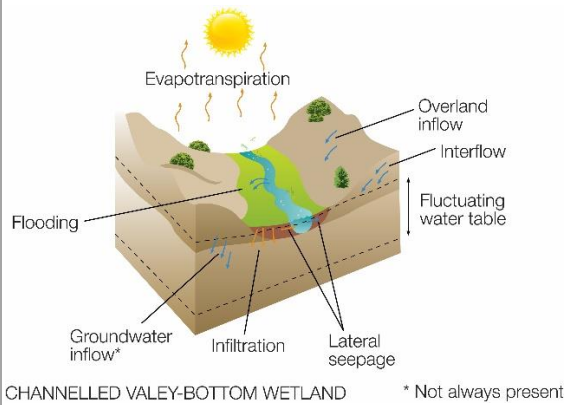
A summary of Levels 1 to 4 of the Classification System of the wetland types found on the study site is presented in Table 2 and Table 3 below.

Table 2: Level 3 classification structure for Inland Systems

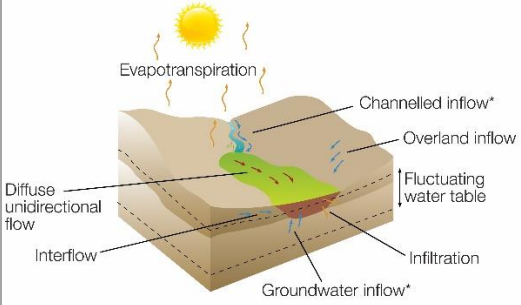
Wetland / Aquatic Ecosystem Context		
Level 1: System	Level 2: Regional Setting	Level 3: Landscape Unit
Inland Systems	DWA Level 1 Ecoregion Or NFEPA WetVeg Groups Or Other Special Framework	Valley Floor - gently sloping lowest surface of a valley, excluding mountain headwater zones.
		Slope - located on the side of a mountain, hill or valley that is steeper than lowland or upland floodplain zones.
		Plain - extensive area of low relief. Different from valley floors in that they do not lie between two side slopes, characteristic of lowland or upland floodplains.
		Bench (Hilltop / Saddle / Shelf) - an area of mostly level or nearly level high ground, including hilltops/crests, saddles and shelves/terraces/ledges.



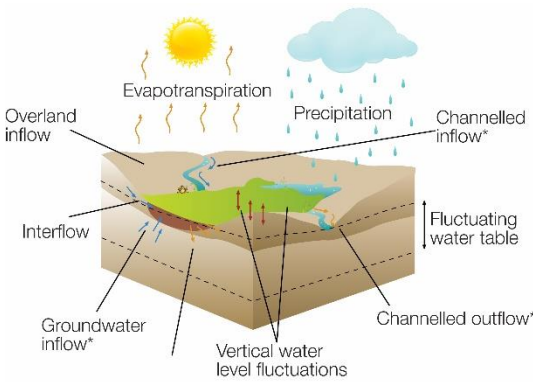
Table 3: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C (Ollis *et al.* 2013)

Functional Unit			
Level 4: Hydrogeomorphic (HGM) Unit			
HGM Type		Longitudinal Zonation / Landform / Outflow Drainage	Landform / Inflow Drainage
A		B	C
<p><i>Valley bottom with a channel</i></p> <p>Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic flow is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no oxbows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.</p>	 <p>CHANNELLED VALEY-BOTTOM WETLAND * Not always present</p>	N/A	N/A



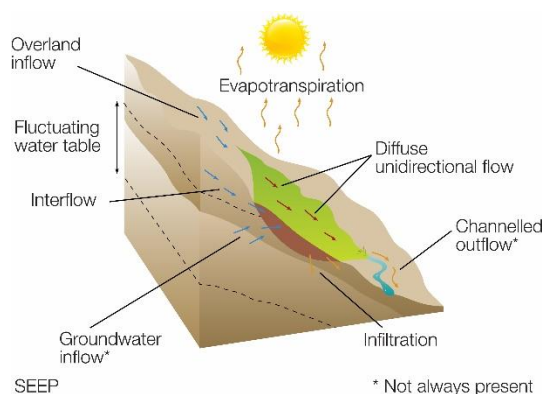
Functional Unit			
Level 4: Hydrogeomorphic (HGM) Unit			
HGM Type		Longitudinal Zonation / Landform / Outflow Drainage	Landform / Inflow Drainage
<p><i>Valley bottom without a channel</i></p> <p>Linear fluvial, net depositional valley bottom surfaces which do not have a channel. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas, or at tributary junctions where the sediment from the tributary smothers the main drainage line.</p>	 <p>UNCHANNELLED VALLEY-BOTTOM WETLAND * Not always present</p>	N/A	N/A



Functional Unit			
Level 4: Hydrogeomorphic (HGM) Unit			
HGM Type		Longitudinal Zonation / Landform / Outflow Drainage	Landform / Inflow Drainage
<p><i>Depressional pans</i></p> <p>Small (deflationary) depressions which are circular or oval in shape; usually found on the crest positions in the landscape. The topographic catchment area can usually be well-defined (i.e. a small catchment area following the surrounding watershed). Although often apparently endorheic (inward draining), many pans are “leaky” in the sense that they are hydrologically connected to adjacent valley bottoms through subsurface diffuse flow paths.</p>	 <p>The diagram illustrates a cross-section of a depressional pan. It shows a central depression with a fluctuating water table. Arrows indicate various water flows: overland inflow from the left, precipitation falling into the pan, evapotranspiration from the surface, interflow within the pan, groundwater inflow from the left, and channelled outflow to the right. A dashed line represents the fluctuating water table. The word 'DEPRESSION' is written at the bottom left of the diagram area. A note at the bottom right states '* Not always present'.</p>	Endorheic	Without channelled inflow



Functional Unit			
Level 4: Hydrogeomorphic (HGM) Unit			
HGM Type		Longitudinal Zonation / Landform / Outflow Drainage	Landform / Inflow Drainage
<p>Seepage Wetlands</p> <p>Seepage wetlands are the most common type of wetland (in number), but probably also the most overlooked. These wetlands can be located on the mid- and footslopes of hillsides; either as isolated systems or connected to downslope valley bottom wetlands. They may also occur fringing depressional pans. Seepages occur where springs are decanting into the soil profile near the surface, causing hydric conditions to develop; or where through flow in the soil profile is forced close to the surface due to impervious layers (such as plinthite layers; or where large outcrops of impervious rock force subsurface water to the surface).</p>		With channelled inflow or outflow	N/A



The watercourses recorded throughout the study site are classified as Seepage Wetlands, Unchannelled Valley Bottom Wetlands, Channelled Valley Bottom Wetlands, and Depressional Pan Wetlands. While inflow and outflow drainage does not apply to the Valley Bottom Wetlands, the Depressional Pan wetlands of the study site are classified as Endorheic Wetlands, indicating that there is no additional inflow and outflow and water exits only through infiltration and evaporation. Lastly, the Seepage Wetlands differed some had channelled inflow, and some channelled outflow. The hydroperiod ranges between the wetlands from permanent, seasonal, and intermittent. (Level 5 Classification Ollis *et al*, 2013). It should be noted that in many wetlands the seasonal and temporary edges have been altered or lost due to the encroachment of agriculture. The substratum ranges from impermeable layers in some depressions to several different soil types including sandy soil, loam soil, and clay soil. The level of redoximorphic features differed between the wetlands although some prominent wetlands soil types such as Avalon, Longlands, and Katspruit were recorded (Level 6 Classification Ollis *et al*, 2013). The vegetation of the wetlands are generally dominated by herbaceous and aquatic vegetation with a mix of Alien Invasive Species (AIS) and indigenous vegetation (Level 7 Classification Ollis *et al*, 2013).



3 RESULTS

3.1 Land Use, Cover, and Ecological State

The elevation profile (Figure 6) of the proposed powerline and substation indicates that the majority of the line is located on a high elevation with clear flow paths indicated by a lower elevation. Historical imagery ranging from 1955-1968 (Figure 7) indicates existing extensive farming and agricultural practices which remains dominant in the area today. Additional impacts in the area include power stations and several mines. Agriculture and mining are expected to alter the hydrological regime of wetlands by changing the infiltration and recharge rates of ground- and surface water in the area.

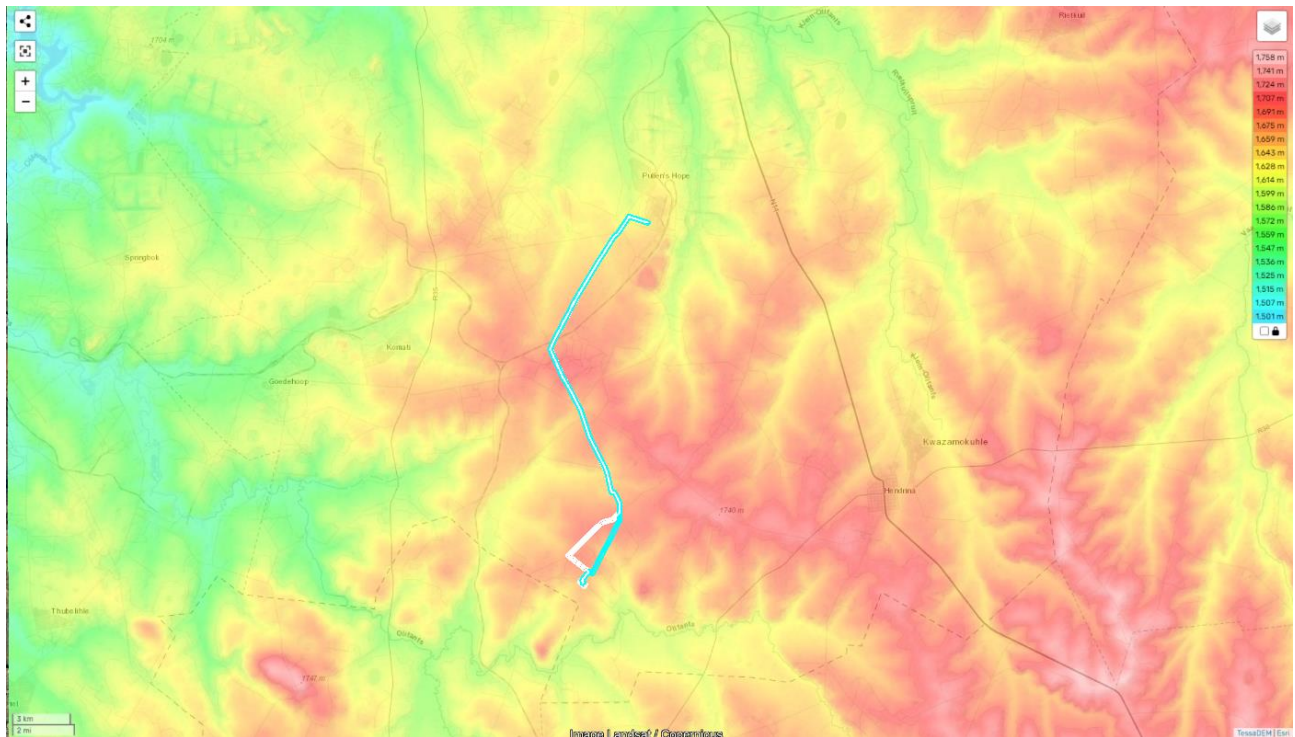


Figure 6: Elevation Profile of the proposed powerline and substation (<https://en-za.topographic-map.com/>)



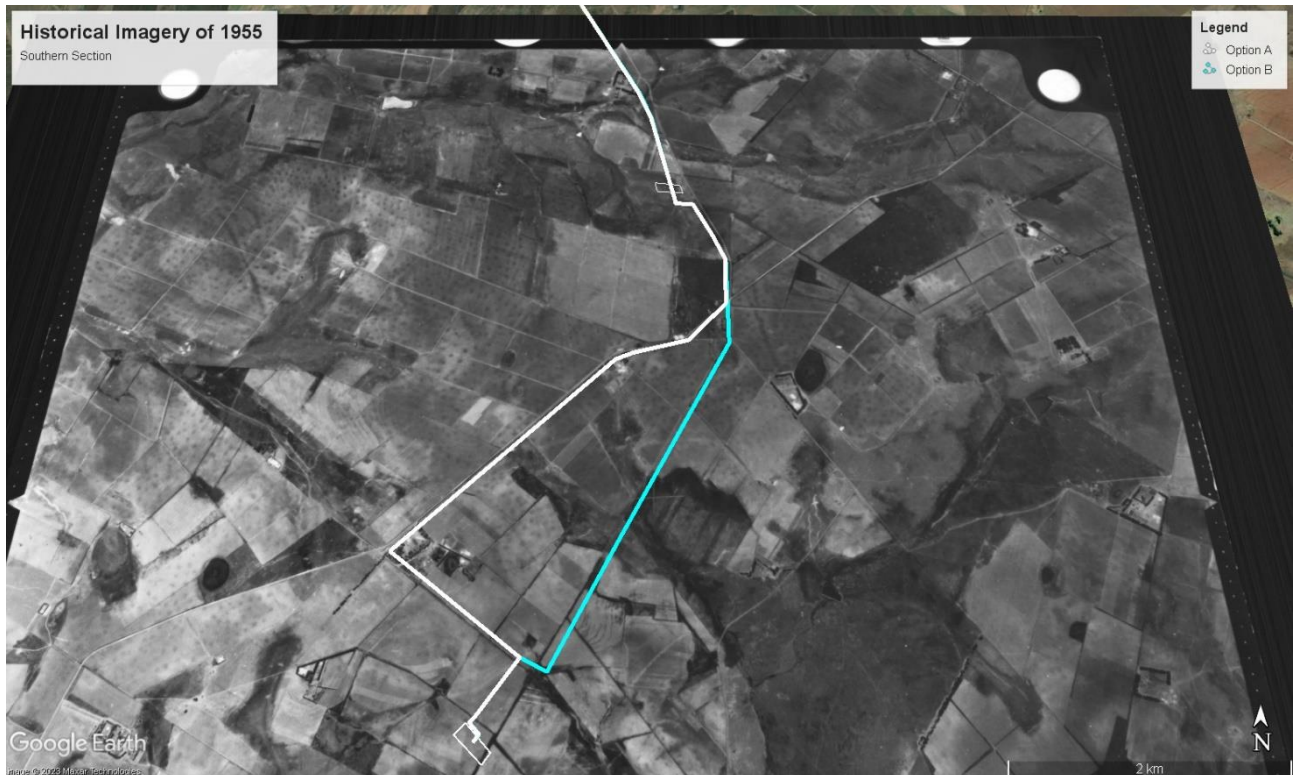


Figure 7: Historical imagery of the Northern Section (1968) (Top), middle section (1955) (Middle) and southern section (1955) (Bottom) indicating prolonged farming and agriculture in the area.

3.1.1 Wetland Classification and Delineation

The wetland types potentially impacted by the proposed powerline and substation are described in full in Section 2 and include 4 types Seepage-, Channeled Valley Bottom-, Unchanneled Valley Bottom, and Depressional Pan Wetlands. The following buffer zones were calculated for the wetlands based on the generic risk categories for Above Ground Power Line Distribution (MacFarlane *et al.*, 2015):

- Seepage Wetland – 24 m
- Valley Bottom Wetlands (Channelled and Unchannelled) – 26 m
- Depressional Pan Wetlands – 27 m

Both the proposed 132 kV Eskom power line options start at the existing Hendrina Powerstation and continue south on the same route and both the options cross a total of 9 wetlands before the options split towards the end. Option 1 then crosses an additional 2 wetlands while Option B crosses an additional 3 wetlands, one of which is very large. Based on the number of wetlands crossing, the ecological health of the wetlands crossed and access to the infrastructure (Figure 8 and Figure 9):

- Option A – 11 Wetlands Crossings, Adjacent to the tarred access road
- Option B – 12 Wetland Crossings. Limited access road

HENDRINA SOUTH 132kV POWERLINE -WETLAND DELINEATION

Figure 8: The location and extent of watercourses crossing the proposed 132kV powerline – Northern Section



HENDRINA SOUTH 132kV POWERLINE -WETLAND DELINEATION

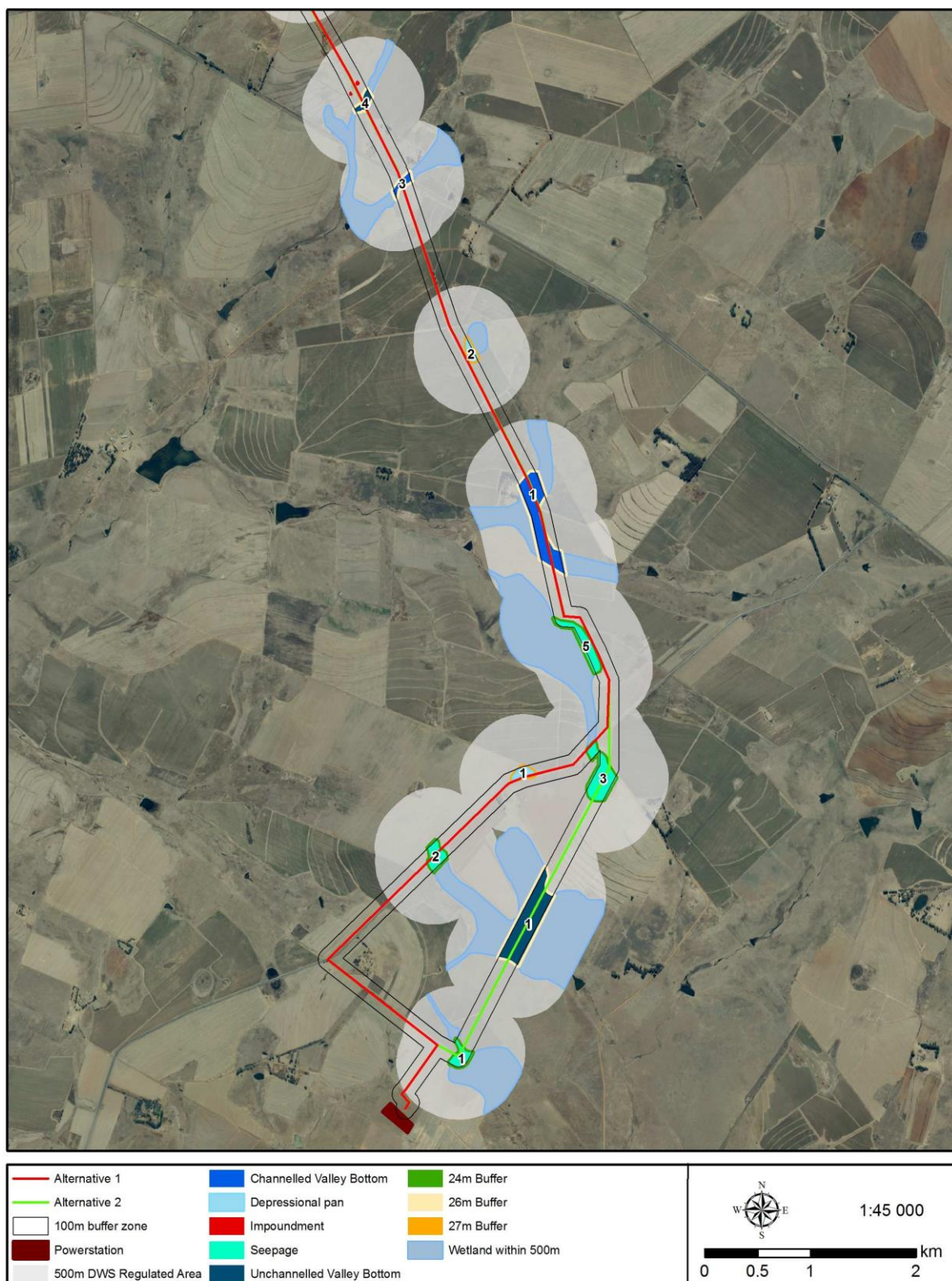


Figure 9: The location and extent of watercourses crossing the proposed 132kV powerline – Southern Section



3.1.2 Vegetation and Soil Indicators

The soil composition of the wetlands differed ranging from sandy soil, loam, and clay. Some impermeable subsurface layers like ferricrete were recorded in some of the depressional wetlands. The soil of the valley bottom wetlands showed clear redoximorphic in the areas not disturbed by farming and agriculture. The dominated wetland soil forms recorded in the wetlands include Avalon, Longlands, and Katspruit. Several hydrophyllic species were recorded in the wetlands with some differentiation between the wetlands especially based on wetland type. The dominant hydrophyllic species recorded include the grasses *Phragmites australis*, *Paspalum dilatatum*, *Paspalum urvillei*, *Paspalum distachum*, *Leersia hexandra*, *Imperata cylindrical*, *Sporobolus africanus* and *Sporobolus pyramidalis*. Other dominant hydrophyllic species recorded include *Typha capensis*, *Persicaria lapthifolia*, *Haplocarpha scaposa*, *Helichrysum mundtii*, *elchrysum nudifolium*, *Monopsis deciepiens*, *Oxalis obliquifolia*, *Kylinga melanosperma*, *Cyperus denadatus*, *Cyperus marginatus*, *Berkheya radula*. Alien invasive species (AIS) were recorded in different densities in the wetlands and were especially high on the edges of the wetlands due to the edge effect of the agricultural fields and roads. The dominant AIS recorded in the wetlands include *Tagetes minuta*, *Verbena bonariensis*, *Canna indica*, *Cosmos bipinnatus*, *Cirsium vulgare*, *Cynodon dactylon*, *Conyza spp*, *Pennisetum clandestinum* while the woody AIS recorded include species such as *Melia azedarach*, *Populus x canescens*, *Eucalyptus spp*, *Acacia mearnsii* and *Salix babylonica*. The general characteristics of the wetlands are illustrated in the images below (Figure 10).



Figure 10: General characteristics of the wetlands recorded on the study site.

3.1.3 Impacts

The main impacts recorded include impacts due to mining and agriculture which includes erosion and sedimentation. The erosion is especially prevalent at dirt road crossings and infrastructure near these watercourses. Furthermore, some wetlands had a high density of AIS. Some of the recorded impacts are illustrated in Figure 11 below:



Figure 11: Impacts recorded near the proposed powerline include erosion, AIS, and overgrazing.

3.2 Wetland Functional Assessment

In addition to the impacts described above, some other impacts within the catchment include mining, agriculture, grazing, impoundments, and dams. Furthermore, the increased hardened surfaces in its local catchment due to increased development and development encroachment onto the wetland and natural buffers have led to an increase in exotic species in the area, increased sediment, and a change in geomorphology. The hydrology has been impacted by the input of foreign materials input from the roads and industrial and mining areas, inadequate stormwater management, and run-off from roads and surfaces leading to an increase in hydro-carbon contamination and sediment input. The geomorphology of the wetlands has been impacted by dumped material including rubble and garden refuse, trenches, gullies, and many roads and footpaths traversing the wetland. Lastly, the vegetation composition has also been impacted because of the changes discussed above.

3.2.1 Scores

3.2.1.1 Present Ecological Status (PES) (Kotze et al., 2020)

The PES of the wetlands ranged from **C – D**.

- **C - Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.
- **D - Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.

3.2.1.2 Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).

The EIS scores are based on both the EIS scores (DWAF, 1999) and the WET-EcoServices assessment (Rountree and Kotze 2013) and ranged from **Low – High**.

- **Low** - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers
- **Moderate** - Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers
- **High** - Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water in major rivers

3.2.1.3 Recommended Ecological Category (REC)

Following the method set out by Rountree *et al.*, (2013), the PES value and EIS class are compared to determine the current REC score (Table 4).

Table 4: Generic Matrix for the determination of REC and RMO for water resources

			EIS			
			Very high	High	Moderate	Low
PES	A	Pristine/Natural	A Maintain	A Maintain	A Maintain	A Maintain
	B	Largely Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good - Fair	B Improve	B/C Improve	C Maintain	C Maintain
	D	Poor	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Very Poor	D Improve	E/F Improve	E/F Maintain	E/F Maintain



3.2.1.4 Site Ecological Importance

Based on the Species Environmental Assessment Guideline (SANBI, 2020) watercourses and specialised habitats should be assessed based on their Site Ecological Importance (SEI). All the watercourses examined in this report should thus be regarded as having a High Sensitivity (Table 5):

Table 5: Ecological Importance of all wetland areas recorded on the study site

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
All Watercourses	High – Confirmed occurrence of watercourses within the development footprint	Medium – Some historical impacts and AIS recorded	Medium – Based on CI and FI	Very Low – Watercourses are not easily restored without significant rehabilitation. Many species are dependent on functional wetland habitat.	Based on BI – Medium and RR – Very Low = High

The integrity of watercourses associated with this area is summarised in Table 6Table 4 and Figure 12 and Figure 13 below.

Table 6: Summary of the integrity of the watercourses associated with the SEZ and associated infrastructure.

Watercourse	Buffer Zone (Macfarlane et al., 2015).	Present Ecological Status (PES) (Kotze et al., 2020).	Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).	Recommended Ecological Category (REC) Rountree et al., (2013)
Seepage Wetland - 1	24 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Seepage Wetland - 2	24 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in	Maintain at D



Watercourse	Buffer Zone (Macfarlane et al., 2015).	Present Ecological Status (PES) (Kotze et al., 2020).	Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).	Recommended Ecological Category (REC) Rountree et al., (2013)
			moderating the quantity and quality of water in major rivers.	
Seepage Wetland - 3	24 m	C - Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	Moderate - Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.	Maintain at C
Seepage Wetland - 4	24 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Seepage Wetland - 5	24 m	C - Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	Moderate - Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.	Maintain at C
Seepage Wetland - 6		D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in	Maintain at D



Watercourse	Buffer Zone (Macfarlane et al., 2015).	Present Ecological Status (PES) (Kotze et al., 2020).	Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).	Recommended Ecological Category (REC) Rountree et al., (2013)
			moderating the quantity and quality of water in major rivers.	
Depressional Pan - 1	27 m	C - Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at C
Depressional Pan - 2	27 m	C - Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	Moderate - Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.	Maintain at C
Depressional Pan - 3	27 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Depressional Pan - 4	27 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in	Maintain at D



Watercourse	Buffer Zone (Macfarlane et al., 2015).	Present Ecological Status (PES) (Kotze et al., 2020).	Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).	Recommended Ecological Category (REC) Rountree et al., (2013)
			moderating the quantity and quality of water in major rivers.	
Unchannelled Valley Bottom - 1	26 m	C - Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	High - Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	Improve to B/C if possible
Unchannelled Valley Bottom - 2	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Unchannelled Valley Bottom - 3	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Unchannelled Valley Bottom - 4	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D



Watercourse	Buffer Zone (Macfarlane et al., 2015).	Present Ecological Status (PES) (Kotze et al., 2020).	Ecological Importance and Sensitivity (EIS) (Kotze et al., 2020).	Recommended Ecological Category (REC) Rountree et al., (2013)
Channelled Valley Bottom - 1	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D
Channelled Valley Bottom - 2	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Moderate - Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.	Maintain at D
Channelled Valley Bottom - 3	26 m	D - Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Low - Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	Maintain at D



HENDRINA SOUTH 132kV POWERLINE -WETLAND PES

Figure 12: PES Scores of the watercourses associated with the proposed powerline and substation.



HENDRINA SOUTH 132kV POWERLINE -WETLAND EIS

Figure 13: EIS Scores of the watercourses associated with the proposed powerline and substation.



3.3 Impacts and Mitigations

Installation of an overhead power line is generally considered a low-risk operation and the impacts are considered to be low, although all development has the potential to impact the surrounding environment and particularly on a watercourse. A range of management measures is available to address threats posed to water resources. In the context of the proposed powerlines, the mitigation measures proposed below are intended to prevent further degradation to the watercourses resulting from the new powerline construction and operation. It is important to note that this section aims to highlight areas of concern. The details of the mitigation measures that are finally put in place should ideally be based on these issues, but must necessarily take into consideration the physical and economical feasibility of mitigation. Any mitigation must be implemented in the context of an Environmental Management Plan to ensure accountability and ultimately the success of the mitigation.

3.3.1 Identification of Potential Impacts/Risks

The largest impact is expected to be during the construction phase, the proposed construction timeframe is estimated to be 6-12 months, according to the information received. The major impacts are as follow:

Construction Phase:

- a) Alteration in flow regime;
- b) Changes in sediment regimes;
- c) Introduction and spread of alien vegetation;
- d) Loss and disturbance of riparian/watercourse habitat and vegetation;
- e) Alteration in water quality due to pollution; and
- f) Loss of aquatic biota.

Operational Phase:

- a) Alteration in flow regime;
- b) Changes in sediment regimes;
- c) Introduction and spread of alien vegetation;
- d) Loss and disturbance of riparian/watercourse habitat and vegetation;
- e) Alteration in water quality due to pollution; and
- f) Loss of aquatic biota.

Decommissioning Phase:

- a) Alteration in flow regime;
- b) Changes in sediment regimes;
- c) Introduction and spread of alien vegetation;
- d) Loss and disturbance of riparian/watercourse habitat and vegetation;
- e) Alteration in water quality due to pollution; and
- f) Loss of aquatic biota.

Cumulative Impacts:

- a) Alteration in flow regime.



3.3.2 Potential Impacts during the Construction Phase

Changes in flow regime arises from the compaction of soil, the removal of vegetation and surface water redirection. Changes to hydrological function at a landscape level which can arise from changes to flood regimes (i.e. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows i.e. too little/too much water in terms of characteristics and requirements of system). Fragmentation (i.e. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).

Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount). Construction and operational activities will result in earthworks and soil disturbance as well as the removal of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourse and increase the turbidity of the water. Possible sources of the impacts include:

- Earthwork activities during construction
- Clearing of surface vegetation will expose the soils, which in rainy events would wash through watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil.
- Disturbance of soil surface
- Disturbance of slopes through creation of roads and tracks adjacent to the watercourse
- Erosion (e.g. gully formation, bank collapse) Changes in sediment regimes of the aquatic ecosystem and its sub-catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns.

The moving of soil and vegetation resulting in opportunistic invasions after disturbance. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system, alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users.

Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation.

Changes in water quality due to input of foreign materials i.e. due to increased sediment load, contamination by chemical and /or organic effluent, and /or eutrophication. During the construction phase a large amount of waste will be produced including sewerage, domestic waste, wash-water, used oils and grease, diesel or lubricant spills, etc. Waste generally contains pollutants and present a potential risk to the water and surrounding environment if not managed effectively. Oil and diesel spillages may occur during the construction phase which can contaminate surface water. Other potential contaminants (i.e. from chemical toilets, domestic waste, storage facilities, workshop facilities, etc.) can reduce surface water quality or result in discharge that exceeds the maximum concentrations permitted by the National Water Act. Changes to the water quality could result in changes to the ecosystem structure and function as well as a potential loss of biodiversity. Water quality



deterioration often leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure.

Aquatic biota can be lost due to the disturbance of the habitat and direct impacts on the watercourse/ rivers/ streams. This can be attributed to Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation.

The impact assessment was conducted using the impact assessment methodology provided as described in Appendix B and below in Table 7.

Table 7: Potential Impacts Associated with the Construction Phase of the proposed Hendrina South 132kV Line.

Environmental Parameter	Environmental Significance Before Mitigation										Environmental Significance After Mitigation									
	E	P	R	L	D	I / M	TOTAL	STATUS	S	E	P	R	L	D	I / M	TOTAL	STATUS	S		
Changes in sediment entering and exiting the system.	3	3	2	2	2	2	24	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Changes in water flow regime	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Introduction and spread of alien vegetation	3	3	2	2	2	2	24	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Changes in water quality due to pollution	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Loss of aquatic biota	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Loss and disturbance of watercourse habitat and fringe vegetation	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		



3.3.3 Potential Impacts during the Operational Phase

During the operational phase the constructed powerline as well as associated infrastructure as it can potentially have an impact on the watercourses / aquatic ecosystems. The major mitigation measure for the operational phase will still be related to move the pylon and associated structures currently known to be located in a wetland or within the wetland buffer layout. The impacts expected in the operational phase are expected to be similar to the construction phase but not as severe in most instances.

The impacts are limited to:

- a) Alteration in flow regime;
- b) Changes in sediment regimes;
- c) Introduction and spread of alien vegetation;
- d) Loss and disturbance of riparian/watercourse habitat and vegetation;
- e) Alteration in water quality due to pollution; and
- f) Loss of aquatic biota.

Alteration in flow regime is possible during the operational phase due to the increase in hardened surfaces. Changes in sediment is still likely especially in the early phase

The impact assessment was conducted using the impact assessment methodology provided as described in Appendix B and below in Table 8.



Table 8: Potential Impacts Associated with the Operational Phase of the proposed Hendrina South 132kV Line.

Environmental Parameter	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
	E	P	R	L	D	I / M	TOTAL	STATUS	S	E	P	R	L	D	I / M	TOTAL	STATUS	S
Changes in sediment entering and exiting the system.	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact
Changes in water flow regime	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact
Introduction and spread of alien vegetation	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact
Changes in water quality due to pollution	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact
Loss of aquatic biota	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact
Loss and disturbance of watercourse habitat and fringe vegetation	3	2	2	2	2	2	22	-	Medium impact	2	2	2	2	2	2	20	-	Low impact

3.3.4 Potential Impacts during the Decommissioning Phase

The proposed Gridline and substation will have a lifespan of have a life expectancy of more than 25 years. During the decommissioning phase it is envisaged that all infrastructure will be removed. Should the mitigation measure of the removal of the layout from wetlands be followed, the impact will also be less during decommissioning. The major mitigation measure for the operational phase will still be related to remove the structures from any wetlands or buffer areas. The impacts expected in the decommissioning phase are expected to be similar to the construction phase.

The impacts are limited to:

- Alteration in flow regime;
- Changes in sediment regimes;
- Introduction and spread of alien vegetation;
- Loss and disturbance of riparian/watercourse habitat and vegetation;
- Alteration in water quality due to pollution; and
- Loss of aquatic biota.



The impact assessment was conducted using the impact assessment methodology provided as described in Appendix D and below in Table 9.

Table 9: Potential Impacts Associated with the Decommissioning Phase of the proposed Hendrina South 132kV Line.

Environmental Parameter	Environmental Significance Before Mitigation										Environmental Significance After Mitigation									
	E	P	R	L	D	I / M	TOTAL	STATUS	S	E	P	R	L	D	I / M	TOTAL	STATUS	S		
Changes in sediment entering and exiting the system.	3	3	2	2	2	2	24	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Changes in water flow regime	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Introduction and spread of alien vegetation	3	3	2	2	2	2	24	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Changes in water quality due to pollution	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Loss of aquatic biota	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		
Loss and disturbance of watercourse habitat and fringe vegetation	3	3	3	2	2	2	26	-	Medium impact	2	2	2	2	2	2	20	-	Low impact		

3.3.5 Mitigation Measures

The following mitigation measures as well as best practice measures and other specialist measures should be implemented to reduce potential risk (Table 10 - Table 15).



Table 10: Impact 1: Changes in water flow regime

Description	<p>Construction and operational activities will result in earthworks and soil disturbance as well as the removal of natural vegetation. This could result in the loss of topsoil, sedimentation of the wetland and increase the turbidity of the water, particularly where pylons are constructed in or in close proximity to watercourses. Possible sources of impacts include:</p> <ul style="list-style-type: none"> • Earthwork activities • Disturbance of soil surface including soil compaction • Disturbance of slopes through creation of roads and tracks adjacent to the watercourses • Creation of additional access roads
Mitigation Construction Phase:	<ul style="list-style-type: none"> • Pylons should be placed outside delineated watercourses and their associated buffer zones. • Prevent access of heavy vehicles and machinery in the wetlands or riparian areas • Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out • Rehabilitation plans must be submitted and approved for rehabilitation of damage during the construction phase and that plan must be implemented immediately upon completion of construction. • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Project engineers should compile a method statement, outlining the construction methodologies. The required mitigation measures to limit the impacts on the watercourse and associated buffers should be contained within the method statement. The method statement must be approved by the ECO and be available on site for reference purposes • Only cross watercourses at designated points should this be necessary
Mitigation Operational Phase	<ul style="list-style-type: none"> • The pylon and substation Structure currently located either within a wetland or within the buffer of a wetland should be moved into nearby impacted areas like agricultural fields • Where development activities are located upslope from wetlands, effective stormwater management should be a priority during both construction and operational phase. This should be monitored as part of the EMP. • Effective culverts should be incorporated into the design of access roads.
Mitigation Decommissioning Phase	<ul style="list-style-type: none"> • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Do not increase hardened surfaces and compaction of the soils after the removal of the solar panels and related infrastructure. • Rehabilitation of exposed soil surfaces should commence as soon as practical after completion of removal of removal of the solar panels and related infrastructure. • Culverts must remain in place and must not be removed if the given road is not removed during the decommissioning phase. • Vehicle movement should be restricted to designated decommissioning areas to prevent the increase in hardened surfaces and subsequent increase in runoff.



Table 11: Impact 2: Changes in sediment entering and exiting the system

Description	<p>Changes in sediment regimes of the aquatic ecosystem and its sub-catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Any activities that change the characteristics of the catchment of a watercourse will affect the way in which water enters into the watercourse. This has an effect on water flow volumes as well as energy. Possible sources of the impacts include:</p> <ul style="list-style-type: none"> • Soil compaction through movement of heavy vehicles • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Disturbance of vegetation cover through trampling • Creation of additional access roads • Any activities within the delineated watercourse
Mitigation Construction Phase:	<ul style="list-style-type: none"> • Where development is located upslope from wetlands, a temporary fence or demarcation must be erected around No-Go Areas outside the proposed works area prior to any construction taking place as part of the contractor planning phase when compiling work method statements to prevent access to the adjacent portions of the watercourse. • Where development is located upslope from wetlands, effective stormwater management including sediment barriers should be a priority during both construction and operational phase. This should be monitored as part of the EMP. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction/earthworks in that area. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Monitoring should be done to ensure that sediment pollution is timeously dressed. • Prevent access of heavy vehicles and machinery in the delineated watercourses • Rehabilitation plans must be submitted and approved for rehabilitation of damage during construction phase and that plan must be implemented immediately upon completion of construction. • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Implementation of best management practices
Mitigation Operational Phase:	<ul style="list-style-type: none"> • The powerline and substation currently located either within a wetland or within the buffer of a wetland should be moved into nearby impacted areas like agricultural fields • Where development is located upslope from wetlands, effective stormwater management including sediment barriers should be a priority during both construction and operational phase. This should be monitored as part of the EMP. • Monitoring should be done to ensure that sediment pollution is timeously dressed. •
Mitigation Decommissioning Phase	<ul style="list-style-type: none"> • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Vehicle movement should be restricted to the minimum that is required for decommissioning. Unnecessary movement of vehicles will increase the degradation of paths and dirt roads leading to increased erosion risk.



	<ul style="list-style-type: none"> Progressive rehabilitation must occur. Rehabilitation has to be take place as soon as decommissioning commences to prevent soil erosion. Monitoring should be done to ensure that sediment pollution is timeously dressed.
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Table 12: Impact 3: Introduction and spread of alien vegetation

Description	The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users
Mitigation Construction Phase:	<ul style="list-style-type: none"> The powerline and substation currently located either within a wetland or within the buffer of a wetland should be moved into nearby impacted areas like agricultural fields Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish. Undertake an Alien Plant Control Plan which specifies actions and measurable targets Alien invasive species that are identified within the construction footprint should be removed prior to construction related soil disturbances. This will prevent seed spreading into disturbed soils Category 1 species, according to the CARA legislation eg <i>Solomon mauritianum</i> should be targeted first, while the larger trees should be selectively thinned out to allow light to penetrate the canopy to facilitate the germination of indigenous species. All cleared vegetation, especially trees, should be removed from the system to ensure the free flow of the stream without any obstacles which will exacerbate flooding events. Appointment of alien plant working group / assign this duty to specific staff Treatment methods should be in alignment with the National Working for Water Herbicide policy. Acquire the necessary equipment for removal and control Planned sequence of areas to be cleared of invasive plants A register of the methods used, dates undertaken, as well as herbicides and dosage used must be kept and available on site. The register must also include incidents of poisoning or spillage Ensure that contractors can identify the relevant plants and are aware of the removal procedures Construction equipment must be cleaned prior to site access. This will prevent alien invasive seed from other sites to spread into disturbed soils Manual removal methods are preferred to chemical control Rehabilitate or revegetate disturbed areas.
Mitigation Operational Phase:	<ul style="list-style-type: none"> Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish. Undertake an Alien Plant Control Plan which specifies actions and measurable targets



	<ul style="list-style-type: none"> • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction/earthworks in that area and returning it where possible afterwards. • Long-term monitoring for the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish, as specified in the Alien Vegetation Management Plan.
Mitigation Decommissioning Phase	<ul style="list-style-type: none"> • Monitor the establishment of alien invasive species within the areas affected by the decommissioning and take immediate corrective action where invasive species are observed to establish. • Undertake an Alien Plant Control Plan which specifies actions and measurable targets • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of decommissioning /earthworks in that area and returning it where possible afterwards. • Rehabilitation must occur concurrently with decommissioning. • The mixture of vegetation seed must be used during rehabilitation. The mix must include: Annual and perennial species, pioneer species, species which are indigenous to the area to ensure there is no ecological imbalance in the area. • Long-term monitoring for the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish, as specified in the Alien Vegetation Management Plan.

Table 13: Impact 4: Loss and disturbance of watercourse habitat and fringe vegetation

<i>Description</i>	Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation.
Mitigation Construction Phase:	<ul style="list-style-type: none"> • The Powerline and substation currently located either within a wetland or within the buffer of a wetland should be moved into nearby impacted areas like agricultural fields • Monitor the establishment of alien invasive species within the areas affected by the construction and take immediate corrective action where invasive species are observed to establish. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed.
Mitigation Operational Phase:	<ul style="list-style-type: none"> • Monitor the establishment of alien invasive species within the areas affected by the construction and take immediate corrective action where invasive species are observed to establish. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Operational activities should not take place within watercourses or buffer zones, nor should edge effects impact on these areas. • Operational activities should not impact on rehabilitated or naturally vegetated areas.
Mitigation Decommissioning Phase	<ul style="list-style-type: none"> • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Vehicle movement should be restricted to the minimum that is required for decommissioning. • Rehabilitation of decommissioned areas must commence concurrently with decommissioning.



	<ul style="list-style-type: none"> • Monitor the establishment of alien invasive species within the areas affected by the decommissioning and take immediate corrective action where invasive species are observed to establish. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Decommissioning activities should not impact on rehabilitated or naturally vegetated areas.
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Table 14: Impact 5: Changes in water quality due to pollution

Description	Changes in water quality due to input of foreign materials e.g. due to increased sediment load, contamination by chemical and /or organic effluent, and /or eutrophication. Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the watercourses and a reduction in watercourse function
Mitigation Construction Phase:	<ul style="list-style-type: none"> • Provision of adequate sanitation facilities located outside of the watercourse or its associated buffer zone. • Implementation of appropriate stormwater management around the excavation to prevent the ingress of run-off into the excavation and to prevent contaminated runoff into the watercourse. • The development footprint must be fenced off from the watercourses and no related impacts may be allowed into the watercourse i.e. water runoff from cleaning of equipment, vehicle access etc. • Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer. • Ensure that no operational activities impact on the watercourse or buffer area. This includes edge effects. • Control of waste discharges and do not allow dirty water from operational activities to enter the watercourse. • Regular independent water quality monitoring should form part of operational procedures in order to identify pollution. • Treatment of pollution identified should be prioritized according to best practice guidelines. • Develop norms and standards for the treatment of spills such as oil or hydraulic fluid. Ensure that the required equipment is available on hand to contain any spills. • Appoint a reliable contractor for the removal of refuse during the construction phase.
Mitigation Operational Phase:	<ul style="list-style-type: none"> • Amend designs to exclude wetlands as well as buffer areas. • Provision of adequate sanitation facilities located outside of the watercourse or its associated buffer zone. • Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer. • Ensure that no operational activities impact on the watercourse or buffer area. This includes edge effects. • Control of waste discharges and do not allow dirty water from operational activities to enter the watercourse. • Regular independent water quality monitoring should form part of operational procedures in order to identify pollution.



	<ul style="list-style-type: none"> • Treatment of pollution identified should be prioritized according to best practice guidelines. • Develop norms and practices for the treatment of spills such as oil or hydraulic fluid. Ensure that the required equipment is available on hand to contain any spills. • Appoint a reliable contractor for the removal of refuse during the operational phase.
Mitigation Decommissioning Phase	<ul style="list-style-type: none"> • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Provision of adequate sanitation facilities located outside of the watercourse or its associated buffer zone. • Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer. • Ensure that no decommissioning activities impact on the watercourse or buffer area. This includes edge effects. • Control of waste discharges and do not allow dirty water from decommissioning activities to enter the watercourse. • Regular independent water quality monitoring should form part of decommissioning procedures in order to identify pollution. • Treatment of pollution identified should be prioritized according to best practice guidelines. • Develop norms and practices for the treatment of spills such as oil or hydraulic fluid. Ensure that the required equipment is available on hand to contain any spills. • Appoint a reliable contractor for the removal of refuse during the operational phase

Table 15: Impact 6: Loss of aquatic biota

Description	Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation.
Mitigation Construction Phase:	<ul style="list-style-type: none"> • This impact is not easily mitigated. Further loss in diversity can be minimised by following the mitigation measures mentioned above • The Structure currently located either within a wetland or within the buffer of a wetland should be moved into nearby impacted areas like agricultural fields
Mitigation Operational Phase:	<ul style="list-style-type: none"> • This impact is not easily mitigated. Further loss in diversity can be minimised by following the mitigation measures mentioned above
Mitigation Decommissioning Phase	



3.3.6 DWS (2016) Risk Assessment

The DHWS Risk Assessment is shown in Table 16 below. Scores fall in the Low-risk category and authorisation may proceed through a General Authorisation.

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Table 16: The severity score derived from the DWS (2016) risk assessment matrix for the proposed overhead powerline**RISK MATRIX** (Based on DWS 2016 publication: Section 21 c and I water use Risk Assessment Protocol): Proposed Eskom Powerlines - Hendrina SouthNAME and REGISTRATION No of SACNASP Professional member: R Bezuidenhout SACNASP # 008867 *Rudi Bezuidenhout*

				Severity																															
Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Veg etation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes														
C	Construction of overhead poweline	Installation/upgrade of foundation for pylon infrastructure	Loss of vegetation cover, compaction of soils, sedimentation, pollution and alien invasive plant establishment	3	2	2	1	2	1	2	5	1	2	5	2	10	50	L	80%	<ul style="list-style-type: none">• Designs should take into account soil properties, slopes and runoff energy with the aim of having a neutral effect on the regional hydrograph.• Construction activities should not be conducted in wet conditions• Minimise the footprint of activities in the wetland and buffer zone by preventing unnecessary access of vehicles and personnel• Implement Eskom best practice policies• Implement effective rehabilitation to reverse construction related impacts	N														
		Construction of new pylon structures		3	2	2	1	2	1	2	5	1	2	5	2	10	50	L	80%		N														
		Movement of equipment and personell during stringing		2	2	1	1	2	1	2	4.5	1	2	5	2	10	45	L	80%		N														
		Upgrade of access roads		1	2	1	1	1	2	4.3	1	2	5	2	10	42.5	L	80%																	
O	Operation of the new powerline	Long term presence of upgraded infrastructure in the wetland	Permanent changes to runoff characteristics in the watercourse including the cumulative impact to downstream watercourses	1	2	1	1	1	1	2	4.2	2	2	5	2	11	46.2	L	80%	<ul style="list-style-type: none">• Control of alien invasive plants should form part of the maintenance plan• Maintenance activities should follow best practice• Monitoring for downstream degradation and effective rehabilitation where necessary	N														
		Ad hoc repair and maintenance to structures		1	1	1	1	1	1	3	1	2	5	2	10	30	L	80%	N																



4 CONCLUSION

The wetland types potentially impacted by the proposed powerline and substation are described in full in Section 2 and include 4 types Seepage-, Channelled Valley Bottom-, Unchannelled Valley Bottom, and Depressional Pan Wetlands. The following buffer zones were calculated for the wetlands based on the generic risk categories for Above Ground Power Line Distribution.

- Seepage Wetland – 24 m
- Valley Bottom Wetlands (Channelled and Unchannelled) – 26 m
- Depressional Pan Wetlands – 27 m

Both the proposed 132 kV Eskom power line options start at the existing Hendrina Powerstation and continue south on the same route and both the options cross a total of 9 wetlands before the options split towards the end. Option 1 then crosses an additional 2 wetlands while Option B crosses an additional 3 wetlands, one of which is very large. Based on the number of wetlands crossing, the ecological health of the wetlands crossed, and access to the infrastructure the following powerline is preferred (Table 17):

Table 17: Route Options and Preferred Option

Alternative	Preference	Reasons (incl. potential issues)
POWERLINE ALTERNATIVES		
Powerline Option 1 *	Favourable - The impact will be relatively insignificant	11 Wetlands Crossings, Adjacent to the tarred access road
Powerline Option 2	Least Preferred - The alternative will result in a high impact	12 Wetland Crossings. Limited access road

*This opinion should be revisited if it does not agree with other specialist findings.

The important factors relevant to the project are summarised in Table 18 below:



Table 18: Summary of findings

	Quaternary Catchment and WMA areas		Important Rivers possibly affected	
	B11A and B12B – #2 WMA Olifants		The main rivers associated with the northern section (Catchment B12B) are Woes-Alleenspruit and East Woes-Alleenspruit. Both drain into the Klein-Olifants River. The main rivers associated with the southern section (Catchment B11A) are the Leeufonteinspruit and Olifants Rivers. The Leeufonteinspruit drains into the Olifants River. B11A and B12B	
NEMA 2014 Impact Assessment	The impact scores for the following aspects are relevant:		Without Mitigation	With Mitigation
	Changes to flow dynamics	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Sedimentation	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Establishment of alien plants	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Pollution of watercourses	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Loss of fringe vegetation and habitat	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L
	Loss of aquatic biota	Construction Phase	M	L
		Operation Phase	M	L
		Decommissioning Phase	M	L



Does the specialist support the development?	The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. It should be noted that Appendix D2 of GN 509 states that the construction of new transmission or distribution powerlines, and minor maintenance on roads, river crossings, towers, and substations, where the footprint remains the same, are exempt from a WUL.
CBA and other important areas	Although the proposed development is located on an endangered vegetation type the proposed development goes through predominantly Heavily modified areas with smaller sections crossing Moderately Modified (Old Lands) and areas described as other natural areas. The powerline is sufficiently buffered from any CBA irreplaceable areas.

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APPENDIX A: Requirements for Aquatic Biodiversity Assessments

The NEMA regulations of 2014 (as amended) specify required information to be included in specialist reports. Table 19 presents a summary of these requirements following GNR982 as amended by GN326. In March 2020, the Department of Environmental Affairs issued General Notice 320 set out requirements of the EIA Screening Tool Protocols for the Assessment and Reporting of Environmental Themes including Aquatic Biodiversity. These specifications overlap somewhat with the 2014 EIA regulations as amended (GN 982 as amended by GN326). Table 20 presents a summary of the requirements of this protocol with notes on sections of the report applicable to each aspect.

Table 19: Legislative report requirements GNR982

GNR982 as amended by GN326	Report Section
(1) A specialist report prepared in terms of these Regulations must contain—	
(a) details of—	
(i) the specialist who prepared the report; and	Page 4
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix D
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pages 3
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.5, Table 1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3.3 Impacts and Mitigations
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2 and APPENDIX B: Detailed Methodology
(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 3
(g) an identification of any areas to be avoided, including buffers;	Section 3



(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;	Figure 8 and Figure 9
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 3
(k) any mitigation measures for inclusion in the EMPr;	Section 3.3
(l) any conditions for inclusion in the environmental authorisation;	Section 4
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 3.3
(n) a reasoned opinion—	
(i) whether the proposed activity, activities or portions thereof should be authorised;	Section 4
(iA) regarding the acceptability of the proposed activity or activities; and	Section 4
(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 4
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not Applicable
(q) any other information requested by the competent authority.	Not Applicable
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not Applicable



Table 20: Content of Specialist report GN320

Requirement	Section
2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including; (a) aquatic ecosystem types; and (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 3
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	Section 1.5, Table 1
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	Section 1.5, Table 1
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including:	Section 3
(a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and	Section 3
(b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 3
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	One alternative was suggested, although it only differs on one section and remains in high sensitivity watercourses
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions:	
2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 3
2.5.2. is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	Section 3



2.5.3. how will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:	Section 3.3
(a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);	Section 3.3
(b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);	Section 3.3
(c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and	Section 3.3
(d) to what extent will the risks associated with water uses and related activities change;	Table 16: The severity score derived from the DWS (2016) risk assessment matrix for the proposed overhead powerline
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include:	
(a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the system);	Section 3.3
(b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over -abstraction or instream or off stream impoundment of a wetland or river);	Section 3.3
(c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland);	Section 3.3
(d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);	Section 3.3
(e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and	Section 3.3
(f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	Section 3.3



<p>2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially:</p> <ul style="list-style-type: none"> (a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage? 	Section 3.3
<p>2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?</p>	Section 3.3
<p>2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to:</p> <ul style="list-style-type: none"> (a) size of the estuary; (b) availability of sediment; (c) wave action in the mouth; (d) protection of the mouth; (e) beach slope; (f) volume of mean annual runoff; and (g) extent of saline intrusion (especially relevant to permanently open systems). 	Not applicable



APPENDIX B: Detailed Methodology

Wetland and Riparian Delineation

Wetlands are delineated based on scientifically sound methods and utilizes a tool from the DWS 'A practical field procedure for identification and delineation of wetlands and riparian areas' (DWAF, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (DWAF, 2008). The delineation of the watercourses presented in this report is based on both desktop delineation and ground-truthing.

Desktop Delineation

A desktop assessment was conducted with wetland and riparian units potentially affected by the proposed activities identified using a range of tools, including:

- 1: 50 000 topographical maps;
- Recent, relevant aerial and satellite imagery, including Google Earth;
- NFEPA wetlands and Rivers (<http://bgisviewer.sanbi.org/>)
- Municipal and DWS spatial datasets.

All areas suspected of being wetland and riparian habitats based on the visual signatures on the digital base maps were mapped using google earth.

Ground Truthing

Field investigations confirmed fine-scale wetland and riparian boundaries.

Wetland Indicators

Wetlands were identified based on one or more of the following characteristic attributes (DWAF, 2005) (Figure 14 & Figure 15):

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The presence of plants adapted to or tolerant of saturated soils (hydrophytes);
- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation; and
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing within 50cm of the soil surface.



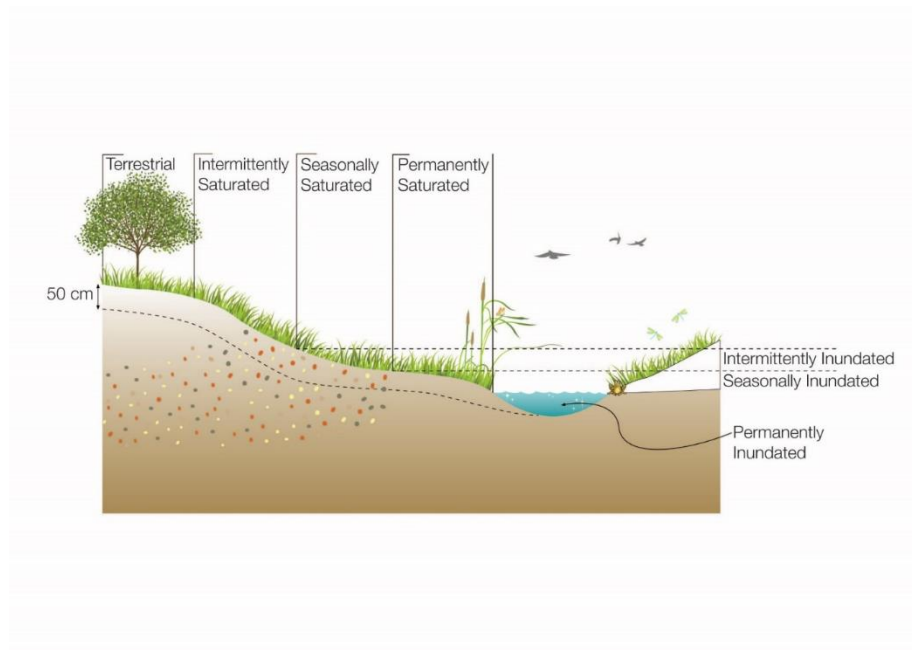


Figure 14: Typical cross section of a wetland (Ollis, 2013)

The terrain unit indicator is an important guide for identifying the parts of the landscape where wetlands might possibly occur and is relevant to the hydrogeological setting of a wetland. For example, some wetlands occur on slopes higher up in the catchment where groundwater discharge is taking place through seeps. The type of wetland which occurs on a specific topographical area in the landscape is described using the Hydrogeomorphic classification which separates wetlands into 'HGM' units. The classification of Ollis, *et al.*, (2013) is used, where wetlands are classified on Level 4 as either Rivers, Floodplain wetlands, Valley-bottom wetlands, Depressions, Seeps, or Flats.

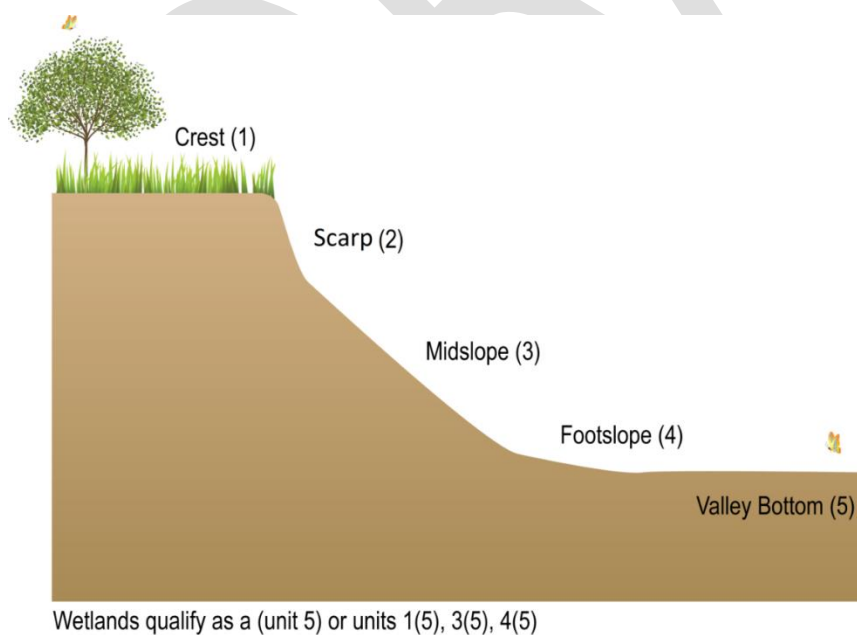


Figure 15. Terrain units (DWAF, 2005).



Riparian Indicators

A riparian area can be defined as a linear fluvial, eroded landform which carries channelized flow on a permanent, seasonal or ephemeral/episodic basis. The river channel flows within a confined valley (gorge) or within an incised macro-channel. The “river” includes both the active channel (the portion which carries the water) as well as the riparian zone (Kotze, 1999).

Riparian habitat is classified primarily by identifying riparian vegetation along the edge of the macro stream channel. The macro stream channel is defined as the outer bank of a compound channel and should not be confused with the active river bank. The macro channel bank often represents a dramatic change in the energy with which water passes through the system. Rich alluvial soils deposit nutrients making the riparian area a highly productive zone. This causes a very distinct change in vegetation structure and composition along the edges of the riparian area (DWAF, 2008). The marginal zone includes the area from the water level at low flow, to those features that are hydrologically activated for the greater part of the Year (WRC Report No TT 333/08 April, 2008). The non-marginal zone is the combination of the upper and lower zones (Figure 16).

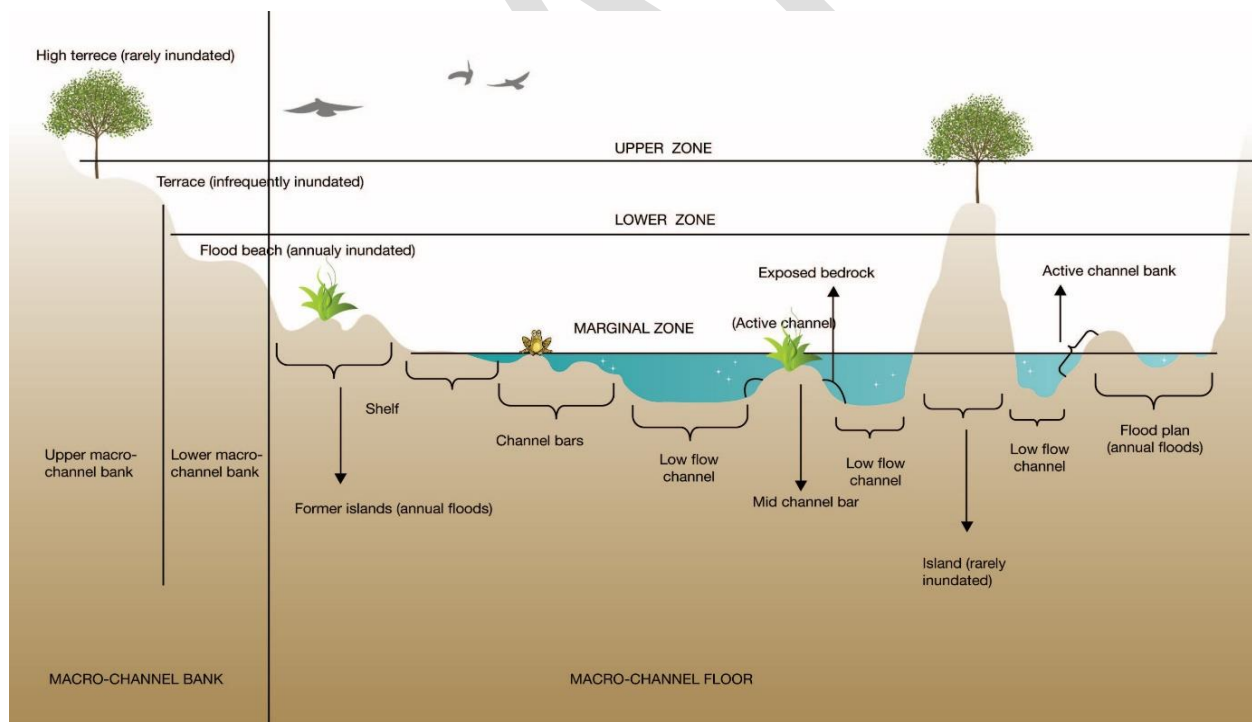


Figure 16: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans *et al*, 2007)

Riparian areas can be grouped into different categories based on their inundation period per year. Perennial rivers are rivers with continuous surface water flow, intermittent rivers are rivers where surface flow



disappears but some surface flow remains, and temporary rivers are rivers where surface flow disappears for most of the channel (Figure 17). Two types of temporary rivers are recognized, namely “ephemeral” rivers that flow for less time than they are dry and support a series of pools in parts of the channel, and “episodic” rivers that only flow in response to extreme rainfall events, usually high in their catchments (Seaman *et al*, 2010).

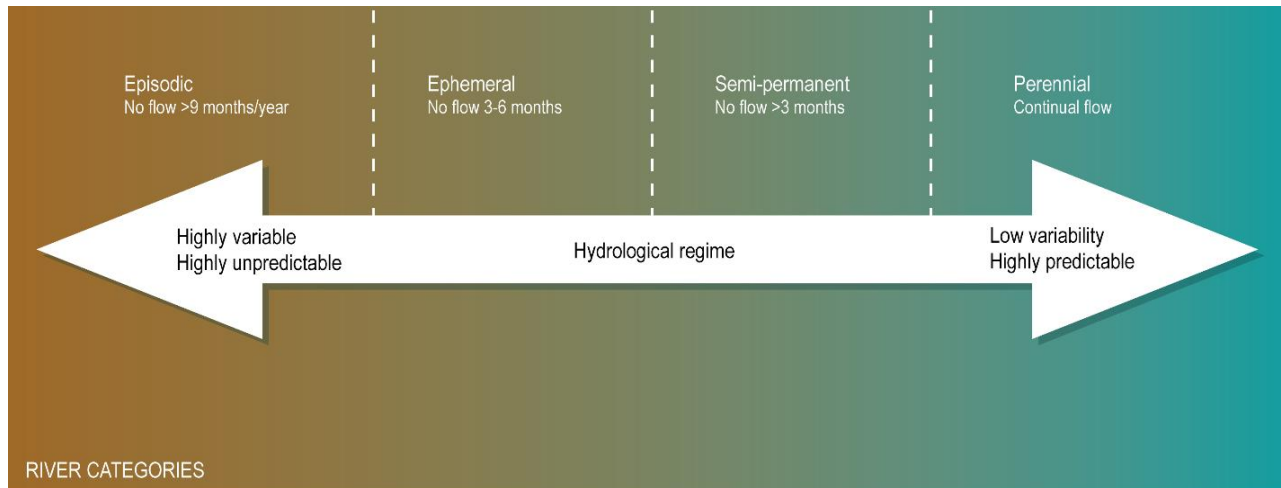


Figure 17: The four categories associated with rivers and the hydrological continuum. Dashed lines indicate that boundaries are not fixed (Seaman *et al*, 2010).

Wetland/Riparian Classification

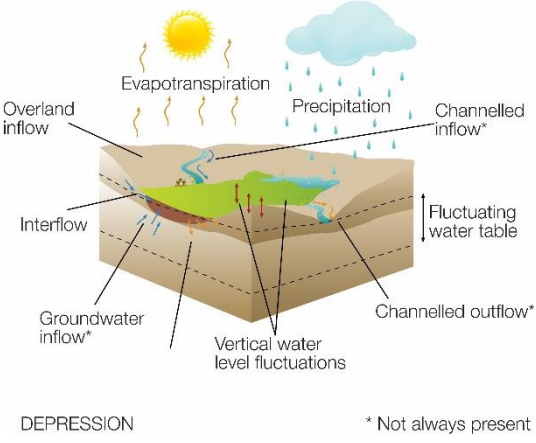
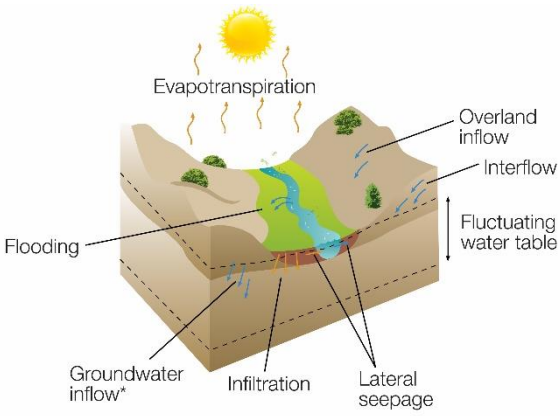
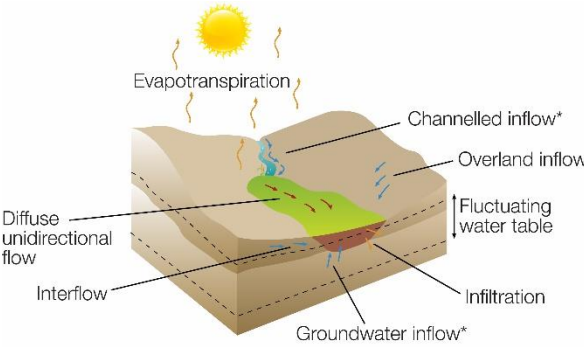
The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2013). The current watercourse assessment follows the same approach by classifying watercourses in terms of a functional unit recognised in the classification system proposed in SANBI (2013). HGM units take into consideration factors that determine the nature of water movement into, through, and out of the watercourse system. In general, HGM units encompass three key elements (Kotze *et al*, 2005):

- Geomorphic setting - This refers to the landform, its position in the landscape, and how it evolved (e.g. through the deposition of river-borne sediment);
- Water source - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
- Hydrodynamics - This refers to how water moves through the wetland.

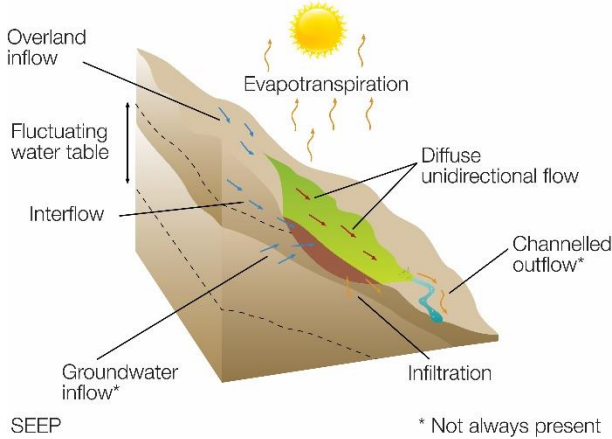
The classification of watercourse areas found within the study site and/or within 500 m of the study site (adapted from Brinson, 1993; Kotze, 1999, Marneweck and Batchelor, 2002 and DWAF, 2005) are as follows (Table 21):



Table 21: Watercourse Types and descriptions

Watercourse Type:	Description:
<p><i>Depressional pans</i></p>  <p>DEPRESSION * Not always present</p>	<p>Small (deflationary) depressions which are circular or oval in shape; usually found on the crest positions in the landscape. The topographic catchment area can usually be well-defined (i.e. a small catchment area following the surrounding watershed). Although often apparently endorheic (inward draining), many pans are “leaky” in the sense that they are hydrologically connected to adjacent valley bottoms through subsurface diffuse flow paths.</p>
<p><i>Valley bottom with a channel</i></p>  <p>CHANNELLED VALEY-BOTTOM WETLAND * Not always present</p>	<p>Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic flow is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no ox-bows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.</p>
<p><i>Valley bottom without a channel</i></p>  <p>UNCHANNELLED VALLEY-BOTTOM WETLAND * Not always present</p>	<p>Linear fluvial, net depositional valley bottom surfaces which do not have a channel. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas, or at tributary junctions where the sediment from the tributary smothers the main drainage line.</p>



Watercourse Type:	Description:
<p>Seepage Wetlands</p>  <p>The diagram illustrates the hydrological processes in seepage wetlands. It shows a cross-section of a hillside with a fluctuating water table. Water enters from overland inflow and groundwater inflow (marked with an asterisk). Evapotranspiration is shown as upward arrows from the surface. Water moves through interflow and diffuse unidirectional flow towards a channelled outflow (also marked with an asterisk). Infiltration is shown at the base of the slope. The word 'SEEP' is written at the bottom left. A note at the bottom right states '* Not always present'.</p>	<p>Seepage wetlands are the most common type of wetland (in number), but probably also the most overlooked. These wetlands can be located on the mid- and footslopes of hillsides; either as isolated systems or connected to downslope valley bottom wetlands. They may also occur fringing depressional pans. Seepages occur where springs are decanting into the soil profile near the surface, causing hydric conditions to develop; or where through flow in the soil profile is forced close to the surface due to impervious layers (such as plinthite layers; or where large outcrops of impervious rock force subsurface water to the surface).</p>

Buffer Zones and Regulated Areas

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAF, 2005). A development has several impacts on the surrounding environment and a watercourse. The development changes habitats, the ecological environment, infiltration rate, amount of runoff, and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is, therefore, often characteristic of transformed catchments. The buffer zone identified in this report serves to highlight an ecologically sensitive area in which activities should be conducted with this sensitivity in mind.

Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include (i) maintaining basic hydrological processes; (ii) reducing impacts on water resources from upstream activities and adjoining land uses; (iii) providing habitat for various aspects of biodiversity. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses/activities planned adjacent to water resources. Although buffer zones can be effective in addressing diffuse source pollution in stormwater run-off, they should typically be seen as part of a treatment train designed to address stormwater impacts (MacFarlane & Brendin, 2017).

Authorisation from the DWS requires the calculation of a site-specific buffer zone (General Notice 267 of 24 March 2017), following Macfarlane *et al* 2015. This Excel-based tool calculates the best-suited buffer for each wetland or section of a wetland based on numerous on-site observations. The resulting buffer zone can thus have large differences depending on the current state of the wetland as well as the nature of the proposed development. Developments with a high-risk factor such as mining are likely to have a larger buffer area compared to residential development with a lower risk factor.



Figure 18Figure 18Figure 19 images represent the buffer zone setback for the watercourse types discussed in this report.

It should be noted that the buffer calculation tool does not take into account the effects of climate change or cumulative impacts to flood flows resulting from transformed catchments. Therefore, a conservative approach to the application of buffer zones is encouraged.

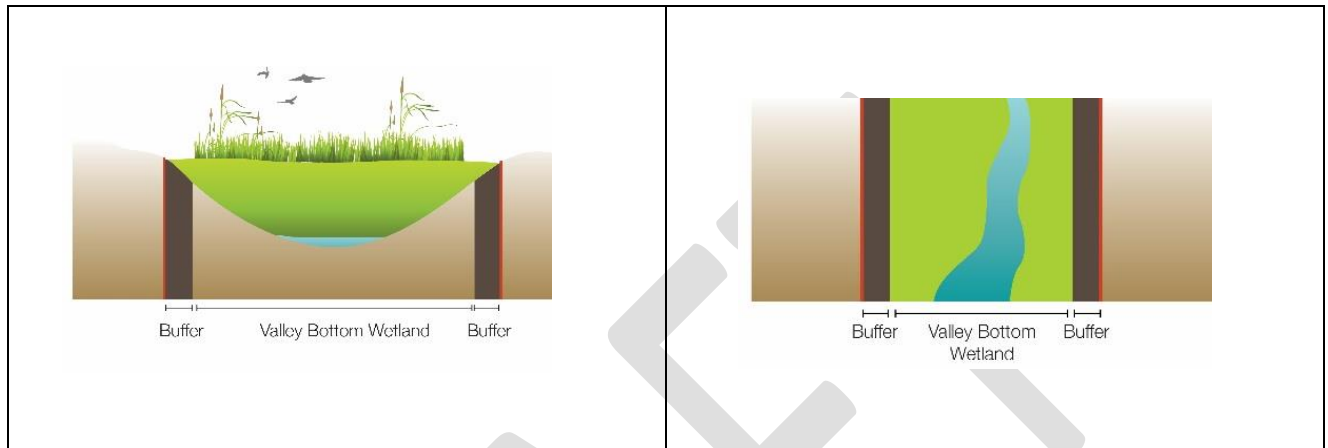


Figure 18: A represent the buffer zone setback for the watercourse discussed in this report

Regulated areas are zones within which authorisation is required. The DWS specify a 500m regulated area around all wetlands and 100m around all riparian zones within which development must be authorised from their department. Development within 32m of the edge of the watercourse triggers the requirement for authorisation under the National Environmental Management Act (NEMA): Environmental Impact Assessment (EIA) Regulations of 2014 (GNR 326) as amended.

Watercourse Functionality, Status, and Sensitivity

The functional assessment methodologies presented below take into consideration subjective recorded impacts to determine the scores attributed to each functional Hydrogeomorphic (HGM) unit. Following the calculation of PES and EC scores, a Recommended Ecological Category can be obtained. This score reflects an auditable management or rehabilitation target to be achieved by the proposed project. The sections below provide a brief description of each method employed in the 2021 assessment.

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. The natural reference condition is based on a theoretical undisturbed state extrapolated from an understanding of undisturbed regional vegetation and hydrological conditions. In the current assessment the hydrological, water quality, geomorphological, and vegetation integrity was assessed for the wetland unit associated with the study site, to provide a Present Ecological Status (PES) score (Macfarlane *et al.*, 2020) and an Environmental Importance and Sensitivity category (EIS) (Kotze *et al.*, 2020). These impacts are based on evidence observed during the field survey and land use changes visible on aerial imagery including historical images.



The allocations of scores in the functional and integrity assessment are subjective and are thus vulnerable to the interpretation of the specialist. The collection of empirical data is precluded at this level of investigation due to project constraints including time and budget. Water quality values, species richness and abundance indices, and surface and groundwater volumes, amongst others, should ideally be used rather than a subjective scoring system such as is presented here.

The functional assessment methodologies presented below take into consideration subjective recorded impacts to determine the scores attributed to each functional Hydrogeomorphic (HGM) wetland unit. The aspect of wetland functionality and integrity that are predominantly addressed include hydrological and geomorphological function (subjective observations) and the integrity of the biodiversity component (mainly based on the theoretical intactness of natural vegetation) as directed by the assessment methodology

Present Ecological Status (PES) – WET-Health

A summary of the four components of the WET-Health (2.0) namely Hydrological; Geomorphological, water quality, and Vegetation Health assessment for the wetlands found on site is described in Table 14. For this assessment, WET-Health Version 2.0 was used. This method builds on the WET-Health Version 1.0 (Macfarlane *et al.* 2008) and Wetland-IHI (DWAf 2007) Tool, offering a refined and more robust suite of tools (Macfarlane *et al.* 2020). The WET-Health Version 2 considers four (4) components to assess the PES of wetland ecosystems. Geology, climate, and topographic position determine the ecological setting of a wetland. Three (3) core interrelated drivers broadly influence all wetlands, namely Hydrology, Geomorphology, and Water Quality (i.e. physicochemical attributes). Wetland biology, and more specifically vegetation, responds to the changes in these drivers and the surrounding environment. A level 2 assessment was used for the wetlands recorded on the study site (Table 22).

Table 22: The three levels of assessment to cater to the application of the WET-Health Version 2 Tool across different spatial scales and for different purposes (Adapted from Macfarlane *et al.* 2020).

Level of Assessment	Spatial Scale	Description
Level 1A	Desktop-based, low resolution	<p>Entirely desktop-based and only uses pre-existing landcover data.</p> <p>Landcover types within a buffer / “pseudo catchment” around a wetland is used to determine the impacts on the wetland arising from the upslope catchment.</p> <p>Impacts arising from within individual wetlands are inferred from landcover types occurring within desktop-delineated wetlands.</p>
Level 1B	Desktop-based, high resolution	<p>Largely desktop-based using pre-existing landcover data but makes a few finer distinctions than Level 1A in terms of landcover types and usually requires “heads-up” interpretation of the best available aerial imagery in order to do so.</p> <p>Upslope catchment of each wetland can be individually delineated at this level, and landcover in this area is used</p>



Level of Assessment	Spatial Scale	Description
		<p>as a proxy of the impacts on a wetland arising from its upslope catchment.</p> <p>Impacts arising from within individual wetlands are inferred from landcover types occurring within desktop-delineated wetlands.</p> <p>In terms of water quality PES, the option is provided to factor in point-source pollution inputs in a Level 1B assessment.</p>
Level 2	Rapid field-based assessment	<p>Strongly informed by desktop landcover mapping; refined by assessing a range of catchment and wetland-related indicators known to affect wetland condition.</p> <p>Impacts arising from the upslope catchment of a wetland are inferred from landcover mapping but are refined based on additional information.</p> <p>Landcover types occurring within the wetland are used as the starting point for assessing human impacts arising from within the wetland but are refined through the assessment of additional indicators as part of a rapid field-based assessment. This involves sub-dividing the wetland into relatively homogenous “disturbance units” and assessing a suite of site-based wetland questions that provide a more direct assessment of change.</p> <p>Determination of water quality PES in a Level 2 assessment requires the identification and characterisation of point-source pollution inputs.</p>

A summary of the change class, description and symbols used to evaluate wetland health are summarised in Table 23. The trajectory of change is summarised in Table 24.

Table 23: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane *et al.*, 2020)

Ecological Category	Description	Impact Score	PES Score (%)
A	Unmodified, natural	0 to 0.9	90-100
B	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	80-89



C	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	60-79
D	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	40-59
E	Seriously Modified. The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	6.0 to 7.9	20-39
F	Critical Modification. The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10	0-19

Table 24: Trajectory class, change scores and symbols used to evaluate Trajectory of Change to wetland health (Macfarlane *et al*, 2007)

Change Class	Description	Symbol
Improve	Condition is likely to improve over the over the next 5 years	(↑)
Remain stable	Condition is likely to remain stable over the next 5 years	(→)
Slowly deteriorate	Condition is likely to deteriorate slightly over the next 5 years	(↓)
Rapidly deteriorate	Substantial deterioration of condition is expected over the next 5 years	(↓↓)

Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) score forms part of a larger assessment called the Wetland Importance and Sensitivity scoring system which also addresses hydrological importance and direct human benefits relevant to a HGM unit. Both PES and EIS form part of a larger reserve determination process documented by the Department of Water and Sanitation.

Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (DWAF, 1999). This classification of water resources allows for an appropriate management class to be allocated to the water resource and includes the following:

- Ecological Importance in terms of ecosystems and biodiversity such as species diversity and abundance;



- Ecological functions including groundwater recharge, provision of specialised habitat and dispersal corridors;
- Basic human needs include subsistence farming and water use.

The Ecological Importance and Sensitivity of the wetlands is represented are described in the results section. Explanations of the scores are given in Table 25

Table 25: Environmental Importance and Sensitivity rating scale used for the estimation of EIS scores (DWAF, 1999)

Ecological Importance and Sensitivity Categories	Rating
Very High Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers.	>3 and ≤4
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and ≤3
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.	>1 and ≤2
Low/Marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.	>0 and ≤1

Ecosystem Services (ES)

The DWS authorisations related to wetlands are regulated by Government Notice 267 published in the Government Gazette 40713 of 24 March 2017. Page 196 of this notice provides detailed “terms of reference” for wetland assessment reports and includes the requirement that the ecological integrity and function of wetlands be addressed. This requirement is addressed through the WetEcoServices toolkit (Kotze *et al.*, 2020). This wetland assessment method is an Excel-based tool that is based on the integral function of wetlands in terms of their hydrogeomorphic setting. Each of the seven benefits is assessed based on a list of characteristics (e.g. slope of the wetland) that are relevant to the particular benefit. Scores are subjectively awarded to characteristics of the wetland and its catchment relative to the proposed activity. Scores are ranked as Very High, High, Moderately-High, Moderate, Moderately-Low, Low, and Very Low (Table 26 & Table 27).



Table 26: Integrating the scores for ecosystem supply and demand into an overall importance score.

Integrating scores for supply & demand to obtain an overall importance score						
		Supply				
		Very Low	Low	Moderate	High	Very High
Demand		0	1	2	3	4
Very Low	0	0.0	0.0	0.5	1.5	2.5
Low	1	0.0	0.0	1.0	2.0	3.0
Moderate	2	0.0	0.5	1.5	2.5	3.5
High	3	0.0	1.0	2.0	3.0	4.0
Very High	4	0.5	1.5	2.5	3.5	4.0

Table 27: Categories used for reporting the overall importance of ecosystem services.

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.



Use of WET-EcoServices for assessing the Ecological Importance and Sensitivity (EIS) of wetlands

The term Ecological Importance and Sensitivity (EIS) is well entrenched in water resource management in South Africa. Ecological Importance (EI) is the expression of the importance of wetlands and rivers in terms of the maintenance of biological diversity and ecological functioning at a local and landscape level. Ecological Sensitivity (S) refers to ecosystem fragility or the ability to resist or recover from disturbance (Rountree and Kotze 2013). The purpose of assessing the ecological importance and sensitivity of water resources like wetlands, and rivers is to be able to identify those systems that provide valuable biodiversity support functions, regulating ecosystem services, or are especially sensitive to impacts. Knowing what ecosystems are valuable enables the appropriate setting of management objectives (i.e. recommended ecological category - REC) and the prioritization of management actions and interventions to promote effective water resource management.

The tool currently used for assessing wetland EIS (Rountree and Kotze 2013) is somewhat outdated but is typically informed by a WET-EcoServices assessment. The implication is that practitioners involved in wetland assessments typically have to complete both a WET-EcoServices assessment and a stand-alone EIS assessment to inform decision-making processes. Recommendations to refine the wetland EIS tool have been documented (Macfarlane et al. 2019) and include the need to revise and update the wetland EIS assessment framework to simply integrate the key outputs of the WET-EcoServices tool to produce an overall ecological importance (EI) score.

Specific recommendations for integrating the WET-EcoServices outputs into the wetland EIS assessment have also been documented. These include a grouping of ecosystem service scores into broad categories which would then be integrated into an overall ecological importance (EI) score:

- **Biodiversity maintenance importance:** This is the importance score derived from the biodiversity maintenance component of WET-EcoServices.
- **Regulating services importance:** This would be calculated as the maximum score of all the importance scores for regulating services considered in WET-EcoServices.
- **Provisioning and cultural services importance:** This would be calculated as the maximum score of all the importance scores for provisioning and cultural services considered in WET-EcoServices.

The EI would be simply derived based on the maximum of these scores and could then be integrated with the ecological sensitivity (ES) score to produce an overall EIS score. A simple schematic of the proposed Wetland EIS framework is shown in Figure 19 below.



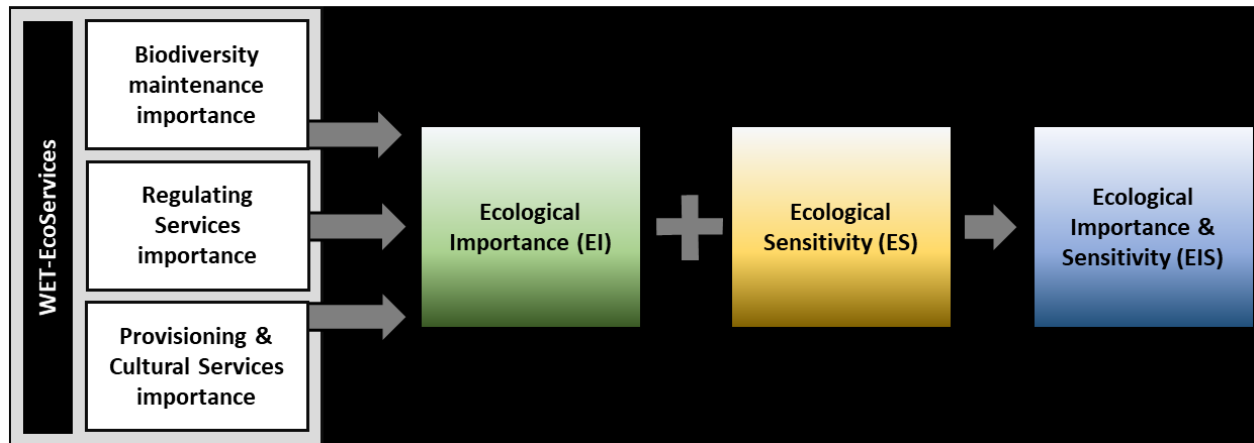


Figure 19: Schematic of the recommended Wetland EIS framework.

4.1.1 SITE ECOLOGICAL IMPORTANCE

Based on the Species Environmental Assessment Guideline (SANBI, 2020) wetlands and specialised habitats should be assessed based on their Site Ecological Importance (SEI). The SEI is based on several factors (Figure 20):

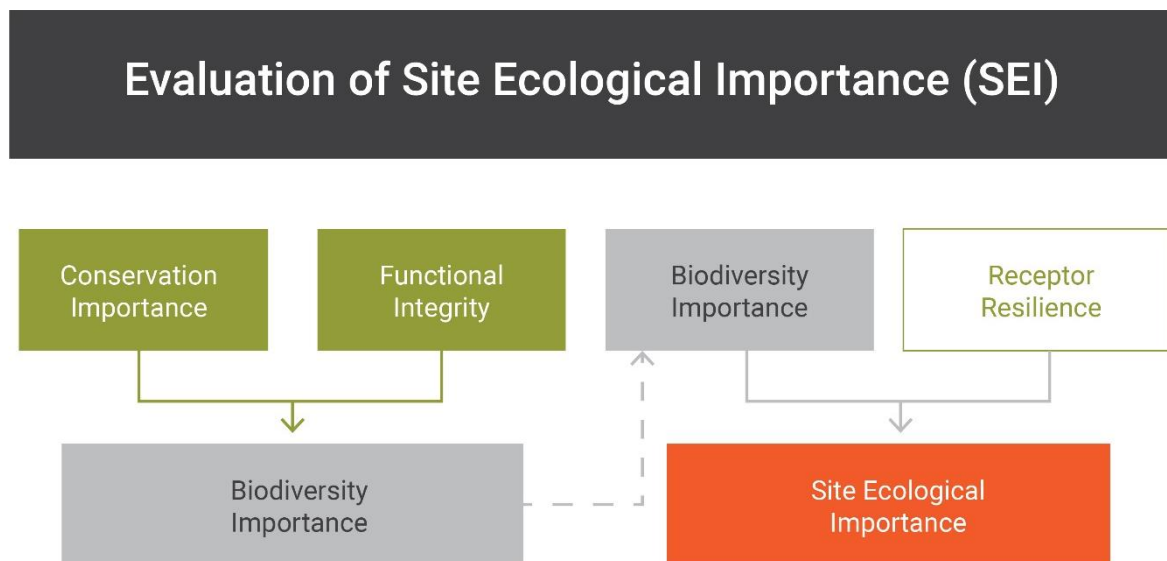


Figure 20: Evaluation of Site Ecological Importance based on CI, FI, BI, RR and SEI (SANBI, 2020).

Conservation Importance (CI) (Table 28) and Functional Integrity (FI) (Table 29) = Biodiversity Importance (Table 30).

Biodiversity Importance (BI) and Receptor Resilience (RR) (Table 30, Table 31) = Site Ecological Importance (Table 32).



Table 28: Conservation Importance (SANBI, 2020).

Conservation importance	Fulfilling criteria
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare ²³ or Critically Rare ²⁴ species that have a global EOO of < 10 km ² . Any area of natural habitat ²⁵ of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent ²⁶) of natural habitat of EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km ² . IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC
Very low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 29: Functional Integrity (SANBI, 2020).

Functional Integrity	Fulfilling criteria
Very High	Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types Very High High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing)
High	Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential
Medium	Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches Mostly minor current negative ecological impacts with some major impacts (e.g.



	established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential
Low	Small (>1 ha but <5 ha) area Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential Several minor and major current negative ecological impacts
Very low	Very small (<1 ha) area No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts

Table 30: Biodiversity Importance (SANBI, 2020)..

Biodiversity Importance		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

Table 31: Receptor Resilience (SANBI, 2020)..

Resilience	Fulfilling criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed
High	Habitat that can recover relatively quickly (~ 5-10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed
Medium	Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50 % of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a



	disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed

Table 32: Site Ecological Importance (SANBI, 2020).

Site Ecological Importance		Biodiversity Importance				
		Very High	High	Medium	Low	Very Low
Receptor Resilience	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Recommended Ecological Category (REC)

The REC is determined by the Present Ecological State of the water resource and the importance and/or sensitivity of the water resource. Water resources which have Present Ecological State categories in an E or F ecological category are deemed unsustainable by the DWS. In such cases the REC must automatically be increased to a D.

Where the PES is in the A, B, C, D or E the EIS components must be checked to determine if any of the aspects of importance and sensitivity (Ecological Importance; Hydrological Functions and Direct Human Benefits) are high or very high. If this is the case, the feasibility of increasing the PES (particularly if the PES is in a low C or D category) should be evaluated. This is recommended to enable important and/or sensitive wetland water resources to maintain their functionality and continue to provide goods and services for the environment and society.

If (Table 33):

- PES is in an E or F category:
The REC should be set at least a D, since E and F EC's are considered unsustainable.
 - The PES category is in an A, B, C or D category, AND the EIS criteria are low or moderate OR the EIS criteria are high or even very high, but it is not feasible or practicable for the PES to be improved:
- The REC is set at the current PES.
 - The PES category is in a B, C or D category, AND the EIS criteria are high or very high AND it is feasible or practicable for the PES to be improved:



- The REC is set at least one Ecological Category higher than the current PES.” (Rountree *et al.*, 2013).

Table 33: Generic Matrix for the determination of REC and RMO for water resources

			EIS			
			Very high	High	Moderate	Low
PES	A	Pristine/Natural	A Maintain	A Maintain	A Maintain	A Maintain
	B	Largely Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good - Fair	B Improve	B/C Improve	C Maintain	C Maintain
	D	Poor	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Very Poor	D Improve	E/F Improve	E/F Maintain	E/F Maintain



1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.



The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.2 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria



ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		



1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:		
Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.		



The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.



APPENDIX C: GLOSSARY OF TERMS

Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area
Hydrophyte	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats
Hydromorphic soil	soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils)
Seepage	A type of wetland occurring on slopes, usually characterised by diffuse (i.e. unchannelled, and often subsurface) flows
Sedges	Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.
Soil profile	the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991)
Wetland:	<i>“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.”</i> (National Water Act; Act 36 of 1998).
Wetland delineation	the determination and marking of the boundary of a wetland on a map using the DWAF (2005) methodology. This assessment includes identification of suggested buffer zones and is usually done in conjunction with a wetland functional assessment. The impact of the proposed development, together with appropriate mitigation measures are included in impact assessment tables



APPENDIX D: Abbreviated CV of participating specialists

RUDI BEZUIDENHOUDT

880831 5038 081

Ecologist / Botanist / Aquatic Specialist

Pr. Sci Nat (Reg. No. 008867)

South African

Single

EDUCATIONAL QUALIFICATIONS

- B.Sc. (Botany & Zoology), University of South Africa (2008 - 2012)
- B.Sc. (Hons) Botany, University of South Africa (2014 – 2016)
- Aquatic & Wetland Plant identification, Cripsis Environment (2019)
- Introduction to wetlands, Gauteng Wetland Forum (2010)
- Biomimicry and Constructed Wetlands. Golder Associates and Water Research Commission (2011)
- Wetland Rehabilitation Principles, University of the Free State (2012)
- Wetland Plant Identification Course, SANBI (2015)
- Tools for Wetland Assessment, Rhodes University (2011)
- Wetland Legislation, University of Free-State (2013)
- Understanding Environmental Impact Assessment, WESSA (2011)
- SASS 5, Groundtruth (2012)
- Wetland Operations and Diversity Management Master Class, Secolo Consulting Training Services (2015)
- Tree Identification, Braam van Wyk – University of Pretoria (2015)
- Wetland Buffer Legislation – Eco-Pulse & Water Research Commission (2015)
- Wetland Seminar, ARC-ISCW & IMCG (2011)
- Invasive Species Training, SAGIC (2016)
- Hydropedology Course. Department of Water and Sanitation (2019)
- Tropical Coastal Ecosystems, edX (2020)
- The Science of Hydropedology – Department of Water and Sanitation (2020)
- Hydropedological Grouping of SA Soil Forms - Department of Water and Sanitation (2020)
- Hydropedological Classification of South Africa Soil Forms - Department of Water and Sanitation (2020)



- Contribution of Hydropedological Assessments to the Availability and Sustainable Management of water for all - Department of Water and Sanitation (2020)

► **WETLAND SPECIALIST/ECOLOGIST**

Experience in the delineation and functional assessment of wetlands and riparian areas in order to advise proposed development layouts, project management, report writing and quality control. This entails all aspects of scientific investigation associated with a consultancy that focuses on wetland specialist investigations. This includes the following:

- Approximately 200+ specialist investigations into wetland and riparian conditions on strategic, as well as fine scale levels in all 9 Provinces of South Africa as well as in bordering countries.
- Ensuring the scientific integrity of wetland reports including peer review and publications.

Major Projects Involve:

- Numerous Eskom Powerline Projects some spanning more than one Province.
- Proposed New Kruger National Camp and Infrastructure (2016)
- Numerous Mining Projects
- Numerous Water infrastructure upgrades
- Numerous Residential and Housing Developments

► **BIODIVERSITY ACTION PLAN**

This entails the gathering of data and compiling of a Biodiversity action plan for various private and government entities.

► **REHABILITATION**

This entailed the management of vegetation and rehabilitation related projects in terms of developing proposals, project management, technical investigation and quality control as well as on-site monitoring.

COURSES PRESENTED

Riparian Vegetation Response Assessment Index (VEGRAI) Training presented to DWA (Department of Water Affairs) (2017)

Numerous Wetland Talks

► **ENVIRONMENTAL CONTROLLING OFFICER:**



Routine inspection of construction sites to ensure compliance with the City's environmental ordinances, the Environmental Management Program and other laws and by-laws associated with development at or near wetland or riparian areas.

- Soweto Zola Park 2011-2013
- Orange Farm Pipeline 2010-2011
- Juksei River Rehabilitation 2018- 2020
- Ga-Mawela Bridge 2019-2020

► **ENVIRONMENTAL AUDIT:**

Audit of Eskom Kusile power station to comply with the Kusile Section 21G Water Use Licence (Department of Water Affairs, Licence No. 04/B20F/BCFGIJ/41, 2011), the amended Water Use Licence (Department of water affairs and forestry, Ref. 27/2/2/B620/101/8, 2009) and the WUL checklist provided by Eskom.

- Kusile Powerstation 2012-2013.

► **INVASIVE SPECIES MANAGEMENT**

- Identifying and classifying invasive species on numerous sites.
- Creating invasive species control and management plans
- Monitoring invasive species control measures

PUBLICATIONS

Bezuidenhoudt. R., De Klerk. A. R., Oberholster. P.J. (2017). Assessing the ecosystem processes of ecological infrastructure on post-coal mined land. COALTECH RESEARCH ASSOCIATION NPC. University of South Africa. Council for Scientific Industrial Research.

