



Update of the wetland assessments for the Proposed Eskom Powerlines between Ferrum and Epsilon, via Hotazel, Mookgoddi and Hermes.

Wetland/Riparian Delineation and Functional Assessment Report

November 2020

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- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

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2020.11.30

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NR.	CONTENT	REFERENCE
a	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix A
b	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 2
c	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
cA	<u>An indication of the quality and age of base data used for the specialist report;</u>	Section 1.1
cB	<u>A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;</u>	Section 2
d	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
e	A description of the methodology adopted in preparing the report or carrying out the specialised process <u>inclusive of equipment and modelling used;</u>	Section 4
f	<u>Details of an assessment</u> of the specific identified sensitivity of the site related to the <u>proposed activity or activities</u> and its associated structures and infrastructure, <u>inclusive of a site plan identifying site alternatives;</u>	Section 2
g	An identification of any areas to be avoided, including buffers;	Section 2
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 2
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 [including identified alternatives on the environment] or activities;	Section 3
k	Any mitigation measures for inclusion in the EMPr;	Section 2 and 3
l	Any conditions for inclusion in the environmental authorisation;	Section 2 and 3
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 2 and 3
n	A reasoned opinion—	Section 3



	i. [as to] whether the proposed activity, activities or portions thereof should be authorised; <u>(iA) regarding the acceptability of the proposed activity or activities; and</u> ii. if the opinion is that the proposed activity, <u>activities</u> or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMP, and where applicable, the closure plan;	
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p	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q	Any other information requested by the competent authority.	None



Document and Quality Control:

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Final Report	Antoinette Bootsma		



EXECUTIVE SUMMARY

Limosella Consulting was appointed by EcoSolve to undertake an update of the wetland assessment conducted by Limosella Consulting in 2012 to inform the current Environmental Authorization process. The project entails the new Ferrum-Hotazel-Mookodi and Mookodi-Epsilon via Hermes overhead 400kV transmission powerlines and substations upgrade. The scope addressed in the current study included a corridor of 460km long and 4km wide. This corridor was broken into two sections as follows:

1. **Ferrum - Hotazel - Mookodi 400kV Transmission Powerline and Substations Upgrade,**
Construction of a 400kV transmission powerline of approximately 200km from Umntu Transmission Substation to Mookodi Substation plus associated work at Mookodi Substation;
2. **Mookodi-Epsilon via Hermes** Construction of approximately 200km Mookodi-Epsilon 400kV, via Hermes Substation plus associated work at the substations.
3. Construction of a 400kV transmission powerline of approximately 60km from Ferrum Substation to Umntu Transmission Substation plus associated work at the Ferrum Substation.

The report is based on fieldwork conducted in March 2012 and again in November 2020.

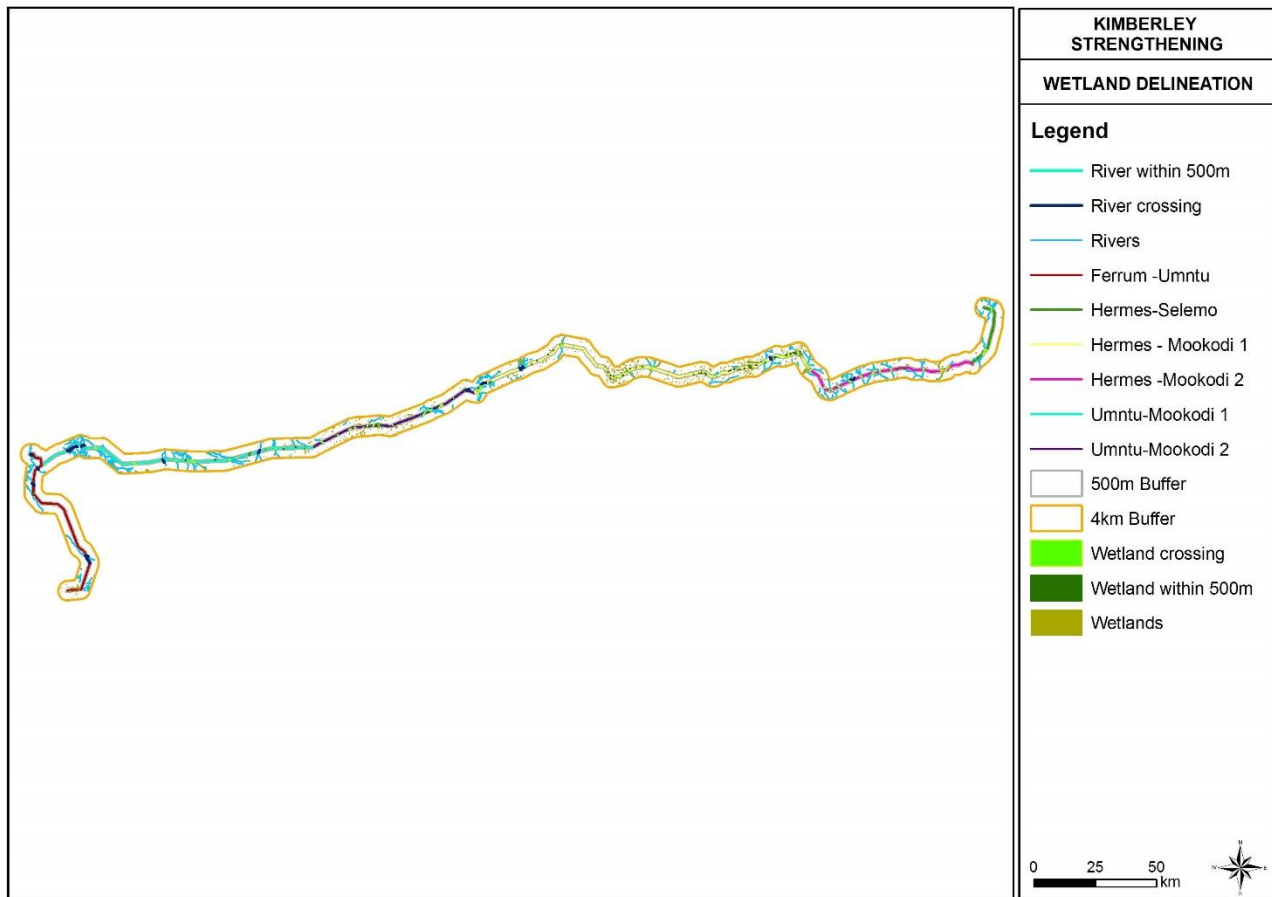
The terms of reference for the current study were as follows:

- Review and verification of the 2012 wetland assessments conducted for the alignment between Ferrum and Epsilon, via Hotazel, Mookodi and Hermes.
- 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,
- Undertake a risk assessment as specified in General Notice 509 in published in the Government Gazette 40713 of 24 March 2017,
- 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 majority of the watercourses in the study area are likely to have been impacted by agriculture and cattle farming to varying degrees, as well as mining in some areas. However, the majority of the proposed line is located on parts of the country that is very sparsely inhabited. Consequently, impacts to watercourses are relatively less significant compared to denser populated areas. The proposed powerline further runs through two provinces that have a very low annual rainfall and often have droughts for extended periods of time. Although these systems respond quickly to rainfall events the lack of robust vegetation growth in areas makes them prone to sedimentation and erosion. Numerous depressional pans occur within the 4 km corridor discussed in this report.



The watercourses were divided into those directly crossed by the proposed powerline and those within the 4 km corridor but not crossed. The watercourses (including the buffer zones) directly crossed by the proposed development are the ones likely to be potentially impacted and form the main focus of this report. A total of 85 watercourse are crossed directly by the proposed line as shown in the image below.



The table below provides a summary of the results recorded watercourses on the proposed section of the powerline alignment.

NEMA 2014 Impact Assessment	The impact scores for the following aspects are relevant:		Without Mitigation	With Mitigation
	Sedimentation	Construction Phase	L	L
		Operation Phase	L	L
	Changes to flow dynamics	Construction Phase	M	L
		Operation Phase	M	L
	Establishment of alien plants	Construction Phase	M	L
		Operation Phase	M	L
	Pollution of watercourses	Construction Phase	M	L
		Operation Phase	L	L
DWS (2016) Risk Assessment	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, minor maintenance on roads, river crossings, towers and substations, where the footprint remains the same, are exempt from a WUL.			
Does the specialist support the development?	Yes, the impacts are expected to be minimal and easily mitigated.			



Table of Contents

1	INTRODUCTION	14
1.1	Terms of Reference	14
1.2	Assumptions and Limitations	14
1.3	Definitions and Legal Framework	15
1.4	Locality of the study site	17
1.4.1	Hermes-Selemo	17
1.4.2	Hermes-Mookodi Section 2	17
1.4.3	Hermes-Mookodi Section 1	17
1.4.4	Umntu-Mookodi Section 2	17
1.4.5	Umntu-Mookodi Section 1	17
1.4.6	Ferrum-Umntu	17
1.5	Description of the Receiving Environment	19
2	METHODOLOGY	30
2.1	Buffer Zones	30
3	RESULTS	31
3.1	Land Use, Cover and Ecological State and Wetlands	31
3.1.1	Watercourse Characteristics	31
3.2	Wetland Functional Assessment	34
3.2.1	Hermes-Selemo	34
3.2.2	Hermes-Mookodi Section 2	36
3.2.3	Hermes-Mookodi Section 1	39
3.2.4	Umntu-Mookodi Section 2	44
3.2.5	Umntu-Mookodi Section 1	47
3.2.6	Ferrum-Umntu	50
3.3	Impacts and Mitigation	52
3.3.1	NEMA (2014) Impact Assessment	53



3.3.2	DWS (2016) Risk Assessment	57
3.4	CONCLUSION	59
	REFERENCES	60
	APPENDIX A: Detailed methodology	62
	Wetland and Riparian Delineation.....	62
3.5	Wetland Classification and Delineation	69
3.6	Wetland Functionality, Status and Sensitivity	72
3.6.1	Present Ecological Status (PES) – WET-Health	72
3.6.2	Ecological Importance and Sensitivity (EIS)	74
3.6.3	Present Ecological Category (EC): Riparian	76
3.6.4	Quick Habitat Integrity Model	77
3.6.5	Recommended Ecological Category (REC)	77
3.6.6	WetEcoServices	78
3.7	Impact Assessments.....	78
3.7.1	NEMA (2014) Impact Ratings	78
3.7.2	DWS (2016) Impact Ratings.....	82
	APPENDIX B: Abbreviated CVs of participating specialists	84
	APPENDIX C: GLOSSARY OF TERMS	90

Figures

Figure 1: Locality Map	18
Figure 2: Catchment area associated with each section of the proposed powerline.	23
Figure 3: Hydrology of the study site and surrounds as per existing spatial layers.....	24
Figure 4: Vegetation type of the proposed line.	25
Figure 5: Wetland Vegetation type of the proposed line.	26
Figure 6: Geology of the proposed powerline.	27
Figure 7: Soil of the proposed powerline upgrade.	28
Figure 8: The Conservation Plan for the proposed powerline upgrade.....	29
Figure 9: Buffer setback of the watercourses of the amendment area.....	31
Figure 10: A model of pan development (Goudie & Thomas, 1995).	32
Figure 11: The location and extent of wetland areas in relation to the proposed powerline upgrade amendment area and the 500 m DHWS regulated area as well as a 4 km corridor.....	33



Figure 12: Section Hermes-Selemo of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	35
Figure 13: Section Hermes-Mookodi 2 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	38
Figure 14: Flamingos recording in the depressional pans proposed to be crossed by the Hermes-Mookodi Section 1 of the powerline.....	42
Figure 15: Section Hermes-Mookodi 1 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	43
Figure 16: Dry ephemeral pan with grazing livestock visible. Characteristic of the pans associated with this section of the powerline route.	45
Figure 17: Section Umntu-Mookodi Section 2 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	46
Figure 18: Section Umntu-Mookodi Section 1 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	49
Figure 19: Section Ferrum-Umntu Section of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.....	51
Figure 20: Images representing the major impacts recorded on the line including dams, erosion, exotic species and farming activities within wetlands.	52
Figure 21: Typical cross section of a wetland (Ollis, 2013)	63
Figure 22: Terrain units (DWAf, 2005).....	64
Figure 23: Wetland Units based on hydrogeomorphic types (Ollis <i>et al.</i> 2013).....	64
Figure 24: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans <i>et al.</i> , 2007).....	65
Figure 25: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans <i>et al.</i> , 2007).....	66
Figure 26: A schematic representation of the processes characteristic of a river area (Ollis <i>et al.</i> , 2013).	68
Figure 27: The four categories associated with rivers and the hydrological continuum. Dashed lines indicate that boundaries are not fixed (Seaman <i>et al.</i> , 2010).	69

Tables

Table 1: Conservation status of the Vegetation Types (Mucina & Rutherford, 2006)	20
Table 2: Soil types associated with the proposed study site and surroundings.	21
Table 3: Summary of the integrity of the watercourses recorded on the proposed powerline crossing for the Hermes-Selemo Section.....	34
Table 4: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Hermes-Mookodi Section 2.	36
Table 5: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Hermes-Mookodi Section 1.	39
Table 6: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Umntu-Mookodi Section 2.....	44
Table 7: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Umntu-Mookodi Section 1.....	47



Table 8: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Ferrum-Umntu Section.	50
Table 9: Changes in sediment entering and exiting the system impact ratings	53
Table 10: Changes in water flow ratings	54
Table 11: Introduction and spread of alien vegetation impact ratings.	55
Table 12: Changes in water quality due to foreign materials and increased nutrients impact ratings.....	56
Table 13: The severity score derived from the DWS (2016) risk assessment matrix for the proposed overhead powerline.	58
Table 14: Description of riparian vegetation zones (Kleynhans et al, 2007).	66
Table 15: Wetland Types and descriptions	70
Table 16: Indirect Benefits provided by wetland habitats (Macfarlane et al, 2007).	73
Table 17: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane et al, 2007)	73
Table 18: Trajectory class, change scores and symbols used to evaluate Trajectory of Change to wetland health (Macfarlane et al, 2007).....	74
Table 19: Direct human benefits associated with wetland habitats (Macfarlane et al, 2007).	75
Table 20: Environmental Importance and Sensitivity rating scale used for the estimation of EIS scores (DWAf, 1999)	75
Table 21: Generic ecological categories for EcoStatus components (modified from Kleynhans, 1996 & Kleynhans, 1999).....	77
Table 22: Criteria for Assessment of Impacts	78
Table 23: Assessment Criteria: Ranking Scales	80
Table 24: Significance Rating Scales without mitigation.....	81
Table 25: Significance Rating Scales with mitigation	81
Table 26: An extract from DWS (2016) indicating the risk scores and classes as well as the implication for the appropriate authorization process	83



1 INTRODUCTION

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- 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

- 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 DHWS Water Use Licence application regulations. In order 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 hydropedological 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 the course of 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 take into account climate change or future changes to watercourses resulting from increasing catchment transformation.
- Various sections of the proposed powerline were not accessible during the multiple site visits due to closed gates, flooded areas and areas without access roads and unsafe or un-driveable roads.

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 Human Settlements, Water and Sanitation (DHWS). The NWA sets out a range of water use related principles that are to be applied by DHWS 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 times 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 (DWAF, 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 DHWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) is applicable 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 are excluded from a GA under either of these regulations, unless the impacts score as low in the requires 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)



1.4 Locality of the study site

The proposed powerline starts north of the town of Klerksdorp and continues towards Hotazel and Kathu. The majority of the proposed powerline occurs in the North-West Province while the final section is located in the Northern Cape. For ease of reading the proposed powerline is divided into 6 sections as follows (Figure 1):

1.4.1 Hermes-Selemo

The route starts at the coordinates 26°41'29.07"S and 26°49'51.35"E north of the town of Stilfontein and ends south of Stilfontein at the Hermes substation at the coordinates 26°53'42.81"S and 26°47'5.62"E. This section is located in the North-West Province.

1.4.2 Hermes-Mookodi Section 2

The route starts at the Hermes substation at the coordinates 26°53'42.81"S and 26°47'5.62"E and continues in a western direction and ends where Hermes-Mookodi Section 2 starts near Witfontein at the coordinates 26°55'17.93"S and 26° 6'52.15"E. This section is located in the North-West Province.

1.4.3 Hermes-Mookodi Section 1

The route starts near Witfontein at the coordinates 26°55'17.93"S and 26° 6'52.15"E and continues in a western direction towards the Mookodi Substation south of Vryburg at the coordinates 27° 0'37.43"S and 24°44'37.75"E. This section is located in the North-West Province.

1.4.4 Umntu-Mookodi Section 2

The route starts at towards the Mookodi Substation south of Vryburg at the coordinates 27° 0'37.43"S and 24°44'37.75"E and continues in a western direction towards a section directly north of the N14 where it meets up with section 2 at the coordinates 27°12'49.74"S and 24° 4'41.85"E. This section is located in the North-West Province.

1.4.5 Umntu-Mookodi Section 1

The route starts at the coordinates 27°12'49.74"S and 24° 4'41.85"E and continues in a western direction towards the Umntu Substation near the town of Hotazel at the coordinates 27°13'42.32"S and 22°54'17.13"E. Only a small section of this route is located in the North-West Province with the remainder located in the Northern Cape Province.

1.4.6 Ferrum-Umntu

The final section starts at the Umntu Substation near the town of Hotazel at the coordinates 27°13'42.32"S and 22°54'17.13"E and continues in a southern direction towards the Ferrum substation just south of the town of Kathu. This section is located in the Northern Cape Province.



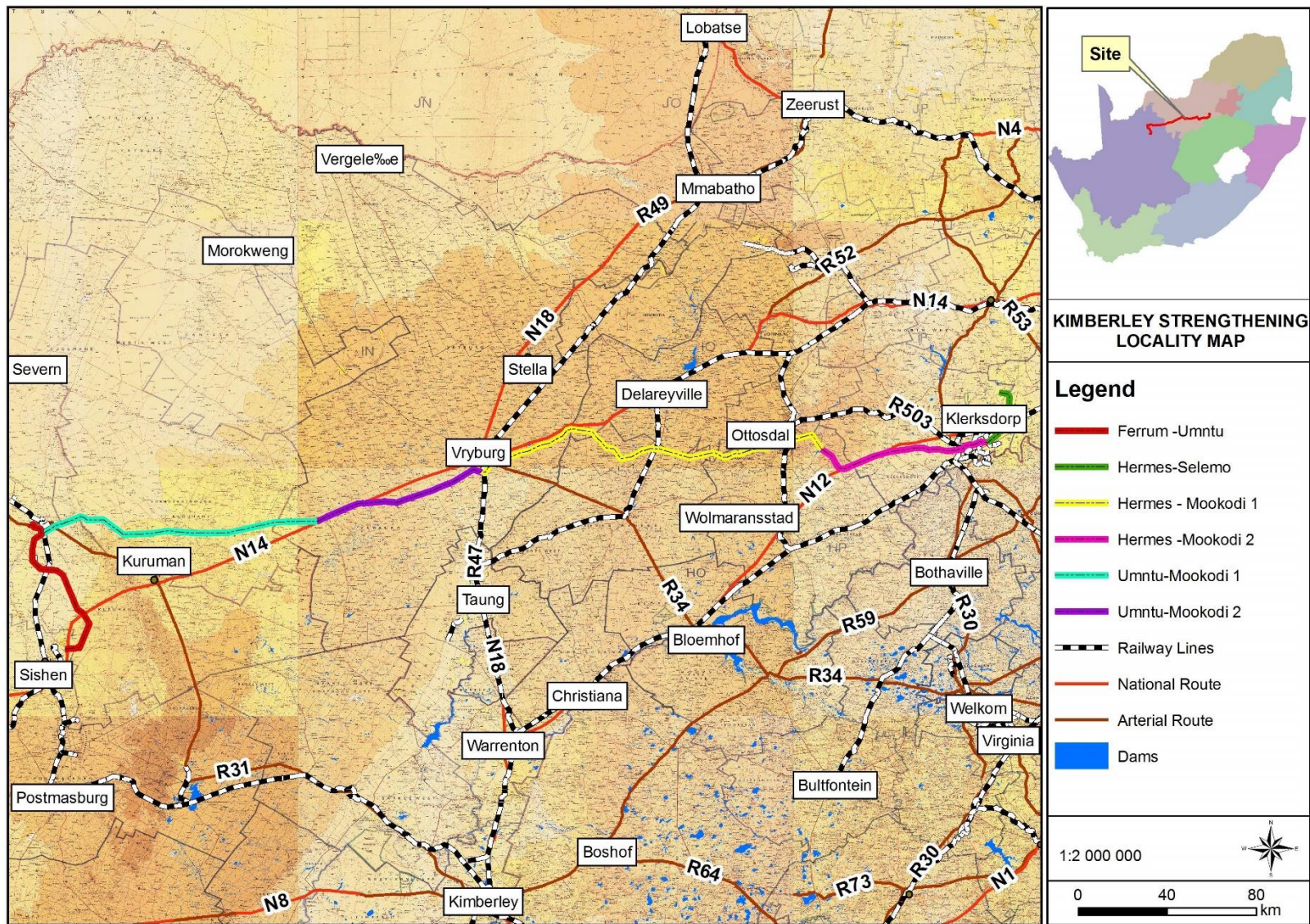


Figure 1: Locality Map



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 to the ecology of the study site in its current state.

Quaternary Catchments and Water Management Area (WMA):

All of the catchments associated with the proposed powerline namely C24A (Hermes-Selemo), C24A, C24B, C24H, C24J, C25A, C25D (Hermes-Mookodi 2), C25D, C25E, C31E, C23C, C23A, C32B (Hermes-Mookodi 1), C32B, C32D (Umntu-Mookodi 2), D41G, D41L, D41K (Umntu-Mookodi 1) and D41K, D41J (ferrum-Umntu) (Figure 2) are located in the fifth water management area (WMA), the Vaal Major (Government Gazette, 16 September 2016). In this WMA the large rivers include the Wilge-, Liebenbergsvlei-, Mooi-, Renoster-, Vals-, Sand-, Vet-, Harts-, Molopo and Vaal Rivers (Figure 2).

Hydrology:

Surface water spatial layers such as the National Freshwater Ecosystems Priority Areas (NFEPA) Wetland Types for South Africa (SANBI, 2010) were consulted for the presence of wetlands, perennial and non-perennial rivers that crosses the proposed line as well as for a 4 km corridor. Based on these spatial layers the proposed line crosses numerous watercourses and especially a large number of depressional pan wetlands (Figure 3).

The main rivers associated with each section include:

- Hermes-Selemo: Kromdraainspruit and Koekemoerspruit.
- Hermes-Mookodi 2: Skoonspruit, Jagspruit, Yesterspruit, Matjiesspruit and Klipspruit.
- Hermes-Mookodi 1: Bamboespruit, Biesieslaagte, Harts, Rietspruit and Droe Harts River.
- Umntu-Mookodi 2: Korobela and Droe Harts.
- Umntu-Mookodi 1: Moshaweng, Mathwaring, Manyeding and Kuruman Rivers.
- Ferrum-Umntu: Witleegte, Ga-Mogara and Vlermuisleegte Rivers.

Regional Vegetation:

According to the Vegetation Map of South Africa, Lesotho and Swaziland Mucina & Rutherford (2006), the powerline crosses 15 vegetation units (Figure 4 & Table 1). The wetlands vegetation groups crossed by the proposed powerline include (Figure 5):

- Dry Highveld Grassland Group 5;
- Dry Highveld Grassland Group 3;
- Eastern Kalahari Bushveld Group 1;
- Eastern Kalahari Bushveld Group 5;



- Eastern Kalahari Bushveld Group 2;
- Eastern Kalahari Bushveld Group 3; and
- Eastern Kalahari Bushveld Group 4.

Table 1: Conservation status of the Vegetation Types (Mucina & Rutherford, 2006)

Vegetation Unit	Conservation Status	Proposed powerline
1. Kathu Bushveld	Least Threatened	•Ferrum-Umntu
2. Gordonia Duneveld	Least Threatened	
3. Kuruman Mountain Bushveld	Least Threatened	•Umntu-Mookodi 1
4. Kuruman Thornveld	Least Threatened	
5. Kuruman Vaalbosveld	Least Threatened	
6. Ghaap Plateau Vaalbosveld	Least Threatened	•Umntu-Mookodi 2
7. Mafikeng Bushveld	Vulnerable	
8. Schweizer-Reneke Bushveld	Endangered	•Hermes-Mookodi 1
9. Western Highveld Sandy Grassland	Endangered	
10. Highveld Alluvial Vegetation	Least Threatened	
11. Klerksdorp Thornveld	Vulnerable	
12. Vaal-Vet Sandy Grassland	Endangered	•Hermes-Mookodi 2
13. Rand Highveld Grassland	Endangered	
14. Carletonville Dolomite Grassland	Vulnerable	
15. Vaal Reefs Dolomite Sinkhole Grassland	Vulnerable	•Hermes-Selemo

Geology and soils:

The study sites are located on a variety geological areas including Andestine, Arenite, Chert, Conglomerate, Dolomite, Granite, Iron Formations, Migmatite, Mudstone, Quarts Porphyry, Sand, Sedimentary, Shale, Tillite and Turf (Figure 6). The soil type found throughout the study site are summarised in Table 2 and Figure 7.



Table 2: Soil types associated with the proposed study site and surroundings.

Soil Type (ARC, 2013)	Description
S2	Freely drained, structureless soils, May have restricted soil depth, excessive drainage, high erodibility, low natural fertility
S3	Red or yellow structureless soils with a plinthic horizon Favourable water-holding properties Imperfect drainage unfavourable in high rainfall areas
S13	Lithosols (shallow soils on hard or weathering rock) May receive water runoff from associated rock Restricted soil depth; associated with rockiness
S17	Association of Classes 1 to 4: Undifferentiated structureless soils Favourable physical properties One or more of: low base status, restricted soil depth, excessive or imperfect drainage, high erodibility
S18	Association of Classes 5, 6, 10, 11, 12: Undifferentiated clays High natural fertility One or more of: high swell-shrink potential, plastic and sticky, restricted
S21	Undifferentiated shallow soils and land classes Soil may receive water runoff from associated rock; water-intake areas Restricted land use options

Critical Biodiversity areas and Biodiversity Sector Plan

Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making. CBA's are therefore areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (Desmet et al, 2009).

In addition, the assessment also made provision for Ecological Support Areas (ESA's), which are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas (Desmet *et al*, 2009).

The biodiversity map indicates where Critical Biodiversity Areas (CBA's) occur. CBA's are Terrestrial (T) and Aquatic (A) features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The CBA's are ranked as follows:

- CBA 1 (including PA's, T1 and A1) which are natural landscapes with no disturbances and which is irreplaceable in terms of reaching conservation targets within the district
- CBA2 (including T2 and A2) which are near natural landscapes with limited disturbances which has intermediate irreplaceability with regards to reaching conservation targets



- In addition, Ecological Support Areas (ESA's) that support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors) in the landscape are also mapped. ESA's are functional landscapes that are moderately disturbed but maintain basic functionality and connect CBA's.

The spatial priorities are accompanied by a set of land-use guidelines with the purpose promoting the effective management of biodiversity as required in Section 41(a) of the Biodiversity Act (Act 10 of 2004, as amended) and in terms of the National Environmental Management Act (Act 107 of 1998, as amended). The guidelines provide advice on which land-uses and activities are most compatible with maintaining the ecological integrity of CBAs and ESAs, and other parts of the landscape, based on the desired management objectives for the land and the anticipated impact of each land-use activity on biodiversity patterns and ecological processes (MPSP, 2015).

Based on the described methods the proposed powerlines is located on all the section described previously (Figure 8). The largest section dominated by CBA 1 is the Hermes-Mookodi 1 section.



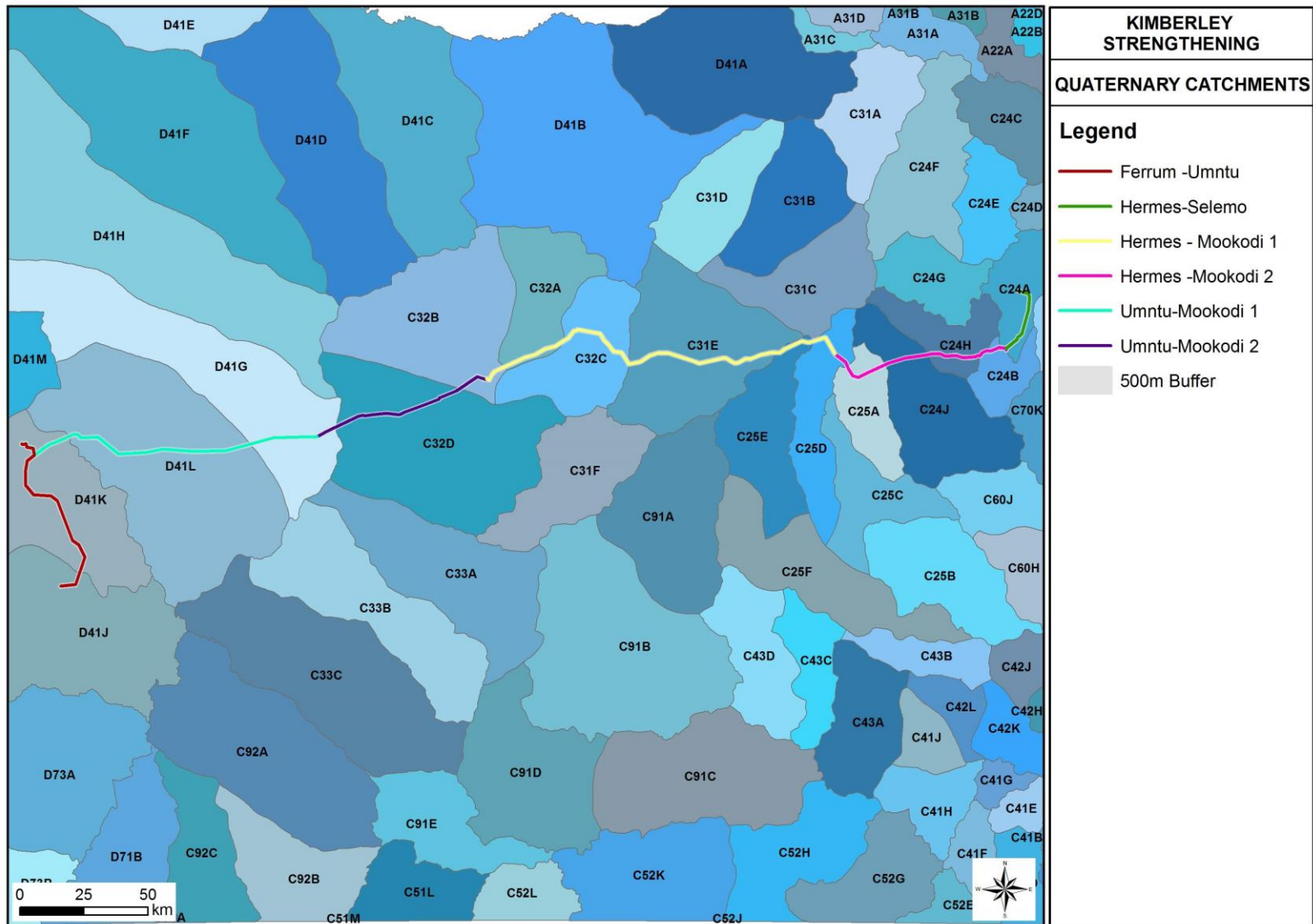


Figure 2: Catchment area associated with each section of the proposed powerline.



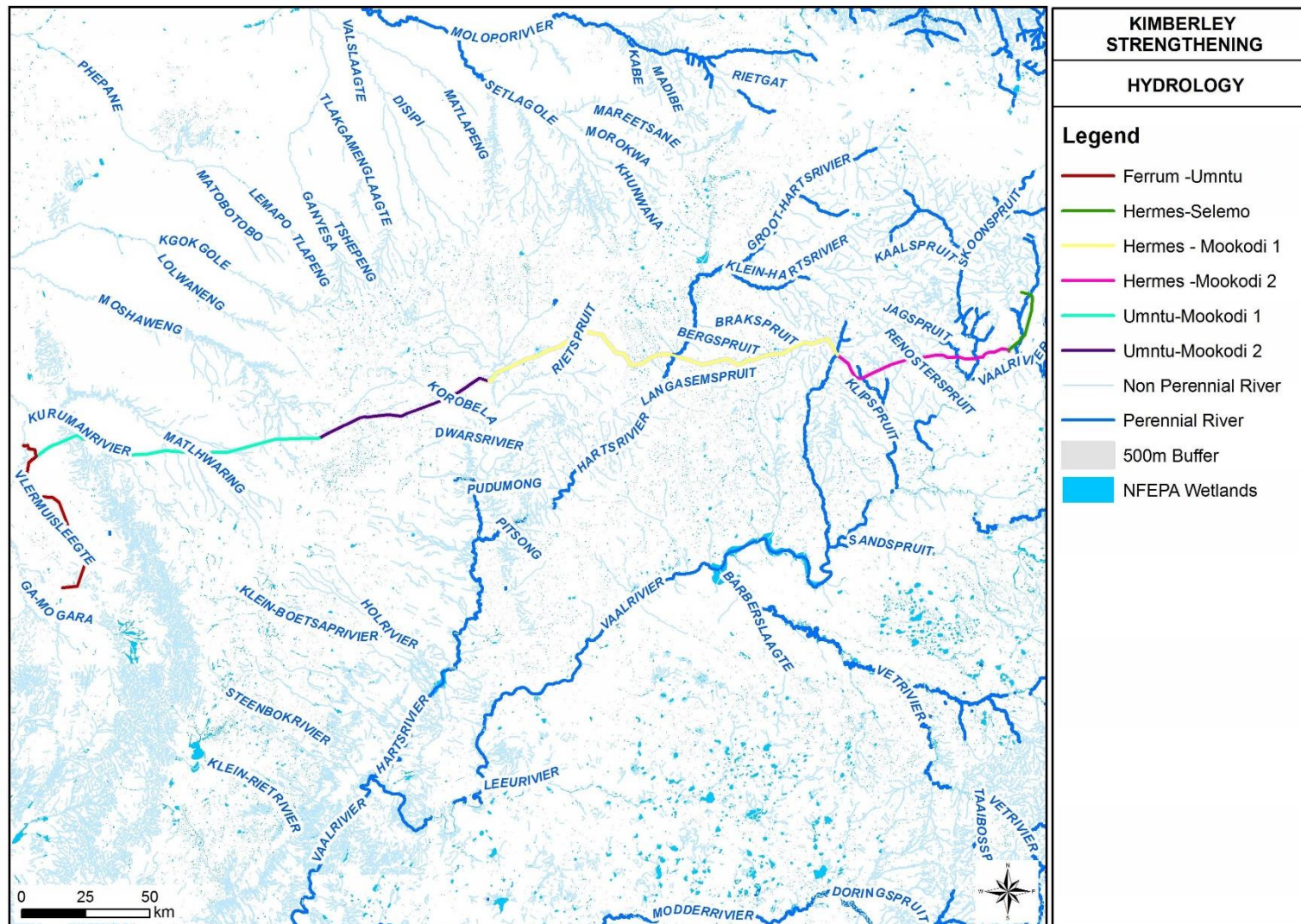


Figure 3: Hydrology of the study site and surrounds as per existing spatial layers.



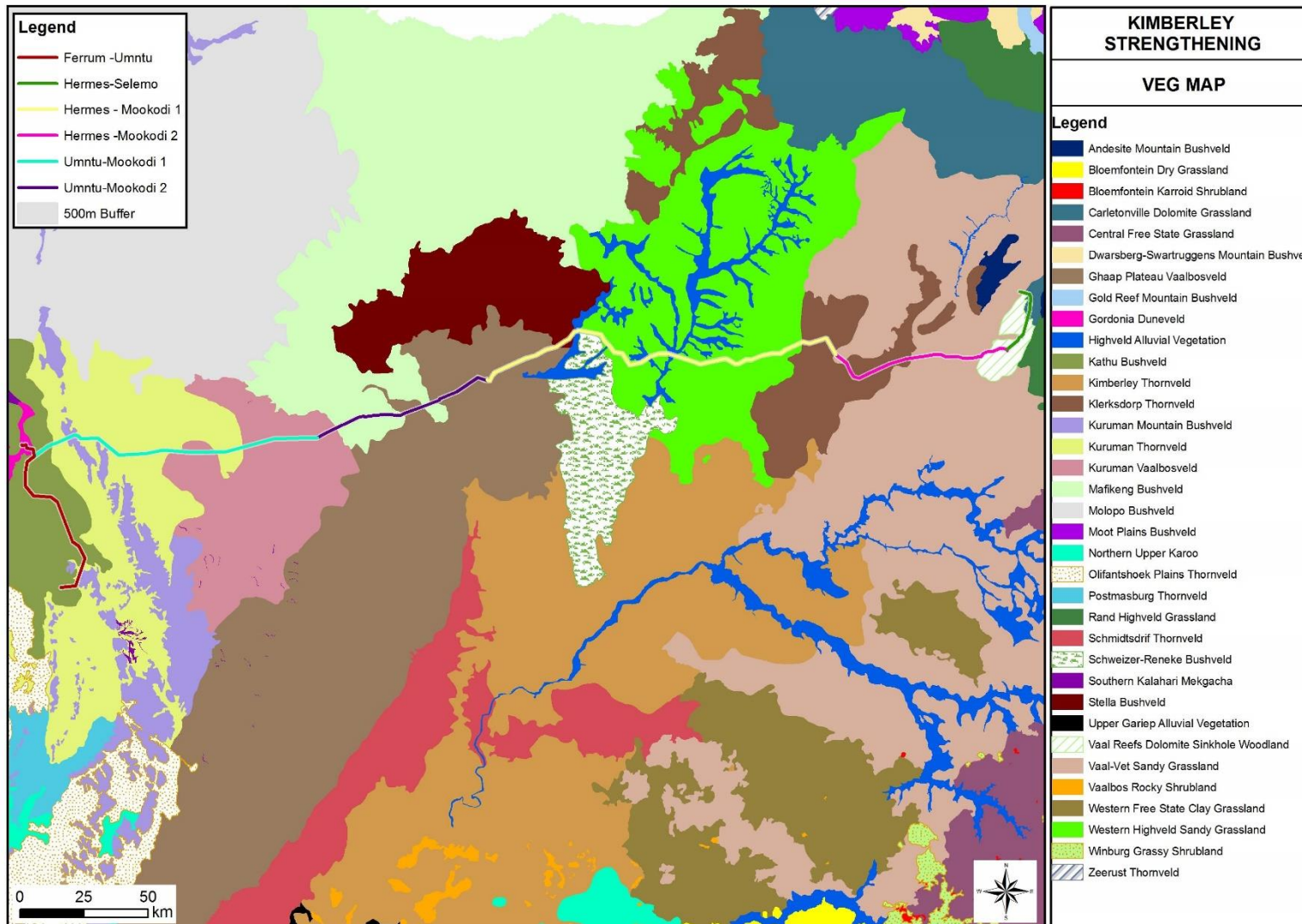


Figure 4: Vegetation type of the proposed line.



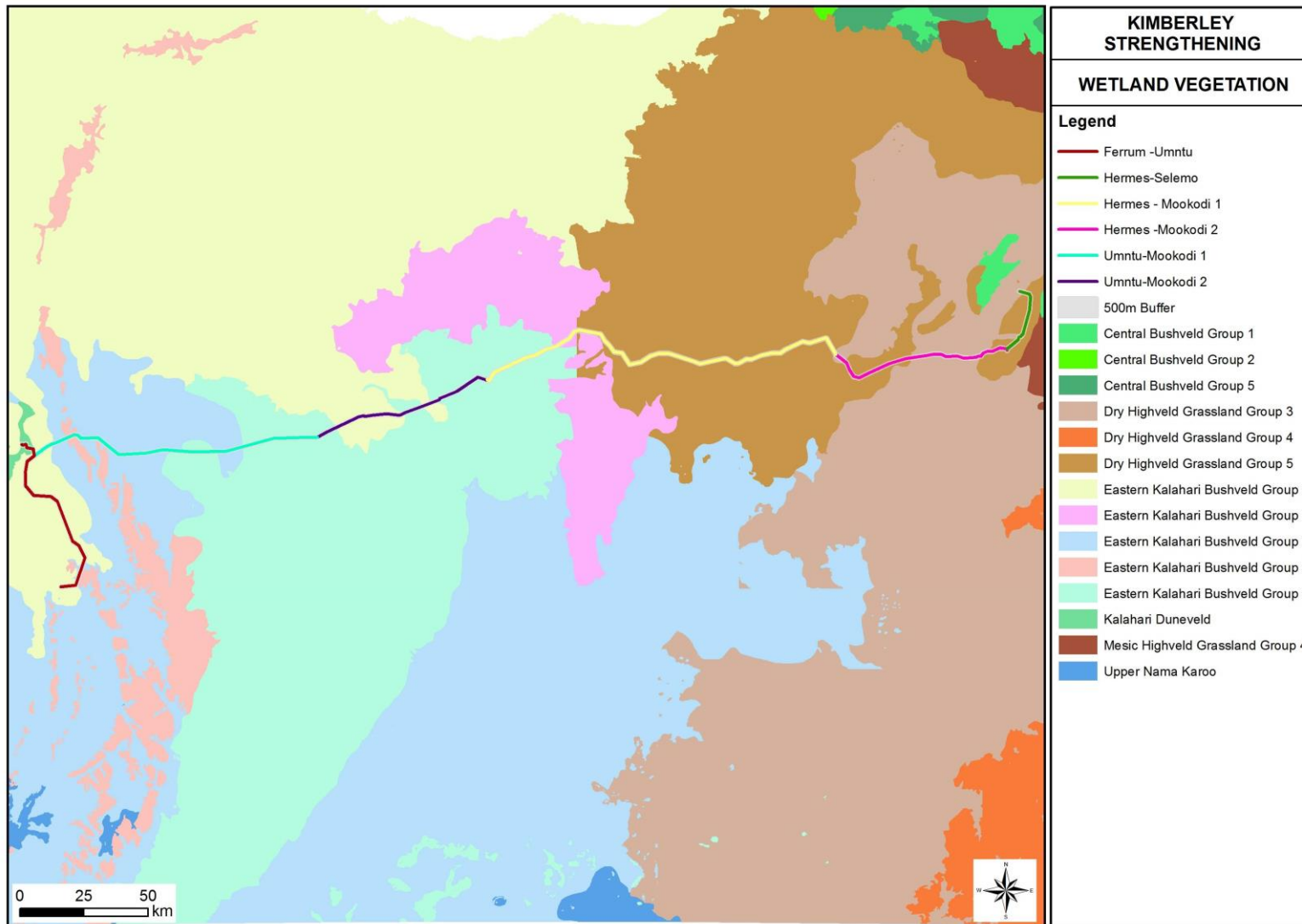


Figure 5: Wetland Vegetation type of the proposed line.



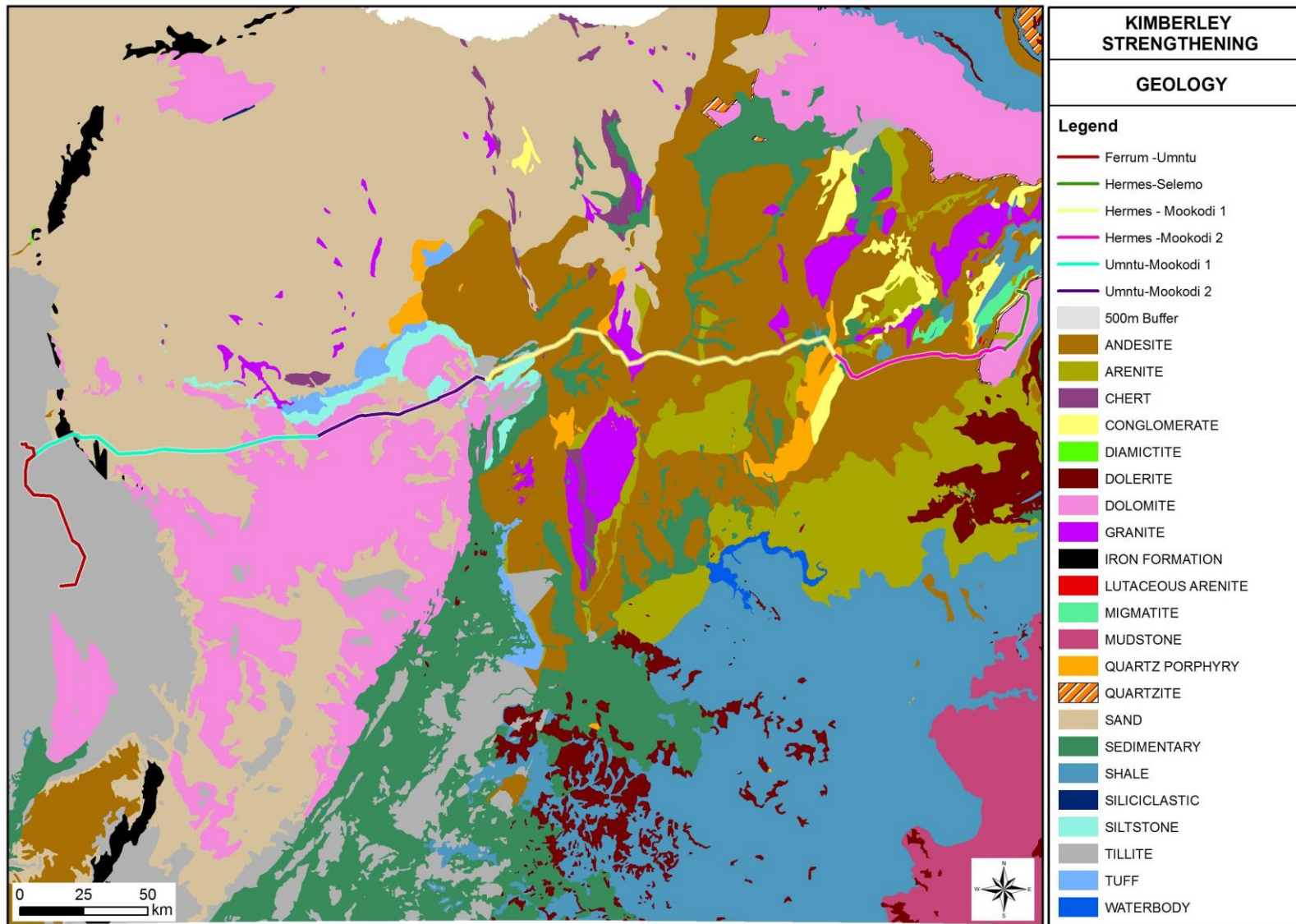


Figure 6: Geology of the proposed powerline.



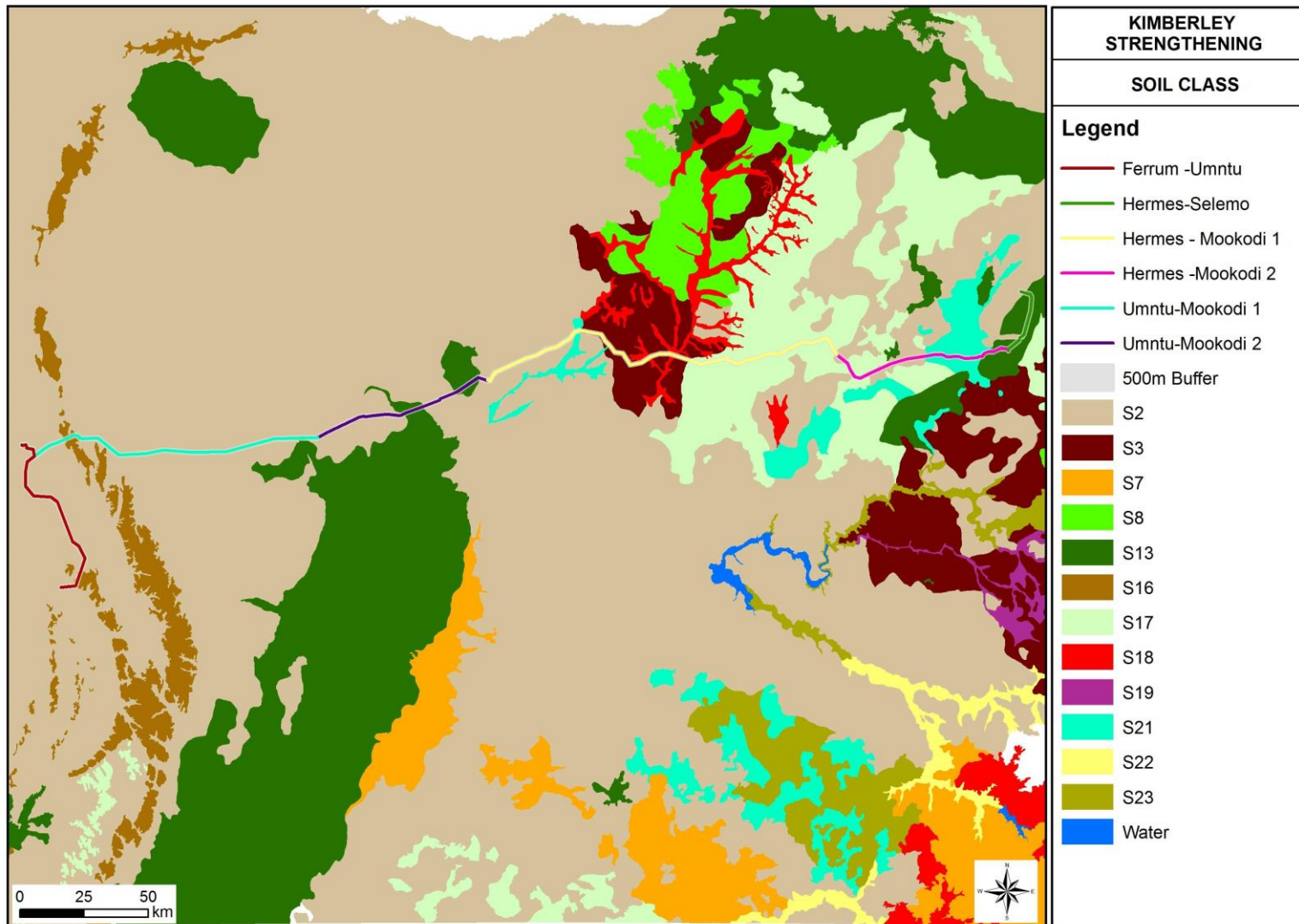


Figure 7: Soil of the proposed powerline upgrade.



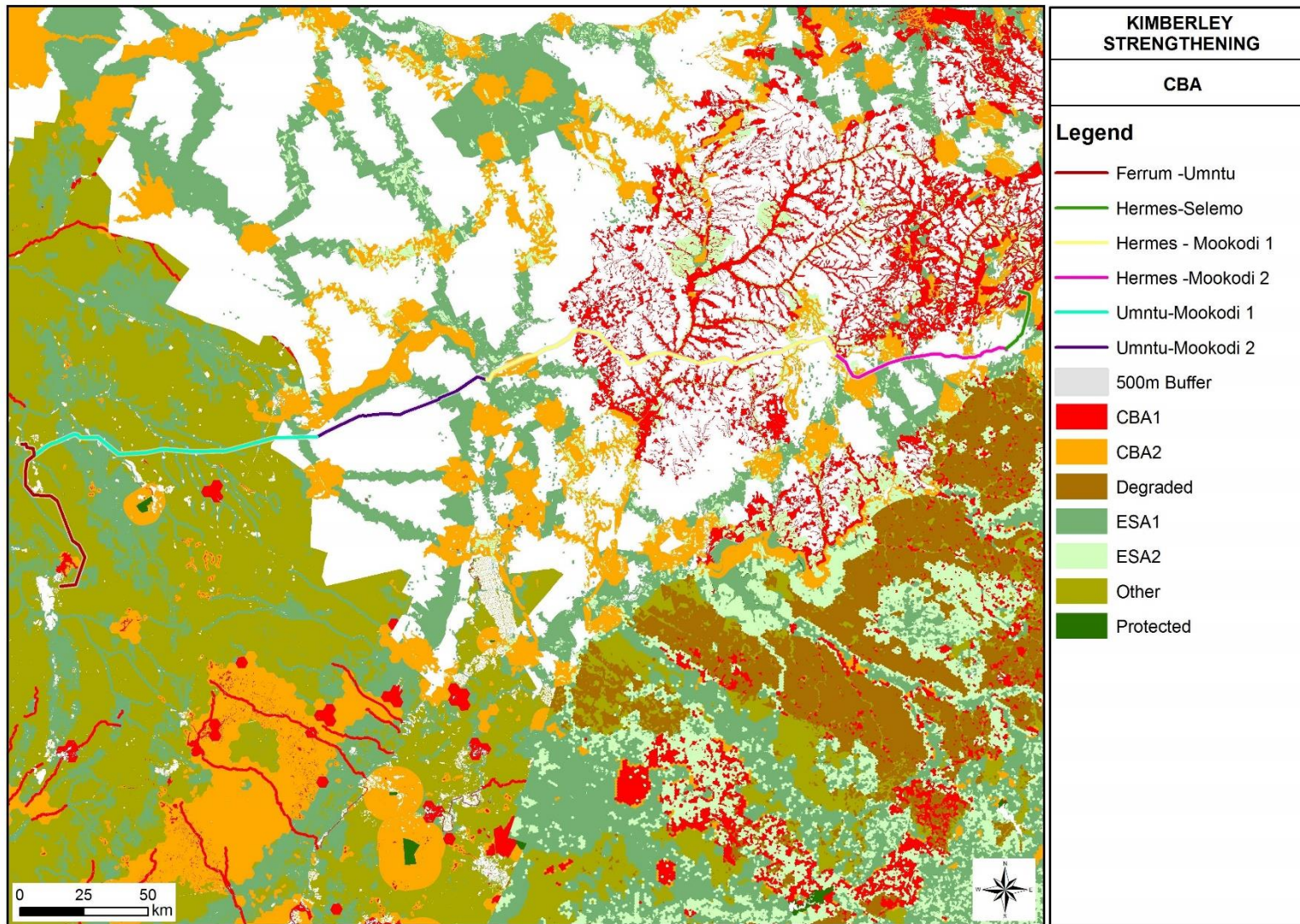


Figure 8: The Conservation Plan for the proposed powerline upgrade.



2 METHODOLOGY

The delineation method documented by the DHWS in their document “Updated manual for identification and delineation of wetlands and riparian areas” (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2014) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*, 2013) was followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

A hand held Garmin Montana 650 and/or a Samsung S10 smartphone was used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey. Applications used on the smartphone includes GPX Viewer Pro and Google Earth.

Following a desktop assessment highlighting wetland areas to be groundtruthed in the field, soil and vegetation sampling on site informed a fine scale delineation. Functional and integrity assessments were conducted to indicate the baseline status of the wetlands identified. In the current study the wetland area was assessed using, WET-Health (Macfarlane *et al*, 2007), EIS (DWAF, 1999) and WetEcoServices, (Kotze *et al*, 2006). The assessment of potential impacts follows the 2014 NEMA regulations (as amended).

In order to ease the legibility of the report, details regarding the methods used in each phase of the watercourse assessment are presented in Appendix A.

2.1 Buffer Zones

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 on a wetland. 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 landuses; (iii) providing habitat for various aspects of biodiversity.

Despite limitations, buffer zones are well suited to perform functions such as sediment trapping, erosion control and nutrient retention which can significantly reduce the impact of activities taking place adjacent to water resources. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. These must however be considered in conjunction with other mitigation measures.

Tools for calculating buffer zones have been developed and been published as “Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries. Consolidated Report” by the WRC (Macfarlane *et al* 2015). This tool aims to calculate the best suited buffer for each wetland or section of a



wetland based on numerous on-site observations. The resulting buffer area 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 a residential development with a lower risk factor.

The calculated buffer for the powerline was based on the category 'Above-ground communication/power (electricity) infrastructure' which is generally a low risk activity. Based on these calculations the buffer zone for the amended area is 50 m for wetlands and 100 m for riparian areas.

Figure 9 images represent the buffer zone setback for the wetlands discussed in this report.

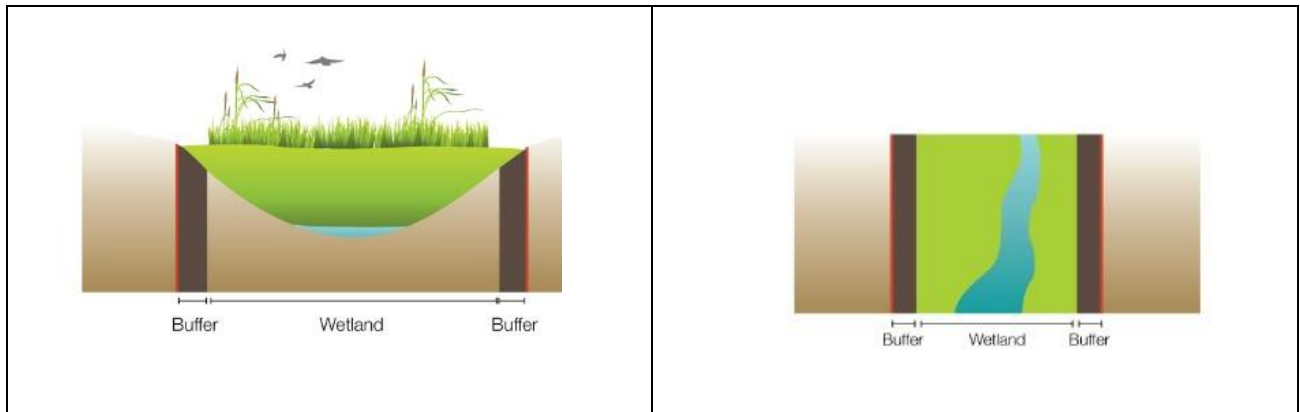


Figure 9: Buffer setback of the watercourses of the amendment area.

3 RESULTS

3.1 Land Use, Cover and Ecological State and Wetlands

The majority of the proposed powerline line is located on agricultural and farming areas. Small sections of the line cross land used for mining, especially near the start of the proposed line near Klerksdorp and the end of the proposed line near Kuruman and Kathu of which Sishen Mine is well known. The proposed powerline does not cross any national parks although it crosses several private hunting and game lodges.

3.1.1 Watercourse Characteristics

A total of 85 watercourse are crossed directly by the proposed line. The majority of the watercourses were classified as rivers (perennial and non-perennial) and wetlands. The majority of the wetlands were classified as Depressional Pans with some Floodplain and Unchannelled valley bottom Wetlands.

Although no consensus has been reached regarding the mechanism of formation of pans (Marshall & Harmse, 1992), Goudie & Wells (1995) suggested that pans are generally formed by aeolian deflation on susceptible surfaces. However, five models have been proposed (Verhagen, 1991; De klerk *et al*, 2016; Goudie & Wells, 1995) and are depicted in Figure 10.

It is likely that pans are formed by a combination of these models as opposed to only one model. System such as pans are dynamic and ever-changing and in order to understand each pan independently these systems should be studied based on their substrate composition, hydrological function, water quality and quantity, and species composition (De Klerk *et al*, 2016). It is important to note that even dry pans potentially

have a large array of dependent species many of which occur underground and only hatch in the right conditions with the right amount of rainfall. It is therefore very important to protect all the pans but also all other watercourses that could potentially be impacted by the proposed powerlines, even if the majority are classified as mostly dry ephemeral and episodic systems.

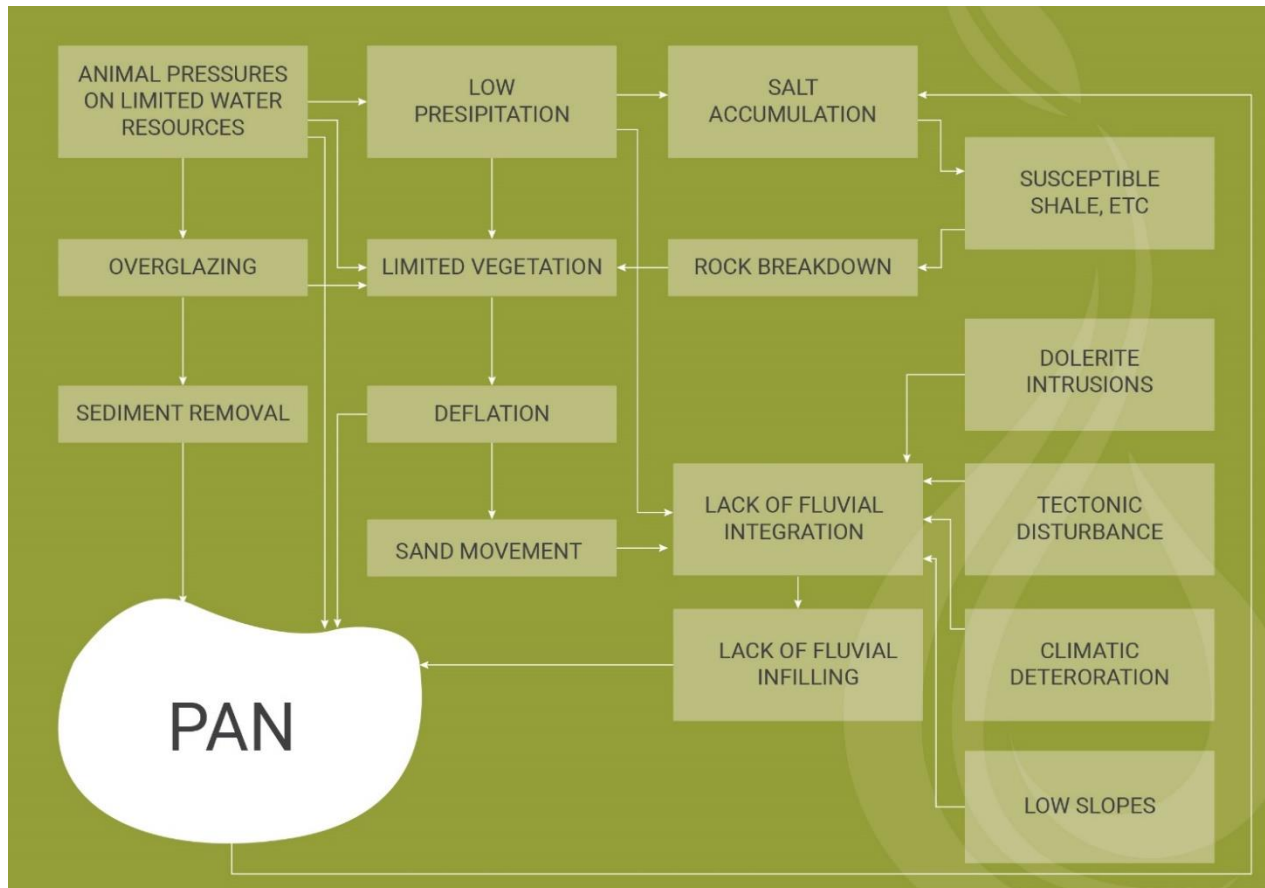


Figure 10: A model of pan development (Goudie & Thomas, 1995).

The watercourses discussed in this report were divided into those directly crossed by the proposed powerline and those within the 4 km corridor but not crossed. The watercourses (including the buffer zones) directly crossed by the proposed development are the ones likely to be potentially impacted and form the main focus of this report. Figure 11 displays all the watercourses recorded in the 4km powerline corridor. Sections 3.2 below provide more detailed information of the watercourses recorded along each section of the proposed powerline route with specific reference to their integrity and function.

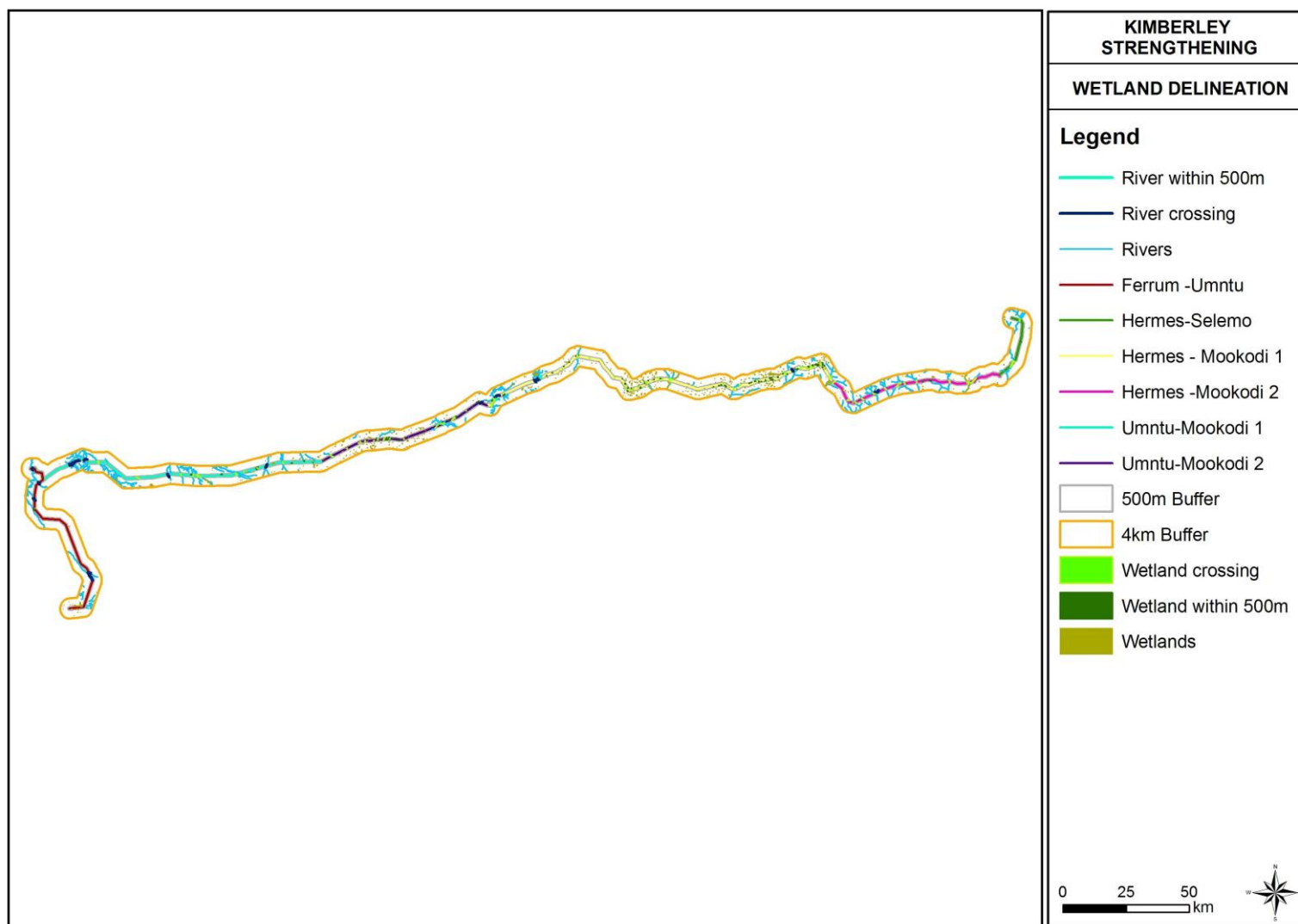


Figure 11: The location and extent of wetland areas in relation to the proposed powerline upgrade amendment area and the 500 m DHWS regulated area as well as a 4 km corridor.



3.2 Wetland Functional Assessment

3.2.1 Hermes-Selemo

This section of the proposed powerline crosses three wetland Hydrogeomorphic (HGM) units namely: a floodplain, riparian area and a seepage area (Table 3 & Figure 12). All three these HGM units form part of the same watercourse system called the Koekemoerspruit that flows into the Vaal River just south of the proposed powerline. The perennial riparian system originates north of the 4 km corridor and flows through mainly farming areas and forms a floodplain wetland towards the south near the town of Khuma from where the seepage wetland also originates.

Table 3: Summary of the integrity of the watercourses recorded on the proposed powerline crossing for the Hermes-Selemo Section.

Catchment	Watercourse and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
C24A	Perennial Riparian Area (Kromdraaispruit)	26°41'52.89"S and 26°51'42.03"E	C	High	C
	Floodplain (Koekemoerspruit)	26°51'5.48"S and 26°50'2.71"E	C	High	C
	Seepage Area	26°50'54.81"S and 26°50'24.94"E	E	Low	D



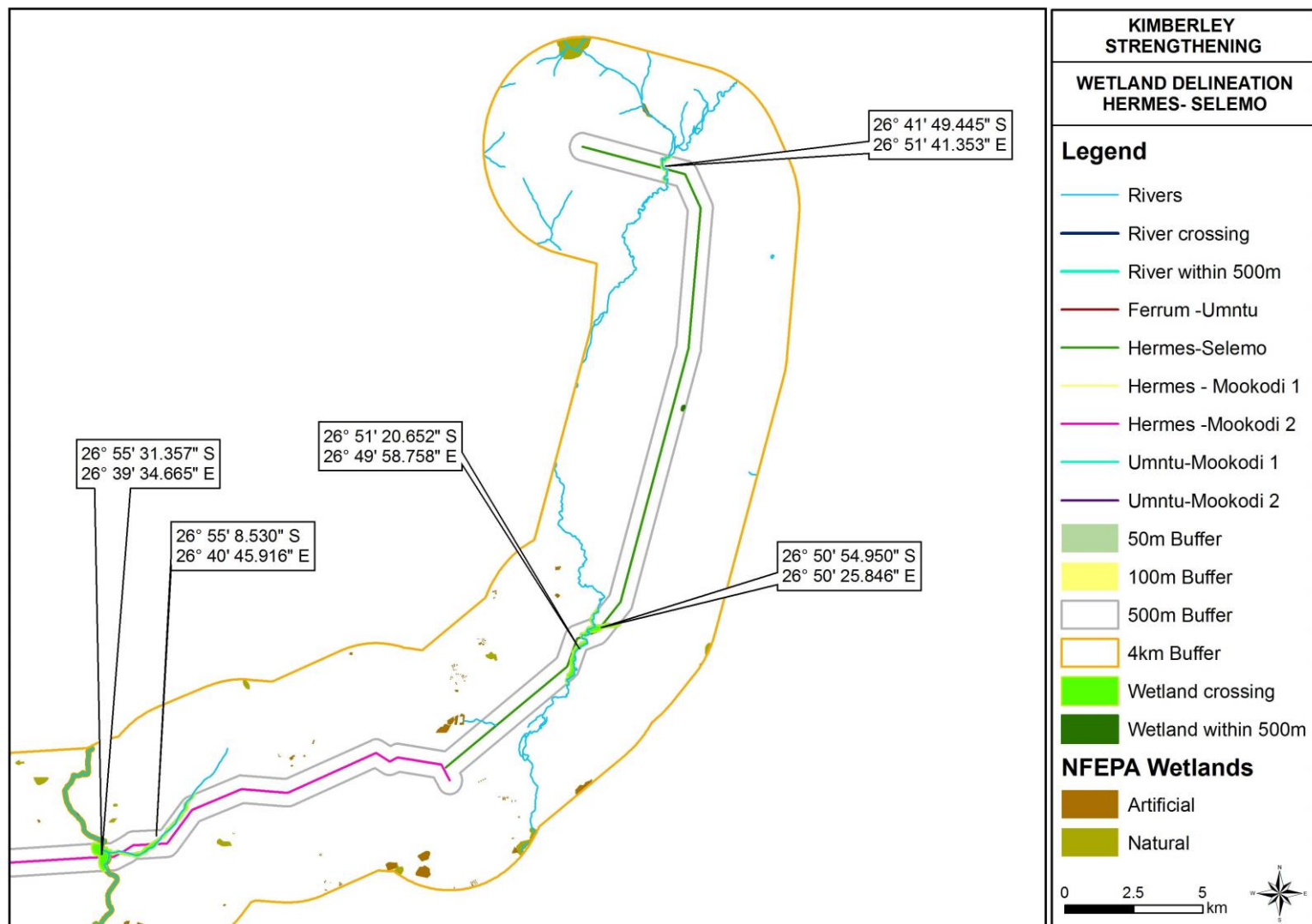


Figure 12: Section Hermes-Selemo of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.



3.2.2 Hermes-Mookodi Section 2

16 watercourses were recorded to cross this section of the proposed powerline that spans over 4 catchment areas. Several riparian river systems were recorded in this section of the proposed powerline. Of these, two, the Skoonspruit and the Jagspruit flow directly into the Vaal River just south of the 4 km corridor and are expected to be more sensitive to potential impacts given the importance of the Vaal River. The watercourses in the remaining section are mostly impacted by farming practices, such as impoundments and encroachment of infrastructure (Table 4). Approximately 14 km of this section is located adjacent the N12 and is therefore somewhat impacted by the N12 and less sensitive than more remote areas. Figure 13 shows the position and extent of watercourses in this section.

Table 4: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Hermes-Mookodi Section 2.

Catchment	Watercourse and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAf, 1999)/QHI (Seaman et al, 2010).	REC
C24H	Unchannelled Valley Bottom	26°55'17.61"S and 26°40'42.27"E	E	Moderate	D
	Perennial River (Skoonspruit)	26°55'33.64"S and 26°39'38.41"E	C	Moderate	C
	Perennial River (Jagspruit)	26°55'16.32"S and 26°35'9.20"E	D	Moderate	D
	Drainage Area	26°55'0.44"S and 26°30'33.73"E	C	Low	C
C24J	Channelled Valley Bottom	26°55'25.88"S and 26°27'14.88"E	D	Moderate	D
	Perennial River (Ysterspruit)	26°55'50.10"S and 26°24'24.21"E	C	Moderate	C
	Unchannelled Valley Bottom	26°56'9.54"S and 26°22'50.76"E	C	Low	C



Catchment	Watercourse and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAf, 1999)/QHI (Seaman et al, 2010).	REC
	Unchannelled Valley Bottom (Matjiespruit)	26°56'57.43"S and 26°19'53.45"E	D	Moderate	D
C25A	Drainage Area	26°57'44.24"S and 26°17'57.11"E	C	Low	C
	Drainage Area	26°58'0.85"S and 26°17'17.10"E	D	Low	D
	Perennial River (Klipspruit)	26°58'5.88"S and 26°17'3.53"E	D	Moderate	D
	Non-Perennial River	26°59'14.27"S and 26°14'22.89"E	D	Moderate	D
	Perennial River	26°59'58.80"S and 26°12'43.07"E	E	Moderate	D
	Depressional Pan	27° 0'5.61"S and 26°12'3.63"E	C	Low	c
	Depressional Pan	26°59'30.66"S and 26°10'49.43"E	C	Moderate	C
C25D	Unchannelled Valley Bottom	26°55'39.26"S and 26° 7'24.21"E	D	Moderate	D



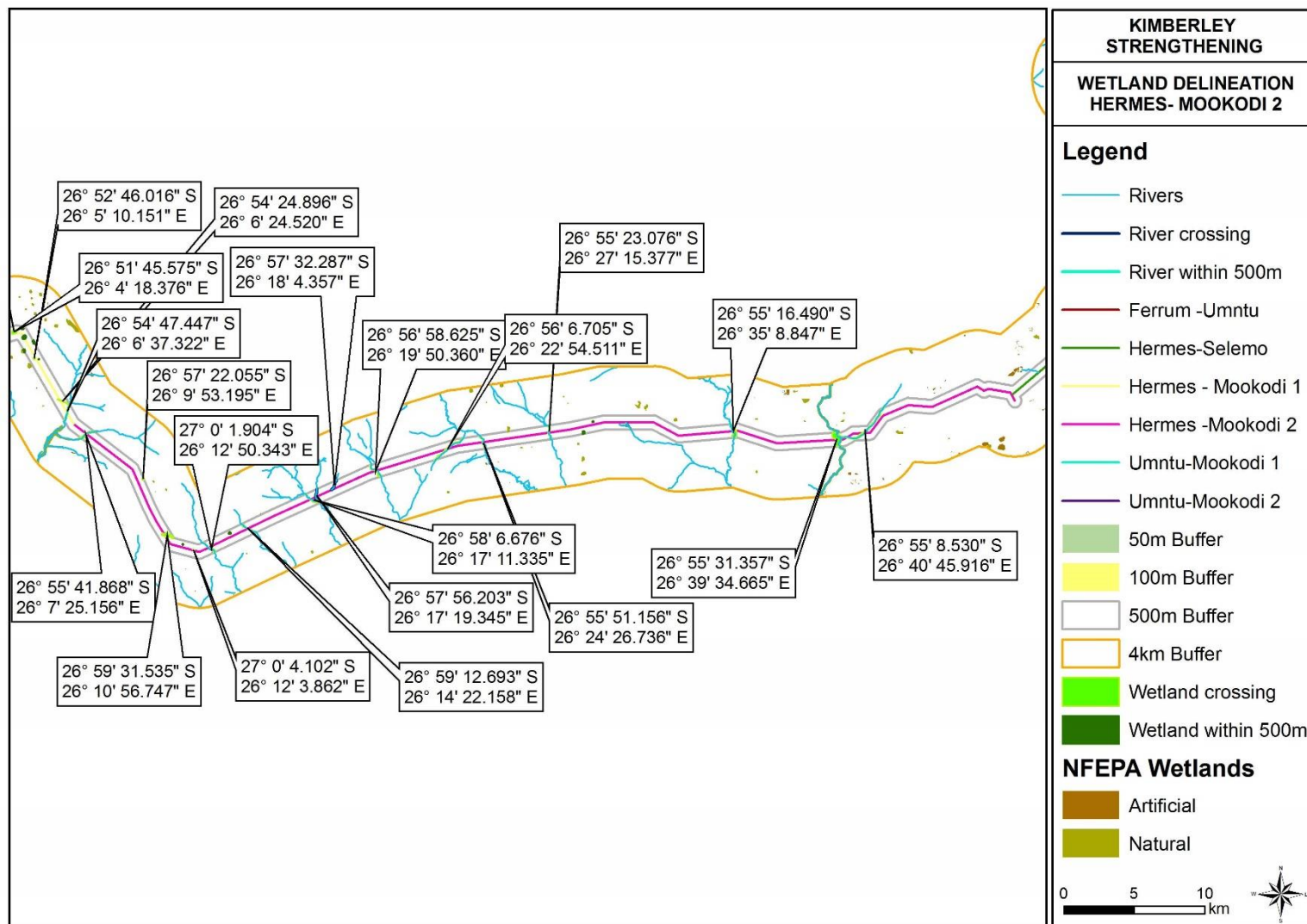


Figure 13: Section Hermes-Mookodi 2 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.



3.2.3 Hermes-Mookodi Section 1

This section of the proposed powerline crossed 34 watercourses over 4 catchment areas. The most important riverine systems potentially impacted by the proposed powerline include the Bamboesspruit, Biesieslaagte, Langasemspruit, Harts, Rietspruit, Leeuspruit and Droe Harts River. It is important to note that a very high density of depressional pans are located in this area, not only directly crossing the proposed powerline but also within the 4 km corridor. Table 5 presents a summary of the integrity and function scores obtained for these watercourses. Numerous bird, including flamingos and other animal species were recorded in some of these pans (Figure 14), and is thus important to consult an avifaunal specialist to determine the flight paths of these animals to avoid potential collisions. Figure 15 shows the position and extent of watercourses in this section.

Table 5: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Hermes-Mookodi Section 1.

Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
C25D	Floodplain	26°54'52.96"S and 26° 6'37.08"E	B	High	B
	Drainage Area	26°54'22.74"S and 26° 6'17.59"E	C	Low	C
	Depressional Pan	26°52'46.43"S and 26° 5'10.39"E	B	Moderate	B
	Depressional Pan	26°51'57.58"S and 26° 4'43.91"E	B	Moderate	B
	Depressional Pan	26°51'48.39"S and 26° 4'18.24"E	C	Moderate	C
	Depressional Pan	26°52'0.28"S and 26° 3'40.33"E	C	Moderate	C
	Depressional Pan	26°52'32.73"S and 26° 1'54.01"E	C	Moderate	C



Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
C25E	Depressional Pan	26°52'44.58"S and 26°1'3.59"E	C	Moderate	C
	Unchannelled Valley Bottom	26°52'40.87"S and 25°59'40.79"E	D	Moderate	D
	Depressional Pan	26°52'57.04"S and 25°58'8.21"E	D	Moderate	D
	Drainage Area	26°53'11.00"S and 25°57'35.82"E	C	Low	C
	Drainage Area	26°53'55.67"S and 25°55'52.86"E	C	Moderate	C
C31E C32C	Drainage Line (Langasemspruit)	26°57'20.32"S and 25°43'31.71"E	D	Moderate	D
	Depressional Pan	26°56'18.00"S and 25°40'59.86"E	D	Low	D
	Floodplain (Harts River)	26°55'23.93"S and 25°28'6.88"E	C	High	C
	Depressional Pan	26°55'15.17"S and 25°25'57.83"E	D	Low	D
	Depressional Pan	26°55'14.39"S and 25°25'33.26"E	D	Low	D
	Drainage Line	26°56'6.49"S and 25°22'41.88"E	D	High	D



Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAf, 1999)/QHI (Seaman et al, 2010).	REC
	Depressional Pan	26°56'59.94"S and 25°21'10.32"E	C	Moderate	C
	Depressional Pan	26°57'10.16"S and 25°20'43.31"E	C	Moderate	C
	Depressional Pan	26°57'23.59"S and 25°19'31.85"E	C	Moderate	C
	Depressional Pan	26°57'33.08"S and 25°18'45.17"E	C	Moderate	C
	Depressional Pan	26°56'59.08"S and 25°17'51.16"E	C	Moderate	C
	Depressional Pan	26°56'43.01"S and 25°17'39.13"E	C	Moderate	C
	Depressional Pan	26°55'0.56"S and 25°15'0.49"E	C	Moderate	C
	Depressional Pan	26°50'47.92"S and 25° 9'2.59"E	D	Low	D
	Unchannelled Valley Bottom	26°50'26.38"S and 25° 6'5.65"E	D	Moderate	D
	Depressional Pan	26°52'58.24"S and 25° 2'29.84"E	C	Low	C
	Drainage Area	26°55'0.17"S and 24°57'24.03"E	B	Low	B



Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWA, 1999)/QHI (Seaman et al, 2010).	REC
	Drainage Area	26°55'12.99"S and 24°56'59.10"E	B	Low	B
	Drainage Area	26°55'24.17"S and 24°56'36.62"E	B	Low	B
	-	26°55'40.90"S and 24°56'1.38"E	C	Low	C
	Drainage Area	26°58'50.07"S and 24°47'28.42"E	C	Low	C
	Floodplain	26°59'37.14"S and 24°46'16.15"E	C	High	C
	Drainage Area	27° 0'40.61"S and 24°45'33.10"E	C	Low	C



Figure 14: Flamingos recording in the depressional pans proposed to be crossed by the Hermes-Mookodi Section 1 of the powerline.

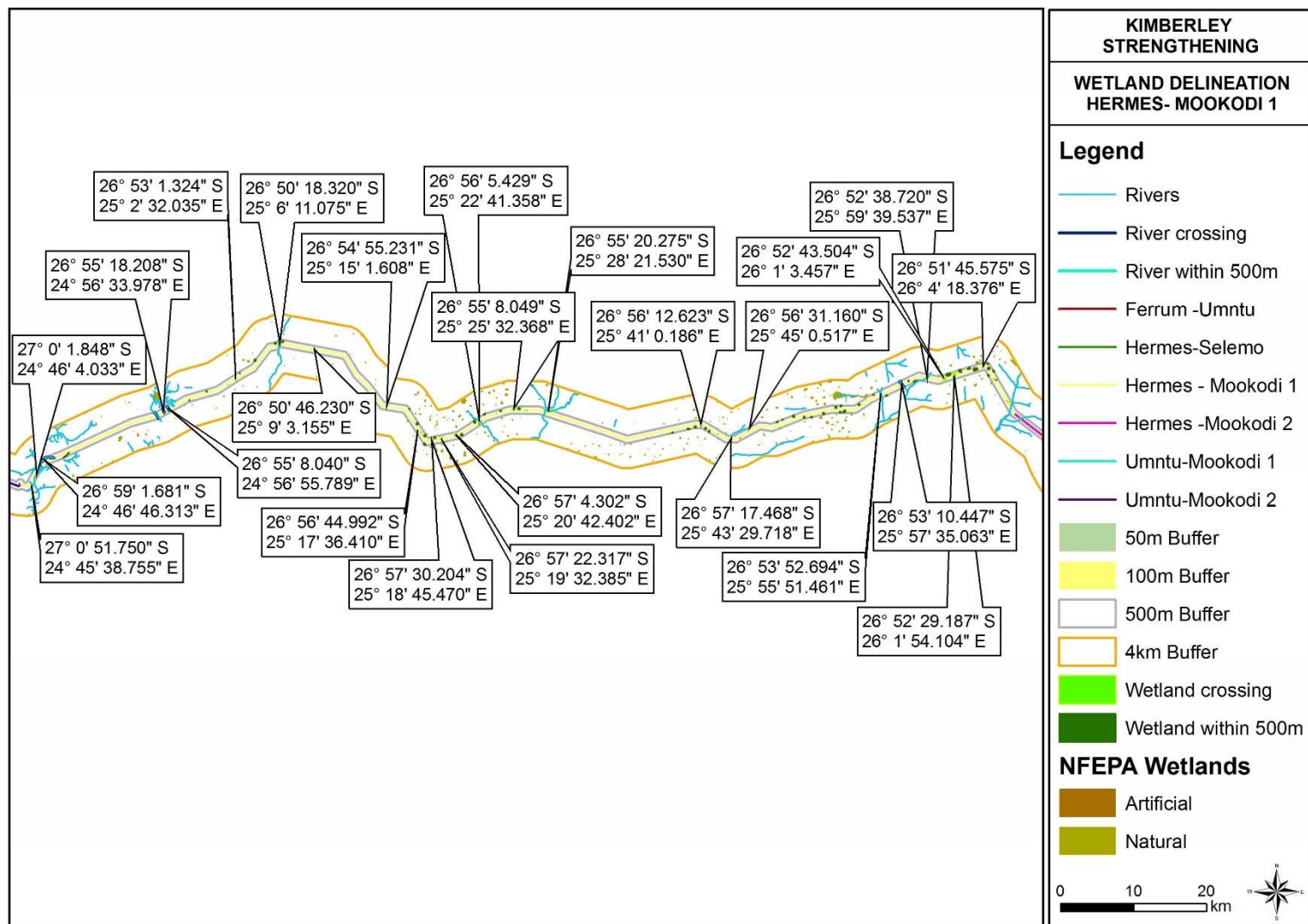


Figure 15: Section Hermes-Mookodi 1 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.



3.2.4 Umntu-Mookodi Section 2

This section crosses over 17 watercourses in three catchments. The majority of these are also pans, these pans were however dry pans and are likely to be ephemeral pans and thus only retain water for a small period of the year. The pans were also located in areas used for grazing which has some impacts on the pans (Table 6 and Figure 16). The first section follows an existing powerline for approximately 10km before moving away where the final section runs parallel with the N14. Figure 17 shows the position and extent of watercourses in this section.

Table 6: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Umntu-Mookodi Section 2.

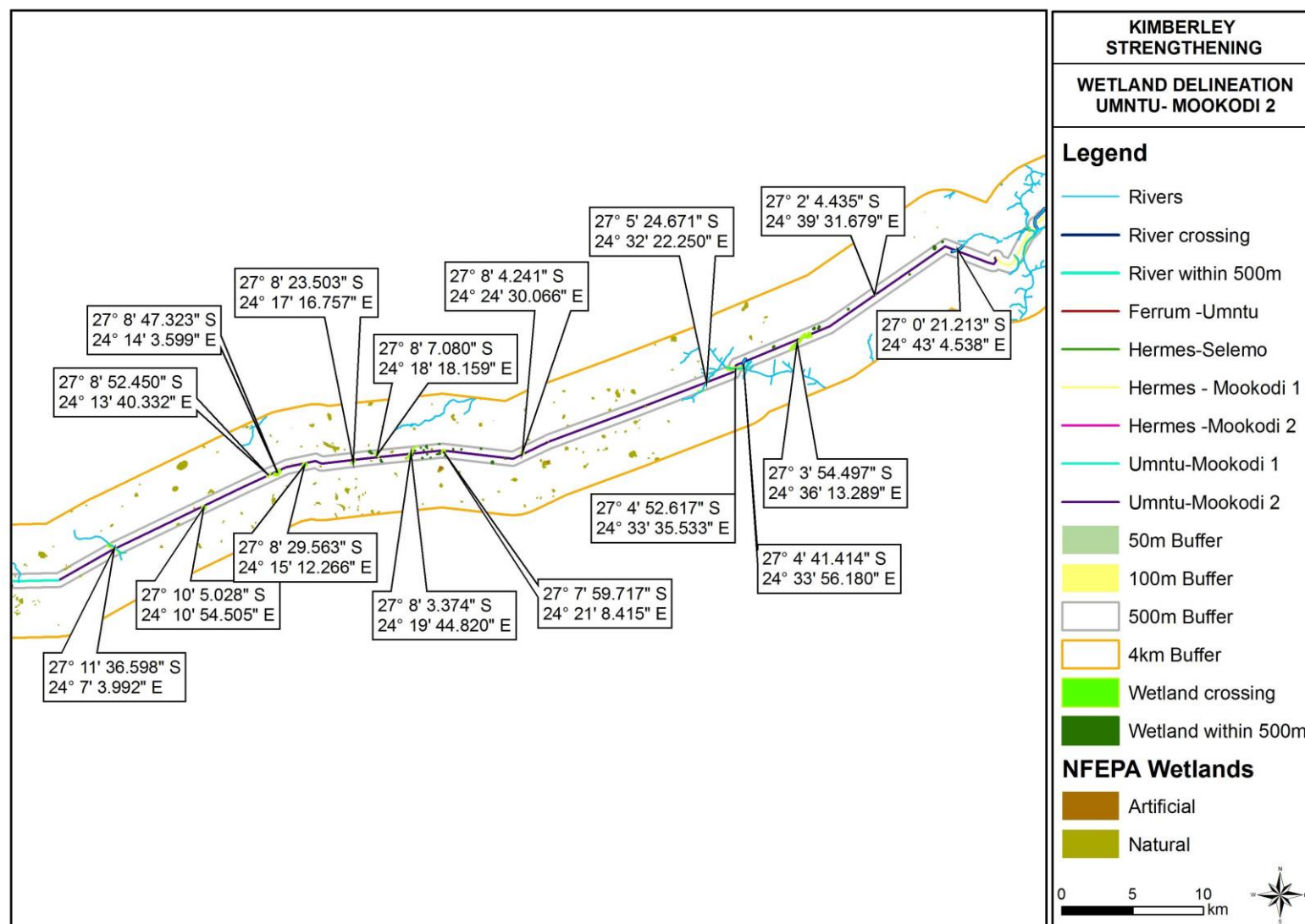
Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAf, 1999)/QHI (Seaman et al, 2010).	REC
C32B	Drainage Area	27° 0'23.75"S and 24°43'1.84"E	B	Low	B
	Depressional Pan	27° 2'5.16"S and 24°39'32.14"E	B	Low	B
C32D	Depressional Pan	27° 3'36.75"S and 24°36'43.44"E	B	Moderate	B
	Depressional Pan	27° 3'44.07"S and 24°36'23.71"E	B	High	B
	Drainage Area	27° 4'38.61"S and 24°33'56.15"E	C	High	C
	Riparian Area (Korobela)	27° 5'24.15"S and 24°32'21.99"E	C	Moderate	C
	Depressional Pan	27° 8'5.73"S and 24°24'33.52"E	D	Low	D
	Depressional Pan	27° 8'15.15"S and 24°23'47.49"E	C	Low	C
	Depressional Pan	27° 7'59.53"S and 24°21'0.85"E	C	Moderate	C
	Depressional Pan	27° 8'5.06"S and 24°19'44.06"E	C	Moderate	C



Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
	Depressional Pan	27° 8'12.03"S and 24°18'22.02"E	C	Moderate	C
	Depressional Pan	27° 8'17.75"S and 24°17'20.64"E	D	Moderate	D
	Depressional Pan	27° 8'24.87"S and 24°15'13.91"E	C	Moderate	C
	Depressional Pan	27° 8'41.31"S and 24°14'8.55"E	C	Moderate	C
	Depressional Pan	27° 8'51.58"S and 24°13'41.20"E	C	Moderate	C
	Depressional Pan	27°10'2.22"S and 24°10'52.81"E	C	Moderate	C
D41G	Drainage Area	27°11'37.59"S and 24° 7'6.46"E	C	Moderate	C



Figure 16: Dry ephemeral pan with grazing livestock visible. Characteristic of the pans associated with this section of the powerline route.



3.2.5 Umntu-Mookodi Section 1

This section crosses 13 watercourses of which the majority are perennial and non-perennial rivers and streams (Table 7 and Figure 18). Large sections of these streams and rivers are located high in the catchment in the remote mountainous areas and are thus far removed from most anthropogenic impacts and thus have better scores. All of the perennial and non-perennial watercourses crossed by this section of the powerline route ultimately flows into the Kuruman River. These rivers include the Moshaweng, Matlhwaring and Ga-Mogara Rivers.

Table 7: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Umntu-Mookodi Section 1.

Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
D41G	Drainage Area	27°12'58.02"S and 23°55'29.26"E	B	Moderate	B
	Drainage Area	27°13'39.21"S and 23°51'27.00"E	C	Moderate	C
D41L	Drainage Area	27°15'19.34"S and 23°44'20.83"E	C	Moderate	C
	Riparian Area (Matlhwaring)	27°15'40.99"S and 23°35'9.49"E	D	Moderate	D
	Riparian Area	27°15'34.42"S and 23°33'55.23"E	D	Moderate	D
	Riparian Area	27°15'20.19"S and 23°31'1.90"E	D	Moderate	D
	Drainage Area	27°15'11.95"S and 23°27'44.28"E	C	Moderate	C
	Drainage Area	27°15'54.50"S and 23°20'35.88"E	C	Moderate	C
	Riparian Area (Kuruman)	27°12'26.29"S and 23°11'13.60"E	D	Moderate	D
	Drainage Area	27°11'47.47"S and 23° 7'55.75"E	B	Low	B



Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAf, 1999)/QHI (Seaman et al, 2010).	REC
D41K	Drainage Area	27°12'3.64"S and 23° 6'21.68"E and 27°12'26.14"S and 23° 5'24.20"E	B	Low	B
	Drainage Area	27°12'34.84"S and 23° 4'59.67"E; 27°12'50.87"S and 23° 4'19.08"E	B	Low	B
	Drainage Area (Ga-Mogara)	27°13'44.00" and 22°55'23.45"E	E	Low	D



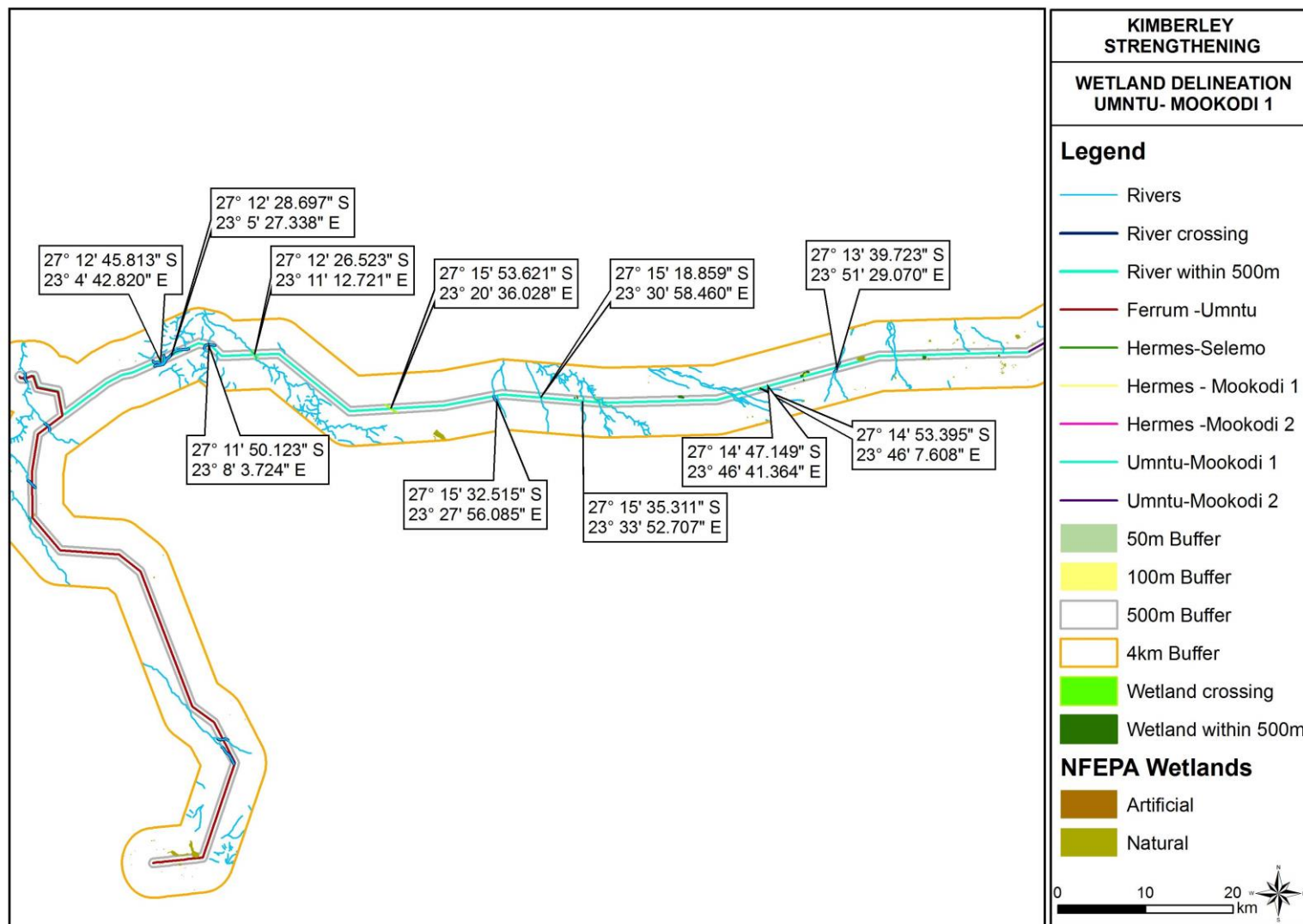


Figure 18: Section Umntu-Mookodi Section 1 of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.



3.2.6 Ferrum-Umntu

This section crosses 4 non-perennial drainage areas across one catchment area (Table 8 and Figure 19). The majority of the watercourses recorded in this section are impacted by the mining activities in Hotazel and Sishen Mine.

Table 8: Summary of the findings of the watercourses recorded on the proposed powerline crossing for the Ferrum-Umntu Section.

Catchment	Wetland and HGM Unit	Crossing Coordinates	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008).	EIS (DWAF, 1999)/QHI (Seaman et al, 2010).	REC
D41K	Drainage Area (Ga-Mogara)	27°13'41.51"S and 22°55'25.11"E	E	Low	D
	Drainage Area	27°16'42.32"S and 22°56'55.50"E	E	Low	D
	Drainage Area	27°36'14.09"S and 23° 8'36.62"E	D	Low	D
	Drainage Area	27°37'26.13"S and 23° 9'19.90"E	D	Low	D



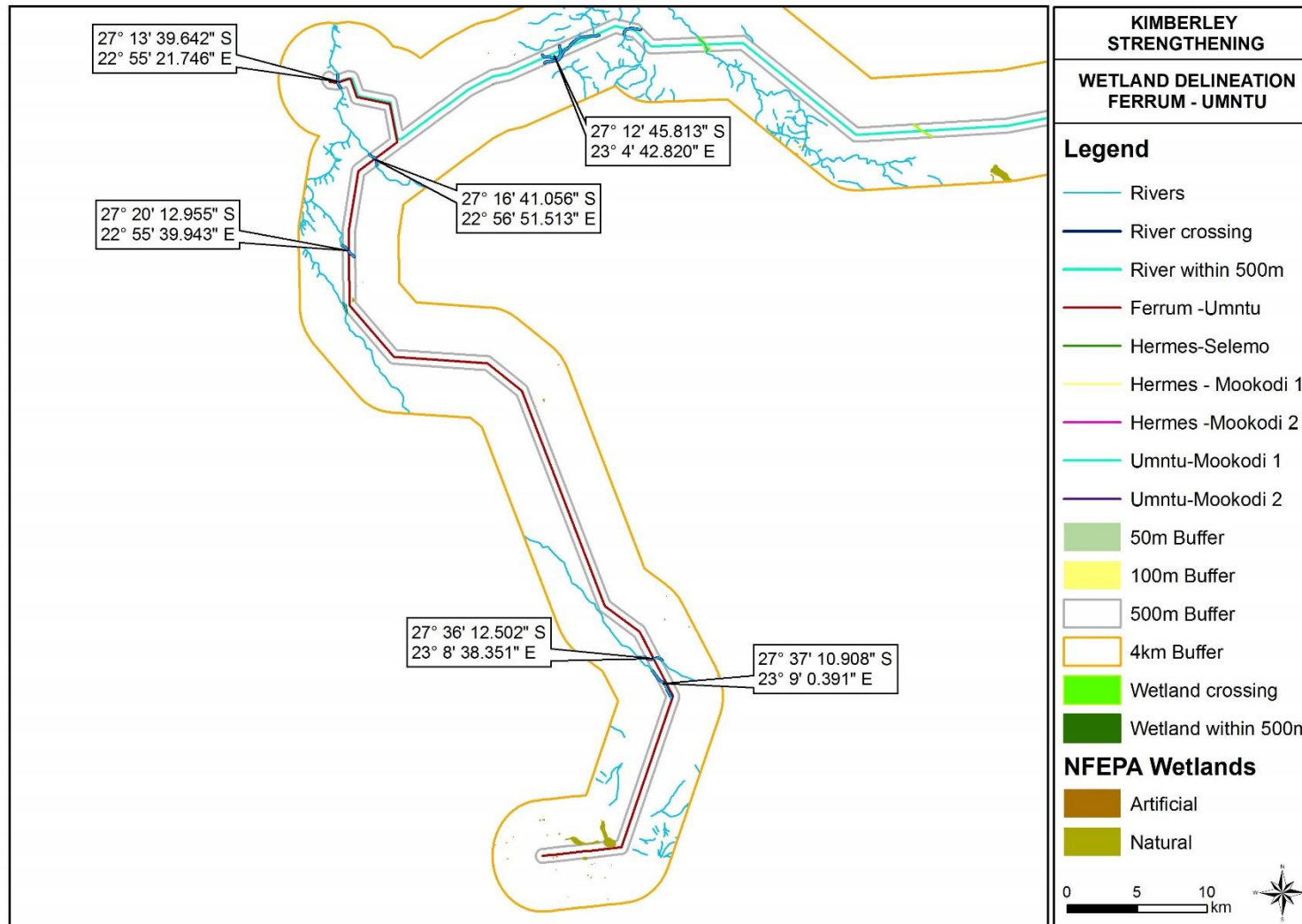


Figure 19: Section Ferrum-Umntu Section of the proposed powerline and the associated crossings and other watercourses within the regulated 500 m and additional 4 km corridor.



In summary, the majority of the watercourses in the study area are likely to have been impacted by mining, agriculture and cattle farming to some degree. However, the proposed route extends over parts of the country that is very sparsely inhabited. Consequently, significant impacts to watercourses in this area are less compared to denser populated areas. The proposed powerline further runs through two provinces that have a very low annual rainfall and often has drought for extended periods of time. Although these watercourse networks respond quickly to rainfall events the lack of robust vegetation growth makes them prone to sedimentation and erosion. A large number of depressional pans occur within the 4 km corridor discussed in this report.

Some of the impacts recorded throughout the study area are visually represented in the images below (Figure 20).



Figure 20: Images representing the major impacts recorded on the line including dams, erosion, exotic species and farming activities within wetlands.

3.3 Impacts and Mitigation

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 on the surrounding environment and particularly on a watercourse. A range of management measures are 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. It is important that any mitigation be implemented in the context of an Environmental Management Plan to in order to ensure accountability and ultimately the success of the mitigation.

3.3.1 NEMA (2014) Impact Assessment

Suggested mitigation/management measures are summarised in Table 9 - 12.

Table 9: Changes in sediment entering and exiting the system impact ratings

Nature: Changes in sediment entering and exiting the system.		
Activity: 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:		
• 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		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Probable (3)	Possible (2)
Duration	Short-term (2)	Short-term (2)
Extent	Regional (3)	Limited to Local Area (2)
Magnitude	Low (3)	Low (3)
Significance	24 (low)	14 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Possible (2)
Duration	Short-term (2)	Short-term (2)
Extent	Regional (3)	Limited to Local Area (2)
Magnitude	Low (3)	Low (3)
Significance	24 (low)	14 (low)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	



Mitigation:

- 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
- 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.
- Implementation of best management practices

Cumulative impacts: May be moderate unless effective mitigation measures are applied.

Residual Risks: Expected to moderate unless the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

Table 10: Changes in water flow ratings

Nature: Changes in water flow in wetlands directly affected as well as downstream watercourses.		
Activity: 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:		
• 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		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Probable (3)	Possible (2)
Duration	Medium-term (3)	Short-term (2)
Extent	Regional (3)	Limited to Local Area (2)
Magnitude	High (8)	Moderate (6)
Significance	42 (medium)	20 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Possible (2)
Duration	Long-term (4)	Short-term (2)
Extent	Regional (3)	Limited to Local Area (2)
Magnitude	High (8)	Moderate (6)
Significance	45 (medium)	20 (low)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	



Mitigation:

- 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

Cumulative impacts: May be high unless effective mitigation measures are applied.

Residual Risks: Expected to high unless the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

Table 11: Introduction and spread of alien vegetation impact ratings.

Nature: Introduction and spread of alien vegetation.		
Activity: Any activities that damage the natural vegetation cover will result in opportunistic invasions after disturbance and the introduction of seed in construction materials and on vehicles. Invasions of alien plants can impact on hydrology, by outcompeting natural vegetation and decreasing the natural biodiversity.		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long-term (4)	Medium-term (3)
Extent	Limited to Local Area (2)	Limited to Local Area (2)
Magnitude	High (8)	Low (4)
Significance	56 (moderate)	27 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Improbable (1)
Duration	Permanent (5)	Permanent (5)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	High (8)	Low (4)
Significance	45 (moderate)	10 (low)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	



Mitigation:

- Implement an Alien Plant Control Plan
- 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.
- 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.
- Rehabilitate or revegetate disturbed areas

Cumulative impacts: Expected to be moderate to low. Regular monitoring should be implemented during construction, rehabilitation including for a period after rehabilitation is completed.

Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

Table 12: Changes in water quality due to foreign materials and increased nutrients impact ratings.

Nature: Changes in water quality due to foreign materials and increased nutrients.		
Activity: Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles resulting in the loss of sensitive biota in the rivers and a reduction in watercourse		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Highly probable (4)	Possible (2)
Duration	Medium-term (3)	Medium-term (2)
Extent	Regional (3)	Local (2)
Magnitude	High (8)	Moderate (6)
Significance	56 (medium)	20 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Possible (2)
Duration	Short term (2)	Short term (2)
Extent	Regional (3)	Regional (3)
Magnitude	Low (4)	Low (4)
Significance	27 (low)	18 (low)



Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Mitigation: • Provision of adequate sanitation facilities located outside of the watercourse or its associated buffer zone during construction. • 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 e.g. water runoff from cleaning of equipment, vehicle access etc. • After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Maintenance of construction vehicles / equipment should not take place within the watercourse or watercourse buffer. • Treatment of pollution identified should be prioritized.		
Cumulative impacts: Expected to be moderate. Once in the system it may take many years for some toxins to be eradicated.		
Residual Risks: Expected to be moderate and relatively simple to mitigate		

3.3.2 DWS (2016) Risk Assessment

The DHWS Risk Assessment is shown in Table 13 below. Scores fall in the Low risk category and authorisation may proceed through a General Authorisation.



Table 13: 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 between Ferrum and Epsilon, via Hotazel, Mookgodi and Hermes																						
NAME and REGISTRATION No of SACNASP Professional member: A Bootsma SACNASP # 400222/09																						
Phases	Activity	Aspect	Impact	Severity				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	
				Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota															
C	Construction of overhead powerline within a watercourse and/or watercourse buffer zone	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%	• 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	Refer to accompanying report
		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 personnel during stringing		2	2	1	1	1.5	1	2	4.5	1	2	5	2	10	45	L	80%		N	
		Upgrade of access roads		1	2	1	1	1.3	1	2	4.25	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	1.2	1	2	4.2	2	2	5	2	11	46.2	L	80%	• 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	Refer to accompanying report
		Ad hoc repair and maintenance to structures		1	1	1	1	1	1	1	3	1	2	5	2	10	30	L	80%		N	



3.4 CONCLUSION

The majority of the watercourses in the study area are likely to have been impacted by agriculture and cattle farming to varying degrees, as well as mining in some areas. However, the majority of the proposed line is located on parts of the country that is very sparsely inhabited. Consequently, impacts to watercourses are relatively less significant compared to denser populated areas. The proposed powerline further runs through two provinces that have a very low annual rainfall and often have droughts for extended periods of time. Although these systems respond quickly to rainfall events the lack of robust vegetation growth in areas makes them prone to sedimentation and erosion. Numerous depressional pans occur within the 4 km corridor discussed in this report.

The watercourses were divided into those directly crossed by the proposed powerline and those within the 4 km corridor but not crossed. The watercourses (including the buffer zones) directly crossed by the proposed development are the ones likely to be potentially impacted and form the main focus of this report.

The table below provides a summary of the results recorded watercourses on the proposed section of the powerline alignment.

NEMA 2014 Impact Assessment	The impact scores for the following aspects are relevant:		Without Mitigation	With Mitigation
	Sedimentation	Construction Phase	L	L
		Operation Phase	L	L
	Changes to flow dynamics	Construction Phase	M	L
		Operation Phase	M	L
	Establishment of alien plants	Construction Phase	M	L
		Operation Phase	M	L
	Pollution of watercourses	Construction Phase	M	L
		Operation Phase	L	L
DWS (2016) Risk Assessment	The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. 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, minor maintenance on roads, river crossings, towers and substations, where the footprint remains the same, are exempt from a WUL.			
Does the specialist support the development?	Yes, the impacts are expected to be minimal and easily mitigated.			



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APPENDIX A: Detailed methodology

The delineation method documented by the Department of Human Settlements, Water and Sanitation in their document “Updated manual for identification and delineation of wetlands and riparian areas” (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2009) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*, 2013) was followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

A hand held Garmin Montana 650 was used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey.

Wetland and Riparian Delineation

The delineation of the watercourses presented in this report is based on both desktop delineation and groundtruthing.

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;
- S A Water Resources;
- Recent, relevant aerial and satellite imagery, including Google Earth.

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

Ground Truthing

Wetlands were identified based on one or more of the following characteristic attributes (DWAF, 2005) (Figure 21):

- 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.



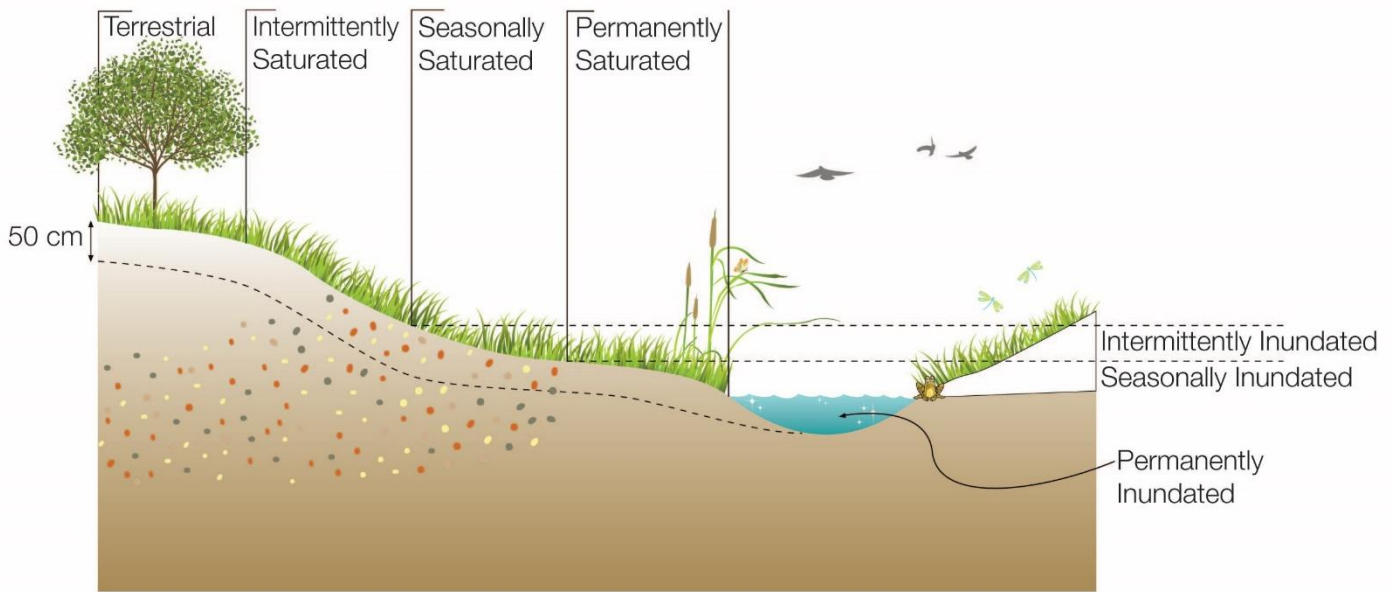


Figure 21: Typical cross section of a wetland (Ollis, 2013)

The Terrain Unit Indicator

The terrain unit indicator (Figure 22) is an important guide for identifying the parts of the landscape where wetlands might possibly occur. Some wetlands occur on slopes higher up in the catchment where groundwater discharge is taking place through seeps. An area with soil wetness and/or vegetation indicators, but not displaying any of the topographical indicators should therefore not be excluded from being classified as a wetland. 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 23).

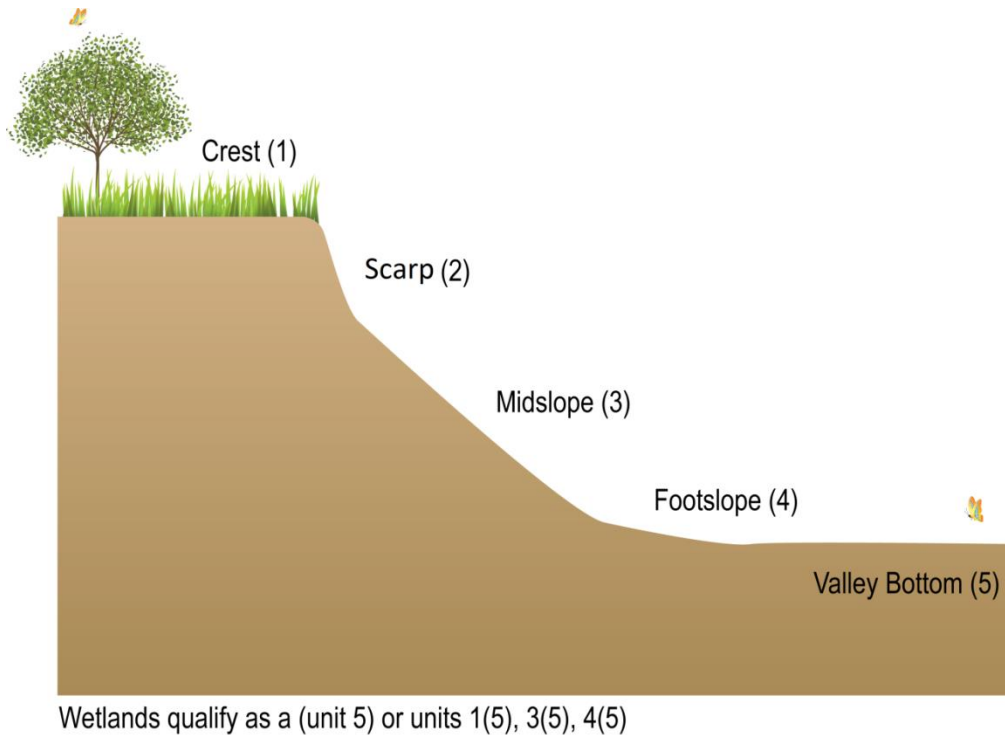


Figure 22. Terrain units (DWAF, 2005).

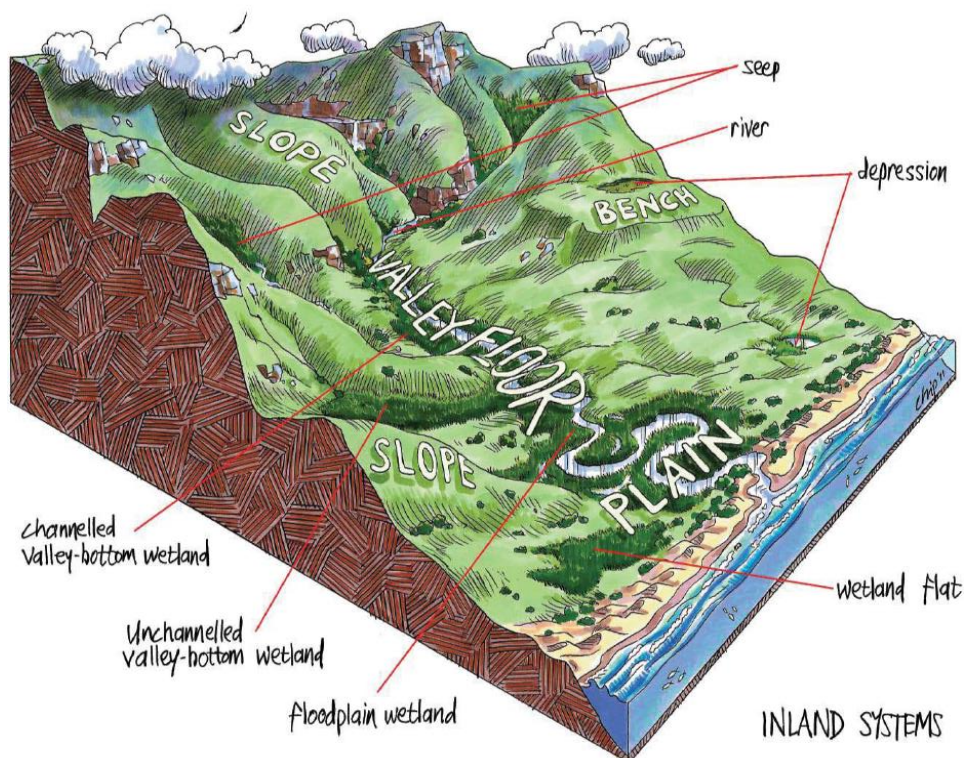


Figure 23: Wetland Units based on hydrogeomorphic types (Ollis et al. 2013)

Riparian Indicators

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 24).

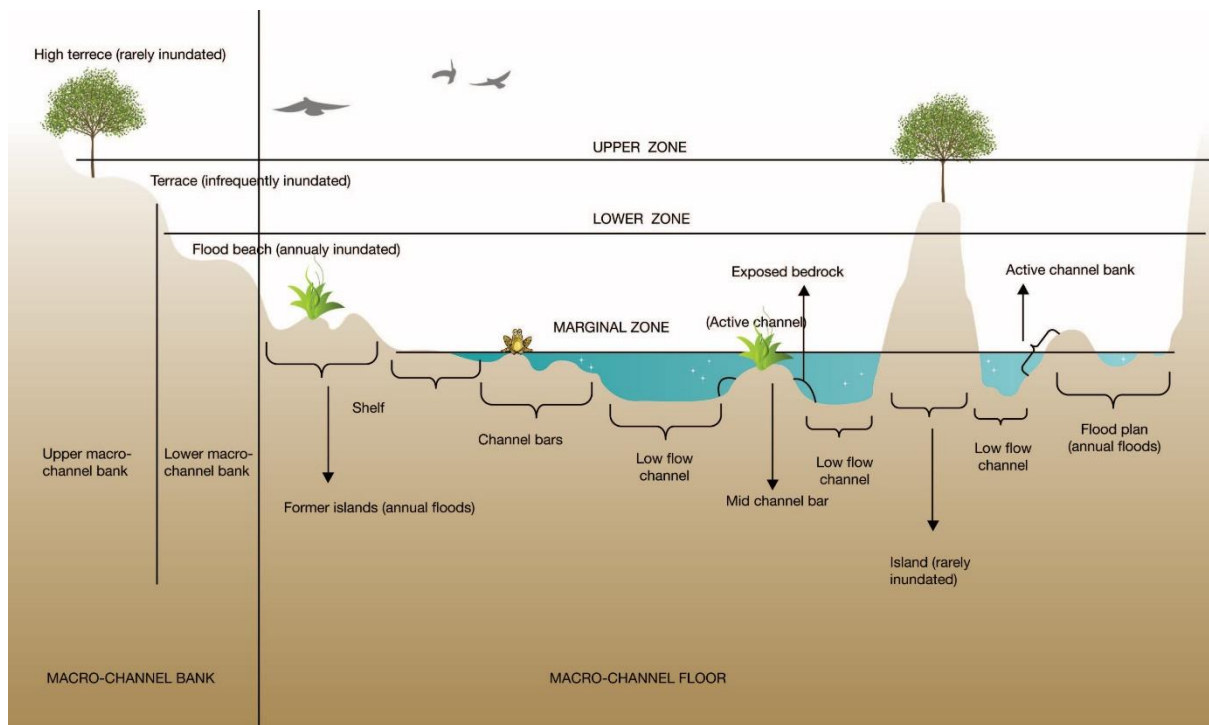


Figure 24: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans *et al*, 2007)

Riparian Indicators

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 25).

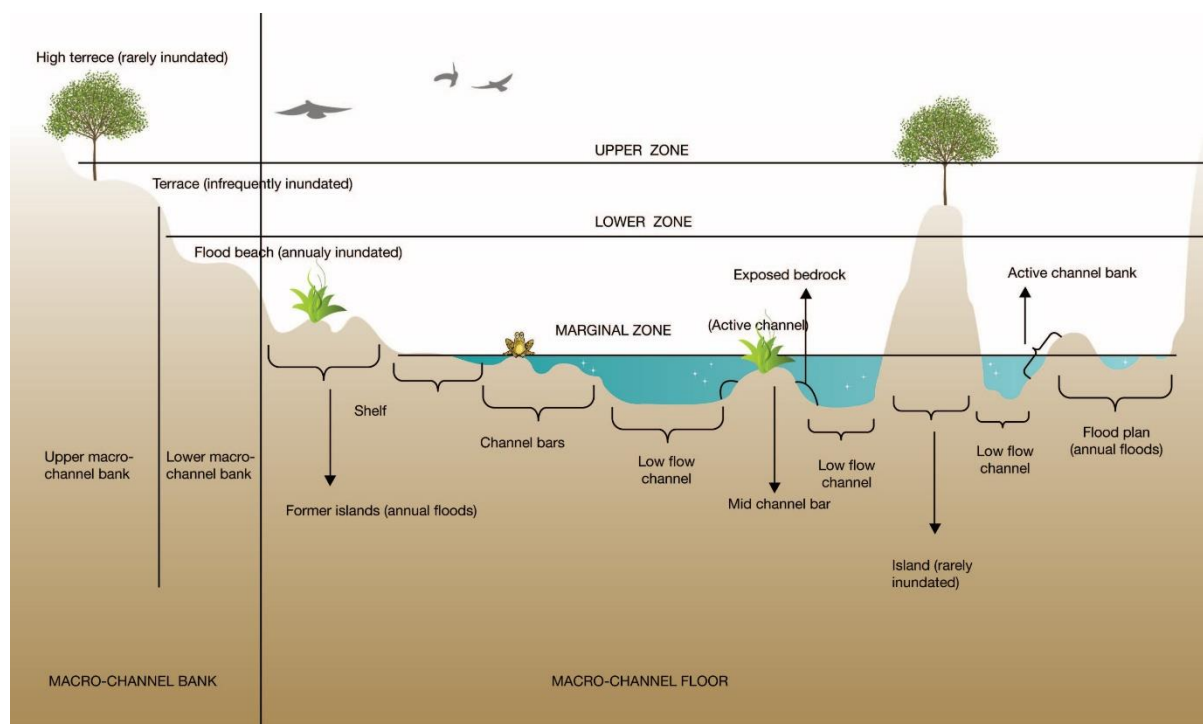


Figure 25: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans *et al*, 2007)

The vegetation of riparian areas is divided into three zones, the marginal zone, lower non-marginal zone and the upper non-marginal zone (Table 14). The different zones have different vegetation growth.

Table 14: Description of riparian vegetation zones (Kleynhans *et al*, 2007).

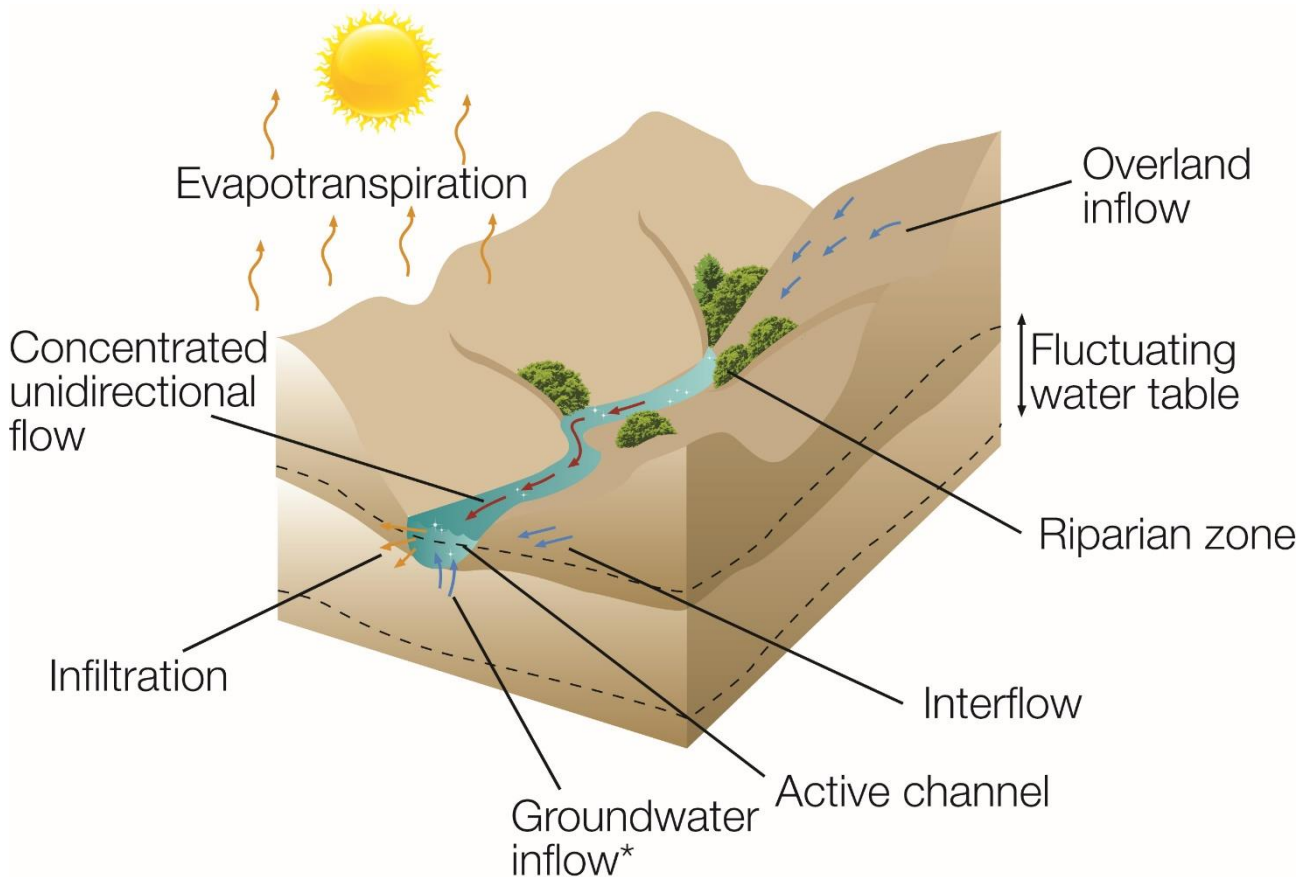
	Marginal	(Non-marginal) Lower	(Non-marginal) Upper
Alternative descriptions	Active features Wet bank	Seasonal features Wet bank	Ephemeral features Dry bank
Extends from	Water level at low flow	Marginal zone	Lower zone
Extends to	Geomorphic features / substrates that are hydrologically activated (inundated or moistened) for the Greater part of the year.	Usually a marked increase in lateral Elevation.	Usually a marked decrease in lateral elevation
Characterized	See above ; Moist	Geomorphic features	Geomorphic features

by	substrates next to water's edge; water loving- species usually vigorous due to near permanent access to soil moisture	that are hydrologically activated (inundated or moistened) on a Seasonal basis. May have different species than marginal zone	that are hydrological activated (inundated or moistened) on an Ephemeral basis. Presence of riparian and terrestrial species Terrestrial species with increased stature
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Riparian Area:

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 (Figure 26) (Kotze, 1999).





RIVER

* Not always present

Figure 26: A schematic representation of the processes characteristic of a river area (Ollis *et al*, 2013).

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, temporary rivers are rivers where surface flow disappears for most of the channel (Figure 27). 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). The riparian areas recorded on site are thus classified as episodic streams due to the high elevation of these streams.

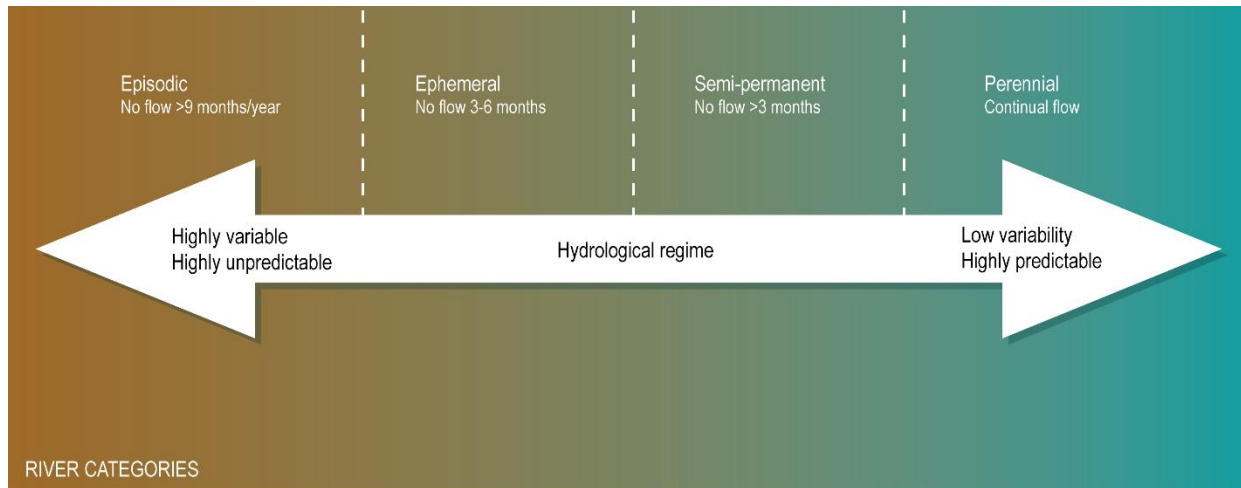


Figure 27: The four categories associated with rivers and the hydrological continuum. Dashed lines indicate that boundaries are not fixed (Seaman *et al*, 2010).

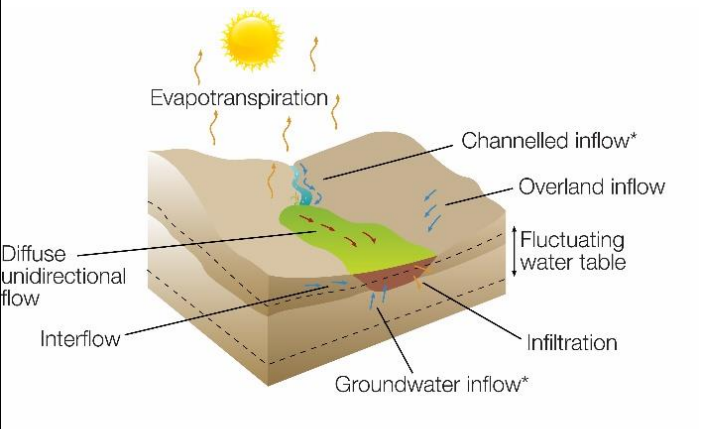
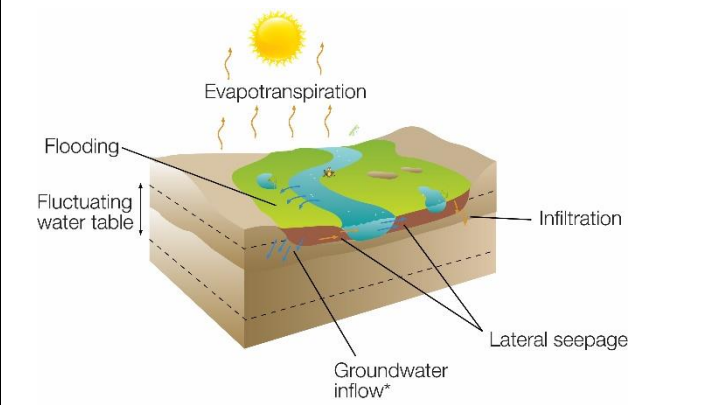
3.5 Wetland Classification and Delineation

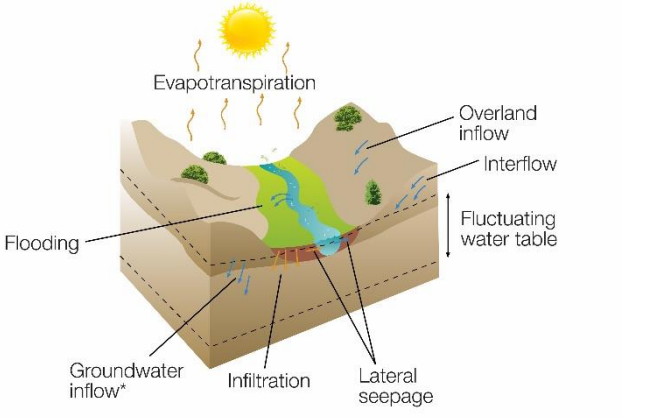
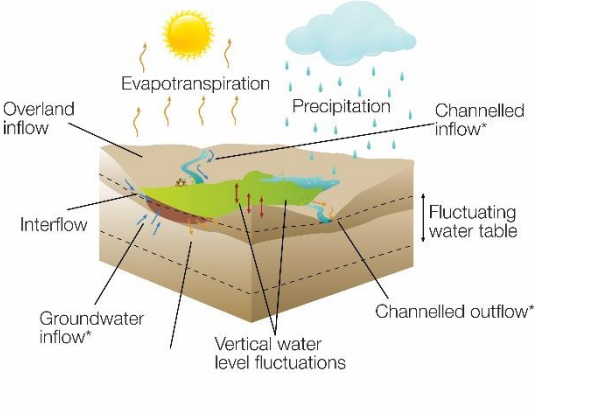
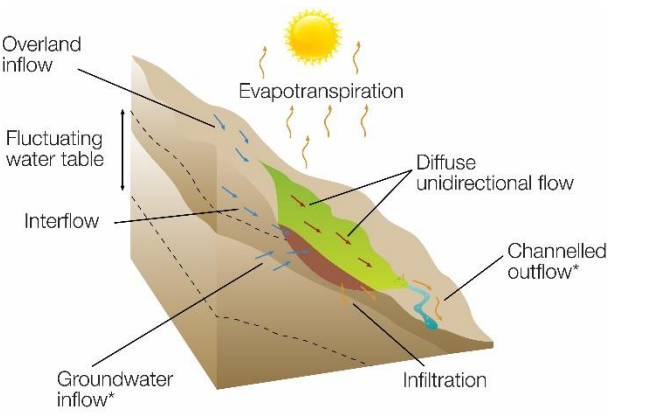
The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2013). The current wetland study follows the same approach by classifying wetlands in terms of a functional unit in line with a level three category recognised in the classification system proposed in SANBI (2009). HGM units take into consideration factors that determine the nature of water movement into, through and out of the wetland 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.

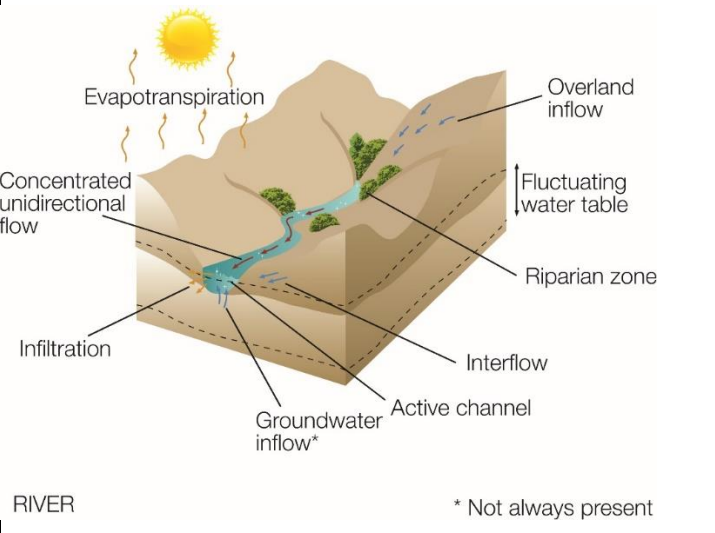
The classification of wetland areas found within the study site and/or within 500 m of the study site (adapted from Brinson, 1993; Kotze, 1999, Marneweck and Batchelor, 2002 and DWAF, 2005) are as follows (Table 15):

Table 15: Wetland Types and descriptions

Wetland Type:	Description:
<i>Valley bottom without a channel</i>  UNCHANNELLED VALLEY-BOTTOM WETLAND * Not always present	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.
<i>Meandering Floodplain</i>  FLOODPLAIN WETLAND * Not always present	Linear fluvial, net depositional valley bottom surfaces which have a meandering channel which develop upstream of a local (e.g. resistant dyke) base level, or close to the mouth of the river (upstream of the ultimate base level, the sea) . The meandering channel flows within an unconfined depositional valley, and ox-bows or cut-off meanders evidence of meandering – are usually visible at the 1:10 000 scale (i.e. observable from 1:10 000 orthomaps). The floodplain surface usually slopes away from the channel margins due to preferential sediment deposition along the channel edges and areas closest to the channel. This can result in the formation of backwater swamps at the edges of the floodplain margins.

Wetland Type:	Description:
<i>Valley bottom with a channel</i>  CHANNELLED VALEY-BOTTOM WETLAND * Not always present	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.
<i>Depressional pans</i>  DEPRESSION * Not always present	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.
<i>Seepage Wetlands</i>  SEEP * Not always present	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).



Wetland Type:	Description:
Riparian habitat  The diagram illustrates a cross-section of a river and its surrounding riparian zone. Key features labeled include: Evapotranspiration (sun and wavy arrows), Concentrated unidirectional flow (in the river channel), Infiltration (into the ground), Groundwater inflow* (into the river), Overland inflow (into the river), Fluctuating water table (indicated by a dashed line), Riparian zone (vegetated area), Interflow (between the river and groundwater), and Active channel (the part of the river carrying water). A legend at the bottom left identifies the 'RIVER' with a blue line. A note at the bottom right states '* Not always present'.	Linear fluvial, eroded landforms which carry 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.

3.6 Wetland Functionality, Status and Sensitivity

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, 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*, 2007) and an Environmental Importance and Sensitivity category (EIS) (DWAf, 1999). These impacts are based on evidence observed during the field survey and land-use changes visible on aerial imagery.

The allocations of scores in the functional and integrity assessment are subjective and are thus vulnerable to the interpretation of the specialist. 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, 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.

In the current study the wetland was assessed using, WET-Health (Macfarlane *et al*, 2007), EIS (DWAf, 1999) and WetEcoServices, (Kotze *et al*, 2006).

3.6.1 Present Ecological Status (PES) – WET-Health

The Present Ecological Score is based on the ability of the wetland to perform indirect benefits (Table 16).

Table 16: Indirect Benefits provided by wetland habitats (Macfarlane *et al*, 2007).

Regulating & supporting benefits	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
	Streamflow regulation		Sustaining streamflow during low flow periods
	Water Quality Enhancement	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
		Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters, thereby enhancing water quality
		Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters, thereby enhancing water quality
		Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters, thereby enhancing water quality
		Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation.
	Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter

A summary of the three components of the WET-Health namely Hydrological; Geomorphological and Vegetation Health assessment for the wetlands found on site is described in Table 17. A Level 1 assessment was used in this report. Level 1 assessment is used in situations where limited time and/or resources are available.

Table 17: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane *et al*, 2007)

Description	Impact Score Range	PES Score	Summary
Unmodified, natural.	0.0.9	A	Very High
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.	1-1.9	B	High
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C	Moderate



Description	Impact Score Range	PES Score	Summary
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	D	Moderate
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E	Low
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.10	F	Very Low

A summary of the change class, description and symbols used to evaluate wetland health are summarised in Table 18.

Table 18: 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	(↓↓)

3.6.2 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 including subsistence farming and water use (Table 19).

Table 19: Direct human benefits associated with wetland habitats (Macfarlane *et al*, 2007).

Subsistence benefits	Water for human use	The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
	Harvestable resources	The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
	Cultivated foods	Areas in the wetland used for the cultivation of foods
Cultural benefits	Cultural heritage	Places of special cultural significance in the wetland, e.g., for baptisms or gathering of culturally significant plants
	Tourism and recreation	Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
	Education and research	Sites of value in the wetland for education or research

The Ecological Importance and Sensitivity of the seepage wetland is represented are described in the results section. Explanations of the scores are given in Table 20.

Table 20: Environmental Importance and Sensitivity rating scale used for the estimation of EIS scores (DWAF, 1999)

Ecological Importance and Sensitivity Categories	Rating	Recommended Ecological Management Class
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	A
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	B



Ecological Importance and Sensitivity Categories	Rating	Recommended Ecological Management Class
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	C
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	D

3.6.3 Present Ecological Category (EC): Riparian

In the current study, the Ecological Category of the riparian areas was assessed using a level 3 VEGRAI (Riparian Vegetation Response Assessment Index) (Kleynhans *et al*, 2007) (Appendix B; Appendix C). Appendix B lists the VEGRAI calculations that determine the Ecological Category (EC) for the riparian area. Table 21 below provides a description of each EC category.



Table 21: Generic ecological categories for EcoStatus components (modified from Kleynhans, 1996 & Kleynhans, 1999)

ECOLOGICAL CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

3.6.4 Quick Habitat Integrity Model

To accommodate a less-detailed process, a desktop habitat integrity assessment (using the Quick Habitat Integrity model) that allows for a coarse assessment was developed. This assessment rates the habitat according to a scale of 0 (close to natural) to 5 (critically modified) according to the following metrics (Seaman *et al*, 2010):

- Bed modification.
- Flow modification.
- Introduced Instream biota.
- Inundation.
- Riparian / bank condition.
- Water quality modification.

3.6.5 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 the goods and services for the environment and society.

If:

- PES is in an E or F category:
The REC should be set at at least a D, since E and F EC's are considered unsustainable.
 - The PES category is in a 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).

3.6.6 WetEcoServices

The Department of Water and Sanitation authorisations related to wetlands are regulated by Government Notice 267 published in the Government Gazette 40713 of 24 March 2017 regarding Section 21(c) and (i). Page 196 of this notice provides a detailed terms of reference for wetland assessment reports and includes the requirement that the ecological integrity and function of wetlands be addressed.

Although it is our opinion that this section should draw from site specific fauna and flora data, this requirement is addressed through the WetEcoServices toolkit (Kotze *et al*. 2006). This wetland assessment method is an excel based tool which is based on the integral function of wetlands in terms of their hydrogeomorphic setting. Each of seven benefits are 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.

3.7 Impact Assessments

3.7.1 NEMA (2014) Impact Ratings

As required by the 2014 NEMA regulations, impact assessment should provide quantified scores indicating the expected impact, including the cumulative impact of a proposed activity. This assessment follows the format presented below (Table 22 & Table 23):

Table 22: Criteria for Assessment of Impacts



Severity (Magnitude)	
The severity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as	
(I)nsignificant	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
(M)oderate	The affected environment is altered, but functions and processes continue, albeit in a modified way.
(V)ery High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Duration	
The lifetime of the impact that is measured in relation to the lifetime of the proposed development.	
(T)emporary	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.
(S)hort term	The impact will be relevant through to the end of a construction phase (1.5–2 years).
(M)edium term	The impact will last up to the end of the development phases, where after it will be entirely negated.
(L)ong term	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
(P)ermanent	This is 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 in such a time span that the impact is transient.
Spatial scale	
Classification of the physical and spatial scale of the impact	
(F)ootprint	The impacted area extends only as far as the activity, such as the footprint occurring within the total site area.
(S)ite	The impact could affect the whole, or a significant portion of, the site.
(R)egional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
(N)ational	The impact could have an effect that expands throughout the country (South Africa).
(I)nternational	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
Probability	
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
(I)mprobable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).



(P)ossible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chance of this impact occurring is defined as 25%.
(L)ikely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chance of this impact occurring is defined as 50%.
(H)ighly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chance of this impact occurring is defined as 75%.
(D)efinite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100%.

In order to assess each of these factors for each impact, the following ranking scales were used (Table 23).

Table 23: Assessment Criteria: Ranking Scales

PROBABILITY		MAGNITUDE	
Description / Meaning	Score	Description / Meaning	Score
Definite/don't know	5	Very high/don't know	10
Highly probable	4	High	8
Probable	3	Moderate	6
Possible	2	Low	4
Improbable	1	Insignificant	2
DURATION		SPATIAL SCALE	
Description / Meaning	Score	Description / Meaning	Score
Permanent	5	International	5
Long Term	4	National	4
Medium Term	3	Regional	3
Short term	2	Local	2
Temporary	1	Footprint	1/0

Details of the significance of the various impacts identified are presented in Table 24 and Table 25.

Determination of Significance – With Mitigation



Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. The Significance Rating (SR) is determined as follows:

$$\text{Significance Rating (SR)} = (\text{Extent} + \text{Intensity} + \text{Duration}) \times \text{Probability}$$

Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a value for each impact (prior to the implementation of mitigation measures). Significance without mitigation is rated on the following scale (Table 24):

Table 24: Significance Rating Scales without mitigation

SR < 30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30 < SR < 60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 60	High (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

Identifying the Potential Impacts with Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale (Table 25):

Table 25: Significance Rating Scales with mitigation

SR < 30	Low (L)	The impact is mitigated to the point where it is of limited importance.
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30 < SR < 60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR > 60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance after mitigation could render the entire development option or entire project proposal unacceptable.

3.7.2 DWS (2016) Impact Ratings

Risk-based management has value in providing an indication of the potential for delegating certain categories of water use “risks” to DWS regional offices (RO) or Catchment Management Agencies (CMA). Risk categories obtained through this assessment serve as a guideline to establish the appropriate channel of authorisation of these water uses.

The DWS has therefore developed a risk assessment matrix to assist in quantifying expected impacts. The scores obtained in this assessment are useful in evaluating how the proposed activities should be authorised.

The formula used to derive a risk score is as follows:

RISK = CONSEQUENCE x LIKELIHOOD

CONSEQUENCE = SEVERITY + SPATIAL SCALE + DURATION

LIKELIHOOD = FREQUENCY OF THE ACTIVITY + FREQUENCY OF THE IMPACT + LEGAL ISSUES + DETECTION

Table 26 below provides a description of the classes into which scores are sorted, and their implication for authorisation.



Table 26: An extract from DWS (2016) indicating the risk scores and classes as well as the implication for the appropriate authorization process

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



APPENDIX B: Abbreviated CVs of participating specialists

Name: **ANTOINETTE BOOTSMA nee van Wyk**

ID Number: 7604250013088

Name of Firm: Limosella Consulting

Position: Director - Principal Specialist

SACNASP Status: Professional Natural Scientist # 400222-09 Botany and Ecology

QUALIFICATIONS

- MSc Ecology, University of South Africa (2017) Awarded with distinction. Project Title: Natural mechanisms of erosion prevention and stabilization in a Marakele peatland; implications for conservation management
- Short course in wetland soils, Terrasoil Science (2009)
- Short course in wetland delineation, legislation and rehabilitation, University of Pretoria (2007)
- B. Sc (Hons) Botany, University of Pretoria (2003-2005). Project Title: A phytosociological Assessment of the Wetland Pans of Lake Chrissie
- B. Sc (Botany & Zoology), University of South Africa (1997 - 2001)

PUBLICATIONS

- A.A. Boostma, S. Elshehawi, A.P. Grootjans, P.L Grundling, S. Khosa. *In Press*. Ecohydrological analysis of the Matlabas Mountain mire, South Africa. *Mires and Peat*
- P.L. Grundling, A Lindstrom., M.L. Pretorius, A. Bootsma, N. Job, L. Delpont, S. Elshahawi, A.P Grootjans, A. Grundling, S. Mitchell. 2015. Investigation of Peatland Characteristics and Processes as well as Understanding of their Contribution to the South African Wetland Ecological Infrastructure Water Research Commission KSA 2: K5/2346
- A.P. Grootjans, A.J.M Jansen, A. Snijdwind, P.C. de Hullu, H. Joosten, A. Bootsma and P.L. Grundling. (2014). In search of spring mires in Namibia: the Waterberg area revisited. *Mires and Peat*. Volume 15, Article 10, 1–11, <http://www.mires-and-peat.net/>, ISSN 1819-754X © 2015 International Mire Conservation Group and International Peat Society

KEY EXPERIENCE



The following projects provide an example of the application of wetland ecology on strategic as well as fine scale as well as its implementation into policies and guidelines. (This is not a complete list of projects completed, rather an extract to illustrate diversity);

- Numerous peer reviews as part of mentorship programs for companies including Gibb, Galago Environmental Consultants, Lidwala Consulting Engineers, Bokamoso Environmental Consultants, 2009 ongoing
- Numerous fine scale wetland and ecological assessments in Gauteng, Mpumalanga, KwaZulu Natal, Limpopo and the Western Cape 2007, ongoing
- Strategic wetland specialist input into the Open Space Management Framework for Kyalami and Ruimsig, City of Johannesburg, 2016
- Fine scale wetland specialist input into the ESKOM Bravo Integration Project 3, 4, 5 and Kyalami – Midrand Strengthening.
- Wetland/Riparian delineation and functional assessment for the proposed maintenance work of the rand water pipelines and valve chambers exposed due to erosion in Casteel A, B and C in Bushbuckridge Mpumalanga Province
- Wetland/Riparian delineation and functional assessment for the Proposed Citrus Orchard Establishment, South of Burgersfort (Limpopo Province) and North of Lydenburg (Mpumalanga Province).
- Scoping level assessment to inform a proposed railway line between Swaziland and Richards Bay. April 2013.
- Environmental Control Officer. Management of onsite audit of compliance during the construction of a pedestrian bridge in Zola Park, Soweto, Phase 1 and Phase 2. Commenced in 2010, ongoing.
- Fine scale wetland delineation and functional assessments in Lesotho and Kenya. 2008 and 2009;
- Analysis of wetland/riparian conditions potentially affected by 14 powerline rebuilds in Midrand, Gauteng, as well submission of a General Rehabilitation and Monitoring Plan. May 2013.
- Wetland specialist input into the Environmental Management Plan for the upgrade of the Firgrove Substation, Western Cape. April 2013
- An audit of the wetlands in the City of Johannesburg. Specialist studies as well as project management and integration of independent datasets into a final report. Commenced in August 2007
- Input into the wetland component of the Green Star SA rating system. April 2009;
- A strategic assessment of wetlands in Gauteng to inform the GDACE Regional Environmental Management Framework. June 2008.
- As assessment of wetlands in southern Mozambique. This involved a detailed analysis of the vegetation composition and sensitivity associated with wetlands and swamp forest in order to inform the development layout of a proposed resort. May 2008.
- An assessment of three wetlands in the Highlands of Lesotho. This involved a detailed assessment of the value of the study sites in terms of functionality and rehabilitation opportunities. Integration of



the specialist reports socio economic, aquatic, terrestrial and wetland ecology studies into a final synthesis. May 2007.

- Ecological studies on a strategic scale to inform an Environmental Management Framework for the Emakazeni Municipality and an Integrated Environmental Management Program for the Emalahleni Municipality. May and June 2007



Name:	RUDI BEZUIDENHOUDT
ID Number	880831 5038 081
Name of Firm:	Limosella Consulting
Position:	Wetland Specialist
SACNASP Status:	pRsCInAT (Reg. No. 008867)

EDUCATIONAL QUALIFICATIONS

- B.Sc. (Botany & Zoology), University of South Africa (2008 - 2012)
- B.Sc. (Hons) Botany, University of South Africa (2013 – Ongoing)
- 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)
- 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)
- Tropical Coastal Ecosystems, edX (2015 – ongoing)

KEY EXPERIENCE

➤ **Wetland Specialist**

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 Gauteng, Limpopo, North-West Province Mpumalanga KwaZulu Natal, North-West Province, Western Cape, Eastern Cape & Northern Cape
- Ensuring the scientific integrity of wetland reports including peer review and publications.



Large Eskom projects include:

- Eskom 88kV Rigi – Sonland
- Eskom 88kV Simmerpan Line
- Eskom 88kV Meteor Line
- Eskom 88kV Kookfontein – Jaguar
- Eskom 132kV Dipomong
- Eskom 132kV Everest – Merapi
- Eskom 132kV Vulcan – Enkangala
- Eskom 400kV Helios – Aggenys
- Eskom 400kV Hendrina – Gumeni
- Eskom 765kV Aries – Helios
- Eskom 765kV Aries – Kronos
- Eskom 765kV Kronos – Perseus
- Eskom 765kV Perseus – Gamma
- Eskom 765kV Helios – Juno
- Eskom 765kV Aries- Helios

➤ **Biodiversity Action Plan**

This entails the gathering of data and compiling of a Biodiversity action plan.

➤ **Wetland Rehabilitation**

This entailed the management of wetland vegetation and rehabilitation related projects in terms of developing proposals, project management, technical investigation and quality control.

➤ **Wetland Ecology**

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.

➤ **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

➤ **Wetland 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.



EMPLOYEE EXPERIENCE:

➤ **GIS Specialist – AfriGIS**

January 2008 – August 2010

Tasks include:

- GIS Spatial layering
- Google Earth Street View Mapping
- Data Input

➤ **Wetland Specialist - Limosella Consulting**

September 2010 – Ongoing

Tasks include:

- GIS Spatial layering
- Wetland and Riparian delineation studies, opinions and functional assessments including data collection and analysis
- Correspondence with stakeholders, clients, authorities and specialists
- Presentations to stakeholders, clients and specialists
- Project management
- Planning and executing of fieldwork
- Analysis of data
- GIS spatial representation
- Submission of technical reports containing management recommendations
- General management of the research station and herbarium
- Regular site visits
- Attendance of monthly meetings
- Submission of monthly reports

MEMBERSHIPS IN SOCIETIES

- Botanical Society of South African
- SAWS (South African Wetland Society) Founding member
- SACNASP (Cert. Nat. Sci. Reg. No. 500024/13)



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

