DIGBY WELLS ENVIRONMENTAL

Your Preferred Environmental and Social Solutions Partner

Providing innovative and sustainable solutions throughout the resources sector

Environmental Impact Assessment Process for the Proposed Iphiva 400/132 kV Substation, KwaZulu-Natal

Wetland Impact Assessment

Prepared for:
SiVEST SA (Pty) Ltd

Project Number:
PEC7506

May 2023

Digby Wells and Associates (South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

Turnberry Office Park, Digby Wells House. 48 Grosvenor Road, Bryanston,2191

Phone: +27 (0) 11 789 9495
Fax: +27 (0) 11 789 9495
E-mail: info@digbywells.com
Website: www.digbywells.com

Directors: DJ Otto, J Mkhabela, L Ratsoenyane

This document has been prepared by Digby Wells Environmental.

Report Type:	Wetland Impact Assessment
Project Name:	Environmental Impact Assessment Process for the Proposed Iphiva 400/132 kV Substation, KwaZulu-Natal
Project Code:	PEC7506

Name	Responsibility	Signature	Date
Aamirah Dramat	Report Compilation	A. Dramat	April 2022
Joelene Govender	Report Compilation	JGovender	May 2023
Willnerie Janse van Rensburg	Site Assessment and Report Compilation	[signature]	May 2023
Byron Bester	Senior Reviewer	[signature]	May 2023
Danie Otto	ExCo Reviewer	[signature]	May 2023

DETAILS AND DECLARATION OF THE SPECIALIST

Digby Wells and Associates (South Africa) (Pty) Ltd

Contact person: Willnerie Janse van Rensburg

Digby Wells House
Turnberry Office Park
48 Grosvenor Road
Bryanston
2191

Tel: 011 789 9495
Fax: 011 789 9498
E-mail: Willnerie.vRensburg@digbywells.com

Brief Background of Specialist

Willnerie Janse van Rensburg is the Soil and Wetland Manager within the Closure and Rehabilitation Department of Digby Wells Environmental. She received her Bachelor of Science in Environmental Geography as well as her Honours degree in Soil Science from the University of the Free State. She has eight years of experience in the fields of Soil Science and Environmental Science. She has experience in completing soil and wetland baseline and impact assessments, soil and wetland delineations, biodiversity plans, wetland offsetting, soil and wetland rehabilitation, land use and capability assessments, irrigation scheduling and provides recommendations on soil amelioration. She has undertaken work in Mali, Sierra Leonne, Tanzania, Lesotho, Botswana and throughout South Africa. Willnerie is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals

Full name:	Willnerie Janse van Rensburg
Title/ Position:	Manager: Wetlands and Soils
Qualification(s):	BSc. (Hons) Soil Science
Experience (years):	8
Registration(s):	SACNASP: 117870

I, Willnerie Janse van Rensburg, declare that: –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
  - I declare that there are no circumstances that may compromise my objectivity in performing such work;

  - I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

May 2023

Signature of the Specialist *Date*

Findings, recommendations and conclusions provided in this report are based on the best available scientific methods and the author's professional knowledge and information at the time of compilation. Digby Wells employees involved in the compilation of this report, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

No form of this report may be amended or extended without the prior written consent of the author and/or a relevant reference to the report by the inclusion of an appropriately detailed citation.

Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

EXECUTIVE SUMMARY

Eskom SOC Limited (Eskom) undertook an Environmental Impact Assessment (EIA) process in 2017 in support of the "Northern KwaZulu-Natal Strengthening Project," which included the construction and operation of the Iphiva substation, associated infrastructure and two 400 kV powerlines, one between Normandie and Iphiva and the other between Iphiva and Duma.

Eskom intends to place the Iphiva substation in a new location that was not assessed in the previous EIA process ('the Project' and the Project Area) and requires a new EIA process to be completed in support of this Project. Margen Industrial Services cc (Margen) appointed Pensu Environmental (Pensu) to undertake this EIA process, who then subsequently requested Digby Wells Environmental (Digby Wells) to undertake updated individual specialist studies in support of the EIA. Following the submission of the draft reports in April 2022, for review by Eskom, the Project layout was amended and now includes an additional potential site for the proposed substation which avoids an artificial wetland system (dam and drainage line). Additionally, Eskom is considering a new access road to the proposed updated layout. This infrastructure was not included in the previous impact assessments. The updated layout required additional assessment by the specialists.

This Wetland Impact Assessment report aims to identify and quantify the potential impacts on wetlands and their supporting ecosystem services due to the development of the proposed Iphiva substation and associated infrastructure (including an access road) and should be read in conjunction with the Fauna and Flora and other specialist reports.

Wetland Delineations

No wetlands were identified within the direct footprint of the infrastructure (Project Area), however, artificial wetlands (dam and drain) and four wetland Hydrogeomorphic (HGM) units were identified within the 500 m regulated area of the Project Area (Area of Influence (AoI)).

The dam is however not connected to a natural watercourse and fills up via re-directed surface runoff using an artificial drain and precipitation. The dam dries up in the dry season. The dam is an artificial wetland system/watercourse, however, has the same legal status as natural wetland systems/water courses in South Africa. The wetlands were categorised into the following HGM units:

- Two Unchannelled Valley Bottom Wetlands (UVB) with a distinct Riparian Zone;
- Two Channelled Valley Bottom Wetlands (CVB) with a distinct Riparian Zone; and
- Artificial wetlands, including a dam and drain.

The natural wetlands cover approximately 9.96 hectares (ha) of the AoI, and the Artificial wet areas (dam and drain) cover approximately 0.6 ha. The infrastructure is not proposed within any delineated wetland/watercourse, however, falls within the 500 meters (m) regulated area. The updated layout avoids the artificial dam and drain.

Wetland Health and Functionality

The delineated wetlands were mostly defined as seasonal or temporary riparian wetlands due to the high runoff potential, shallow soil depths and lateral movement of water. All the natural wetlands were classified as having a Present Ecological State (PES) Category C (Moderately Modified), whereas the artificial wet areas were classified as having a PES E (seriously modified) (adapted methodology). It is therefore expected that the proposed activities will lead to negligible changes to the natural wetlands' PES scores, as the wetlands are not directly impacted by the proposed activities. The riparian/wetland areas, as well as the surrounding catchment area, are dominantly used for agropastoral activities (including subsistence cultivation and livestock-rearing) and established infrastructure (including roads, fence lines, bridges and culverts). Consequently, sections of the wetlands have been cleared of vegetation for cultivation and are heavily overgrazed, which leads to a low base vegetation cover, evidence of head-cut erosion in selected areas and sedimentation within the downstream systems.

Soils within the seasonal and permanent wet areas were observed to support hydrophytic plants, whilst soils near the edge of the streams (temporary zones) were dry and supported typical terrestrial and riparian vegetation. Established linear infrastructure, including fence lines, drainage lines, stormwater trenches, and roads has led to the formation of large erosion gullies. Due to the shallow nature of the soils and high runoff potential, the soils are highly mobile and susceptible to erosion, leading to sedimentation of the low-lying areas.

The Ecosystem Services (EcoServices) of all the wet areas ranged from Very Low to Low. The highest EcoServices provided by the natural wetlands is biodiversity maintenance and the highest EcoServices provided by the Artificial wet areas is a water supply for domestic and animal use. The wetland and riparian areas also serve as sediment traps and supply water for domestic purposes, as well as provide natural provisioning resources for water, food, firewood and medicinal plants.

The sensitivity of wetlands in the AoI was assessed based on the opinion of the specialist, considering the PES and EcoServices ratings. The sensitivities ranged from Medium to Low. The most sensitive wetlands are associated with the wetlands containing Species of Conservation Concern (SCC), including *Crinum macowanii, Sclerocarya birrea subsp caffra and Spirostachys africana*.

Impact Assessment

The overall impacts of the Project on the natural wetlands within the AoI were determined to be minor to negligible prior mitigation and largely negligible significance following the implementation of the proposed mitigation measures. It is the opinion of the specialist that should the proposed mitigation measures and monitoring programme be implemented correctly; the impacts on the natural wetlands will be insignificant.

Recommendations

The following actions are recommended to reduce adverse effects on the wetlands within the proposed Project Area and AoI:

- Limit infrastructure within wetlands as far as practically possible to avoid and minimise impacts on adjacent and downstream wetlands (e.g., sedimentation, erosion and contamination
- Establish at least a 15 m buffer around the CVB wetlands and a 16 m buffer around the UVB wetlands to protect wetland areas from infrastructure that may lead to erosion and sedimentation of the receiving watercourses (refer to the buffer tool assessment in Section 8);
- Rehabilitate impacted wetlands within the AoI (only when impacted by the proposed activities);
- Monitor and mitigate wetlands affected by the activities;
- Ensure rehabilitation with special attention to reshaping the impacted areas, re-vegetating and mitigating potential contamination;
- A protective barrier/ no-go buffer against cattle should be implemented around the rehabilitated areas, during the rehabilitation phase only, to ensure the re-establishment of vegetation as soon as possible to maintain the wetland functionality and prevent erosion, sedimentation and creation of preferential flow paths;
- Promote the naturally diffuse flow of water through the landscape from the infrastructure areas to prevent erosion (or channelisation), sedimentation and formation of preferential flow paths;
- Implement the recommended monitoring program to detect impacts to the wetlands within the AoI early on and implement remediation/remedies as soon as impacts are observed; and
- Reduce the risk of erosion, compaction, and the creation of preferential flow paths by re-vegetating exposed areas, maintaining linear infrastructure and culverts and installing sediment traps and erosion berms.

It is recommended to follow the mitigation hierarchy which includes firstly the avoidance of an impact. When it is not possible to avoid an impact, the next step is to minimise the impact and thereafter rectify or reduce the impact.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS, ABBREVIATIONS AND DEFINITION

°C	Degree Celsius
AIP	Alien Invasive Plant
CBA	Critical Biodiversity Area
cm	Centimetre
CMA	Catchment Management Agencies
CSIR	Council for Scientific and Industrial Research
CVB	Channelled Valley Bottom Wetlands
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPr	Environmental Management Program
EP	Environmental Practitioner
ESA	Ecological Support Area
Eskom	Eskom SOC Limited
FEPA	Freshwater Ecological Priority Area
ha	Hectare
HGM	Hydro-geomorphic
ILISO	ILISO Consulting (Pty) Ltd
IUCN	International Union for Conservation of Nature
km	Kilometre
m	Metre
m.a.m.s.l.	Metres above mean sea level
mm	Millimetre

NBA	National Biodiversity Assessment
NBF	National Biodiversity Framework
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecological Priority Area
NWA	National Water Act, 1998 (Act No. 36 of 1998)
ONA	Other Natural Area
PA	Protected Area
Pensu	Pensu Environmental
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SFI	Soil Form Indicator
SWI	Soil Wetness Indicator
SWMP	Storm Water Management Plan
TUI	Terrain Unit Indicator
UVB	Unchannelled Valley Bottom Wetlands
WET-EcoServices	Wetland Ecological Services
WET-Health	Wetland Ecological Health Assessment
WMA	Water Management Areas
WWF	Worldwide Fund for Nature

1. Introduction

Eskom SOC Limited (Eskom) undertook an Environmental Impact Assessment (EIA) process in 2017 in support of the "Northern KwaZulu-Natal Strengthening Project" which included the construction and operation of the Iphiva substation, associated infrastructure and two 400 kV powerlines, one between Normandie and Iphiva and the other between Iphiva and Duma. ILISO Consulting (Pty) Ltd (trading as NAKO ILISO Consulting [Pty] Ltd) (ILISO) undertook the EIA process as the independent Environmental Assessment Practitioners (EAPs) on Eskom's behalf.

Eskom intends to place the Iphiva substation in a new location not assessed in the previous EIA process ('the Project' and the Project Area) and requires a new EIA process to be completed in support of this Project. Margen Industrial Services cc (Margen) appointed Pensu Environmental (Pensu) to undertake this EIA process, who then subsequently requested Digby Wells Environmental (Digby Wells) to undertake updated individual specialist studies in support of the EIA.

Following the submission of the draft reports for review by Eskom, the Project layout was amended and now includes an additional potential site for the proposed substation which avoids an artificial wetland system (dam and drainage line). Additionally, Eskom is considering a new access road to the proposed updated layout. This infrastructure was not included in the previous impact assessments. The updated layout required additional assessment by the specialists.

This Wetland Impact Assessment report aims to identify the potential impacts on wetlands and their supporting ecosystem services due to the development of the proposed Iphiva substation and associated infrastructure (including an access road) and should be read in conjunction with the Fauna and Flora and other specialist reports.

1.1. Project Background

Eskom proposes to establish the Iphiva 400/132 kilo volt (kV) substation to "de-load" the primary sub-transmission network and improve voltage regulation to alleviate existing and future network constraints in northern KwaZulu-Natal.

To achieve this strategic objective, Eskom plans to construct the new Iphiva 400/132 kV substation near the town of Mkuze, which will be integrated into the 400 kV network by two 400 kV lines. The location of the Iphiva substation has changed since the compilation of the previous EIA (Digby Wells Environmental, 2018) and therefore a new EIA process will be completed.

The previous EIA process was completed and authorised for four separate applications, including two applications for 400 kV transmission lines, one for the 132 kv distribution line and one for the Iphiva Substation. The Iphiva Substation is however planned to be moved 50 meters northwest due to the high expense of cut and fill required for the already authorised site and to avoid the artificial dam and drain.

The proposed substation will comprise of the following:

- A total footprint of 600 x 600 m (i.e., 36 ha) will be required for the development, within a site-specific study area of 1km x 1 km. This footprint will include construction requirements and will be rehabilitated and fenced off.
- The 36-ha development footprint area includes provisions for the following:
  - 80 m high microwave radio communication mast; and
  - Oil and fuel storage facilities, and an oil bund to contain any accidental transformer oil spills.
- The proposed substation will comprise standard electrical equipment, including transformers, reactors, busbars, and isolators.

A new main access road will be established to provide access to the Iphiva Substation. The proposed road will be as follows:

- The main access road (gravel) will be approximately 6 - 7m wide and approximately 2.1km in length; and
- It should be noted that the proposed project site will be accessed via a new proposed road from the P234 Gravel Road which branches off the N2 National Road. The proposed project location is approximately 9km north-west of the N2 National Road.

For this project to be realised, Eskom is required to undertake an Environmental Authorisation (EA) process in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

1.2. Study Areas

For the purpose of this report, the following applies:

- Project Area defines the newly proposed Iphiva substation footprint (red section on the maps); and
- Area of Influence (AoI) defines a 500 m regulated area around the Project Area in terms of the potential impact the Project will have on the wetlands. The Zone of Regulation is the 500m area surrounding a wetland in which activities must be authorised by a Water Use Licence (WUL).

1.3. Project Locality

The Project is located near the town of Mkuze in the Zululand District Municipality, northern KwaZulu-Natal (Figure 1-1, Figure 1-2, Table 1-1). Land use varies across the area with dispersed rural settlements, subsistence farming, areas formally protected for conservation, private game farms and linear peri-urban development adjacent to the National Route 2 (N2).

Table 1-1: Summary of the Project Location Details

Province	KwaZulu-Natal
District Municipality	Zululand District Municipality
Local Municipality	Phongolo Local Municipality
Nearest Town	Mkuze (~ 50 km)
GPS Co-ordinates **(Relative centre point of study area)**	27°39'06.9"S
	31°56'06.4"E

1.4. Project Description and Proposed Activities

A substation must be situated within proximity to an existing network, in this instance the existing 132 kV KZN network. It is envisaged that a total footprint of 400 x 400 metres (m) (i.e. 0.04 hectares (ha)) will be required for the development footprint, within a site-specific Project Area of 1 x 1 kilometres (km). The development footprint area includes provisions for an 80 m high microwave radio communication mast, oil and fuel storage facilities, and an oil bund to contain any accidental transformer oil spills (Figure 1-3).

The proposed substation will comprise standard electrical equipment, including but not limited to:

- Transformers;
- Reactors;
- Busbars; and
- Isolators.

The substation will accommodate three, 400 kV and seven, 132 kV powerlines entering/leaving the site in various directions. The proposed infrastructure is shown in Figure 1-3 and activities of the Project per phase are provided in Table 1-2 below. Construction is scheduled to commence in 2023 and will take approximately 24 months to complete.

Table 1-2: Project Phases and Associated Activities

Project Phase	Associated Activities
Construction Phase	• Vegetation clearing; • Surface clearing, levelling and terracing; • Laying of concrete foundations and other applicable works such as storm water drainage pipes, slabs, bund walls, control room and storage facilities; • Erection of steelworks; • Delivery and installations of transformers; and • Construction of access roads.
Rehabilitation Phase	• Rehabilitation around areas disturbed by construction activities; and • Vegetation management around the substation.
Operational Phase	• Maintenance of substation and associated infrastructure (including the access road).

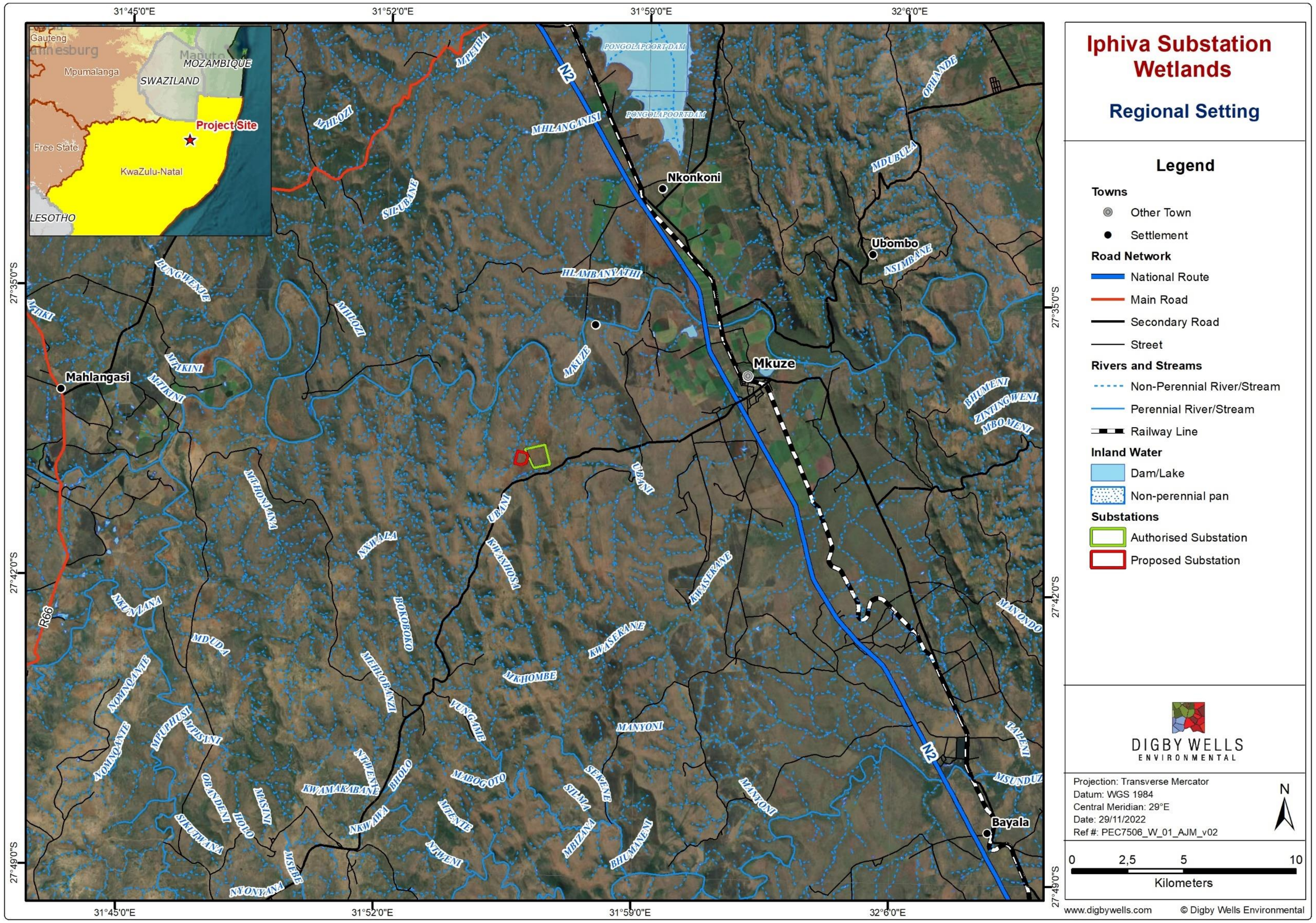


Figure 1-1: Regional Setting of the Project Area

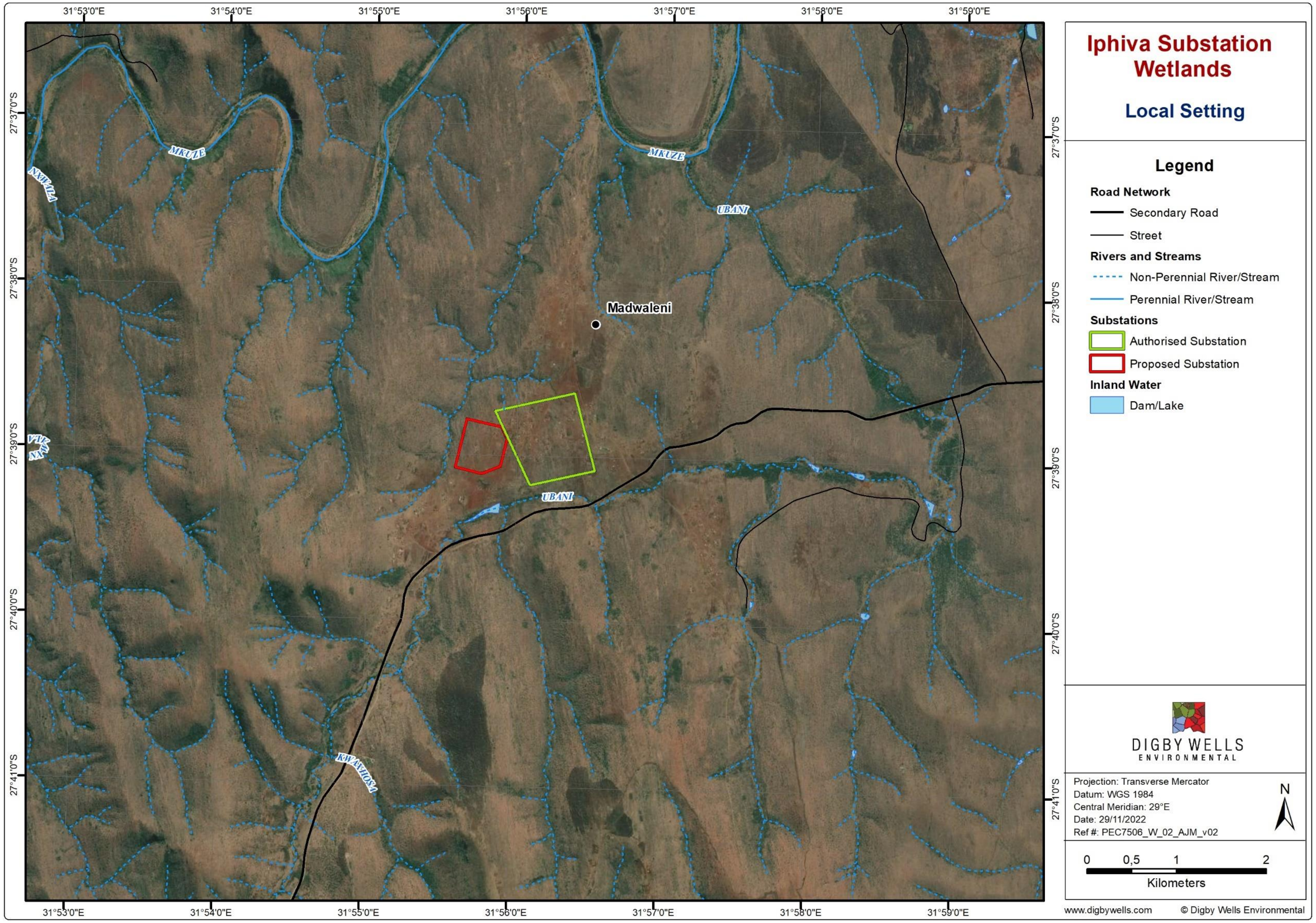


Figure 1-2: Local Setting of the Project Area

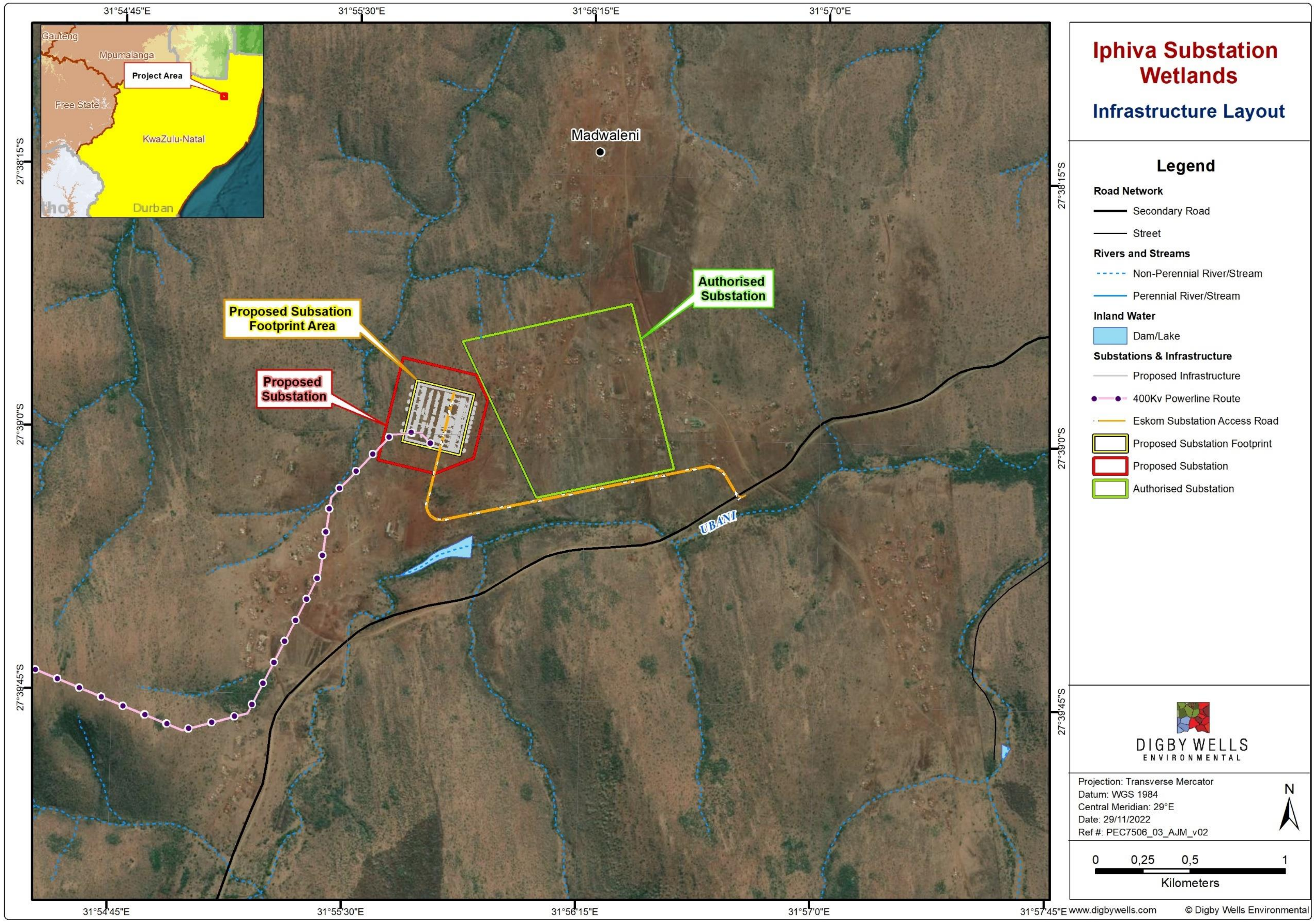


Figure 1-3: Proposed Plant Infrastructure Layout of the Project Area

2. Relevant Legislation, Standards and Guidelines

The Project is required to comply with all the obligations in terms of the provisions of the National legislations, regulations, guidelines and by-laws. The guidelines directing the Wetland Assessment are detailed in Table 2-1.

Table 2-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law
Section 24 of the Constitution of the Republic of South Africa,1996 (Act No. 108 of 1996) Wetlands are protected under the Act which states that everyone has the right to an environment that is not harmful to their health or well-being. It also states that the environment must be protected for the benefit of present and future generations through responsible legislative measures. The Act: • Prevents pollution and ecological degradation; • Promote conservation and secure ecological sustainability; and • Promote justifiable economic and social development using natural resources.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). NEMA (as amended) was set in place under Section 24 of the Constitution. Certain environmental principles under NEMA must be adhered to, to inform decision making for issues affecting the environment. Section 24 of NEMA states that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment must be considered, investigated and assessed before their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* • The NEMA requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimised and treated.
The National Water Act, 1998 (Act No. 36 of 1998) (NWA) • Section 19 of the National Water Act (NWA), 1998 (Act 36 of 1998) that includes the prevention and remediation of the effects of pollution; and • Section 21 of the NWA (Act 36 of 1998) includes Water Uses.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: • Alien and Invasive Species Lists, 2020 (terms of GNR 1003 in GG 43726 dated 18 September 2020 – effective from 18 October 2020); • Threatened and Protected Species Regulations; and • National list of Ecosystems Threatened and in need of protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GNR 1002, 9 December 2011).
Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005) To delineate any wetland the following criteria are used in line with the Department of Water Affairs and Forestry (DWAF): A practical field procedure for identification and delineation of wetlands and riparian areas (2005). These criteria are: • Topographical location of the wetland in the landscape; • Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation (such as grey horizons, mottling streaks, hardpans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation); • A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 centimetre (cm) of the soil; and • The presence, at least occasionally, of water-loving (hydrophilic) plants (i.e. hydrophytes).
Wetland Management Series (published by Water Research Commission (WRC, 2007) The WET-Management Series is a set of integrated tools that can be used to guide well-informed and effective wetland management and rehabilitation.

Legislation, Regulation, Guideline or By-Law
The WET-Management tools are designed to be used at different spatial and institutional levels as needed, from national and provincial to the level of specific wetland sites involving individual landowners, to meet a range of wetland management and rehabilitation needs.
National Freshwater Ecosystems Priority Areas (NFEPA), (Nel, et al., 2011)**)** The NFEPA project was a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water and Sanitation (DWS) formerly known as the Department of Water Affairs and Forestry (DWAF)), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute for Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The NFEPA project aimed to: • Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and • Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers. The NFEPA study responded to the high levels of threat prevalent in a river, wetland, and estuary ecosystems of South Africa. It provides strategic spatial priorities for conserving the country's freshwater ecosystems and supporting the sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or 'FEPAs'.

3. Assumptions, Limitations and Exclusions

The compilation of this Impact Assessment Report is based on the following assumptions and limitations in Table 3-1.

Table 3-1: Limitations and Assumptions with Resultant Consequences

Assumptions and Limitations	Consequences
No additional site assessment was undertaken for this updated Wetland Impact Assessment Report (amended layout)	Some discrepancies may occur such as the confidence level of delineations and wetland health assessments. The additional areas/ systems were scrutinised at a desktop level using aerial imagery, contours and available digital elevation models.
This wetland study forms part of a larger EIA and should be read in conjunction with the EIA and other related specialist studies.	This report does not include any other specialist studies other than the wetland assessment. The wetland report cannot be used as a stand-alone report in the application for a WUL.

4. Details of the Specialist

The following is a list of Digby Wells' staff who were involved in the Wetland Environmental Impact Assessment:

- **Danie Otto** manages the South African Operations and Technical Services at Digby Wells. He holds an M.Sc. in Environmental Management with B.Sc. Hons (Limnology & Geomorphology, and GIS & Environmental Management) and B.Sc. (Botany and Geography & Environmental Management). He is a biogeomorphologist that specialises in ecology of wetlands and rehabilitation. He has been a registered Professional Natural Scientist since 2002. Danie has over 25 years of experience in the mining industry in environmental and specialist assessments, management plans, audits, rehabilitation, and research. He has experience in 8 countries and his experience is in the environmental sector of coal, gold, platinum (PGMs), diamonds, asbestos, rock, clay & sand quarries, copper, phosphate, andalusite, base metals, heavy minerals (titanium), uranium, pyrophyllite, chrome, nickel etc. He has wetland and geomorphology working experience across Africa including specialist environmental input into various water resource related studies. These vary from studies of the wetlands of the Kruger National Park to swamp forests in central Africa to alpine systems in Lesotho.
- **Byron Bester** attained his master's degree in aquatic health from the University of Johannesburg. He has the experience and broad knowledge of various aspects of aquatic ecosystem assessment throughout South Africa and abroad (i.e. Botswana, Democratic Republic of Congo, Ghana, Namibia, and Zambia), including water quality assessment, sediment composition, fish biometric indices determination,

histopathological fish health assessments and human health risk assessments via the consumptive pathway. He has completed numerous specialist aquatic biodiversity assessments in a wide range of sectors, including mining (e.g. coal, gold, platinum, titanium, etc.), industrial (e.g. smelters, brick-making projects, special economic zones, etc.), transport infrastructure upgrades (e.g. roads, airports, etc.), services infrastructure (e.g. powerline installations, bulk water pipelines, etc.), as well as mixed-use, residential and commercial developments

- **Willnerie Janse van Rensburg** is the Soil and Wetland Manager within the Closure and Rehabilitation Department of Digby Wells Environmental. She received her Bachelor of Science in Environmental Geography as well as her Honours degree in Soil Science from the University of the Free State. She has seven years of experience in the fields of Soil Science and Environmental Science. She has experience in completing soil and wetland baseline and impact assessments, soil and wetland delineations, biodiversity plans, wetland offsetting, soil and wetland rehabilitation, land use and capability assessments, irrigation scheduling and provides recommendations on soil amelioration. She has undertaken work in Mali, Sierra Leonne, Tanzania, Lesotho, Botswana and throughout South Africa. Willnerie is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.
- **Aamirah Dramat** is a Rehabilitation Consultant in the Rehabilitation, Closure and Soils Department at Digby Wells. She received her Bachelor of Science Degree in Applied Biology and Environmental and Geographical Science (EGS) as well as her Honours Degree in Biological Sciences from the University of Cape Town. She joined Digby Wells in 2020 as a Rehabilitation Intern and has since gained experience in the environmental services sector with specialised focus on Soils, Wetlands and Rehabilitation, both locally and internationally. She has been involved in the report compilation and undertaking of Baseline Assessments, Environmental Impact Assessments (EIAs), Rehabilitation and Closure Plans (RCPs), Rehabilitation Strategy and Implementation Plans (RSIPs), Alien Invasive Plant (AIP) Assessments, Re-vegetation Trial Studies and Monitoring Assessments. Aamirah is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.

5. Methodology

This section provides the methodology used in the compilation of the Wetland Impact Assessment Report. A detailed methodology is described in Appendix A and is summarized in Figure 5-1 below.

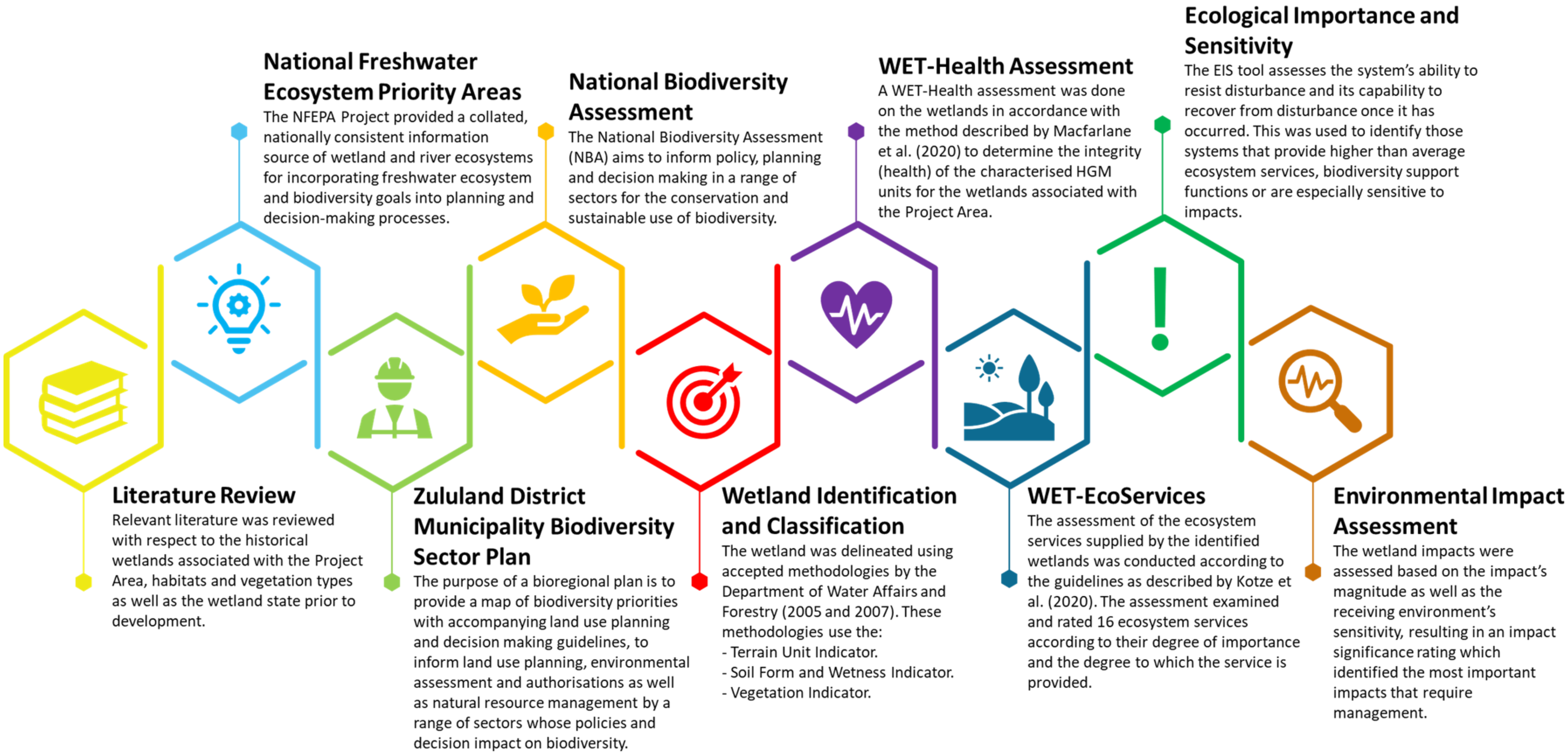


Figure 5-1: Wetland Scoping Assessment Methodology

6. Regional Baseline Environment and Desktop Review

Relevant literature was reviewed concerning the wetlands associated with the Project Area. This includes the habitats and vegetation types as well as the wetland state. Baseline, background information and the previously conducted site assessment were researched and used to understand the Project Area. The baseline information is described in Table 6-1 below.

Table 6-1: Baseline Environment of the Project Area

Ecoregional Context (Kleynhans, Thirion, & Moolman, 2005; Darwall, Smith, Tweddle, & Skelton, 2009; Climate-data.org, n.d.)		**Plant Species Characteristic of the Zululand Lowveld (SVI 23)** (Mucina & Rutherford, 2012) **(Figure 6-1)**	
Ecoregion	Zululand Lowveld	Tall, Small and Succulent Trees	Tall Trees*: Senegalia burkei, S. nigrescens, Sclerocarya birrea subsp. caffra.* Small Trees*: Vachellia tortilis subsp. heteracantha, V. gerrardii, V. natalitia, V. nilotica, S. senegal var. rostrata, A. welwitschii subsp. welwitschii, Boscia albitrunca, Combretum apiculatum, C. molle, Ozoroa paniculosa, Phoenix reclinata, Schotia brachypetala, Spirostachys africana, Teclea gerrardii, Ziziphus mucronata.* Succulent Trees: *Aloe marlothii subsp. marlothii, Euphorbia grandidens, E. ingens.*
Köppen-Geiger Climate Classification (Köppen & Geiger, 1936)	*Bsh* (Hot semi-arid climate)	Tall, Low and Soft Shrubs	Tall Shrubs: *Dichrostachys cinerea, Euclea divinorum, Coptosperma supra-axillare, Crotalaria monteiroi, Euclea crispa subsp. crispa, E. schimperi, Galpinia transvaalica, Gardenia volkensii, Gymnosporia maranguensis, G. senegalensis, Jatropha zeyheri, Lycium acutifolium, Olea europaea subsp. africana, Tarchonanthus parvicapitulatus, Tephrosia polystachya, Triumfetta pilosa var. tomentosa.* Low Shrubs: *Barleria obtusa, Crossandra greenstockii, Felicia muricata, Gymnosporia heterophylla, Indigofera trita subsp. subulata, Justicia flava, J. protracta subsp. protracta, Melhania didyma, Orthosiphon serratus, Pearsonia sessilifolia, Ruellia cordata, Sida serratifolia, Tetraselago natalensis.* Succulent Shrubs: *Euphorbia grandicornis, E. trichadenia, E. vandermerwei.* Soft Shrub: *Pavonia columella.*
Mean Annual Precipitation (mm)	621	Herbaceous Climber	*Fockea angustifolia.*
Rainfall Seasonality	Early to late summer	Graminoids	*Dactyloctenium australe, Enteropogon monostachyus, Eragrostis capensis, E. curvula, E. racemosa, Heteropogon contortus, Panicum maximum, Sporobolus pyramidalis, Themeda triandra, Aristida bipartita, A. congesta, Bothriochloa insculpta, Chloris mossambicensis, Cymbopogon caesius, Digitaria natalensis, Leptochloa eleusine, Panicum deustum, Schizachyrium sanguineum, Setaria incrassata, Sporobolus nitens, Trachypogon spicatus, Tristachya leucothrix.*
Mean Annual Temp. (°C)	21.1	Herbs	*Acrotome hispida, Aloe parvibracteata, Argyrolobium rupestre, Aspilia mossambicensis, Chamaecrista biensis, C. mimosoides, Corchorus asplenifolius, Felicia mossamedensis, Gerbera ambigua, Helichrysum rugulosum, Hibiscus pusillus, Kohautia virgata, Lotononis eriantha, Senecio latifolius, Stachys aethiopica, Tragia meyeriana, Vernonia capensis.*
Water Management Area	Pongola-Mtamvuna	Status	Vulnerable.
Quaternary Catchment (Figure 6-2)	W31G	**Zululand District Municipality Biodiversity Sector Plan** (Ezemvelo KZN Wildlife, 2015) **(Figure 6-3)**	
Watercourse	Mkuze River and Mtiki Tributary	The northwest corner and southern section of the authorised substation consist of land classified as **Critical Biodiversity Area (CBA) Irreplaceable,** associated with riparian wetlands**.** A minor section of the northwest corner of the footprint of the proposed substation is also classified as **CBA Irreplaceable**. A large area to the northeast of the Project Area (approximately 2 km away) is classified as a corridor connecting CBA Irreplaceable terrestrial feature, Zululand Rhino and Somkhanda Nature Reserve to the iThala landscape corridor.	
National Biodiversity Assessment (NBA) (SANBI, 2018)		**National Freshwater Ecological Priority Area (NFEPA) Wetland Classification** (Nel, et al., 2011) **(Figure 6-5)**	
No areas within the Project Area were classified under the NBA. The Hlambanyathi River located to the far north and two areas located to the north-west of the Project Area have a Wetland Ecosystem Threat Status of Endangered and Vulnerable, respectively, and are Poorly Protected at a Wetland Ecosystem Protection Level.		NFEPA Wetlands	No FEPA Wetlands are located within the Project Area. Below the Project Area is a Channelled Valley Bottom (Rank 6), which has also been verified on site as a low-capacity dam within a riparian/UVB wetland system.
		River FEPA	The Mkuze River, to the far North of the Project Area, is classified as a Class A: Unmodified, Natural NFEPA River.

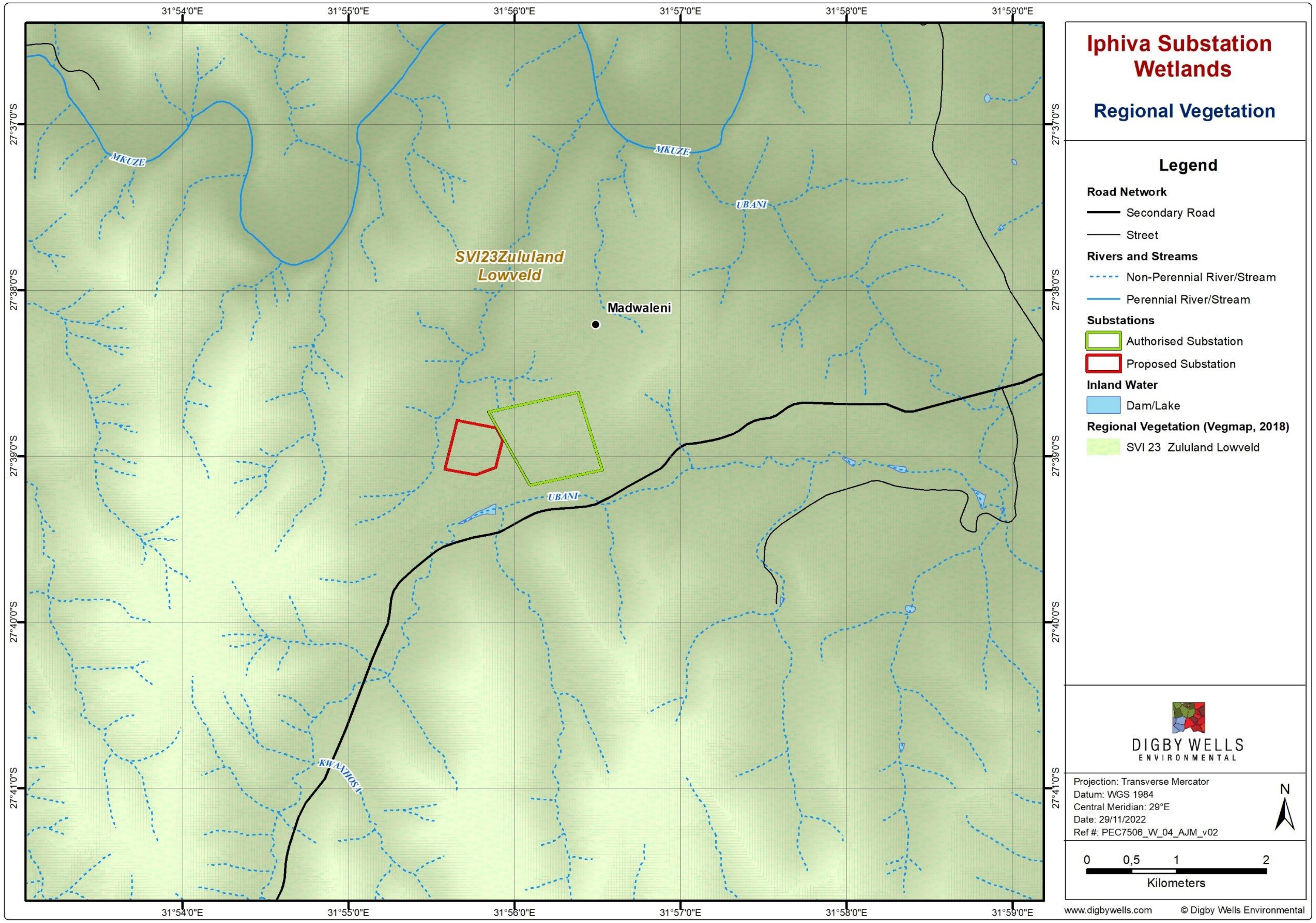


Figure 6-1: Regional Vegetation

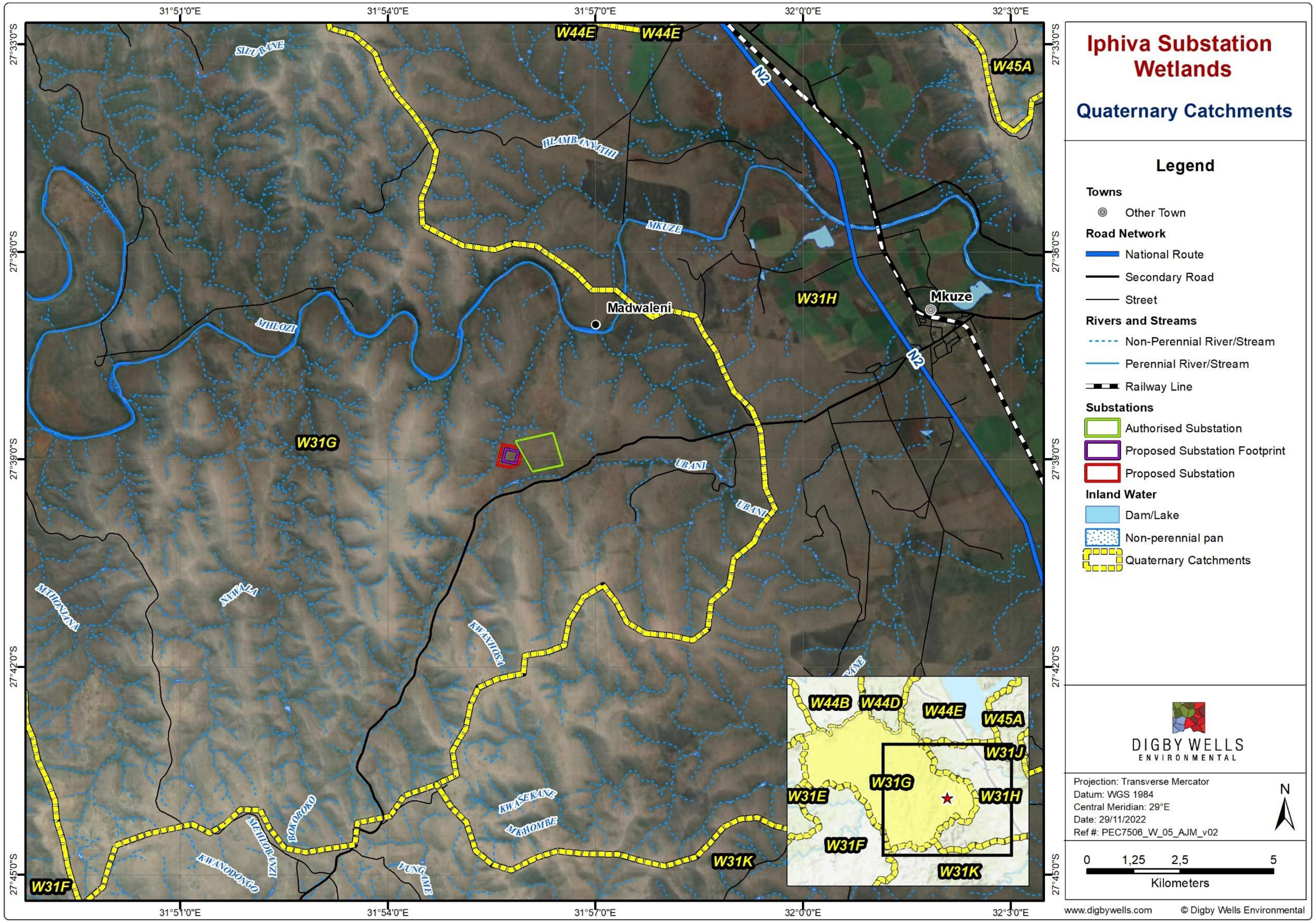


Figure 6-2: Quaternary Catchment

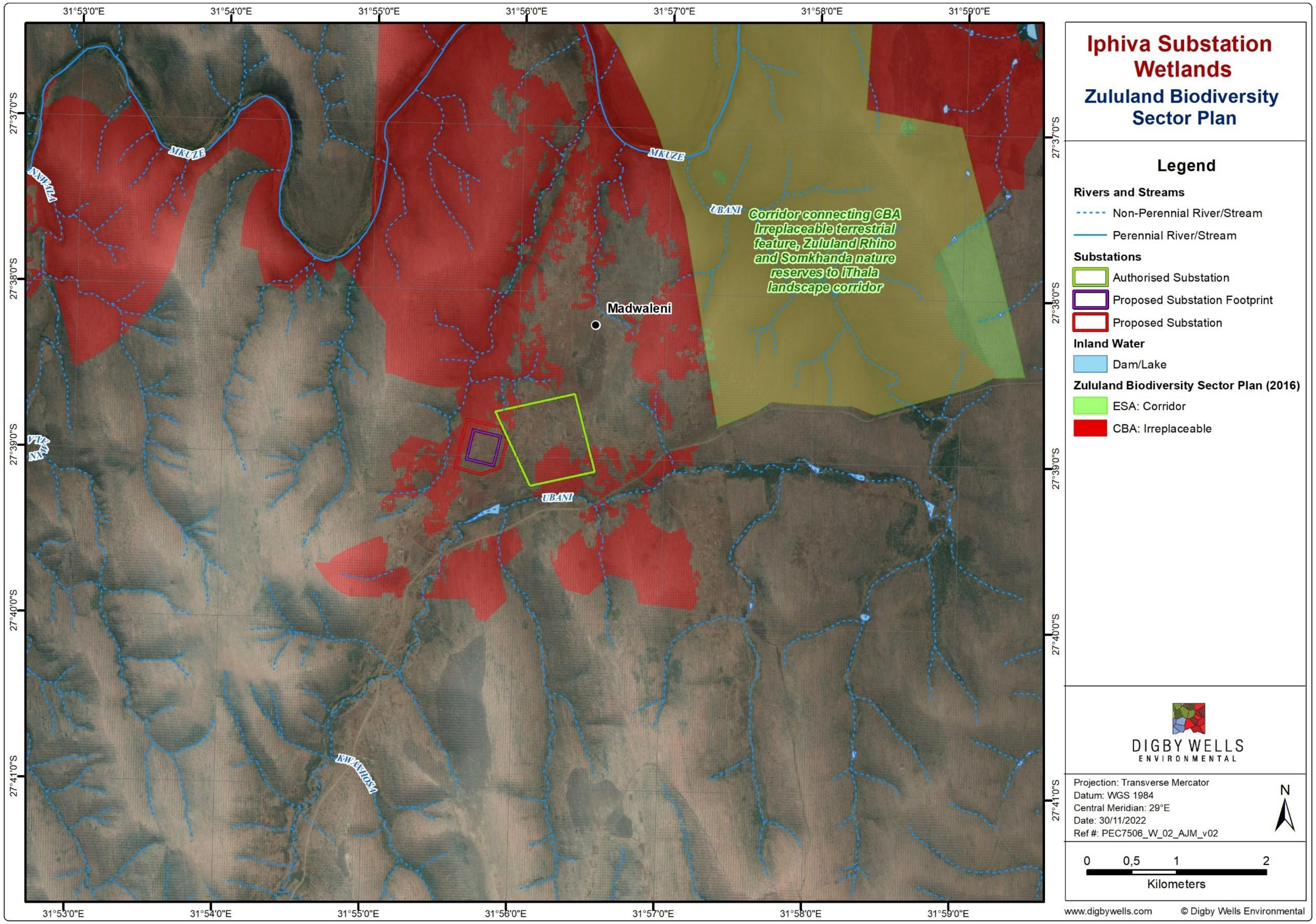


Figure 6-3: Zululand District Municipality Biodiversity Sector Plan

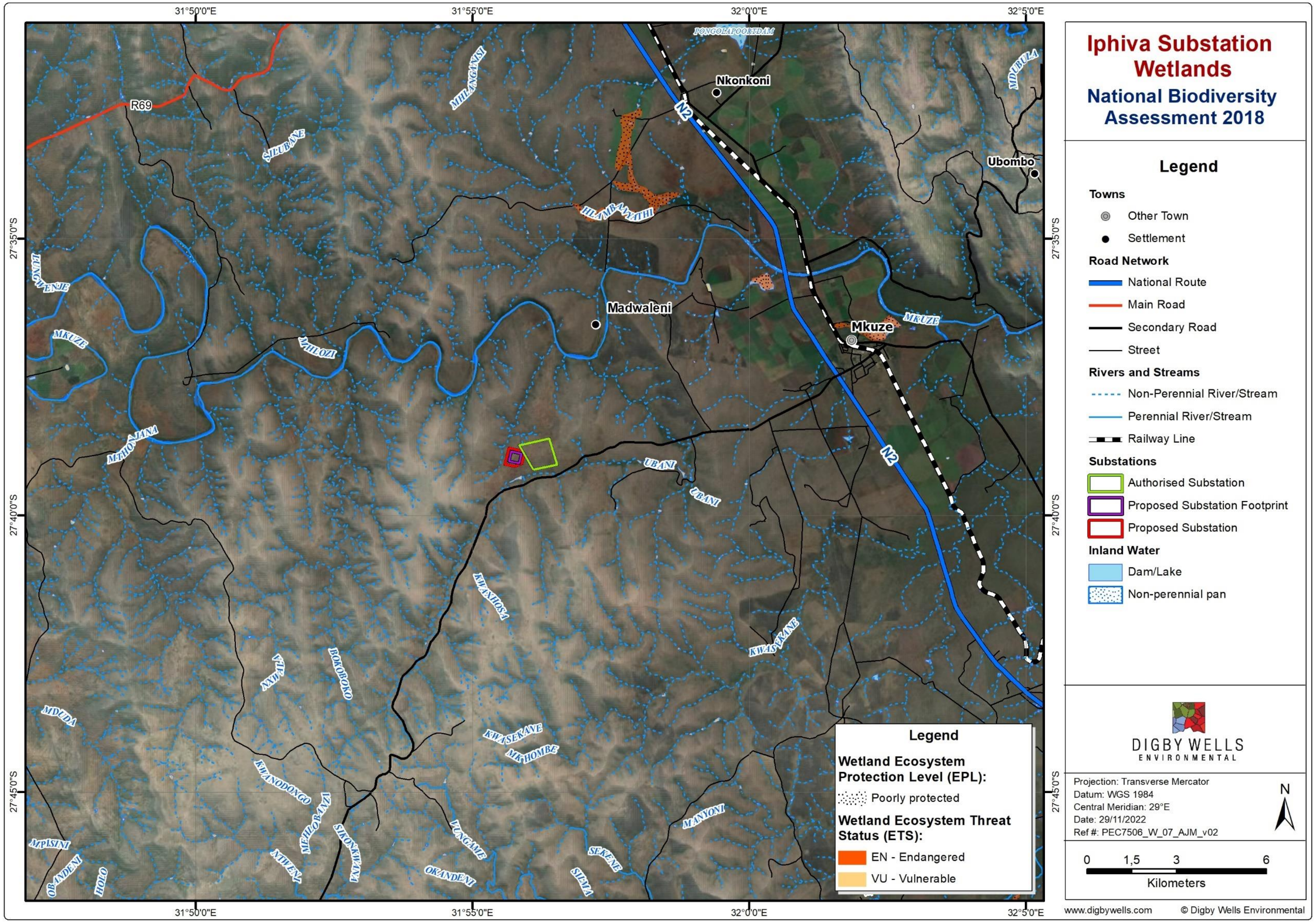


Figure 6-4: National Biodiversity Assessment

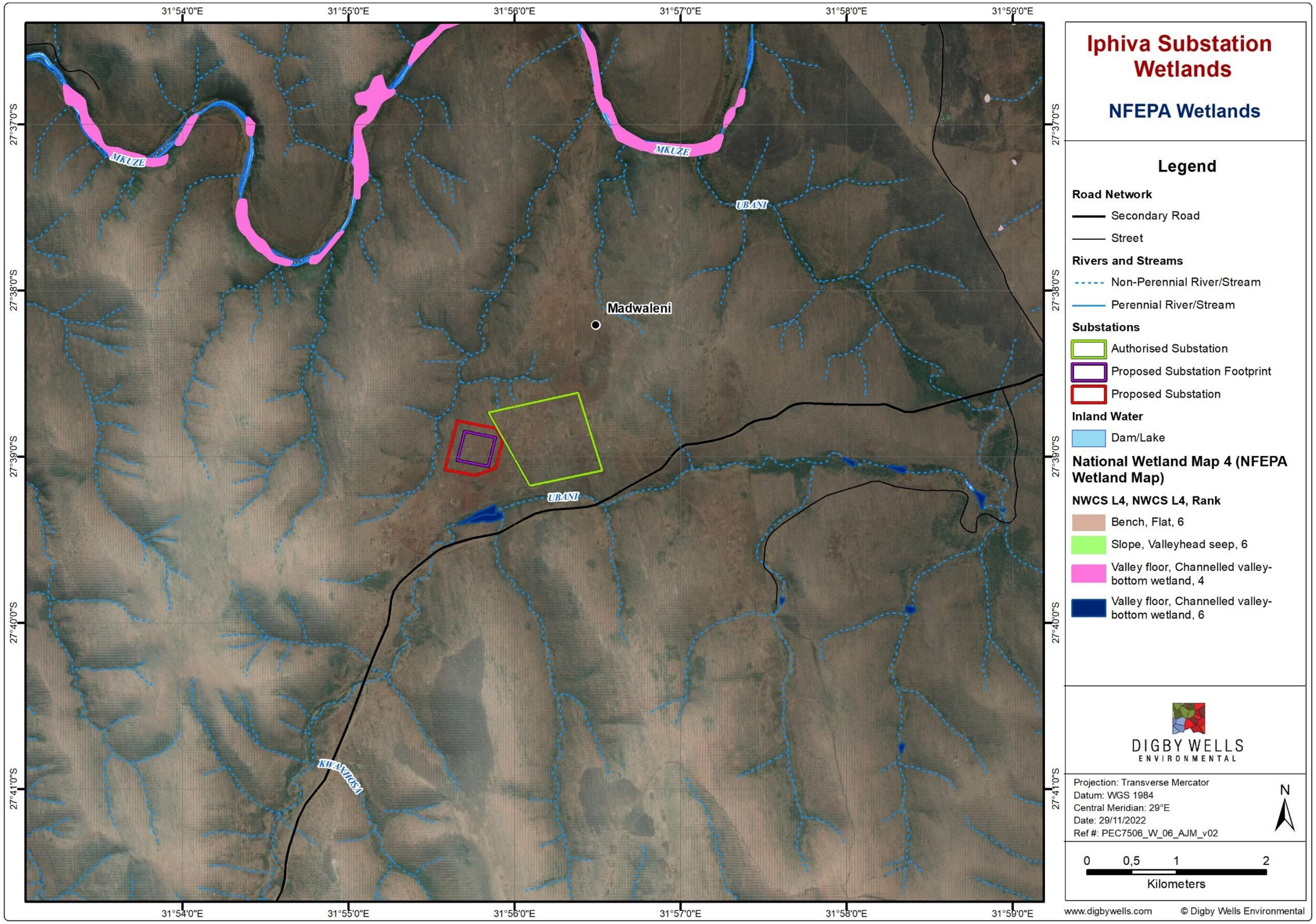


Figure 6-5: NFEPA Wetlands

7. Results and Discussion

The wetlands associated with the previous layout were desktop delineated and confirmed during a rapid site survey. In addition, the site observations and surrounding land use activities were considered for interpretation and determination of the wetland Present Ecological State (PES) and Ecosystem Services (EcoServices). The site survey was conducted in April 2022. The layout was however updated following the Scoping and Impact Assessment Report recommendations to avoid impacts to the existing artificial wet areas. This updated Impact Assessment Report is therefore solely desktop based and information from the previous assessment was used to determine the preliminary impacts on the wetlands.

Dams and artificial wet areas were delineated to measure the extent of the existing disturbances. The origin of wetlands is not distinguished in the various Acts that protect them in South Africa and therefore artificial wetlands enjoy legal protection.

A dam and artificial drain have been identified in the AoI. The dam is however not connected to a natural water course and fills up through the artificial drain, surface runoff and rainwater. The dam dries up in the dry season.

The riparian/wetland areas were mainly impacted by cattle grazing, historical cultivation and infrastructure. Soils within the wet areas were observed to support hydrophytic plants, whilst soils near the edge of the riverbanks were dry and supported typical terrestrial and riparian vegetation. Plant communities undergo distinct changes in species composition as one moves along the wetness gradient from the centre of a wetland to its edge and into adjacent terrestrial areas. This change in species composition provides valuable indications for determining the wetland boundary and wetness zones (DWAF, 2007). The outer boundary of the wetland is defined as the point where the indicators are no longer visible. The soil and plant indicators were used to delineate watercourses (as described in more detail in the subsections below).

The catchment has been impacted by dominantly agropastoral activities (cultivation and livestock). Sections of the HGM units have been cleared of vegetation for cultivation as well as overgrazed, leading to low base cover, head-cut erosion and sedimentation into the downstream systems.

Linear infrastructure, including fence lines, drainage lines, stormwater trenches and roads has led to large erosion gullies. Due to the shallow nature of the soils, the soils are highly mobile and susceptible to erosion, leading to sedimentation of the low-lying areas.

The riparian/wetland areas have been identified as temporary and seasonal wetland zones. Furthermore, the freshwater catchment has been modified as an outcome of changes in the water input volumes and flow regimes, as well as water distribution and retention patterns of water passing through the wetlands.

7.1. Wetland Delineation

The wetland delineation was completed and updated according to a combination of the accepted methodologies from the Department of Water and Sanitation ‘A practical field procedure for identification and delineation of wetlands and riparian areas (Department of Water Affairs and Forestry, 2005) and the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry, 2008).

The methodology includes four wetland indicators; Soil Wetness Indicator (SWI), Soil Form Indicator (SFI), Vegetation and Terrain and are discussed in the subsections below. Unlike wetland areas, riparian zones are usually not saturated for long enough for redoximorphic features to develop. Riparian zones instead develop in response to (and are adapted to) the physical disturbances caused by frequent overbank flooding from the associated water course. Both perennial and non-perennial systems support riparian vegetation (Department of Water Affairs and Forestry, 2008).

No wetlands were identified within the direct footprint of the infrastructure (Project Area), however, artificial wetlands (dam and drain) and four wetland Hydrogeomorphic (HGM) units were identified within the 500 m regulated area of the Project Area (AoI). The wetlands were categorised into the following HGM units:

- Two Unchannelled Valley Bottom Wetlands (UVB) with a distinct Riparian Zone;
- Two Channelled Valley Bottom Wetlands (CVB) with a distinct Riparian Zone; and
- Artificial wetlands, including a dam and drain.

The natural wetlands cover approximately 9.65 hectares (ha) and the Artificial wet areas cover approximately 0.6 ha of the AoI. The proposed substation will not occur on delineated wetlands and following the previous Scoping Report (April 2022), the Artificial wet areas are now being avoided and the impacts on these areas are minimised. The breakdown of the areas is detailed in Table 7-1 below.

Table 7-1: Wetland HGM Units of the Project Area

HGM Unit Number	HGM Unit	Area (ha)
1	Riparian/ UVB	6.84
2	Riparian/ UVB	0.23
3	Riparian/ CVB	2.30
4	Riparian/ CVB	0.58
-	Artificial (dam and drain)	0.60
Total Area (ha)		**10.57**

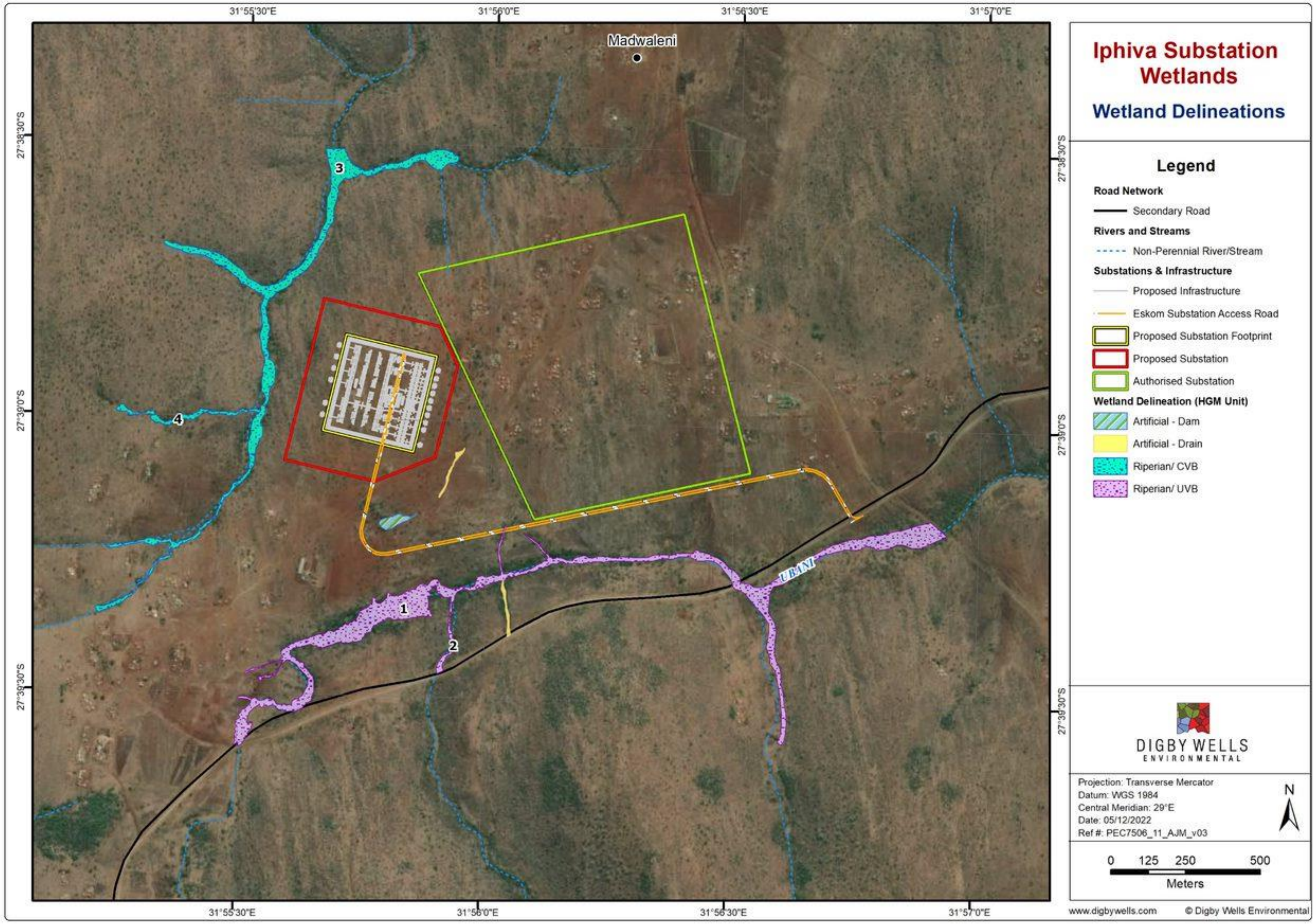


Figure 7-1: Wetland Delineation

7.1.1. Terrain Unit Indicators

Terrain Unit Indicators (TUI) help to identify areas in the landscape where wetlands are more likely to occur. Google Earth imagery and contours, coupled with the April 2022 field verifications, allow the geomorphic setting of the wetland and catchments to be understood and the HGM unit to be determined. Terrain indicators are important for understanding the hydrological and specific functionality of the wetland and determining the potential risks from anthropological activities on the wetlands.

The topography of the Project Area is typical of the Lowveld Ecoregion. Drainage of the Project Area is dominantly towards the northwest Riparian/CVB wetland (HGM3). Surface water is limited as most of the drainage lines and small streams dry up after the rains. Typical terrain indicators identified in the Project Area can be seen in Figure 7-2.

Riparian/UVB system south of the Project Area (HGM 1)

Artificial dam, collecting rainwater runoff and being used for cattle watering

Riparian/CVB west of the Project Area (HGM 3)

Figure 7-2: Terrain Indicators

7.1.2. Soil Indicators

Soil indicators, including Soil Form Indicators (SFI) and Soil Wetness Indicators (SWI) were used to identify and confirm wetland boundaries, HGM units and wetness zones (i.e., permanent, seasonal, or temporary).

The SFI identifies the soil forms, which are associated with prolonged and frequent saturation. These included for example, Katspruit, Longlands, Rensburg and Arcadia soils. The SWI identifies the morphological “signatures” developed in the soil profile as a result of prolonged and frequent saturation (i.e., redox reactions), such as mottles, gleying and leaching.

The SWI was limited and not well defined due to the temporary/seasonal nature of the wetlands and due to the sandy nature of the soils and free-draining properties. Thus, the wetlands were delineated mostly based on the more prominent indicators, such as vegetation and terrain.

Figure 7-3 below illustrates soil indicators within the Project Area.

Shallow, leached soil with minor SWI (HGM 1)

A typical profile of the Riparian/CVB system (HGM 3), showing deposition of soil layers due to large flood events over time.

Figure 7-3: Soil Indicators of the Project Area

7.1.3. Vegetation Indicators

Plant communities undergo distinct changes in species composition along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas.

The dominant wetland vegetation indicators identified include (refer to the Terrestrial Biodiversity Impact Assessment for a complete list (Digby Wells Environment, 2022)):

- *Abutilon austro-africanum*
- *Crinum macowanii;*
- *Cynanchum viminale;*
- *Cyperus textilis;*
- *Eragrostis curvula;*
- *Ficus sycamorus;*
- *Gymnosporia buxifolia;*
- *Hibiscus calyphyllus;*
- *Hippobromus pauciflorus;*
- *Ipomoea carnea*
- *Panicum deustum;*
- *Pennisetum clandestinum;*
- *Spirostachys africana;*
- *Vachellia xanthophloea*; and
- *Ziziphus mucronate*.

Figure 7-4 below illustrates vegetation indicators within the Project Area.

Pennisetum clandestinum together with large trees and shrubs along the riparian zone (HGM 1)

Cyperus textilis within the seasonal wet areas (HGM 1)

Figure 7-4: Vegetation Indicators of the Project Area

7.2. Wetland Health and Functionality

Land use activities and infield observations show that the freshwater catchment has been modified as an outcome of changes in the water input volumes and flow regimes, as well as changes in the distribution and retention patterns of water passing through the wetlands.

The dominant land use activities affecting the PES, EIS and EcoServices of the delineated wetlands in the Project Area include (Figure 7-5):

- Agropastoral activities, including cattle grazing and cultivation; and

- Civil infrastructure, including roads, stormwater drainage lines/infrastructure and bridges.

The PES, EIS and EcoServices were calculated accordingly for the four HGM units identified as presented in the subsections below.

Civil infrastructure leading to head cut erosion and sedimentation (HGM 1)

Intensive cattle grazing, leads to low ground cover, increasing the risk of erosion and sedimentation in the low-lying areas

Figure 7-5: Land Uses of the Project Area

7.2.1. Wetland Ecological Health Assessment (WET-Health)

Guidance Note:

According to Macfarlane, Kotze, & Ellery (2009), the health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. A level 1b WET-Health (PES) assessment was conducted on the wetlands following the method described by Macfarlane et al., (2020) to determine the integrity (health) of the characterised HGM units for the Project area. Level 1 was selected due to the large size of the Project Area.

A PES analysis was conducted to establish baseline integrity (health) for the associated wetlands. The PES assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions.

Impact Category	Description	Combined Impact Score	PES Score (%)	PES Category
None	Unmodified, natural.	0-0.9	90-00	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	80-89	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	40-59	D
Serious	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39	E
Critical	Critically modified. Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19	F

According to the integrity (health) method described by Macfarlane et al. (2009; 2020), all the wetlands were described as **Category C** wetlands. A **Category C** wetland is a **Modified wetland**. This is further described as a wetland with moderate changes to the ecosystem processes with loss of natural habitats, however the natural habitat remains predominantly intact.

The wetlands and associated catchments are dominated by residential land and agropastoral activities. Large areas of the wetland habitat have already been impacted by historical and current land uses. The PES score was determined based on hydrological, vegetation and geomorphological health factors. Figure 7-6 below illustrates the delineated wetlands together with the PES score. The most impacted wetlands are associated with cattle grazing. These activities change the physical attributes of the landscape (i.e., geomorphology and terrain) and therefore impact the naturally occurring vegetation and water flow (i.e., hydrology).

It is not expected that the proposed activities will lead to changes to the PES scores as the wetlands are already impacted and the wetlands are not directly located within the Project Area. The following points were acquired from the data presented in Table 7-2:

- HGM unit 3 is the most impacted. The wetland is heavily incised with large sections of erosion and sedimentation;
- HGM unit 4 is the least impacted. This wetland is located further away from the villages and road and less impacted by anthropological activities; and
- The Water Quality Health of HGM 4 is the least impacted.

Table 7-2: Wetland Ecological Health Assessment Scores

HGM No	HGM Unit	Hydrological Health	Geo-morphological Health	Water Quality Health	Vegetation Health	Final PES	PES Category
1	Riparian/ UVB	2.9	2.9	2.5	3.8	3.0	C
2	Riparian/ UVB	2.8	3.5	2.0	3.8	3.0	C
3	Riparian/ CVB	4.1	4.2	2.0	5.2	3.9	C
4	Riparian/ CVB	2.8	2.7	1.0	3.2	2.5	C

The methodology was adapted to determine the ecological state of the Artificial dam and drainage line within the AoI. As the area is highly degraded due to current agropastoral activities, the Artificial wet areas were determined to be **Category E**. A Category E wetland is Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable. The natural vegetation around the dam is highly impacted by cattle tramping and erosion (Table 7-3).

Table 7-3: Artificial Wet Areas Ecological Health Assessment Scores

HGM No	HGM Unit	Hydrological Health	Geo-morphological Health	Water Quality Health	Vegetation Health	Final PES	PES Category
-	Artificial	7.1	5.4	1.4	9.6	6.3	E

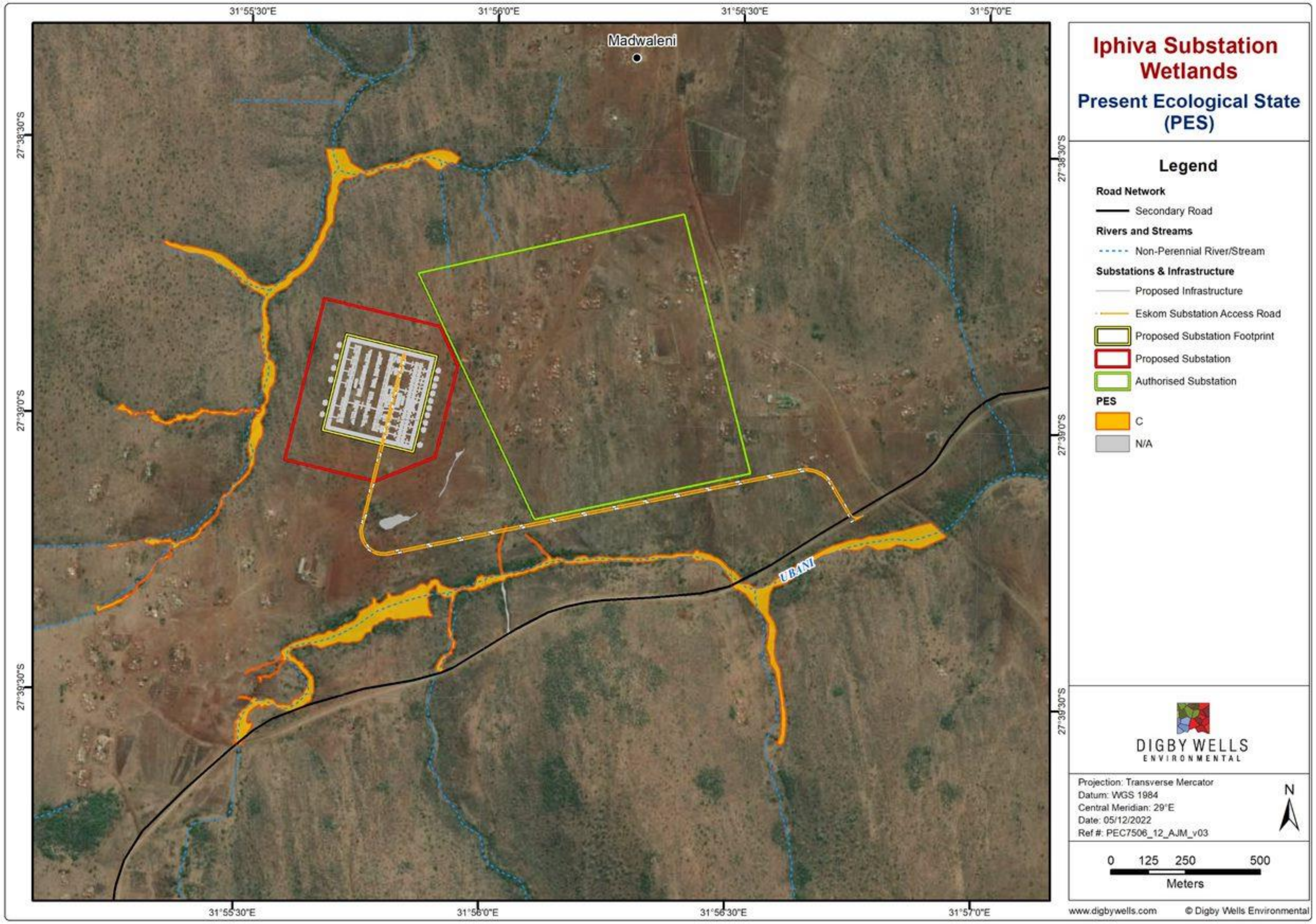


Figure 7-6: Present Ecological State of the Wetlands

7.2.2. Wetland Ecological Services (WET-EcoServices)

Guidance Note:

The importance of a water resource in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class (South African Department of Water Affairs and Forestry, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines described by Kotze et al. (2020). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided.

The characteristics were used to quantitatively determine the value and, by extension, the sensitivity of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

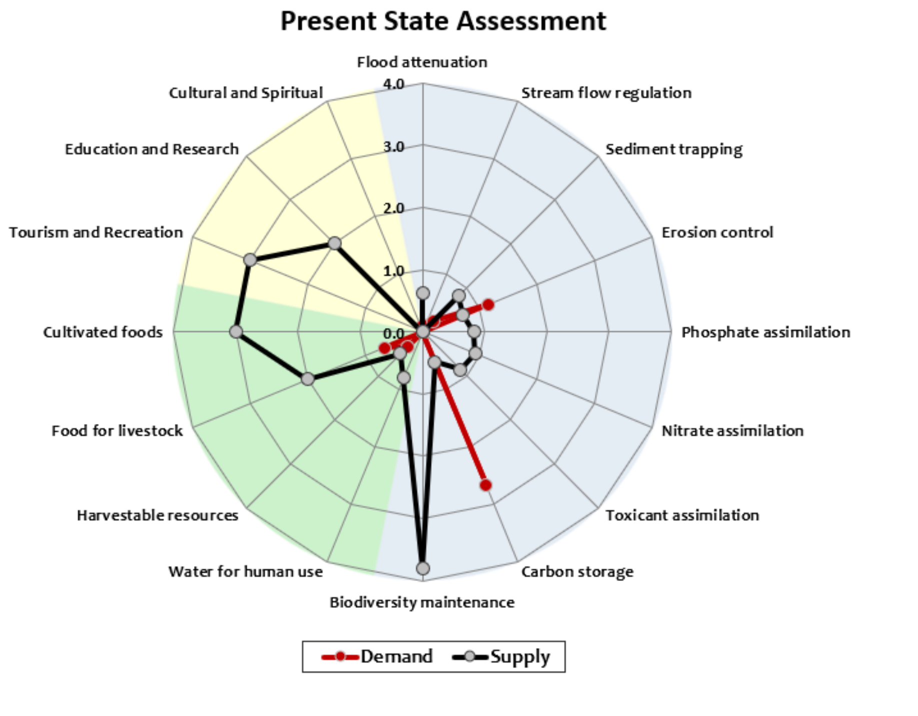
Importance Category		Description
0 – 0.79	Very Low	The importance of services supplied is very low relative to that supplied by other wetlands.
0.8 – 1.29	Low	The importance of services supplied is low relative to that supplied by other wetlands.
1.3 – 1.69	Moderately Low	The importance of services supplied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

The EcoServices of the HGM units ranged from **Very Low** to **Low**. Figure 7-7 and Figure 7-9 represent radial plots showing the relative importance of each ecosystem service.

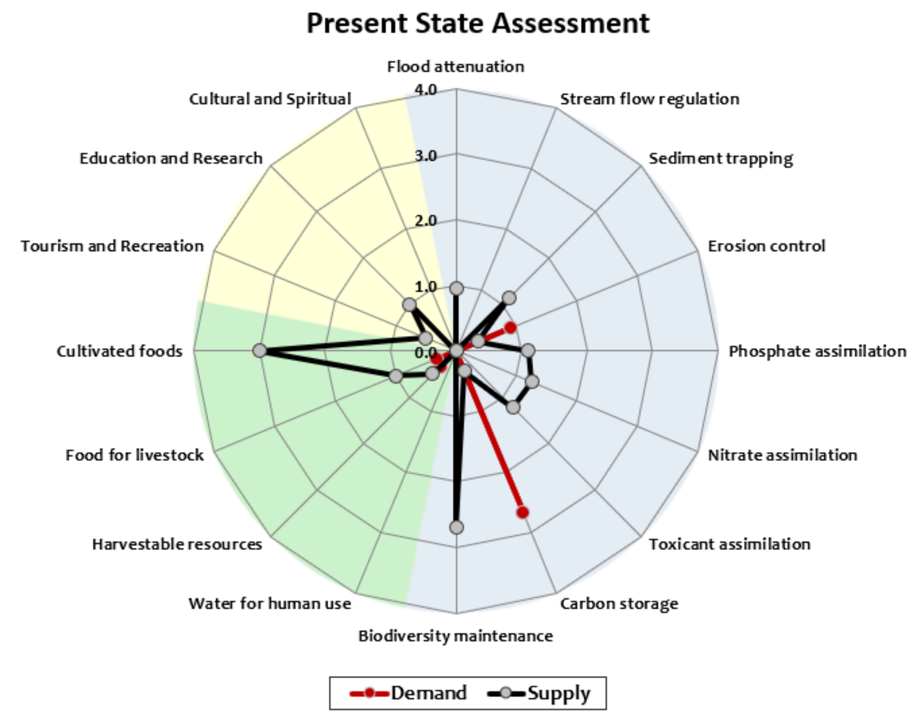
Due to the impacts on the wetlands, the ecosystem services provided by the wetlands are low and the local communities rely on various other sources for ecosystem services. The highest EcoServices provided by the wetlands are biodiversity maintenance, due to the various Species of Conservation Concern (SCC), including *Crinum macowanii, Sclerocarya birrea subsp caffra and Spirostachys africana* within these systems (Digby Wells Environment, 2022).

The wetlands and riparian areas also serve as sediment traps and supply water for domestic purposes as well as provide natural resources for water, food, firewood and medicinal plants. Riparian areas perform a variety of functions that are of value to society, especially the protection and enhancement of water resources and the provision of habitat for plant and animal species (Department of Water Affairs and Forestry, 2008).

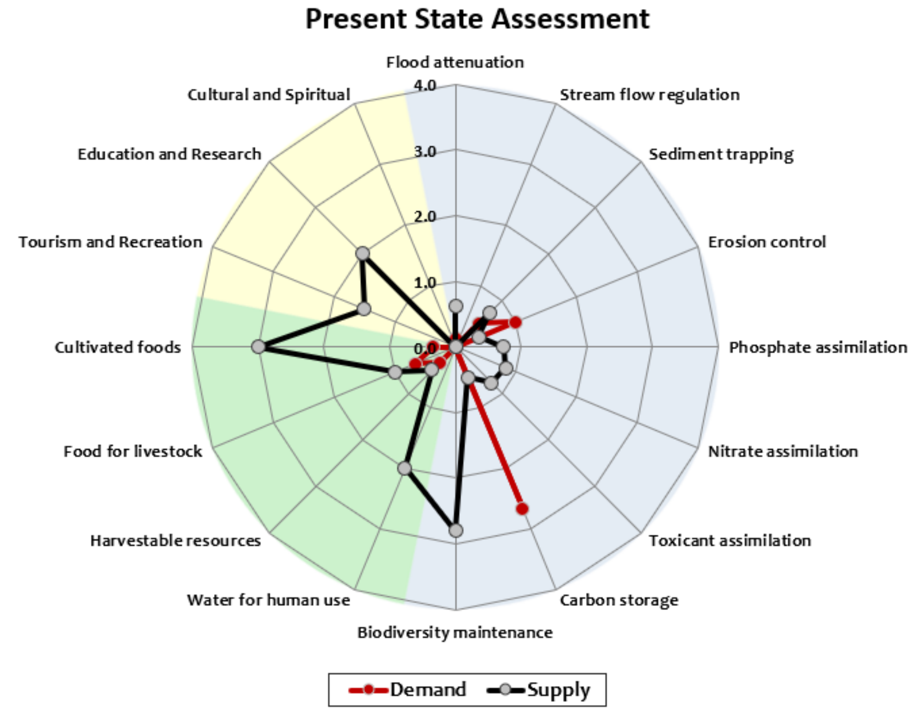
Riparian/ UVB (HGM 1)



Riparian/ UVB (HGM 2)



Riparian/ CVB (HGM 3)



Riparian/ CVB (HGM 4)

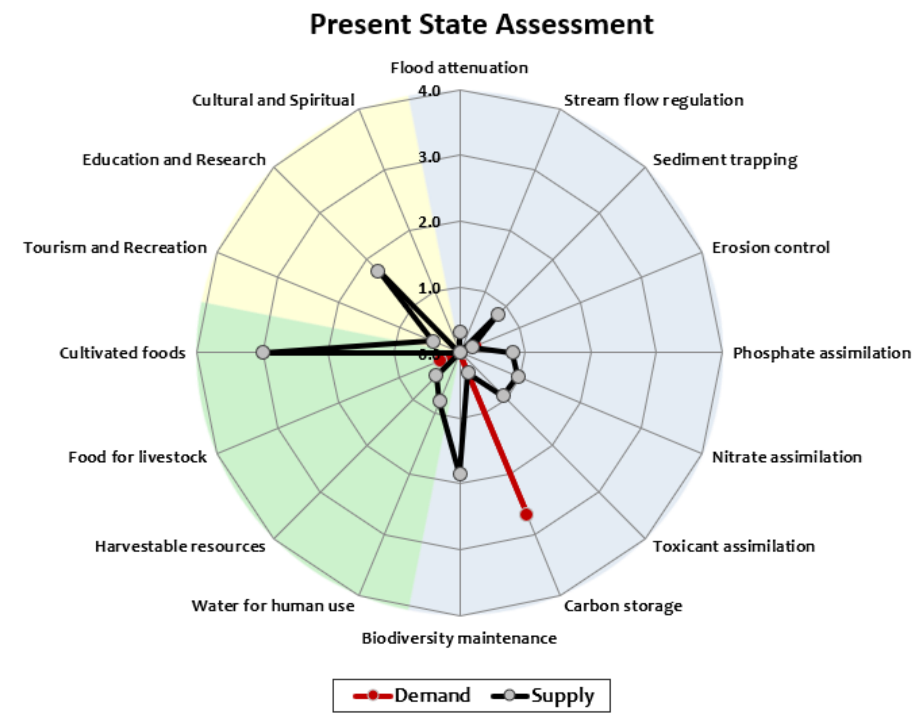


Figure 7-7: Wetland Ecological Services

The EcoServices methodology was adapted to determine the ecosystem services provided by the Artificial wet area within the AoI. The highest Ecoservices provided by the dam and drain are cultivated foods (harvestable resources) and water supply for human and animal consumption. The Artificial wet areas are therefore providing various services to the local communities (Figure 7-8).

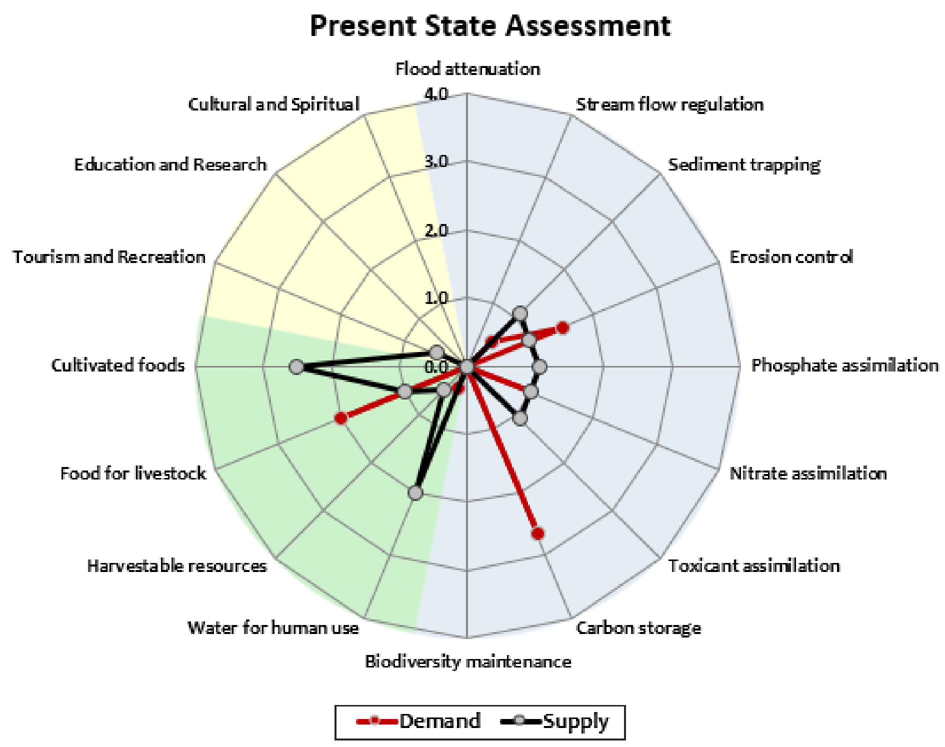


Figure 7-8: Artificial Wet Areas Ecological Services

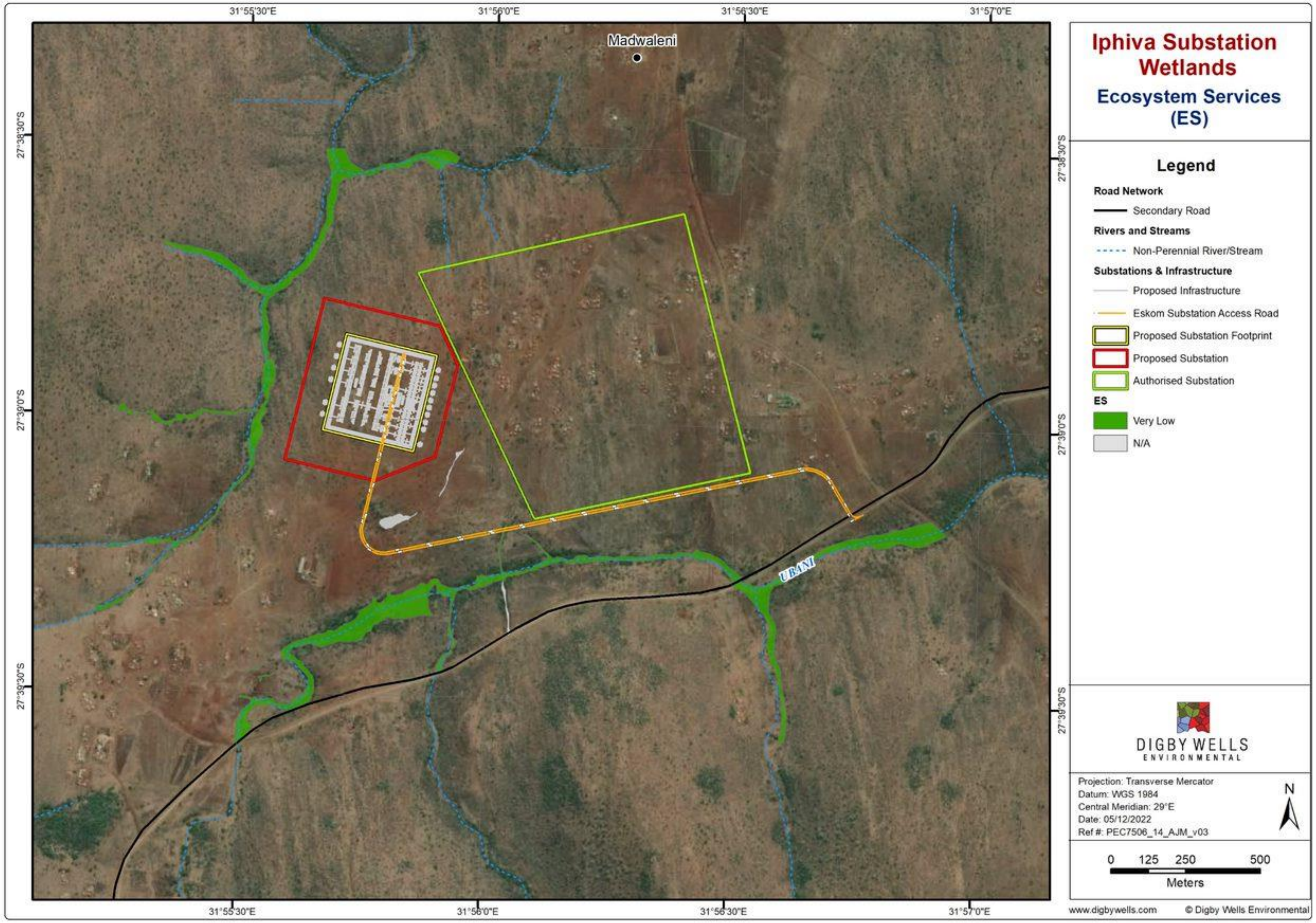


Figure 7-9: Ecosystem Services of the Wetlands

7.2.3. Ecological Importance and Sensitivity (EIS)

Guidance Note:

The ecological importance of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on a local and wider scale. Additionally, ecological sensitivity refers to the wetland's ability to resist disturbance and capability to recover from disturbance that has occurred (Department of Water Affairs and Forestry, 1999). It is important to note that the EIS score is a combination of the Ecological Importance & Sensitivity, Hydrological/Functional Importance, and the Direct Human Benefits.

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term. This study utilised the methodology outlined by DWAF (1999) and updated in Kotze and Rountree (Kotze, Ellery, Macfarlane, & Jewitt, 2012; Rountree, Malan, & Weston, 2013).

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

The EIS scores for the delineated wetlands ranged from **Low** to **High** as shown in Table 7-4 and Figure 7-10 below. The EIS of the Artificial system cannot be determined. The following can be derived from the data:

- HGM 1 has the highest EIS which can be mainly attributed to the high biodiversity maintenance of this system; and
- HGM 4 had the lowest EIS as this system was not rated as sensitive at any scale. The biodiversity is not sensitive to flow and or modifications.

Table 7-4: Wetland Ecological Importance and Sensitivity Scores

HGM No	HGM Unit	Ecological Importance & Sensitivity	Hydrological/Functional Importance	Direct Human Benefits	Final EIS	EIS Category
1	Riparian/ UVB	2.3	0.1	0.9	2.3	High
2	Riparian/ UVB	1.2	0.0	0.6	1.2	Moderate
3	Riparian/ CVB	1.3	0.0	0.7	1.3	Moderate
4	Riparian/ CVB	0.4	0.0	0.7	0.7	Low

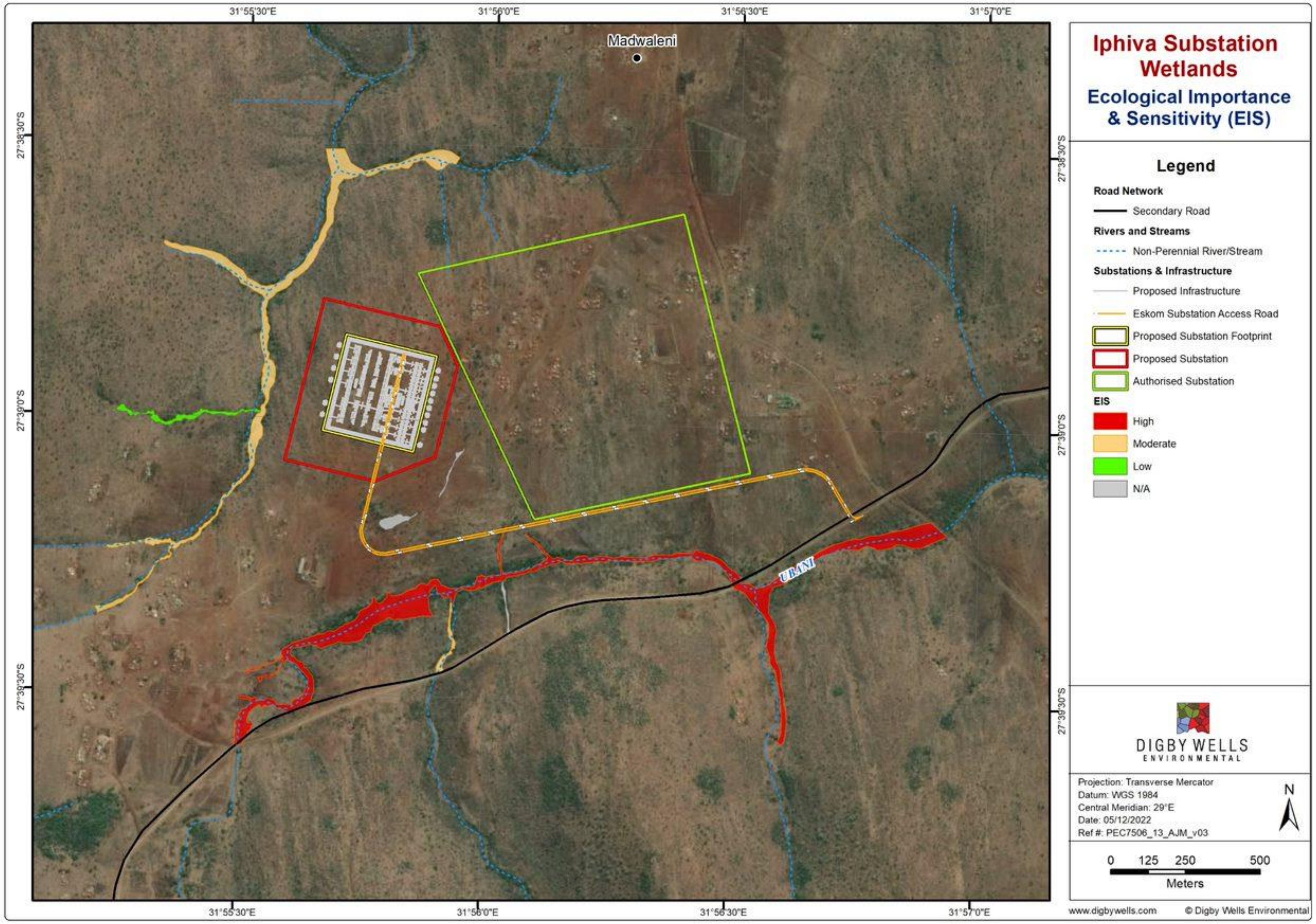


Figure 7-10: Ecological Importance and Sensitivity of the Wetlands

8. Wetland Buffers

The DWS Buffer tool (Department of Water and Sanitation, 2014) was utilised to determine the scientific buffer along the wetlands to avoid and minimise impacts on the wetlands. The following buffers are recommended presented in Table 8-1 below.

Table 8-1 Wetland Buffer Tool

HGM No	HGM Unit	Desktop Buffer (m)	Site Specific Buffers (Post Mitigation)	
			Construction Phase (m)	Operational Phase (m)
1	Riparian/ UVB	70	15	15
2	Riparian/ UVB	70	15	15
3	Riparian/ CVB	70	16	16
4	Riparian/ CVB	70	16	16

9. Sensitivity Analysis

The sensitivity was assessed based on the opinion of the specialist, while considering HGM type, size, PES, EIS and EcoServices. The sensitivity ranged from Medium to Low (Table 9-1 and Figure 9-1).

The Project Area can be characterised as moderately degraded due to modifications made to the natural habitat for various anthropogenic activities. Wetlands with a PES C rating support some level of ecological functioning; however, the freshwater catchment has been largely modified as an outcome of changes in the water input volumes and flow regimes, as well as distribution and retention patterns of water passing through the wetlands. Sedimentation from cultivated lands and civil infrastructure within the wetlands decreases the quality of water in selected areas and affects large areas of vegetation and underlying geomorphology.

Roads, bridges, and other infrastructure have been built within the wetlands and consequently, increase run-off in selected areas, creating preferential and artificial flow paths.

Table 9-1: Sensitive Areas

HGM No	HGM Unit	PES	EcoServices	EIS	Sensitivity
1	Riparian/ UVB	C	Very Low	High	Moderate
2	Riparian/ UVB	C	Very Low	Moderate	Low
3	Riparian/ CVB	C	Very Low	Moderate	Low
4	Riparian/ CVB	C	Very Low	Low	Low

Relevant threats to the biodiversity and ecosystem services of wetlands include habitat loss, degradation and fragmentation, AIPs, overexploitation of the agricultural resource (soils), hydrological changes to the wetlands, nutrient loading due to anthropological activities; and potential pollution due to sewage, pesticides and herbicides and domestic use of the freshwater systems.

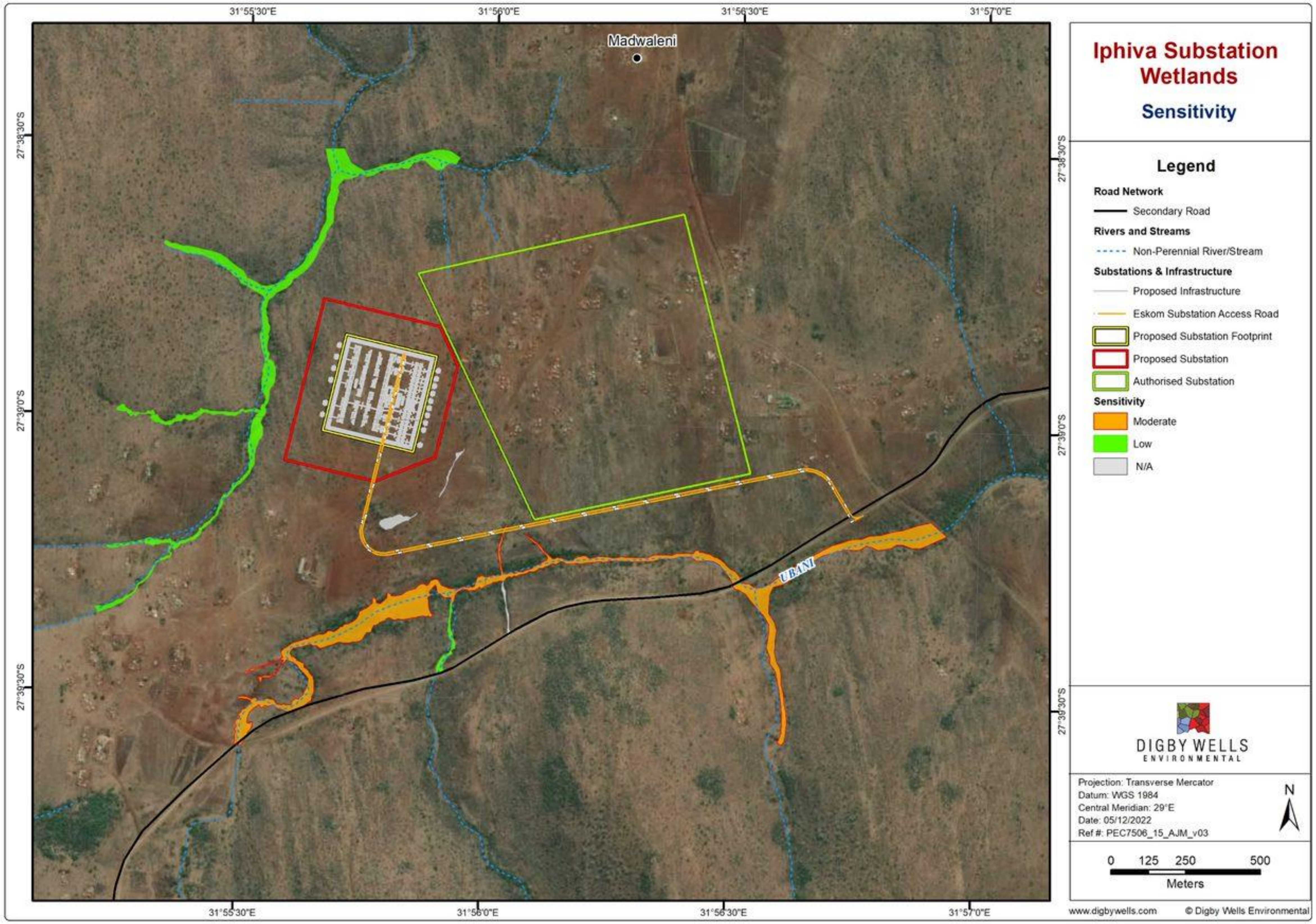


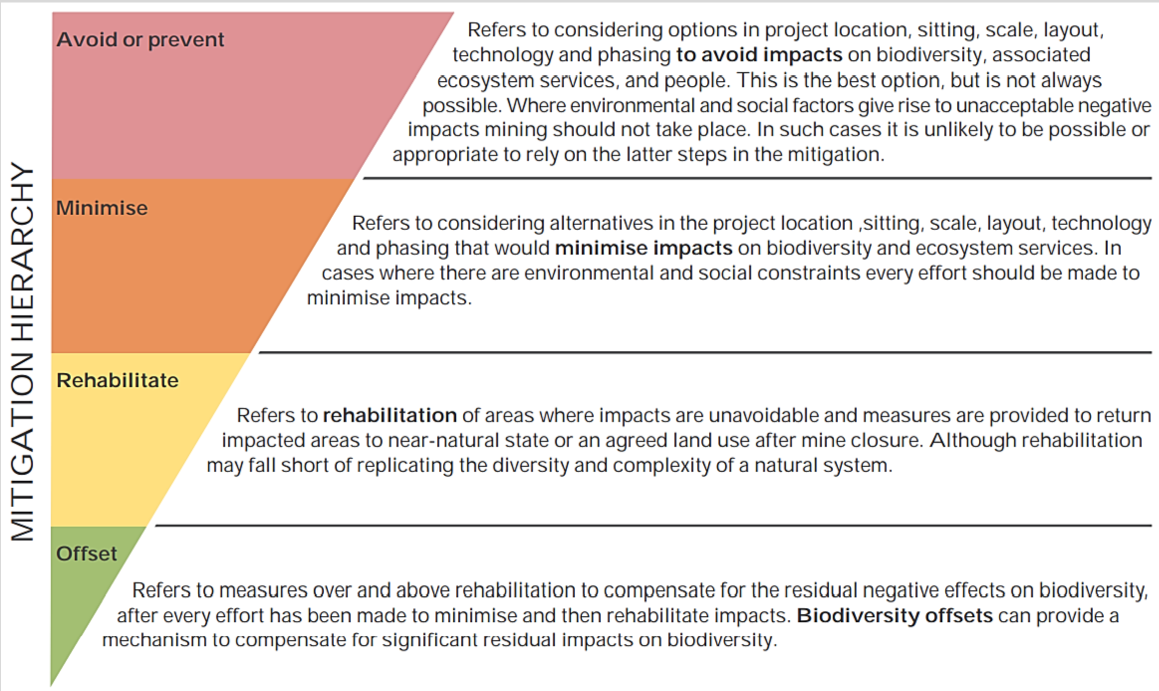
Figure 9-1: Wetland Sensitivity

10. Wetland Impact Assessment

Guidance Note:

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are a result of both the environment in which the proposed project activities take place, as well as the actual activities. The potential impacts are discussed per aspect and per each phase of the Project, i.e., the Construction Phase, Operational and Rehabilitation/Closure Phases, where applicable.

The Impact Assessment considered both direct and indirect impacts on the wetland systems. In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering alternative options in project location, sitting, scale, layout, technology and phasing to avoid impacts. The aim of the Impact Assessment is to strive to avoid damage to, or loss of, ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts. Offsets to compensate for the loss of habitat are regarded as a last resort after all efforts have been made to avoid, reduce and mitigate the impacts (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013) .



As there are no natural wetlands identified within the Project Area, resulting impacts from the infrastructure on the wetlands within the AoI were assessed. The Artificial wet areas adjacent to the Project Area have high EcoServices to the local communities and should be avoided as far as possible.

Any development in a natural (or modified) system will potentially negatively impact the surrounding environment. The purpose of the impact assessment component is to identify and assess the significance of impacts likely to arise during the Project and provide a description of the mitigation measures required to limit the magnitude of the identified impacts on the associated environment.

A detailed description of the Impact Assessment Criteria and Calculations used during the assessment is presented in the methodology section (Appendix A).

Wetlands, adjacent and downstream of the Project Area impacted by the activities, such as sedimentation, erosion and contamination must be rehabilitated, where possible.

No natural wetlands will be affected by the proposed construction activities. Activities during the Construction, Rehabilitation and Operational Phases that may have potential impacts on the wet areas are described below.

The following are discussed below:

- Table 10-1: Interactions and Impacts of Activity;
- Table 10-2: Pre-mitigation Impact Ratings;
- Table 10-3: Mitigation Measures; and
- Table 10-4: Post-mitigation Rating.

Table 10-1: Interactions and Impacts of Activity

Project Phase	Project Activity	Impact	Description
Construction Phase	• Vegetation clearing; • Surface clearing, levelling and terracing; • Laying of concrete foundations and other applicable works such as storm water drainage pipes, slabs, bund walls, control room and storage facilities; • Erection of steelworks; • Delivery and installations of transformers; and • Construction of access roads	• Increased runoff and creation of preferential flow paths through erosion; • Sedimentation and increased sediment loads into the adjacent freshwater ecosystems; • Potential spillage of hydrocarbons such as oils, fuels and grease, entering the surface and groundwater and entering the freshwater ecosystems; • Alien Invasive Plant (AIP) infestation due to disturbance; and • Soil compaction from moving machinery leads to decreased soil depth for root/water penetration and increased runoff from hardened surfaces.	• The site clearance, removal of vegetation, soil stripping and stockpiling could potentially lead to erosion and sedimentation of the adjacent wetlands systems. This will alter the hydrological regime and flow of water. This could contribute to further loss of wetlands adjacent and downstream of the infrastructure area, referred to as indirect loss. • Exposed surfaces may result in dust, erosion and sedimentation into the low-lying areas and wetlands. • Construction of infrastructure and laying of concrete foundations may result in soil compaction, increased surface runoff and increased risk of erosion, contamination and sedimentation of the wetlands adjacent of the Project Area. • Among the impacts associated with the proposed Project are potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for the construction activities. The contamination of water resources will result in the deterioration of water quality which will result in impacts to the aquatic faunal species, terrestrial faunal species and vegetation. • Removal of vegetation and disturbance of soils in the vicinity of the construction footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and AIP species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the project footprint. • The potential for chemical pollution and soil contamination exists during site preparation and construction when hydrocarbon spills or leaks (e.g., fuels, oils and lubricants) from construction vehicles or machinery occur. Fluids used for vehicles and machinery may spill during filling or direct leakage. • The construction of access roads may lead to preferential flow paths and sedimentation of the adjacent and downstream wetlands. The hardened surfaces may lead to increased runoff and changes to the hydrological regime of the wetlands.
Rehabilitation Phase	• Rehabilitation around areas disturbed from construction activities (including the access roads); and • Vegetation management around substation.	Negative Impacts: • Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; • Newly rehabilitated areas (bare surfaces) leading to erosion and sedimentation; and • Increased AIPs. Positive Impacts: • Increased natural flow pathways; • Increase vegetation cover; • Remediation of potentially contaminated wetlands; and • Reducing the risk of erosion, sedimentation and loss of the soil resource.	• All impacted areas will be rehabilitated and monitored. The areas will be landscaped and rehabilitated. Impacts are therefore somewhat positive as rehabilitation will reduce the risk of indirect impacts to the adjacent wetlands. • If rehabilitation is not properly controlled and managed, the activities could lead to impacts on the wetlands and freshwater systems downstream of the site. Impacts include loss of vegetation, compaction, and loss of topsoil through erosion due to exposed areas, soil and water contamination by hydrocarbon waste, reduced infiltration, increased runoff and increased AIPs. • The movement of heavy machinery during rehabilitation of the infrastructure areas (including the substation and access roads) could lead to soil compaction, which reduces the vegetation's ability to grow and as a result erosion and loss of soil organic material. • Rehabilitation could potentially lead to soil, water and wetland contamination, resulting in decreased soil fertility, increased AIPs, decreased biological activity and wetland health.
Operational Phase	• Maintenance of substation and associated infrastructure	• Vehicle movement in the area, leading to soil compaction and	• If maintenance is not properly controlled and managed, the activities could lead to impacts on the wetlands and freshwater systems.

Project Phase	Project Activity	Impact	Description
	(including the access road).	increased runoff and erosion potential; and • Increased AIPs.	• Impacts include loss of vegetation, compaction, and loss of topsoil through erosion due to exposed areas, wetland contamination by hydrocarbon waste, sedimentation and increased AIPs. • The vehicle movement could lead to soil compaction, which reduces the vegetation's ability to grow and as a result erosion and loss of soil organic material and sedimentation into the adjacent wetlands.

10.1. Impact Ratings

Table 10-2 and Table 10-4 present the impact ratings associated with the Project for all the phases prior to and post-mitigation, whereas

Table 10-3 presents the mitigation measures to be implemented to avoid, reduce, and rehabilitate impacts.

Table 10-2: Pre-mitigation Impact Ratings

Pre-Mitigation Rating									
Project Phase	**Project Activity**	**Impact**	**Duration/ Reversibility**	**Extent**	**Intensity/ Replicability**	**Probability**	**Nature**	**Significance**
	Vegetation clearing.	• Increased runoff and creation of preferential flow paths through erosion; • Sedimentation and increased sediment loads into the adjacent freshwater ecosystems; • Potential spillage of hydrocarbons such as oils, fuels and grease, entering the surface and groundwater and entering the freshwater ecosystems; • Alien Invasive Plant (AIP) infestation due to disturbance; and • Soil compaction from moving machinery leads to decreased soil depth for root/water penetration and increased runoff from hardened surfaces.	Permanent (7)	Limited (2)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-20)
	Surface clearing, levelling and terracing.		Permanent (7)	Limited (2)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-20)
	Laying of concrete foundations and other applicable works such as storm water drainage pipes, slabs, bund walls, mast, control room and storage facilities.		Permanent (7)	Very Limited (1)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-18)
	Erection of steelworks.		Short Term (2)	Very Limited (1)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-8)
	Delivery and installations of transformers.		Short Term (2)	Very Limited (1)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-8)
	Construction of access roads		Permanent (7)	Limited (2)	Moderate Loss (3)	Unlikely (3)	Negative	Minor (-36)
Rehabilitation Phase	Rehabilitation around areas disturbed from construction activities.	Negative Impacts: • Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and • Increased AIPs.	Medium Term (3)	Limited (2)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-12)

Pre-Mitigation Rating									
Project Phase	Project Activity	Impact	Duration/ Reversibility	Extent	Intensity/ Replicability	Probability	Nature	Significance
	Vegetation management around substation.	Positive Impacts: • Increased natural flow pathways; • Increase vegetation cover; • Remediation of potentially contaminated wetlands; and • Reducing the risk of erosion, sedimentation and loss of the soil resource.	Project Life (5)	Limited (2)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-16)
Operational Phase	Maintenance of substation and associated infrastructure (including the access road).	• Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and • Increased AIPs.	Project Life (5)	Limited (2)	Minimal Loss (1)	Rare (2)	Negative	Negligible (-16)

Table 10-3: Mitigation Measures

Project Phase	Mitigation Measures
Construction Phase	• Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area. • Limit vegetation removal activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible with a suitable mix of plant species as determined by a qualified botanist. • No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the footprint and access roads. • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction. • At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing. • Ensure a soil management programme is implemented and maintained to minimize erosion and sedimentation. • Stripped topsoil stockpiles and bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction. • All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off-limits to all unauthorised vehicles and personnel. • Implement a Storm Water Management Plan (SWMP). • Implement concurrent rehabilitation to prevent and minimise impacts to the freshwater systems.

Project Phase	Mitigation Measures
Rehabilitation Phase	• Wetland monitoring must be carried out during both the construction and rehabilitation phases to ensure no unnecessary impacts to wetlands takes place. Monitoring should take place on an annual basis during the summer/wet season and carried out by an independent consultant for the duration of the rehabilitation phase. Monitoring should continue to take place every two years until the systems are considered stable. • Wetlands and their associated buffer, to be clearly demarcated and avoided. • An AIP management plan to be implemented and managed for the life of the proposed rehabilitation phase of the Project. • As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils and vegetation, clearance should be kept to a minimum as the biomass in the area is not very high and so therefore plants will not grow quickly. • All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses. • Preventative measures such as hessian sheeting should be used in steep re-seeded areas where high erosion potentials exist. • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated 500m regulated area. All vehicles must remain on demarcated roads and within the project area footprint. • All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • All spills should be immediately cleaned up and treated accordingly.
Operational Phase	• Ensure that sound environmental management is in place during the proposed operational phase. • Ensure that as far as possible all operational activities take place outside of wetland/riparian areas and their associated buffers. • Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed operational activities. • All erosion noted within and in the vicinity of the area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan. • All soils compacted as a result of operational activities should be ripped and profiled. • A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones. • Permit only essential personnel within the buffers for all wetland features identified. • All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel. • No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained. • No material may be dumped or stockpiled within any wetland areas in the vicinity of the proposed footprint. • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated 500m regulated area. All vehicles must remain on demarcated roads and within the Project area footprint. • All vehicles must be regularly inspected for leaks and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • All spills should be immediately cleaned up and treated accordingly. • Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility.

Table 10-4: Post-mitigation Rating

Post-Mitigation Rating								
Project Phase	Project Activity	Impact	Duration/ Reversibility	Extent	Intensity/ Replicability	Probability	Nature	Significance
	Vegetation clearing.		Permanent (7)	Very Limited	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-9)

Post-Mitigation Rating								
Project Phase	**Project Activity**	**Impact**	**Duration/ Reversibility**	**Extent**	**Intensity/ Replicability**	**Probability**	**Nature**	**Significance**
		• Increased runoff and creation of preferential flow paths through erosion; • Sedimentation and increased sediment load into the adjacent freshwater ecosystems; • Potential spillage of hydrocarbons such as oils, fuels and grease, entering the surface and groundwater and entering the freshwater ecosystems; • Alien Invasive Plant (AIP) infestation due to disturbance; and • Soil compaction from moving machinery leads to decreased soil depth for root/water penetration and increased runoff from hardened surfaces.		(1)				
	Surface clearing, levelling and terracing.		Long Term (4)	Very Limited (1)	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-6)
	Laying of concrete foundations and other applicable works such as storm water drainage pipes, slabs, bund walls, control room and storage facilities.		Long Term (4)	Very Limited (1)	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-6)
	Erection of steelworks.		Short Term (2)	Very Limited (1)	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-4)
	Delivery and installations of transformers.		Short Term (2)	Very Limited (1)	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-4)
	Construction of access roads.		Permanent (7)	Very Limited (1)	Minor Loss (2)	Rare (2)	Negative	Negligible (-10)
Rehabilitation Phase	Rehabilitation around areas disturbed from construction activities.	Negative Impacts: • Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and • Increased AIPs. Positive Impacts: • Increased natural flow pathways; • Increase vegetation cover; • Remediation of potentially contaminated wetlands; and • Reducing the risk of erosion, sedimentation and loss of the soil resource.	Medium Term (3)	Very Limited (1)	Low Positive (2)	Unlikely (2)	Positive	Negligible (+12)
	Vegetation management around substation.		Project Life (5)	Very Limited (1)	Low Positive (2)	Unlikely (2)	Positive	Negligible (+16)
Operation al Phase	Maintenance of substation and associated infrastructure (including the access road).	• Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and • Increased AIPs.	Long Term (4)	Very Limited (1)	Minimal Loss (1)	Highly Unlikely (1)	Negative	Negligible (-6)

10.2. Cumulative Impacts

According to Hegmann et al. (1999), cumulative impacts may be defined as changes to the environment that are caused by an action in combination with other past, present and future actions. The construction of the Power station may trigger other associated infrastructure developments in the area and potential change to the present state of the wetlands. However, considering the low to moderate wetland sensitivities and limited EcoServices, cumulative effects in the area are not expected to be significant.

The freshwater resources in this area are currently impacted as a result of various cumulative impacts. In addition, other impacts to the freshwater resources present in the vicinity of the proposed project include agricultural cultivation and grazing activities, as well as impacts from increasing urbanisation and other anthropogenic activities.

It is the opinion of the specialist that should this Project be allowed to proceed, and the recommended management and mitigation measures supplied in this report are adhered to, the ecological integrity and functioning of the regional wetland ecosystems present are likely to be unimpacted.

10.3. Unplanned and Low Risk Events

There is a risk that wetland areas associated with the operations/infrastructure throughout the life of the proposed Project might be affected by the entry of hazardous substances, such as hydrocarbons, in the event of a spillage or unseen seepage from storage facilities.

Accidents or deterioration of structures along the roadways and river/wetland crossings, including pipelines, culverts and bridges, may result in impacts to the habitat and water quality.

Table 10-5 outlines mitigation measures that must be adopted in the event of unplanned impacts throughout the life of the proposed Project.

Table 10-5: Unplanned Events and Associated Mitigation Measures

Unplanned Risk	Mitigation Measures
• Chemical and (or) contaminant spills from operation, infrastructure and associated activities.	• Ensure correct storage of all chemicals at operations as per each chemical's specific storage requirements (e.g. sealed containers for hydrocarbons); • Ensure staff involved at the proposed Project have been trained to correctly work with chemicals at the sites; and • Ensure spill kits (e.g. Drizit) are readily available at areas where chemicals are known to be used. Staff must also receive appropriate training in the event of a spill, especially near wetlands, watercourses and/or drainage lines.

Unplanned Risk	Mitigation Measures
• Unplanned structural deterioration or accidents along the roadways and pipelines in the vicinity of wetlands.	• Maintenance of roadways, river crossings and bridges should be considered an ongoing process. Where issues arise or are observed, it should be reporting to acting Environmental Control Officer (ECO) of the Project immediately after notice.

11. Environmental Management Plan

Mitigation measures and the respective timeframes, targets and performance indicators for the proposed activities are recommended in Table 11-1 to ensure the protection of wetlands.

Table 11-1: Environmental Management Plan

<table>
<tr><th>Phase</th><th>Project Activity</th><th>Potential Impacts</th><th>Mitigation Measures</th><th>Mitigation Type</th><th>Period for Implementation</th></tr>
<tr><td rowspan="6">Construction Phase</td><td>Vegetation clearing.</td><td rowspan="6">• Increased runoff and creation of preferential flow paths through erosion;
• Sedimentation and increased sediment loads into the adjacent freshwater ecosystems;
• Potential spillage of hydrocarbons such as oils, fuels and grease, entering the surface and groundwater and entering the freshwater ecosystems;
• Alien Invasive Plant (AIP) infestation due to disturbance; and
• Soil compaction from moving machinery leads to decreased soil depth for root/water penetration and increased runoff from hardened surfaces.</td><td rowspan="6">• Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area.
• Limit vegetation removal activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible with a suitable mix of plant species as determined by a qualified botanist.
• No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the footprint and access roads.
• Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction.
• At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing.
• Ensure a soil management programme is implemented and maintained to minimize erosion and sedimentation.
• Stripped topsoil stockpiles and bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction.
• All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off-limits to all unauthorised vehicles and personnel.
• Implement a Storm Water Management Plan (SWMP).
• Implement concurrent rehabilitation to prevent and minimise impacts on the freshwater systems.</td><td rowspan="6">Control and Remedy</td><td rowspan="6">Life of Construction Phase</td></tr>
<tr><td>Surface clearing, levelling and terracing.</td></tr>
<tr><td>Laying of concrete foundations and other applicable works such as storm water drainage pipes, slabs, bund walls, control room and storage facilities.</td></tr>
<tr><td>Erection of steelworks.</td></tr>
<tr><td>Delivery and installation of transformers.</td></tr>
<tr><td>Construction of access roads</td></tr>
<tr><td rowspan="2">Rehabilitation Phase</td><td>Rehabilitation around areas disturbed by construction activities.</td><td rowspan="2">Negative Impacts:
• Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and
• Increased AIPs.
Positive Impacts:
• Increased natural flow pathways;
• Increase vegetation cover;
• Remediation of potentially contaminated wetlands; and
• Reducing the risk of erosion, sedimentation and loss of the soil resource.</td><td rowspan="2">• Wetland monitoring must be carried out during both the construction and rehabilitation phases to ensure no unnecessary impacts to wetlands takes place. Monitoring should take place on an annual basis during the summer/wet season and be carried out by an independent consultant for the duration of the rehabilitation phase. Monitoring should continue to take place every two years until the systems are considered stable.
• Wetlands and their associated buffers, are to be clearly demarcated and avoided.
• An AIP management plan to be implemented and managed for the life of the proposed rehabilitation phase of the Project.
• As much vegetation growth as possible should be promoted within the proposed development area during all phases. To protect soils and vegetation, clearance should be kept to a minimum as the biomass in the area is not very high and so therefore plants will not grow quickly.
• All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses.
• Preventative measures such as hessian sheeting should be used in steep re-seeded areas where high erosion potentials exist.</td><td rowspan="2">Control, Stop and Remedy</td><td rowspan="2">Life of Rehabilitation Phase</td></tr>
<tr><td>Vegetation management around the substation.</td></tr>
</table>

Phase	Project Activity	Potential Impacts	Mitigation Measures	Mitigation Type	Period for Implementation
			• No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated 500m regulated area. All vehicles must remain on demarcated roads and within the project area footprint. • All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • All spills should be immediately cleaned up and treated accordingly.		
Operational Phase	Maintenance of substation and associated infrastructure (including the access road).	• Vehicle movement in the area, leading to soil compaction and increased runoff and erosion potential; and • Increased AIPs.	• Ensure that sound environmental management is in place during the proposed operational phase. • Ensure that as far as possible all operational activities take place outside of wetland/riparian areas and their associated buffers. • Limit the footprint area of the operational activities to what is absolutely essential to minimise impacts as a result of vegetation clearing and compaction of soils. • Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed operational activities. • All erosion noted within and in the vicinity of the area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan. • All soils compacted as a result of operational activities should be ripped and profiled. • A suitable AIP control programme must be put in place to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones. • Permit only essential personnel within the buffers for all wetland features identified. • All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel. • No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained. • No material may be dumped or stockpiled within any wetland areas in the vicinity of the proposed footprint. • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated 500m regulated area. All vehicles must remain on demarcated roads and within the Project area footprint. • All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • All transformers are to be bunded to SANS specifications. • All spills should be immediately cleaned up and treated accordingly. • Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility.	Control and Remedy	Life of Operational Phase

12. Monitoring Programme

Guidance Note:

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented together with ensuring effectiveness of the management measures in place.

Monitoring should be done in terms of:

- EIA Regulations, 2014 promulgated under the NEMA;
- NEMA;
- NEM: WA; and
- The CARA.

The Manager and the Environmental Practitioner are responsible to report on results of the monitoring program. Internal monitoring reports should be required, reporting on the progress of the state of the monitoring and rehabilitation programme. This should be completed after each external monitoring report.

Table 12-1 describes the monitoring plan which should be followed from the Construction Phase through to the Rehabilitation and Operational Phases. The table below includes each aspect of monitoring together with the frequency of monitoring and the person responsible thereof.

The monitoring programme is based on the following points:

- Undertake monitoring of the adjacent and downstream wetlands to detect and rectify any secondary impacts caused by the Project;
- Commence with monitoring prior to the Construction Phase to collect baseline information regarding adjacent and downstream wetlands, soils and vegetation and to monitor any changes due to the proposed activities;
- Undertake annual monitoring throughout the Construction Phase, for wetlands, soils and vegetation, preferably one survey after the rainy season (January to March);
- Undertake annual wetland monitoring throughout the Rehabilitation Phase, preferably one survey after the rainy season (January to March); and
- Internal monitoring reports should be required, reporting on the progress of the state of the monitoring and rehabilitation programme. This should be completed after each external monitoring report.

Table 12-1: Monitoring Plan

Monitoring Element	Comment	Requirement	Frequency	Phase	Responsibility	Duration
Wetland composition (i.e., Size and physical impacts to the wetlands, including erosion, sedimentation, geomorphological impacts, hydrological impacts and increased AIPs)	Implementation of mitigation measures should the wetlands be impacted by the proposed activities	Wetland update report and recommendations for impact mitigation, if any. Monitor fixed transects across the Project Area of directly impacted and adjacent wetlands.	Once every year	Construction Rehabilitation Operational	Environmental Officer	Until the wetlands are stable and or unimpacted for at least 2 years
Wetland health and existing conditions compared to prior-construction conditions (i.e., PES, EIS, EcoServices)	Implementation of mitigation measures should the wetlands be impacted by the proposed activities	Wetland update report and recommendations for impact mitigation, if any.	Annually (Construction) Once every 2 years (Rehabilitation, Operational)	Construction Rehabilitation Operational	Environmental Officer	2 years after Rehabilitation
Infrastructure (i.e., Including erosion, sedimentation, preferential flow paths, fragmentation, culverts and roads)	Implementation of mitigation measures.	Determine the rehabilitation's success and provide recommendations if impacts are observed.	Only when impacts are observed	Construction Rehabilitation Operational	Environmental Officer	3 months thereafter or until the wetlands are stable

13. Recommendations and Specialist Opinion

The overall impacts of the Project on the natural wetlands within the AoI are expected to be minor to negligible prior mitigation and negligible significance following the implementation of the proposed mitigation measures. It is the opinion of the specialist that should the proposed mitigation measures and monitoring programme be implemented correctly; the impacts on the natural wetlands should be insignificant.

It is recommended to follow the mitigation hierarchy which includes firstly the avoidance of an impact. When it is not possible to avoid an impact, the next step is or to minimise the impact and thereafter rectify or reduced the impact. Wetlands, downstream and adjacent to the Project Area, impacted by the activities, such as sedimentation, erosion and contamination must be rehabilitated, where possible.

The wetland management and monitoring requirements as set out in Sections 11 and 12 should form part of the conditions for the EA. It is recommended to include at least a 16 m buffer around the adjacent CVB wetlands and a 15 m buffer around the UVB wetlands to any activities, such as construction and infrastructure. Wetlands and natural water resources are a valuable natural asset, especially within the Lowveld area.

14. Conclusion and Recommendations

This Wetland Impact Assessment report aims to identify and quantify the potential impacts on wetlands and their supporting ecosystem services due to the development of the proposed Iphiva substation, access road and associated infrastructure and should be read in collaboration with the fauna and flora and other specialist reports.

A total of four HGM units were identified within the AoI. The natural wetlands cover approximately 9.65 hectares (ha) and the Artificial wet areas cover approximately 0.6 ha of the AoI. The proposed substation will not occur on delineated wetlands and following the previous Scoping Report (April 2022), the Artificial wet areas are now being avoided and the impacts on these areas are minimised.

The delineated wetlands were mostly defined as seasonal or temporary riparian wetlands due to the high runoff potential, shallow soil depths and lateral movement of water. All the natural wetlands were classified as having a PES Category C (Moderately Modified), whereas the artificial wet areas were classified as having a PES E (seriously modified) (adapted methodology). It is therefore expected that the proposed activities will lead to negligible changes to the natural wetlands PES scores, as the natural wetlands are not directly impacted by the proposed activities.

The EcoServices of all the wet areas ranged from Very Low to Low. The highest EcoServices provided by the natural wetlands is biodiversity maintenance and the highest EcoServices provided by the Artificial wet areas is water supply for domestic and animal use. The wetlands and riparian areas however also serve as sediment traps and assists with supply water for human use and are a natural resource for water, food, firewood and medicinal plants.

The sensitivity of wetlands in the Project area was assessed based on the opinion of the specialist, taking into consideration the PES and EcoServices scores. The sensitivities ranged from Medium to Low. The most sensitive wetlands are associated with the wetlands containing Species of Conservation Concern (SCC), including *Crinum macowanii, Sclerocarya birrea subsp caffra and Spirostachys africana*.

The overall impacts of the Project on the natural wetlands within the AoI were determined to be minor to negligible prior mitigation and largely negligible significance following the implementation of the proposed mitigation measures. It is the opinion of the specialist that should the proposed mitigation measures and monitoring programme be implemented correctly; the impacts on the natural wetlands will be insignificant.

The following actions are recommended to reduce adverse effects on the wetlands within the proposed Project Area:

- Limit infrastructure within wetlands as far as practically possible to avoid and minimise impacts on adjacent and downstream wetlands (e.g., sedimentation, erosion and contamination;
- Establish at least a 15 m buffer around the CVB wetlands and a 16 m buffer around the UVB wetlands to protect wetland areas from infrastructure that may lead to erosion and sedimentation of the receiving watercourses (refer to the buffer tool assessment in Section 8);
- Rehabilitate impacted wetlands within the AoI (only when impacted by the proposed activities);
- Monitor and mitigate wetlands affected by the activities;
- Ensure rehabilitation with special attention to reshaping the impacted areas, re-vegetating and mitigating potential contamination;
- A protective barrier/ no-go buffer against cattle should be implemented around the rehabilitated areas, during the rehabilitation phase only, to ensure the re-establishment of vegetation as soon as possible to maintain the wetland functionality and prevent erosion, sedimentation and creation of preferential flow paths;
- Promote the naturally diffuse flow of water through the landscape from the infrastructure areas to prevent erosion (or channelisation), sedimentation and formation of preferential flow paths;
- Implement the recommended monitoring program to detect impacts to the wetlands within the AoI early on and implement remediation/remedies as soon as impacts are observed; and
- Reduce the risk of erosion, compaction, and the creation of preferential flow paths by re-vegetating exposed areas, maintaining linear infrastructure and culverts and installing sediment traps and erosion berms.

15. References

Climate-data.org. (n.d.). *Climate-data.org*. Retrieved from Climate-data.org: https://en.climate-data.org/

Darwall, W., Smith, K., Tweddle, D., & Skelton, P. (2009). *The status and distribution of freshwater biodiversity in southern Africa.* Gland, Switzerland: IUCN and Grahamstown, South Africa: SAIAB.

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute. (2013). *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.* Pretoria.

Department of Water Affairs and Forestry. (1999). *South African Version 1.0 of Resource Directed Measures for Protection of Water Resources.*

Department of Water Affairs and Forestry. (2005). *A practical field procedure for the identification and delineation of wetlands and riparian areas.* Pretoria: DWAF.

Department of Water Affairs and Forestry. (2008). *Updated manual for identification and delineation of wetlands and riparian areas.* Pretoria: DWAF.

Department of Water and Sanitation. (2014). Buffer Zone Tool for the Determination of Aquatic Impact BUffers and Additional Setback Requirements for Wetland Ecosystems.

Digby Wells Environment (C. Ndlovu). (2022). *Archaeology and Heritage Impact Assessment Report.* Bulawayo.

Digby Wells Environment. (2022). *Terrestrial Biodiversity Impact Assessment.* Johannesburg.

Digby Wells Environmental. (2018). *Environmental Impact Assessment for Eskom's Northern Kwa-Zulu Natal Strengthening Project: Wetland Assessment.*

Digby Wells Environmental. (2022). *Surface Water Impact Assessment.* Johannesburg.

Driver, A., Nel, J., Snaddon, K., Murray, K., Roux, D., & Hill, L. (2011). *Implementation Manual for Freshwater Ecosystem Priority Areas. Draft Report for the Water Research Commission.* Retrieved from http://www.wrc.org.za/Knowledge Hub D

Ezemvelo KZN Wildlife. (2015). *Zululand District Municipality: Biodiversity Sector Plan.*

Kleynhans, C., Thirion, C., & Moolman, J. (2005). *A Level 1 River Ecoregion classification System for South Africa, Lesotho and Swaziland.* Water.

Köppen, W., & Geiger, R. (1936). *Handbuch der klimatologie.* Berlin.

Kotze, D., & Ellery, W. (2009). *WET-Outcome Evaluate: an evaluation of the rehabilitation outcomes at six wetland sites in South Africa.* Pretoria: WRC: TT 343/09.

Kotze, D., & Marneweck, G. (1999). *Guidelines for delineating the wetland boundary and zones within a wetland under the South African Water Act.*

Kotze, D., Ellery, W., Macfarlane, D., & Jewitt, G. (2012). *A rapid assessment for coupling anthropogenic stressors and wetland ecological condition.* Ecological Indicators.

Kotze, D., Macfarlane, D., & Edwards, R. (2020). *WET-EcoServices (Version 2): A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas.* WRC Project K5/2737.

Macfarlane, D., Kotze, D., & Ellery, W. (2009). *WET-Health: A technique for rapidly assessing wetland health (TT 340/09).* WRC Report.

Macfarlane, D., Ollis, D., & Kotze, D. (2020). *WET-Health (Version 2.0): A Refined Suite of Tools for Assessing the Present Ecological State of Wetland Systems.* WRC Report No. TT 820/20.

Mucina, L., & Rutherford, M. C. (2012). *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

Nel, J., Murray, K., Maherry, A., Petersen, C., Roux, D., Driver, A., . . . Nienaber, S. (2011). *Technical Report for the National Freshwater Priority Areas project.* WRC: 1801/2/11.

Rountree, M., Malan, H., & Weston, B. (2013). *Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0).*

SANBI. (2018). *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report.* Pretoria: South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries.

SANBI and DWS. (2016). *Wetland Offsets: A Best Practice Guideline for South Africa.* WRC.

WRC. (2007). *WET-RoadMap: A Guide to the Wetland Management Series.* Water Research Commission.

Appendix A: Methodology

Literature Review and Desktop Assessment

Relevant literature was reviewed concerning the historical wetlands associated with the Project Area, habitats and vegetation types as well as the wetland state prior to development. This was completed to obtain relevant information on the wetland ecology of the Project Area and its vicinity to acquire enough information to compile a Wetland Environmental Impact Assessment Report.

For this assessment, wetland areas were identified, and preliminary wetland boundaries were delineated at the desktop level using detailed aerial imagery and wetland signatures, along with 5 m contours. Baseline and background information was researched and used to understand the area on a desktop level prior to fieldwork confirmation. This included but was not limited to:

- A practical field procedure for the identification and delineation of wetlands and riparian areas (Department of Water Affairs and Forestry, 2005);
- WET-RoadMap: A Guide to the Wetland Management Series (WRC, 2007);
- National Freshwater Ecological Priority Areas (NFEPA) (Driver, et al., 2011; Nel, et al., 2011);
- Vegetation types of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2012);
- uMkhanyakude District Municipality Biodiversity Sector Plan (Ezemvelo KZN Wildlife, 2015);
- Wetland Offsets: A Best Practice Guideline for South Africa (SANBI and DWS, 2016); and
- Wetland Environmental Impact Assessment for Eskom’s Northern Kwa-Zulu Natal Strengthening Project (Digby Wells Environmental, 2018).

National Freshwater Ecosystem Priority Areas

The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011). The spatial layers (FEPAs) include the nationally delineated wetland areas that are classified into Hydro-geomorphic (HGM) units and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetlands.

The NFEPA Project represents a multi-partner Project between the CSIR, SANBI, WRC, DWS, DEA, WWF, SAIAB and SANParks. The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011).

More specifically, the NFEPA Project aims to:

1. Identify FEPAs to meet national biodiversity goals for freshwater ecosystems; and
2. Develop a basis for enabling the effective implementation of measures to protect FEPAs, including free-flowing rivers.

The first aim uses systematic biodiversity planning to identify priorities for conserving South Africa's freshwater biodiversity within the context of equitable social and economic development. The second aim is comprised of two separate components: the (i) national component aimed to align DWS and DEA policy mechanisms and tools for managing and conserving freshwater ecosystems, while the (ii) sub-national component is aimed to use three case studies to demonstrate how NFEPA products should be implemented to influence land and water resource decision-making processes. The Project further aimed to maximize synergies and alignment with other national level initiatives, including the National Biodiversity Assessment (NBA) and the Cross-Sector Policy Objectives for Inland Water Conservation (Driver, et al., 2011).

Based on a desktop-based modelled wetland condition and a combination of special features, including expert knowledge (e.g. intact peat wetlands, presence of rare plants and animals, etc.) and available spatial data on the occurrence of threatened frogs and wetland-dependent birds, each of the wetlands within the inventory was ranked in terms of their biodiversity importance and as such, Wetland FEPAs were identified in an effort to achieve biodiversity targets (Driver, et al., 2011). Table 1 below indicates the criteria that were considered for the ranking of each of these wetland areas. Whilst being a valuable tool, it is important to note that the FEPAs were delineated and studied at a desktop and relatively low-resolution level. Thus, the wetlands delineated via the desktop delineations and ground-truthing work done through this study may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective.

Table 1: NFEPA Wetland Classification Ranking Criteria (Nel et al., 2011)

Criteria	Rank
Wetlands that intersect with a Ramsar site.	1

Criteria	Rank
• Wetlands within 500 m of an International Union for Conservation of Nature (IUCN) threatened frog point locality; • Wetlands within 500 m of a threatened water-bird point locality; • Wetlands (excluding dams) with most of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
Wetlands (excluding dams) in A or B condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5
Any other wetland (excluding dams).	6

Zululand District Municipality Biodiversity Sector Plan

The Biodiversity Sector Plan has been developed for the Zululand District Municipality as a precursor to a bioregional plan (Ezemvelo KZN Wildlife, 2015). The purpose of a bioregional plan is to provide a map of biodiversity priorities with accompanying land use planning and decision-making guidelines, to inform land use planning, environmental assessment and authorisations as well as natural resource management by a range of sectors whose policies and decisions impact biodiversity.

The publication includes terrestrial and freshwater biodiversity areas that are mapped and classified as Critical Biodiversity Areas and Ecological Support Areas (Table 2).

Table 2: Zululand District Municipality Biodiversity Sector Plan Categories

Map Category	Definition	Desired Management Objectives
CBAs	Natural or near natural landscapes that are considered critical for meeting biodiversity targets and thresholds, and which safeguard areas required for the persistence of viable populations of species and the functionality of ecosystems. It is divided into CBA Irreplaceable and CBA Optimal	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESAs	Functional but not necessarily entirely natural landscapes are largely required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within critical biodiversity areas.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorization process that ensures the underlying biodiversity objectives are not compromised.

National Biodiversity Assessment (NBA)

The National Biodiversity Assessment (NBA) presents the best available science on South Africa's biodiversity (SANBI, 2018). It aims to inform policy, planning and decision making in a range of sectors for the conservation and sustainable use of biodiversity. The NBA 2018 builds on the National Spatial Biodiversity Assessment 2004 and 2011 thus providing a comprehensive picture of South Africa's biodiversity threat status and protection level over time (SANBI, 2018).

The NBA has four indicators, providing information on the threat status and protection level of ecosystems and species. The threat status indicators use the established IUCN Red List of Species and Red List of Ecosystems assessment frameworks. The risk of extinction (species) or collapse (ecosystems) is evaluated across all realms and for taxonomic groups for which sufficient data exists. The protection level indicators reflect how well our species and ecosystem types are represented in the protected area network (SANBI, 2018).

Wetland Identification, Delineation and Classification

The wetland delineations were verified according to the accepted methodology from the Department of Water and Sanitation 'A practical field procedure for identification and delineation of wetlands and riparian areas (Department of Water Affairs and Forestry, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry, 2008). These methodologies use the:

- **Terrain Unit Indicator**: Identifies those parts of the landscape where wetlands are more likely to occur;
- **Soil Form Indicator**: Identifies the soil forms, which are associated with prolonged and frequent saturation;
- **Soil Wetness Indicator**: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- **Vegetation Indicator**: Identifies hydrophilic vegetation associated with frequently saturated soils.

Terrain Unit Indicator

Terrain Unit Indicator (TUI) areas include depressions and channels where water would be most likely to accumulate. These areas are determined with the aid of topographical maps, contour data, aerial photographs and engineering and town planning diagrams (Department of Water Affairs and Forestry, 2005). In accordance with the guidelines provided by the DWS (Department of Water Affairs and Forestry, 2005) wetlands are identified and classified into various HGM units based on their characteristics and setting within the landscape. The HGM unit classification system focuses on the hydro-geomorphic setting/position of wetlands in a landscape which incorporates geomorphology; water movement into, through and out of the wetland. The HGM unit is dependent on various aspects, including whether the drainage is open or closed, water is dominating the system or is sub-surface water, how the water flows from and into the wetlands and how water is contained within the wetland. Once wetlands have been identified, they are categorised into HGM units as shown in Table 3.

Table 3: Description of the Various HGM Units for Wetland Classification

Hydromorphic Wetland Type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel are usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from the channel entering the wetland and also from adjacent slopes.
Hillslope seepage linked to a stream channel		Slopes on hillsides, are characterised by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.
Isolated hillslope seepage		Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow is either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression		A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. It is inward draining). It may also receive subsurface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

Soil Indicators

Soil Form Indicators

Hydromorphic soils are characterized as soils that have undergone redox reactions because of the fluctuation of water and oxygen within the soil profile, creating segregations of iron (Fe) and manganese (Mn) particles. This fluctuation of water and oxygen in the soils can be attributed to the fluctuating ground water table, creating seasonal, temporary and permanent wet zones. Hydromorphic soils are thus Soil Form Indicators (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (Department of Water Affairs and Forestry, 2005). The permanent, as well as occasional saturation of soil results in anaerobic conditions of the soil causing a chemical, physical and biological change to the soil.

Hydromorphic soils are often identified by the colours of various soil components. The frequency and duration of the soil saturation periods strongly influence the colours of these components. Grey colours become more prominent in the soil matrix the higher the duration and frequency of saturation in a soil profile (Department of Water Affairs and Forestry, 2005). A feature of hydromorphic soils is coloured mottles (iron and manganese accumulation) which are usually absent in permanently saturated soils and are most prominent in seasonally saturated soils and are less abundant in temporarily saturated soils (Department of Water Affairs and Forestry, 2005). The hydromorphic soils must display signs of wetness within 50 cm of the soil surface, as this is necessary to support hydrophytic vegetation.

Soils that are commonly associated with wetlands are Champagne, Rensburg, Arcadia, Katspruit, Kroonstad, Longlands, Fernwood and Westley soil forms. These soil forms are associated with high clay content and accumulation of clay, promoting water logging and creating low drainage, thus water logging conditions. These soils are commonly associated with low-laying landscapes such as valley bottoms, foot-slopes and mid-slopes.

Soil Wetness Indicators

In practice, the Soil Wetness Indictor (SWI) is used as the primary indicator (Department of Water Affairs and Forestry, 2005). Iron and manganese accumulation in a soil profile, termed mottles, are some of the recognized ‘wet indicators’. These two elements are insoluble under aerobic (unsaturated) conditions and become soluble when the soil becomes anaerobic (saturated). The fluctuating water table creates these conditions by increasing and reducing the oxygen levels in the soil profile by increasing and reducing water levels. Iron is one of the most abundant elements in soils and is responsible for the red and brown chroma of many soils.

During anaerobic (saturated) conditions, the iron and manganese in the soils are mobile and thus begin to leach out of the soil profile. Where oxidation takes place around for example roots, aggregate surfaces and pores, relatively insoluble ferric oxides are deposited leading to the formation of red/green mottles and concretions. These soil profiles are commonly known as leached soils, gleysol, E-horizons or Albic horizons. Resulting from prolonged anaerobic conditions, the soil matrix is left a grey, greenish or bluish colour, and is said to be "gleyed". The recurrence of the cycle of wetting and drying over many decades concentrates these insoluble iron compounds. Thus, soil that is gleyed and has mottles within the first 0.5 m of the surface are indicating a zone that is seasonally or temporarily saturated, interpreted and classified as a wetland (Department of Water Affairs and Forestry, 2005).

Vegetation Indicator

Plant communities undergo distinct changes in species composition along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas. Valuable information for determining the wetland boundary and wetness zone is derived from the change in species composition. A supplementary method for employing vegetation as an indicator is to use the broad classification of the wetland plants according to their occurrence in the wetlands and wetness zones (Kotze & Marneweck, Guidelines for delineating the wetland boundary and zones within a wetland under the South African Water Act, 1999; Department of Water Affairs and Forestry, 2005). This is summarised in Table 4 below.

When using vegetation indicators for delineation, emphasis is placed on the group of species that dominate the plant community, rather than on individual indicator species (Department of Water Affairs and Forestry, 2005). In areas where soils are a poor indicator (black clay, vertic soils), vegetation (as well as topographical setting) is relied on to a greater extent and the use of the wetland species classification as per Table 5 becomes more important. If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (Department of Water Affairs and Forestry, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineate wetland areas.

Table 4: Classification of Plant Species According to Occurrence in Wetlands

Type	Description
Obligate Wetland Species (OW)	Almost always grow in wetlands: > 99% of occurrences.
Facultative Wetland Species (FW)	Usually grow in wetlands but occasionally are found in non-wetland areas: 67-99% of occurrences.
Facultative Species (F)	Are equally likely to grow in wetlands and non-wetland areas: 34-66% of occurrences.
Facultative Dry-land Species (FD)	Usually grow in non-wetland areas but sometimes grow in wetlands: 1-34% of occurrences.

(Source: (Department of Water Affairs and Forestry, 2005))

Wetland Ecological Health Assessment (WET-Health)

According to Macfarlane et al. (2009; 2020), the health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. A Level 1 WET-Health assessment was done on the wetlands in accordance with the method described by Macfarlane et al., (2020) to determine the integrity (health) of the characterised HGM units for the wetlands associated with the Project Area. A Present Ecological State (PES) analysis was conducted to establish baseline integrity (health) for the associated wetlands. The health assessment attempts to evaluate the hydrological, geomorphological, vegetation and water quality health in four separate modules to attempt to estimate similarity to or deviation from natural conditions. The overall health score of the wetland was then calculated.

Central to WET-Health is the characterisation of HGM units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated, or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described above.

The overall approach is to quantify the impacts on wetland health and then convert the impact scores to a PES score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores and PES categories are provided in Table 5 (Macfarlane, Kotze, & Ellery, 2009; Macfarlane, Ollis, & Kotze, 2020).

Table 5: Impact Scores and Present Ecological State Categories (WET-Health; Macfarlane et al., 2009 and 2020)

Impact Category	Description	Combined Impact Score	PES Score (%)	PES Category
None	Unmodified, natural.	0-0.9	90-00	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	80-89	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	40-59	D

Impact Category	Description	Combined Impact Score	PES Score (%)	PES Category
Serious	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39	E
Critical	Critically modified. Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19	F

Wetland Ecological Services (WET-EcoServices)

The importance of a water resource in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class (Department of Water Affairs and Forestry, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described Kotze et al. An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided (Table 7).

Table 7: Ecosystem Services

Regulating and Supporting Services	Provisioning Services	Cultural Services
Flood Attenuation	Provision of Water for Human Use	Cultural and Spiritual Experience
Streamflow Regulation	Provision of Harvestable Resources	Tourism and Recreation
Sediment Trapping	Food for Livestock	Education and Research
Phosphate Assimilation	Provision of Cultivated Foods	
Nitrate Assimilation		
Toxicant Assimilation		
Erosion Control		
Carbon Storage		
Biodiversity Maintenance		

The characteristics were used to quantitatively determine the value and, by extension, the sensitivity of the wetlands. Each characteristic was scored to reflect the importance of the wetland in providing the service relative to other wetlands and riparian areas (Table 8).

Table 8: Categories Used for Reporting the Overall Importance of Ecosystem Services

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

Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) tool was derived to assess the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The purpose of assessing the importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term. The methodology outlined by DWAF (1999) and updated in Kotze and Rountree (Kotze, Ellery, Macfarlane, & Jewitt, 2012; Rountree, Malan, & Weston, 2013), was used for this study.

In this method there are three suites of importance criteria; namely:

- **Ecological Importance and Sensitivity:** incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWS and thus enabling consistent assessment approaches across water resource types;

- **Hydro-functional Importance:** which considers water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- **Importance in Terms of Basic Human Benefits:** this suite of criteria considers the subsistence uses and cultural benefits of the wetland system.

These determinants are assessed for the wetlands on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. It is recommended that the highest of these three suites of scores be used to determine the overall Importance and Sensitivity category of the wetland system, as defined in Table 9.

Table 9: Interpretation of Overall EIS Scores for Biotic and Habitat Determinants

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

Impact Assessment

The wetland impacts were assessed based on the impact's magnitude as well as the receiving environment's sensitivity, resulting in an impact significance rating which identified the most important impacts that require management. Based on international guidelines and legislation, the following criteria were taken into consideration when potentially significant impacts were examined relating to wetlands:

- Nature of impacts (direct/indirect and positive/negative);
- Duration (short/medium/long-term; permanent (irreversible)/temporary (reversible) and frequent/seldom);
- Extent (geographical area and size of affected population/species);
- Intensity (minimal, severe, replaceable/irreplaceable);

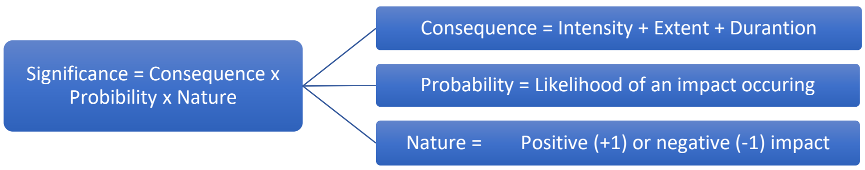
- Probability (high/medium/low probability); and
- Measures to mitigate avoid or offset significant adverse impacts.

Significance Rating

Impacts and risks have been identified based on the description of the activities to be undertaken. Once the impacts were identified, a numerical environmental significance rating process was undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a specific environmental impact.

The severity of an impact was determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact was then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures were incorporated into the EMP. Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below. The significance rating process follows the established impact/risk assessment formula:



Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculated the rating out of 147, whereby intensity, extent, duration and probability were each rated out of seven as indicated in Table 12. The weight assigned to the various parameters was then multiplied by +1 for positive and -1 for negative impacts.

Parameter Rating

Impacts are rated prior to mitigation and again after consideration of the mitigation proposed in this report. The significance of an impact is then determined and categorised into one of seven categories, as indicated in Table 11, which is extracted from Table 12. The description of the significance ratings is discussed in Table 13.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Mitigation Hierarchy

The aim of the Impact Assessment is to strive to avoid damage to or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013). Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is represented in Table 10.

Table 10: Mitigation Hierarchy

	Avoid or Prevent	Refers to considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, construction should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the other steps in the mitigation.
	Minimize	Refers to considering alternatives in the Project location, sitting, scale, layout, technology and phasing that would minimize impacts on biodiversity, associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimize impacts.
	Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable, and measures are provided to return impacted areas to near natural state or an agreed land use after removal. Rehabilitation can, however, fall short of replicating the diversity and complexity of natural systems.
	Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made to minimize and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

Table 11: Impact Assessment Parameter Ratings

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	**Irreplaceable loss** or damage to biological or physical resources or **highly sensitive** environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and/or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the Project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	**Irreplaceable loss** or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond Project Life: The impact will remain for some time after the life of the Project and is potentially irreversible even with management.	Almost Certain/Highly Probable: It is most likely that the impact will occur. > 65 but < 80% probability.
5	**Serious loss** and/or damage to physical or biological resources or **highly sensitive** environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/Region Will affect the entire province or region.	Project Life (> 15 years): The impact will cease after the operational life span of the Project and can be reversed with sufficient management.	Likely: The impact may occur. < 65% probability.
4	**Serious loss** and/or damage to physical or biological resources or **moderately sensitive** environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/items of cultural significance.	Average to intense natural and/or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long Term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. < 50% probability.
3	**Moderate loss** and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local including the site and its immediate surrounding area.	Medium Term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur. < 25% probability.
2	**Minor loss and/or effects** to biological or physical resources or **low sensitive** environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited extending only as far as the development site area.	Short Term: Less than 1 year and is reversible.	Rare/Improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. < 10% probability.
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and/or social benefits felt by a very small percentage of the baseline.	Very Limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly Unlikely/None: Expected never to happen. < 1% probability.

Table 12: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Consequence																																					

Table 13: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and/or social environment.	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and/or social environment.	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and/or social environment.	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and/or social environment.	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

DIGBY WELLS
ENVIRONMENTAL